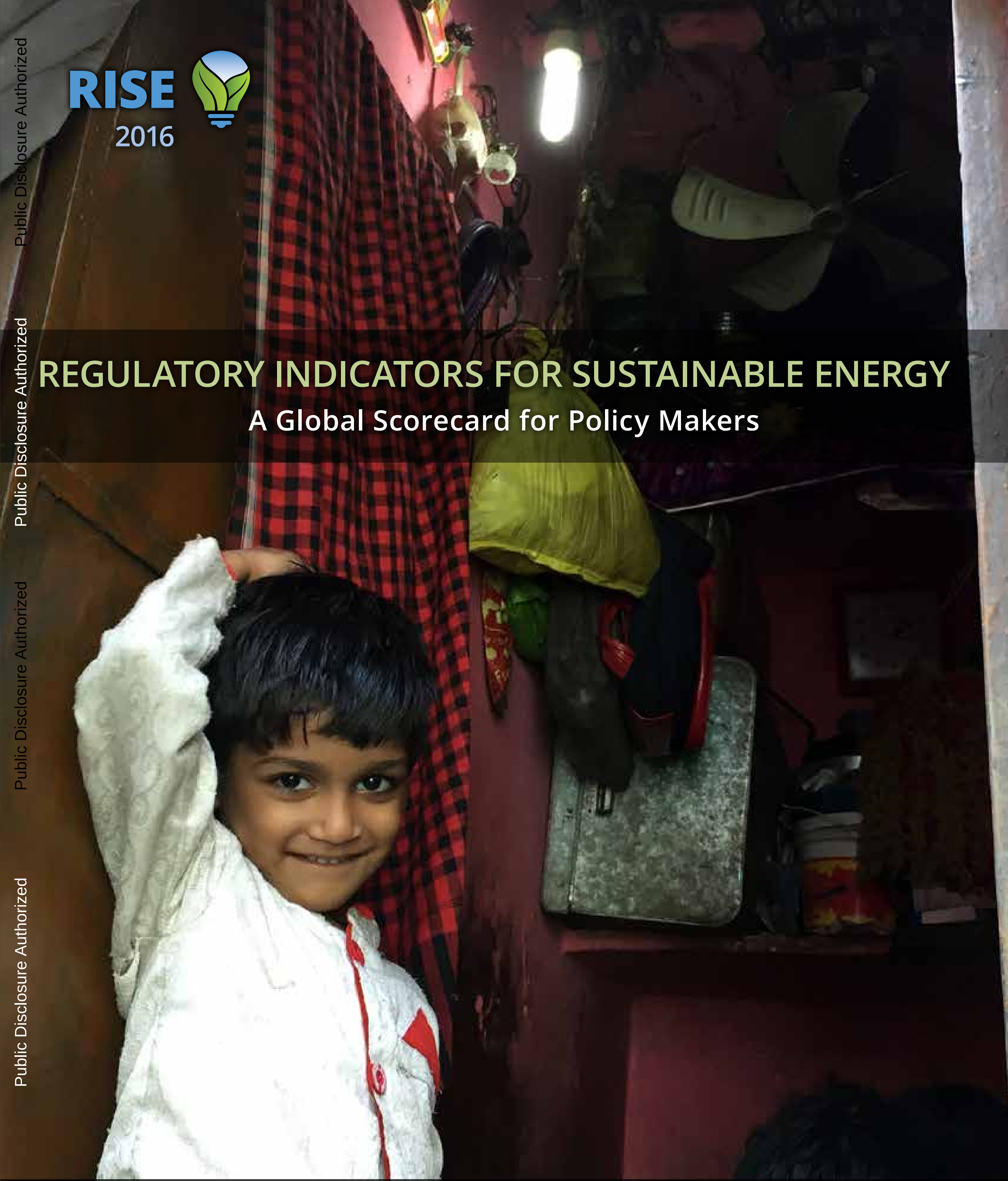

RISE
2016

# REGULATORY INDICATORS FOR SUSTAINABLE ENERGY

## A Global Scorecard for Policy Makers

WORLD BANK GROUP
ESMAP
Energy Sector Management Assistance Program
CLIMATE INVESTMENT FUNDS
SUSTAINABLE ENERGY FOR ALL

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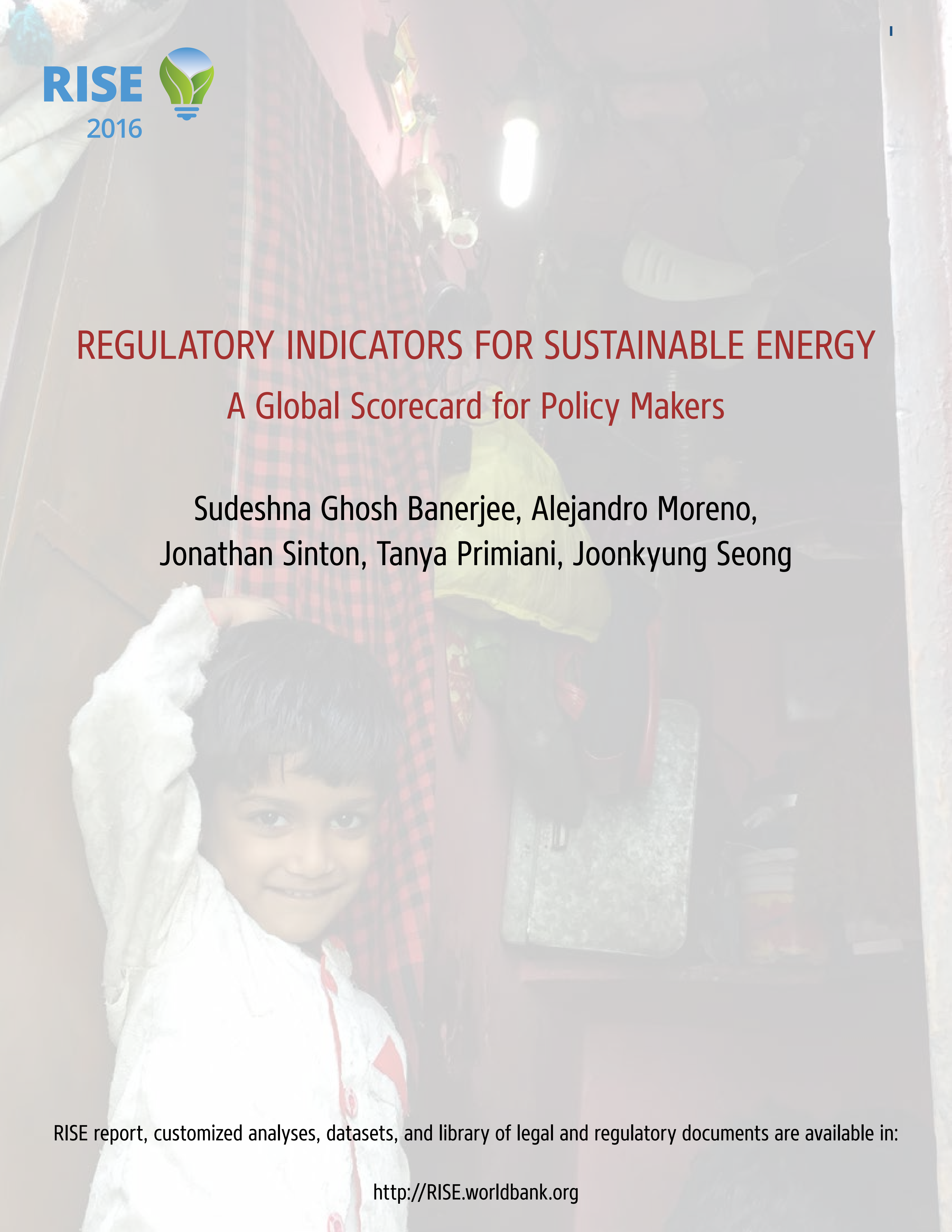

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## A Global Scorecard for Policy Makers

Sudeshna Ghosh Banerjee, Alejandro Moreno,
Jonathan Sinton, Tanya Primiani, Joonkyung Seong

RISE report, customized analyses, datasets, and library of legal and regulatory documents are available in:

http://RISE.worldbank.org

# FOREWORD

Access to clean, modern energy is a cornerstone of growth and human development, leading to better education and health, more jobs and safer communities. Knowing these benefits makes it all the more urgent to accelerate our efforts to reach the 1.1 billion people who still live without electricity and the 3 billion without access to clean cooking. We need more than $1 trillion in annual investments by 2030 to reach those goals.

Clearly we cannot get there alone.

Development organizations, governments and the private sector each have a crucial role to play in this endeavor. It is in each country's hands to provide the right set of policies and regulations to attract private investments in the energy sector. But what supporting policy frameworks are needed to ensure there is sufficient financing for sustainable energy and that investors' concerns are kept in check and their returns are adequate? And where can investors find comprehensive/in-depth information about policies and regulations that create the right investment climate for sustainable energy?

RISE sets out to provide just that. It is a global scorecard with an exhaustive set of indicators that rank national policy and regulatory frameworks for sustainable energy. It offers a critical, objective overview of what is happening in 111 countries, allowing policymakers and investors to benchmark progress across countries through its databases that provide access to a treasure trove of primary policy and regulatory information at the national level.

The good news is that many countries are already committed to the sustainable energy agenda and have put in place the fundamental measures needed to reach those goals. These range from plans that chart the path to universal electricity access, to laws that enable scaling up energy efficiency and renewable energy. Still, much more is needed to translate these commitments into robust policy frameworks, particularly in lower income countries.

The data in RISE highlights the strong progress and broad uptake in advancing renewables policy across many countries, but also notes that critical areas—such as grid integration—need strengthening. RISE puts a spotlight on the untapped opportunities for energy efficiency and suggests an important role for utilities in meeting efficiency as well as access objectives.

By regularly taking stock of where we are through its two-yearly updates, RISE also helps leaders to stay on track for a clean energy transition that offers growth and job-rich development.

It is our hope that leaders will use and learn from the data in this report and focus their efforts on where action is needed most to extend affordable, reliable, sustainable and modern energy to people who need it most. With greater action and determination, we can go further and faster towards a better world—for all.

**Riccardo Puliti**
Senior Director
Head of Energy & Extractives
World Bank Group

**Rachel Kyte**
CEO of Sustainable Energy for All and Special Representative of the UN Secretary-General for Sustainable Energy for All

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RISE was managed by a core team led by Sudeshna Ghosh Banerjee and comprising Alejandro Moreno, Jonathan Sinton, Tanya Primiani, and Joonkyung Seong. Specifically, the work was coordinated by the following staff and consultants:

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RISE is underpinned by individual data collection efforts in each of the 111 countries covered. The full list of data collectors is in appendix 6, and the list of those who provided information in each country is on the RISE website. The team would like to particularly recognize the project managers for each of the firms that led data collection across multiple countries: Prabaljit Sarkar (Castlerock Asia); Sylvana Bohrt, Stephen Casey, Alexander LaBua, and Patrick Longmire (Greenmax Capital Advisors); Michel Layec, Costina Timofte, and Valentina Villoria (MWH); Akram Al Mohamadi, Hind Il Idrissi, Maged Mahmoud, and Nurzat Myrsalieva (Regional Centre for Renewable Energy and Energy Efficiency); and Analía Marsella and Sebastien Raoux (Transcarbon International).

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# ABBREVIATIONS

| | |
|---|---|
| **AEPC** | Alternative Energy Promotion Center (Nepal) |
| **AKRSP** | Aga Khan Rural Support Program |
| **ASSYST** | Advanced Software Systems Inc. |
| **CAIDI** | customer average interruption duration index |
| **CC** | climate change |
| **CE** | Conformité Européenne (EU energy efficiency standards certification mark) |
| **CLASP** | Collaborative Labeling and Appliance Standards Program |
| **CNIS** | China National Institute of Standardization |
| **COC** | certificate of compliance |
| **CODOA** | power purchase obligation certificate, France |
| **COE** | certificate of endorsement |
| **CSA** | Canadian Standards Association |
| **DDUGJY** | Deendayal Upadhyaya Gram Jyoti Yojana |
| **DOE** | Department of Energy, Department of Environment |
| **DSM** | demand-side management |
| **EA** | energy access |
| **EAP** | East Asia and Pacific |
| **EBITDA** | earnings before interest, tax, depreciation, and amortization |
| **ECA** | Europe and Central Asia |
| **EE** | energy efficiency |
| **EEO** | Energy efficiency obligation |
| **EESL** | Energy Efficiency Services Limited |
| **EIA** | environmental impact assessment |
| **EPA** | Environmental Protection Agency |
| **ERB** | energy regulation board (Zambia) |
| **ESCOM** | Malawi electricity utility |
| **ESCOs** | energy service companies |
| **ESE** | Electricity Supply Enterprise |
| **ETS** | emissions trading system |
| **EU** | European Union |
| **EU-ETS** | EU emissions trading system |
| **GIZ** | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| **GNI** | gross national income |
| **IEC** | International Electrotechnical Commission |
| **ILAC** | International Laboratory Accreditation Cooperation |
| **IRENA** | International Renewable Energy Agency |
| **JEMA** | Japanese Electrical Manufacturer's Association |
| **KEA** | Korean Energy Agency |
| **kt** | kiloton |
| **kVA** | volt amps |
| **kWh** | kilowatt hour |
| **LAC** | Latin America and Caribbean |
| **LCOE** | levelized cost of energy |
| **LEED** | Leadership in Environmental Energy & Design |
| **LV** | low voltage |
| **MENA** | Middle East and North Africa |
| **MEPS** | minimum energy performance standards |
| **METI** | Ministry of Economy, Trade, and Industry |
| **MSA** | market surveillance authority |
| **MV** | medium voltage |
| **MV&E** | monitoring, verification, and enforcement |
| **MW** | mega watts |
| **NIAF** | Nigeria Infrastructure Advisory Facility |
| **NYSERDA** | New York State Energy Research and Development Authority |
| **OECD** | high income/OECD high-income countries |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PPA** | power purchase agreement |
| **RE** | renewable energy |
| **REC** | renewable energy certificate |
| **REFIT** | Renewable Energy Feed-in Tariff (Zambia) |
| **RESP-2** | Rural Electrification Strategy and Plan |
| **RGGI** | Regional Greenhouse Gas Initiative |
| **RISE** | Regulatory Indicators for Sustainable Energy |
| **ROC** | renewable obligation certificate |
| **RSC** | regional service centers |
| **S&L** | standards and labelling |
| **SAIDI** | system average interruption duration index |
| **SAIFI** | system average interruption frequency index |
| **SAR** | South Asia |
| **SCADA/EMS** | supervisory control and data acquisition/energy management system |
| **SEforALL** | Sustainable Energy for All |
| **SEAD** | Super-efficient Equipment and Appliance Deployment |
| **SREP** | Scaling Up Renewable Energy Program |
| **SSA** | Sub-Saharan Africa |
| **T&D** | transmission and distribution |
| **TANESCO** | Tanzanian Electric Supply Co. |
| **TEC** | tax exemption certificate |
| **UN** | United Nations |
| **US$** | U. S. dollar |
| **USc** | U.S. cent |
| **VAT** | value-added tax |
| **VEC** | Village Electricity Committee |
| **Wabo** | Dutch all-in-one permit for developers |
| **WGI** | Worldwide Governance Indicators |

# EXECUTIVE SUMMARY

**Energy is at the forefront of the development agenda.** Recognizing energy's vital role in development and prosperity, the world has committed to Sustainable Development Goal 7 to "Ensure access to affordable, reliable, sustainable and modern energy for all" as one of 17 goals for 2030, as well as to dramatically increase energy efficiency and the use of renewable energy. The historic climate change agreement in Paris in 2015 also draws attention to the essential scale-up of clean energy to attain a 2°C world, with energy featuring prominently in many countries' Nationally Determined Contributions.

**Achieving these global energy goals calls for more than a trillion dollars of investment annually.**[1] Reaching the 2030 targets set by Sustainable Energy for All (SEforALL)—universal access to electricity and clean cooking fuels, doubling the rate of improvement of energy efficiency, and doubling the share of renewable energy—requires an unprecedented scale-up of both public and private finance. Investment in sustainable energy is affected by many factors, including market size, country risk, and financial markets, to name but a few. But a country's policies and regulations also matter, and they are directly under the control of government. This report—based on a new and comprehensive global policy scorecard called Regulatory Indicators for Sustainable Energy (RISE) (box 1)—answers two important questions. Are policymakers around the world truly rising to the challenge posed by the new global sustainable energy agenda? Where is further action most critically needed?

## WHAT IS RISE?

**RISE is a set of indicators to help compare national policy and regulatory frameworks for sustainable energy.** RISE assesses countries' policy and regulatory support for each of the three pillars of sustainable energy—access to modern energy, energy efficiency, and renewable energy. With 27 indicators covering 111 countries and representing 96 percent of the world population—RISE provides a reference point to help policymakers benchmark their sector policy and regulatory framework

### Box 1 Regulatory Indicators for Sustainable Energy

- ➔ RISE, a product of the Sustainable Energy for All initiative's Knowledge Hub, aligns with the targets of Sustainable Development Goal 7 and SEforALL
- ➔ RISE provides information on how a country's regulatory environment compares with its peers and identifies priorities for improvement going forward.
- ➔ RISE reports on 27 indicators and 80 subindicators to capture the quality of policies and regulations for energy access, renewable energy and energy efficiency (see the box figure).
- ➔ RISE covers 111 countries across the developed and developing world, which together account for more than 90 percent of global population and energy consumption.
- ➔ RISE classifies countries into a green zone of strong performers in the top third, a yellow zone of middling performers, and a red zone of weak performers in the bottom third.
- ➔ RISE is underpinned by a vast public information base of primary policy and regulatory documents available to users at rise.worldbank.org.
- ➔ RISE indicators will be published bienially, with the next report due in 2018.

**BOX FIGURE:** Capturing the quality of the policy environment

| | Policies and Regulations | | | Administrative Procedures* |
|---|---|---|---|---|
| **Energy Access** | • Existence and monitoring of officially approved electrification plan<br>• Scope of officially approved electrification plan | • Framework for grid electrification<br>• Framework for minigrids<br>• Framework for stand-alone systems | • Consumer affordability of electricity<br>• Utility transparency and monitoring<br>• Utility creditworthiness | • Establishing a new household grid connection<br>• Permitting a new minigrid |
| **Energy Efficiency** | • National energy efficiency planning<br>• Energy efficiency entities<br>• Information provided to electricity consumers<br>• Incentives from electricity rate structures | • Mandates & incentives: large consumers<br>• Mandates & incentives: public sector<br>• Mandates & incentives: utilities<br>• Financing mechanisms for energy efficiency | • Minimum energy performance standards<br>• Energy labeling systems<br>• Building energy codes<br>• Carbon pricing and monitoring | • Securing energy efficiency appliance standards certification |
| **Renewable Energy** | • Legal framework for renewable energy<br>• Planning for renewable energy expansion | • Incentives & regulatory support for renewable energy<br>• Attributes of financial and regulatory incentives | • Network connection and access<br>• Counterparty risk<br>• Carbon pricing and monitoring | • Permitting a new renewable energy project |

*Source:* RISE team.
*Not scored

against those of regional and global peers, and a powerful tool to help develop policies and regulations that advance sustainable energy goals. Each indicator targets an element of the policy or regulatory regime important to mobilizing investment, such as establishing planning processes and institutions, introducing dedicated incentives or support programs, and ensuring financially sound utilities. Together, they provide a comprehensive picture of the strength and breadth of government support for sustainable energy and the actions they have taken to turn that support into reality.

## QUESTION 1: ARE POLICYMAKERS RISING TO THE CHALLENGE?

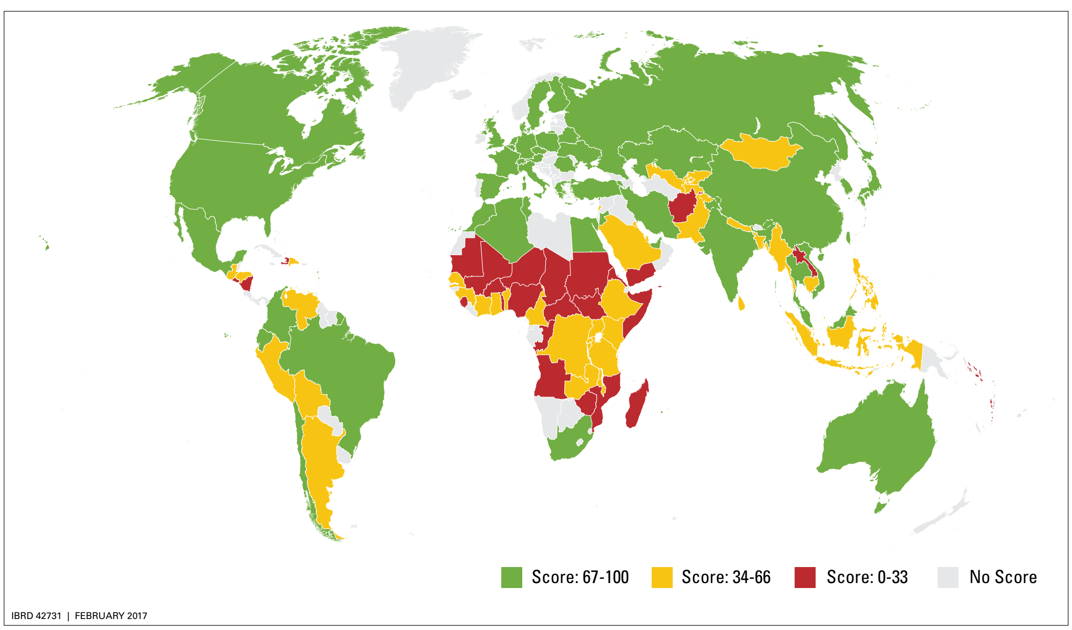
**Across the globe, countries are embracing the sustainable energy policy agenda.** Almost 80 percent of the 111 countries scored by RISE have begun to implement elements of supportive policy frameworks, and over a third—some 45 in all—are already at a reasonably advanced stage. Unsurprisingly, high-income OECD countries, long engaged on this agenda, tend to have stronger policy and regulatory frameworks, although there are some exceptions. The 24 countries making limited or negligible progress toward supporting sustainable energy development present a call for action to the international community (figure 1).

**Numerous countries are emerging as sustainable energy leaders across the developing world.** About half of the 45 countries with strong policy environments across all three pillars of sustainable energy are emerging economies, with examples in all regions and every peer group. They can be found in Africa (South Africa), Asia (China, India, Malaysia, Thailand, Vietnam), Europe and Central Asia (Armenia, Belarus, Kazakhstan, Russia, Turkey, Ukraine, Uzbekistan), Latin America (Brazil, Chile, Colombia, Mexico), and the Middle East (Algeria, Egypt, Iran, Jordan, Morocco, Tunisia) (figure 2).

**Larger economies—with the greatest impact on global targets—tend to be among the top performers in putting in place a robust policy framework.** Achieving the global targets for sustainable energy rests disproportionately on a fairly small group of countries with the largest populations and economies. The good news is that many of these highest impact countries have a supportive policy agenda. Of the world's ten largest energy consumers, seven score in the top tier of RISE countries for renewable energy, offering strong policy frameworks. Of the top ten energy suppliers, eight provide a similar high level of support for energy efficiency. But of the world's ten countries with the largest number of people without electricity, only five provide widespread policy support for energy access (figure 3).

**The basics of renewable energy policy frameworks have been very widely adopted.** The spread of renewable energy regulations has been remarkable. Almost all countries surveyed have a renewable energy target, and about three-quarters of them have adopted legislation and strategic plans and assigned responsible institutions to achieve those targets. There is also a very strong consensus that the private sector should participate in renewable energy development, now allowed in more than 90 percent of countries.

**FIGURE 1** RISE overall scores




IBRD 42731 | FEBRUARY 2017
This map was produced by the Cartography Unit of the World Bank Group. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

*Source:* RISE database and *Doing Business*, World Bank.

**FIGURE 2** Most of the top RISE performers in each region have high scores (green dots)

| | Developing world | | | | | | High income OECD |
|---|---|---|---|---|---|---|---|
| | East Asia & Pacific | Europe and Central Asia | Latin America & Caribbean | Middle East & North Africa | South Asia | Sub-Saharan Africa | |
| Energy access[a] | Philippines 🟢<br>Cambodia 🟢<br>Indonesia 🟡 | *Not applicable* | Guatemala 🟢<br>Nicaragua 🟢<br>Peru 🟢 | *Not applicable* | India 🟢<br>Bangladesh 🟢<br>Sri Lanka 🟢 | Kenya 🟢<br>Uganda 🟢<br>Tanzania 🟢 | *Not applicable* |
| Renewable energy | China 🟢<br>Malaysia 🟢<br>Philippines 🟢 | Kazakhstan 🟢<br>Romania 🟢<br>Turkey 🟢 | Mexico 🟢<br>Brazil 🟢<br>Dominican Republic 🟡 | Jordan 🟢<br>UAE 🟢<br>Egypt 🟡 | Pakistan 🟢<br>India 🟢<br>Sri Lanka 🟡 | South Africa 🟢<br>Malawi 🟡<br>Kenya 🟡 | Denmark 🟢<br>Netherlands 🟢<br>Germany 🟢 |
| Energy efficiency | Vietnam 🟢<br>China 🟢<br>Thailand 🟡 | Romania 🟢<br>Russian Federation 🟢<br>Turkey 🟡 | Mexico 🟢<br>Ecuador 🟡<br>Colombia 🟡 | Tunisia 🟢<br>Iran, Islamic Rep. 🟡<br>UAE 🟡 | India 🟡<br>Sri Lanka 🟡<br>Pakistan 🟡 | South Africa 🟢<br>Kenya 🟡<br>Ghana 🟡 | United States 🟢<br>Denmark 🟢<br>Canada 🟢 |

*Source:* RISE database, World Bank.
a. Does not include countries whose energy access policies were not assessed because of high electrification rates.

**FIGURE 3** Most of the highest-impact countries for energy efficiency and renewable energy perform well in RISE (green dots); but for energy access, many see scores in the middle or lower ranges (yellow and red dots, respectively)

| Top 10 countries with highest electricity access deficit | Energy access | Top 10 countries with highest primary energy demand | Renewable energy | Top 10 countries with highest primary energy supply | Energy efficiency |
|---|---|---|---|---|---|
| India | 🟢 | China | 🟢 | China | 🟢 |
| Nigeria | 🔴 | United States | 🟢 | United States | 🟢 |
| Ethiopia | 🔴 | Russian Federation | 🟡 | Russian Federation | 🟢 |
| Bangladesh | 🟢 | India | 🟢 | India | 🟡 |
| Congo, Dem. Rep. | 🟡 | Japan | 🟢 | Japan | 🟢 |
| Tanzania | 🟢 | Canada | 🟢 | Germany | 🟢 |
| Kenya | 🟢 | Germany | 🟢 | Brazil | 🟡 |
| Uganda | 🟢 | Brazil | 🟢 | Korea, Rep. | 🟢 |
| Sudan | 🟡 | Indonesia | 🟡 | Canada | 🟢 |
| Myanmar | 🟡 | Iran, Islamic Rep. | 🟡 | France | 🟢 |

*Source:* RISE database, World Bank.

## QUESTION 2: WHERE IS FURTHER ACTION MOST CRITICALLY NEEDED?

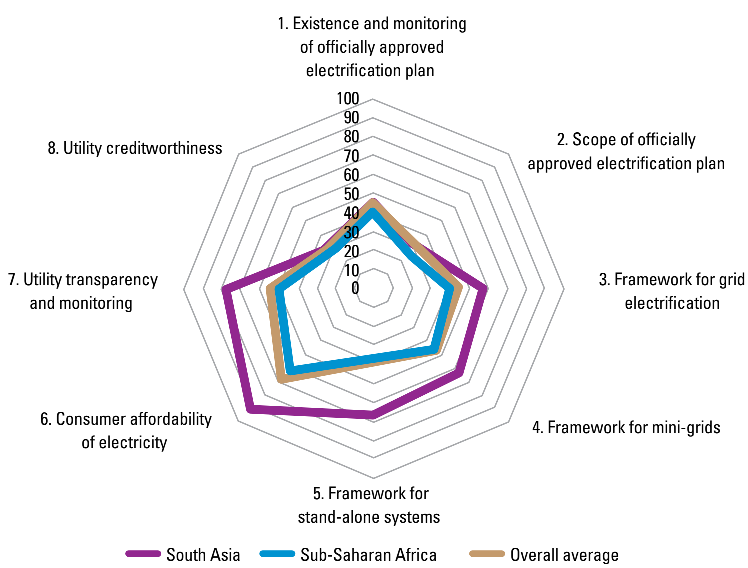
**While progress is encouraging, there remain significant gaps in policy and regulatory frameworks.** The RISE scorecard helps to pinpoint the places and issues where policies are lagging (box 1).

**Sub-Saharan Africa—the least electrified continent and home to about 600 million people without electricity—has one of the least developed policy environments to support energy access.** Of particular concern are Ethiopia, Nigeria, and Sudan—three of the most populous energy deficit countries, with a total unserved population of 116 million people. And as many as 70 percent of Africa's least electrified nations—each with access rates below 20 percent of the population—have barely begun to establish an enabling environment for energy access. Even so, some good performers have strong policy frameworks in place, such as Kenya, Uganda, and Tanzania. In contrast, countries in South Asia—specifically India and Bangladesh—are emerging as leaders in the access agenda with an innovative mix of grid and off-grid solutions. Sub-Saharan Africa trails South Asia in all RISE energy access indicators except the adoption of an officially approved electrification plan (figure 4).

**Policy frameworks for grid densification and expansion, the mainstay of electrification efforts, lag substantially behind and still need much progress.** As many as 60 percent of access deficit countries score in the lowest tier for grid-based electrification (figure 5). Widespread problems are lack of capital subsidies to fund high up-front costs of household connection or expansion into rural areas, as well as lack of performance standards for new connections.

**By neglecting enabling policies for stand-alone solar home systems, too many countries are missing out on the solar revolution's access dividend.** Grid extension has been the mainstay of almost all countries that have already achieved universal electrification today. But technological change and the rapidly declining costs of solar PV now offer the possibility of complementing grid expansion with decentralized off-grid solutions, potentially accelerating the pace of electrification, particularly in remote areas. While countries —such as Madagascar, Nicaragua, the Philippines and Tanzania—score relatively well on the policy framework for minigrids; overall, there has been less enthusiasm for policy measures to facilitate uptake of stand-alone solar home systems. A few notable exceptions are Cambodia, Ghana, Kenya, and Uganda. In fact, the top RISE scorers in energy access do well across all three possible energy supply solutions—grids, minigrids, and stand-alone systems—suggesting they are being pursued not as substitutes but as complements.

**FIGURE 4** South Asian countries score higher on nearly all aspects of energy access policies than their counterparts in Sub-Saharan Africa

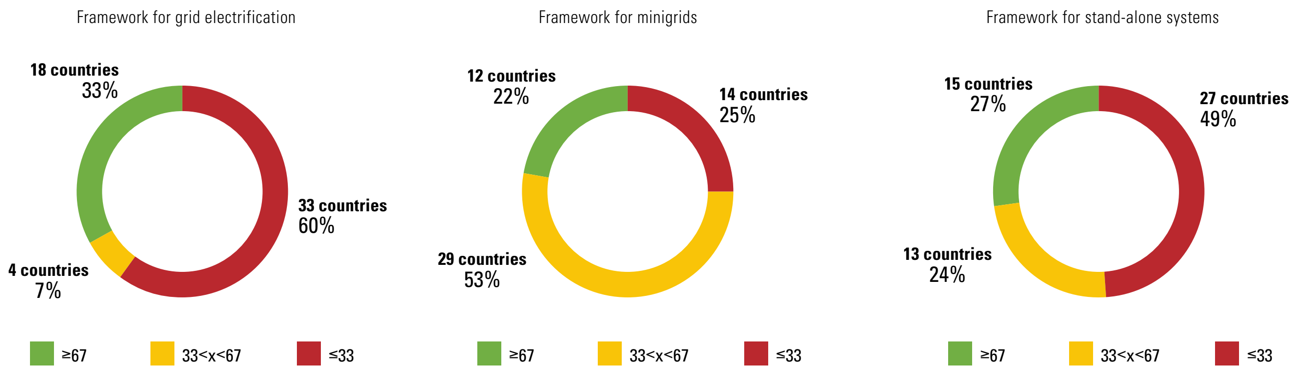



*Source:* RISE database and *Doing Business*, World Bank.

**Reaching universal access is more likely to be constrained by financially unviable utilities—limiting investments in grid expansion—than prices that are too high to be affordable.** RISE finds that the affordability of electricity is not as significant a barrier to energy access as some might think. In part due to effective "lifeline" tariffs for those who consume the least amount of electricity, even the poorest 20 percent of households in the vast majority of countries can meet basic energy needs—for lighting, phone charging, and radio—with less than 5 percent of the family budget (figure 6). A bigger problem for access expansion may be that utilities are not collecting enough revenue in order to expand the distribution grid and offer electricity to new customers. In over three-quarters of countries, the utility is not a creditworthy entity, and most likely unable to fund new investments from its own balance sheet. Balancing affordability and financial viability requires policymakers to set tariffs (or allow them to be set) high enough that a utility's total revenue base—across all its consumers—allows for full cost-recovery, while ensuring that low-income customers are not asked to pay more than they can bear. Such a balance should be possible in many countries, although some small-island (Solomon Islands), fragile (Liberia), and landlocked (Burkina Faso) states face such high costs of electricity—often above US$0.30 per kilowatt-hour—that affordability and cost recovery may prove very difficult to reconcile.

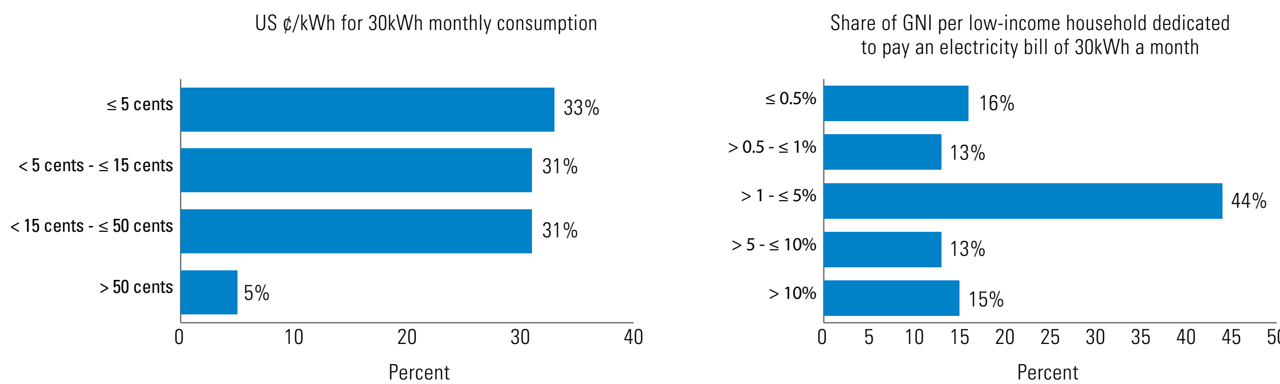
**With the expansion of renewable energy, the practicalities of integrating wind and solar power into the grid become more important.** As renewable energy costs fall and the share of renewable energy in power systems rises, understanding and planning for the integration of variable renewable

**FIGURE 5** Many RISE countries see low scores for support to grid electrification and stand-alone systems. The number of countries with high scores are in green, medium in yellow, and low in red




*Source:* RISE database, World Bank.

**FIGURE 6** Retail electricity tariffs usually are less than 15 cents per kilowatt-hour (left) and electricity typically takes up less than 5 percent of the lowest-income families' budgets (right)



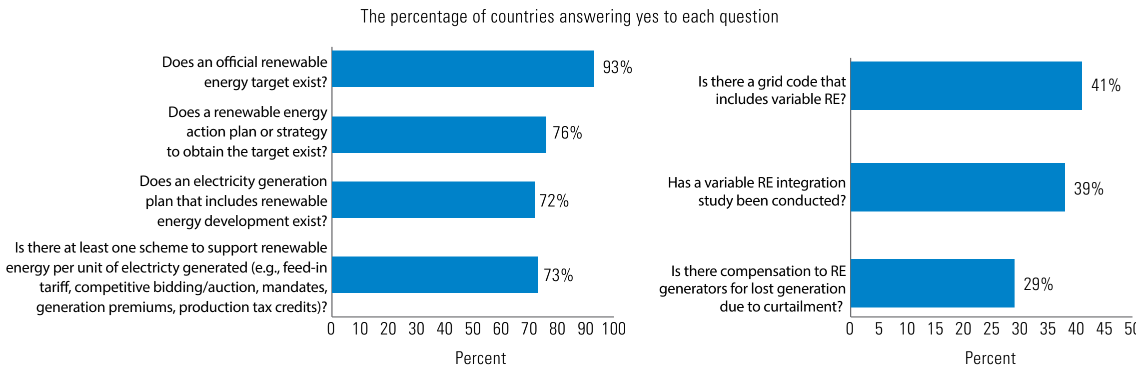

*Source:* RISE database, World Bank.

energy becomes essential (figure 7). Most countries have not yet conducted studies to understand the implications of bringing variable renewable energy into the grid, nor do they have technical codes in place that specify how renewable energy generators can connect to the grid. Elements such as these that are critical to the scale-up of renewables are far more likely to be in place in countries with significant shares of variable renewable energy already in the system. Of countries where wind and solar power account for at least 5 percent of total electricity generated in 2014, more than 80 percent have completed an integration study.

**Energy efficiency is too often overlooked in the policy agenda.** Although countries that pursue renewable energy policies are more likely to also pursue energy efficiency policies, the former seems to lag the latter systematically across a wide range of countries. The average score for efficiency is more than ten points below that for renewables, and far more countries have few or no policies in place to support it (figure 8). Given that energy efficiency measures are among the most cost-effective means of reducing a country's carbon footprint, this is another missed opportunity.

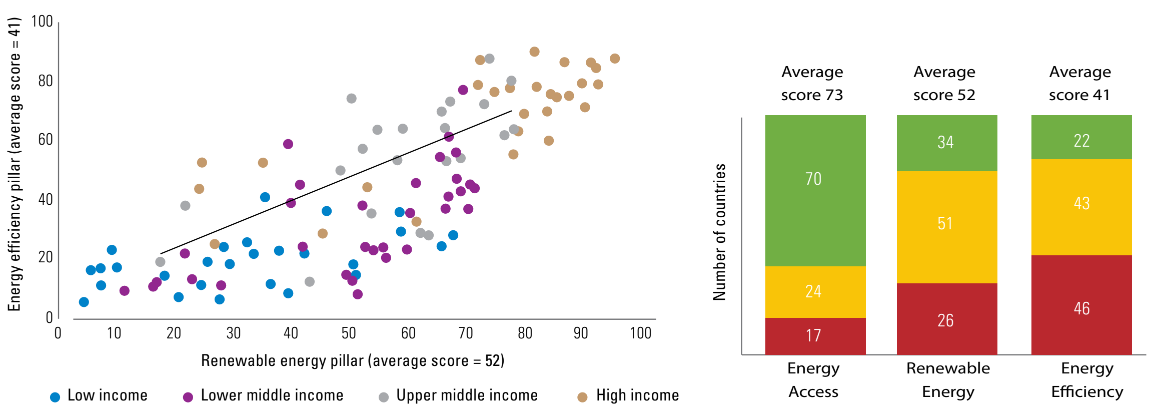
**Many countries that have engaged on the energy efficiency agenda tend to do so at a relatively superficial level.** Around the world, many of the basic elements of a regulatory framework for energy efficiency remain to be developed. Barely a third of countries have made serious progress in labeling energy-efficient appliances—or establishing building energy codes for construction or minimum energy performance standards for industry.

**FIGURE 7** Most countries have renewable energy targets, plans and incentives; far fewer have grid codes that address RE or renewable energy integration studies




*Source:* RISE database, World Bank.

**FIGURE 8** High renewable energy and energy efficiency scores are often found together (left), but far more countries have limited or no policy support for efficiency than the other two pillars (right)

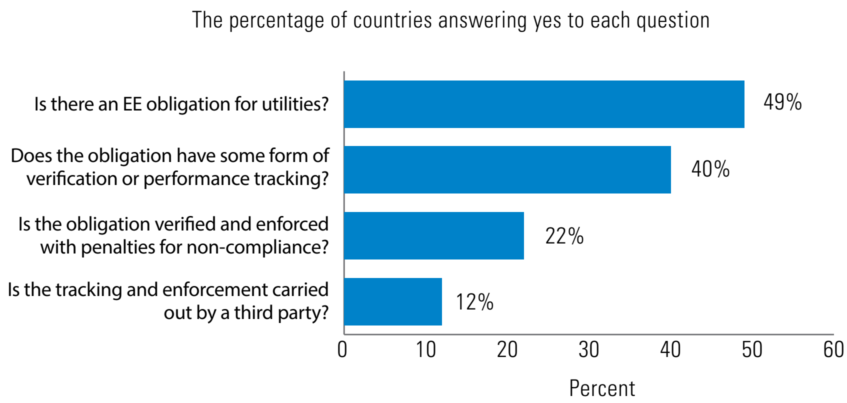



*Source:* RISE database, World Bank.

**Critical aspects of energy efficiency, including the role of utilities, remain in their infancy.** Utilities are one of the major actors in the power sector, but given their commercial incentive to sell power they are not always naturally aligned with the energy efficiency agenda. This tension can be overcome by altering the regulatory incentives under which utilities operate. Although the utilities face conflicts of interest with their commercial incentive to sell power and accrue more revenues, these can be corrected through suitable regulatory measures. Yet only half of countries require their utilities to undertake energy efficiency measures (figure 9).

**However sound the sustainable energy policy framework, progress may remain slow without efficient administrative procedures.** Critical to the enabling environment are both the policies on the books and the effectiveness of their implementation. It really matters how much consumers pay and how long they wait for a grid connection, or how long it takes a developer to get all the permits to start-up a minigrid, establish a wind farm, or certify an energy efficient appliance. The full cost of connecting to the grid, which varies from US$22 in Bangladesh to US$500 in several African countries, exceeds US$100 in the vast majority of countries—well beyond the means of a family living below the poverty line (on less than US$1.90 a day). Obtaining permits to expand energy access through a minigrid can take between 2 months (Madagascar) and 52 months (Sri Lanka), with an average lapse of 14 months. Setting up a grid-connected renewable energy project, such as a wind farm, takes 17 months on average, but again ranges between 1 month (Ukraine) and 60 months (Honduras). So to get the full benefit of good policies enacted, it is necessary to improve the administrative procedures that go with them.

**FIGURE 9** Utilities have at least some form of energy efficiency obligation in half of RISE countries, but tracking or compliance mechanisms are often not in place




*Source:* RISE database, World Bank.

## LOOKING FORWARD

This first global edition of RISE provides a snapshot in time, with all scores and information as of the end of 2015. Encouragingly, many of the countries with the greatest impact on global sustainable energy outcomes are developing, or have developed, strong policies and regulations. Yet policy frameworks on energy access are seriously lagging behind, especially in populous countries of Sub-Saharan Africa and those with particularly low electrification rates. Accelerating performance on access will require setting tariffs high enough to allow for new investments to expand the distribution grid while making sure the poorest populations can afford basic service, as well as improving the policy environment both for grid and off-grid technologies. Although progress on renewable energy and energy efficiency go together, the latter lags systematically behind. And while many countries have taken basic policy support measures for clean energy, these are still lacking in depth. For example, renewable energy policies need to give greater attention to the pressing issue of grid integration of variable renewable energy.

This is just the beginning. New, fully updated editions will be published biennially, with the next scheduled for 2018. It is expected that the value of RISE and the quality of underlying data will increase over time, as the indicators have been designed to allow for comparability not only across regions but year-on-year, and future editions will be able to consider the evolution of sustainable energy policies and, eventually, evaluate the effectiveness of different types of government support to the sector. At the same time, RISE is also intended to be flexible: appropriate policy approaches in any sector will evolve as technologies mature and new challenges arise, and the RISE indicators will be re-evaluated and updated as needed in each subsequent edition.

### NOTES

1. 2015 Global Tracking Framework, the World Bank.

# OVERVIEW

## CONCEPT AND AIMS OF THE REGULATORY INDICATORS FOR SUSTAINABLE ENERGY

The Sustainable Development Goal on energy to "ensure access to affordable, reliable, sustainable, and modern energy for all" by 2030 is a recognition of the power of energy to transform lives, economies, and the planet. This important milestone is a culmination of efforts by the Sustainable Energy for All (SEforALL) initiative co-led by the United Nations (UN) Secretary General and the World Bank President. SEforALL has brought multiple stakeholders to commit to achieving three objectives by 2030: assuring universal access to modern energy services, doubling the rate of improvement in energy efficiency, and doubling the share of renewable energy in the global energy mix. The five SDG targets[1] correspond closely to these three SEforALL objectives and emphasize the role of technology and international partnerships.

The World Bank serves as a knowledge hub for SEforALL, and the Regulatory Indicators for Sustainable Energy (RISE) is one of its flagship products[2] focusing on the question: How can policies and regulations contribute to investments needed to achieve SEforALL objectives? The finance committee[3] constituted by SEforALL estimated in 2014 that US$1.16 trillion annually is required to achieve the three objectives—way beyond current spending of about US$400 billion. For energy access, the public sector has historically played the dominant role and will continue to do so in the near future, although the opportunities for private activity are expanding. The two clean energy objectives (energy efficiency and renewable energy) constitute the overwhelming share of investment needs, although the ratio between investment needs and available funding is highest for energy access. Investments of this size cannot be realized through public funds alone, so private investment must step up, but not all aspects of sustainable energy are equally attractive to the private sector.

RISE shows a snapshot of policies and regulations in the energy sector encapsulated in a suite of indicators across each of the three pillars of energy (electricity) access,[4] energy efficiency, and renewable energy. It builds on the empirical understanding that policies and regulations matter in attracting investment to sustainable energy and captures this facet of the investment climate.[5] RISE is premised on the fact that good practices in policies and regulations exist, but must be customized to the local context. They can be particularly important in the power sector, which can require heavy upfront capital investments and pose potentially steep risks for investors. The Organisation for Economic Co-operation and Development (OECD), in its principles for private sector participation in infrastructure,[6] underscores the need for an enabling policy framework for investment.

RISE is inspired by the Bank's flagship report on *Doing Business* and builds on its methodology. *Doing Business* is recognized for its track record in measuring countries' laws and regulations for small and medium domestic enterprises and in leveraging reforms. While *Doing Business* measures countries' overall investment climate, RISE focuses only on the sustainable energy sector. In this way, relationships can be drawn to see if a country's results on RISE are better or worse than on its overall investment climate.

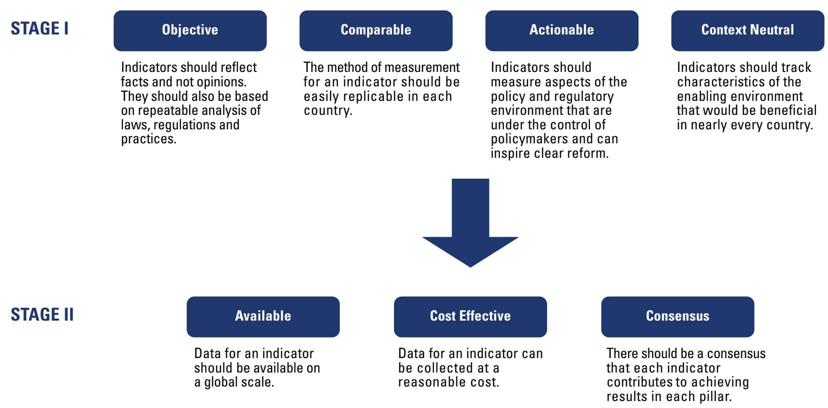
## EVOLUTION

RISE originates from a request from member countries of the Climate Investment Fund's Scaling Up Renewable Energy Program (SREP), which wanted to assess their policy readiness to attract investments in sustainable energy. The SREP secretariat provided the initial funding to develop a methodology and test. RISE therefore drew on a previous World Bank Group initiative focusing on renewable energy, the Climate Investment Readiness Index,[7] which evaluated the environment for private investment in climate mitigation and low-carbon technologies in South Asian countries.

RISE has been underpinned by a multi-stakeholder consultation process. The starting point in developing RISE in 2013–14 was a long list of indicators, developed from a literature review that was filtered down using guiding principles (figure O.1). They were then presented in consultations with an internal advisory group (comprising World Bank Group experts) and an external advisory group (of eminent experts), especially constituted for each of the three RISE pillars (appendix 5) and private sector consultations in Washington, DC, Delhi, Dubai, Kathmandu, and Nairobi (figure O.2). Following these various levels of screening, 28 indicators were formulated to be tested as a pilot exercise.

A pilot comprising 17 countries[8] was carried out in 2014 and a final report was launched in November 2014 in an SREP subcommittee meeting. The selection of countries was predisposed toward those participating in SREP. Non-SREP countries such as Chile, Denmark, India, and the United States were included for wider representation. The report allowed for a validation of the methodology, and presented lessons from developing and implementing the suite of

**FIGURE O.1** Guiding principles




*Source:* RISE database, World Bank.

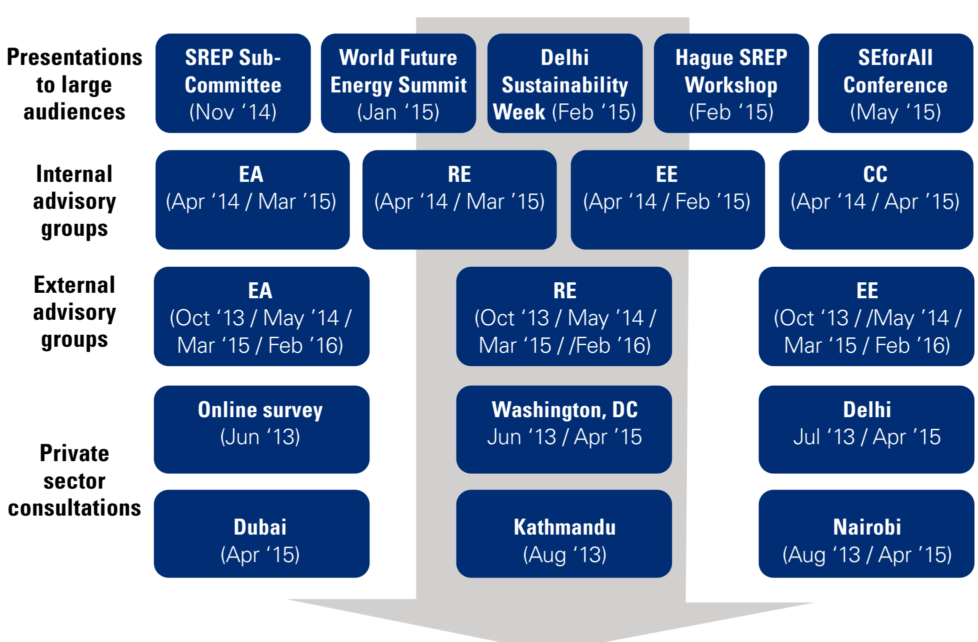
indicators across countries (which had varying data availability and quality). It served as a starting point by allowing for refinements in the methodology and interpretation of indicators. Most important, it formed a solid base for consultation for the global rollout of RISE in 2015–2016.

## GLOBAL ROLLOUT OF RISE

This report presents the methodology and results of a global rollout of RISE, encompassing 111 countries that cover all World Bank Group regions and incomes and that represent 96 percent of the global population, 91 percent of global energy consumption, and 97 percent of the global electricity access deficit. The economies selected were the top 50 SEforALL high-impact countries for each pillar as reported in the 2015 Global Tracking Framework,[9] all SEforALL opt-in countries with a population above 5 million, and all 17 RISE pilot countries. For energy access, only 55 countries are relevant (those without asterisks in table O.1) since the rest (those with asterisks) have universal electrification.

RISE scores are grounded in 27 indicators across the three pillars, underpinned by 80 subindicators and 158 questions (table O.2). Every country therefore has at least 158 unique data points. Most subindicators and questions are formulated in a binary yes or no form to ensure objectivity, but aggregating them enables an overview of a country's achievement on the indicator. There are 8 indicators in energy access, 12 in energy efficiency, and 7 in renewable energy. RISE indicators are designed to measure policy actions to address barriers to scaling up sustainable energy across the three pillars (figure O.3). The policies and regulatory indicators cover an entire gamut of actions on planning, incentives, mandates, and policies that directly support sustainable energy. They represent the vision of governments translated into plans at the national level and their attributes for good practice, as well as policies and incentives focusing on appropriate price signals to markets and subsidy mechanisms to facilitate the development of sustainable energy. All countries' indicator results are in appendix 1.

**FIGURE O.2** RISE consultation process




*Source:* RISE database, World Bank.

**TABLE O.1** The 111 countries in RISE, 2016 edition[a]

| Sub-Saharan Africa | East Asia & Pacific | Latin America & the Caribbean |
|---|---|---|
| Angola | Cambodia | Argentina* |
| Benin | China* | Bolivia* |
| Burkina Faso | Indonesia | Brazil* |
| Burundi | Lao PDR | Colombia* |
| Cameroon | Malaysia* | Dominican Republic* |
| Central African Republic | Mongolia | Ecuador* |
| Chad | Myanmar | Guatemala |
| Congo, Dem. Rep. | Philippines | Haiti |
| Congo, Rep. | Solomon Islands | Honduras |
| Côte d'Ivoire | Thailand* | Mexico* |
| Eritrea | Vanuatu | Nicaragua |
| Ethiopia | Vietnam* | Peru |
| Ghana | **South Asia** | Venezuela, RB* |
| Guinea | Afghanistan | **Middle East & North Africa** |
| Kenya | Bangladesh | Algeria* |
| Liberia | India | Bahrain* |
| Madagascar | Maldives* | Egypt, Arab Rep.* |
| Malawi | Nepal | Iran, Islamic Rep.* |
| Mali | Pakistan | Jordan* |
| Mauritania | Sri Lanka | Kuwait* |
| Mozambique | **OECD High Income** | Lebanon* |
| Niger | Australia* | Morocco* |
| Nigeria | Austria* | Qatar* |
| Rwanda | Belgium* | Saudi Arabia* |
| Senegal | Canada* | Tunisia* |
| Sierra Leone | Chile* | United Arab Emirates* |
| Somalia | Czech Republic* | Yemen, Rep. |
| South Africa | Denmark* | **Europe & Central Asia** |
| South Sudan | Finland* | Armenia* |
| Sudan | France* | Belarus* |
| Tanzania | Germany* | Kazakhstan* |
| Togo | Greece* | Kyrgyz Republic* |
| Uganda | Italy* | Romania* |
| Zambia | Japan* | Russian Federation* |
| Zimbabwe | Korea, Rep* | Tajikistan* |
| | Netherlands* | Turkey* |
| | Poland* | Ukraine* |
| | Spain* | Uzbekistan* |
| | Sweden* | |
| | Switzerland* | |
| | United Kingdom* | |
| | United States* | |

*Source:* RISE team.
*Denotes countries not evaluated on the energy access pillar, where the access rate is above 90 percent or fewer than 1 million people are without access.
a. Energy access pillar does not include evaluation of countries where the access rate is above 90 percent or fewer than 1 million people are without access.

**TABLE O.2** The number of scored indicators, subindicators, and questions for each RISE pillar

| | RISE score | | |
|---|---|---|---|
| | Indicators | Subindicators | Questions |
| Energy access | 8 | 29 | 59 |
| Energy efficiency | 12 | 32 | 48 |
| Renewable energy | 7 | 19 | 51 |
| Total | 27 | 80 | 158 |

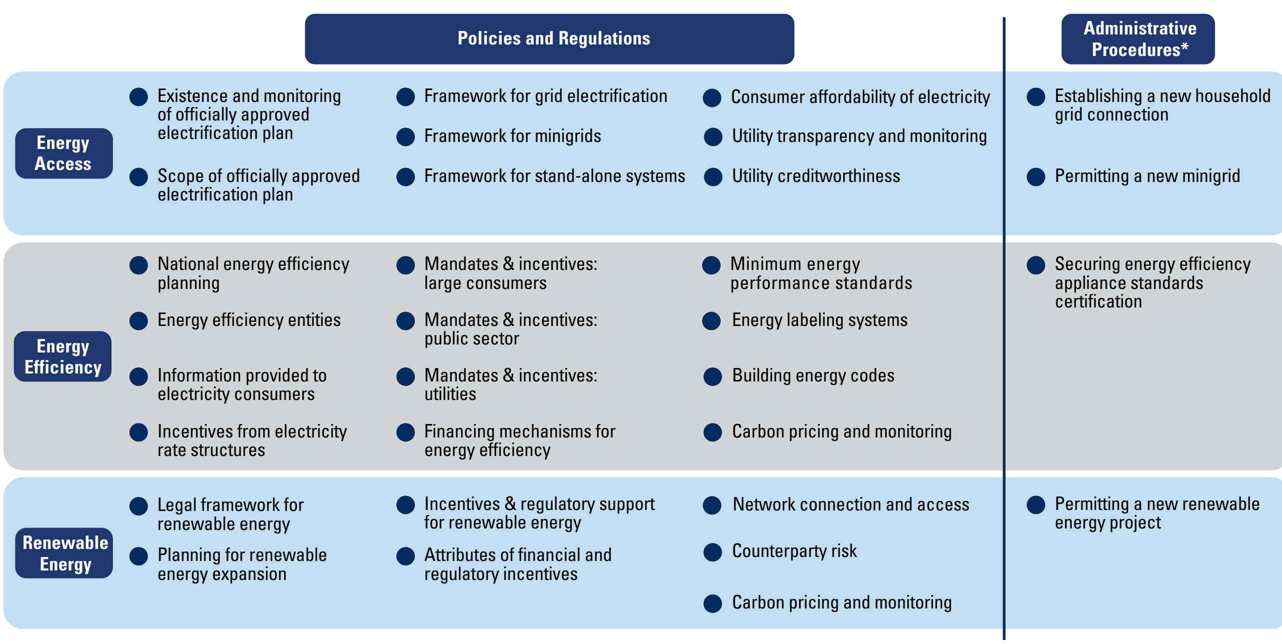
RISE has also collected a wealth of non-scored information. There are two categories of such data points. First, administrative procedures for sustainable energy (figure O.3), which collect data on the realized time, cost, and procedures required to implement key sustainable energy activities (such as getting a new household connection, setting up a minigrid facility, establishing an on-grid renewable energy project, and certifying an appliance for EE). Second, metrics in the energy sector that provide a context for understanding how and why countries have adopted certain practices, including power sector structure, key companies and institutions, generation data, and tariff schedules. A snapshot of these metrics for a selected group of countries is presented in annex 3.

RISE can help national policymakers benchmark their energy sector framework against those of regional and global peers. By highlighting global and regional trends across all types of sustainable energy policies and making available detailed information on best practices or successful approaches in comparable countries, RISE can provide a structured platform for comparison. Focusing on actions within policymakers' control, RISE will contribute to domestic policy debates by providing a global reference point on measures to facilitate the environment needed to support sustainable energy investments and to inform country interventions under SEforALL. The indicators aim to balance depth of information with relevance and comparability across countries and over time. They ensure that RISE can offer a base of comparison across regions, incomes, and energy sector structures, and that the indicators are focused on those measures that energy sector policymakers —the primary RISE target audience—can directly affect. They also ensure that a country's answers are not dependent on the subjective perspective of any individual and that any differences or changes over time in answers reflect changes to policy.

RISE is a valuable source of information to private investors and developers—of sustainable energy projects, products, and services—who ultimately make the decision on where to invest. From this perspective, RISE is one element of a much larger toolkit to assess the risks and rewards of investment, and can help direct companies to countries where the government prioritizes the types of investments they provide, or where certain regulations or incentives are in place.

RISE's significance is amplified when its information base is complemented with other initiatives. RISE's value rests on design attributes that build on initiatives measuring the enabling environment for sustainable energy worldwide. For example, the International Energy Efficiency Scorecard

**FIGURE O.3** RISE indicators—scored and nonscored




*Source:* RISE database, World Bank.
*Not scored

of the American Council for an Energy-Efficient Economy ranks energy efficiency policies and programs in the world's 16 largest economies. *Climatescope*—an Inter-American Development Bank/Bloomberg New Energy Finance publication—assesses the investment climate and policies for clean energy investments in 55 emerging markets in Africa, Asia, and Latin America and the Caribbean (appendix 7).

**Box O.1 Traffic light system**

| | |
|---|---|
| **Green zone:** | Scores between 67–100. Most elements of a strong policy framework to support sustainable energy are in place. |
| **Yellow zone:** | Scores between 34–66. Significant opportunities exist to strengthen the policy framework. |
| **Red zone:** | Scores between 0–33. Few or no elements of a supportive policy framework have been enacted. |

## RISE METHODOLOGY

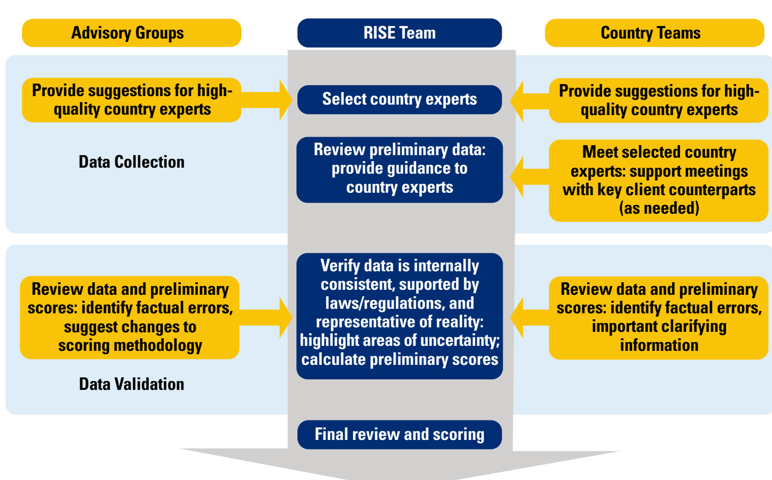
All indicators are scored between 0 and 100 and are weighted equally to reach a score for the pillar. This approach is not intended to imply that all indicators are equally important, as a policy decision measured by RISE may often be critical to support investment while another might only provide a minor incentive. But, the relative importance of each indicator often differs by country (based on factors like the size and maturity of the market for sustainable energy, the strength and structure of the power sector, and external political and economic risks) and among stakeholders within a country.[10]

A traffic light system conveys a country's aggregate score in sustainable energy on each pillar and indicator, categorizing countries into green, yellow, and red zones (box O.1). A green light for a pillar, for example, indicates that the policy framework addresses many of the key areas that will help attract the type of investments the government seeks, and is a strong indication that the government has prioritized that pillar and devoted resources to support its growth. But a green light does not necessarily mean that the country lacks attributes to improve on, and instead signals the government has made good-faith efforts to support investment instead and instead signals its current policy readiness for investment. For the investor, this provides evidence of the commitment and credibility of government policymaking to create an attractive enabling environment. A country with a red light usually has enormous scope for improving its policy space. Such a diagnostic of gaps could be used by the international community to assemble resources to help create an enabling environment.

The unit of analysis in RISE is a country. Many of its questions therefore address national sustainable energy policies. In some instances, however, these policies are set at the state or even municipal level. To address this inconsistency, RISE has adopted the methodology developed by the World Bank's *Doing Business Report*. RISE measures and scores questions from the perspective of the state where the largest business city is located. For some questions, it also allows for differentiation between national, state, and municipal policies. For questions pertaining to a utility, the largest utility in the largest business city is considered. In some cases, however, results from one state might still be misleading in large federal countries. RISE therefore is piloting a deep dive component that aims to better represent the policy and regulatory variance that could, in large federal countries, affect RISE scores (appendix 4).

RISE data represents the situation as of December 2015. RISE has drawn on the World Bank's global reach to collect data with an identical questionnaire for each country. Energy experts were hired in each of the 111 countries to collect data and the data collection phase spanned from August to December 2015. Filling out the questionnaire in each country took about three months, with a cutoff date of December 31, 2015 for making changes. The comprehensive process involved numerous steps (figure O.4). The questionnaire needs to be completed and each answer requires validation, a step ensuring that the data are accurate and credible. An answer is validated either through providing a public document (for example, an official legal or

**FIGURE O.4** RISE data collection and validation




*Source:* RISE database, World Bank.

policy document) that demonstrates the answer, or through interviews with at least two energy experts in the country. The RISE team reviewed every answer and its supporting documentation. The data were then reviewed and validated by the World Bank country teams and checked for consistency by the internal and external advisory groups.

The RISE data platform hosts a wealth of data on sustainable energy, beyond policies and regulations. While the report focuses on regional and income trends, highlighting and identifying the key messages for each pillar, the platform contains all the raw data disaggregated at the question level. It allows users to search for specific information and to download the dataset for their own analysis. The website also allows users to view the overall data for each pillar on a map, offering numerical scores and other information for each country. The details of the indicators are available in indicator pages where users can see the description of each indicator, the list of subindicators, and the scoring distribution. The results page displays each country's score for each pillar, with the ability to sort by country name, region, score, and so on. Users can manipulate the weighting of the indicators to change the overall scores for each country. The page also has a custom chart feature that allows users to compare countries.

## INTERPRETING RISE

RISE measures only one facet of the investment climate for sustainable energy. It measures how far a country is from offering an attractive policy environment, not how much investment is likely under current conditions. Investment in renewable energy is heavily influenced by factors well beyond what energy sector policies can govern. For this reason, RISE should not be interpreted as a comprehensive evaluation of whether a country is attractive for investment. Successive editions of RISE will, however, make it possible for users to estimate how increments in RISE scores affect increments in investments through an econometric assessment.

RISE does not internalize the time element of policies. It assesses policy frameworks as they appear today, with an eye to how they will affect investment in the future. This means that policies implemented recently will have the same value as those that have been in place for years, and RISE does not incorporate into its scoring whether policies have proven effective. In future editions, once RISE has established a baseline, certain retrospective measures may be imported. For example, RISE will be able to track policy changes over time, and may be able to gauge the effectiveness of some individual support mechanisms by looking at, for example, whether projects awarded at auction were eventually built.

RISE is limited in its ability to capture implementation outcomes of policies. Though indicators on administrative procedures attempt to measure effectiveness of policy implementation, RISE does not yet offer a comprehensive assessment of how policies, as designed, are implemented. For instance, the capacity of sector entities—regulatory agencies, ministries, utilities, and the private sector—is important. But government and private sector staff numbers and budgets, for instance, are hard to collate—in absolute or relative terms—in ways that have the same significance in every country. And even where such information is measurable, channels of reporting may limit how easily it is aggregated and made available to the surveyor. Even if staff numbers are known, factors that substantially affect staff performance (such as technical capability or degree of authority) may not be easily accounted for. A small department of energy specialists in one country could be equivalent in effect to an untitled (and therefore uncounted) individual in an influential position in another.

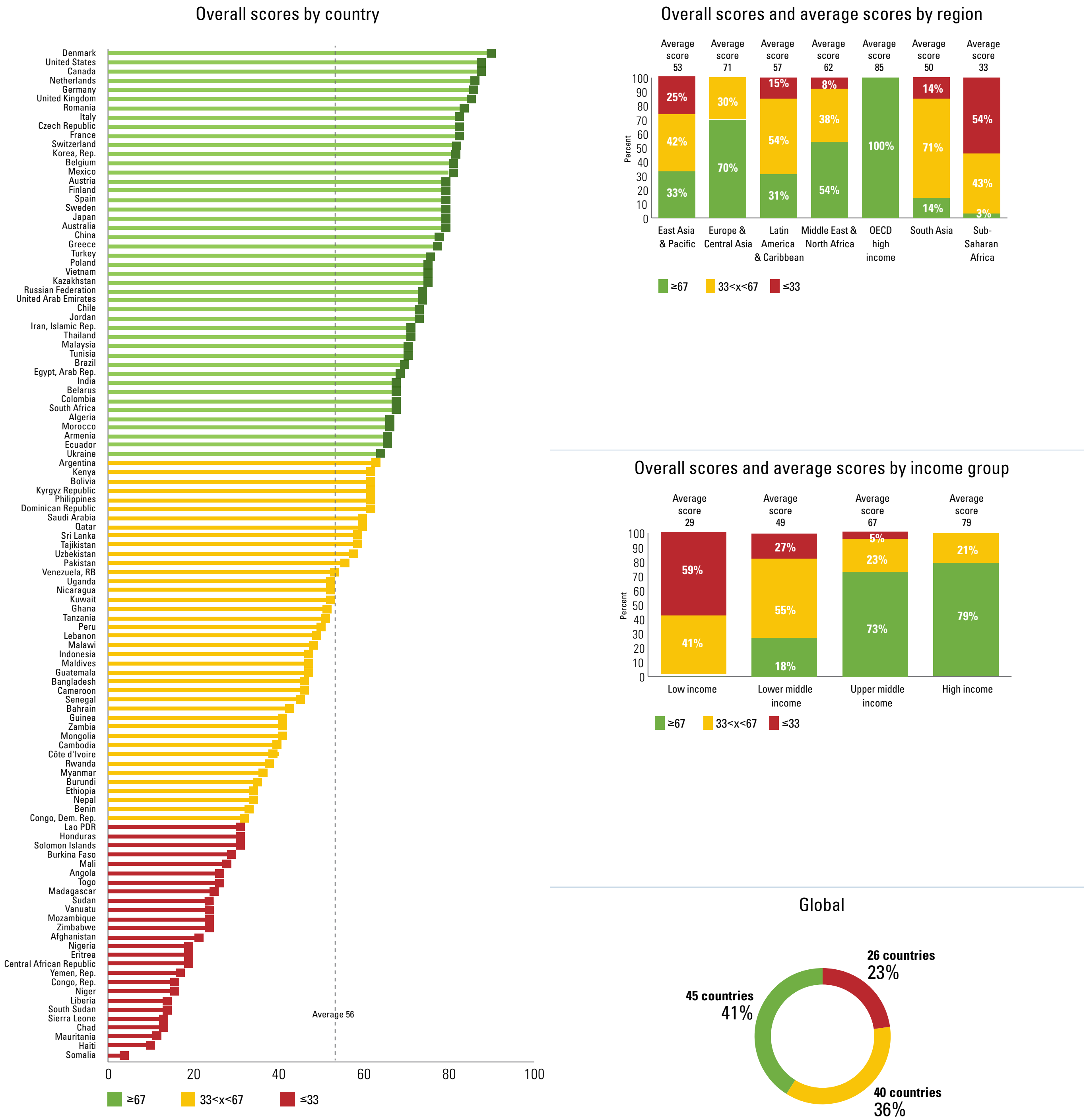
While the RISE indicators point to good practices in building an attractive enabling environment, it is not designed as a policy prescription nor as a roadmap for reforms. With this first global rollout, RISE is still not at a point to explain a relationship between enabling environment and its relationship with investments; thus the selection of indicators has been based on current (and available) understanding of what might work in a robust investment climate. RISE is a live initiative housed within the SEforALL knowledge hub, and so will continue to evolve as consensus on good practices also progresses, and the ability to establish a robust relationship with investment flows matures.

## KEY FINDINGS: RISE AGGREGATE SCORE

Most countries around the world are making some effort to build a sound policy environment for sustainable energy. Aggregating scores across the three pillars of RISE gives a high-level overview of the overall quality of a country's policy environment for sustainable energy. Of a possible maximum of 100, scores range from more than 90 in Denmark to less than 10 in Somalia. Rather than focusing on individual scores, however, RISE classifies countries according to whether they score in the green zone (67–100), yellow zone (34–66), or red zone (0–33). What is striking is that nearly 80 percent of countries worldwide score in either the green or yellow zone—roughly half in each; close to 20 percent score in the red zone (figure O.5). About half the countries with more appropriate policy environments for sustainable energy are emerging economies, even if it is hardly surprising that OECD countries feature prominently among those in the green zone and dominate the top 20 RISE scorers. Nevertheless, it is noteworthy that about half of the countries located in the green zone are from the developing world. All continents are in that zone: Africa (South Africa), Asia (China, India, Malaysia, Thailand, and Vietnam), Europe and Central Asia (Armenia, Belarus, Kazakhstan, Romania, Russian Federation, Turkey, and Ukraine), Latin America (Brazil, Chile, Colombia, Ecuador and Mexico), and the Middle East (Algeria, the Arab Republic of Egypt, the Islamic Republic of Iran, Jordan, Morocco, and Tunisia, and United Arab Emirates).

The quality of the policy environment for sustainable energy drops markedly between upper-middle and lower-middle-income country groupings. The quality of the policy environment for sustainable energy is strongly associated with country income group, as might be expected. High-income and upper-middle-income countries score almost equally well, but there is a very steep decline in scores between the

**FIGURE O.5** Overall RISE scores



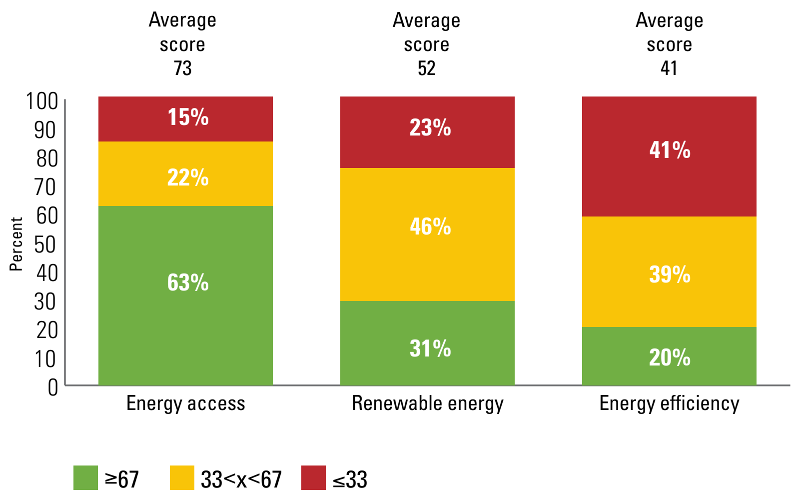

*Source:* RISE database, World Bank.

upper-middle- and lower-middle-income groups, which seems to present the income threshold for major progress on the sustainable energy policy environment. Among the lower-middle-income group, only about 18 percent of countries are in the green zone, and that share drops to zero for the low-income group.

Among developing regions, East Asia and the Middle East seem most advanced on sustainable energy policy environments. They are followed by Latin America and South Asia, where the majority of countries are still in the yellow zone, while in Sub-Saharan Africa over half of the countries are in the red zone.

Across the board, the quality of the policy environment for energy efficiency lags significantly behind that for renewable energy and energy access. The average score is highest for energy access, since more than 60 percent of countries have reached universal electrification and are thus in the green zone. For renewable energy, more than 40 percent of countries are in the yellow zone. For energy efficiency, more than 40 percent of countries are in the red zone (figure O.6).

**FIGURE O.6** Country distribution for energy access, renewable energy, and energy efficiency




*Source:* RISE database, World Bank.
*Note:* Energy access includes countries not assessed (and given score of 100) due to high electrification rates. The corresponding breakout of only countries assessed by RISE can be found on page 3.

For all pillars, the high-impact countries score well on their sustainable energy policy frameworks, indicating that they are taking these policy changes very seriously. The Global Tracking Framework identifies high-impact countries as those that, due to size, have the most potential to contribute to the global achievement of sustainable energy for all objectives. For energy access, these are the highest access-deficit countries, in terms of number of people without access; for renewable energy and energy efficiency, these are the highest energy consumers, measured by primary energy supply (for energy efficiency) and final demand (for renewable energy). Seven of the top 10 high-impact countries score in the green zone in renewable energy, and eight of the top 10 in energy efficiency. This pattern is to be expected, as large consumers would have greater cause to pay attention to energy-related issues. The relationship between clean energy scores and per capita energy consumption is very similar—higher consumption tends to be associated with higher clean energy pillar scores. In the energy access space, Bangladesh, India, Kenya, Tanzania, and Uganda are good examples of large energy access-deficit countries in the green zone (table O.3). Even so, important exceptions demand urgent attention, notably two of the largest access-deficit countries in Sub-Saharan Africa—Nigeria and Ethiopia—are in the red zone for energy access.

Across all pillars, countries are more likely to have a strong legal framework and undertake sector planning than to tackle more challenging aspects of the policy environment. For instance, more than three-quarters of all RISE countries score in the green zone on the legal framework for renewable energy indicator, while only 9 percent do for their energy efficiency mandates and incentives for utilities. While most countries have prepared electrification plans, crafted a renewable energy legal framework, and established energy efficiency plans and energy efficiency entities, most countries have struggled on many other indicators, as seen in the five indicators with the fewest countries scoring green: incentives and mandates for the energy efficiency of utilities, information provided to consumers about electricity usage, scope of officially approved electrification plan, carbon pricing and monitoring mechanism, and utility creditworthiness (figure O.7).

High RISE scores are found in all geographic regions and income groups, suggesting there is plenty of scope to learn from peers. Most geographic regions have at least one country in the green zone, whether on energy access, energy efficiency, or renewable energy. Some emerging economies score in the green zone for both energy efficiency and renewable energy—notably China, Mexico and Romania. Some regional leaders may not be global achievers, but are paving the way within their region and should be recognized for this (table O.4).

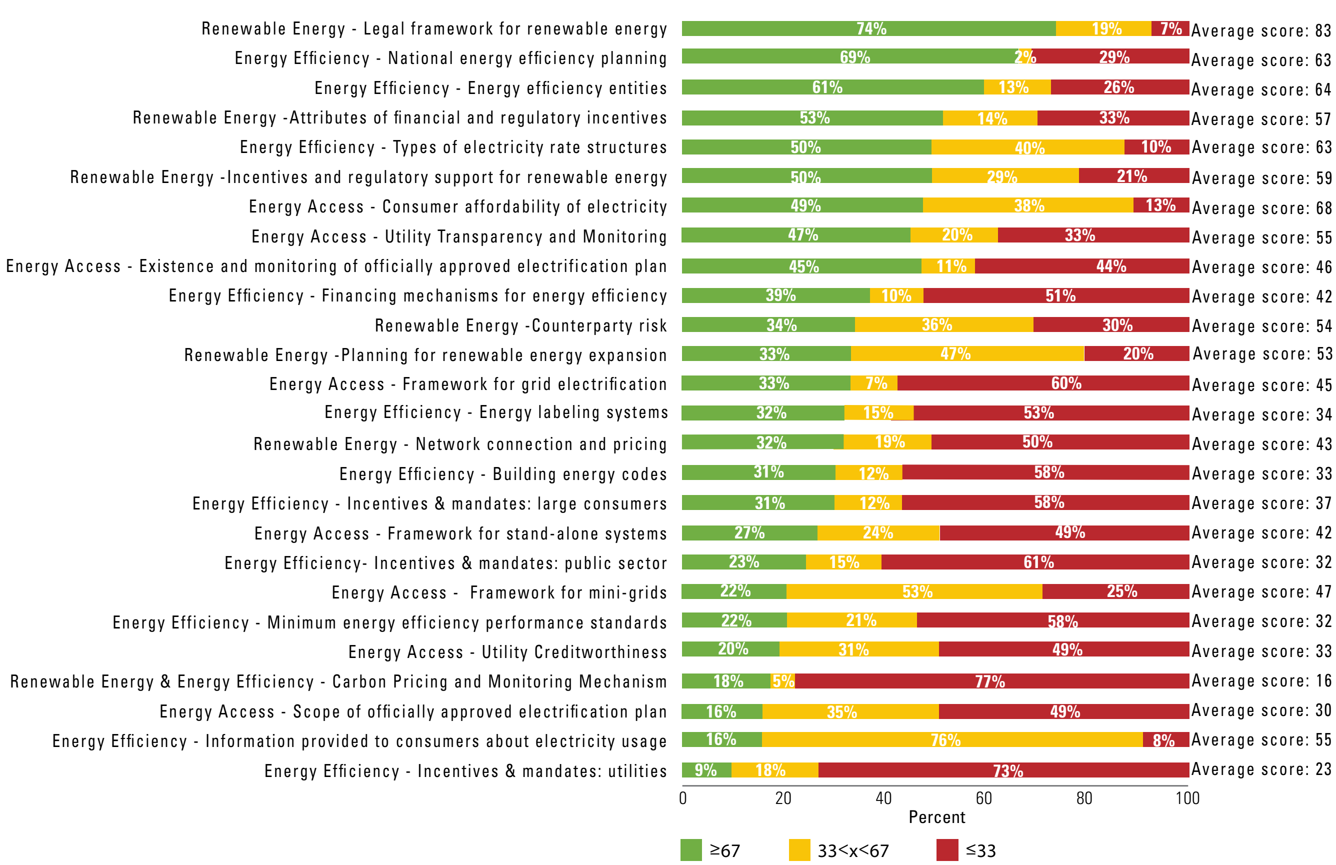
The progress on clean energy policy frameworks is strongly associated with income. The majority of high-income countries are in the green zone for both energy efficiency and renewable energy, the majority of middle-income countries are in the yellow zone, and the majority of low-income countries are in the red zone. Energy efficiency still appears as a domain of richer countries, and only Vietnam in the lower-middle-income group is in the green zone. Renewable energy sees a marked drop in scores between lower-middle-income and low-income countries, while for energy efficiency that drop occurs between upper-middle- and lower-middle-income countries. No low-income country is in the green zone for energy efficiency or renewable energy. In energy access, as the overwhelming majority of high- and

**TABLE O.3** Overall scores for the 10 highest access-deficit countries, the 10 highest energy consumers and the 10 highest energy suppliers

| Top 10 countries with highest electricity access deficit | RISE overall score | Energy access score | Top 10 countries with highest primary energy demand | RISE overall score | Renewable energy score | Top 10 countries with highest primary energy supply | RISE overall score | Energy efficiency score |
|---|---|---|---|---|---|---|---|---|
| India | Green | Green | China | Green | Green | China | Green | Green |
| Nigeria | Red | Red | United States | Green | Green | United States | Green | Green |
| Ethiopia | Yellow | Red | Russian Federation | Green | Yellow | Russian Federation | Green | Green |
| Bangladesh | Yellow | Green | India | Green | Green | India | Green | Yellow |
| Congo, Dem. Rep. | Yellow | Yellow | Japan | Green | Green | Japan | Green | Green |
| Tanzania | Yellow | Green | Canada | Green | Green | Germany | Green | Green |
| Kenya | Yellow | Green | Germany | Green | Green | Brazil | Green | Yellow |
| Uganda | Yellow | Green | Brazil | Green | Green | Korea, Rep. | Green | Green |
| Sudan | Red | Yellow | Indonesia | Yellow | Yellow | Canada | Green | Green |
| Myanmar | Yellow | Yellow | Iran, Islamic Rep. | Green | Yellow | France | Green | Green |

*Source:* RISE database, World Bank.

**FIGURE O.7** Aggregated RISE indicator scores for all subindicators, by percentage of countries scoring green




*Source:* RISE database, World Bank.

**TABLE O.4** Top scorers by region

| | Developing world | | | | | | High income OECD |
|---|---|---|---|---|---|---|---|
| | East Asia & Pacific | Europe and Central Asia | Latin America & Caribbean | Middle East & North Africa | South Asia | Sub-Saharan Africa | |
| Energy access[a] | Philippines 🟢<br>Cambodia 🟢<br>Indonesia 🟡 | *Not applicable* | Guatemala 🟢<br>Nicaragua 🟢<br>Peru 🟢 | *Not applicable* | India 🟢<br>Bangladesh 🟢<br>Sri Lanka 🟢 | Kenya 🟢<br>Uganda 🟢<br>Tanzania 🟢 | *Not applicable* |
| Renewable energy | China 🟢<br>Malaysia 🟢<br>Philippines 🟢 | Kazakhstan 🟢<br>Romania 🟢<br>Turkey 🟢 | Mexico 🟢<br>Brazil 🟢<br>Dominican Republic 🟡 | Jordan 🟢<br>UAE 🟢<br>Egypt 🟡 | Pakistan 🟢<br>India 🟢<br>Sri Lanka 🟡 | South Africa 🟢<br>Malawi 🟡<br>Kenya 🟡 | Denmark 🟢<br>Netherlands 🟢<br>Germany 🟢 |
| Energy efficiency | Vietnam 🟢<br>China 🟢<br>Thailand 🟡 | Romania 🟢<br>Russian Federation 🟢<br>Turkey 🟡 | Mexico 🟢<br>Ecuador 🟡<br>Colombia 🟡 | Tunisia 🟢<br>Iran, Islamic Rep. 🟡<br>UAE 🟡 | India 🟡<br>Sri Lanka 🟡<br>Pakistan 🟡 | South Africa 🟢<br>Kenya 🟡<br>Ghana 🟡 | United States 🟢<br>Denmark 🟢<br>Canada 🟢 |

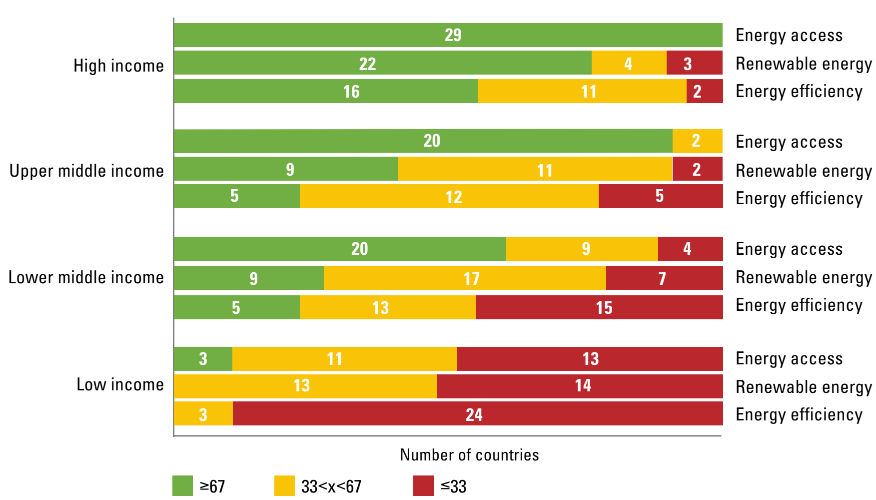
*Source:* RISE database, World Bank.
a. Does not include countries whose energy access policies were not assessed because of high electrification rates.

upper-middle-income countries have completed universal electrification, they are in the green zone. Nearly half of low-income countries are in the red zone, but Cambodia, Tanzania, and Uganda are in the green zone.

Progress in energy efficiency and renewable energy generally go hand in hand (figure O.8). There is a strong correlation between RISE scores for energy efficiency and renewable energy (figure O.9), suggesting that countries motivated to improve their policy environments for clean energy may consider both of these dimensions. Nevertheless, low- and lower-middle-income countries show a tendency to prioritize policies for renewable energy before those for energy efficiency, while among upper-middle- and high-income countries, attention shifts to improving energy efficiency policies. In these two clean energy pillars, the convergence is largely among a group of OECD countries, including Denmark, the Netherlands, Germany, Belgium, the United States, the United Kingdom, and Italy. These countries have taken many steps to support both renewable energy and energy efficiency. Mexico is the only developing country in the top 20 RISE scorers common to both the clean energy pillars.

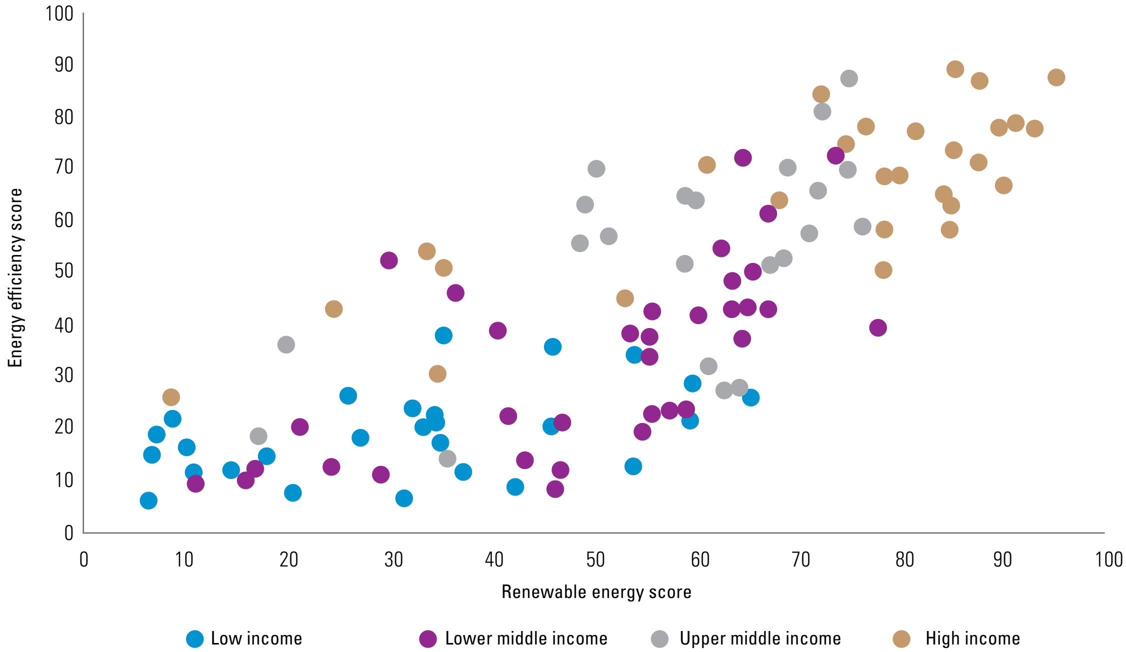
RISE scores show a generally positive relationship with a country's investment climate. The World Bank's Worldwide Governance Indicators (WGI) rule of law and regulatory quality indexes each measure perceptions of the extent to which rules (such as contract enforcement and property rights) are adhered to and the government's ability to design and implement policies

**FIGURE O.8** Aggregated RISE indicator scores for all pillars, by income and by number of countries scoring green




*Source:* RISE database, World Bank.

**FIGURE O.9** RISE energy efficiency and renewable energy scores




*Source:* RISE database, World Bank.

and regulations for private investment. In countries with a weak investment climate, sustainable energy policies alone may not be enough to mobilize investment. While RISE scores and the investment climate indicators show a positive correlation (table O.5), a handful of countries score notably better or worse on RISE than expected from the WGI indexes. In countries where general regulations are weak, it is likely that the policy elements measured by RISE are either inadequately implemented or insufficient to address more comprehensive barriers to investment. For example, Pakistan scores in the green zone for renewable energy, as does Russia for energy efficiency, while all score poorly on both WGI indicators. In such cases, the steps measured by RISE may need to be taken as part of a broader governance and policy reform agenda to scale up investment.

Similarly, the World Bank's *Doing Business* project measures business regulations and their enforcement through a suite of indicators, such as getting electricity and registering property. The better a country is ranked on *Doing Business*, the higher the RISE score (figure O.10). The same correlation is observed more specifically on the getting electricity indicator of *Doing Business*.

**TABLE O.5** Correlation between RISE and investment climate

| | WGI rule of law | WGI regulatory quality |
|---|---|---|
| RISE aggregate | 1.00 | 0.73 |
| RISE energy access | 0.61 | 0.58 |
| RISE energy efficiency | 0.71 | 0.69 |
| RISE renewable energy | 0.74 | 0.75 |

*Source:* RISE database, World Bank; WGI 2014.
*Note:* Correlation coefficient ranges from 0 (no correlation) to 1 (perfect correlation).

**FIGURE O.10** Association between RISE score and *Doing Business* ranking

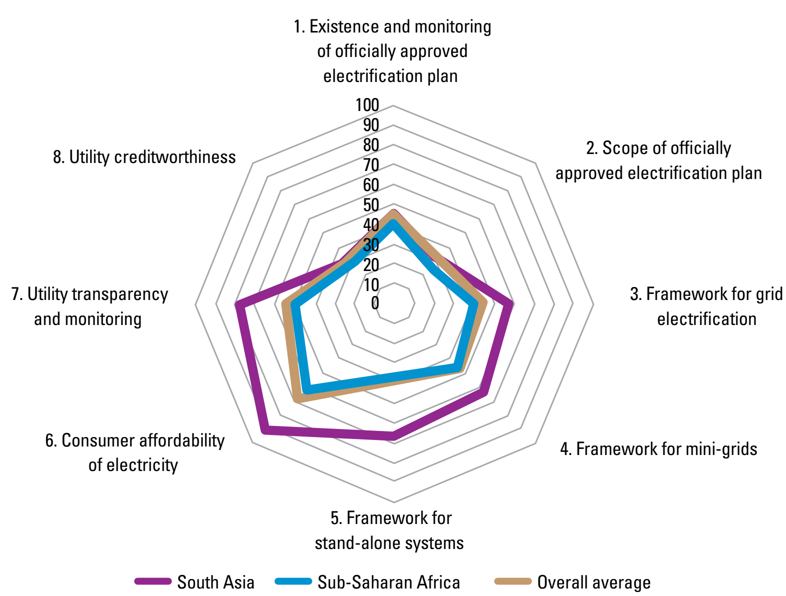

*Source:* RISE database and Doing Business, World Bank.

## KEY FINDINGS: RISE ENERGY ACCESS PILLAR

On almost all policy dimensions, Africa shows weaker policy frameworks than other access-deficit regions, particularly South Asia. This is a matter of concern since Africa has the largest electricity access deficit and its progress historically has been slower than other regions. Aside from the existence and monitoring of an approved electrification plan, where Sub-Saharan Africa has slightly higher scores than South Asia (the only other region with a wide electricity access deficit), the opposite is true on all other indicators. On the three indicators to measure progress in creating an enabling environment for the three supply options of grids, mini-grids, and stand-alone systems, South Asia scores in the green or yellow zone. For Sub-Saharan Africa, all the three average scores are in the yellow zone (figure O.11). But there are bright spots as a group of East African countries—Kenya, Tanzania, and Uganda—are leading efforts to create an attractive enabling environment across the three options.

While countries score highly for their electrification planning, the quality and coverage of the electrification plan often is limited. Only a few align with good practices such as inclusion of grid or off-grid, community and productive load, service quality standards, and geospatial maps. On this pillar, the indicator on the scope of officially approved electrification plan has the fewest countries in the green zone and has the lowest average score. Although a significant majority of countries have established an officially approved electrification plan, few align it with good practices, thus reducing

**FIGURE O.11** Average indicator scores on energy access




*Source:* RISE database, World Bank.

their scores. The highest-scoring indicator is consumer affordability of electricity, where all but seven countries are in the green or yellow zone. (On no other indicator is achievement more than 50.)

The 10 countries with the highest energy access deficit typically score quite well on RISE. But Ethiopia, Nigeria, and Sudan do not, and it is particularly important for these countries to make progress on policy frameworks for electrification. Large countries such as the Democratic Republic of Congo and Ethiopia can make progress by adopting, monitoring, and scoping an officially approved electrification plan—relatively low-hanging fruit. However, Nigeria—Sub-Saharan Africa's largest economy—is in the red zone in six of the eight indicators. The brightest light is India: though 250 million still live without electricity, it reports green on the eight indicators (table O.6).

Most of the 10 countries with the lowest electrification rate are in the red zone (table O.7). Tanzania is the only country in this group in the green zone. Some countries have more mixed outcomes (such as Burkina Faso, Burundi, and Malawi) with good results in planning but significant lags in establishing an environment to promote grid and off-grid solutions. Specifically, stand-alone home systems—a low-cost pre-electrification solution—offer an early opportunity for six countries in the red zone and two in the yellow zone, because all except Tanzania are in the red zone in establishing a framework for grid electrification.

**TABLE O.6** Energy access scores per indicator for top 10 countries with the highest access deficit

| | Energy access score | 1. Existence and monitoring of officially approved electrification plan | 2. Scope of officially approved electrification plan | 3. Framework for grid electrification | 4. Framework for minigrids | 5. Framework for stand-alone systems | 6. Consumer affordability of electricity | 7. Utility transparency and monitoring | 8. Utility creditworthiness |
|---|---|---|---|---|---|---|---|---|---|
| India | 84 | 80 | 75 | 100 | 77 | 69 | 100 | 96 | 76 |
| Nigeria | 22 | 0 | 0 | 17 | 35 | 22 | 100 | 0 | 0 |
| Ethiopia | 28 | 0 | 0 | 50 | 40 | 69 | 50 | 17 | 0 |
| Bangladesh | 68 | 80 | 25 | 33 | 74 | 80 | 100 | 100 | 54 |
| Congo, Dem. Rep. | 46 | 0 | 0 | 33 | 53 | 82 | 100 | 42 | 60 |
| Tanzania | 75 | 100 | 50 | 100 | 96 | 73 | 100 | 83 | 0 |
| Kenya | 82 | 100 | 50 | 67 | 66 | 93 | 100 | 96 | 86 |
| Uganda | 78 | 100 | 63 | 67 | 64 | 93 | 100 | 79 | 59 |
| Myanmar | 59 | 100 | 38 | 33 | 48 | 67 | 100 | 8 | 75 |
| Sudan | 35 | 0 | 0 | 100 | 35 | 11 | 50 | 50 | 38 |

*Source:* RISE database, World Bank.

≥67 33<x<67 ≤33

**TABLE O.7** Energy access scores per indicator for top 10 countries with the lowest electrification rate

| | Energy access score | 1. Existence and monitoring of officially approved electrification plan | 2. Scope of officially approved electrification plan | 3. Framework for grid electrification | 4. Framework for minigrids | 5. Framework for stand-alone systems | 6. Consumer affordability of electricity | 7. Utility transparency and monitoring | 8. Utility creditworthiness |
|---|---|---|---|---|---|---|---|---|---|
| South Sudan | 18 | 0 | 0 | 0 | 30 | 11 | 42 | 62 | 0 |
| Chad | 14 | 0 | 0 | 17 | 30 | 11 | 50 | 4 | 0 |
| Burundi | 45 | 0 | 0 | 17 | 48 | 11 | 100 | 87 | 100 |
| Malawi | 64 | 80 | 38 | 33 | 74 | 76 | 29 | 83 | 100 |
| Liberia | 20 | 0 | 0 | 17 | 30 | 56 | 0 | 25 | 36 |
| Central African Republic | 11 | 0 | 0 | 0 | 10 | 11 | 0 | 17 | 50 |
| Burkina Faso | 40 | 80 | 50 | 33 | 58 | 22 | 0 | 42 | 34 |
| Sierra Leone | 17 | 0 | 0 | 0 | 35 | 44 | 50 | 8 | 0 |
| Niger | 29 | 0 | 0 | 17 | 48 | 22 | 45 | 67 | 34 |
| Tanzania | 75 | 100 | 50 | 100 | 96 | 73 | 100 | 83 | 0 |

*Source:* RISE database, World Bank.

≥67 33<x<67 ≤33

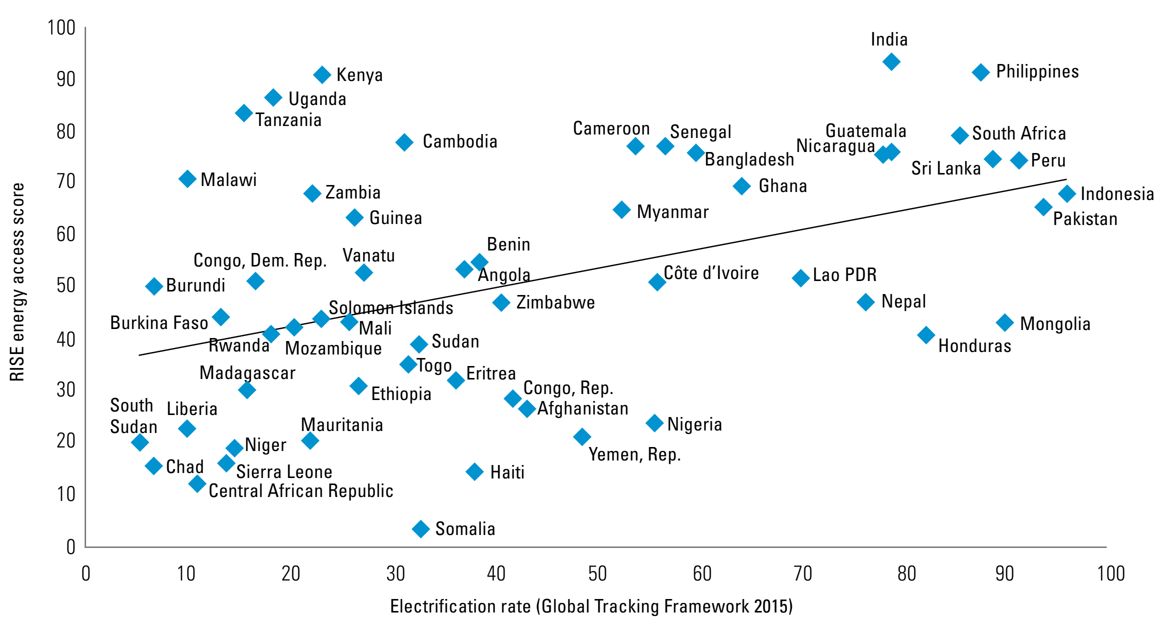
This result is consistent with the finding that the association is strong between a country's RISE score and its electrification rate (figure O.12). The top-left quadrant shows countries where, despite a high RISE score, electrification is low. This group includes many countries recently active in developing new policies for adopting good practices. It is hoped that the impact of these policy and regulatory changes will lead to faster progress and higher electrification rates in the future, something that will need to be monitored through the Global Tracking Framework that follows global progress on electrification. All countries bar one in this quadrant are in Sub-Saharan Africa, including those making substantial progress, such as Kenya, Tanzania, and Uganda. The top-right quadrant has countries with high RISE scores and high electrification rates. Countries such as India, the Philippines, South Africa, and Sri Lanka have introduced policies supporting electrification for decades and have benefited from the outcomes. The bottom-left quadrant has countries where RISE scores and electrification rates are low and substantial scope to adopt good practices exists. The bottom-right quadrant has relatively few countries where electrification rates are high alongside low RISE scores, and includes large countries such as Indonesia and Pakistan.

Many countries have moved ahead on creating an enabling environment for grids, but have paid much less attention to supporting the diffusion of minigrids and stand-alone systems. A little less than one-third of the countries are in the green zone for supporting grid electrification. The best scorers, such as Cambodia, India, South Africa, and Zambia, have set up a comprehensive legal and regulatory framework including funding, financing support to the payment of connection charges, and standards of performance. But a majority of countries score poorly, especially on defining standards of performance and supporting end-users to pay connection charges. Whereas only a quarter of the countries are in the red zone for minigrids, half are in that zone for stand-alone systems. Given the plummeting costs of solar home systems and their ability to provide first-tier electrification, this is an important missed opportunity. Good country examples are emerging, however, including Ghana, Kenya, and Uganda in stand-alone systems, and Senegal and Tanzania in minigrids.

Despite widespread concerns about the affordability of electricity tariffs, the RISE affordability indicator suggests that this problem may be less common than feared, with almost half the countries in the green zone and only 13 percent in the red zone. It appears, however, to be an issue in the 10 countries with the lowest electrification rate, where as many as 40 percent are in the red zone for affordability due to a mix of relatively high tariffs, with 60 percent of them having a tariff higher than US$0.15 per kilowatt hour (kWh) and relatively low incomes (on gross national income [GNI] per capita in 2015 ranging from US$250 in Malawi to US$1,010 in Chad).

Urban consumers can pay as little as US$22 to connect to grid electricity in Bangladesh but must pay more than US$500 in eight countries in Sub-Saharan Africa, based on data gathered to estimate administrative procedures. For rural consumers, the charge ranges from US$19 in Mali to more than US$500 in five countries. In countries with low connection costs, grid connection usually involves a simple hook up to the nearest distribution pole, and the customer does not incur the costs of any additional external connection works. About one-third

**FIGURE O.12** Association between RISE energy access score and electrification rate




*Source:* RISE database, World Bank.

of consumers in urban and rural areas pay US$100–200 to get a grid connection (figure O.13). The biggest driver of connection costs is capital investment for buying materials, including poles, cables, and transformers. Sub-Saharan Africa has the highest fees, in most cases because customers have to pay for electrical equipment (circuit breakers, meters, cables).

The average time to get an electricity connection is longer in rural areas (82 calendar days) than in urban areas (69 calendar days). In rural areas, the period ranges from three days in Sierra Leone to 589 days in Myanmar; in urban areas, from three days in Guinea to 323 days in Eritrea. In South Asia, it takes three times as long for rural customers to get a connection as urban end users. In Sub-Saharan Africa, the waiting time is about the same in urban and rural areas, averaging two and a half months. Delays in connecting to electricity can be caused by a multitude of factors at the utility, including shortage of materials and shortage of staff.

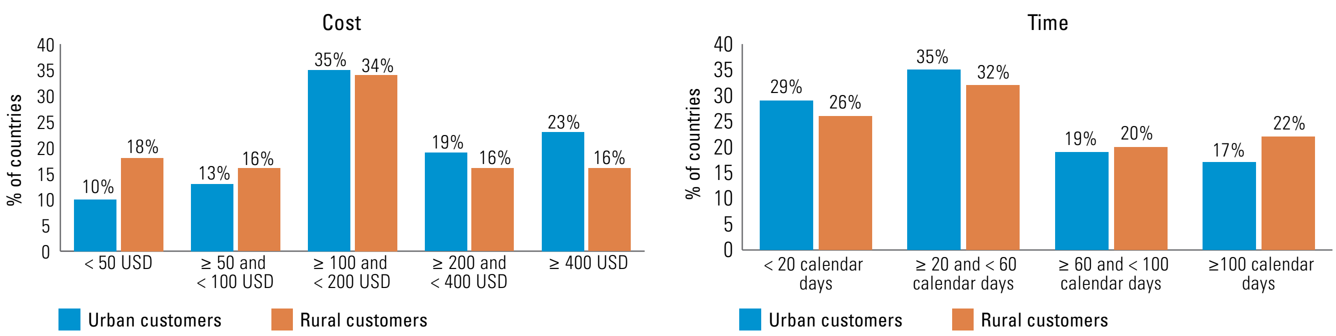
To establish a minigrid facility, it takes on average a year and half to obtain common permits and licenses (based on information recorded in 17 countries), ranging from 61 days in Madagascar to 4.3 years in Sri Lanka. The more common procedures to set up a minigrid include obtaining authorizations from public agencies and municipalities, submitting an environmental impact assessment, and obtaining a generation license. The less common procedures include obtaining land use permits, construction and building permits, indigenous peoples' rights approval, renewable energy incentive subsidy approvals, and power purchase agreements (PPAs). Minigrid developers undergo three procedures on average to obtain the necessary permits. The average cost of permits across 17 countries is US$1,982 (table O.8).

**TABLE O.8** Time and cost of setting up a minigrid, 17 countries

| | |
|---|---|
| **Time** | |
| Less than 6 months | Bangladesh; Congo, Dem. Rep.; Ethiopia; Guinea; Madagascar; Nepal |
| Between 6 months and 1 year | Afghanistan; Cambodia; Mali; Solomon Islands |
| Between 1 year and 2 years | Malawi; Senegal; Zambia |
| More than 2 years | Burkina Faso; Philippines; Sri Lanka; Uganda |
| **Cost (US$)** | |
| Less than 100 | Burkina Faso; Cambodia; Guinea; Mali; Senegal |
| Between 100 and 500 | Ethiopia; Madagascar; Nepal; Sri Lanka |
| Between 500 and 1,000 | Afghanistan |
| Between 1,000 and 5,000 | Bangladesh; Congo, Dem. Rep.; Solomon Islands; Uganda; Zambia |
| More than 5,000 | Malawi; Philippines |

*Source:* RISE database, World Bank.

**FIGURE O.13** Cost and time to get a household electricity connection




*Source:* RISE database, World Bank.

## KEY FINDINGS: RISE ENERGY EFFICIENCY PILLAR

Countries around the world are doing relatively well on some aspects of the enabling environment for energy efficiency but seem to be systematically neglecting others. Most countries are providing essential signals and information that consumers need to use electricity more efficiently and are putting in place the basic structures necessary to encourage energy efficiency. Well-scoring aspects include the provision of information about energy consumption to consumers, the issuance of energy efficiency plans, the designation of entities with institutional responsibility for energy efficiency, and the adoption of rising block tariff structures.

For six of the energy efficiency indicators, however, roughly 50–80 percent of countries fall into the lowest third of scores. Areas neglected in many countries include sectorally-targeted policies for large consumers, the public sector, and utilities; development of financing mechanisms; and adoption of minimum energy performance standards, appliance labels, and building codes. Some of these approaches can be challenging to implement and enforce, so the results are not surprising. But relatively straightforward, well-tested measures on energy standards and labels would allow many more countries to benefit from the savings they generate, suggesting that this may be a fruitful area for near-term action.

Looking across developing regions, the leading scorers are Europe and Central Asia, and the Middle East and North Africa; the lagging scorers are East Asia and Pacific, Latin America and the Caribbean, South Asia, and Sub-Saharan Africa. Europe and Central Asia shows markedly poor results in energy standards, and the Middle East and North Africa show good performance in every arena but utility energy efficiency. China's score in the green zone is evidence of progress through energy efficiency policy, as it is not only currently the world's largest energy consumer but also has achieved rapid improvement in its energy intensity since 1990 (Global Tracking Framework 2013). Also notable is the correlation of scores on the first two indicators (planning and entities), suggesting that countries tend to pair their strategic commitments with setting up implementing bodies. South Asia and Sub-Saharan Africa report results at the opposite end of the spectrum; the regions are not in the green zone on any of this pillar's indicators, and are in the red zone for most (table O.9).

While the highest scorers tend to be from wealthier countries and the lowest scores from poorer countries, there is considerable heterogeneity in performance among the groups. The high-income group has some members that score in the yellow zone (e.g., Sweden, Venezuela, and the UAE), while there are several middle-income group

**TABLE O.9** Regional average traffic light scores by energy efficiency indicator

| | East Asia & Pacific | Europe & Central Asia | Latin America & Caribbean | Middle East & North Africa | OECD high income | South Asia | Sub-Saharan Africa |
|---|---|---|---|---|---|---|---|
| Energy efficiency overall score | **35** | **55** | **40** | **46** | **72** | **32** | **22** |
| 1. Planning | 49 | 84 | 53 | 81 | 82 | 50 | 48 |
| 2. Entities | 64 | 91 | 64 | 77 | 82 | 65 | 42 |
| 3. Information | 56 | 55 | 58 | 54 | 66 | 54 | 49 |
| 4. Rate structures | 60 | 62 | 58 | 61 | 80 | 63 | 57 |
| 5. Large consumers | 40 | 46 | 37 | 53 | 64 | 33 | 13 |
| 6. Public sector | 28 | 60 | 27 | 38 | 68 | 4 | 8 |
| 7. Utilities | 19 | 43 | 25 | 22 | 36 | 24 | 9 |
| 8. Financing | 31 | 74 | 49 | 46 | 81 | 39 | 10 |
| 9. Standards | 22 | 24 | 40 | 34 | 76 | 23 | 8 |
| 10. Labels | 29 | 41 | 44 | 41 | 70 | 17 | 10 |
| 11. Buildings | 16 | 62 | 14 | 51 | 83 | 16 | 4 |
| 12. Carbon pricing and monitoring | 5 | 20 | 6 | 0 | 70 | 0 | 0 |

*Source:* RISE database, World Bank.

≥67 33<x<67 ≤33

members in the green zone (e.g., Romania, Vietnam and Tunisia). Still, well over half the high-income group and one-third of the upper-middle-income group score in the green zone, whereas more than four-fifths of the low-income group are in the red zone.

Robust administrative procedures to carry out monitoring, verification, and enforcement (MV&E) of energy standards and labeling are largely limited to developed countries. Appliance standards and labeling (S&L) programs set market rules to stimulate the production and purchase of more energy-efficient products. Central to the success of S&L programs are robust MV&E programs to ensure compliance tailored to domestic markets. Because of the diversity of approaches, it is not possible to directly compare the performance of countries against a single process that is relatively uniform across countries, but the survey did gather results on how national programs function in 23 countries with refrigerator S&L programs. Nearly half the surveyed countries use a product registration system to monitor entry conditions, and the same number (11) use government or third-party certified laboratories for testing (pre- or post-market). In many cases, having a refrigerator approved with testing in a third-party lab can be done in less than 30 days. RISE was unable to gather detailed data on market surveillance, because regulators consider this confidential, but did find that 13 of the surveyed countries conduct at least some spot testing. Only two countries, Australia and the United States, implement all three steps of the MV&E process.

## KEY FINDINGS: RISE RENEWABLE ENERGY PILLAR

Many elements of policy support for renewable energy are fairly common, including legal frameworks, planning, and generation incentives. The promulgation of renewable energy targets, for instance, is almost universal, and the majority of RISE countries have laws governing the sector and at least some financial or regulatory incentives for renewable power generation. The two areas that seem to be most systematically neglected are network connection and access, and carbon pricing and monitoring. Some more detailed or technical measures are also less common, as barely one-third of RISE countries use probabilistic modeling in generation planning; have conducted studies to evaluate the integration of variable renewables into the grid; or have undertaken systematic siting or zoning for renewable power generation. Even fewer ensure compensation to generators for delays in offtake infrastructure or curtailment.

Strong renewable energy policies can be found in all regions, although the Middle East and North Africa and Sub-Saharan Africa lag behind somewhat. While most high-income OECD countries score highly on every RISE renewable energy indicator, every region has at least one country with a renewable energy score in the green zone. But some indicators score much lower than others nearly everywhere and are seldom found in certain parts of the world. Supportive network policies are quite rare in both the Middle East and North Africa and Sub-Saharan Africa, while carbon pricing and monitoring are nearly nonexistent outside high-income OECD countries (table O.10).

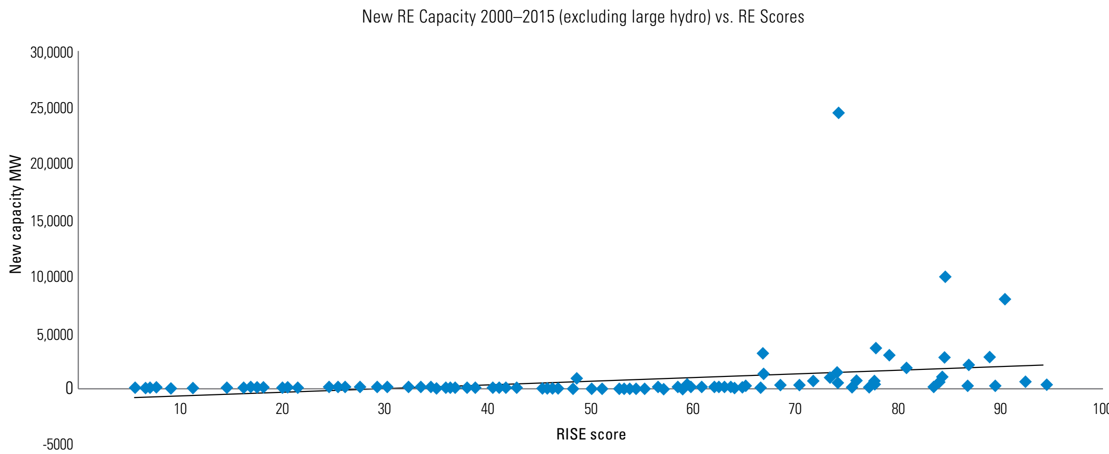
**TABLE O.10** Regional average traffic light scores by renewable energy indicator

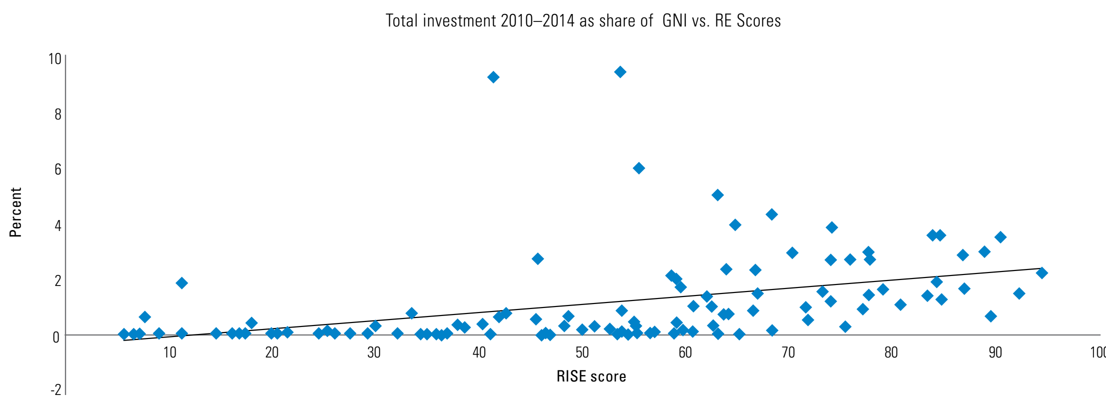
| | East Asia & Pacific | Europe & Central Asia | Latin America & Caribbean | Middle East & North Africa | OECD high income | South Asia | Sub-Saharan Africa |
|---|---|---|---|---|---|---|---|
| Renewable energy overall score | **53** | **58** | **51** | **45** | **83** | **53** | **35** |
| 1. Legal framework | 83 | 100 | 92 | 77 | 100 | 86 | 67 |
| 2. Planning | 49 | 52 | 59 | 58 | 70 | 62 | 39 |
| 3. Incentives and regulatory support | 57 | 60 | 65 | 54 | 77 | 71 | 46 |
| 4. Attributes of incentives | 66 | 70 | 55 | 44 | 86 | 63 | 37 |
| 5. Network connection and access | 50 | 58 | 44 | 28 | 83 | 47 | 16 |
| 6. Counterparty risk | 60 | 44 | 37 | 53 | 94 | 41 | 39 |
| 7. Carbon pricing and monitoring | 5 | 20 | 6 | 0 | 70 | 0 | 0 |

*Source:* RISE database, World Bank.

≥67 33<x<67 ≤33

**FIGURE O.14** RISE renewable energy score compared with renewable energy capacity added in 2000–15




*Source:* RISE database, World Bank; IRENA; Bloomberg New Energy Finance.
*Note*: Excluding large hydro and pumped storage.

**TABLE O.11** Overall renewable energy and indicator scores for countries by level of renewable energy capacity installed since 2000

| Economy | | Overall renewable energy score | Legal framework | Planning | Incentives | Attributes | Network policies | Counterparty risk | Carbon pricing |
|---|---|---|---|---|---|---|---|---|---|
| All countries | | 53 | 84 | 54 | 59 | 58 | 44 | 54 | 16 |
| Countries that have added non-hydro renewable energy capacity of: | < 10 MW | 31 | 60 | 38 | 37 | 30 | 12 | 38 | 0 |
| | 10–100 MW | 40 | 78 | 43 | 49 | 42 | 24 | 41 | 0 |
| | 100–1,000 MW | 59 | 98 | 63 | 74 | 74 | 50 | 49 | 3 |
| | > 1,000 MW | 78 | 98 | 69 | 75 | 82 | 81 | 84 | 58 |

*Source:* RISE database, World Bank.

≥67 33<x<67 ≤33

A threshold effect seems to be at play for the renewable energy policy environment and the amount of renewable generation capacity built in countries (figure O.14). In particular, there seems to be a threshold score of 60–70, below which countries are very unlikely to have developed more than a token amount of renewables. It also is clear that good policies alone do not guarantee investment. Many countries with scores above the threshold—and in some cases far above it—have seen little or no improvement.

Countries that have the most renewable energy (other than large hydropower) since 2000 tend to score higher on each RISE indicator. Countries that have developed at least 1,000 MW typically score 15–20 points higher on each indicator than the average across all RISE countries, and those with 100–1,000 MW score 20–30 points higher than those with less than 10 MW—except for carbon pricing and monitoring, which is nearly nonexistent in both groups (table O.11). As with top RISE scorers, the difference is notable particularly for network policies: countries that have added between 100 and 1,000 MW of renewable energy on average score 30 points higher than those adding less than 100 MW, and countries adding more than 1,000 MW score another 30 points higher.

Controlling for the size of a country's total generation capacity, it still appears that countries with higher RISE scores are more likely to have added greater shares of renewable energy to their power systems. The total installed capacity does not tell the whole story though, since it is as much a function of the overall size of the energy sector as a country's success in attracting renewable energy generation. Many RISE countries have relatively small power sectors, including some of those with the strongest policy frameworks. Some relatively low-scoring countries have seen meaningful levels of renewable energy development compared with the overall power sector, although these primarily are very small countries where a single (and sometimes government-funded) project can represent a significant share of the generation mix.

**TABLE O.12** Procedure time (days)

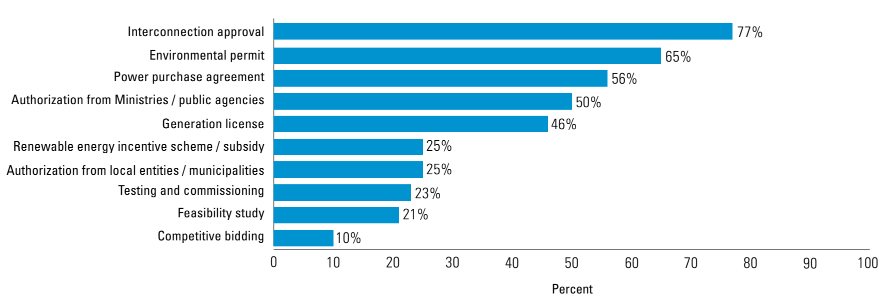
| Technology | 0–3 MW | 3–10 MW | 10–40 MW | 40+ MW | All (median) |
|---|---|---|---|---|---|
| Solar | 125 | 470 | 344 | 491 | **274** |
| Wind | N/A | 539 | 708 | 828 | **747** |
| Hydro | 774 | 924 | 518 | N/A | **755** |
| Overall* | 234 | 589 | 531 | 670 | **502** |

*Source:* RISE database, World Bank.
*Includes countries with no majority technology.

The relative importance of certain barriers to the deployment of renewable energy sources often changes as a market matures and the share of renewables in the power system rises. Any policy and regulatory environment will need to evolve to be effective, with some issues becoming more critical as the deployment of such sources increases.[11] For RISE, this means that some elements are important at all stages of deployment—if they are not present, deployment at any scale is unlikely—while others may always be beneficial, but are unlikely to present a major barrier to investment in countries where the renewable energy sector is in its initial stages. For example, 98 percent of countries that have added more than 100 MW in renewable energy since 2000 have primary legislation governing renewable energy (against 51 percent of countries with less than 10 MW added and 76 percent of countries overall), and 96 percent currently have in place at least one incentive or procurement mechanism to support renewable energy generation. By contrast, far fewer (57 percent) have conducted an integration study, but the likelihood that one has been carried out is much greater for countries with considerably greater development of the sector (69 percent of countries with more than 1,000 MW of capacity addition, and more than 80 percent of countries where wind and solar power make up at least 5 percent of the generation mix).
There is substantial variability in time and number of procedures required to set up a grid-connected renewable facility, among the 190 projects RISE surveyed.
The average permitting time for all countries is 502 days (table O.12), or around 1.5 years; 50 percent of all countries range between 194 and 646 days. Permitting time varied from as little as 34 days in Ukraine to over five years in Honduras. This disparity is explained in part by the nature of the projects surveyed: the projects in the Ukraine are solar and averaged 0.2 MW, and required six procedures, while hydropower projects in Honduras averaged 4.5 MW and had four procedural steps. (The number of procedures was not found to be indicative of permitting time.)

The number of procedures necessary to set up a grid-connected renewable energy facility ranges from two in the Netherlands to 17 in Russia. Reporting five to seven

**FIGURE O.15** Procedure types (percentage of countries)




*Source:* RISE database, World Bank.

procedures was most common—52 percent of countries fall into this range, while 88 percent of countries reported three to nine procedures. Interconnection approval is the most common procedure type (figure O.15). All types of permits were found across all technologies. Environmental permits, however, were less common for solar projects because many solar projects were much smaller (50 percent under 1.5 MW) than their wind and hydropower counterparts.

## LOOKING AHEAD

This first snapshot of the global policy environment for sustainable energy reveals a world on the move. The majority of countries have taken at least some significant measures to begin to improve their regulatory frameworks, and 40 percent of them are scoring fairly well. While the high-income countries are leading the pack, almost half the countries in the green zone are emerging economies, typically the larger middle-income countries across all continents, and there are good examples to be studied in every neighborhood. The high-impact countries representing the largest contribution to the global challenge on sustainable energy for all are, for the most part, demonstrating a real commitment to creating the right kind of policy environment.

Much remains to be done, however. Countries tend to begin with some of the more straightforward aspects of sustainable energy policy, such as legislation and planning, and the quality of these plans does not always stand up to scrutiny. Even among countries embracing the clean energy agenda by making progress with renewable energy, there seems to be a systematic neglect of creating a supportive policy environment for energy efficiency. Moreover, several of the neglected policy areas for energy efficiency, such as performance standards and appliance labels, are not that difficult to implement. There is a striking reluctance to develop efficiency incentives for power utilities—the central energy actors in most countries. On energy access, Sub-Saharan Africa, by far the world's highest energy access-deficit region, systematically lags behind South Asia on almost all dimensions of the policy environment. Unfortunately, the bulk of countries with the lowest electrification rate—under 20 percent—are in the red zone on energy access, indicating that they have barely begun to grapple with this serious development issue.

RISE puts a new tool in the hands of policymakers eager to advance the sustainable energy agenda. By providing an objective characterization of a sound sustainable energy policy environment and by benchmarking the full range of global outcomes, RISE hopes to contribute to the process of helping countries set policy agendas. RISE helps pinpoint where a country needs to make progress, identify peers who may have experience to share, and provide a supporting wealth of resources on the details of the underlying policies adopted. Future RISE reports will make it possible to examine progress over time.

RISE is a live initiative expected to be updated every two years to ensure an accurate reflection of policy developments in the sustainable energy sector with an aim to quantify why RISE matters. Over the next editions, the time series will allow countries to benchmark their progress on adapting and customizing policy measures tailored to their strengths and weaknesses, and to compare themselves with their peers. With successive editions of RISE and the Global Tracking Framework, it will be possible to evaluate the relationship between policy frameworks and investments in the energy sector. Of primordial importance remains the need to quantify this relationship: continually testing and refining indicators as they can be correlated with results, raising the bar in policy space, and testing methodologies to evaluate relationships between policies and results.

## NOTES

1. SDG targets: 1: By 2030, ensure universal access to affordable, reliable, and modern energy services. 2: By 2030, increase substantially the share of renewable energy in the global energy mix. 3: By 2030, double the global rate of improvement in energy efficiency. 4: By 2030, enhance international cooperation to facilitate access to clean energy research and technology (including renewable energy, energy efficiency, and advanced and cleaner fossil-fuel technology), and promote investment in energy infrastructure and clean energy technology. 5: By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states, and land-locked developing countries, in accordance with their respective programs of support.
2. The two other SEforALL knowledge products are the Global Tracking Framework and the Multi-Tier Framework of Energy Access.
3. http://www.worldbank.org/content/dam/Worldbank/document/Energy/SEforALL/SEforALL-Finance-Committee-2014-06-01-Final.pdf.
4. Development of indicators for modern cooking solutions has been excluded in this report and will be considered for the next edition of RISE.
5. A number of other factors affect investments, for instance, rule of law, property and contractual rights, strength of local capital markets, macroeconomic situation, and political stability.
6. OECD 2007.
7. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/09/27/000158349_20120927081935/Rendered/PDF/wps6211.pdf.
8. Armenia, Chile, Denmark, Ethiopia, Honduras, India, Kenya, Liberia, Maldives, Mali, Mongolia, Nepal, the Solomon Islands, Tanzania, the United States, Vanuatu, and the Republic of Yemen.
9. Apart from the Democratic People's Republic of Korea; Papua New Guinea; and Taiwan, China.
10. The *Doing Business* project that inspires RISE has analyzed several ways of weighting indicators but they have proved inconclusive, and so it has not proceeded with weighting. There is an implicit weighting in the sense that one indicator can have two subindicators with 50 percent weight while another indicator may have five subindicators with 20 percent weight. For this reason, the RISE website allows users to manually adjust the weights of the individual indictors most relevant to them, and see the scores change in response.
11. Analysis by the International Energy Agency (IEA) has addressed this changing policy context in terms of a policy journey as deployment grows and costs and prices fall and converge with international norms. It has identified three main phases: inception, take-off, and mainstreaming. The policy priorities differ: initially a very secure investment climate is needed to encourage early investors, and an appropriate regulatory framework must be put in place; once deployment takes off the emphasis shifts to encouraging cost reduction and to managing support costs; in the mainstreaming phase, physical and market integration become the key challenges. IEA 2011. "Deploying Renewables—Best and Future Policy Practice." http://www.iea.org/publications/freepublications/publication/Deploying_Renewables2011.pdf. IEA. 2015. "Insights Paper: Enabling Renewable Energy and Energy Efficiency Technologies: Opportunities in Eastern Europe, Caucasus, Central Asia, Southern and Eastern Mediterranean." http://www.iea.org/publications/insights/insightpublications/EnablingRenewableEnergyandEnergyEfficiencyTechnologies.pdf.

# CHAPTER 1
# METHODOLOGY

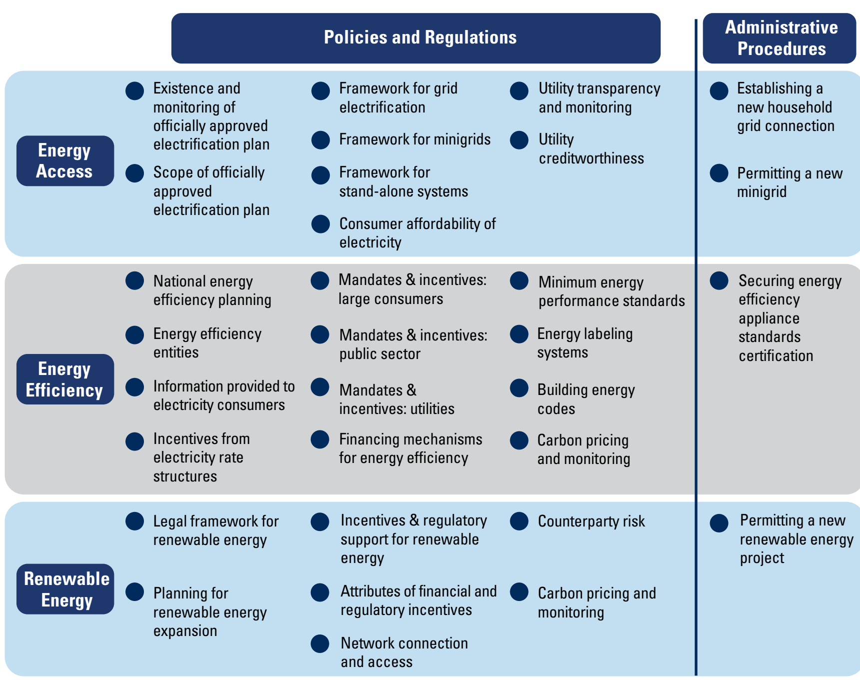
RISE is a snapshot of policies and regulations in the energy sector encapsulated in a suite of indicators in the three pillars of energy (electricity) access,[1] energy efficiency, and renewable energy. The primary focus of RISE—as a tool for policymakers—is to identify areas where energy sector policies can strengthen support for sustainable energy, and to help countries make progress toward national and global objectives. As a resource for governments, investors, researchers, and civil society, RISE has been designed to be easily replicable, facilitating its spread to new countries and ensuring that data updates and future editions generate a meaningful time series of core information. RISE will not be static, however, as the indicators and methodologies are envisaged to be easily adaptable to reflect the evolution of sustainable energy technologies and good practice policies to support them.

This 2016 global rollout edition of RISE comprises a set of 27 scored indicators (figure 1.1), each composed of one or more subindicators, many of which in turn are built up from more detailed (often binary yes or no) questions. The indicators score countries across the major areas of sustainable energy, including high-level targets and strategies; incorporation of sustainable energy into broad sector planning and primary legislation; regulations, incentives, and programs aimed at attracting investment and development in each pillar; and energy policy decisions or sector characteristics, such as the transparency and performance of key power utilities and the cost (and availability) of access to transmission and distribution (T&D) lines.

This chapter outlines the methodology behind the indicators (scoring principles, geographic coverage, data collection and validation, and selected grouping variables) and discusses the rationale for them, while chapters 2–4 present the indicators' scores in detail, by pillar. These four chapters form the bulk of this document.

RISE also has collected a wealth of unscored information, in two categories. First are administrative procedures—the time, cost, and processes required to implement key sustainable energy activities such as getting a new household connection, setting up a minigrid facility, establishing an on-grid renewable energy project, and certifying an appliance for energy efficiency. These administrative procedures are discussed in chapter 5. Second, RISE has collated metrics in the energy sector that provide a context for understanding how and why countries have adopted certain practices, including information on the power sector structure, key companies and institutions, generation data, and tariff schedules. The full list of collected data points is shown in appendix 2. The entire dataset for all RISE countries is on the RISE website.

**FIGURE 1.1** RISE indicators for the 2016 global rollout




*Source:* RISE Team.
*Note:* Administrative procedures were not scored.

Each area encompasses a tremendous range of detailed policies, and the precise design of each should reflect the specific risks, opportunities, and priorities in a country. The objective of RISE requires that indicators balance depth of information with relevance and comparability across countries and over time. In order to achieve this comparability, and ensure RISE provides actionable guidance to energy sector policy-makers, all RISE indicators were designed according to the specific principles outlined in figure 1.2. It is important to be clear that RISE does not score how well a particular policy is designed to address the specific objectives or risks in the country where it is found, nor does it include a qualitative evaluation of a policy's implementation. This is not because these issues are unimportant —they matter tremendously to a policy's ultimate success—but because evaluating them would require applying criteria that are either country-specific or subjective. In particular, such details of design and implementation are more likely to be distinguishing factors in the strength of a country's policy frameworks for countries with most or all of the policies measured by RISE in place—that is, those with the highest scores.

RISE data includes only those measures legally in force for existing and new entrants to a market, as of December 2015, with additions and updates incorporated periodically on the RISE website. Policies expired or in draft, and those applying exclusively to existing projects or entities, are noted but do not count in the scoring.[2]

## SCORING PRINCIPLES

### Calculating scores

All indicator and subindicator scores are calculated on a scale of 0–100, with 100 representing the best score. All indicators are weighted equally, with the total score for each pillar the average score of each indicator. Likewise, the score of each indicator is the simple average of the scores of its component subindicators, and each subindicator score reflects the average score for each question within that subindicator. Most individual questions are formulated in a binary yes or no form. Questions with quantitative answers, such as the financial ratios of selected utilities, are scored either on a straight sliding scale or based on predetermined thresholds.

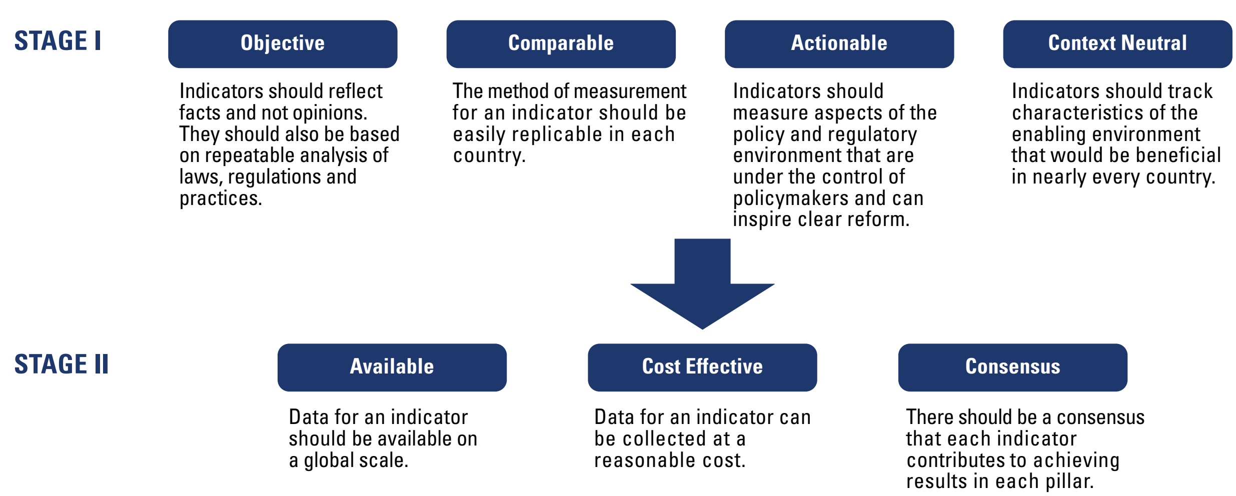
The equal weighting approach does not mean that all indicators are equally important: one policy decision measured by RISE may be critical to support investment while another might provide only a minor added incentive. However, when the indicators were developed, it was apparent that the relative importance of the policy decisions—and by extension, each RISE indicator, subindicator, or question—was influenced by factors specific to an individual country, including the size and maturity of the market for sustainable energy, the strength and structure of the power sector, and external political and economic risks. Thus there was no clear consensus on specific indicators or subindicators that should in all cases receive greater or lesser weighting. For this reason, RISE website users can manually adjust the weights of individual indictors as most relevant to them, and can see the scores change in response. However, due to differences in the number of subindicators within each indicator (and the number of questions within each subindicator), certain questions or subindicators may contribute more than others to the overall final score. Box 1.1 provides examples of how individual country scores have been calculated for three indicators, and the instructions for calculating each indicator are presented later in this chapter.

### Traffic lights

Pillar and indicator scores are grouped into three categories, based on a traffic light system, where green represents the highest scores, red the lowest, and yellow in between. For the overall and pillar results, scores in the upper and lower half of each color group are shaded to represent the wide range of country performances within them.

- Green: Scores between 67–100. Many or most elements of a policy framework to support sustainable energy are in place
- Yellow zone: scores between 34–66. Some supportive policies are in place, but opportunities exist to form a comprehensive policy framework
- Red zone: scores between 0–33. Few or no elements of a supportive policy framework have been enacted

**FIGURE 1.2** Guiding principles




*Source:* RISE Team.

## Box 1.1 Calculating indicator scores: three examples

For most RISE indicators, a country's score is the simple average of the score of each component subindicator, and the score of each subindicator is the average of its component questions.

**Example 1: Energy access, Indicator 1: Malawi.** Malawi has an officially approved electrification plan, last updated in 2013, that specifies a time frame for electrification. The plan is not publicly available. Malawi scores 80 on this indicator, in the green zone, calculated as follows:

| Indicator 1. Existence and monitoring of officially approved electrification plan | Score/Answer 80 |
|---|---|
| Subindicator 1. Existence | **100** |
| 1.1 Is there an officially approved national electrification plan? | Yes = 100 |
| Subindicator 2. Public availability of electrification plan | **0** |
| 2.1 Are the electrification plan and the updates publicly available? | No = 0 |
| Subindicator 3. Regular update of electrification plan | **100** |
| 3.1 When was the last update of the electrification plan? | < 5 years = 100 |
| Subindicator 4. Entity responsible for tracking progress of electrification plan | **100** |
| 4.1 Is there an institution responsible for tracking the plan progress? | Yes = 100 |
| Subindicator 5. Time frame | **100** |
| 5.1 Is there a time frame defined for electrification plan? | Yes = 100 |
| Indicator score = 80 ● | **400/500 = 80%** |

Other indicators include subindicators with multiple questions, or the same question asked across multiple sectors: for example, RISE investigates whether there are energy efficiency requirements and incentives for utilities in generation (Gen.), T&D, and demand-side management (DSM), and assesses the presence of seven different possible mechanisms to help them recover costs. In some cases—like subindicator 19 below—the score for each question is the average for each sector and question; in others, like subindicator 20, a certain threshold number of mechanisms must be in place to receive a full score (in this case, three); fewer than three mechanisms receive a partial score, while no mechanisms results in a score of 0.

**Example 2: Energy efficiency, Indicator 7: Kenya.** Kenya has set a requirement for the national distribution company, Kenya Power, to reduce technical losses and carry out DSM activities, with progress tracked by the Energy Regulatory Commission. Some of the program's costs are passed through to customers' electricity bills. Kenya scores 58 on this indicator, in the yellow zone, calculated as follows:

| Indicator 7. Mandates and incentives: Utilities | | | Score/Answer 58 |
|---|---|---|---|
| Subindicator 19. Mandates for utilities | | | **66.7** [200/3] |
| | Gen. | T&D | DSM = Score |
| 19.1 Are utilities required to carry out energy efficiency activities? | No | Yes | Yes = 50 [25x2] |
| 19.2 Are there penalties in place for noncompliance with energy efficiency requirements? | No | Yes | Yes = 50 [25x2] |
| 19.3 Are energy savings or other target indicators measured to track performance in meeting energy efficiency requirements? | No | Yes | Yes = 50 [25x2] |
| 19.4 Are the requirements measured or validated by an independent third party? | No | Yes | Yes = 50 [25x2] |
| Subindicator 20. Cost-recovery mechanisms for utilities | | | 50 [1-2 mechanisms in place] |
| 20.1 Are any of the following mechanisms available for utilities to recover costs associated with or revenue lost from mandated energy efficiency activities: | | | |
| • Public budget financing | | | No |
| • Compensation for revenue losses from energy efficiency activities via a tracking account | | | No |
| • Revolving funds and/or credit lines for energy efficiency activities | | | No |
| • Partial risk guarantees | | | No |
| • Program cost recovery | | | No |
| • Energy service companies | | | Yes |
| • On-bill financing/pre-payment | | | Yes |
| Indicator score = 58 ● | | | **(66.7 + 50)/200 = 58.4%** |

*(continued)*

**Box 1.1 Calculating indicator scores: three examples** *(continued)*

Other indicators include questions that only apply in specific cases. For example, certain attributes of renewable energy policies are only relevant to some types of policies: regulations that modify tariff levels over time to account for technology cost reductions only make sense if tariffs are set by mandate in the first place; and provisions to discourage unrealistically low bids are only relevant if competitive bidding exists. In these cases, attributes only relevant to policies not present in a country are recorded as not applicable and do not affect the score. For attributes that may apply to multiple incentives or programs, a country receives a yes if it is a feature of any of them.

**Example 3: Renewable energy, Indicator 4: Uganda:** Uganda has a feed-in tariff program for renewable energy projects under 20 MW, and has held competitive tenders for solar power. Project developers are required to meet specific timelines and the tariff is denominated in U.S. dollars. The level of the feed-in tariff is adjusted over time, and auctions include pre-qualification requirements. The cost of the program is not, however, passed on to the consumer in the retail tariffs. Uganda scores 67 on this indicator, in the green zone, calculated as follows:

| Indicator 4. Attributes of financial and regulatory incentives | Score/Answer 67 |
|---|---|
| Subindicator 9. Predictability and efficiency (policy-neutral) | **100** [33.3x3] |
| 9.1 Is the market entry mechanism for private renewable energy projects defined (for example, first-come, first-served, tenders)? | Yes = 33.3 |
| 9.2 Are projects subject to development timelines or milestones? | Yes = 33.3 |
| 9.3 Are tariffs indexed (in part or in whole) to an international currency or to inflation? | Yes = 33.3 |
| Subindicator 10. Predictability and efficiency (policy-specific) | **100** [300/3] |
| 10.1 If there is a guaranteed tariff, are there rules governing how prices are modified over time for new entrants (e.g., declination)? | Yes = 100 |
| 10.2 If there is a guaranteed tariff, do tariff levels differ based on the size of the generation plant? | Yes = 100 |
| 10.3 If there is competitive bidding or auctions, are there provisions to discourage unrealistically low bids (bid-bonds, project milestones, eligibility requirements)? | Yes = 100 |
| 10.4 If there is a renewable purchase obligation, can it be met with tradable certificates (including RECs, ROCs, TECs)? | Not applicable (no purchase obligation) |
| Subindicator 11. Sustainability | **0** |
| 11.1 Is the renewable energy price subsidy/benefit passed through to the final electricity consumer? | No = 0 |
| Indicator score = 67 ● | (100 + 100 + 0)/300 = 66.7% |

## GEOGRAPHIC COVERAGE

### Selection of countries

The 2016 global rollout of RISE covers 111 countries (table 1.1), representing 96 percent of the global population, 91 percent of global energy consumption, and 97 percent of unelectrified people, selected on the basis of the following criteria:

- The SEforALL top 50 high-impact countries for each pillar (countries where support for energy access, energy efficiency, or renewable energy could provide the greatest contribution to SEforALL's global goals).[3]
- The 78 SEforALL opt-in countries with a population greater than 5 million (to capture additional countries where governments have indicated an interest in supporting sustainable energy and whose contribution will have a significant global impact).

Specifically, the RISE assessment on energy access was carried out on a subset of 55 countries where an access deficit exists, with the remaining 56 countries having reached universal electrification (or close to it).

### Location of analysis

The unit of analysis in RISE is a country. Many questions therefore address national sustainable energy policies. However, some policies are set at the state or even municipal level. To address this, RISE has adopted the methodology developed by the World Bank's *Doing Business Report*, with data and scores reflecting the perspective of the largest business city in each country. The methodology for choosing the selected utility is as follows:

- **Generation:** the largest generation entity in the country by installed capacity.
- **Transmission:** the largest transmission provider in the country by units of electricity transmitted.
- **Distribution without retail sales:** the largest distribution entity in the largest city by units of electricity sold.
- **Distribution with sales/unbundled retail sales:** the largest entity in the largest city by number of customers.

### Deep dive pilot

Results from the largest city rarely represent the entire country, particularly large countries where regions or states have wide policy autonomy. To capture the magnitude of such regional differences on RISE scores, this 2016 edition includes a pilot deep dive exercise that looks at multiple locations in three large and politically or economically diverse countries: Brazil, India, and the United States.

In each country, the survey was completed in three regions. One was selected using the standard methodology, that is, the state with the country's largest business city. As the largest city often coincides with a particularly high-income region of a country,

**TABLE 1.1** The 111 countries in RISE, 2016 edition

| Sub-Saharan Africa | East Asia & Pacific | Latin America & the Caribbean |
|---|---|---|
| Angola | Cambodia | Argentina* |
| Benin | China* | Bolivia* |
| Burkina Faso | Indonesia | Brazil* |
| Burundi | Lao PDR | Colombia* |
| Cameroon | Malaysia* | Domenican Republic* |
| Central African Republic | Mongolia | Ecuador* |
| Chad | Myanmar | Guatemala |
| Congo, Dem. Rep. | Philippines | Haiti |
| Congo, Rep. | Solomon Islands | Honduras |
| Côte d'Ivoire | Thailand* | Mexico* |
| Eritrea | Vanuatu | Nicaragua |
| Ethiopia | Vietnam* | Peru |
| Ghana | **South Asia** | Venezuela, RB* |
| Guinea | Afghanistan | **Middle East & North Africa** |
| Kenya | Bangladesh | Algeria* |
| Liberia | India | Bahrain* |
| Madagascar | Maldives* | Egypt, Arab Rep.* |
| Malawi | Nepal | Iran, Islamic Rep.* |
| Mali | Pakistan | Jordan* |
| Mauritania | Sri Lanka | Kuwait* |
| Mozambique | **OECD High Income** | Lebanon* |
| Niger | Australia* | Morocco* |
| Nigeria | Austria* | Qatar* |
| Rwanda | Belgium* | Saudi Arabia* |
| Senegal | Canada* | Tunisia* |
| Sierra Leone | Chile* | United Arab Emirates* |
| Somalia | Czech Republic* | Yemen, Rep. |
| South Africa | Denmark* | **Europe & Central Asia** |
| South Sudan | Finland* | Armenia* |
| Sudan | France* | Belarus* |
| Tanzania | Germany* | Kazakhstan* |
| Togo | Greece* | Kyrgyz Republic* |
| Uganda | Italy* | Romania* |
| Zambia | Japan* | Russian Federation* |
| Zimbabwe | Korea, Rep* | Tajikistan* |
| | Netherlands* | Turkey* |
| | Poland* | Ukraine* |
| | Spain* | Uzbekistan* |
| | Sweden* | |
| | Switzerland* | |
| | United Kingdom* | |
| | United States* | |

*Source:* RISE Team.
* Energy access policies were not assessed in countries where less than 10% of the population and fewer than 1million people lack access to electricity.

the other two were chosen to represent a medium- and a low-income region with enough people to be somewhat representative of the whole country. In each country, RISE selected the state with the lowest and the median per capita income among those with the 10 largest populations (table 1.2). (The results of each pillar's deep dive are in appendix 4.) Only the region with the largest city contributed to the country's scores.

**TABLE 1.2** The three large and diverse countries assessed by RISE's deep dive

| Country | State with largest city | State with median per capita income (among top 10 pop'n) | State with lowest per capita income (among top 10 pop'n) |
|---|---|---|---|
| Brazil | São Paulo | Minas Gerais | Maranhão |
| India | Maharashtra | Andhra Pradesh | Bihar |
| United States | New York | Pennsylvania | Florida |

*Source:* RISE Team.

## DATA COLLECTION AND VALIDATION

The majority of RISE data was collected and provided to the World Bank by local energy experts within each country (appendix 6). The experts were guided by a detailed questionnaire developed by the RISE team (available in RISE website). Most questions were binary or multiple choice with a box ticked for each policy or attribute in place. Questions that required direct text entry were limited to numbers, names, and (for occasional nonscored questions) brief descriptions of a policy or program.

The answers for all questions were found from primary source documents (wherever possible) that, to be accepted, must have been original laws, regulations, government plans and strategies, or otherwise officially endorsed or legally in force. Secondary reports and analyses were not considered sufficient. Where no such documentation could be found, either because the policy or regulation in question does not exist or the codifying documents are not publicly available, answers were found through interviews with government officials or other high-placed stakeholders within the country's energy sector. A minimum of two interviewees providing the same answer typically was required for an answer to be counted.[4] (Interviewees were given the option to be listed as a contributor to RISE: appendix 6.)

Along with the submission of the questionnaire, country experts were required to provide a copy of the source documentation used to justify answers, with a citation (and translation if required) of the language used. The RISE team reviewed the documentation for each answer to ensure that the intent of the question was understood and the documents were interpreted correctly. Interview answers were reviewed for internal consistency and for coherence with known elements of each country's energy sector and policies. After the initial internal validation of each data point by the RISE team, each country's data were reviewed by the World Bank team working in that country, and revised further if necessary. In countries without World Bank programs—primarily high-income country members of the Organisation for Economic Co-operation and Development (OECD)—the data were reviewed by independent experts with wide experience in the region.

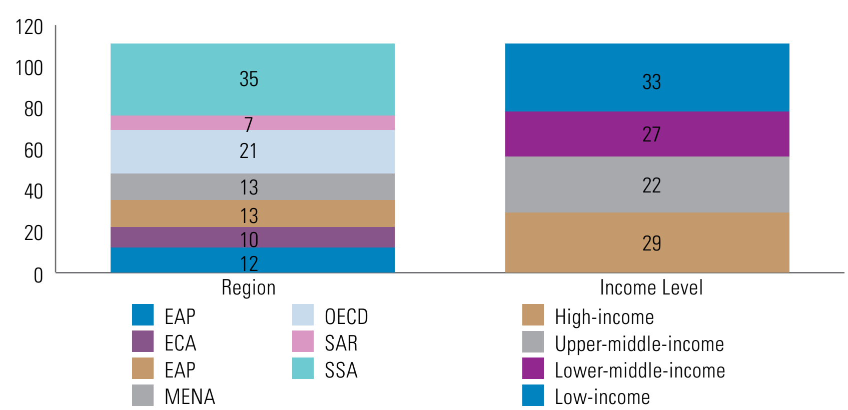
## GROUPING VARIABLES

As part of the analysis of RISE results, each pillar chapter (2, 3, and 4) occasionally groups countries by grouping variables—region, income, and SEforALL high-impact and fragile countries—to highlight features in the data, such as regional trends or comparisons among similar countries. These variables also reveal preliminary correlations between RISE scores and certain types of results, for example, by showing scores across countries with access rates in a certain range, or a certain track record attracting investment in renewable energy.

### Region

RISE countries are categorized in seven regional groups. Six are the primary regional designations of World Bank clients: East Asia and the Pacific, Europe and Central Asia, Latin American and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa. The seventh group consists of high-income OECD countries (table 1.1). Four countries—Chile, the Czech Republic, Poland, and Romania—are high-income OECD members and officially assigned to a World Bank region, but for all RISE analysis Chile, the Czech Republic and Poland are regarded as only in the high-income OECD group and Romania is regarded as only in the ECA region.

**FIGURE 1.3** RISE countries by regional and income groups




*Source:* RISE database, World Bank.

### Income

Each country is classified by its official World Bank lending group classification for fiscal year 2016 (figure 1.3), determined by threshold levels of per capita gross national income as calculated using the World Bank Atlas method.

### High-impact and fragile countries

For each pillar, RISE assessed performance in countries where progress toward the relevant SEforALL objective could have the greatest global impact (table 1.3).

For the energy access pillar, high-impact countries are the 10 countries with the highest access deficit, or greatest number of inhabitants without access to modern energy services. (The 10 with the lowest electrification rate, or smallest percentage of inhabitants connected to grid-powered electricity are also evaluated.) These are countries where the least progress has been made and that have an opportunity for relatively modest initial efforts to deliver significant results. For energy efficiency, RISE assessed the 20 countries with the highest primary energy supply and for renewable energy the 20 countries with the greatest final energy consumption and that offer the greatest potential to reduce consumption and contribute large volumes of renewable energy power generation to the global energy mix. For the energy access pillar, RISE also assessed 20 countries the World Bank officially designates as in fragile situations for fiscal year 2016 (table 1.3). Countries in this group include all those with either a harmonized average rating of 3.2 or less on the World



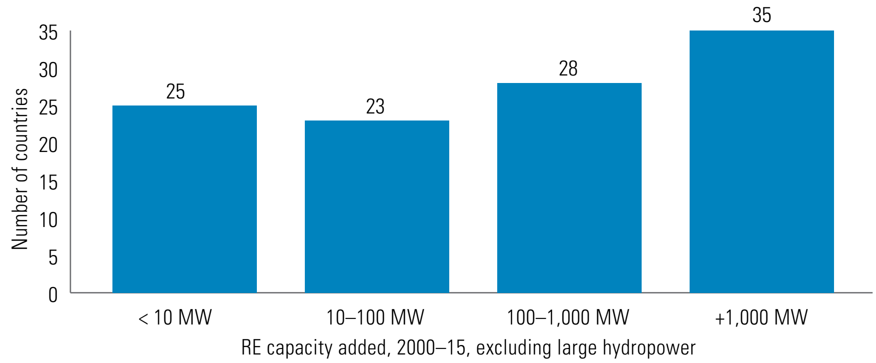
**TABLE 1.3** RISE high-impact and fragile and conflict-affected countries (2012 data)

| Energy access | | | Energy efficiency | Renewable energy |
|---|---|---|---|---|
| Highest electricity access deficit (number of people in millions) | Lowest electrification rate (%) | Fragile and conflict-affected countries | Highest primary energy supply (exajoules) | Highest total final energy consumption (exajoules) |
| India (263) | South Sudan (5%) | Afghanistan | China (121.2) | China (65.6) |
| Nigeria (75) | Chad (6%) | Burundi | United States (89.6) | United States (55.6) |
| Ethiopia (67) | Burundi (7%) | Central African Republic | India (33.0) | India (19.9) |
| Bangladesh (62) | Malawi (10%) | Chad | Russian Federation (31.7) | Russian Federation (16.5) |
| Congo, Dem. Rep. (55) | Liberia (10%) | Congo, Dem. Rep. | Japan (18.9) | Japan (11.8) |
| Tanzania (40) | Central African Republic (11%) | Côte d'Ivoire | Germany (13.1) | Canada (10.5) |
| Kenya (33) | Burkina Faso (13%) | Eritrea | Brazil (11.8) | Germany (8.3) |
| Uganda (30) | Sierra Leone (14%) | Haiti | Korea, Rep. of (11.0) | Brazil (7.6) |
| Sudan (25) | Niger (14%) | Liberia | France (10.6) | Indonesia (6.2) |
| Myanmar (25) | Tanzania (15%) | Madagascar | Canada (10.5) | Iran, Islamic Rep. (6.1) |
| | | Mali | Iran, Islamic Rep. (9.2) | France (6.0) |
| | | Myanmar | Indonesia (8.9) | Spain (5.3) |
| | | Sierra Leone | Saudi Arabia (8.4) | Korea, Rep. (5.1) |
| | | Solomon Islands | United Kingdom (8.0) | United Kingdom (5.1) |
| | | Somalia | Mexico (7.9) | Nigeria (4.8) |
| | | South Sudan | Italy (6.6) | Italy (4.8) |
| | | Sudan | South Africa (5.9) | Mexico (4.6) |
| | | Togo | Nigeria (5.6) | Turkey (3.4) |
| | | Yemen, Rep. | Australia (5.4) | Saudi Arabia (3.3) |
| | | Zimbabwe | Thailand (5.3) | Australia (3.1) |

*Source:* Global Tracking Framework 2015, World Bank's harmonized list of fragile situations FY15.

Bank Country Policy and Institutional Assessment (CPIA), or the presence of a UN and/or regional peace-keeping or peace-building mission during the past three years. The CPIA rates countries on 16 criteria across four dimensions: economic management, structural policies, policies for social inclusion/equity, and public sector management and institutions.[5]

**FIGURE 1.4** Number of RISE countries with renewable energy capacity installed, 2000–15




*Source:* International Renewable Energy Agency.

### Renewable energy capacity additions

RISE considers the number of megawatts (MW) of renewable energy developed in each country over 2000–15, excluding large hydropower and pumped storage, based on statistics from the International Renewable Energy Agency (IRENA).[6]

The time frame 2000–15 was used to provide the most comprehensive look at each country's recent success—or lack thereof—in developing renewable energy, as some countries in the RISE sample have had policy support in place for renewable energy since the start of the century or earlier. Four groups of countries were considered (figure 1.4): those with over 1,000 MW added, representing countries that have attracted consistent renewable investment; those with 100–1,000 MW added, that have at least one or two projects and have planted the seeds of a successful sector; those with 10–100 MW added, with at least one small utility-scale project; and those with less than 10 MW added, having seen little or no investment in the sector.

## ENERGY ACCESS INDICATORS

Eight scored energy access indicators encompass multi-dimensional aspects of policies and regulations. The scores are analyzed in chapter 2. Two nonscored administrative procedures indicators are described in chapter 5. The rationale for choosing these indicators is based on successful rural electrification programs in developing countries (Barnes 2008), including policies to encourage low-income consumers to adopt electricity, a tariff structure that allows for companies to recover their operating costs, effective planning so that communities can make the most of electricity, and good practices for billing, customer service, and consumer education on productive use. In addition, proper monitoring and evaluation of electricity access allows companies to

**TABLE 1.4** Energy access pillar

| Policies and Regulations | | |
|---|---|---|
| ● Existence and monitoring of officially approved electrification plan<br>• Existence<br>• Public availability<br>• Regular update<br>• Tracking institution<br>• Timeframe | ● Framework for grid electrification<br>• Funding support for grid electrification<br>• Funding support for consumer connections<br>• Standards of performance | ● Consumer affordability of electricity<br>• Cost of subsistence consumption<br>• Policy to support low-volume consumers |
| ● Scope of officially approved electrification plan<br>• Service level target<br>• Inclusion of off-grid solutions<br>• Inclusion of community and productive services<br>• Geospatial mapping | ● Framework for minigrids<br>• Legal framework for operation<br>• Ability to charge cost-reflective tariffs<br>• Funding incentives<br>• Standards and quality | ● Utiltity transparency and monitoring<br>• Public financial statements<br>• Public annual reports<br>• Public reliability measurements<br>• Usage of outage recording system |
| | ● Framework for stand-alone systems<br>• Existence of national program<br>• Funding incentives<br>• Standards and quality | ● Utility creditworthiness<br>• EBITDA margin<br>• Days payable outstanding<br>• Debt service coverage ratio<br>• Current ratio |

*Source:* RISE database, World Bank.

### Indicator 1. Existence and monitoring of officially approved electrification plan

| Questions | Scoring | Traffic light |
|---|---|---|
| I. Existence and monitoring of officially approved electrification plan | *X = Sum and divide by 5* | |
| 1. Existence | | If the score X is:<br>$X \geq 67$ (green)<br>$33 < X < 67$ (yellow)<br>$33 \leq X$ (red) |
| 1.1 Is there an officially approved national electrification plan? | Yes – 100, No – 0 | |
| 2. Public availability of electrification plan | | |
| 2.1 Are the electrification plan and the updates publicly available? | Yes – 100, No – 0 | |
| 3. Regular update of electrification plan (< 5 years) | | |
| 3.1 When was the last update of the electrification plan? | < 5 years – 100, other – 0 | |
| 4. Entity responsible for tracking progress of electrification plan | | |
| 4.1 Is there an institution responsible for tracking the plan progress? | Yes – 100, No – 0 | |
| 5. Timeframe | | |
| 5.1 Is there a timeframe defined in the electrification plan? | Yes – 100, No – 0 | |

make service changes based on changing customer needs.

Planning is a crucial element to address the challenge of access to electricity and is a prerequisite for any program to be efficiently implemented. In addition to a framework, electrification planning identifies and maps groups of consumers and local resources. This helps for planning the future development of distribution infrastructure in the country. A national electrification plan complete with technical, institutional, and financial considerations indicates government commitment to a method for achieving universal access.

Good practices typically include a well-articulated system of prioritized areas to be electrified and an associated timeline. They also include a multiyear vision coordinating both grid and off-grid efforts underpinned by technology options, grid and off-grid comparative economic analysis, and publicly disclosed market studies. Good planning also involves a regional approach that considers other aspects of rural development, including such features as access to markets, roads, and skills. This is accompanied by a defined institutional framework of the roles and responsibilities of key stakeholders, including private and public parties.[7]

Draft versions of electricity plans are not considered sufficient because of the uncertainty that they will never be completed or implemented. An electrification plan must be officially approved by the relevant authority to attest to the government's commitment to carrying out the defined tasks. Further, the plan should be updated regularly to reflect the latest technical, financial, and socioeconomic changes in the country. It is important that the plan be made public to stakeholders. A national entity should be identified as responsible for tracking progress as this generally reflects a seriousness to implement and update the plan. Finally, the plan should include a detailed time frame that defines intermediate and global objectives. This means prioritizing areas to be provided with electricity over a given period.

### Indicator 2. Scope of officially approved electrification plan

| Questions | Scoring | Traffic light |
|---|---|---|
| II. Scope of officially approved electrification plan | *X = Sum and divide by 4* | |
| **6. Service level target** | | If the score X is:<br>X ≥ 67 (green)<br>33 < X < 67 (yellow)<br>33 ≤ X (red) |
| 6.1 Does the plan target a service level (e.g., power availability, number of guaranteed hours of power supply, etc.)? | Yes – 100, No – 0 | |
| **7. Inclusion of off-grid solutions** | | |
| 7.1 Does the electrification plan include both grid and off-grid? | Yes – 100, No – 0 | |
| **8. Inclusion of community and productive services** | | |
| 8.1 Does the plan include productive use (e.g., agricultural, commercial, and industrial activities)? | Yes – 50, No – 0 | |
| 8.2 Does the plan include community facilities (e.g., health centers, schools, administrative buildings)? | Yes – 50, No – 0 | |
| **9. Geospatial mapping** | | |
| 9.1 Are there geospatial maps conveying the timeframe of planned grid extension? | Yes – 50, No – 0 | |
| 9.2 Are these geospatial maps made publicly available? | Yes – 50, No – 0 | |

The electrification plan provides guidance on implementation of electricity access programs. Mere existence and implementation of the plan alone does not mean much. Rather, the plan must cover both the specific needs of the population without electricity as well as concerns for the commercial viability of expanding a distribution network to rural areas. A plan has to detail which areas get electricity according to a specified time frame, along with the necessary levels of electricity service based on past experience or studies.

Electricity planning should not be only for expansion of the grid, but should include options for decentralized expansion of electricity. The idea is to ensure electricity services are affordable, meet demand requirements, and are provided on a sustainable financing basis over the long run. The development of geospatial mapping is important to facilitate investment plans and capacity development. Beyond providing tools and analyzing the different electrification options, electrification planning must focus on customers' requirements and must define the necessary service levels, including power and availability and the number of guaranteed hours of power supply appropriate to meet the needs of different consumer classes. Finally, in addition to households, the plans should assess the needs of community facilities and productive users of electricity.

## Indicator 3. Framework for grid electrification

| Questions | Scoring | Traffic light |
|---|---|---|
| III. Grid electrification | *X = Sum and divide by 3* | |
| **10. Funding support for grid electrification** | | If the score X is: |
| 10.1 Does the government have a dedicated funding line or budget for electrification (e.g., funded national program, budget item, rural electrification fund to finance grid extension)? | Yes – 50, No – 0 | X ≥ 67 (green) |
| 10.2 Are there capital subsidies paid to the utilities to provide distribution systems to rural areas/villages? | Yes – 50, No – 0 | 33 < X < 67 (yellow) |
| **11. Funding support for consumer connections** | | 33 ≤ X (red) |
| 11.1 Are there consumer financing mechanisms (i.e., utility loans, on bill financing, micro-loans, etc.) and/or direct subsidies available to support the payment of connection fees by consumers? | Yes – 100, No – 0 | |
| **12. Standards of performance on quality of supply** | | |
| 12.1 Does the government specify standards of performance on reliability along with new connections (e.g., number of guaranteed hours per day, etc.)? | Yes – 100, No – 0 | |

Grid power supply typically provides the most reliable and affordable electricity to a diverse mix of domestic, commercial, and industrial customers. For countries with mature electricity networks, the grid makes it possible to supply reliable power to existing and new customers. But in countries with limited grid network supplying only a fraction of its population, the capital needs of building out the grid to new areas is a major challenge.

Dedicated and assured funding is crucial to meet the capital cost of extending grid electricity services to new customers, and an assured funding plan reveals the priority a government places on expanding electricity to unserved populations. This funding support can come from a dedicated line in the national budget or from a fund dedicated to the capital costs of rural electrification.

For the power company, funding support for consumer connections is important to promote adoption of electricity when the grid becomes available. High connection charges might not be affordable for many households because of limited ability to pay, especially in rural areas where income often is seasonal.

Strategies for lowering connection charges may include spreading them over a reasonable period, rolling them into monthly service payments, subsidizing connections, or amortizing them through loans. Performance standards also are important because brownouts and blackouts, especially during the evening, may discourage households from adopting electricity. Households must weigh common fixed monthly charges against the level of service they receive when it is most needed.

### Indicator 4. Framework for minigrids

| Questions | Scoring | Traffic light |
|---|---|---|
| IV. Isolated minigrids | *X = Sum and divide by 4* | |
| 13. Legal framework for operation | | |
| 13.1 Are minigrids legally allowed to operate in the country? | Yes – 20, No – 0 | |
| 13.2 Can minigrids be owned and operated by private operators? | Yes – 20, No – 0 | |
| 13.3 Do the regulations clarify what will occur when the interconnected grid reaches a minigrid? | Yes – 20, No – 0 | |
| 13.4 Do the regulations detail procedures for consumers to get connected to minigrids? | Yes – 20, No – 0 | |
| 13.5 Do the regulations differ by size of minigrids? | Yes – 20, No – 0 | |
| 14. Ability to charge cost-reflective tariffs | | |
| 14.1 Do the regulations detail a retail electricity tariff schedule for minigrids? Or, are minigrid operators legally allowed to charge a different tariff from the national tariff? | Yes – 100, No – 0 | If the score X is: |
| 15. Financial incentives | | $X \geq 67$ |
| 15.1 Are there publicly funded mechanisms to secure viability gap funding for operators? | Yes – 50, No – 0 | $33 < X < 67$ |
| 15.2 Are there duty exemptions and/or subsidies for minigrid systems and/or individual components? | Yes – 50, No – 0 | $33 \leq X$ |
| 16. Standards and quality | | |
| 16.1 Are there technical standards detailing the requirements for minigrids to connect the grid? | Yes – 16.7, No – 0 | |
| 16.2 Are technical standards made publicly available? | Yes – 16.7, No – 0 | |
| 16.3 Are there safety standards for minigrids (e.g., overcurrent protection, system control, etc.)? | Yes – 16.7, No – 0 | |
| 16.4 Are safety standards made publicly available? | Yes – 16.7, No – 0 | |
| 16.5 Does the government implement certification programs for minigrid installers? | Yes – 16.7, No – 0 | |
| 16.6 Does the government provide or endorse certification programs for one or more components or equipment required for minigrids? | Yes – 16.7, No – 0 | |

Minigrids have emerged as an alternative solution to grid electrification by harnessing local resources to connect remote populations. RISE defines minigrids as local generation that supplies electricity through a small distribution grid. They can provide service to nearby domestic, productive, and community customers. As stand-alone facilities, minigrids can be powered by any fuel, including diesel or fuel oil, as well as renewable energy. A well-defined legal framework for minigrids is critical since it provides a level of certainty for potential investors and enables minigrid operators to assess long-term cost-effectiveness on a level playing field. Licenses can allow operators to have the peace of mind that they can conduct their business in a certain way and over a given period.

Good practice in creating an enabling environment for minigrids includes regulations adjusted to minigrids' size and an outline of operators' rights and operating conditions. Regulations often differ by size of minigrids. Typically, licenses are for larger businesses and registration is for smaller minigrids. In addition, regulations outline operators' rights and clarify the implications of grid arrival in their service territory. Regulations also detail the way consumers are connected to minigrids to encourage electricity adoption.

A barrier to minigrid development is commercial viability. Ensuring affordability for consumers and providing adequate returns for investors is an equation that policymakers must resolve. Operators are not always allowed to charge a cost-recovery tariff for political reasons or because it is not aligned with the national or regional grid tariff. But given the high cost and low consumption pattern in rural areas, the cost-recovery tariff often is quite high. Therefore, operators and regulators must find ways to deal with the gap between the cost of constructing minigrid systems and anticipated revenue. Measures to close this gap may include allowing minigrids to charge above the national tariff, crossubsidizing consumer groups, and having the flexibility to decide on tariff structures most appropriate for operators.

Financial incentives may be an option to help developers close this financial viability gap. To support minigrid development, governments can offer financial incentives such as duty exemptions or subsidies. This encourages investment since it reduces the need for financing. In addition, subsidies or duty exemptions help make tariffs more affordable, in turn encouraging more households to adopt electricity.

Regulators also have a responsibility to protect consumers by mandating technical and safety standards. Whatever the design, minigrid electricity should be affordable to encourage adoption by consumers. Minigrid operators in turn must be responsible for upholding good service standards and providing consumers with reliable electricity supply. Both are necessary for building trust and ensuring sustainability of minigrids. To achieve this, the government can endorse certification programs for minigrid installers or subcomponents of minigrid systems.

### Indicator 5. Framework for stand-alone systems

| Questions | Scoring | Traffic light |
|---|---|---|
| V. Stand-alone systems | *X = Sum and divide by 3* | |
| **17. Existence of national program** | | If the score X is:<br>$X \geq 67$<br>$33 < X < 67$<br>$33 \leq X$ |
| 17.1 Are there national programs which aim to develop stand-alone systems or support the development of stand-alone systems? | Yes – 20, No – 0 | |
| **18. Financial incentives** | | |
| 18.1 Are there duty exemptions and/or subsidies to support stand-alone home systems? | Yes – 20, No – 0 | |
| 18.2 Are there legal restrictions that limit the prices stand-alone home system retailers or service providers can charge? | Yes – 20, No – 0 | |
| 18.3 Are there specific financing facilities available to support operators/consumers to develop/ purchase stand-alone home systems? | Yes – 20, No – 0 | |
| **19. Standards and quality** | | |
| 19.1 Has the government adopted international quality standards for stand-alone systems? | Yes – 20, No – 0 | |
| 19.2 Has the government adopted international testing methods? | Yes – 20, No – 0 | |
| 19.3 Does the regulation accept testing done elsewhere/in another country? | Yes – 20, No – 0 | |
| 19.4 Is there a governmental certified program for solar equipment installers? | Yes – 20, No – 0 | |
| 19.5 Are there environmental regulations on the disposal of solar devices and stand-alone home systems products or components? | Yes – 20, No – 0 | |

Stand-alone systems are off-grid, small-scale electricity systems for remote locations or areas not reachable by conventional electricity distribution systems. Such systems notably include solar PV systems, including rooftop solar panels and lanterns. They can be used for a variety of purposes, including in private homes, irrigation pumps, and street lights.

In some circumstances stand-alone systems can be more cost effective than extending power lines or establishing a minigrid. Such systems are particularly relevant in areas with low population density, low energy demand, and a dearth of other infrastructure.

To promote stand-alone systems, national programs are valuable for scaling up their deployment across remote areas. A national commitment to a program to deploy stand-alone systems signals government dedication to pursuing this option, and instructs how such systems will be integrated into other options for electricity access. Financial incentives are relevant for stand-alone systems. Testing standards for stand-alone systems are a common feature in the better programs. As demonstrated in Lighting Africa and the Bangladesh Solar Home System program, reliance on standards backed by testing builds credibility in products and helps prevent them from getting a bad name in the market. Finally, environmental regulations on the disposal of solar devices and stand-alone system products can be introduced.

### Indicator 6. Consumer affordability of electricity

| Questions | Scoring | Traffic light |
|---|---|---|
| VI. Affordability of electricity | *X = Sum and divide by 2* | |
| **20. Cost of subsistence consumption**<br>20.1 What is the annual cost of subsistence consumption (30kWh/month) as a percentage of GNI per household of bottom 20 percent of population? | If the percentage X is:<br>X ≥ 10% – 0<br>5% < X < 10% – scale<br>X ≤ 5% – 100 | If the score X is:<br>X ≥ 67 (green)<br>33 < X < 67 (yellow)<br>33 ≤ X (red) |
| **21. Policy to support low-volume consumers**<br>21.1 Is there a mechanism to support low-volume consumers such as cross-subsidization, social or lifeline tariff? | Yes – 100, No – 0 | |

The power companies' financial sustainability is important to the success of energy access projects. The typical pattern holds that the capital costs of rural electrification are subsidized in part by the government or by international donors, leaving a portion of the capital costs and all of the operating costs to be borne by consumers. Making electricity affordable for consumers after all subsidies are considered is vital for ensuring a flow of revenue commensurate with the cost to provide services. The assessment of the amount that consumers can afford is important in evaluating the necessary subsidies for reaching all households in a community or country. The challenge is finding the right balance between the power company's cost recovery and affordability among a wide group of consumers. If electricity is not affordable, access expansion will not reach all households.

Most well-off households can afford electricity, but many low-income households have difficulty paying monthly service costs or the up-front costs of electricity connection. Policymakers have therefore introduced measures targeting low-volume consumers that do not have enough paying capacity. For low-income households, typical practices involve social or lifeline tariffs where other consumer groups cross-subsidize low-volume consumers. Through this mechanism, others—industrial, commercial, and high-volume residential consumers—are charged a higher tariff relative to the cost of supply. Cross-subsidization, though typically defined among consumer income groups, sometimes is used among different services or different regions.

There is no universally accepted definition of affordability. Households in developing countries typically spend anywhere from 3 to 10 percent of household expenditure on electricity. In Eastern Europe and Central Asia, heating is part of the household energy bill, and so as much as 20 percent of household expenditures are for electricity.[8] Affordability thus depends on local customs for energy use alongside local and national circumstances.

In RISE, electricity is considered affordable if annual expenditure on 30 kWh per month is at most 5 percent of GNI per household of the bottom 20 percent of the population. Electricity is considered unaffordable if 30 kWh per month costs more than 10 percent of expenditures for the bottom 20 percent of the population.

### Indicator 7. Utility transparency and monitoring

| Questions | Scoring | Traffic light |
|---|---|---|
| VII. Utility transparency and monitoring | *X = Sum* | |
| **22. Are the financial statements of the largest utility publicly available?** | | |
| a) Generation | Yes – 25/8, No – 0 | |
| b) Transmission | Yes – 25/8, No – 0 | |
| c) Distribution | Yes – 25/8, No – 0 | |
| d) Retail sales | Yes – 25/8, No – 0 | |
| If yes, are they audited by an independent auditor? | | |
| e) Generation | Yes – 25/8, No – 0 | |
| f) Transmission | Yes – 25/8, No – 0 | |
| g) Distribution | Yes – 25/8, No – 0 | |
| h) Retail sales | Yes – 25/8, No – 0 | If the score X is: |
| **23. Are the following metrics published in a primary official document (by the utility, regulator or ministry and/or government)?** | | X ≥ 67 (green) |
| a) Transmission — Transmission loss rate | Yes – 25/4, No – 0 | 33 < X < 67 (yellow) |
| b) Distribution — Distribution loss rate | Yes – 25/4, No – 0 | 33 ≤ X (red) |
| c) Retail sales — Bill collection rate | Yes – 25/4, No – 0 | |
| d) Retail sales — Amount of electricity available for sale to end-users | Yes – 25/4, No – 0 | |
| **24. Is the utility operating an incidence/outage recording system (or SCADA/EMS with such functionality)?** | Yes – 25, No – 0 | |
| **25. Is the utility measuring the SAIDI and SAIFI or any other measurements for service reliability?** | Yes – 25/3, No – 0 | |
| a) Are the measurements reported to the regulatory body? | Yes – 25/3, No – 0 | |
| b) Are the measurements available to public? | Yes – 25/3, No – 0 | |

For assessment on this indicator, the largest utilities in generation, T&D, and retail sales in the country are selected.[8]

The first subindicator evaluates whether the largest generation, T&D, and retail companies in the country have publicly available financial statements including a balance sheet, income statement, and cash-flow statement and whether the financial statements of the largest generation, transmission, distribution, and retail companies are audited by an independent third party. This independent third party should be an independent government body or a professional accounting firm, otherwise an assessment would not be credible to potential investors. The second sub-indicator tracks whether key performance metrics—such as transmission loss rate, distribution loss rate, bill collection rate, and electricity available for sale to end-users—are publicly available. These performance metrics should be in a primary official document published by the utility or utilities, regulator, or relevant ministry or government body. The last two indicators cover aspects of utility reliability. It is important for policymakers and investors to have access to information on the technical reliability and the systems in place to identify and record outages. This would include acceptable indicators reported to a regulatory body and whether such indicators are made available to the public.

### Indicator 8. Utility creditworthiness

| Questions | Scoring | Traffic light |
|---|---|---|
| VIII. Utility financial viability | *X = Sum* | |
| 26. Current ratio | < 1 – 0<br>in between – scale<br>≥ 1.2 – 25 | If the score X is:<br>X ≥ 67<br>33 < X < 67<br>33 ≤ X |
| 27. EBITDA margin | < 0 – 0<br>in between – scale<br>≥ 15% – 25 | |
| 28. Debt service coverage ratio | < 1 – 0<br>in between – scale<br>≥ 1.2 – 25 | |
| 29. Days payable outstanding | > 180 – 0<br>in between – scale<br>≤ 90 – 25 | |

The indicator on the financial health and the performance of power companies can provide a basis for investors and project developers for assessing investment opportunities when utilities are significant counterparts.

For assessment on this indicator, the largest utilities in generation, T&D, and retail sales in the country are selected.[10]

Financially healthy and creditworthy utilities are better able to invest from their own resources and through borrowing, enabling them to expand the number of connections and provide better service to existing consumers. This indicator assesses the financial health of the selected utility or utilities through a suite of four financial metrics that are calculated and evaluated based on financial statements.

The current ratio provides a snapshot of a utility's short-term liquidity: whether the utility has sufficient current assets to meet current liabilities due within a year. The debt-service coverage ratio measures the cash flow available to pay current debt obligations. A utility, or any company, must have sufficient cash flow to meet its debt service, or it will not be able to pay the full cost of its obligations or will have to liquidate other assets or borrow from elsewhere. Days payable outstanding estimates the average number of days the selected utility takes to pay its accounts payable. The operating margin—EBITDA—is a measure of a utility's operating profitability. Because it excludes financing cost, depreciation, and amortization as well as non-operating profit and losses, EBITDA provides investors with a clear view of a utility's profitability on its core business.

## ENERGY EFFICIENCY INDICATORS

There are 12 scored indicators in energy efficiency encompassing multi-dimensional aspects of policies and regulations. The scores are analyzed in chapter 3. One nonscored administrative procedures indicator is described in chapter 5.



**TABLE 1.5** Energy efficiency pillar

Policies and Regulations

- National energy efficiency planning
  - Existence of legislation/action plan
  - National targets
  - Sector targets
- Energy efficiency entities
  - Functions covered by dedicated entities
- Information provided to electricity consumers
  - Reports on electricity use
  - Quality of information
  - Comparisons with other users
  - Energy saving information
- Types of electricity rate structures
  - Electricity rate structure
  - Demand charges (large customers)
  - Time of use tariffs
- Mandates & incentives: Large consumers
  - Mandates for large consumers
  - Incentives for large consumers
  - Performance recognition
- Mandates & incentives: Public entities
  - Obligations for public buildings
  - Obligations for other public facilities
  - Public procurement of energy efficient products
  - Ability to retain energy savings
- Mandates & incentitves: Utilities
  - Mandates for utilities
  - Cost recovery mechanisms for utilities
- Financing mechanisms for energy efficiency
  - Type of mechanism in each sector
- Minimum energy performance standards
  - Range of product types covered
  - Verification and penalties for noncompliance
- Energy labeling system
  - Range of product types covered
  - Mandatory vs. voluntary system
- Building energy codes
  - New residential/commercial buildings
  - Renovated buildings
  - Compliance system
  - Building energy information
  - Building energy efficiency incentives
- Carbon pricing and monitoring
  - Carbon pricing mechanism
  - Monitoring, reporting and verification (MRV) system

### Indicator 1. National energy efficiency planning

| Questions | Scoring | Traffic light |
|---|---|---|
| I. National energy efficiency planning | *X = Sum and divide by 3* | |
| 1. **Energy efficiency legislation/action plan** | | |
| 1.1 Is there legislation or a national action plan that aims to increase EE? | Yes – 100, No – 0 | |
| 2. **National energy efficiency targets** | | |
| 2.1 Is there an energy efficiency goal or target at the national level? | Yes – 100, No – 0 | If the score X is: |
| | | X ≥ 67 (green) |
| 3. **Sub-sectoral targets** | | 33 < X < 67 (yellow) |
| 3.1 Are there targets defined for any of the following sectors? | | 33 ≤ X (red) |
| a) Residential sector | Yes – 25, No – 0 | |
| b) Commercial services sector | Yes – 25, No – 0 | |
| c) Industrial sector | Yes – 25, No – 0 | |
| d) Power sector | Yes – 25, No – 0 | |

Establishing a national energy efficiency plan, especially one with specific, time-bound targets and supporting laws and plans to meet them, is crucial for providing direction to all stakeholders making decisions on energy efficiency investments. This indicator reflects whether there is a national target for energy efficiency and whether there are targets for sectors that in most countries account for the majority of energy consumption—households, commercial services (including transport), industry, and power generation. This indicator also scores for the presence of supporting legislation or action plans to reach those targets, as the mere act of enunciating a target is rarely sufficient to achieve it. Any action plan explicitly stating the goal of increasing energy efficiency is accepted. Plans for reducing greenhouse gas (GHG) emissions qualify if efficiency is explicitly mentioned. Such plans and targets often are a reference point or foundation for the policies and regulations aimed at sectoral implementation, and they provide a means of measuring progress.

### Indicator 2. Energy efficiency entities

| Questions | Scoring | Traffic light |
|---|---|---|
| II. Energy efficiency entities | *X = Sum and divide by 7* | |
| 4. Energy efficiency entities in place | | If the score X is:<br>X ≥ 67 (green)<br>33 < X < 67 (yellow)<br>33 ≤ X (red) |
| 4.1 Are there governmental and/or independent bodies that carry out formulation and implementation of EE strategy, policy and regulation for each of the roles listed below? | | |
| a) Setting EE strategy | Yes – 100, No – 0 | |
| b) Setting EE standards | Yes – 100, No – 0 | |
| c) Regulating EE activities of energy suppliers | Yes – 100, No – 0 | |
| d) Regulating EE activities of energy consumers | Yes – 100, No – 0 | |
| e) Certifying compliance with equipment EE standards | Yes – 100, No – 0 | |
| f) Certifying compliance with building EE standards | Yes – 100, No – 0 | |
| g) Selecting and/or approving third party auditors tasked with certifying EE standards | Yes – 100, No – 0 | |

Legislation, action plans, and targets are empty without agencies or entities dedicated to their development and implementation. Energy efficiency is a diffuse and varied field, so such bodies need specialized functional competencies and may need to be located at different levels of government jurisdiction, depending on local circumstances. Additionally, they may be either governmental or independent bodies. RISE does not attempt to judge the best approach or level of jurisdiction, but due to the need for specialization, scores are based on the number of functional areas covered. Functions that have proven important include setting energy efficiency policies and standards, regulating energy efficiency activities (on the supply side and among end users), and monitoring compliance with energy performance standards. Government legislation or action plans on energy efficiency generally are best developed and implemented by a dedicated planning entity. Regulatory entities are needed to oversee energy suppliers and consumers, though this responsibility may be divided among more than one organization. Dedicated entities are essential for setting energy efficiency standards for buildings and equipment, certifying compliance with the set standards, and where necessary, managing a third-party auditor system of compliance. For example, a regulatory body may commission an independent agency to perform audits of industrial facilities to verify the accuracy of self-reported data. Such entities ensure that the correct steps are taken to meet targets in the national energy efficiency planning indicator.

### Indicator 3. Information provided to consumers about electricity usage

| Questions | Scoring | Traffic light |
|---|---|---|
| III. Information provided to consumers about electricity usage | *X = Sum and divide by 4* | |
| **5. Reports on electricity usage** | | |
| 5.1 Is it mandatory for the selected utility to provide the following customers with reports of their energy usage, in a bill or by other means for | | |
| a) Residential customers (R)? | Yes – 33.3, No – 0 | |
| b) Commercial services customers (C)? | Yes – 33.3, No – 0 | |
| c) Industrial customers (I)? | Yes – 33.3, No – 0 | |
| **6. Quality of information in report** | | |
| 6.1 At what intervals do they receive these reports (times per year)? | ≤ 1 month – 100<br>1–6 months – 75<br>6–12 months – 50<br>> 12 months – 0<br>*Divide by 3* | If the score X is: |
| 6.2 Do the reports include the price levels customers pay for energy usage? | Yes – 33.3, No – 0 | X ≥ 67 |
| 6.3 Does the regulator track the utility's compliance with laws for providing energy usage information to customers? | Yes – 33.3, No – 0 | 33 < X < 67 |
| | | 33 ≤ X |
| **7. Comparison with other users** | | |
| 7.1 Do customers receive a bill or report which compares them to other users in the same region and/or usage class? | Yes – 100, No – 0 | |
| **8. Information related to energy savings** | | |
| 8.1 Do customers receive a bill or report that shows their energy usage compared to previous bills or reports over time? | Yes – 33.3, No – 0 | |
| 8.2 Does the selected utility offer customers access to real-time feedback on energy usage (for either prepaid or post-paid systems)? | Yes – 33.3, No – 0 | |
| 8.3 Does the selected utility offer customers the ability to manage energy usage levels remotely (through apps or other technology mediums that can track real time usage)? | Yes – 33.3, No – 0 | |

It is a truism that consumers need to know how much energy they use before they can economize on it. Beyond that, however, the information they receive, how often, and against what it is compared can make a difference in motivating them to adopt the right measures. Thus, among the energy efficiency indicators included in RISE is one on the information that consumers receive regarding their electricity use—how much they use, how much they pay, how often they receive this information, and whether they are given comparisons with other users in the same class or information on available efficiency measures. Scores include information on residential, commercial, and industrial consumers.

This indicator also measures whether consumers receive comparisons to their previous levels of consumption and with other, similar consumers. Such comparisons can be powerful motivators. This indicator also measures the use of real-time feedback—a mechanism giving consumers the option to access information and to control their energy usage as it is consumed. Such a mechanism can be implemented in prepaid or postpaid systems, provided that consumers have access to the information about their consumption. Mechanisms can involve a computer program or mobile app that shows energy use in a specific location instantly, and over past intervals. This gives consumers information to base decisions about adjusting their consumption, particularly when demand is high.

METHODOLOGY

## Box 1.2 Retail price of electricity

Retail price of electricity is an important driver of investment in each type of sustainable energy, while not part of the RISE score. The level of the retail price relates differently to each of the RISE pillars. While higher electricity prices incentivize customers to seek energy efficiency measures, lower prices with cross-subsidization allow for better expansion of services into new areas. By contrast, renewable energy investors will look toward wholesale or contract prices granted by offtakers, rather than retail prices. Given the complexity of the relationship between retail electricity prices and investments in energy access, renewable energy, and energy efficiency, this indicator is presented separately for information purposes.

**Methodology**

Calculating the average level of retail prices is based on total revenue from sales of electricity and amount of electricity sold from the selected utility, which is the utility offering power distribution and retail services to the largest amount of customers in the largest business city metropolitan area.

The average retail electricity tariff across all customer classes is calculated as:

$$\frac{\textit{revenue from sales of electricity to end-users (US\$)}}{\textit{amount of electricity consumed by end-users (kWh)}}$$

The retail electricity tariff for residential, commercial and industrial customer classes is calculated as:

$$\frac{\textit{revenue from sales of electricity to end-users within given customer class (US\$)}}{\textit{amount of electricity consumed by end-users within given customer class (kWh)}}$$

The actual average retail price can be determined regardless of the structure of tariff schedules or different consumption profile by customer. But this methodology may not be able to capture sales tax and other levies if they are accounted separately from revenue. In a liberalized market where utilities can offer different prices, this estimate from the selected utility may not represent the entire market.

**Results**

Regardless of income, countries are distributed among different price ranges (box table). A larger number of countries are in the range of 5 to 15 U.S. cents per kWh, while a handful of countries are in the lowest range.

Small island developing states in general have a relatively high level of retail price given high costs of electricity supply due to their geography. Bahrain, the Dominican Republic, Haiti, Maldives, Papua New Guinea, Solomon Islands, and Vanuatu are included in RISE, with the highest average price close to US$1.0/kWh in Vanuatu.

**LIST OF COUNTRIES BY INCOME GROUP BY RETAIL PRICE RANGE**

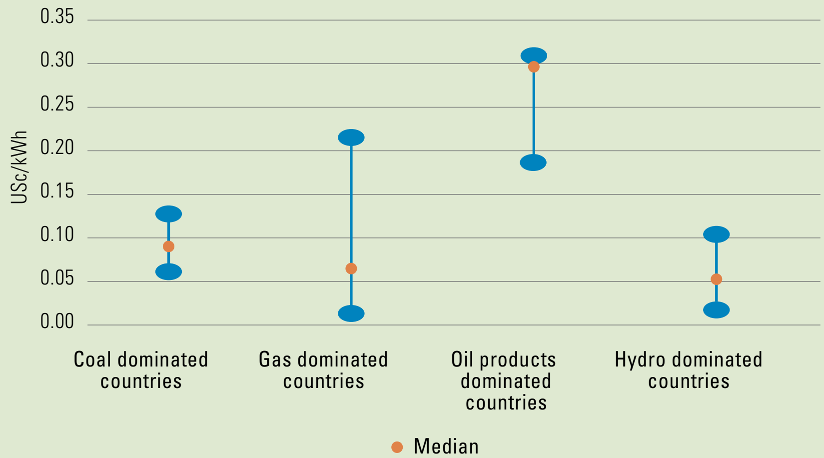
| Tariff (USc/kWh) | Countries by income group | |
|---|---|---|
| 0–5 | High | Qatar; Saudi Arabia; Venezuela |
| | Upper-middle | Angola |
| | Lower-middle | Egypt, Arab Rep.; Kyrgyz Republic; Sudan; Uzbekistan |
| | Low | — |
| 5–10 | High | Korea, Rep.; Netherlands; Russian Federation |
| | Upper-middle | China; Ecuador; Kazakhstan; Malaysia; South Africa; Tunisia; Turkey |
| | Lower-middle | Armenia; India; Indonesia; Lao PDR; Mongolia; Vietnam; Yemen, Rep. |
| | Low | Afghanistan; Bangladesh; Burundi; Ethiopia; Guinea; Myanmar; Nepal; Zimbabwe |
| 10–15 | High | Australia; Belgium; Chile; Denmark; United States |
| | Upper-middle | Argentina; Brazil; Mexico; Peru; Romania; Thailand |
| | Lower-middle | Cameroon; Côte d'Ivoire; Pakistan; Sri Lanka |
| | Low | Malawi; Tanzania; Zambia |
| 15–20 | High | Greece; Switzerland |
| | Upper-middle | Colombia; Dominican Republic |
| | Lower-middle | Ghana; Philippines; South Sudan |
| | Low | Cambodia; Kenya; Madagascar; Mali; Niger; Uganda |
| > 20 | High | Japan; Spain; United Kingdom |
| | Upper-middle | — |
| | Lower-middle | Nicaragua; Senegal; Solomon Islands; Vanuatu |
| | Low | Benin; Burkina Faso; Haiti; Rwanda; Sierra Leone; Togo |

(continued)

## Box 1.2 Retail price of electricity *(continued)*

An analysis by dominant fuel type shows that (box figure) countries where hydropower plants supply more than 90 percent of electricity have the lowest range of average retail prices due to low cost of generation, including operation and maintenance. These countries include the Democratic Republic of Congo, Ethiopia, Kyrgyz Republic, Malawi, Mozambique, Nepal, Tajikistan, Venezuela, and Zambia. Countries dominated by oil products, including diesel and heavy fuel oil, show the highest range of prices, reflecting the high cost of generation, including fuel supply. Coal and gas fall in between.

**RETAIL PRICE BY DOMINANT FUEL TYPE (USc/kWh)**




*Source:* RISE Team.

### Indicator 4. Energy efficiency incentives from electricity rate structures

| Questions | Scoring | Traffic light |
|---|---|---|
| IV. EE incentives from electricity rate structures | *X = Sum and divide by 3* | |
| **9. Electricity rate structure** | | |
| 9.1 What types of electricity rate structure do the (R) residential, (C) commercial services and (I) industiral customers face? | If a country selects more than one option, the highest score is selected. | |
| a) Flat fee (per connection) | 33 | |
| b) Constant (uniform) block rates | 67 | |
| c) Declining block rates | 0 | |
| d) Increasing block rates | 100 | |
| | *Sum and divide by the 3 sectors* | |
| **10. Demand charges (large customers)** | | |
| 10.1 Which of the following charges do electricity customers pay in the (R) residential sector, (C) commercial services sector and (I) industrial sector (only industrial and commercial will be scored)? | | If the score X is: |
| a) Energy (kWh) | Yes – 33.3, No – 0 | $X \geq 67$ |
| b) Demand (kW) | Yes – 33.3, No – 0 | $33 < X < 67$ |
| c) Reactive power (kVAr) | Yes – 33.3, No – 0 | $33 \leq X$ |
| | *Sum and divide by 2 sectors* | |
| **11. Time of use tariffs** | | |
| 11.1 Are any of the following time-of-use (TOU) rate structures applied to the (R) residential sector, (C) commercial services sector and (I) industrial sector? | For each sector | |
| a) Real-time pricing | Yes to 1 or more – 100 | |
| b) Variable peak pricing | No to all – 0 | |
| c) Critical peak pricing | *Sum and divide by the 3 sectors* | |
| d) Seasonal rate | | |
| e) Peak-time rebates | | |

*Source:* Definitions of each rate structure are in box 1.3.

The retail price of electricity is of prime importance in motivating efficiency. Beyond retail prices, electricity rate structures can have a powerful effect. Unlike average retail price levels, which are difficult to determine and even more troublesome to compare across countries in a context-neutral manner, rate structures can be categorized as providing more or less incentive to adopt energy efficiency. Increasing block tariffs, through which consumers pay higher prices as they consume more, is considered the best price structure to incentivize efficient electricity use. Other possible structures include uniform block rates, declining block rates, and flat fees.

For larger industrial and commercial end-users, charges for demand and reactive power alongside charges for energy consumption can induce load shifting. This may not have a large effect on efficiency at the site of use, but may improve efficiency on the supply side. Time-of-use tariffs also may lead to gains in end-use or power system efficiency. These tariffs include real-time pricing, variable peak or critical peak pricing, seasonal rates, and peak-time rebates, all of which are scored on this indicator. The effectiveness of such mechanisms depends on close communication between utilities and educated consumers able to take advantage of these opportunities.

### Box 1.3 Definitions of rate structures

**Electricity rate structure**

*Flat fee:* Flat rate to gain access to electricity, independent of the amount of electricity consumed. The fee may vary by customer type, such as sector or size.

*Constant (uniform) block rate:* Single rate per kWh consumed, regardless of amount consumed.

*Declining block rate:* Progressively lower rates per kWh as consumption increases above thresholds or blocks, such as 1–250 kWh, 250–500 kWh.

*Increasing block rate:* Progressively higher rate per kWh as consumption rises above thresholds or blocks. May be used to incentivize conservation by customers.

**Demand charges (large customers)**

*Demand charge:* Billed as a fixed rate per kilowatt of peak demand during a billing cycle, regardless of when the peak demand occurred.

*Reactive power charge:* In addition to net consumption, loads (like electric motors) in AC power circuits require reactive power (kVAr), which is absorbed and returned. Reactive power is higher for customers with a higher power factor, typically from less efficient motors and transformers. Charges are levied as for demand charges, but per kVAr, the unit of measurement of reactive power.

**Time-of-use tariffs**

*Real-time pricing:* Tariff linked to the hourly market price for electricity. Customers are made aware of hourly prices on either a day-ahead or hour-ahead basis, providing the incentive to reduce consumption at the most expensive times.

*Critical peak pricing:* Customers are given advance notice that they will pay higher prices during days when wholesale prices are the highest or when the power grid is severely stressed, typically up to 15 days per year during the season(s) of the system peak.

*Variable peak pricing:* Similar to critical peak pricing, with the exception that the window of critical peak hours is not fixed. The specific hours of the event are provided to participants at the same time that they are notified of the upcoming critical peak event (typically one day in advance).

**Seasonal rates**

These vary by time of year but not by time of day. This provides a greater incentive for load shifting according to seasonal consumption patterns.

*Peak-time rebates:* Peak-time rebates are rates that vary according to the time of day, or rebates that typically are offered as an alternative to critical peak pricing. Rather than charging a higher rate during critical peak events, participants are paid for load reductions.

### Indicator 5. Mandates and incentives: Large consumers

| Questions | Scoring | Traffic light |
|---|---|---|
| V. Incentives & mandates: large consumers | *X = Sum and divide by 3* | |
| 12. Mandates for large consumers | | |
| 12.1 Are there any of the following energy-efficiency mandates for large energy users? | | |
| a) Targets (e.g., kWh savings of lower energy intensity or carbon dioxide reductions, etc.) | Yes to 1 or more – 33.3 | |
| b) Mandatory audits | No to all – 0 | |
| c) Progress/tracking reports | | |
| d) Energy-management system (computer technologies to optimaize energy use) | | |
| 12.2 Are there penalties in place for noncompliance with regulatory obligations for EE? | Yes – 33.3, No – 0 | |
| 12.3 Is it required for the consumption and/or savings of large-scale energy users to be tracked and documented on a regular basis? | Yes – 16.7, No – 0 | If the score X is: |
| 12.4 Is there a measurement and verification program in place? | Yes – 16.7, No – 0 | X ≥ 67 (green) |
| | | 33 < X < 67 (yellow) |
| 13. Incentives for large consumers | | 33 ≤ X (red) |
| 13.1 Are energy efficiency incentives in place for large-scale users that have achieved significant energy savings measures? | Yes – 100, No – 0 | |
| 14. Performance recongnition | | |
| 14.1 Is there a program to publicly recognize large-scale users that have achieved significant energy savings measures? | Yes – 33.3, No – 0 | |
| 14.2 Are energy savings and/or financial savings publicized? | Yes – 33.3, No – 0 | |
| 14.3 Does the program offer assistance (from a government or independent entity) to large-scale users to identify energy savings investments opportunities? | Yes – 33.3, No – 0 | |

Large consumers are an important segment of the energy market, and in many countries they account for a significant portion of total energy consumption and a similar share of efficiency potential. This indicator measures the extent to which policies and regulatory measures are in place and known to be effective in creating and enforcing incentives to increase efficiency of large consumers—typically factories, but potentially also large commercial and institutional facilities. (Government facilities are covered by the next indicator.)

The definition of large varies by country, so this indicator first determines whether the government has identified priority consumers that consume energy above a certain threshold. (For example, all facilities that consume over 500 kWh per day, or all facilities that emit over 25 kt $CO_2$e per year.) The indicator next measures whether efficiency mandates are in place for this class of consumer, and whether these include requirements to track energy consumption on a regular basis—an important basic step toward achieving energy efficiency gains. The indicator also covers targets, mandatory audits, and energy management systems, all of which are well-documented contributors to energy efficiency.

As for other classes of consumers, mandates are most effective if supported by a system of monitoring and verification and subject to penalties for noncompliance. In most circumstances, such systems are best managed by an independent third party. Voluntary measures can positively influence large consumers towards energy efficiency. Financial and tax incentives for demonstrating well-defined efficiency improvements can spur energy efficiency investment. Public recognition programs, such as awards and certifications for energy-efficient practices, also serve as a call to action and have the added benefit of raising awareness of energy efficiency solutions among consumers.

### Indicator 6. Mandates and incentives: Public sector

| Questions | Scoring | Traffic light |
|---|---|---|
| VI. Incentives & mandates: public sector | *X = Sum and divide by 4* | |
| **15. Obligations for public buildings** | | |
| 15.1 Are there building energy savings obligations for public buildings? | Yes – 50, No – 0 | |
| 15.2 Are energy savings from efficiency activities at public buildings tracked (either in-house or by a third party)? | Yes – 50, No – 0 | |
| **16. Obligations for other public facilities** | | |
| 16.1 Are there building energy savings obligations for other public facilities (may include water supply, wastewater services, municipal solid waste, street lighting, transportation, and heat supply)? | Yes – 50, No – 0 | |
| 16.2 Are energy savings from efficiency activities at other public facilities tracked? | Yes – 50, No – 0 | |
| **17. Public procurement of energy efficient products** | | If the score X is: |
| 17.1 Is there a specific policy or mandated guidelines for public procurement of energy-efficient products and services at the following levels? | | X ≥ 67<br>33 < X < 67 |
| a) National level | Yes to 1 or more – 100 | 33 ≤ X |
| b) Region/state/province level | No to all – 0 | |
| c) Municipal/city/county level | | |
| **18. Ability to retain energy savings** | | |
| 18.1 Do public budgeting regulations and practices allow public entities to retain energy savings at the following levels? Tick all applicable levels: | | |
| a) National level | Yes to 1 or more – 100 | |
| b) Region/state/province level | No to all – 0 | |
| c) Municipal/city/county level | | |

Public sector energy efficiency measures greatly affect overall energy savings given the large share of infrastructure assets typically owned and operated by governments. Public programs offer opportunities for governments to provide leadership and to foster nascent markets for energy-efficient products and services.

For public entities, such as government offices and public services, rules requiring the procurement of energy efficient devices and systems combined with budgetary rules allowing retention of energy cost savings have proven fundamental to implementing energy efficiency measures. Several questions in the survey capture such provisions at different levels of government. Public procurement guidelines are graded for inclusion of standards for energy efficiency in the tendering of works, goods, and services.

This indicator also considers the quality of energy savings obligations and incentives for public buildings and energy-intensive facilities such as water supply, wastewater services, municipal solid waste, street lighting, transportation, and heat supply. Regulations should set minimum standards for energy use in well-defined areas for each facility. As an incentive, the overseeing public entity of a given facility or department should be allowed to retain budgetary savings from efficiency gains, as the prospect of a shrinking budget rarely spurs investment. This indicator does not consider the stringency of energy efficiency standards that may be used since such values are highly context specific.

## Indicator 7. Mandates and incentives: Utilities

| Questions | Scoring | Traffic light |
|---|---|---|
| VII. Incentives & mandates: utilities | *X = Sum and divide by 2* | |
| **19. Mandates for utilities** | | |
| For each area: (i) generation, (ii) transmission and distribution networks and (iii) demand-side management: | *Sum and divide by the 3 areas* | |
| 19.1 Are utilities required to carry out energy efficiency activities in this area? | Yes – 25, No – 0 | |
| 19.2 Are there penalties in place for noncompliance with EE requirements? | Yes – 25, No – 0 | |
| 19.3 Are energy savings or other target indicators measured to track performance in meeting EE requirements? | Yes – 25, No – 0 | |
| 19.4 Are the requirements measured/validated by an independent third party? | Yes – 25, No – 0 | If the score X is: $X \geq 67$ <br> $33 < X < 67$ <br> $33 \leq X$ |
| **20. Cost recovery for utilities** | | |
| 20.1 Are any of the following mechanisms available for utilities to recover costs associated with or revenue lost from mandated energy efficiency activities? | | |
| a) Public budget financing | Yes to 3 or more – 100 | |
| b) Compensation for revenue losses from EE activities via a tracking account | Yes to 1 or 2 – 50 | |
| c) Revolving funds and/or credit lines for EE activities | No to all – 0 | |
| d) Partial risk guarantees | | |
| e) Program cost recovery | | |
| f) ESCOs | | |
| g) On-bill financing/repayment | | |

For electricity supply utilities, expanding into energy efficiency involves mandates to achieve savings and changes in regulations allowing the recovery of costs and the ability to profit from customers' efficiency investments. Many consider mandates and incentives an important pathway to achieving significant end-use energy savings, but their use is not universally adopted among high-scoring countries. Several European countries with well-developed energy efficiency programs have opted out of the European Union (EU) directive calling for member states to adopt energy efficiency obligations on utilities operating within their borders, choosing instead to adopt other measures with equivalent effects.

This indicator measures whether energy efficiency requirements are applied to the generation, T&D, and demand-side management operations of utilities, and the extent to which there are mechanisms for utilities to recover the costs associated with energy savings. For mandates to be effective, utility performance should be tracked and verified, ideally by a third party, with well-defined penalties for noncompliance. Proven cost-recovery mechanisms include public financing, compensation for lost revenue via tracking accounts, agreements with energy service companies, credit lines, on-bill financing or repayment, and partial risk guarantees. As with the other indicators, only the availability of cost-recovery mechanisms is measured, as the effectiveness of each would differ depending on the circumstances of each country, such as the degree of electricity privatization.

### Indicator 8. Financing mechanisms for energy efficiency

| Questions | Scoring | Traffic light |
|---|---|---|
| VIII. Financing mechanisms for energy efficiency* | *X = Sum and divide by 3 sectors* | |
| **21. Financing mechanisms available in each sector**<br>21.1 Are any of the following financing mechanisms for energy efficiency activities available in the (R) residential sector, (C) commercial services sector and (I) industrial sector?<br>a) Tax duties/incentives<br>b) Discounted "green" mortgages<br>c) On-bill financing/repayment<br>d) Credit lines and/or revolving funds with banks for energy efficiency activities<br>e) Energy services agreements (pay-for-performance contracts)<br>f) Green or energy efficiency bonds<br>g) Vendor credit and/or leasing for energy efficiency activities<br>h) Partial risk guarantees<br>i) Other | For each sector<br>Yes to 3 or more – 100<br>Yes to 1 or 2 – 50<br>No to all – 0 | If the score X is:<br>X ≥ 67 (green)<br>33 < X < 67 (yellow)<br>33 ≤ X (red) |

* Market/government mechanism information was tracked but not incorporated into the scoring.

Financing initial investment costs is one of the most challenging hurdles to improving energy efficiency. This indicator measures the extent to which specialized financing mechanisms for energy efficiency investments in the residential, commercial, and industrial sectors are offered by public and private entities. These include mortgage discounts, utility prepayment, credit lines or revolving funds, pay-for-performance energy savings contracts, and vendor credits. This indicator is scored higher the more mechanisms are available in each sector up to a threshold of three mechanisms. The effectiveness of public support for energy efficiency financing depends on the particular circumstances of a given market. Typically, public support is most effective at the early stages of market development and is phased out as markets mature. No survey can objectively measure how well such mechanisms perform for those countries that have them, but in general, more mechanisms are better than fewer.

This indicator does not distinguish the source of financing in the scoring because the best-practice context varies by economy, but such information is tracked for future analytical purposes. Market-driven mechanisms are defined as financial transaction mechanisms that proceed without any direct government approval, authorization, or other mediation procedure. As such, discounted mortgages or credit terms offered by market entities such as private banks, financial institutions, or utility companies do not require government approval and are considered market driven. Such transactions typically are subject to regulatory oversight and reporting requirements, but not direct government intervention.

By contrast, government-driven mechanisms require approval, authorization, or other form of direct participation by government bodies. Thus, government bonds and risk guarantees for energy efficiency investments require agencies to acquire and disburse funds, even though the agencies may not enter directly into transactions with project hosts.

### Indicator 9. Minimum energy performance standards

| Questions | Scoring | Traffic light |
|---|---|---|
| IX. Minimum energy efficiency performance standards | *X = Sum and divide by 2* | |
| 22. Have minimum energy performance standards been adopted for: | | |
| 22.1 Refrigerators? | For each category | |
| 22.2 Air conditioners? | Yes – 100, No – 0 | |
| 22.3 Lighting equipment? | *Sum and divide by the 6 categories* | |
| 22.4 Industrial electric motors? | | |
| 22.5 Other industrial equipment? | | If the score X is: |
| 22.6 Light vehicles (heavy duty transport vehicles were tracked but not included in the scoring)? | | $X \geq 67$ |
| | | $33 < X < 67$ |
| 23. Verification and penalties for noncompliance | For each category | $33 \leq X$ |
| 23.1 Is there a verification program in place? | Yes – 33.3, No – 0 | |
| 23.2 Is it carried out by a third party? | Yes – 33.3, No – 0 | |
| 23.3 Is there a penalty for noncompliance with energy efficiency standards? | Yes – 33.3, No – 0 | |
| | *Sum and divide by the 6 categories* | |

Well-designed minimum energy performance standards (MEPS) are among the most effective policy interventions for improving energy efficiency. They can be set at levels and phased in to yield benefits that far outweigh the costs for consumers, manufacturers, and suppliers. Mandatory minimum standards set a floor, and products failing to meet that minimum standard cannot legally be sold. Other approaches to standards setting are possible, like Japan's Top Runner program that sets a standard in accordance with the best available model on the market and other products are labeled accordingly. However, because minimum standards are more widely applied and have been shown to work, the survey measures them.

This indicator covers the adoption of MEPS for refrigerators and air conditioners (representing domestic appliances), lighting equipment, industrial electric motors (the equipment category that consumes more electricity worldwide than any other), other industrial equipment (credit is given for any of a variety of categories), and light- and heavy-duty vehicles. Credit is given only for mandatory standards; voluntary programs are not scored.

As with other indicators, there is no attempt to compare the relative stringency of standards, but such data is collected for informational purposes. Credit is given if countries have monitoring and verification systems in place, ideally implemented by a third party, and penalties for noncompliance. MEPS may be domestically developed or adapted from standards developed elsewhere, so the credit can be given to importing countries that have neither their own appliance and equipment manufacturers nor the resources to build their own standards from scratch.

### Indicator 10. Energy labeling systems

| Questions | Scoring | Traffic light |
|---|---|---|
| X. Energy labeling systems | *X = Sum and divide by 2* | |
| **24. Have energy efficiency labeling schemes been adopted for:** | | |
| 24.1 Refrigerators? | For each category | |
| 24.2 Air conditioners? | Yes – 100, No – 0 | |
| 24.3 Lighting equipment? | *Sum and divide by the 6 categories* | |
| 24.4 Industrial electric motors? | | If the score X is: |
| 24.5 Other industrial equipment? | | $X \geq 67$ (green) |
| 24.6 Light vehicles (heavy duty transport vehicles were tracked but not included in the scoring)? | | $33 < X < 67$ (yellow) |
| | | $33 \leq X$ (red) |
| **25. Mandatory vs. voluntary labeling system** | For each category | |
| 25.1 Are any of the above labeling schemes mandatory? | Yes – 100, No – 0 | |
| | *Sum and divide by the 6 categories* | |

Alongside mandatory (and occasionally voluntary) standards, energy labels are complementary tools that ensure market players have appropriate information for decision-making. Requiring energy labels has proven to have substantial behavioral effects with respect to manufacturing and purchasing energy-intensive products. This indicator measures whether energy labels are applied to each key product category and whether these labels are mandatory or voluntary. Mandatory labeling systems are the most effective means of incentivizing market suppliers to meet energy efficiency standards. Similar to the energy performance standards indicator, the original source of the labeling system—external or domestic—is tracked but not scored.

### Indicator 11. Building energy codes

| Questions | Scoring | Traffic light |
|---|---|---|
| XI. Building energy codes | *X = Sum and divide by 5* | |
| 26. New residential and commercial buildings | | |
| 26.1 Are there energy efficiency codes for new residential buildings? | Yes – 50, No – 0 | |
| 26.2 Are there energy efficiency codes for new commercial buildings? | Yes – 50, No – 0 | |
| 27. Compliance system | | |
| 27.1 Is there a system to ensure compliance with building energy efficiency codes? | Yes – 50, No – 0 | |
| 27.2 Is it carried out by a third party? | Yes – 50, No – 0 | |
| 28. Renovated buildings | For each sector | |
| 28.1 Are renovated buildings required to meet a building energy code, in (R) residential and (C) commercial sectors? | Yes – 50, No – 0 | If the score X is:<br>X ≥ 67 (green)<br>33 < X < 67 (yellow)<br>33 ≤ X (red) |
| 29. Building energy information | | |
| 29.1 Is there a mandatory standardized rating or labeling system for the energy performance of existing buildings? | Yes – 33.3, No – 0 | |
| 29.2 Are commercial and residential buildings required to disclose property energy usage at the point of sale or when leased? | Yes – 33.3, No – 0 | |
| 29.3 Are large commercial and residential buildings required to disclose property energy usage annually? | Yes – 33.3, No – 0 | |
| 30. Building energy efficiency incentives | | |
| 30.1 Are there mandates or targets for new building stocks to achieve high quality energy efficiency certifications, such as LEED (Leadership in Energy & Environmental Design) (e.g., percentage of new building stocks that must be LEED certified)? | Yes – 100, No – 0 | |

Energy-efficient buildings are more prevalent thanks to a growing number of building efficiency standards, often based on international platforms and adapted to local circumstances. Investing in energy efficiency should be considered with renovations to existing buildings and during initial development and construction of new buildings. Major efficiency improvements have been achieved with mandatory codes and voluntary programs.

This indicator measures the existence and stringency of energy efficiency codes in residential and commercial buildings, newly developed and renovated. Creating a standardized rating system for buildings according to their energy use is an effective way to implement building energy codes. The codes should have a verification system, ideally carried out by a third party. Buildings should be required to disclose energy usage information annually and at the point of sale or lease of any of their units. Because voluntary programs to meet high-quality efficiency standards have proven to be as effective or even more effective of an influence on building developers, this indicator also considers the existence of incentives and recognized certification programs for energy-efficient buildings.

### Indicator 12. Carbon pricing and monitoring

| Questions | Scoring | Traffic light |
|---|---|---|
| XII. Carbon pricing and monitoring | *X = Sum* | |
| 31. Carbon pricing mechanisms | | If the score X is: |
| 31.1 For any carbon pricing mechanism (e.g., carbon tax, emission trading system), what is the portion of national GHG emissions covered? | 100% coverage – 50,<br>< 100% – scaled | X ≥ 67 (green)<br>33 < X < 67 (yellow) |
| 31.2 Is there a monitoring, reporting and verification system for greenhouse gas emissions in place? | Yes – 50, No – 0 | 33 ≤ X (red) |

Putting a price on carbon has long been held as an efficient way to internalize the external costs associated with carbon emissions from energy use, thus helping mitigate the threat of climate change, and to encourage a faster transition to low-carbon economies. The latest report from the United Nations Intergovernmental Panel on Climate Change[11] recognizes the importance of carbon pricing to help limit the increase in the global mean temperature. In developing sustainable energy, an adequate price on GHG emissions helps mobilize the financial investments required to support diverse actions, such as renewable energy deployment, adoption of energy efficiency measures, and use of low-carbon technologies in industry.[12]

This indicator assesses the status of carbon pricing and the monitoring regimes' ability to track these emissions reliably. For this report, carbon pricing refers to initiatives that put an explicit price on GHG emissions, expressed as a value per ton of carbon dioxide, which is aligned with the latest report of the World Bank on carbon pricing.[13] These initiatives include emissions trading systems, carbon taxes, offset mechanisms, and results-based finance linked directly to GHG emissions that result in an explicit valuation of carbon dioxide emissions.

Other policies that implicitly price GHG emissions, such as the removal of fossil fuel subsidies, energy taxation, support for renewable energy, and energy efficiency certificate trading are not included. Nor does this indicator regard international flexible mechanisms, such as the clean development mechanism of the United Nations framework convention on climate change or similar regional agreements, as national carbon-pricing mechanisms.

Coverage of the carbon pricing regime matters for the energy efficiency and renewable energy pillars. A price on carbon signals to investors the true relative price of the consumption of fossil fuels, thus making power generation from renewable energy sources somewhat more competitive (holding everything else constant). Aside from creating a more level playing field for renewables relative to conventional fuels, carbon pricing mechanisms can raise revenues to provide additional incentives to potential renewable energy investors. A carbon price also makes use of fossil fuels more expensive to use, so the pursuit of greater efficiency in the supply and utilization of energy becomes more attractive from a financial standpoint. Such pricing would reinforce the regulatory and administrative mechanisms necessary to a successful portfolio approach to encouraging greater energy efficiency.

The first subindicator measures the proportion of national GHG emissions[14] covered under carbon-pricing mechanisms, if any. Countries without such a mechanism are automatically evaluated at 0 percent. This information indicates the effectiveness of the mechanism regardless of price level. For example, if a country has a comprehensive mechanism that is applied to all sectors and entities emitting carbon, the coverage is close to 100 percent. A country imposing a carbon tax only on large electricity producers has lower coverage. RISE does not assess the carbon price as there is no globally accepted standardized methodology to determine the appropriate level.

The second subindicator measures the presence of a mandatory reporting requirement of GHG emissions by emitters on a regular basis. It allows transparent and accurate information on GHG emissions through a bottom-up approach from the individual entity level. This information provides a robust foundation to monitor and quantify the mitigation effect of investment in low-carbon technologies, including renewable energy and energy efficiency, thus attracting international private or public financing for the deployment of sustainable energy and, more broadly, low-carbon technologies.

## RENEWABLE ENERGY INDICATORS

There are seven scored indicators in renewable energy encompassing multi-dimensional aspects of policies and regulations. The scores are analyzed in chapter 4. One nonscored administrative procedures indicator is described in chapter 5.



**TABLE 1.6** Renewable energy pillar

**Policies and Regulations**

- Legal framework for renewable energy
  - Primary legislation
  - Legal private ownership of generation
- Planning for renewable energy expansion
  - Renewable energy targets and plans
  - Renewable energy in generation planning
  - Renewable energy in transmission planning
  - Resource data and siting
- Incentives & regulatory support
  - Financial and regulatory incentives
  - Grid access and dispatch
- Attributes of financial and regulatory incentives
  - Predictabillity and efficiency (policy-neutral)
  - Predictability and efficiency (policy-specific)
  - Long-term sustainability
- Network connection and use
  - Connection cost allocation
  - Network usage and pricing
  - Renewable grid integration
- Counterparty risk
  - Payment risk reduction
  - Utility creditworthiness
  - Utility transparency and monitoring
- Carbon pricing and monitoring
  - Carbon pricing mechanism
  - Monitoring, reporting and verification (MRV) system

### Indicator 1. Legal framework for renewable energy

| Questions | Scoring | Traffic light |
|---|---|---|
| I. Legal framework for renewable energy | *X = Sum and divide by 2* | |
| 1. Primary legislation | | If the score X is:<br>X ≥ 67 (green)<br>33 < X < 67 (yellow)<br>33 ≤ X (red) |
| 1.1 Does a legal framework for renewable energy development exist? | Yes – 100, No – 0 | |
| 2. Legal private ownership of generation | | |
| 2.1 Is private sector ownership of renewable energy generation legally authorized? | Yes – 100, No – 0 | |

Primary legislation providing a clear and well-designed legal framework for renewable energy is a fundamental signal of a government's commitment to harnessing its renewable resources. Importantly, it provides legally binding authorization to develop the sector, and often provides guidance on how such development will be undertaken and the steps the government will take to support it. The legal framework can be part of a broader energy or power sector law or a stand-alone measure, but it must enshrine the vision for renewable energy and allow public institutions and private actors to understand their roles.

RISE considers whether the private sector can legally own renewable energy generation capacity. Private ownership refers to any arrangement where a private operator retains revenue from power sales, such as build-own-operate or build-own-operate-transfer arrangements. It does not refer to private participation limited to project operation such as engineering, procurement and construction, or management contracts. Ideally, the private sector's right to own and operate plants should be stated explicitly in the primary legislation, communicating to private developers their expected role in the sector, minimizing regulatory risk, and ultimately reducing financing costs. But other instruments demonstrating equivalent de facto legal approval, such as regulations or permits designed specifically for private projects, also can provide potential investors with sufficient certainty to proceed.

### Indicator 2. Planning for renewable energy expansion

| Questions | Scoring | Traffic light |
|---|---|---|
| II. Planning for renewable energy expansion | *X = Sum and divide by 4* | |
| 3. Renewable energy targets and plans | | |
| 3.1 Does an official renewable energy target exist? | Yes – 25, No – 0 | |
| 3.2 Does a renewable energy action plan or strategy to attain the target exist? | Yes – 25, No – 0 | |
| 3.3 Does the plan or strategy define the amount of investment necessary to meet the RE target? | Yes – 25, No – 0 | |
| 3.4 Is there an institution responsible for tracking progress in renewable energy development? | Yes – 25, No – 0 | |
| 4. Renewable energy in generation planning | | |
| 4.1 Does an electricity generation plan that includes renewable energy development exist? | Yes – 50, No – 0 | |
| 4.2 Is the generation plan based on a probabilistic approach? | Yes – 50, No – 0 | |
| 5. Renewable energy in transmission planning | | If the score X is: |
| 5.1 Does the current transmission planning consider renewable energy scale-up? | Yes – 50, No – 0 | X ≥ 67 (green) |
| 5.2 Has the country conducted a variable renewable energy integration study? | Yes – 50, No – 0 | 33 < X < 67 (yellow) |
| | | 33 ≤ X (red) |
| 6. Resource data and siting | | |
| For each relevant RE technology:* | | |
| 6.1 Does the government publish or endorse a resource atlas or other data on the abundance and quality of the resource? | Yes – 25, No – 0 | |
| 6.2 To what extent does the map follow best practices of data quality and availability (criteria defined in table 1.4)? | 0–25 – scale | |
| 6.3 Has the country carried out strategic planning or produced zoning guidance to inform the commercial development of the resource? | Yes – 25, No – 0 | |
| 6.4. Has the planning or zoning guidance been carried out according to best practice by 1) being undertaken as part of a strategic environmental and social assessment or equivalent process; and 2) making the outputs publicly available? | 0–25 – scale<br>*Sum and divide by number of relevant technologies* | |

* A relevant technology is one for which the country has a specific resource target or, if no resource targets exist, has high resource potential according to IRENA country profiles.

Setting a concrete renewable energy target and communicating that target publicly signals to the public and potential investors that the government is committed to developing renewable energy in order to support critical developmental objectives, including energy security, energy access, environmental sustainability, and economic development. The level or type of target does not affect the score, as the ideal amount or share of renewable energy in a country is specific to its circumstances. A target itself, however, typically is not enough, as even the most ambitious goals have little meaning without a realistic plan for implementation or at least a clear understanding of what needs to be done. Thus, a full score requires a government to communicate how the target will be met, for example through a strategy or action plan; to define the required investment to meet the target; and to track progress toward the target.

Long-term planning exercises—from national least-cost development plans to individual utilities' integrated resource planning—map out the infrastructure needed to meet future electricity demand. These typically are designed to minimize costs while guaranteeing sufficient supply and reliability. But renewable energy resources often are not included in such plans, either because their potential (and cost) is not understood or, as with wind and solar power, their generation characteristics (in particular variability and the steps that can be taken to reduce it) are not easily incorporated into traditional models. However, including renewable energy in the long-term planning process is important, both to ensure that a country can realize the benefits of renewable energy and that the renewable generation plants that are built provide the greatest long-term value.

The level at which this planning occurs differs based on the structure of the power sector. In many countries, it will be undertaken at least in part by a government entity (such as an energy ministry or state-owned utility). In more competitive markets there may be an independent planning body, or planning exercises may be conducted by private utilities. In either case, RISE assesses whether renewables have been explicitly incorporated in the most recent generation planning,[15] and whether that planning considers the probabilities of key inputs when determining the best long-term investments.[16]

As with generation, planning for the expansion of a national transmission system must incorporate potential future renewable energy development to avoid constraints on generation and to ensure that the strongest resources can be developed and utilized. Unlike conventional generation, most renewable power plants can be developed only in certain locations, where the resource is strongest. This requires the deliberate design of a transmission system to reach those areas, rather than passively allowing generation to be developed around existing or planned transmission lines. Transmission plans that explicitly incorporate renewable energy also allow an existing network to accept more electricity or maximize flexibility to integrate electricity from variable renewable resources. Integration studies identify the flexibility of an existing power system to accommodate variable renewables (for example, through existing dispatchable generation, storage systems, or demand-response measures) and the necessary future steps to increase flexibility at an acceptable cost and without sacrificing reliability.

To understand how best to develop a country's renewable energy resources, it is important to understand the extent of such resources. While developers take detailed measurements at a site before deciding a project's viability, national or regional data indicating the strength and locations of renewable resources provides critical input to sector planning and helps potential investors decide whether or not to look more closely at a country or region. The best resource maps maximize accuracy and communicate their methodology. Table 1.7 shows the characteristics measured by RISE for maps of each resource.[17] For scoring purposes, RISE considers only maps for resources that governments have prioritized through national targets or, if no resource-specific targets exist, that otherwise offer strong potential for power generation.[18]

Based in part on resource maps, an appropriate strategic planning or zoning guidance systematically and publicly identifies sites or zones for development of renewable energy as well as routes for the efficient transmission of electricity to load centers. Such maps are important sources of information for renewable energy developers because they provide guidance on where and how each renewable energy resource should be developed. Ideally, siting or zoning is carried out as part of a broader strategic environmental and social assessment, ensuring that renewable energy development happens in a coordinated, economical, sustainable, and socially inclusive way.



**TABLE 1.7** Attributes measured by RISE for each renewable energy resource map for each technology

| Biomass | Hydropower |
|---|---|
| • Includes an explanation of the methodology<br>• Includes publicly available source data<br>• Is validated by ground-based survey or officially reported data | • Includes an explanation of the methodology<br>• Includes publicly available source data<br>• Is validated by ground-based water run-off data and/or site surveys from potential sites |
| **Solar/wind** | **Marine** |
| • Has a spatial resolution of 5km or less<br>• Includes an explanation of the methodology<br>• Includes publicly available source data<br>• Is validated by at least 5 ground-based measurements taken for at least a year<br>• Is based on modeling inputs of at least 10 years | • Includes an explanation of the methodology<br>• Includes publicly available source data |
| **Geothermal** | |
| • The government has produced a national geological map or atlas<br>• The government has carried out surface exploration (geological, geochemical, temperature gradient) at potential geothermal sites<br>• The government has collected and recorded well data at potential geothermal sites | • The government has carried out test drilling at one or more potential geothermal sites (slim bore or full well)<br>• The government has supported the creation of a reservoir model in at least one site<br>• Includes publicly available source data |

### Indicator 3. Incentives and regulatory support

| Questions | Scoring | Traffic light |
|---|---|---|
| III. Incentives and regulatory support for renewable energy | *X = Sum and divide by 2* | |
| 7. Financial and regulatory incentives for renewable energy | | If the score X is:<br>X ≥ 67 (green)<br>33 < X < 67 (yellow)<br>33 ≤ X (red) |
| 7.1 Is there at least one scheme to support renewable energy per unit of electricity generated? (e.g., feed-in tariff, competitive bidding/auction, mandates, generation premiums, production tax credits)? | Yes – 50, No – 0 | |
| 7.2 Does the government offer other direct fiscal incentives for renewable energy (e.g., capital subsidies, grants or rebates, investment tax credits, tax reductions)? | Yes – 50, No – 0 | |
| 8. Grid access and dispatch | | |
| 8.1 Does the country provide guaranteed access to the grid for RE? | Yes – 25, No – 0 | |
| 8.2 Do RE projects receive priority in dispatch? | Yes – 25, No – 0 | |
| 8.3 Are there provisions to compensate seller if offtake infrastructure is not built in time? | Yes – 25, No – 0 | |
| 8.4 Are there mechanisms to compensate RE projects for lost generation due to certain curtailments after project commissioning? | Yes – 25, No – 0 | |

Financial and regulatory incentives refer to measures to improve the financial returns or reduce the risk of private renewable generation projects and usually clarify precisely how such projects may enter the market. RISE looks first at those acting directly on the price or revenue received by the renewable energy generator for each unit of energy provided, then at other common government-support mechanisms. These include some of the most well-known and common programs such as feed-in tariffs and renewable energy auctions. Combined, these incentives offer policy-makers a range of choices for how to most effectively—and cost effectively—support private investment. Not all incentives imply a subsidy. For example, a feed-in tariff can be set at the utility's avoided cost, or an auction can result in prices below those paid to fossil-fuel generators. In such cases, the incentive is in the stability of a guaranteed price rather than the level it is set, as well as a clear articulation of the steps required to enter the market. Each option operates differently and with its own pros and cons, depending on its design.[19]

Another key element of renewable energy support is to give confidence to potential investors that their projects can connect to the grid and sell power, assuming a reason-able and transparent threshold for technical performance and safety is met. The former is typically achieved through regulatory mechanisms that guarantee or prioritize grid access for power plants based on renewable resources, and the latter through measures that increase the likelihood renewable energy will be dispatched and that costs to generators will be reduced if offtakers are unable to accept electricity due to weaknesses in the network or other reasons outside the generator's control. RISE does not, however, judge which interruptions should be compensated. Some, such as those for regular maintenance, typically would not be.

### Box 1.4 Fossil fuel subsidy for power generation

Subsidies for fossil fuels can undermine the competitiveness of renewables. If the primary fuel source of the country is subsidized, it artificially lowers the cost of service for both the utilities and consumers. This can make any clean energy investment in either renewable energy or energy efficiency less competitive, and can make it harder to mobilize finance.

Fossil fuel subsidies are prevalent, estimated at about US$600 billion annually and concentrated in a handful of countries. Particularly problematic, and all too common, are universal price subsidies that distort market signals, drain government budgets, encourage wasteful energy consumption, disproportionately benefit the better off. These subsidies encourage firms to overproduce and consumers to use more fossil fuels, with heavy environmental implications.

In the RISE pilot, it was attempted to present countries that provide subsidy to fossil fuel consumed for electricity production by indicating the proportion of electricity that is generated by subsidized fossil fuel regardless of the magnitude of subsidy provided. In the RISE global rollout, data was collected to estimate the scale of fossil fuel subsidy for the power sector, i.e., electricity generation.

**Methodology**

The equation below shows that the difference between the adjusted reference unit price and the local price paid is multiplied by the total units of the fuel consumed locally to obtain the price gap:

*Price gap = (adjusted reference unit price – local unit price) x (units consumed).*

The price gap value does not reflect all subsidies for power generation. It measures only economic input subsidies provided to lower the price of fossil fuels used for power generation. A positive price gap value represents the situation where the local fuel price is less than the traded price on competitive international markets. This gap is seen as an economic loss that would otherwise not have occurred in an efficiently operating market. It can be caused by some forms of government intervention, such as a budget or off-budget subsidy, cross-subsidy, price ceiling, or export or import restriction. However, the price gap approach would be unlikely to capture other forms of government intervention such as tax credit, direct revenue support, below-market provision of loans, loan guarantees, or grants for energy-related activities.

**Results**

The methodology was applied to make a preliminary estimation in some sample countries (box table), normalized by government revenue to compare the scale across countries.

The indicator was not included in RISE global rollout due to challenges in applying this methodology consistently across all RISE countries. In some cases the required data set was unavailable or hard to collect, including shipping or inland transportation costs of fossil fuel. There were also many cases where generation companies faced different situations for fuel supply, so a single generation company was unlikely to represent the entire market of the country.

**FOSSIL FUEL SUBSIDY FOR POWER GENERATION (PERCENTAGE OF GOVERNMENT REVENUE) FOR SELECTED COUNTRIES (2013–14)**

| Country | Fossil fuel subsidy |
|---|---|
| Angola | 4.27 |
| Bangladesh | 2.96 |
| Haiti | 17.20 |
| Myanmar | 2.18 |
| Saudi Arabia | 14.09 |
| Uzbekistan | 26.10 |

*Source:* RISE database, World Bank, Argus.

### Indicator 4. Attributes of financial and regulatory incentives

| Questions | Scoring | Traffic light |
|---|---|---|
| IV. Attributes of financial and regulatory incentives | *X = Sum and divide by 3* | |
| 9. Predictability and efficiency (policy-neutral) | | |
| 9.1 Is the market entry mechanism for private RE projects defined (e.g., 1st come 1st served, tenders)? | Yes – 33.3, No – 0 | |
| 9.2 Are projects subject to development timelines or milestones? | Yes – 33.3, No – 0 | |
| 9.3 Are tariffs indexed (in part or in whole) to an international currency or to inflation? | Yes – 33.3, No – 0 | |
| 10. Predictability and efficiency (policy-specific) | | If the score X is:<br>X ≥ 67<br>33 < X < 67<br>33 ≤ X |
| 10.1 If there is a guaranteed tariff, is there a mechanism to adjust the level of the tariff for new entrants (e.g., declination)? | Yes – 100, No – 0 | |
| 10.2 If there is a guaranteed tariff, is there a mechanism to differentiate tariffs based on the size of the generation plant? | Yes – 100, No – 0 | |
| 10.3 If there is competitive bidding/auctions, are there provisions to ensure full and timely project completion (e.g., bid-bonds, project milestones, eligibility requirements)? | Yes – 100, No – 0 | |
| 10.4 If there is a renewable energy mandate, can it be met with tradable certificates (e.g., RECs, ROCs, TECs)? | Yes – 100, No – 0<br>*Divide by number of relevant incentives in place* | |
| 11. Long-term sustainability | | |
| 11.1 Is the price subsidy/benefit implied by a renewable energy incentive program passed through in full or in part to the final electricity consumer? | Yes – 100, No – 0 | |

The likelihood that any given financial or regulatory incentive will attract investment at an acceptable cost depends on the measure's design. Key risks inherent in developing private power projects must be allocated fairly and to parties that can best absorb them. The risks and appropriate risk allocations differ widely by country, as does the choice of instruments and their design characteristics.

Still, certain key features are universally important, including whether policies are clear, predictable, and financially sustainable in the long term. These attributes are only a small sample of the types of design elements that affect whether government support for renewable energy will work as intended, and their presence (or absence) will not guarantee success (or failure). Together, however, they can provide insight into whether a country's approach to attracting renewables has been designed carefully and is likely to be effective, efficient, and sustainable.

Critical to the success of any renewable energy support instrument is that its provisions are predictable (ensuring that private developers can reliably gauge their future costs and revenue) and efficient (leading to well-performing projects at low cost). RISE assesses predictability through three measures applicable in the context of any financial or regulatory incentive (and to the market alone when none is in place), and four measures specific to different support schemes:

#### Policy-neutral

- There is a defined market entry mechanism for private renewable energy projects, providing clear guidance to potential developers and investors on the steps to enter the market. An example could be a generation license available in a first-come-first-served basis or a public tender explicitly requesting bids.
- Project development timelines or milestones are a condition for retaining renewable energy generation licenses to ensure that new generation can come on line when promised and that high-quality resources are not blocked by stalled projects.
- Tariffs are indexed (in part or in whole) to an international currency or to inflation, so investors are certain their revenue will cover their costs regardless of currency fluctuations.

#### Policy-specific

- There are rules governing the price level modification and frequency, to ensure that governments benefit from technology cost reductions and that developers know in advance the price they will receive for their power (feed-in tariff only).
- Tariff levels differ by the size of generation plant to benefit from the economies of scale for large plants while still providing support for smaller ones (feed-in tariff only).
- Tenders or auctions have provisions to discourage unrealistically low bids (such as bid bonds), to help ensure that winning bidders can deliver projects at the bid price (competitive bidding only).
- Any renewable purchase obligation can be met with tradable certificates (RECs, ROCs, TECs) to encourage the most efficient renewables projects (purchase obligation only).

Equally important is that the cost of renewable energy incentives does not pose an unsustainable burden on public sector finances. If it does, it is not likely a wise policy choice for the country and may deter potential investors if they question whether proposed payments will materialize in the later years of the project. Of course, the price paid—particularly any subsidy—is the primary determinant of whether the cost is sustainable. What specific price is sustainable depends on the current and future finances of a country, however, and a universally sustainable price does not exist. The treatment of the levels and prices of renewable energy support mechanisms is discussed in box 1.5. Another way to ensure sustainability is to include at least part of any subsidy given to renewable energy producers in the final bills paid by consumers. This sends accurate price signals to consumers and makes it more likely that utilities can recover their costs.



### Box 1.5 Affordability of renewable energy

One important attribute of any renewable energy incentive or support scheme that RISE does not score is the price or level the incentive is set. While price may play a larger role than any other attribute in determining if an incentive attracts investment and meets its objectives, the appropriate price of a given incentive depends on individual characteristics of a country and the specific objectives of the incentive itself. Even for the same technology in the same country, an incentive targeted on smaller projects may need to be set higher than one focused on larger projects that enjoy greater economies of scale.

While setting incentives higher may attract more investment, policymakers must pay attention to long-term budget implications. If incentives are too expensive, they may represent poor use of resources and—critical to investors—may not be sustainable over the projected lifetime of the policy or program. When this happens, incentives can be reversed retrospectively, denying projects future subsidies that previously had been guaranteed.

The RISE pilot attempted to account for the downside of excessively high incentive levels by calculating the subsidy implied by each incentive (the difference between the price received by renewable energy generators and the wholesale price of conventional fossil fuels) and comparing it with the country's per capita income. In the RISE global rollout, reliable data could not be collected to estimate a subsidy level in all countries, but it was deemed important to display incentive levels where possible to compare them with a relevant benchmark.

Thus RISE has compared the prices of each feed-in tariff[a] and the winning bids of each competitive tender with the levelized cost of energy (LCOE) for that technology in the country, as estimated by the IRENA. The results for wind and solar projects are displayed in the box figure in box 4.4 of chapter 4; all incentive prices are available on the RISE website (rise.worldbank.org). The comparison is for informational purposes only, as prices that fall outside the LCOE range are not necessarily too high or too low. In particular, the IRENA LCOE estimates are based on costs reported by actual projects in the same geographic region; however, as certain regions have very few projects, they should be interpreted as estimates only. For more information on the IRENA cost calculation program, see www.irena.org.

a When feed-in tariff levels differ by project size, RISE uses the level offered to the largest plants.

### Indicator 5. Network connection and access

| Questions | Scoring | Traffic light |
|---|---|---|
| V. Network connection and access | *X = Sum and divide by 3* | |
| 12. Connection cost allocation | | |
| 12.1 Are there rules defining the allocation of connection costs? | Yes – 50, No – 0 | |
| 12.2 What is the type of the connection cost allocation policy (i.e., shallow/deep)? | Shallow – 50, Deep – 0 | |
| 13. Network usage and pricing | | |
| 13.1 Are there rules that allow electricity customers to purchase power directly from a third party (i.e., an entity other than the designated utility in a service area)? | Yes – 50, No – 0 | |
| 13.2 Do the rules define the size and allocation of costs for use of the transmission and distribution system (e.g., wheeling charges, locational pricing)? | Yes – 50, No – 0 | If the score X is:<br>X ≥ 67<br>33 < X < 67<br>33 ≤ X |
| 14. Renewable grid integration | | |
| 14.1 Does the country have a grid code that includes measures or standards addressing variable renewable energy? | Yes – 33.3, No – 0 | |
| 14.2 Are there rules for exchanging power between balancing areas that penalize variable renewable energy (e.g., through imbalance penalties)? | Yes – 0, No – 33.3 | |
| 14.3 Are there provisions in the power exchange rules that allow for plant forecasting? | Yes – 33.3, No – 0<br>Note: questions 14.2 and 14.3 only scored in countries with multiple balancing areas. | |

For a private renewable energy project to be financially viable, the costs of physically connecting to the grid must be understood before project development and not so high as to render the project unprofitable. Connection provisions often are negotiated directly in PPAs, but explicit rules governing the connection process and costs reduce uncertainty and the possibility that individual utilities will impose arbitrary or costly connection procedures. RISE assesses whether such rules exist and whether they require the generator to pay solely for the connection (shallow) or also for general upgrades to the transmission system to absorb the additional power (deep).

RISE also looks at whether generators are allowed to use existing T&D networks to sell power to parties other than the owner of the lines or another single, authorized offtaker (single buyer). Allowing nondiscriminatory access to T&D lines encourages additional generation options by increasing the range of potential projects and allowing customers to negotiate mutually acceptable prices directly with generators. Of course, allowing third parties to use their system imposes costs on the network operators, who can charge for the service. The design of those charges varies, but they must be defined clearly to allow project developers and investors to account for them in their financial calculations.

A legally binding grid code is important so renewable energy project operators know the technical specifications that must be met by power entering the T&D networks. It should explicitly consider the effect on the system of variable generation. In countries with multiple balancing areas or wholesale power markets, rules allowing for flexibility in meeting balancing requirements—that is, ensuring the amount of power delivered at a given time is comparable with what was promised—may reduce disincentives to purchasing variable renewable generation.

### Indicator 6. Counterparty risk

| Questions | Scoring | Traffic light |
|---|---|---|
| VI. Counterparty risk | *X = Sum and divide by 3* | |
| **15. Payment risk mitigation** | | |
| 15.1 Does the government offer or allow backing of utility power purchase payments (e.g., through a letter of credit, escrow account, payment guarantee, or other)? | Yes – 100, No – 0 | |
| **16. Utility transparency and monitoring** | | |
| 16.1. Are the financial statements of the largest utility publicly available? | | |
| a) Generation | Yes – 25/8, No – 0 | |
| b) Transmission | Yes – 25/8, No – 0 | |
| c) Distribution | Yes – 25/8, No – 0 | |
| d) Retail sales | Yes – 25/8, No – 0 | |
| If yes, are they audited by an independent auditor? | | |
| e) Generation | Yes – 25/8, No – 0 | |
| f) Transmission | Yes – 25/8, No – 0 | |
| g) Distribution | Yes – 25/8, No – 0 | |
| h) Retail sales | Yes – 25/8, No – 0 | |
| 16.2. Are the following metrics published in a primary official document (by the utility, regulator or ministry and/or government)? | | |
| a) Transmission — Transmission loss rate | Yes – 25/4, No – 0 | If the score X is: |
| b) Distribution — Distribution loss rate | Yes – 25/4, No – 0 | X ≥ 67 (green) |
| c) Retail sales — Bill collection rate | Yes – 25/4, No – 0 | 33 < X < 67 (yellow) |
| d) Retail sales — Amount of electricity available for sale to end-users | Yes – 25/4, No – 0 | 33 ≤ X (red) |
| 16.3. Is the utility operating an incidence/outage recording system (or SCADA/EMS with such functionality)? | Yes – 25, No – 0 | |
| 16.4. Is the utility measuring the SAIDI and SAIFI or any other measurements for service reliability? | Yes – 25/3, No – 0 | |
| a) Are the measurements reported to the regulatory body? | Yes – 25/3, No – 0 | |
| b) Are the measurements available to public? | Yes – 25/3, No – 0 | |
| **17. Utility creditworthiness** | | |
| 17.1. Current ratio | < 1 – 0<br>in between – scale<br>≥ 1.2 – 25 | |
| 17.2. EBITDA margin | < 0 – 0<br>in between – scale<br>≥ 15% – 25 | |
| 17.3. Debt service coverage ratio | < 1 – 0<br>in between – scale<br>≥ 1.2 – 25 | |
| 17.4. Days payable outstanding | > 180 – 0<br>in between – scale<br>≤ 90 – 25 | |

In many countries, a key barrier to renewable energy investment (and all private power generation) is the risk that the buyer may not be able to follow through on contractual obligations and may not pay for its power purchases in a timely manner. This typically is a concern in countries with limited options for potential counterparties and where those in place may not have a steady, reliable revenue stream to cover costs. RISE estimates this risk by assessing the transparency and creditworthiness of the selected utility, and whether the government provides mechanisms to reduce the risk of non- or delayed payment.

Such risk is uncommon in countries where international investors trust the financial and legal systems, reporting requirements are robust, and economy-wide laws and regulations offer protections for investors. RISE uses a country's sovereign credit rating as a proxy for overall investor confidence and does not independently calculate this indicator in countries where two of the three international credit ratings agencies—Standard and Poor's, Fitch, and Moody's—consider national long-term risk to be low (defined as an A- rating or above from Standard and Poor's and Fitch, and A3 or above from Moody's).[20] Scores for all other countries are calculated as described on page 63.

The most valuable long-term solution to utility performance issues is to undertake reforms improving governance and accountability and to ensure that utilities' annual revenue (usually from retail power sales) covers their costs. Reaching this equilibrium may be a long-term process in many countries, entailing major reform of the power sector. But there are steps a government can take in the interim to reduce the risk of non- or delayed payment.

Payment risk mitigation measures whether the government provides at least one mechanism to reduce the risk that the offtaker (or other counterparty) does not pay the private generator in full and on time. Such measures include letters of credit and escrow accounts, or a sovereign guarantee of the payment itself.

Utility transparency and monitoring evaluates whether key information about the financial and technical performance of the selected utility company is collected, reported to the regulator, and made publicly available. This information can provide a basis for investors and developers in assessing investment opportunities where utilities are critical counterparts. Thus, a lack of transparency in disclosing this information may damage the business environment for private renewable energy development. Moreover, utilities' capacity to monitor the reliability of electricity services is important to maintain high operating efficiency and financial viability of their core business. For assessment on this indicator, the largest utilities in generation, transmission, distribution, and retail sales in the country are selected, as listed in appendix 3. Detailed questions look at the disclosure and auditing of key financial and technical information, whether financial reports have been independently audited, and the utility's capacity for monitoring the reliability of its services.

Utility creditworthiness assesses the financial health of the selected utility in each country[21] through a suite of four financial metrics: current ratio, debt-service coverage ratio, days payable outstanding, and EBITDA. Since the selected utility in most RISE countries is a buyer of power, its creditworthiness directly affects the risk of non- or late payment to independent power producers, and low creditworthiness can be a barrier to private investment in the sector.

### Indicator 7. Carbon pricing and monitoring

| Questions | Scoring | Traffic light |
|---|---|---|
| VII. Carbon pricing and monitoring | *X = Sum* | |
| 18. Carbon pricing and monitoring | | If the score X is: |
| 18.1 For any carbon pricing mechanism (e.g., carbon tax, emission trading system), what is the portion of national GHG emissions covered)? | 100% coverage – 50, < 100% – scaled | X ≥ 67 (green); 33 < X < 67 (yellow) |
| 18.2 Is there a monitoring, reporting and verification system for greenhouse gas emissions in place? | Yes – 50, No – 0 | 33 ≤ X (red) |

Putting a price on carbon increasingly is emphasized as an effective tool to internalize the environmental externality of carbon emission and transition toward low-carbon economies. This indicator assesses the status and extent of a carbon pricing and monitoring regime. (See Indicator 12 under energy efficiency above for further discussion.)



## NOTES

1. Development of indicators for modern cooking solutions has been excluded in this report and could be considered for the next edition of RISE.
2. Apart from questions on topics where new entrants are irrelevant, such as monopoly utilities or government bodies. For example, an incentive that expired but is received by projects built before a certain date is excluded; a mandate written to specifically cover the one and only distribution company in a country is scored.
3. For energy access, these are defined as the groups of countries with the highest number of people without access to modern energy services and countries with the lowest rates of electrification. For energy efficiency and renewable energy, they are the countries with the greatest primary and final electricity consumption.
4. One interviewee was accepted in certain limited cases where the sole interviewee was speaking as an official representative of the government or was otherwise considered authoritative.
5. More information about the CPIA methodology is at: http://web.worldbank.org/WBSITE/EXTERNAL/EXTABOUTUS/IDA/0,,contentMDK:21378540~menuPK:2626968~pagePK:51236175~piPK:437394~theSitePK:73154,00.html.
6. The International Renewable Energy Agency (IRENA). (MASDAR CITY, 2015) “Renewable Power Capacity Statistics 2000-2014.” IRENA Tableau Dashboard Extract, November 2015. Accessed May 2, 2016. The renewable power capacity data shown here represents the maximum net generating capacity of power plants and other installations that use renewable energy sources to produce electricity. Data has been obtained from a variety of sources, including: the IRENA questionnaire; official statistics; industry association reports; consultants reports; and news articles. The data reflects the capacity installed and connected at the end of the calendar year.
7. World Bank 2010.
8. Banerjee et al. 2008; Banerjee et al. 2014; Fankhauser and Tepic 2007.
9. Largest generation company in the country by installed capacity; largest transmission company in the country by amount of electricity transmitted; largest distribution company in the largest business city by amount of electricity sold to retailers in the largest business city’s metropolitan area; and largest retail company in the largest business city by number of customers served in the largest business city’s metropolitan area.
10. Largest generation company in the country by installed capacity; largest transmission company in the country by amount of electricity transmitted; largest distribution company in the largest business city by amount of electricity sold to retailers in the largest business city’s metropolitan area; and largest retail company in the largest business city by number of customers served in the largest business city’s metropolitan area.
11. IPCC 2014.
12. Kossoy et al. 2015.
13. Kossoy et al. 2015.
14. National GHG emissions used in RISE exclude emissions from land use, land-use change, and forestry.
15. Ideally, renewable energy planning expansion involves two tiers: incorporation of the specific characteristics of renewable energy into long-term expansion planning; and use of other complementary tools to assess the contribution of renewable energy to individual or multiple policy objectives. For practical reasons and as a first stage, RISE assesses good practices by whether renewable energy is integrated into long-term expansion planning.
16. Planning is counted as probabilistic if it includes a probability distribution for at least one input to the planning model, for example load forecasts, generator reliability, hydrological flows.
17. For geothermal energy the provision of information goes beyond maps, reflecting the very high degree of resource uncertainty associated with geothermal surface exploration and the generally accepted need for test drilling to attract investment.
18. As determined by the IRENA Country Profile and Global Atlas.
19. In its scoring, RISE does not consider the type of incentive in place, because the correct financial or regulatory incentive depends entirely on the characteristics of a particular country and the government’s priorities. Financial incentives can be calculated based on electricity generated over time or the costs of equipment or project development; aim to increase revenue, lower costs, or reduce risk; be paid directly by the government or passed through to consumers; target a desired amount of development (or a specific project); or set an overall price for the market. More details are on the RISE website (www.rise.worldbank.org).
20. For full definitions of each agency’s ratings, see: https://www.moodys.com/sites/products/AboutMoodysRatingsAttachments/MoodysRatingSymbolsandDefinitions.pdf (Moody’s); https://www.fitchratings.com/site/definitions/nationalratings (Fitch); and https://www.standardandpoors.com/en_US/web/guest/article/-/view/sourceId/504352 (Standard and Poor’s).
21. The list of selected utilities is in appendix 3.

# CHAPTER 2
# ENERGY ACCESS

## PILLAR OVERVIEW AND KEY MESSAGES

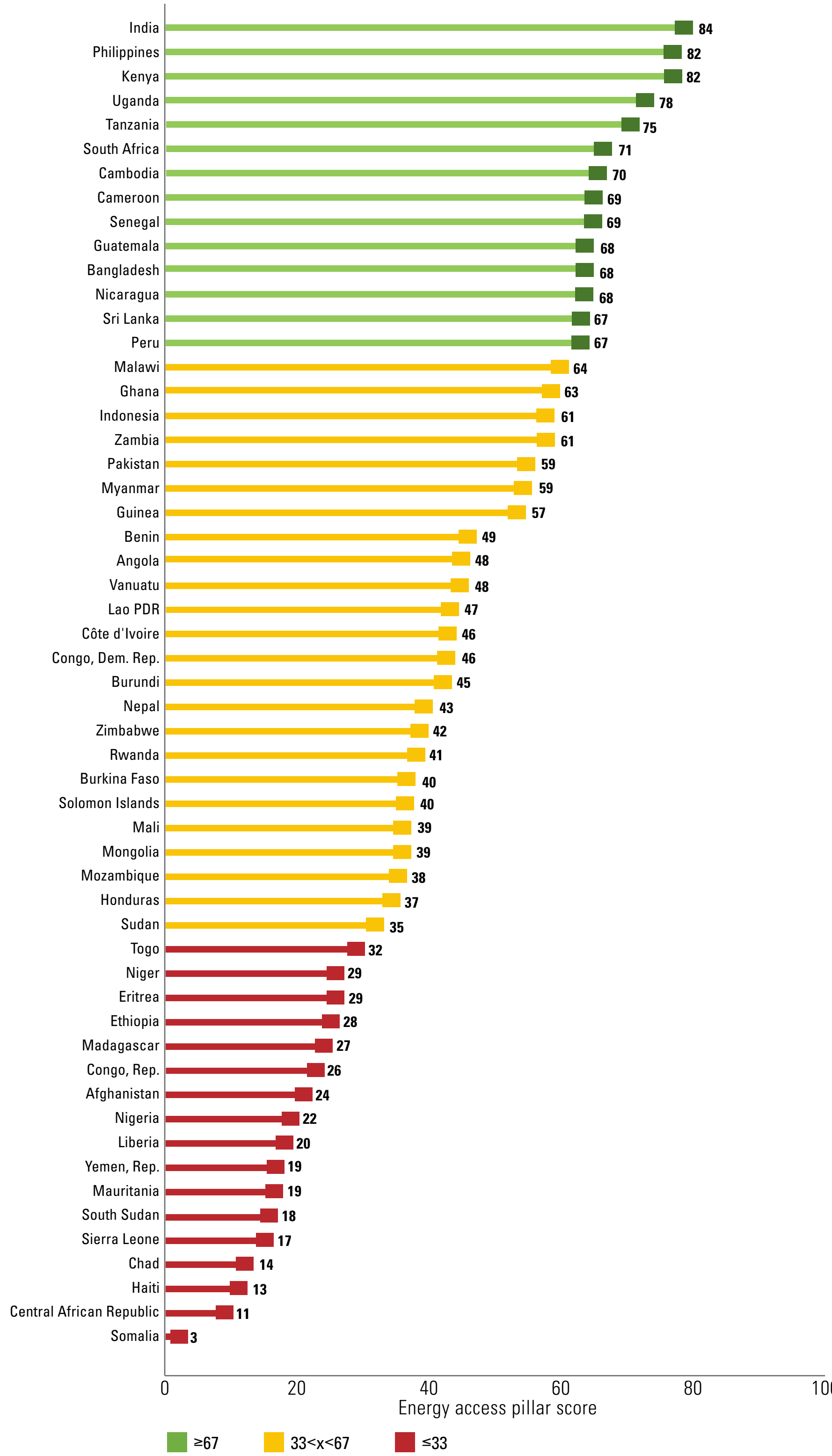
The RISE scores range from 84 in India to 3 in Somalia, with an average of 46. More than half the countries have scores below the halfway mark. Almost half of the countries are clustered in the yellow zone (figure 2.1). With only 14 of 55 countries having established a policy environment to put them in the green zone, the majority are a work in progress, representing an opportunity for stakeholders, including donor partners.

The 55 countries where access deficits exist are overwhelmingly represented by low-income countries, of which far more are in the red zone than lower-middle- and upper-middle-income countries. There is extensive overlap between the low-income group and Sub-Saharan Africa, the region with the most countries in the red zone and the fewest in the green zone. In South Asia, the only other region with a substantial access deficit, the RISE scores are impressive: half the countries are in the green zone (figure 2.2).

India, the Philippines, Kenya, Uganda, and Tanzania are the top five scorers (table 2.1). In Sub-Saharan Africa, the three East African countries are leading, followed by South Africa, Cameroon and Senegal—all are in the green zone. In South Asia, Bangladesh, India, and Sri Lanka are trailblazers. In East Asia and the Pacific, Cambodia and the Philippines are doing well in adopting good practices to scale-up energy access. Thus every region and peer group has good examples of countries whose experiences can be customized and emulated.

The 10 high-impact countries—those with the highest access deficit—report mixed results, with higher than the global average score of 58 (figure 2.2). Bangladesh, India, Kenya, Tanzania and Uganda all are in the

**FIGURE 2.1** Distribution of energy access pillar scores, 55 countries




*Source:* RISE database, World Bank.

**FIGURE 2.2** Distribution of energy access scores


*Source:* RISE database, World Bank.
*Note:* Middle East and North Africa comprises only the Republic of Yemen.

green zone, while two countries—Ethiopia and Nigeria—are in the red zone. However, these are the two most populous countries in Sub-Saharan Africa.

The 10 countries with lowest electrification and the 20 affected by conflict report a consistently poor policy environment. Six of the 10 countries with lowest electrification rate[1] are in the red zone; only Tanzania is in the green zone. Among the 20 fragile and conflict affected countries,[2] 12 are in the red zone. The average score at 29 is lower than the global average of 46, underlining the need for more nuanced support in customizing policy and promoting capacity building in institutions.

Among the eight indicators, consumer affordability of electricity (Indicator 6) is the most prevalent, suggesting that monthly payments for small amounts of electricity will not impose a heavy burden on households (figure 2.3). All countries except seven are in the green or yellow zone on this indicator. Subsistence consumption of 30 kWh a month costs less than US$1/kWh in all countries but Somalia, and costs less than 5 percent of the household budget in 42 countries. Still, consumers in fragile and conflict-affected countries pay exorbitant amounts—particularly Liberia, Madagascar, Solomon Islands, and Somalia.

A sizable group of countries meet the requirements for the existence and monitoring of an officially approved electrification plan (Indicator 1), but only a smaller subset adopt the good practices of the scope of an officially approved electrification plan (Indicator 2). Although the former is a relatively easy step, 44 percent of countries are in the red zone. The latter indicator is where the average score is lowest and the fewest countries are in the green zone.

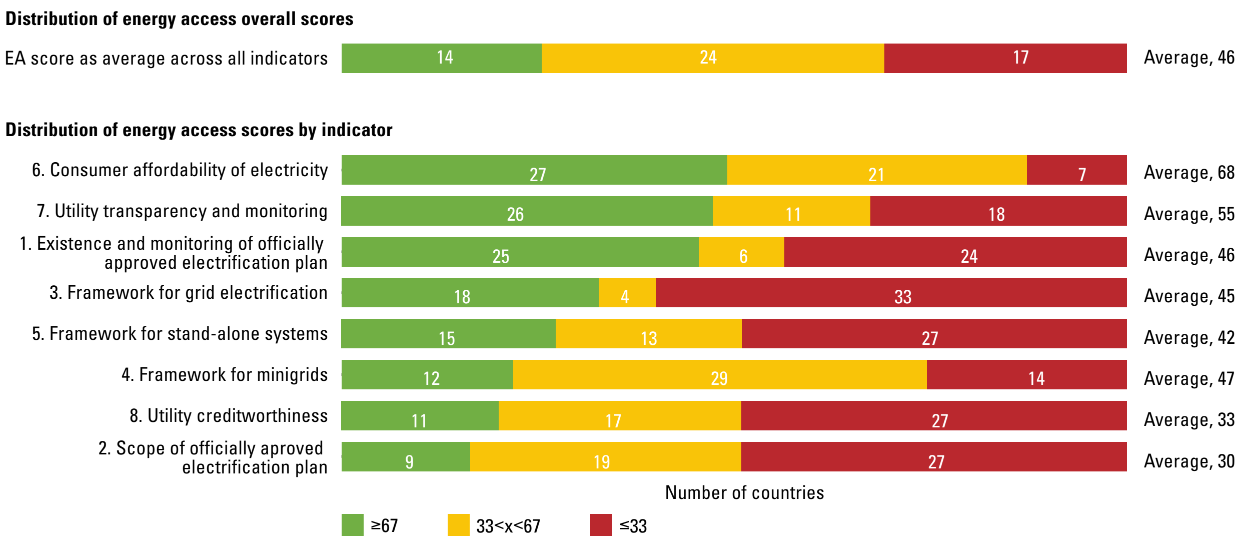
Establishing a framework for grid electrification (Indicator 3)—the mainstay for progressing toward universal access—has the most countries (33) in the red zone among the eight indicators (18 countries are in the green zone). Similarly, for minigrids (Indicator 4) and stand-alone systems (Indicator 5), a majority of countries are a long way from establishing a comprehensive framework. Madagascar, Nicaragua, the Philippines, and Tanzania have, however, set up a robust policy framework in minigrids and Cambodia, Ghana, Kenya, and Uganda have done so for stand-alone systems.

**TABLE 2.1** Score distribution by indicator for the top 10 and the bottom 10 countries

| Top 10 energy access score countries | Energy access overall score | 1. Existence of plan | 2. Scope of plan | 3. Grid electrification | 4. Minigrids | 5. Stand-alone systems | 6. Affordability | 7. Utility transparency and monitoring | 8. Utility credit-worthiness |
|---|---|---|---|---|---|---|---|---|---|
| India | 84 | 80 | 75 | 100 | 77 | 69 | 100 | 96 | 76 |
| Philippines | 82 | 100 | 75 | 67 | 85 | 62 | 100 | 87 | 82 |
| Kenya | 82 | 100 | 50 | 67 | 66 | 93 | 100 | 96 | 86 |
| Uganda | 78 | 100 | 63 | 67 | 64 | 93 | 100 | 79 | 59 |
| Tanzania | 75 | 100 | 50 | 100 | 96 | 73 | 100 | 83 | 0 |
| South Africa | 71 | 100 | 38 | 100 | 10 | 76 | 100 | 96 | 51 |
| Cambodia | 70 | 80 | 38 | 100 | 65 | 93 | 50 | 46 | 90 |
| Cameroon | 69 | 80 | 88 | 33 | 65 | 73 | 100 | 67 | 50 |
| Senegal | 69 | 100 | 88 | 100 | 72 | 36 | 50 | 96 | 15 |
| Guatemala | 68 | 100 | 75 | 50 | 39 | 33 | 100 | 62 | 87 |
| **Bottom 10 energy access score countries** | **Energy access overall score** | **1. Existence of plan** | **2. Scope of plan** | **3. Grid electrification** | **4. Minigrids** | **5. Stand-alone systems** | **6. Affordability** | **7. Utility transparency and monitoring** | **8. Utility credit-worthiness** |
| Somalia | 3 | 0 | 0 | 0 | 5 | 22 | 0 | 0 | 0 |
| Central African Republic | 11 | 0 | 0 | 0 | 10 | 11 | 0 | 17 | 50 |
| Haiti | 13 | 0 | 0 | 0 | 43 | 11 | 50 | 0 | 0 |
| Chad | 14 | 0 | 0 | 17 | 30 | 11 | 50 | 4 | 0 |
| Sierra Leone | 17 | 0 | 0 | 0 | 35 | 44 | 50 | 8 | 0 |
| South Sudan | 18 | 0 | 0 | 0 | 30 | 11 | 42 | 62 | 0 |
| Mauritania | 19 | 0 | 0 | 33 | 48 | 11 | 50 | 8 | 0 |
| Yemen, Rep. | 19 | 0 | 0 | 33 | 19 | 22 | 50 | 29 | 0 |
| Liberia | 20 | 0 | 0 | 17 | 30 | 56 | 0 | 25 | 36 |
| Nigeria | 22 | 0 | 0 | 17 | 35 | 22 | 100 | 0 | 0 |

*Note:* Top 10 and bottom 10 by overall RISE energy access score.

**FIGURE 2.3** Score distribution by indicator, number of countries, and average score



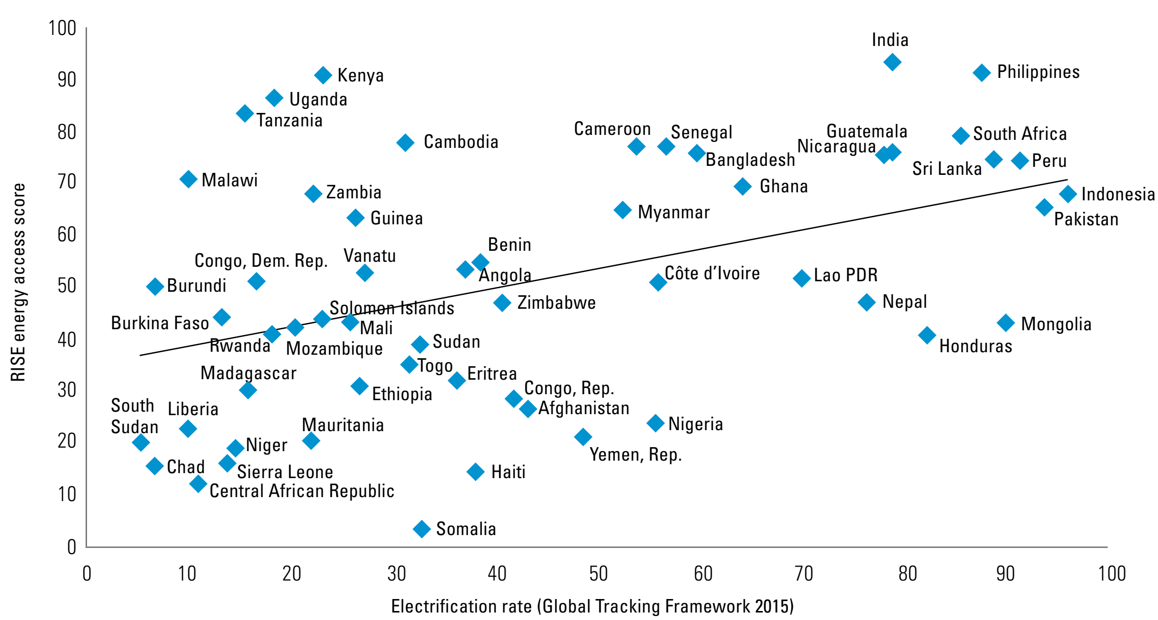

*Source:* RISE database, World Bank.

The good news is that top RISE scorers do well across three energy supply solutions—grids, minigrids, and stand-alone systems, suggesting they are not being pursued as substitutes but rather as complements. India and Tanzania, for example, report a score in the green zone for all three solutions. A worrying sign is that the 10 worst RISE scorers (table 2.1) show little progress on any of these three dimensions.

There is a strong association between a country's RISE score and its electrification rate (figure 2.4). The top-left quadrant shows countries where, despite a high RISE score, electrification is low. This group includes countries recently active in developing new policies for adopting good practices. It is hoped that the effect of these policy and regulatory changes will lead to faster progress and higher electrification rates, something that must be monitored through the Global Tracking Framework. All countries but one (Cambodia) in this quadrant are in Sub-Saharan Africa, including those making substantial progress, such as Kenya, Tanzania, and Uganda.

The top-right quadrant has countries with high RISE scores and high electrification rates. Countries such as India, the

**FIGURE 2.4** Association between RISE energy access score and electrification rate




*Source:* RISE database, World Bank.

Philippines, South Africa, and Sri Lanka have introduced policies supporting electrification for decades and have benefited from the outcomes. The bottom-left quadrant includes countries where RISE scores and electrification rates are low and offer substantial scope to adopt good practices. The bottom-right quadrant shows countries where electrification rates are high alongside low RISE scores, and includes large countries such as Indonesia and Pakistan.

## INDICATOR SCORES

### Indicator 1. Existence and monitoring of officially approved electrification plan

A majority of economies have designed electrification planning strategies, typically a first step to implementing their energy access vision, underpinned by joint efforts of national governments, utilities, and other stakeholders. However, 44 percent of countries—primarily fragile, low-income, often in Sub-Saharan Africa—do not have electrification plans and are in the red zone (figure 2.5). Among them, the Democratic Republic of Congo, Ethiopia, Haiti, Liberia, Mongolia, Nepal, Nigeria, Sierra Leone, Solomon Islands, South Sudan, Sudan, and the Republic of Yemen have draft, yet unapproved, plans. Afghanistan, Burundi, Central Africa Republic, Chad, Madagascar, Mali, Mauritania, Mozambique, Niger, Pakistan, Somalia, and Togo do not report having a draft plan.

A group of countries with an officially approved plan have set up good practice measures to share, update, and track progress: Guatemala, Indonesia, Kenya, Myanmar, Nicaragua, the Philippines, Senegal, South Africa (box 2.1), Tanzania, and Uganda. These countries have developed comprehensive mechanisms that include publicly available data, regular reviews, as well as an entity responsible for tracking the implementation and a time frame with defined targets, showcasing their countries' engagement and proactivity to ensure the quality and sustainability of electrification programs, going beyond the existence of a plan. The Indonesian government, for example, adopted the 2015–2024 Electricity Power Supply Business Plan to reach universal access by 2020. The state-owned utility, PLN, monitors the extension of the grid while off-grid development programs are executed by line ministries and local governments. By contrast, countries such as Côte d'Ivoire and Zimbabwe do not report the existence of such good practices: Côte d'Ivoire has not made its plan publicly available, has not set up a dedicated entity for tracking, and does not have a time frame for the plan, while Zimbabwe has a plan that has no time frame, is not publicly available, and has not been updated in the last five years.

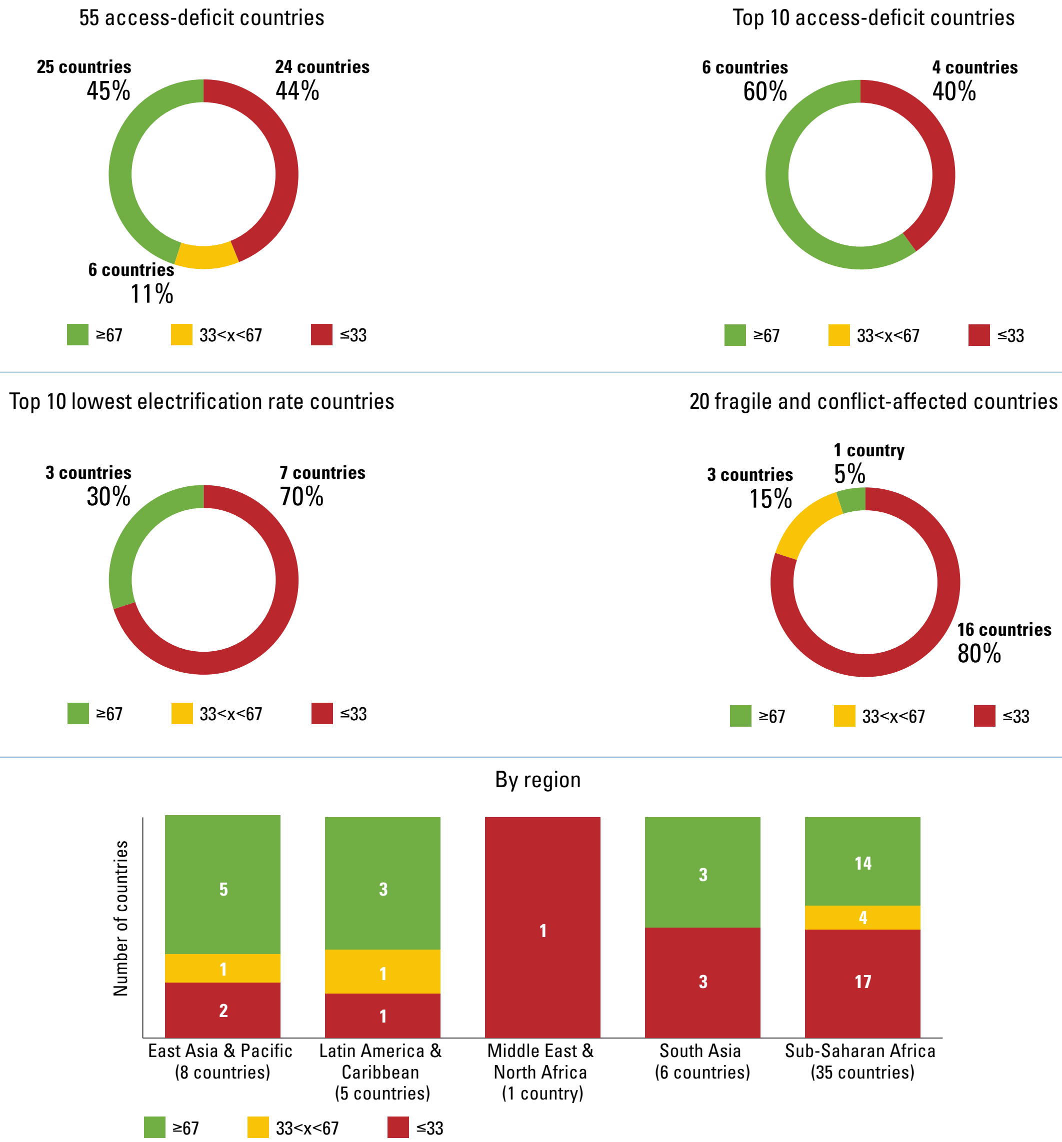
Ninety percent of countries with an officially approved plan have established a dedicated entity for tracking the plan (figure 2.6). In 45 percent of countries, the Ministry of Energy (or equivalent) tracks electrification progress, followed by 28 percent of countries that have dedicated electrification agencies. The remaining countries have entrusted either the utilities or both the utilities and electrification agencies to track progress. Benin, for example, established the Agence Béninoise d'Electrification Rurale et de Maîtrise d'Énergie, India has the Rural Electrification Corporation Ltd., and Senegal the National Agency for Electrification. In a few countries, such as Eritrea and Indonesia, tracking the plan's progress is an explicit part of the utility mandate. In four countries (Honduras, Myanmar, Tanzania, and Zambia), this responsibility is split between the utility and a dedicated agency. Also in a few countries, responsibility for grid and off-grid electrification is split: in Myanmar for example, the Ministry of Electric Power deals with grid extension and the Department of Rural Development with off-grid activities, and in Tanzania, the utility TANESCO tracks on-grid progress, whereas the Rural Energy Agency monitors off-grid electrification.

Among countries with an officially approved plan, 81 percent have defined intermediary milestones and time-bound targets. These same countries have updated their plans in the last five years, with most having a 2013 or 2014 plan in place.

Only 55 percent of countries with an officially approved plan make it publicly available. This is the subindicator least complied with. Plans for Cambodia, Guatemala, Guinea, Honduras, India, Indonesia, Kenya, Myanmar, Nicaragua, the Philippines, and South Africa are fully or partly available online. Plans for Benin, Senegal, Tanzania, Uganda, Vanuatu, and Zambia usually are available upon request.

The 10 countries with the highest energy access deficit demonstrate good results: 60 percent are in the green zone. Among the 10 countries with the lowest electrification rate, however, only three countries are in the green zone (figure 2.5). In the former category, six countries (Bangladesh, India, Kenya, Myanmar, Tanzania, and Uganda) have an officially approved electrification plan with some follow up mechanism included (table 2.2). In the latter, three (Burkina Faso, Malawi, and Tanzania) are in the green zone. Four-fifths of countries in fragile and conflict-affected situations do not have a plan. Among this group, only Myanmar is in the green zone with an officially approved plan with elements in place to monitor it.

**FIGURE 2.5** Distribution of Indicator 1 scores




*Source:* RISE database, World Bank.

## Box 2.1 Long-term supporting policies boost electrification: South Africa

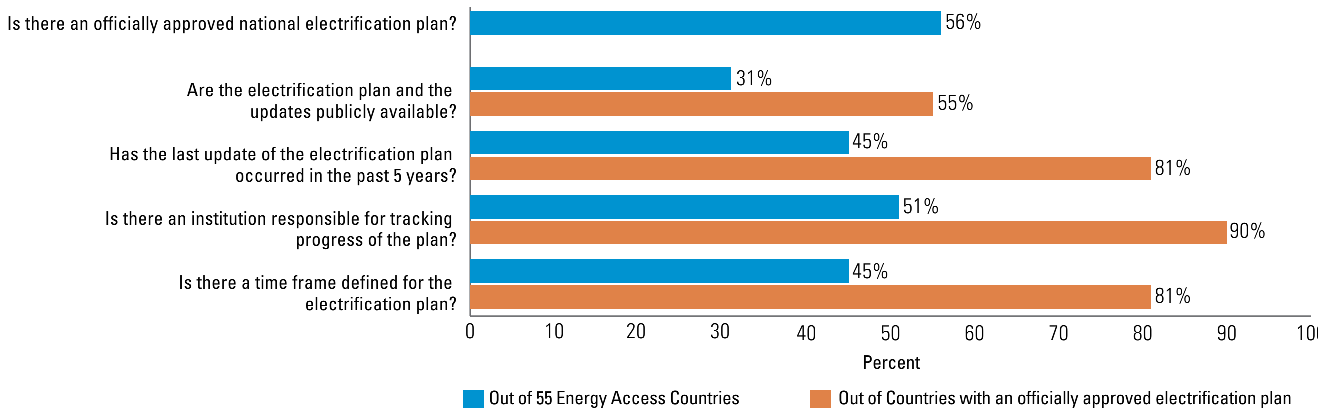
Through robust electrification planning and dedicated supporting mechanisms, South Africa's electrification rate has risen from 34 percent in 1994 to 76 percent in 2014. Since 2002, electrification has been carried out through the Integrated National Electrification Programme.

The government approved the New Household Electrification Strategy in 2013, with the aim of supplying electricity to all households by 2025. Through policy guidelines, the Department of Energy provides directives on implementation for certain customer groups, including isolated regions, informal settlements, schools and clinics, and farm dwellings, prioritizing grid electrification, which accounts for 90 percent of new connections every year, and the rest via off-grid technologies.

Challenges include rising connection costs as projects go deeper into rural areas, lack of technical skills in municipalities, underuse of funds, and minigrid concessionaires' struggles to find a sustainable business model.

*Source:* RISE database, World Bank; McKinsey & Company, International Finance Corporation.

**FIGURE 2.6** Percentage of 55 energy access countries answering yes to questions about the existence and monitoring of officially approved electrification plan




*Source:* RISE database, World Bank.

**TABLE 2.2** Existence and monitoring of electrification plan in the top 10 access-deficit countries

| Country | Officially approved electrification plan | Vision | Plan publicly available | Last update | Tracking institution | Existence of a timeframe |
|---|---|---|---|---|---|---|
| India | Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Remote Village Electrification Programme | Universal access by 2019 | Yes | 2014 | Rural Electrification Corporation Ltd. | — |
| Nigeria | No | — | — | — | — | — |
| Ethiopia | No | — | — | — | — | — |
| Bangladesh | Rural Electrification Board 3-year Master Plan | Universal access to electricity for households by 2021 | No | 2012 | Bangladesh Rural Electrification Board | Yes |
| Congo, Dem. Rep. | No | — | — | — | — | — |
| Tanzania | National Electrification Program Prospectus | 50% of electricity access by 2020 | Yes | 2014 | TANESCO, Rural Energy Agency | Yes |
| Kenya | Rural Electrification Master Plan, Distribution Master Plan | Universal access by 2020 | Yes | 2013 | Rural Electrification Authority | Yes |
| Uganda | Rural Electrification Strategy and Plan (RESP-2) | Universal electrification by 2040 | Yes | 2012 | Rural Electrification Agency | Yes |
| Myanmar | Myanmar National Electrification Plan | Universal electricity access by 2030 | Yes | 2014 | National Electrification Executive Committee | Yes |
| Sudan | No | — | — | — | — | — |

*Source:* RISE database, World Bank.

### Indicator 2. Scope of officially approved electrification plan

None of the countries with electrification plans have all the good practice characteristics representing the scope of an officially approved plan, namely that it includes a definition of a service level target, a plan for developing both off-grid and on-grid solutions, inclusion of productive and community users, and publicly available geospatial maps (table 2.3). Only nine countries are in the green zone (figure 2.7). The Republic of the Congo and Côte d'Ivoire have officially approved electrification plans without incorporating any of these characteristics.

Among the countries with an officially approved electrification plan, 90 percent have grid and off-grid solutions and 77 percent have community and productive services (figure 2.8). Beyond households, policymakers hope to include anchor consumers, such as community and productive facilities, which provide a consistent source of revenue and support local economic development.

A geospatial plan and a service level target for the plan are uncommon (figure 2.8). Only nine countries contain geospatial mapping conveying the time frame of planned grid extension, and only five (Guatemala, Guinea, Honduras, Peru, and Zambia) make those maps public. Only seven countries have a defined target on service level (Cameroon, India, Indonesia, Nicaragua, the Philippines, Senegal, and Sri Lanka). The defined target usually is about quality of service delivery, such as number of guaranteed hours of power supply. In India, the Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) program entails minimum daily electricity supply of 6 to 8 hours. In Nicaragua, targets are defined for the stage of plan implementation and the supplied areas, ranging, for instance, from 1.8 to 8 interruptions per semester, with a duration varying from three to seven hours. In the Philippines, the target for grid electrification is to supply power 24 hours a day; the target for off-grid supply is from 6 to 24 hours.

India is the only country in the green zone among the 10 countries with the highest access deficit; none of the countries with the lowest electrification rate is. In the latter category, 7 of the 10 countries are in the red zone. Among fragile and conflict-affected states, Eritrea, Myanmar, and Zimbabwe are the only countries with a plan and some desired qualitative attributes.

**TABLE 2.3** Share of countries with officially approved electrification plan and good practice characteristics on scope

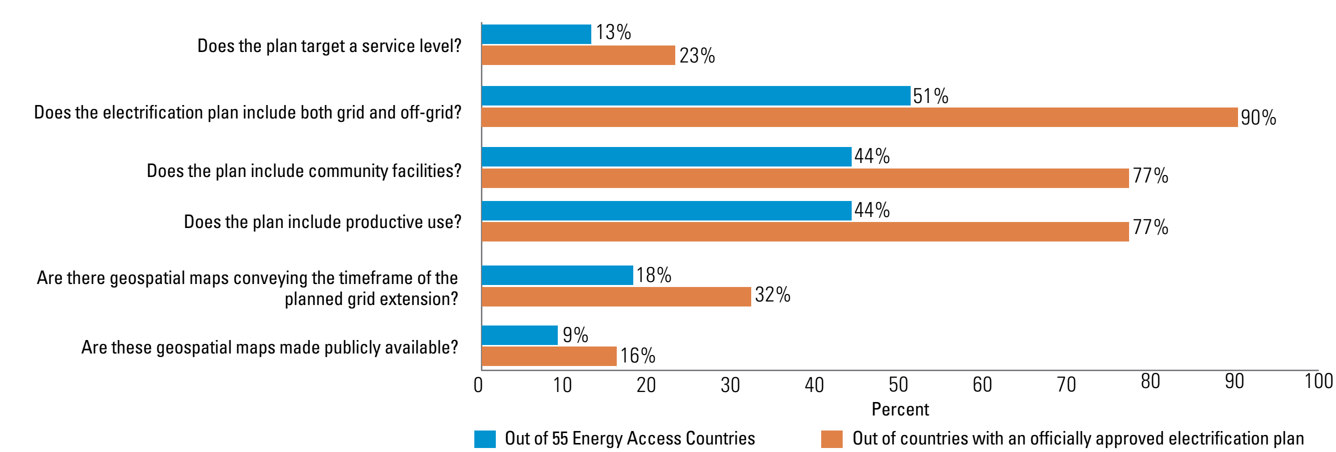
| Number of the six characteristics in the plan | Countries |
|---|---|
| None | Republic of the Congo, Côte d'Ivoire |
| One | None |
| Two | Bangladesh, Cambodia, Malawi, Myanmar, Nicaragua, South Africa |
| Three | Angola, Benin, Burkina Faso, Eritrea, Ghana, Honduras, Kenya, Lao PDR, Rwanda, Tanzania, Vanuatu, Zimbabwe |
| Four | India, Indonesia, Peru, Philippines, Uganda |
| Five | Cameroon, Senegal, Sri Lanka, Guatemala, Guinea, Zambia |
| Six | None |

*Source:* RISE database, World Bank

**FIGURE 2.7** Distribution of Indicator 2 scores


*Source:* RISE database, World Bank.

**FIGURE 2.8** Percentage of 55 energy access countries answering yes to questions about the scope of officially approved electrification plan




*Source:* RISE database, World Bank.

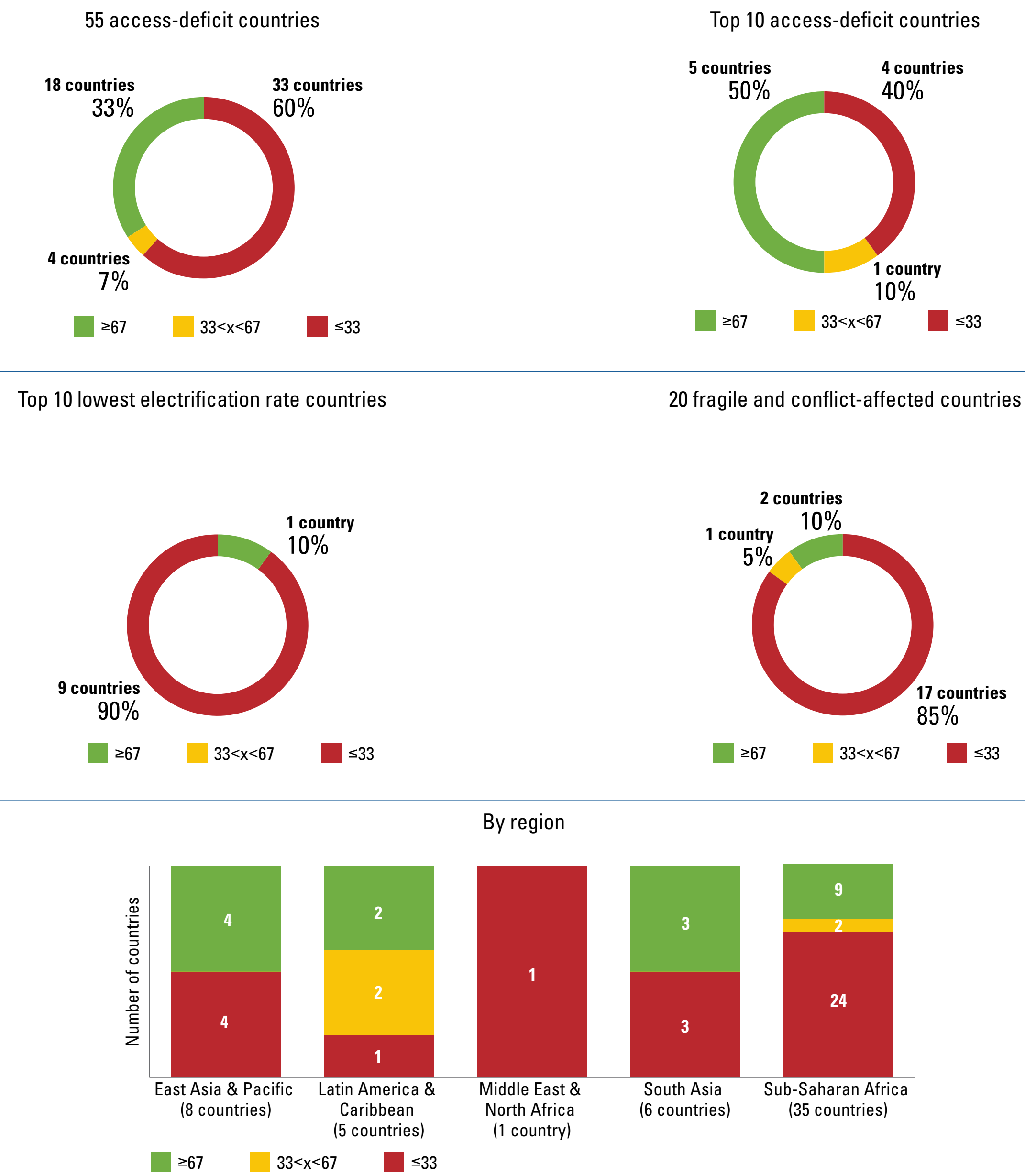
### Indicator 3. Framework for grid electrification

Among the 55 access-deficit countries, 60 percent are in the red zone despite having developed some form of framework for grid electrification. Among the 18 countries in the green zone, eight have defined funding support for grid electrification, funding support for consumer connections, and standards of performance on quality of supply (figure 2.9). A few countries—Central African Republic, Haiti, Sierra Leone, Somalia, and South Sudan—offer no support of any kind for grid electrification.

Funding support for electrification, either through dedicated funding or capital subsidies to utilities, is the most common arrangement (figure 2.10). About 84 percent of the countries have developed at least one of these support mechanisms, and 56 percent have implemented both, including Benin, Myanmar, Nepal, Senegal, and Uganda. But nine countries do not have funding support of any kind for electrification, including Cameroon, Central African Republic, Democratic Republic of Congo, Haiti, Sierra Leone, Somalia, South Sudan, Sri Lanka, and Vanuatu.

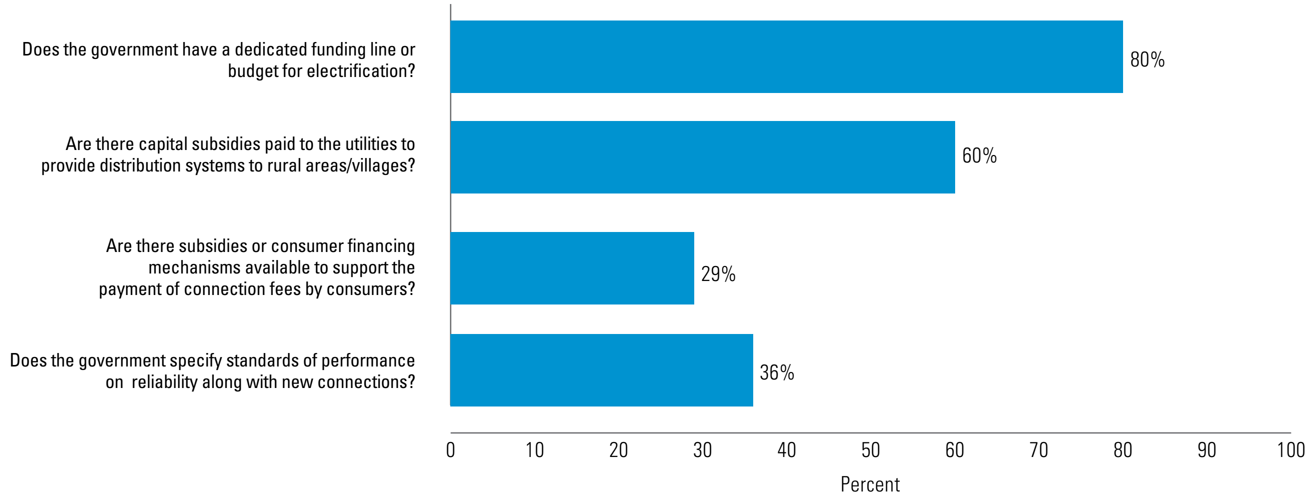
Funding support to consumers for connection cost, through direct subsidies to

**FIGURE 2.9** Distribution of Indicator 3 scores




*Source:* RISE database, World Bank.

**FIGURE 2.10** Percentage of 55 energy access countries answering yes to the questions about the framework for grid electrification




*Source:* RISE database, World Bank.

consumers or consumer financing mechanisms, is prevalent in less than one third of the countries (figure 2.10). Cambodia, Ethiopia, Mongolia, and Pakistan are among the nine countries where only consumer financing mechanisms (such as on-bill financing, consumer loans) are available. In Cambodia, a rural electrification fund provides interest free loans to low-income rural households to support payment of grid connection charges. In Pakistan, the national utility recovers its single-phase electricity connection charges in two stages, PRs 300 at the time of connection, and PRs 2,700 in nine equal installments in each subsequent bill. India, Nicaragua, South Africa, and Vanuatu offer only direct subsidies. Kenya, Tanzania, and Uganda develop both solutions to support payment of connection fees. Kenya Power supports low-income households through loan programs, with customers paying 20 percent upfront with the balance spread over 24 months. Kenya Power also developed—through an agreement with World Bank's Global Partnership on Output Based Aid—a subsidy targeting end-users in informal settlements and low-income areas. The program allows eligible residents to connect to prepaid meters and to pay a minimal charge of about US$15 per connection. The connection fee is recovered from the customer's purchase of prepaid tokens over 12 months.

Standards of performance on reliability exist in 36 percent of countries (figure 2.10). Such regulations usually insist on the principle of uninterrupted and reliable power supply, and then define a certain degree of tolerance on this target. For example, in 2004 Cambodia introduced a comprehensive regulation under its electricity law on overall performance standards for electricity suppliers. The law details objectives for scheduled outages, standards for response of suppliers in case of complaints on voltage, and standards for reconnection after temporary disconnection. In India, the Maharashtra Electricity Regulatory Commission in 2014 defined standards of performance and determination of compensation requirements applicable to Maharashtra State Electricity Distribution. Among other things, they define standards on quality of power and system reliability. In the Democratic Republic of Congo, a five-year contract of performance was signed in 2012 between the government and the utility provider Société Nationale d'Electricité (SNEL). It specifies a target of power availability rate for Inga 1 and Inga 2 (a proportion of MW) and a limit of average interruption duration by cut-off customers. In Guatemala, the National Commission for Electricity issued technical standards specifying distribution service quality, including allowances for interruption of service. There are minimum requirements for the frequency of interruptions and total time of interruption for both the distribution network as a whole and for individual customers. The commission also details a system of service quality control that tracks voltage regulation, power factor, harmonic distortion, and flicker, and a corresponding sanction mechanism.

Among the 10 countries with the highest access deficit, India, Kenya, Sudan, Tanzania, and Uganda have set up robust frameworks for grid electrification (table 2.4) and are in the green zone. Results are mixed for the 10 countries with the lowest electrification rate, as Tanzania is the only country in the green zone. Among the 20 fragile and conflict-affected countries, Sudan and Togo have set up comprehensive policies and regulations to support grid electrification (figure 2.9).

**TABLE 2.4** Framework for grid electrification in the top 10 access-deficit countries

| Country | Dedicated funding line or budget for electrification | Capital subsidies for utilities to provide distribution systems to rural areas | Consumer financing mechanisms and/or direct subsidies available to support the payment of connection fees by consumers | Standards of performance on quality of supply |
|---|---|---|---|---|
| India | Yes | Yes | No | Yes |
| Nigeria | Yes | No | No | No |
| Ethiopia | Yes | No | Yes | No |
| Bangladesh | Yes | Yes | No | No |
| Congo, Dem. Rep. | No | No | No | Yes |
| Tanzania | Yes | Yes | Yes | Yes |
| Kenya | Yes | Yes | Yes | No |
| Uganda | Yes | Yes | Yes | No |
| Myanmar | Yes | Yes | No | No |
| Sudan | Yes | Yes | Yes | Yes |

*Source:* RISE database, World Bank.

## Indicator 4. Framework for minigrids

Only 12 countries are in the green zone on this indicator, and most countries have yet to ensure favorable regulatory conditions for minigrids (figure 2.11). Madagascar, Nicaragua, the Philippines (box 2.2), and Tanzania report an attractive enabling environment for minigrids, especially through financial incentives. Tanzania demonstrates the strongest enabling environment, with a legal framework for operation, the right to freely charge tariffs, financial incentives, and standards (box 2.3). However, a quarter of the countries, most in Sub-Saharan Africa, are in the red zone.

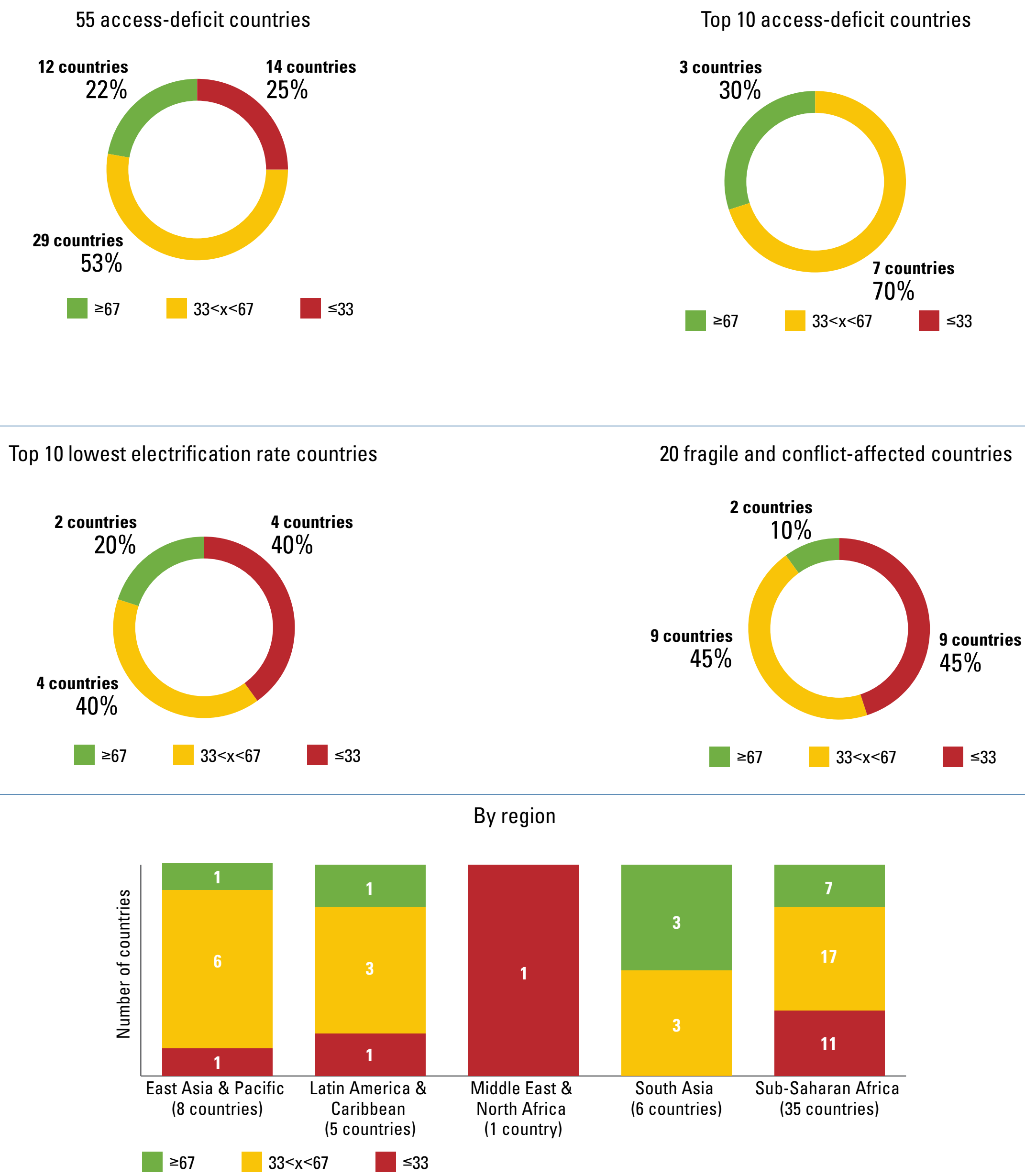
All countries have developed some regulatory provisions for minigrid operation, providing a legal framework for minigrids to operate (figure 2.12). All countries, except Sri Lanka, allow private players to develop minigrids. In Sri Lanka, electricity consumer societies, formed in grid-isolated areas, are the only entities allowed to operate minigrids. In 85 percent of the 55 countries, regulations legally authorize minigrids to operate in the country, usually through dedicated legislation on minigrid concessions or through specific provisions within the general power sector legislation. India—the top country in South Asia—through the Electricity Act of 2003, the National Electricity Policy in 2005, and the Rural Electrification Policy in 2006 has provided a regulatory framework encouraging the development of decentralized distributed generation wherever grid-based electrification is not technically or economically feasible. Chad, Eritrea, Ghana, Haiti, Liberia, Somalia, and Zambia allow private developers to own and operate minigrids despite lacking specific legal framework.

Very few countries clarify what occurs when the interconnected grid reaches a minigrid (figure 2.12). Only 22 percent of countries have such regulations, which most frequently give opportunities to developers either to convert from a power producer to a power distributor that buys electricity from the interconnected grid and resells to its local customers, or to sell electricity to the interconnected grid operator (no longer selling to retail customers). Selling the distribution grid to the interconnected grid operator and receiving compensation for the sale of the asset is the least shared option given to minigrid developers. In Sri Lanka, as the national grid expands, three pilot micro-hydro minigrids have been interconnected, selling electricity under a power purchasing agreement. If these pilots are successful and investment funds can be mobilized, other micro-hydro units may be connected to the grid.

Regulations that differ by size of minigrids are rare, with only 15 percent of countries adapting the rights and mandates of developers according to minigrid capacities. For example, under Bangladesh's renewable energy policy, entrepreneurs developing solar minigrids with a maximum capacity of 5 MW must get a waiver certificate, but are exempted from getting a license from the Bangladesh Energy Regulatory Commission. A few countries (Burkina Faso, Cambodia, Cameroon, Kenya, Malawi, and Tanzania) have regulations detailing procedures for how consumers should connect to minigrids.

Three-fourths of countries allow minigrid operators to charge a different tariff from the national rate, though doing so

**FIGURE 2.11** Distribution of Indicator 4 scores




*Source:* RISE database, World Bank.

may require official approval from public authorities. Among these countries, almost three-quarters have minigrids in operation charging a different tariff, while the remaining countries have no operating minigrids. Seven percent (Burkina Faso, Mauritania, Senegal, and Tanzania) have defined a retail electricity tariff schedule specific to minigrids. Whether minigrids should charge a price other than the uniform national tariff has implications for the subsidy contribution from the government or crossubsidies from other consumers. For instance, in Mali, the Philippines, and Tanzania, an external subsidy is provided to minigrid operators to either buy down the cost to charge at reasonable levels or to charge uniform national tariffs.

Sixty-two percent of countries define some mechanisms to financially incentivize minigrid development and serve as an input to the private sector's decision to invest in minigrids. Duty exemptions are the most common mechanism, shared by 58 percent of countries. Subsidies also are designated in 29 percent of cases. Both can involve entire minigrid systems or just components as energy generators or distribution systems. About 22 percent have set up publicly funded mechanisms to secure viability gap funding for operators. Among the best scorers on this indicator, Nicaragua has introduced grants for decentralized electrification projects through the Fund for Electric Industry Development.

### Box 2.2 Successful minigrid development in the Philippines

Geographic realities often check the expansion of centralized grids in archipelagic countries. The Philippines has one of the largest populations of islanders in the world, and since many households and small businesses are unlikely to be connected to the main grid soon, policymakers strongly support off-grid solutions. The country now has about 375 MW of installed capacity in diesel minigrids. The main operator is the National Power Cooperation through the Small Power Utility Group, which operates 279 MW of this capacity in 221 areas.

To develop minigrids, the government has built a robust legal framework. A serie of resolutions from the energy regulatory commission (notably Resolution No. 15, series of 2013, adopting small grid guidelines) specifies standards for operations and describes the planning and operational responsibility for users. The government also established two institutions that issue certificates for minigrid installers: the department of energy for the certificate of endorsement and the energy regulatory commission for the certificate of compliance.

To scale up minigrid development, policymakers adjusted regulations to require distribution utilities and electricity cooperatives to outsource power generation to private companies and community initiatives. A competitive bidding process was set up to assign 15-year concessions. Subsidies also were introduced to cover the difference between generation costs and end-user tariffs.

Thus far, this minigrid development program has been considered successful, primarily due to technology neutrality that gives more generation options for developers, widespread communication programs targeting end-users, and a well-developed financial market.

*Source:* RISE database, World Bank.

### Box 2.3 A legal framework as a necessary step to effectively develop minigrids: Tanzania

Tanzania's rural electrification investment prospectus estimates that about half the rural population could be served more cost-effectively by minigrids and off-grid options than by the centralized grid. Minigrids could provide electricity access to 9.1 million people. To realize this potential, the government, supported by stakeholders, has developed an enabling environment cited as an example for minigrid development.

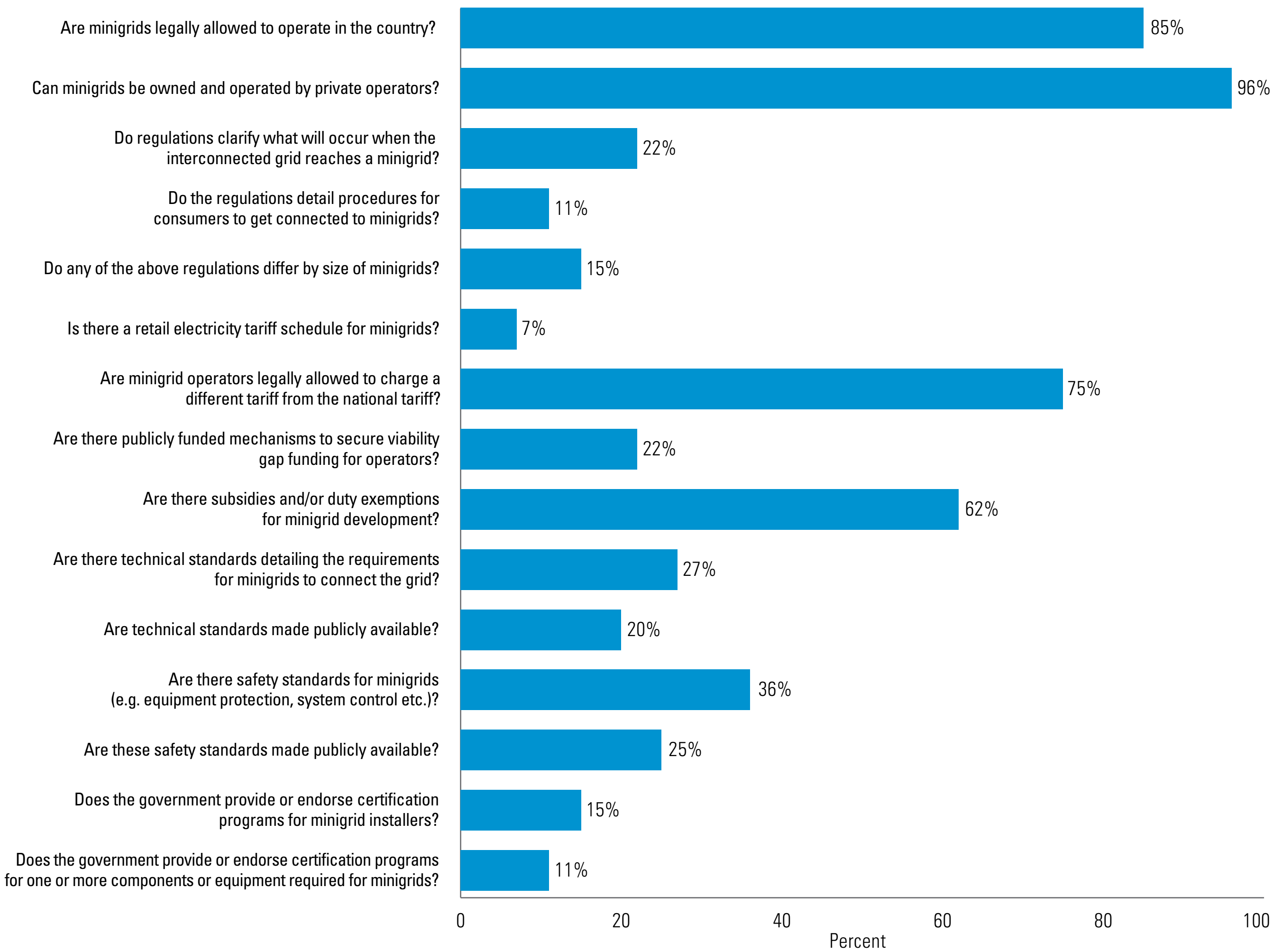
The construction of the minigrid regulatory framework started with the National Energy Policy and the Energy and Water Utilities Regulatory Authority Act in 2003, the Rural Energy Act in 2005, and the Electricity Act in 2008. A key feature of all is the role of the small power producer, "an entity generating electricity using renewable energy, fossil fuels, a cogeneration technology, or some hybrid system combining fuel sources … and either sells the generated power at wholesale to a distribution network operator or sells at retail directly to end customers or some combination of the two. A small producer may have an installed capacity greater than 10 MW but may only export power outside of its premises not exceeding 10 MW."[a] The framework specifies the necessary permits, clearances, and procedures for application, standards for interconnections, and a standardized tariff methodology based on utility avoided costs. The establishment of Tanzania's Rural Energy Agency in 2001 has enabled the performance of isolated and connected minigrids to be monitored, and funding support mechanisms to be offered for lowering initial connection costs and for financing feasibility studies and environmental assessments.

In practice, despite this comprehensive enabling environment, minigrids primarily are used by faith-based and other nonprofit organizations. On the commercial side, only five small power producers are in operation, though a dozen are in preparation. Barriers still limit minigrid development (including high interest rates loans from commercial banks, and lack of clarity about ownership of land and water rights for these producers). Access to finance for both debt and equity capital remains critical, as minigrid developers must demonstrate commercial viability of their system. Human capital and technical capacity are scarce. Market data is virtually nonexistent.

*Source:* RISE database, World Bank; Tenenbaum, Bernard, Chris Greacen, Tilak Siyambalapitiya, and James Knuckles 2014.

a. Detailed tariff calculation for 2012 for the sale of electricity to the minigrids in Tanzania under standardized small PPAs in Tanzania, Tanzania's Energy and Water Utilities Regulatory Authority, 2012.

**FIGURE 2.12** Percentage of 55 energy access countries answering yes to the questions about the framework for minigrids




*Source:* RISE database, World Bank.

The fund aims to bridge the gap between costs and tariffs for minigrids fueled by renewable energy, depending on the end-users' capacity to pay. Guinea also has developed this type of mechanism through the Decentralized Rural Electrification Fund (Fonds d'Électrification Rurale Décentralisée). The targeted financing scheme for diesel, solar, and pico hydro minigrids is 20 percent equity and 80 percent public funds. The public funding is divided into 38 percent subsidies and 62 percent loans.

About half of the countries have developed technical or safety standards (or both), along with certification programs. Safety standards protecting the device, system, and people have been introduced by 36 percent of energy access countries and have been made public in two-third of the countries. Technical standards detailing requirements for minigrids to connect to the grid—such as standards on insulators and line accessories, switching equipment, pole stays, cable crossections—have been developed in 27 percent of countries and are publicly available in 73 percent of cases. Angola, Benin, Guatemala, Honduras, India, Madagascar, Mali, Nicaragua, Pakistan, the Philippines, Senegal, Sri Lanka, Tanzania, and Zimbabwe have produced both technical and safety standards. Certification programs for minigrid installers and for minigrid components are endorsed in 15 and 11 percent of countries, respectively. Kenya and the Philippines (box 2.2) provide both programs. Tanzania in particular has scored in green on all the desired characteristics (box 2.3).

For the top 10 access-deficit countries, seven are in the yellow zone and only three in the green zone (Bangladesh, India, and Tanzania) (figure 2.11 and table 2.5). Among the 10 countries with the lowest electrification rate, four are in the red zone, but Malawi and Tanzania are in the green zone. Though the average score of fragile and conflict-affected states on this indicator is below the overall average score, it is one of the indicators on which fragile states have the best results.

**TABLE 2.5. Framework for minigrids in the top 10 access-deficit countries**

| Country | Legal framework authorizing the operation of minigrids in the country | Regulations clarifying what will occur when the interconnected grid reaches a minigrid | Ability for developers to charge a different tariff from the national one | Subsidies for minigrid systems or components | Duty exemptions for minigrid systems or components | Technical standards for minigrids | Safety standards for minigrids |
|---|---|---|---|---|---|---|---|
| India | Yes | No | Yes—Rural electrification policy, 2006 | Yes—Remote Village Electrification Programme | Yes—Letter from the Ministry of New and Renewable Energy grant of exemption of excise duty and concessional custom duty on the procurement of material/ components required for setting up minigrid and microgrid photovoltaic solar power plants, 2013 | Yes—Guidelines for off-grid and decentralized solar applications & rooftop and other small solar power plants | Yes—Guidelines for off-grid and decentral-ized solar applications & rooftop and other small solar power plants |
| Nigeria | Yes | No | Yes | No | No | No | No |
| Ethiopia | Yes | Yes | No | No | Yes—Investment incentives and investment areas reserved for domestic investors Council of Ministers Regulation No. 270/2012 | No | No |
| Bangladesh | Yes | Yes | Yes—Guidelines for the implementation of Solar Power Development Program, 2013 | No | Yes—Tariff schedule, National Board of Revenue of Bangladesh | No | Yes |
| Congo, Dem. Rep. | Yes | No | Yes—Electricity Law, 2014 | No | Yes | No | No |
| Tanzania | Yes | Yes | Yes—National electrification program prospectus | Yes—National Electrification Program Prospectus | Yes | Yes | Yes |
| Kenya | Yes | No | Yes—Electricity licensing regulations, 2015 | No | Yes—Value Added Tax Act, 2013 | No | No |
| Uganda | Yes | No | Yes—The Electricity (Tariff Code) Regulation, 2003 | No | Yes—The East African Community Customs Management Act, Revised 2009 | No | No |
| Myanmar | Yes | No | Yes—Electricity Law, 2014 | No | Yes—Union Tax Law 20/2014 | No | No |
| Sudan | Yes | No | Yes | No | No | No | No |

*Source:* RISE database, World Bank.

### Indicator 5. Framework for stand-alone systems

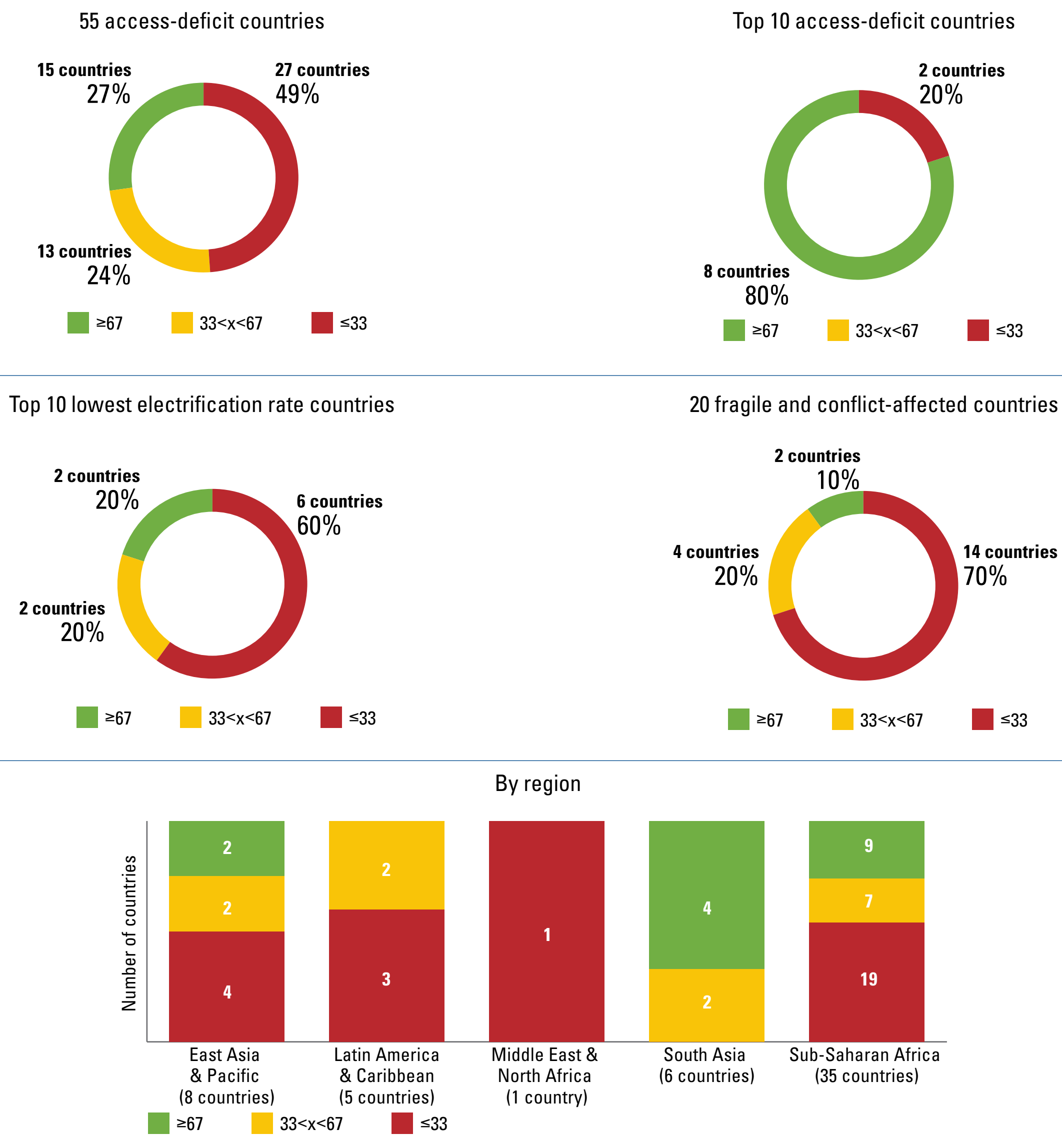
About half of the 55 access-deficit countries are in the green or yellow zone on this indicator (figure 2.13). Unlike capital-intensive grid and minigrid solutions, stand-alone systems use low-cost technologies that are easily deployed. Four countries stand out—Cambodia, Ghana, Kenya, and Uganda. They exhibit almost all the desirable characteristics to promote stand-alone systems. This group aside, Bangladesh, Cameroon, the Democratic Republic of Congo, Ethiopia, India, Malawi, Myanmar, Nepal, Pakistan (box 2.4), South Africa, and Tanzania are also in the green zone.

Forty-four percent of the 55 countries surveyed have defined and implemented a national program aimed at developing stand-alone systems (figure 2.14). The top country in South Asia, Nepal, has designed the National Rural and Renewable Energy Programme, which works to develop 600,000 solar home systems over 2012–16. In Bangladesh, the Infrastructure Development Company Limited, which aims to ensure access to clean electricity for isolated off-grid areas, deployed 3 million solar home systems between 2003 and 2015, reaching 9 percent of the country's population.[3]

All countries except Peru provide financial support to promote stand-alone systems through direct financial incentives, such as duty exemptions or subsidies, or by allowing developers to price their products freely. Of the 58 percent of countries with either subsidies or duty exemptions, 52 percent have introduced duty exemptions for stand-alone systems as a whole or for specific equipment. Subsidies are less widespread—31 percent of countries provide subsidies targeting either operators or consumers (figure 2.14). In Cambodia, the rural electrification fund provides a US$100 subsidy for remote rural households with



**FIGURE 2.13** Distribution of Indicator 5 scores




*Source:* RISE database, World Bank.

### Box 2.4 Initiatives and mechanisms to support the development of stand-alone systems in Pakistan

The potential for stand-alone system development in Pakistan is tremendous: 35 percent of the population is not connected to the grid, and grid-connected areas are struggling with power cuts and supply shortages.

Under the Roshan Pakistan Program and Parliamentarian Schemes for Rural Electrification, 8,000 villages will be electrified, mainly through solar home systems powered by solar PV modules. Other similar initiatives, handled by the Alternative Energy Development Board, include the development of off-grid solar applications such as solar street lighting and commercial lighting.

To support market expansion, stand-alone systems are exempted from import duties, including batteries integrated with solar electrification systems, solar air conditioning systems, solar water heaters, and PV modules.

On the end-user side, some programs subsidize the purchase of these solutions. The provincial government of Khyber Pakhtunkhwa, for example, will pay 90 percent of the cost of the solar equipment with the rest shouldered by households. Banking and microfinance institutions provide financing support for operators and consumers.

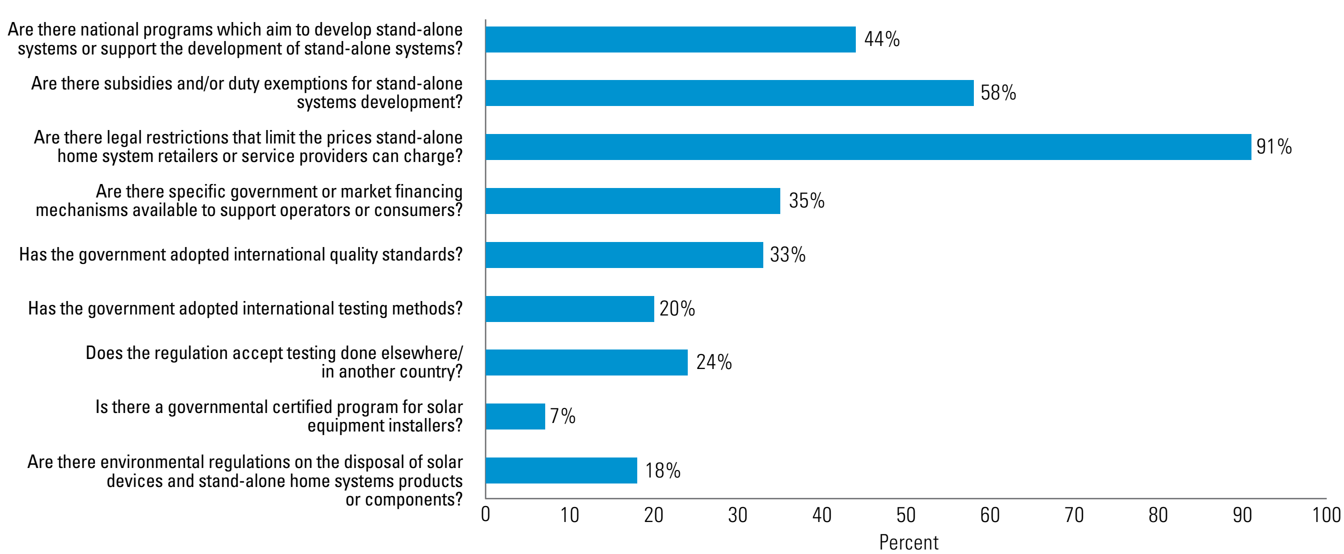
Standards and certification programs have not been officially approved in Pakistan. However, to prevent distribution of poor-quality off-grid lighting products, Pakistan joined the Lighting Asia program in 2015, which arranges product testing and quality verification for interested manufacturers.

*Source:* RISE database, World Bank.

no access to the grid and offers payment plans. Thirty-five percent of countries have developed financing mechanisms or facilities targeting off-grid solar businesses or consumers, offered either by the government or the market. In Uganda, the Finance Trust Bank, working with the Uganda Energy Credit Capitalization Company, provides solar energy loans to support bank customers in buying solar facilities for their homes. A majority of countries impose no restrictions on the price of stand-alone systems, but five countries doing so are Indonesia, Malawi, Nepal, Nicaragua, and Peru.

Only a few countries score well on adopting quality standards, testing methods, and certification programs. On standards, 33 percent have adopted international quality standards (covering durability, lumen maintenance, warranties, and so on). In India, the Ministry of

**FIGURE 2.14** Percentage of 55 energy access countries answering yes to the questions about the framework for stand-alone systems




*Source:* RISE database, World Bank.

**Box 2.5 Lighting Global quality assurance framework: Quality standard for off-grid lighting products**

Quality assurance helps market actors make informed purchasing, investment, and regulatory decisions and ensures that the systems delivered to end-users operate effectively and as advertised. Following this approach, Lighting Global is the World Bank Group's initiative supporting commercial development of markets for affordable, quality-assured, off-grid lighting.

A major dimension is quality assurance of pico-PV products and stand-alone home systems kits. Incorporated into an IEC technical specification in 2013, the Lighting Global framework consists of three components: definition of test methods and quality standards; testing and verification through independent laboratories; and communication of test results to stakeholders. The test methods assess the performance of off-grid products, and the quality standards define requirements for truth in advertising, durability, quality, lumen maintenance, battery, performance information, and warranty terms. If test results of a product verify that it meets the minimum quality standards, the product is listed on the Lighting Global website and the manufacturer becomes eligible for business support services from Lighting Global and associated programs in Africa and Asia.

In Sub-Saharan Africa, sales of products that have met the program's minimum quality standards have exceeded 6 million units since pilot projects were introduced in 2007. Approved in 2012, the International Development Association's Electricity Network Reinforcement and Expansion Project in Ethiopia is an example of boosting the off-grid lighting market. The project entails a US$20 million credit line (as a financial intermediary loan) administered by the Development Bank of Ethiopia. Since 2013, the project's credit line has resulted in the local sale of almost 700,000 Lighting Africa–quality, verified pico-PV systems and is on track to surpass 2 million products by the end of 2016.[a]

*Source*: Lighting Global program.
a. https://www.lightingafrica.org/where-we-work/ethiopia/.

New and Renewable Energy has adopted International Electrotechnical Commission (IEC) quality standards transposed by the Bureau of Indian Standards to a national level. Thus PV modules must conform to the latest edition of IEC-equivalent standards. The ministry also accredited test centers and laboratories to certify the compliance of off-grid equipment. Four countries have designed their own national standards (Lao PDR, Mongolia, Peru, and Senegal) and six have only endorsed international quality standards (Benin, the Democratic Republic of Congo, Eritrea, Ethiopia, Guinea, and the Philippines). To avoid the spread of low-quality systems, programs such as the Lighting Global Initiative (box 2.5) support countries in adopting quality standards and procedures. Twenty percent of countries have adopted international testing methods. Among the countries with international testing or quality standards, 24 percent accept testing done in another country. Only 18 percent have introduced environmental regulations covering the disposal of solar devices and stand-alone home system products or components. Only Ghana, Kenya, Nepal, and Uganda (7 percent) have government-certified programs for solar-equipment installers.

Among the 10 countries with the highest access deficit, eight are in the green zone; among the 10 with the lowest electrification rate, six are in the red zone (figure 2.13). Only two countries in the former category—Nigeria and Sudan—are far from significant accomplishments (table 2.6). In the latter category, Malawi and Tanzania are doing well. Among fragile and conflict-affected states, 70 percent of countries score in the red zone, although the Democratic Republic of Congo and Myanmar score well with implementation of national programs and enforcement of financial incentives. The former country also adopted international quality standards and testing methods.

**TABLE 2.6.** Framework for stand-alone systems in the top 10 access-deficit countries

| Country | National program promoting the deployment of stand-alone home systems | Subsidies to support stand-alone home systems and/or components | Duty exemptions to support stand-alone home systems and/ or components | Minimum international quality standards | Governmental certified program for solar equipment installers | Environmental regulations on the disposal of pico-PV and stand-alone home systems products or components |
|---|---|---|---|---|---|---|
| India | Yes—Off-grid & decentralized solar applications scheme | Yes—Power for All | No | Yes—Minimal technical requirements/ standards for solar PV systems and plants | No | No |
| Nigeria | No | No | No | No | No | No |
| Ethiopia | Yes—Program to increase sustainable access to electricity services and to contribute to the overall goal of universal access to electricity services by 2025 | No | No | Yes—Incandescent lamps safety specifications | No | No |
| Bangladesh | Yes—Infrastructure Development Company Limited solar homes system program | Yes—Guidelines for the Implementation of Solar Power Development Program, 2013 | Yes—Tariff schedule, National Board of Revenue of Bangladesh | Yes—Lighting Global quality standards for pico-PV products | No | Yes—Updated environmental and social management framework, 2014 |
| Congo, Dem. Rep. | Yes—Service National des Energies Nouvelles et Renouvelables strategy | No | Yes—Decree law #15/009, 2015 | Yes—IEC standards | No | Yes—Electricity Law, 2014 |
| Tanzania | Yes—Lighting Rural Tanzania Initiative; National electrification program prospectus | Yes—National electrification program prospectus | Yes | No | No | Yes |
| Kenya | Yes—Rural electrification program | No | Yes—Value Added Tax Amendment Act, 2014 | Yes—ISO/IEC guide 21-1: 2005 | Yes | Yes—Solar PV regulations, 2012 |
| Uganda | Yes | No | Yes—The East African Customs Management Act, 2009 | Yes | Yes | No |
| Myanmar | Yes—National electrification project | Yes—The Tax of the Union Law, 2014 | Yes—The Tax of the Union Law, 2014 | No | No | No |
| Sudan | No | No | No | No | No | No |

*Source:* RISE database, World Bank.

## Indicator 6. Consumer affordability of electricity

In just over half of the access-deficit countries, electricity is unaffordable for the poorest (figure 2.15). On the two subindicators, Burkina Faso, the Central African Republic, Liberia, Rwanda, and Somalia have unaffordable tariffs for the bottom quintile and offer no policy support to low-volume consumers. South Asia and Latin America and the Caribbean have the best scores. In South Asia, all countries are in the green zone except Afghanistan. In Latin America and the Caribbean, only Haiti and Honduras are lagging.

The cost of a subsistence volume of electricity—about 30 kWh a month for residential users—varies among countries from US$ 1/ kWh in Somalia to US$ 0.1/ kWh in Angola, reflecting differences in costs of service and national policies (figure 2.16). Somalia is the most expensive: 30 kWh can cost US$30 per month, far beyond the reach of the poorest 20 percent of households at well over three times the average household income (expressed as GNI). Burkina Faso, Liberia, Madagascar, the Solomon Islands, and South Sudan are other countries with very high tariffs. At the other end is Angola, where such subsistence consumption is a negligible share—0.06 percent of the GNI per household for the bottom quintile. Similarly, Pakistan supplies almost free electricity to low-volume consumers (0.15 percent of the GNI per household for the bottom quintile). The Democratic Republic of Congo, Ethiopia, Guinea, Pakistan, Sudan, and Zimbabwe have among the lowest tariffs.



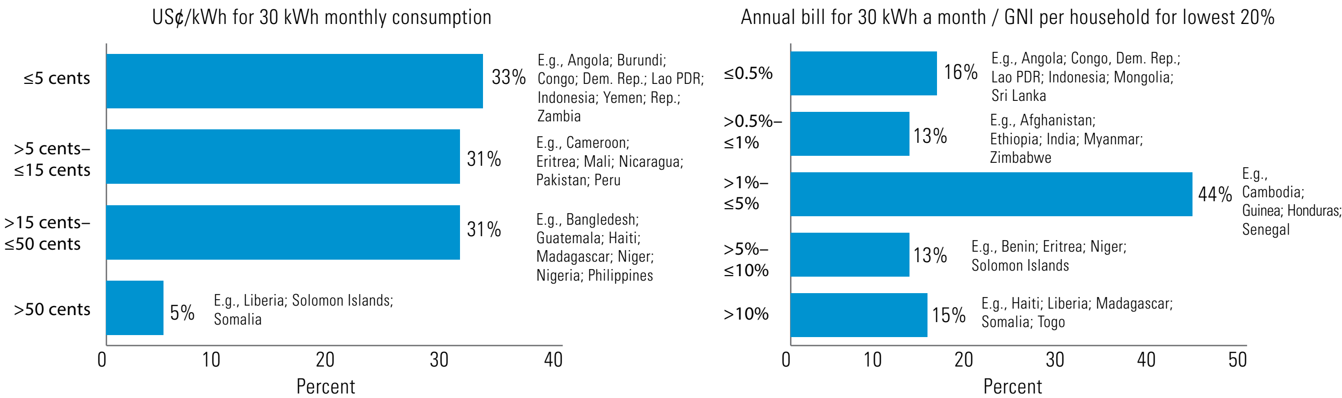
**FIGURE 2.15** Distribution of Indicator 6 scores


*Source:* RISE database, World Bank.

More than half the countries have policies to support low-volume consumers, especially through a lifeline tariff (figure 2.17 and box 2.6). The threshold for qualification of such tariffs varies for customers consuming less than 300 kWh a month. Peru has a cross subsidy mechanism, the Fondo de Compensación Social Eléctrico (Electricity Social Compensation Fund), under which users with consumption below 100 kWh a month are subsidized by those who consume more than that. The subsidy is set by law, and is dependent on the typical sector and users' consumption range.

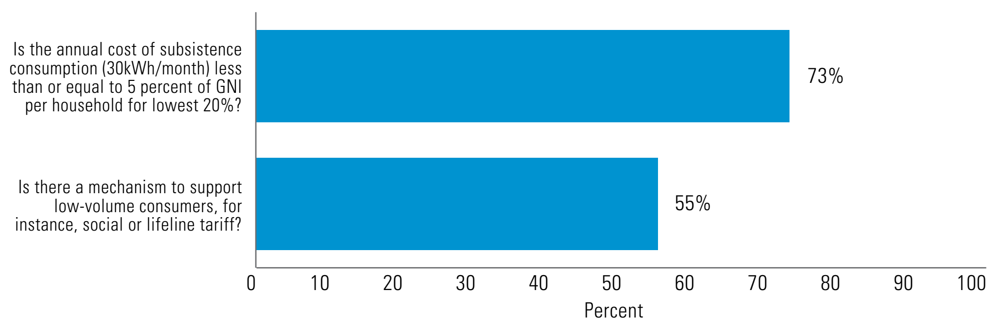
Eight of the top 10 access-deficit countries, except Ethiopia and Sudan, are in the green zone (figure 2.15), having both an affordable cost of subsistence electricity consumption and a policy to support low-volume consumers. Among the 10 lowest electrification countries, only Burundi and Tanzania are in the green zone, with the rest in the yellow and red zones. Among fragile and conflict-affected states, 25 percent score in the green zone (Burundi, the Democratic Republic of Congo, Côte d'Ivoire, Mali, and Myanmar).

**FIGURE 2.16** Cost of subsistence consumption




*Source:* RISE database, World Bank.

**FIGURE 2.17** Percentage of 55 energy access countries answering yes to the questions about the consumer affordability of electricity




*Source:* RISE database, World Bank.

**Box 2.6 Lifeline tariffs: Cross-subsidies make subsistence electricity consumption affordable**

Refining the design of increasing block tariffs, lifeline (or social) tariffs are targeted subsidies that improve the affordability of basic electricity needs. Any block above that should be charged at a commercial rate. The definition of a lifeline customer is critical, and varies widely depending on countries' incomes (box table).

This instrument has limits, however. Cross-subsidies can create distortions and deteriorate the utility's financial performance. Moreover, as seen in countries with high energy subsidies, quantity-based consumption subsidies do not target low-income consumers well, since such households do not necessarily have access to the service or are not metered. Thus the reduction of cross subsidies, or tariff rationalization, has been the main driver of tariff reforms, with subsidies limited to promoting basic consumption and making service access easier. Lifeline tariffs do not systematically mean affordable connection fees, even if high connection fees discriminate against low-income households.

*(continued)*

**Box 2.6 Lifeline tariffs: Cross-subsidies make subsistence electricity consumption affordable** *(continued)*

**LIFELINE TARIFFS TARGETING RESIDENTIAL LOW-VOLTAGE END-USERS, DECEMBER 2015[a]**

| Country | Local currency | US c/kWh[b] | Monthly threshold, up to (kWh)[c] |
|---|---|---|---|
| Angola | 1.156 Kz/kWh | 1.2 | 50 |
| Bangladesh | 3.33 Tk/kWh | 4.0 | 50 |
| Benin | 78 FCFA/kWh (no VAT) | 15.6 (no VAT) | 20 |
| Burundi | — | 3.7 | 100 |
| Cameroon | 50 FCFA/kWh | 9.7 | 110 |
| Côte d'Ivoire | 36.05 FCFA/kWh (no VAT) | 7.1 (no VAT) | 40 |
| Congo, Dem. Rep. | — | 2.7 | 100 |
| Ghana | 21.0795 GHp/kWh | 8.3 | 50 |
| Guatemala | 1.142176 Q/kWh | 14.2 | 300 |
| Guinea | 90 GNF/kWh | 1.2 | 60 |
| Haiti | 4.80 Gourdes/kWh | 5.7 | 30 |
| India | 0.65 Rs/kWh | 1.1 | 30 |
| Indonesia | 169 IDR/kWh | 1.5 | 30 |
| Kenya | 50 Ksh/kWh | 54.5 | 50 |
| Lao PDR | 348 KIP/kWh | 4.3 | 25 |
| Madagascar | 141 Ariary/kWh | 5.9 | 25 |
| Mali | 59 FCFA/kWh (no VAT) | 11.7 (no VAT) | 50 |
| Mozambique | 1.07 MT/kWh | 3.5 | 50 |
| Myanmar | 35 KYAT/kWh | 3.9 | 100 |
| Nepal | 4 Rs/Kwh | 4.2 | 20 |
| Nicaragua | — | 2.36 (no VAT) | 25 |
| Nigeria | 4 R/kWh | 2.4 | 50 |
| Pakistan | 2 Rs/kWh | 1.9 | 50 |
| Peru | 31.95 Sc/kWh | 11.5 | 100 |
| Philippines | Lifeline discount—100% of generation, transmission, system loss, distribution, supply, and metering charges | | 20 |
| South Africa | Affordability subsidy charge payable on utility-related active energy sales to non-local authority tariffs | | — |
| Sri Lanka | 2.50 LKR/kWh | 1.8 | 30 |
| Tanzania | 100 TZS/kWh | 5.9 | 75 |
| Togo | 63 FCFA/kWh | 12.7 | 40 |
| Uganda | 150 Shs/kWh | 5.7 | 15 |

VAT = Value-added tax.

*Source:* RISE database, World Bank.

a. Monthly fixed charges not specified: end-users benefiting from lifeline tariffs can be exempted of service charge as in Nigeria or Pakistan or have a reduced service charge as in India.

b. Atlas conversion rate (LCU/US$)—2015.

c. Beyond a monthly threshold, other criteria for eligibility can be enforced (voltage, household revenue, etc.).

### Indicator 7. Utility transparency and monitoring

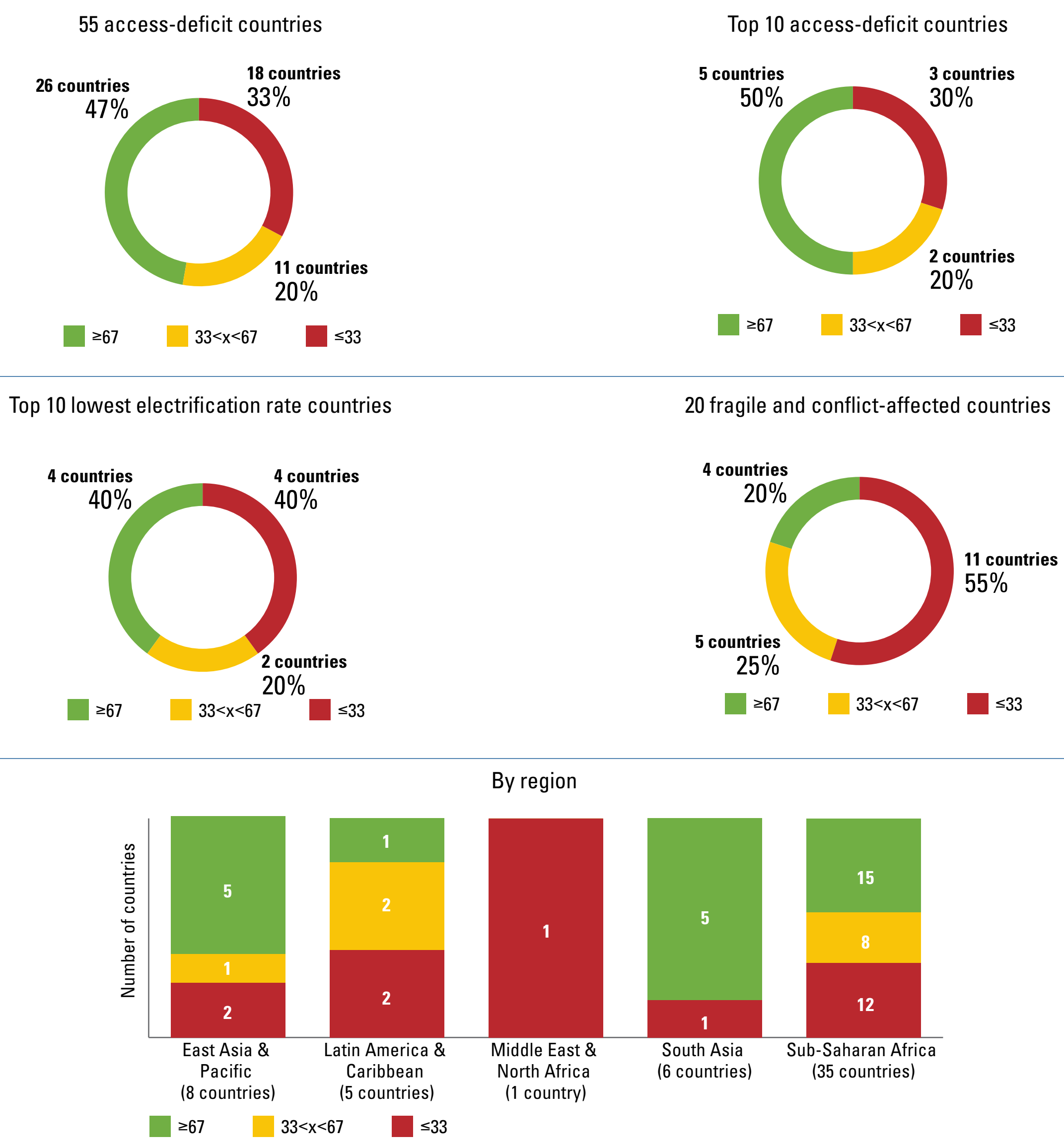
Almost half the countries are in the green zone, with fairly robust mechanisms for information disclosure, information auditing, and reliability monitoring (figure 2.18). Bangladesh, Ghana, Indonesia, and Senegal have all of these mechanisms in place. Haiti, Nigeria, and Somalia have none of them.

For information disclosure, several countries report a high degree of information transparency (figure 2.19). Across all four segments (retail, distribution, transmission, and generation), around 50 percent of the utilities make their financial statements public. Among the four key performance metrics, the transmission loss rate is the least available, with about half of the utilities providing this metric through an official source. All other metrics are made public on average by 70 percent of utilities. Twelve countries make publicly available both their utility financial statements and the four key performance metrics.

Forty-seven percent of utilities (22 countries) have their financial statements audited by an independent third party (figure 2.20). These statements are equally likely to be audited among the four power sector segments, because the majority of sampled utilities are vertically integrated and thus covered by the same accounting standards.

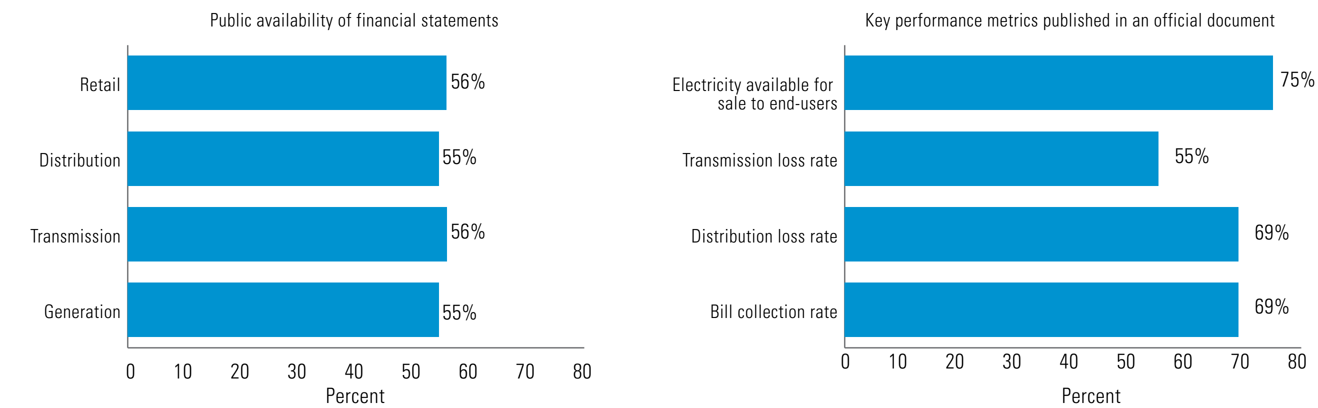
On the reliability monitoring subindicator, 18 countries have utilities with all the required attributes, that is, operating an incidence outage system, measuring service reliability, making data available to the public, and reporting data to a regulatory body (figure 2.20). Among them, Bangladesh is the only country where the selected utility did not report SAIDI or SAIFI, but instead reported a similar metric, the length of power interruption due to trouble in the transmission system. In 10 countries, the selected utility neither monitors nor reports the quality

**FIGURE 2.18** Distribution of Indicator 7 scores




*Source:* RISE database, World Bank.

**FIGURE 2.19** Utility transparency and monitoring: Information disclosure




*Source:* RISE database, World Bank.

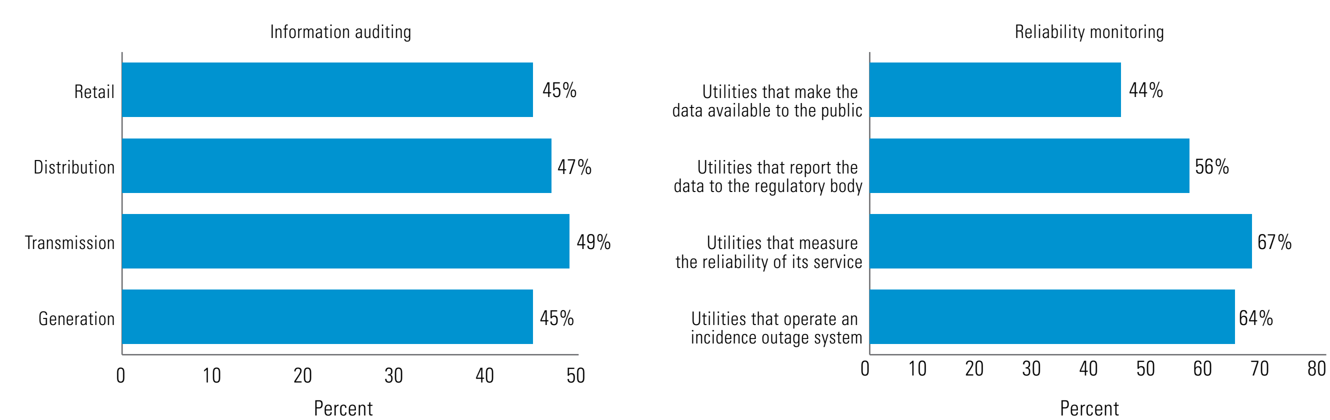
of its service. Twenty-five countries (45 percent) state that their selected distribution and retail sales utilities operate a supervisory control and data acquisition/energy management system (SCADA/EMS) or another system to record incidence and outage during the electricity service, and measure the reliability of the service through SAIDI, SAIFI, or similar metrics. Among 36 countries that monitor, 31 have SAIDI or SAIFI, while only five have another similar metric such as medium frequency of interruptions for installed kVA, minutes of interruption against a target value of minutes, or transmission system availability. Only 56 percent of the countries report the measurement of service reliability to the regulatory body, and only 44 percent disclose this information to the public. Many countries have the capacity for reliability monitoring, but fewer make the related information transparent to either the regulatory body or the public.

Among the top 10 countries with the lowest electrification rate, the four countries in the green zone make independently-audited financial statements publicly available for most of their largest utilities (figure 2.18). However, the same number of countries are in the red zone (Central African Republic, Chad, Liberia, and Sierra Leone). No red zone country has independently audited financial statements, and only Liberia has publicly available financial statements. For reliability monitoring, all red zone countries receive a score of 0 except for Liberia, which measures the reliability of its services.

Among the top 10 access-deficit countries, four of the five that score in the green zone make independently-audited financial statements publicly available. Uganda is the exception, lacking publicly available and independently audited financial statements for its largest generation company. These five countries also have, on average, three of the four key metrics publicly available (Tanzania aside, which has none). For reliability monitoring, four of the five that score in the green zone receive full scores, again except for Uganda, where the selected distribution and retail company does not provide its reliability data to the public.

Among fragile countries, the majority scores in the red zone. But four are in the green zone, and their selected companies open their financial statements to the public and have them independently audited, with the exception of Côte d'Ivoire, which does neither for its largest generation company (figure 2.18). On average, the top four countries also have three of four key metrics available. For reliability monitoring, the green zone countries receive full scores, except for Burundi and the Solomon Islands, where the selected distribution and retail companies do not report reliability data to a regulator.

**FIGURE 2.20** Utility transparency and monitoring: Auditing by an independent third-party and reliability monitoring




*Source:* RISE database, World Bank.

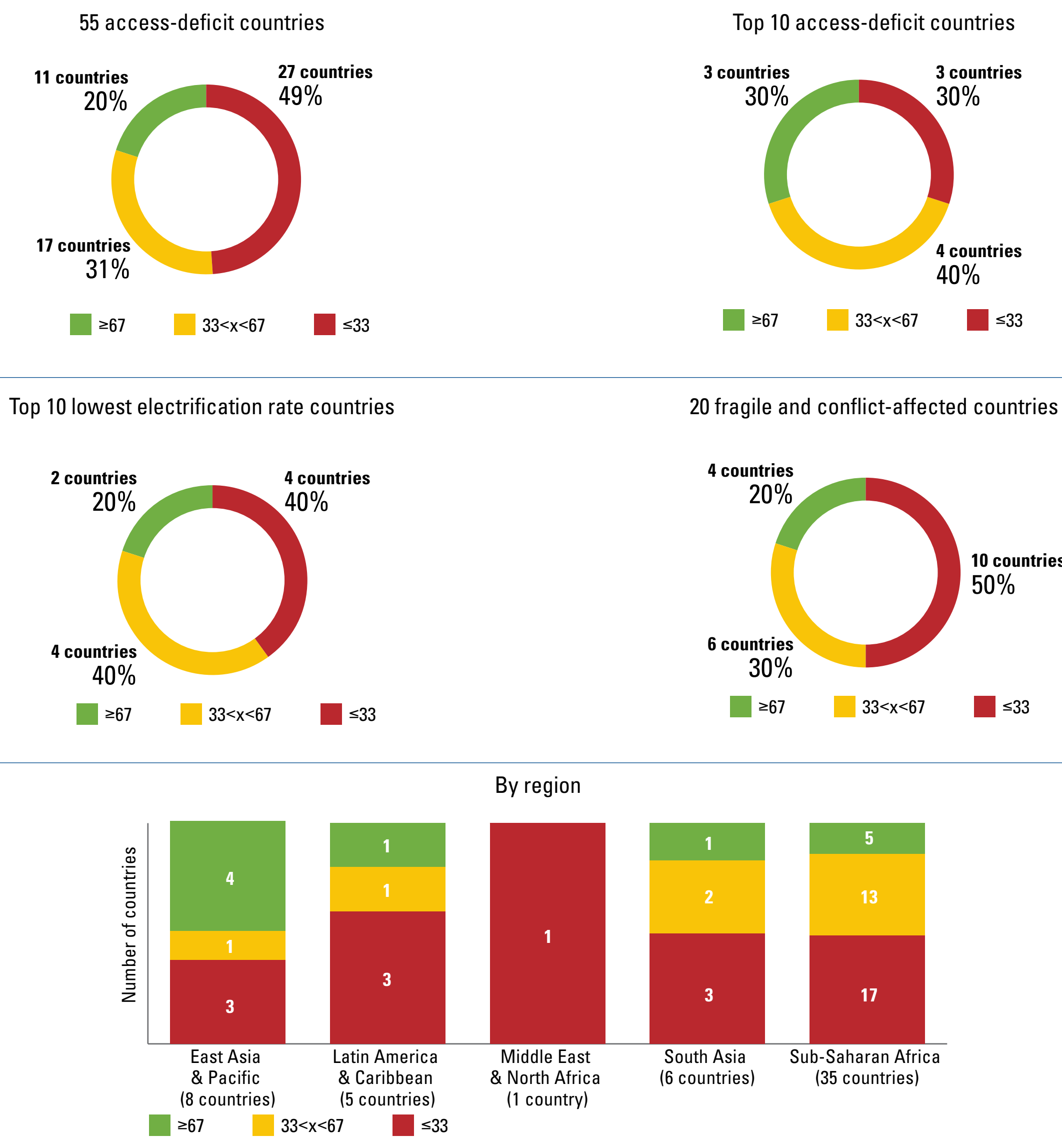
### Indicator 8. Utility creditworthiness

Only 11 countries are in the green zone and 27 countries are in the red zone (figure 2.21). The selected utilities in Burundi, Malawi, and the Solomon Islands receive a full score, exceeding the recommended thresholds on all four subindicators. Twenty-one countries receive a score of zero, primarily because their financial statements were not obtainable, thus preventing the calculation of key financial metrics. Despite the electricity supply challenges facing Malawi's electricity sector, the selected utility ESCOM emerges as the best scorer among the 55 countries in the energy access subset. This is partly explained by national and international efforts to improve the utility's financial and operational performance. In early 2014 Ernst & Young developed a financial model under the Millennium Challenge Account Project with the goal of improving the operational and financial performance of ESCOM.[5] Jointly managed by the Government of Malawi and the Millennium Challenge Corporation, the compact has allowed Ernst & Young to audit the utility's financial statements and create first financial model to improve its financial performance during the four-year support contract. Implemented steps include the first functioning fixed asset inventory register and a "reduction in the company's accounting codes to about 90."[6]

Utilities showed the greatest difficulty meeting the minimum scoring threshold on days payable (figure 2.22). Utilities struggle to honor payables, including payments to independent power producers, within 90 or even 180 days. Thus only 17 percent (six) of the countries that reported this metric meet the 90-day benchmark. The selected utility in Indonesia serviced its payables within 28 days, making it the best scorer on this subindicator, while Nepal's selected utility had days payable of nearly two years.

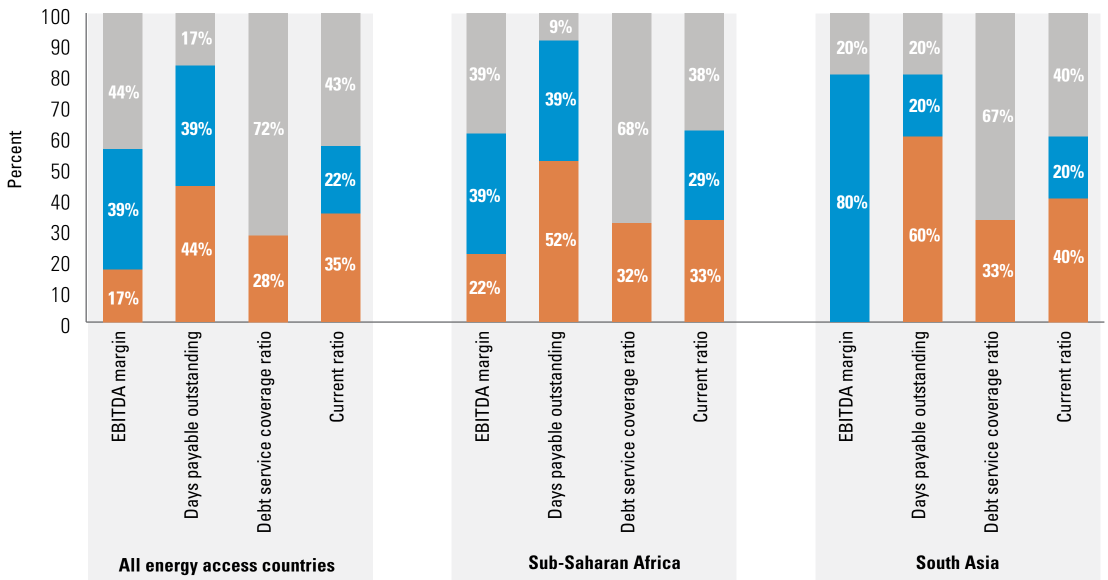
About three-fourths of the countries for which a debt-service coverage ratio was calculated (for 29 countries) had a ratio of

**FIGURE 2.21** Distribution of Indicator 8 scores




*Source:* RISE database, World Bank.

**FIGURE 2.22** Utility creditworthiness: Percentage of countries meeting the specified thresholds for each subindicator




| | Current ratio | Debt service coverage ratio | Days payable outstanding | EBITDA margin |
|---|---|---|---|---|
| Top Bracket | ≥1.2 | ≥1 | ≤90 | ≥15% |
| Middle Bracket | ≥1 and <1.2 | none | >90 and ≤180 | ≥0 and <15% |
| Lower Bracket | <1 | <1 | >180 | <0 |

*Source:* RISE database, World Bank.

at least 1.2, making this the highest scoring subindicator. The highest ability to service principal repayment was identified in Malawi, while the utility in Madagascar showed the worst debt-service coverage due to a large income loss in the years of analysis. The debt-service coverage ratio was excluded from the analysis for the following seven countries since the principal repayment is considered too low to cover the estimated debt repayment due: Bangladesh, Benin, Central African Republic, the Democratic Republic of Congo, Ghana, Liberia, and Nepal. These countries therefore appear in the category of countries where data are not available.

The current ratio and EBITDA margin fall in between, with 43 percent of the 37 countries for which this ratio could be calculated having a current ratio of at least 1.2, and 44 percent of 36 countries having an EBITDA margin of at least 15 percent. The best and worst scoring utilities on the current ratio, respectively, are in the Solomon Islands and Nepal, and on the EBITDA margin, Malawi and Madagascar.

Twenty-seven percent of the 55 energy access countries meet or exceed the minimum recommended thresholds for all four key metrics. For all key metrics except days payable outstanding, at least 38 percent of Sub-Saharan African countries that report this indicator exceed the top recommended threshold. In this region, 14 percent of countries meet or exceed the minimum recommended thresholds for all four key metrics. Nine percent of selected utilities in the region pay suppliers in 90 days or less, compared with 17 percent of selected utilities among all countries.

Out of the six energy access countries in the South Asia region, only India exceed the top recommended threshold for all four key metrics. All selected utilities in the region reporting data exceeded the minimum recommended threshold for the EBITDA margin against 83 percent of all countries reporting data.

The countries reporting the lowest electrification rate exhibit the same share of countries in the red zone as in the yellow zone (4). The exceptions in this grouping are the utilities in Burundi and Malawi, which score in the green zone. Fragile and conflict-affected countries exhibit a lowest average utility creditworthiness score, 32. In this group, Burundi, Mali, Myanmar, and the Solomon Islands stand out as utilities in the green zone by passing the thresholds on at least three out of the four financial ratios. The top 10 access-deficit countries earn the highest average score of 45, with India, Kenya, and Myanmar the best scorers. All three countries in the green zone have a current ratio of at least 1.2 and an EBITDA margin of at least 15 percent, suggesting low leverage and sufficient cash flow from operating activities.

## NOTES

1. Global Tracking Framework 2015.
2. Harmonized list of fragile situations FY15, World Bank.
3. Sadeque et al. 2015.
4. Data as of December 2015. The tariff reform in Somalia introduced early 2016 will be taken into account during the next RISE rollout.
5. Millennium Challenge Account Malawi (2013) [http://www.mca-m.gov.mw/index.php/resource].
6. Ibid.

# CHAPTER 3
# ENERGY EFFICIENCY

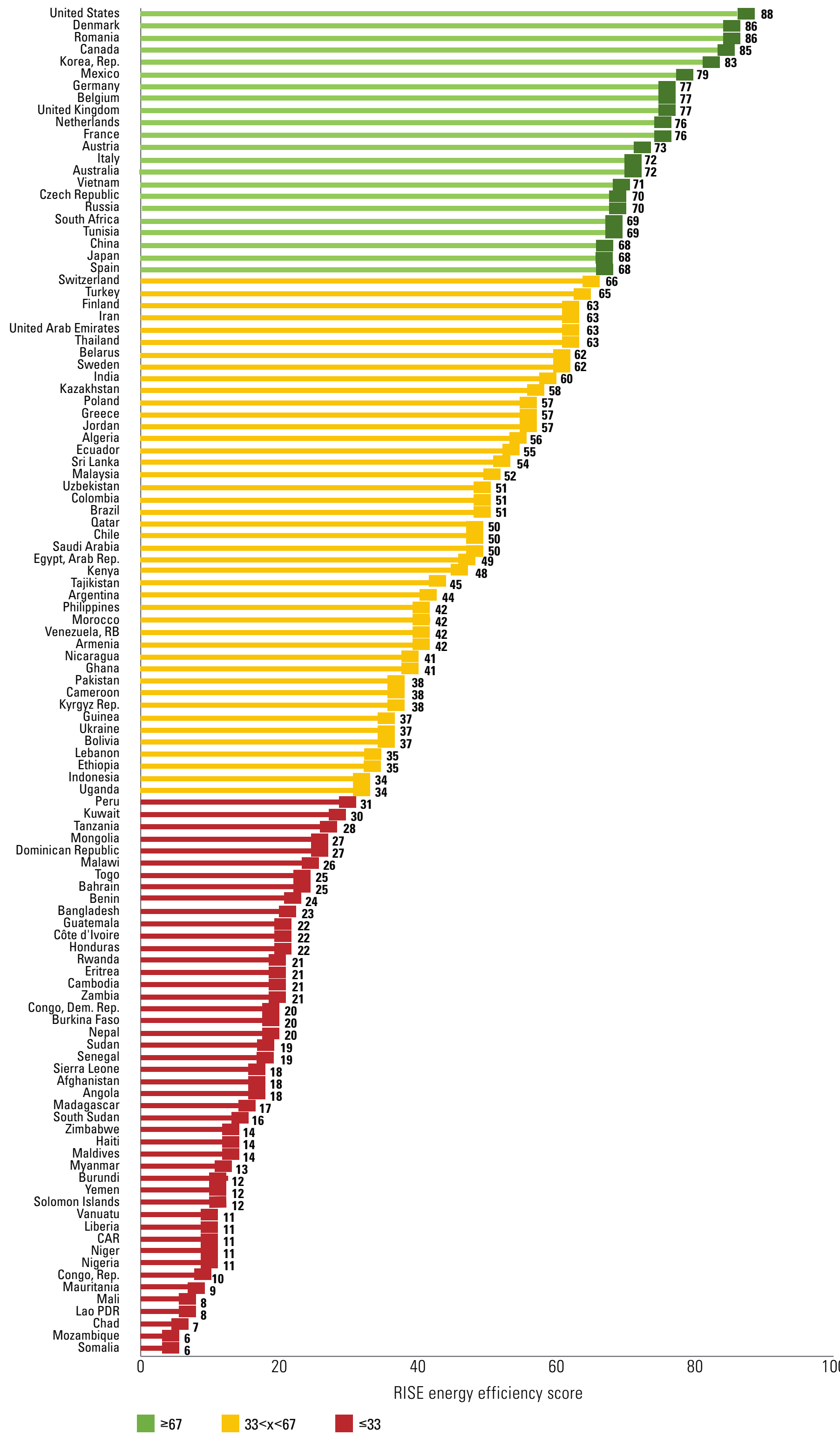
## PILLAR OVERVIEW AND KEY MESSAGES

All 111 surveyed countries show at least some accomplishment in one or more of the areas surveyed, but not even the highest-scoring countries achieve full marks. Even advanced countries have room for improvement. About one-fifth of the countries earned scores in the top third of the range. A nearly equal number of countries were scored in the middle and lower thirds (figure 3.1).

Examples of good practice in institutions, policies, and mechanisms to promote energy efficiency are found across regions and income groups (figure 3.2), as well as levels of energy consumption. Better scorers tend to be wealthier, larger countries, but there is no strict one-to-one correlation between income and energy efficiency scores. While the highest scorers tend to be wealthier and the lowest ones poorer (as with the renewable energy pillar), there is considerable overlap. The high-income group, for instance, has members that score in the red zone, while the lower-middle-income group has a member in the green zone. Moreover, countries scoring the highest on energy efficiency are not necessarily the wealthiest or those that have pursued energy efficiency policies the longest, with Vietnam providing an example of this (box 3.3). Still, low-income countries, and Sub-Saharan Africa as a region, had very low average scores for all indicators, barring the two concerned with high-level targets and entities and the two utility-mediated indicators.

Most countries are encouraging consumers to use electricity more efficiently, and are establishing basic structures to promote energy efficiency. Two of the highest-scoring indicators—information provided to electricity consumers and electricity rate structures—are mediated by electric utilities. The two other indicators with the highest scores, national energy efficiency

**FIGURE 3.1** Distribution of energy efficiency pillar scores, 111 countries

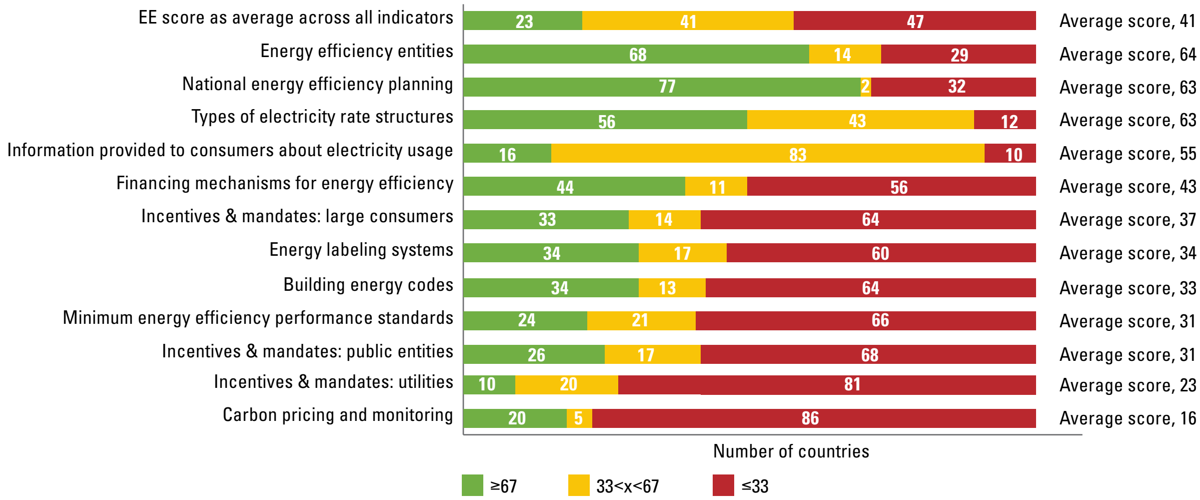



*Source:* RISE database, World Bank.

**FIGURE 3.2** Distribution of energy efficiency scores


*Source:* RISE database, World Bank.

**FIGURE 3.3** Energy efficiency score distribution by indicator, number of countries and average score




*Source:* RISE database, World Bank.

planning and energy efficiency entities, reflect actions that can be simple or sophisticated but are within the grasp of any functioning government (figure 3.3).

The world's 20 largest energy consumers measured by primary energy supply—identified as high-impact countries—achieved higher than average overall scores in this pillar (figure 3.2).Thirteen have energy efficiency pillar scores in the green zone, while six score in the yellow zone, and just one in the red zone. This is to be expected, as large consumers are more likely to have reason to address energy-related issues in general, and efficiency in particular.

There were several indicators where high-impact countries scored better than the global average, including mandates and incentives to large consumers, energy efficiency financing, energy performance labeling, and, to a lesser degree, standards. For this group, building energy codes and incentives, and mandates for the public sector and utilities are areas with the most room for improvement. This is similar for other countries, but it is unfortunate that performance on public sector policies is not better, as this is one area where governments can directly achieve energy savings while jump-starting markets for efficiency products and services.

The scores identify areas where there are opportunities for quick wins. For eight of the indicators, 50–80 percent of the countries surveyed fall into the lowest third of scores. These include a variety of mandates and incentives as well as building codes, which are challenging to implement, and the results are not surprising. MEPS also fall into this group, even though they are simpler to deploy, suggesting that this may be an area for near-term action in many countries.

There is a fundamental transition between the two middle-income groups that is worthy of deeper analysis. The difference in scores between income groups is largest between lower-middle- and upper-middle-income; it is much smaller between low- and lower-middle income, and between upper-middle- and high-income groups. One possibility is that as income rises, per capita energy use rises as well, creating market opportunities for energy efficiency. The differences by indicator also suggest that some changes would be more suitable than others at different phases of socio-economic development. This is an area of analysis that could be investigated as RISE builds a database of survey results.

Examining regional scores by indicator shows some patterns similar to those in the income-group analysis, yielding additional insights. The absence of low scores in the Europe and Central Asia region reveals the high institutional capacity of countries in the region, a number of which have been in the course of complying with the EU's Energy Efficiency Directive (box 3.1). The region with the next lowest share of low-scoring countries is Middle East and North Africa—good news, as there is a great deal of potential for savings in this region with fast-growing demand.

The RISE energy efficiency pillar score is not a proxy for past performance in either energy efficiency investments or energy savings. China, which has made the biggest contribution to avoided global energy consumption since 1990 and has been a leader in developing new approaches to energy efficiency policy, is not in the top 10, though it does score in the green zone.

**Box 3.1 Utility energy efficiency obligations in the EU Energy Efficiency Directive**

EU member states are required to adopt utility energy efficiency obligation (EEO) programs, under which utilities attempt to reach an agreed savings target in end-use sectors. The current target aims for yearly savings of 1.5 percent of annual energy sales to final consumers. The directive also calls for measurement, independent verification of results, and penalties for noncompliance.

Countries may be exempted from certain directives if they commit to implementing measures that demonstrate equivalent or better savings. Instead of EEOs, member states may establish alternative energy efficiency obligations or voluntary agreements that achieve the Directive's energy savings targets in end-use sectors. Each member state submits the projected savings and milestones according to the European Commission's standard methodology. Austria, the Czech Republic, Finland, Germany, the Netherlands, and Sweden do not include any utility energy efficiency initiatives to meet their savings targets, instead focusing on how to achieve savings in end-use sectors through policy.[a]

a https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive/national-energy-efficiency-action-plans

## INDICATOR SCORES[1]

### Indicator 1. National energy efficiency planning

Most countries surveyed have taken initial steps towards establishing national energy efficiency strategies. About two-thirds of the countries surveyed scored in the green zone (figure 3.4), making this indicator one of the best areas of global performance. All regions had countries that achieved high scores, though average scores for this indicator were highest, on average, in the Europe and Central Asia and Middle East and North Africa regions, edging out high-income OECD countries, where efforts of many were spurred in the 1970s by concerns about energy security.

There is more than one way for countries to achieve a high score. For some high scorers, particularly in Europe and Central Asia and East Asia and the Pacific, this is reflective of the competencies developed when they had planned economies. For others, such as the Maghreb countries, there may be elements that carry over from long traditions of civil administration. In others, as with some Gulf Cooperation Council member states, it may stem from attention from strong central leaders who champion energy efficiency.

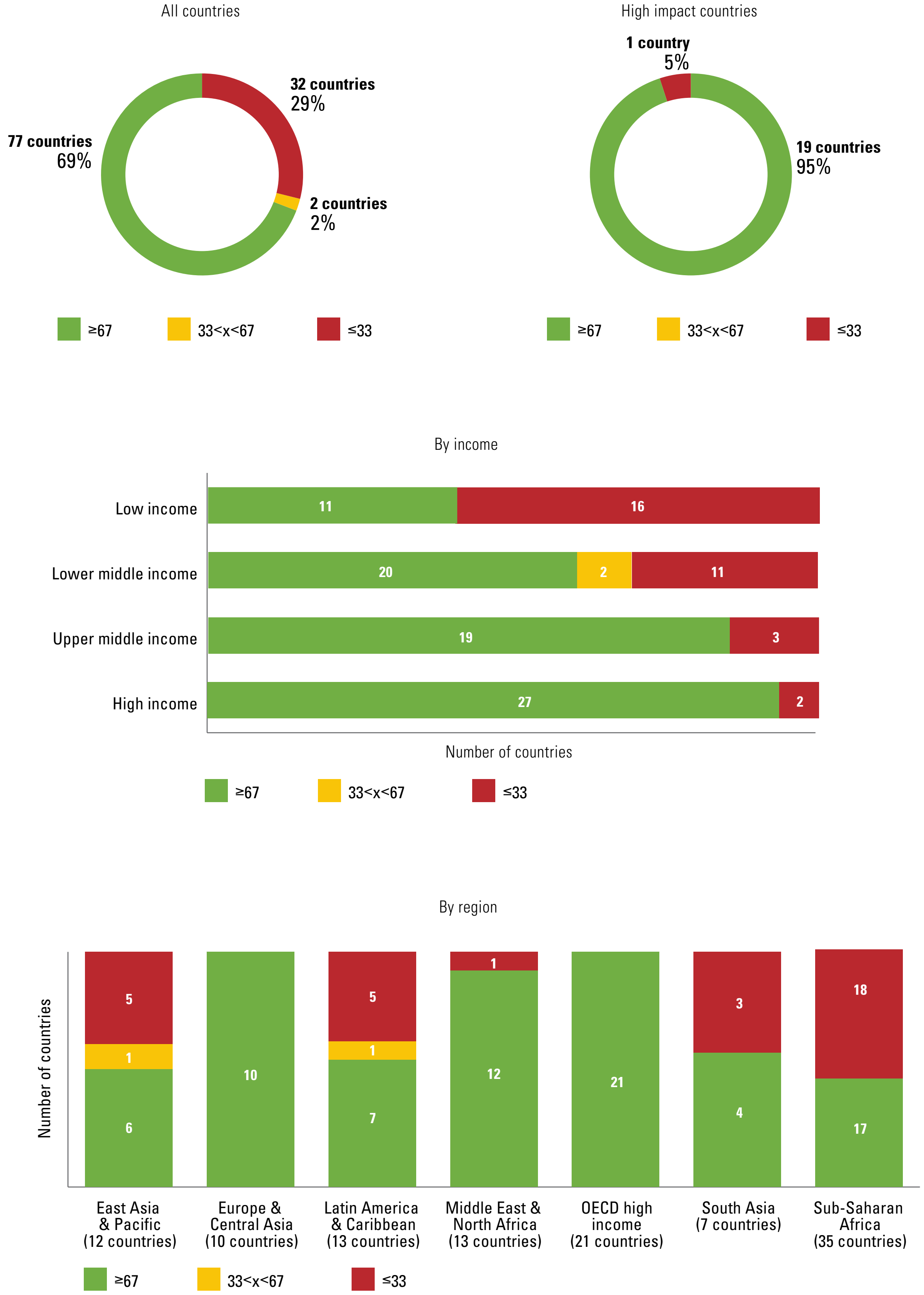
About three-quarters of the countries surveyed in 2015 had legislation or an action plan to pursue energy efficiency. Somewhat fewer—two-thirds—had targets alongside the legislation or plans. This is an important distinction (figure 3.5), as progress toward policy goals is not measurable without targets. Several countries surveyed are in the process of adopting targets, so future trends in this indicator will be more revealing than the snapshot of 2015 the present survey captures. Among the sectors that RISE measures—residential, commercial services (including transport), industry, and power—half of the countries set targets in at least one sector. Targets for industry were most common (40 percent of countries), while those for commercial services were least common (33 percent).

It is rare for countries to set targets for a single sector; most countries with targets set them for all or most sectors surveyed. Seventeen percent of countries set targets in all four sectors, 10 percent in the power sector only, 9 percent in all three demand-side sectors (industry, commercial, and residential), and another 9 percent use a combination of targets in the power sector and two of the three demand-side sectors (figure 3.6). India and Saudi Arabia each set targets in the energy-intensive power and industrial sectors, respectively. Germany is the only country that has set targets in only the residential and commercial services sectors, and Algeria has targets in the residential and industrial sectors. In the countries with a single sectoral target (Austria, Benin, Brazil, Denmark, Ghana, the Islamic Republic of Iran, Japan, Kyrgyz Republic, Madagascar, South Sudan, Togo, and the Unted Arab Emirates), the power sector was by far the most common, at 11 percent; only Peru had a single demand-side target (residential). Half the countries surveyed have no sector-specific targets; 70 percent of these are in the low-income or lower-middle-income groups.

These findings suggest that those countries with sectoral targets tend to target the most energy-intensive sectors (power) first. Further, if they pursue targets in any demand-side sector, they tend to follow a multisectoral approach. Completeness of coverage does not appear to be correlated by region or income, as countries across the globe and across the scale of development set energy efficiency targets on both the supply and demand sides.

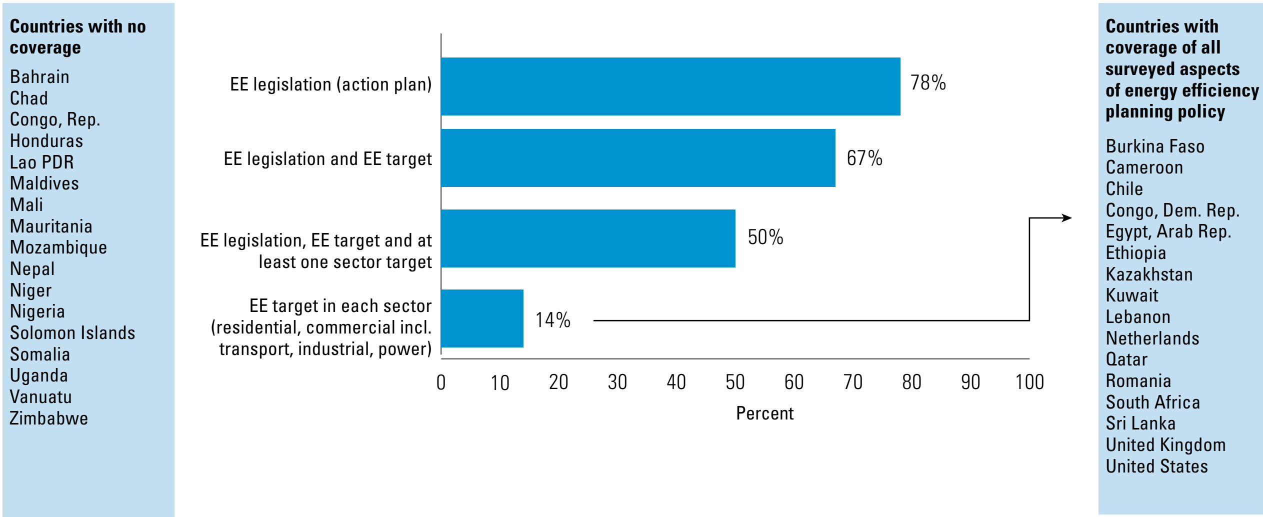
Among the 20 high-impact countries (listed in table 1.3), all but one have national energy efficiency plans in place, reinforcing the notion that for energy users, energy efficiency is too important to ignore. Scoring on energy efficiency plans and targets clearly follows income, but even among high-income countries, there still is a small minority that lags in adopting them (figure 3.4).

**FIGURE 3.4** Distribution of Indicator 1 scores



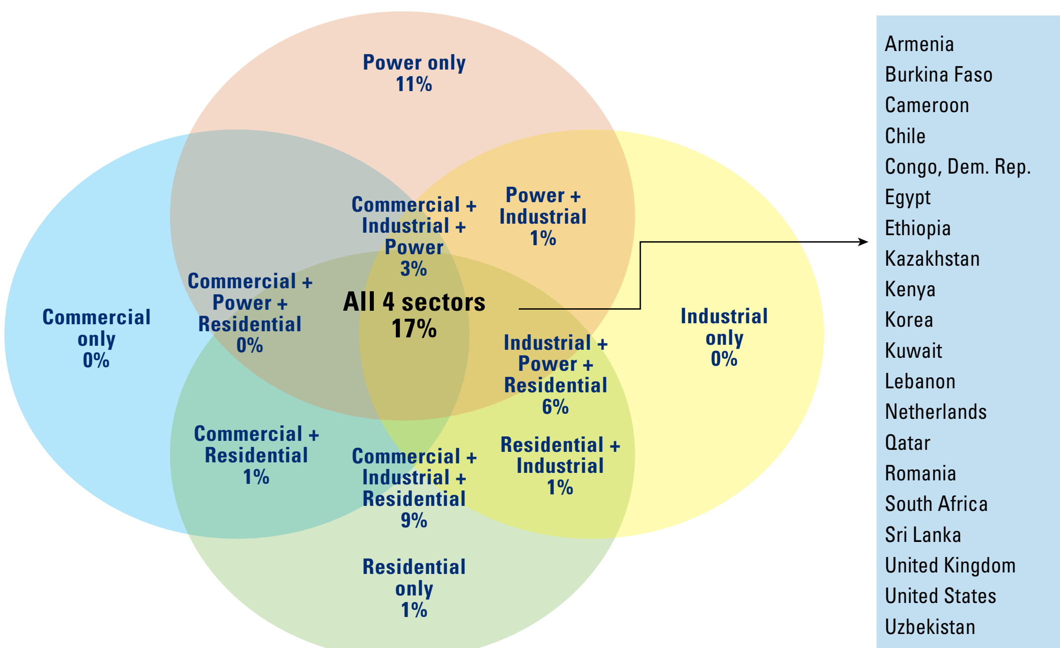

*Source:* RISE database, World Bank.

**FIGURE 3.5** National energy efficiency planning: Shares of countries with progressively more complete coverage




*Source:* RISE database, World Bank.

**FIGURE 3.6** Shares of countries with different combinations of sectoral energy efficiency targets




*Source:* RISE database, World Bank.

## Indicator 2. Energy efficiency entities

Nearly all countries have an entity with authority for energy efficiency, but practice varies considerably. The share of countries that scored in the top third for this indicator —60 percent—was somewhat less than for the previous indicator (figure 3.7). Performance on the two indicators correlated highly, which should not be surprising, but there were areas of divergence. While 11 percent of countries had energy efficiency entities in place despite having no national action plan or targets for energy efficiency activities, the opposite instance of divergence was true in only 4 percent of countries, that is, these countries have an approved national energy efficiency action plan but have yet to establish an entity to implement the plan. The average score for Europe and Central Asia topped those for all other regions.

Most countries have an entity dedicated to setting energy efficiency strategy and policy, and many have an entity for setting energy efficiency standards (figure 3.8). Many developing countries do not have mandatory energy performance standards, but have an entity dedicated to setting and enforcing future standards. Independent energy efficiency entities are relatively rare; the majority are government bodies. Independent entities are most common for certifying compliance with energy efficiency standards for appliances, equipment, and buildings, and for approving audits. Kuwait and Malawi are the only countries that have designated an independent entity to set energy efficiency strategy and policy. Thirty-two countries have entities that cover all functions surveyed (table 3.1), while 12 countries have no entity dedicated to energy efficiency functions.

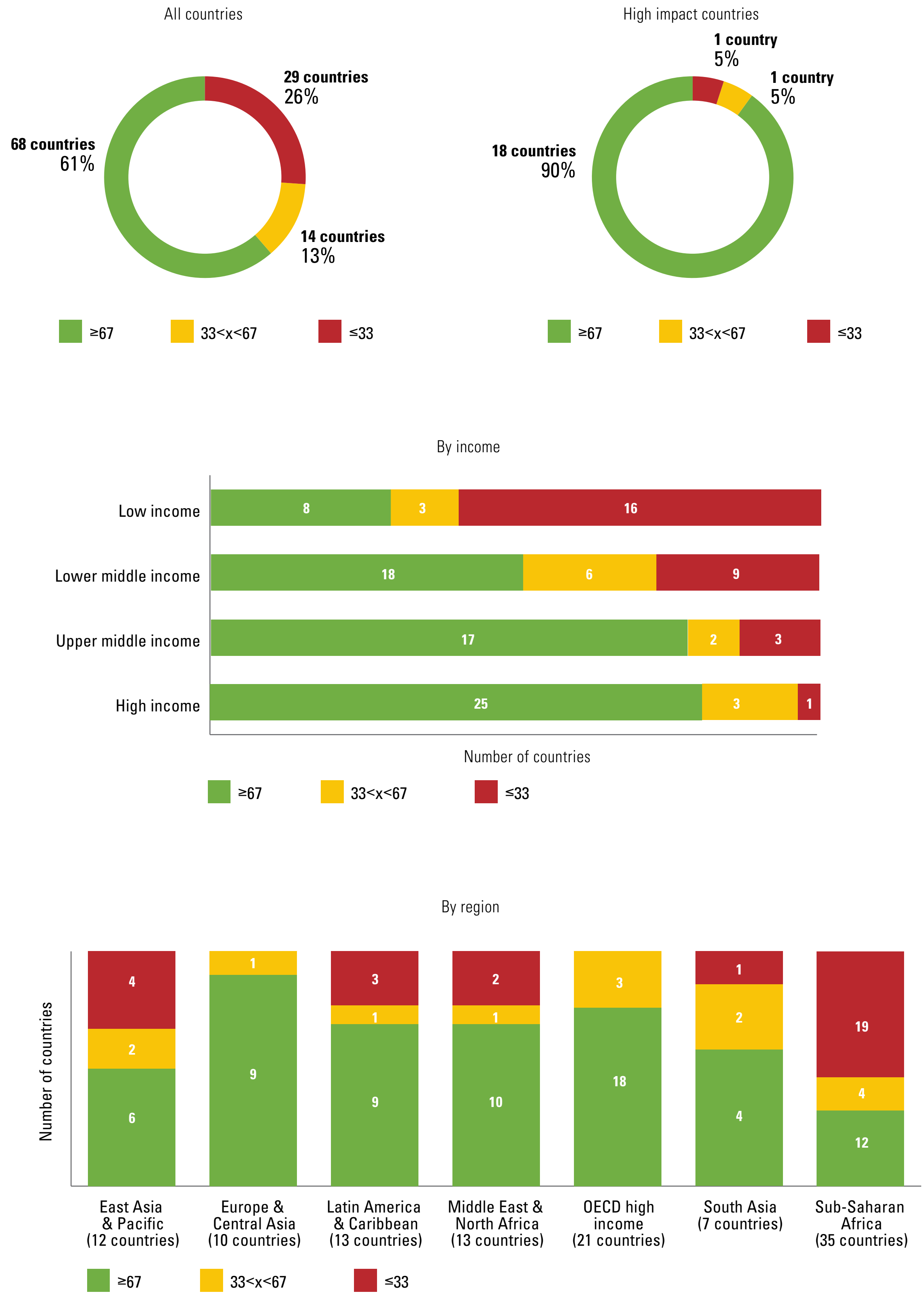
This indicator provides a glimpse of the areas that could be improved in countries scoring poorly overall in the energy efficiency pillar. Those that scored green or yellow have entities that cover most of the core functions surveyed, but red-zone countries lag far behind. The largest gaps are in setting energy efficiency strategy, policy, and standards; certifying compliance with standards; and regulating energy efficiency activities of energy consumers and suppliers. In only one case did a country have no entity in place to set energy efficiency policy, or standards, yet had an entity dedicated to certifying standards in a specific sector. Rwanda has no national energy efficiency planning body but has energy performance aspects to building codes for new residential and commercial building construction, and local urban planning authorities are responsible for certifying that new buildings meet energy efficiency requirements.

There is little difference in the results of this indicator for different incomes, implying that low income does not restrict countries from taking steps to implement energy efficiency strategies through dedicated entities, whether independent or government bodies. Of course, the mere presence of an entity does not guarantee effective implementation of the core functions necessary to improve energy efficiency. In all but two functions there are more yellow- than green-zone countries with dedicated entities, and the scores indicate that the yellow-zone entities have yet to fully implement best practice energy efficiency policies.

The presence of entities focused on a specific function is a necessary step in achieving solid results. This is most evident in the scores for MEPS and energy labels. Regardless of income, virtually all the surveyed countries with established entities dedicated to setting energy efficiency standards, certifying compliance with equipment energy efficiency standards, and selecting and approving third-party auditors to certify compliance also implemented standards and labels (figure 3.9).

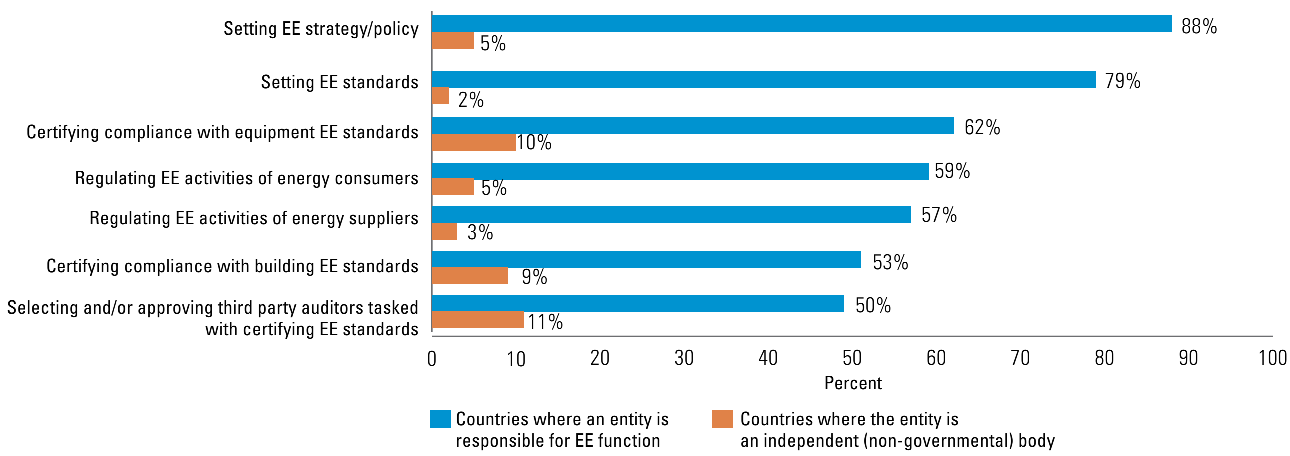
For this indicator, as for the previous indicator, there are near universal scores in the green zone among the high-impact countries (figure 3.7). For income groups, the results are similar to those for the national energy efficiency planning indicator, except here the two lower income brackets score significantly lower overall. This is perhaps understood as a result of sequencing, that is, countries tend to establish responsible entities after they have put in place the mandate requiring such a body.

**FIGURE 3.7** Distribution of Indicator 2 scores




*Source:* RISE database, World Bank.

**FIGURE 3.8** Energy efficiency entities by function: Overall share of countries surveyed and share of independent (nongovernmental) entities




*Source:* RISE database, World Bank.

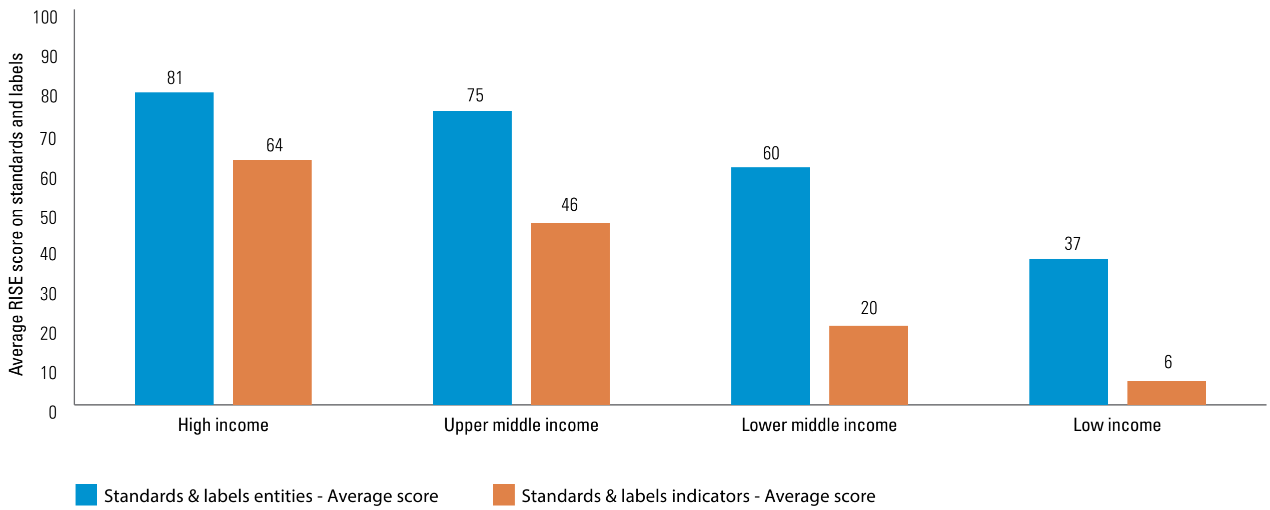
**TABLE 3.1** Energy efficiency entities by function: Averages and top scorers by income group

| | High income | Upper middle income | Lower middle income | Low income |
|---|---|---|---|---|
| Setting energy efficiency strategy/policy | 100 | 96 | 91 | 67 |
| Setting energy efficiency standards | 96 | 91 | 85 | 44 |
| Certifying compliance with equipment energy efficiency standards | 71 | 65 | 58 | 33 |
| Certifying compliance with building energy efficiency standards | 82 | 70 | 45 | 19 |
| Regulating energy efficiency activities of energy consumers | 71 | 78 | 52 | 41 |
| Regulating energy efficiency activities of energy suppliers | 82 | 78 | 58 | 33 |
| Selecting and/or approving third party auditors tasked with certifying EE standards | 71 | 61 | 42 | 26 |
| Countries with entities covering all functions | Korea, Rep. | Ecuador | Côte d'Ivoire | Uganda |
| | Belgium | Mexico | Pakistan | Cambodia |
| | Denmark | Brazil | Kyrgyz Republic | Eritrea |
| | Germany | Algeria | Vietnam | Kenya |
| | Saudi Arabia | Belarus | Cameroon | Tajikistan |
| | Finland | Thailand | Sri Lanka | Ethiopia |
| | Russian Federation | Tunisia | Uzbekistan | |
| | Netherlands | Kazakhstan | | |
| | United States | Romania | | |
| | | South Africa | | |

*Source:* RISE database, World Bank.

ENERGY EFFICIENCY

**FIGURE 3.9** Energy efficiency entities: Entities and indicators related to standards and labels




*Source:* RISE database, World Bank.

## Indicator 3. Information provided to consumers about electricity usage

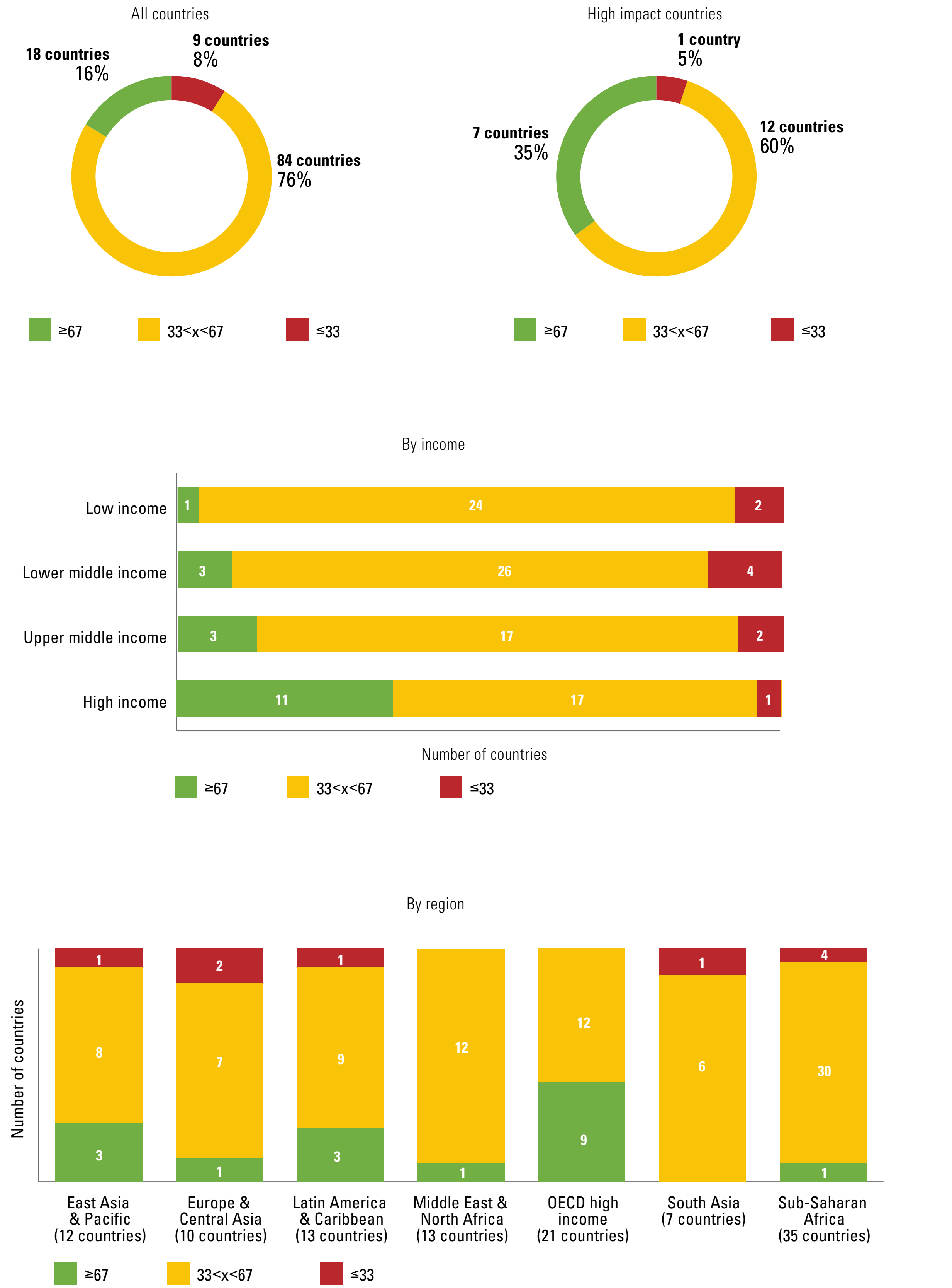
Most countries have made strides toward adopting good practices in providing electricity consumers with information they need to make decisions about improving efficiency, but many have more to do. All but two surveyed countries charge for electricity use, and consumers in nearly all countries receive an electricity bill at some time. This indicator exhibited the smallest difference in average score between regions (15 points), and the second-smallest number of countries scoring in the red zone (4) (figure 3.10). Nevertheless, scores of individual countries spanned the possible range, and no country received full marks.

The majority of countries provide information or bills to consumers (across sectors) frequently, and only 8 percent of countries do not report to consumers at least monthly (figure 3.11). Consumers in most countries (90 percent) are provided with price levels they pay for electricity, and a lesser majority (65 percent) are provided with historical data. But in only eight countries are consumers given information that compares their electricity consumption with other users in similar consumption categories or regions (Australia, Denmark, Japan, the Republic of Korea, the Netherlands, Nigeria, Romania, and the United Arab Emirates). Six of the eight (except Nigeria and the United Arab Emirates) have overall energy efficiency pillar scores in the green zone. In some countries, a comparison with other categories or regions is not considered best practice if it infringes upon the perception of sovereignty, though it can provide an effective signal for consumers to adjust their consumption patterns toward better efficiency.

Best practices in electricity consumption information are not limited to static reports. Many energy suppliers now are equipped with the technology to present information to consumers in real time. Twenty-seven percent of the surveyed countries offer consumers real-time feedback on their energy consumption, and the wealth and capacity of a country does not necessarily determine its ability to offer such information. More than half of these countries are in the lower-middle- and low-income categories, ten of which are in Sub-Saharan Africa and have taken advantage of advances in prepaid metering systems: Angola, Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Liberia, Nigeria, Somalia, South Sudan, and Sudan. Giving consumers the capability to control their electricity consumption remotely in real time, such as through mobile applications, is less common: only 12 percent of countries offer this service. Again, lower-income countries earn nearly half the higher scores.

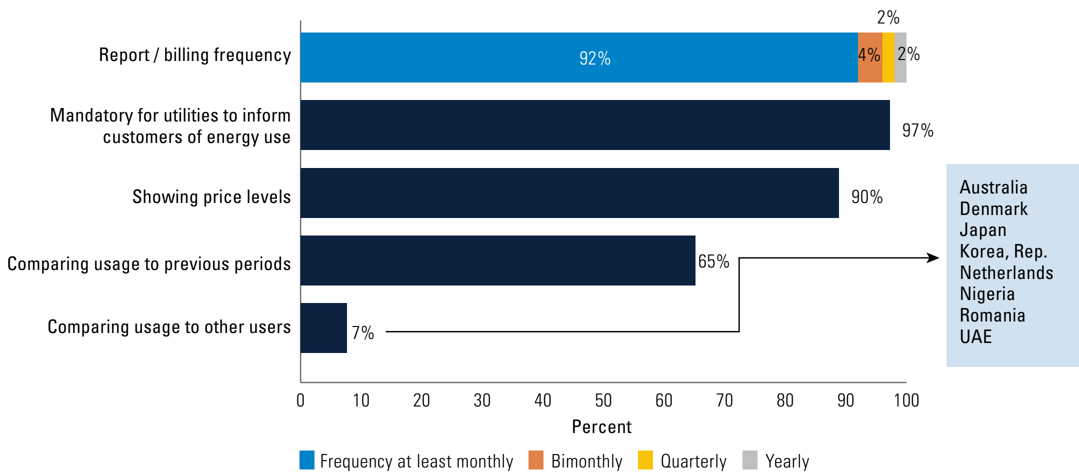
Average scores among high-impact countries on this indicator were slightly better than for the survey population as a whole (figure 3.10). And while the relationship among higher scores and greater wealth is apparent in the share of countries scoring in the green zone for the different income groups, all groups had only one or two countries in the red zone (figure 3.10). This reinforces the point that good performance in this characteristic is not tied to the attributes typically employed to sort countries.

**FIGURE 3.10** Distribution of Indicator 3 scores




*Source:* RISE database, World Bank.

**FIGURE 3.11** Information provided to consumers about electricity usage, all sectors




*Source:* RISE database, World Bank.

## Indicator 4. Energy efficiency incentives from electricity rate structures

Most countries have some of the rate structure features necessary to promote more efficient electricity use. Although the level of electricity prices is, of course, also important, it was not possible in this survey to compare the relative incentive value of the prices prevailing in different countries (box 3.2). This indicator had the fewest countries (3) that received scores in the red zone (figure 3.12). One interpretation might be that the bar was set too low for this indicator, but countries did, in fact, score over most of the possible range. Only a handful of countries received full marks, so it appears to be a useful tool for identifying improvements.

The countries with the highest marks—having better rate structures applied to virtually all customer classes—came from many regions. Chile, the Philippines, and Sweden received full marks. All three countries use increasing rate blocks for energy charges across all sectors, and all three levy demand and reactive power charges to large commercial and industrial customers. On time-of-use incentives, all three countries use seasonal rates; the Philippines and Sweden use real-time pricing based on the hourly electricity market, and Sweden offers customers across all sectors options to negotiate rate structures with peak-time rebates.

While most of the countries scoring high marks on this indicator were among the

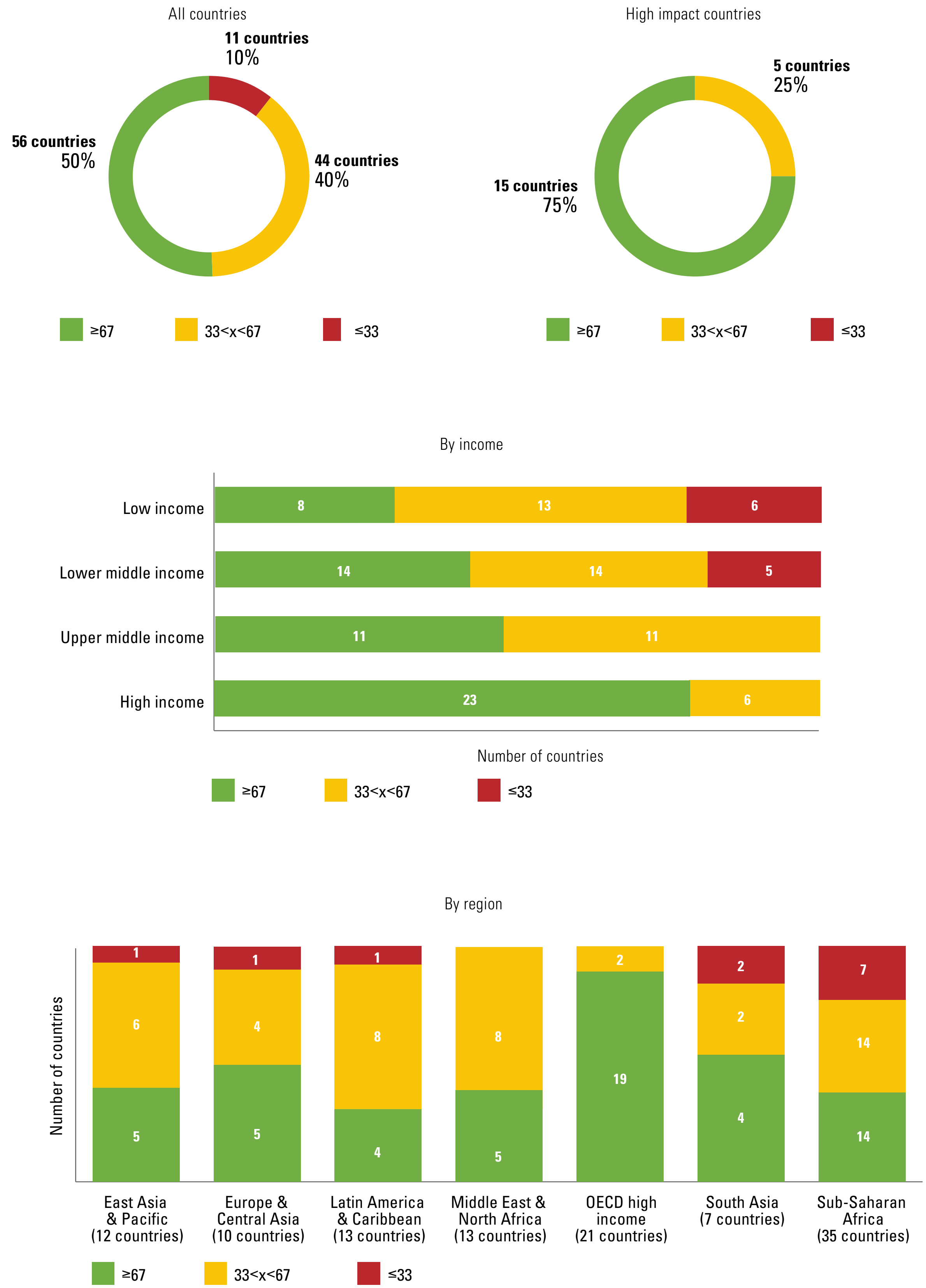
### Box 3.2 Electricity tariff levels

Alongside the energy efficiency indicators surveyed by RISE, the levels of retail electricity tariffs paid by consumers are fundamental drivers of efficiency behavior. While RISE has collected data on tariffs and retail electricity sales by customer class in each country surveyed, prices are surprisingly hard to measure and compare consistently in simple terms. Average retail prices can be difficult to characterize, even for one customer class in one jurisdiction, let alone across different customer classes and jurisdictions (including national). The incentive value of identical electricity tariff levels in two countries may differ significantly owing to diverse factors, such as different per capita incomes, dissimilar levels of underlying demand (for example, due to climatic, geographic, and cultural factors), diverse expectations about future price levels, and different costs of other household consumption items or factors of production.

Prices arise in different economic systems, and depart to varying degrees from ideal practice (long-run marginal cost pricing). In some countries, direct or indirect subsidies are important (if not particularly efficient) elements of socioeconomic policy. Even if all electricity tariffs were cost-reflective, the underlying unique cost structures in each country would result in different prices, so there is no basis for normalizing to an ideal uniform level across countries.

The RISE team will continue to work to find ways to measure aspects of electricity tariffs that bear on adoption of energy efficiency measures in ways that are context neutral.

**FIGURE 3.12** Distribution of Indicator 4 scores




*Source:* RISE database, World Bank.

### Box 3.3 The factors in Vietnam's success

Vietnam scores the highest in the energy efficiency pillar among all developing countries. Its policy progress was driven largely by surging economic growth since the 1990s. The Ministry of Energy, the public utility Vietnam Electricity, and large consumers collaborated to implement sound incentives for load shedding in response to anticipated supply-demand gaps.

Vietnam experienced demand growth at over 20 percent per year throughout the 1990s, and 15 percent growth on average in the 2000s. Vietnam Electricity worked with large industrial and commercial enterprises to introduce a time-of-use tariff to incentivize peak load reduction. The utility first introduced a time-of-use tariff in 1998, complementing this with the purchase and installation of time-of-use meters for all customers with loads over 50 kVA or consumption in excess of 5,000 kWh per month. With each successive five-year plan over the subsequent 15 years, this program was extended to commercial, services, and agricultural (irrigation) consumers. The average peak load reduction from this program has been estimated at 70 MW every five years. This program has been a success at targeting large consumers—one of the most important end-use focus areas for energy efficiency planning.

wealthiest surveyed, a few were not, notably the Philippines, Romania, Russia, Saudi Arabia, and Tunisia. Wealthier countries fared better as a group, scoring on average 20 points higher than the other groups, which had averages clustering around 60. This suggests that a process of market development generally is needed to move toward the widest adoption of better tariff structures.

Fifty-eight percent of economies impose demand charges on large industrial and/or commercial consumers, while 44 percent impose reactive power charges. Such practices require a higher level of sophistication among utilities and customers, but are quite important in raising the standard of service for grids, and are an important element in maintaining the technical and financial health of utilities. The scores on this subindicator by region and income group are close to the scores on the rate structure indicator as a whole.

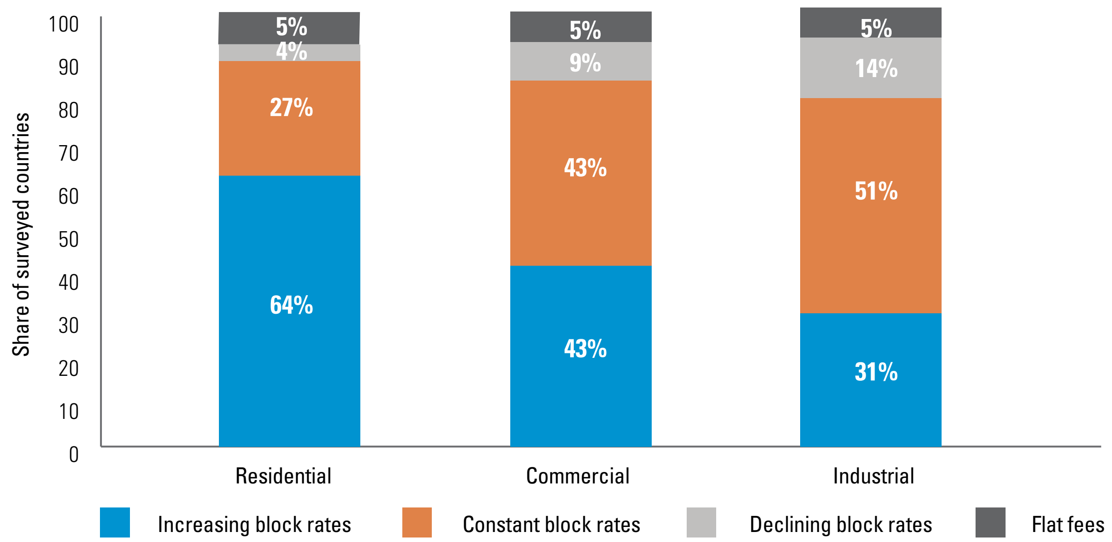
Increasing block rates are the most prevalent in the residential and commercial sectors, with a lower (though still significant) incidence of constant block rates and flat fees for connections. Declining block rates, which do most to encourage greater consumption, are quite rare in all three sectors, but still apply to industrial customers in 14 percent of countries (figure 3.13). Slightly more than half the countries have constant block rates or flat fees applicable to industrial users. Countries that charge for connections only and not for electricity consumption—Brazil, Guatemala, Kuwait, South Sudan, and Tajikistan—also grade poorly on the previous indicator (providing information to consumers about electricity consumption and pricing). There is an opportunity to raise customer awareness of their energy consumption through billing, especially as the previous indicator shows nearly all countries inform customers about their consumption levels, and thus already are metering.

Time-of-use pricing is relatively uncommon. Among the countries surveyed, 51 percent offer some form of time-of-use pricing in the industrial sector, 45 percent in the commercial sector, and 41 percent in the residential sector. On the highest marks, 42 percent of countries offer time-of-use pricing across all sectors. Such pricing programs are used most often for industrial customers, but not by large margins.

The most prevalent form of time-of-use tariff is real-time pricing (box 1.3), used for the industrial and commercial sectors in 23 percent of countries, and the residential sector in 16 percent (figure 3.14). Other approaches vary by sector; critical peak pricing is the next most common for industrial consumers, which tend to closely monitor daily electricity use. Real-time pricing programs can be effective when combined with load reduction incentives, such as critical peak pricing, variable peak pricing, or peak-time rebates. Only 14 countries implement this combination of time-of-use tariffs in any sector—Algeria, Cameroon, Canada, Côte d'Ivoire, the Czech Republic, Denmark, Ecuador, Mongolia, Romania, Russia, Sweden, Switzerland, the United Kingdom, and the United States. Seasonal rates, on the other hand, are the next most common pricing structure for commercial and residential consumers, who generally are less attentive to daily fluctuations in their usage.

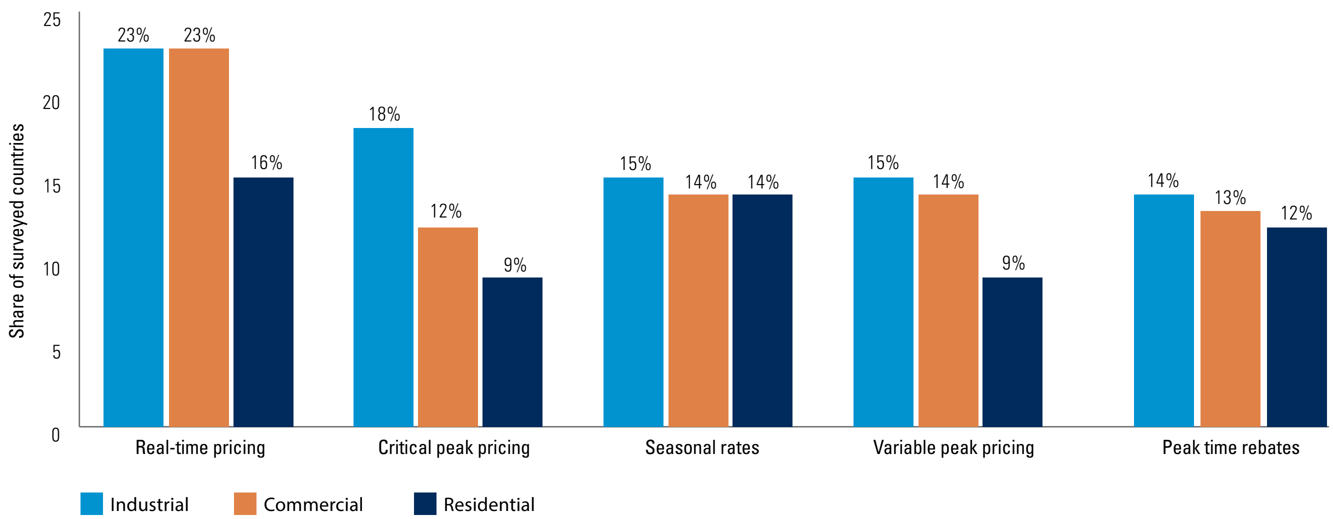
Most high-impact countries scored well on this indicator, with none in the red zone (figure 3.12). While the income groups displayed the typical positive association between wealth and score, the low-income group had no countries in the red zone—only the lower-middle- and high-income groups had countries there (Guatemala, Kuwait, and Tajikistan). This underlines the suitability of one rate structure over another as more a matter of choice than one of income or size of country.

**FIGURE 3.13** Types of electricity rate structures by sector




*Source:* RISE database, World Bank.

**FIGURE 3.14** Time-of-use tariff structures by sector




*Source:* RISE database, World Bank.
*Note:* The categories in this figure are nonexclusive: 21 percent of countries with one type of time-of-use tariff also have others.

## Indicator 5. Mandates and incentives: Large consumers

All regions have countries scoring in the green zone for this indicator, but adoption is nowhere near universal, even among the wealthiest countries (figure 3.15). Of the surveyed countries, 55 percent (59) impose some form of energy efficiency mandate on large consumers. The most prevalent obligation is mandatory reporting of energy consumption on a regular basis, and is adopted by nearly half of those countries (figure 3.16). Simply requiring tracking of consumption is a major step toward efficiency, whether a country chooses an incentive-based approach to action or has a program of mandatory targets like those instituted by China (among the 19 percent of countries that have them), covering progressively wider swathes of energy-consuming enterprises. Energy audits are mandated in over a quarter of countries, but only 10 percent require energy management systems to be adopted by large consumers. Such systems often are adopted voluntarily by larger industrial consumers absent any regulatory requirement due to their usefulness in controlling production costs.

All countries with energy management system mandates have implemented standards in accordance with ISO 50001 guidelines, which specify actions that meet the three other types of mandate surveyed. Energy management systems can be used to track and control a building's energy use, and if necessary, plan and implement energy-saving operations and investments. Only three countries—Algeria, Qatar, and Russia—impose all four types of mandates simultaneously.

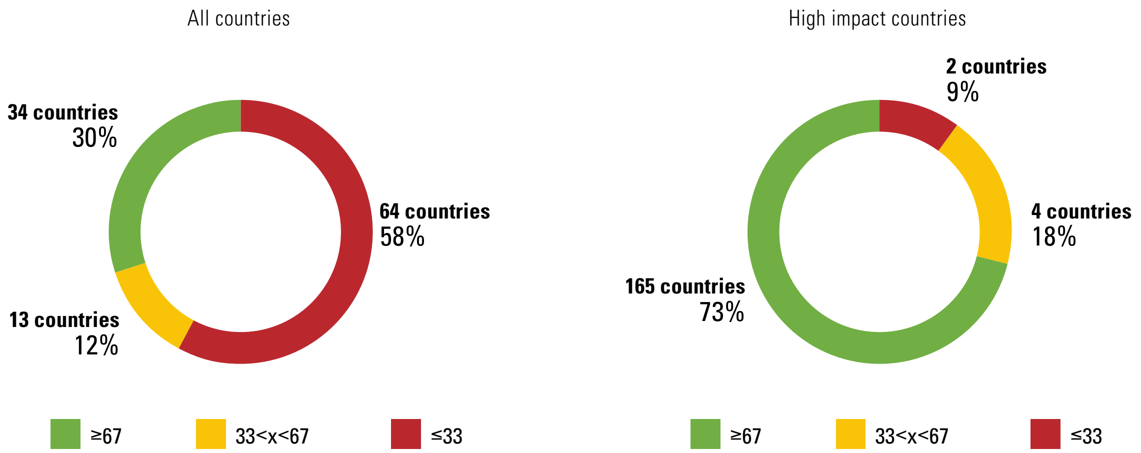
Implementing measures to support mandates are less common than the mandates themselves (figure 3.17). Only 31 percent of countries require verification of the data reported by large consumers, and even fewer have penalties for noncompliance. Independent verification by a third party—the gold standard for monitoring—features in 14 percent of countries in a broad geographic span, similar to the overall scores for this indicator. Five countries have penalties on the books for noncompliance, but have no monitoring and verification system implemented. In Ethiopia, Italy, Malaysia, Romania, and Turkey, companies that meet the threshold for being a large energy consumer are required to self-report their energy consumption improvements. In Italy and Turkey, companies are required to install an ISO 50001-compliant energy management system for monitoring and self-reporting.

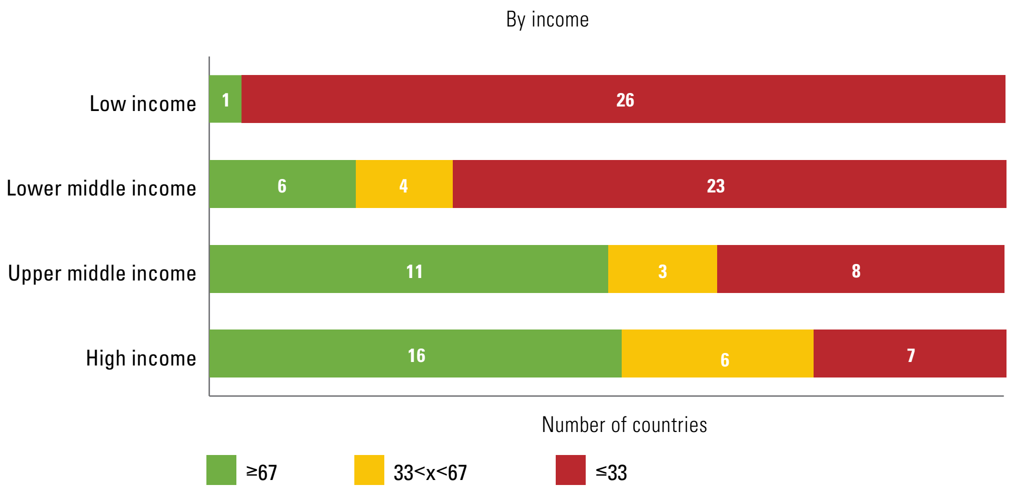
Despite the rich data on policy inputs, their quality cannot be compared on a global basis. For example, 50 percent of countries mandate regular reports of energy usage among large consumers, yet it is impossible to determine and compare the accuracy and effectiveness of these reports for each economy.

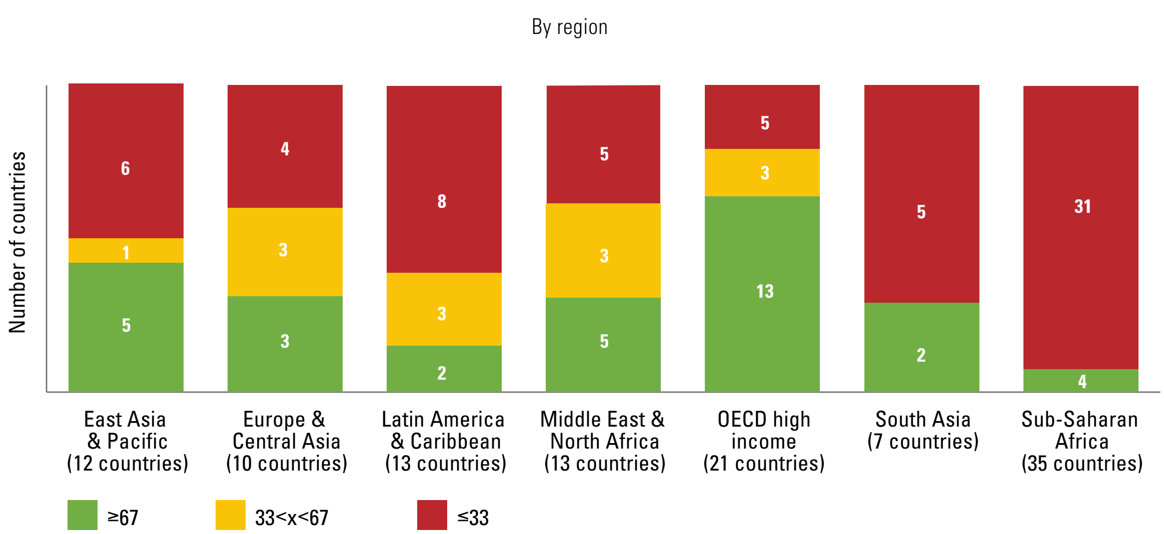
Public recognition may factor in guiding energy efficiency investment decisions for large consumers. Governments and trade associations have begun introducing programs to assist, recognize, and even award organizations that undertake major energy efficiency initiatives. Sweden has a program that has successfully promoted efficiency through incentives, but it demonstrates the potential for such measures to be viewed as inappropriate subsidies (box 3.4). About a quarter of countries have a program in place to help large consumers identify opportunities for investment in energy efficiency improvements (figure 3.18). Award programs are more common—about a third of countries offer public recognition or award ceremonies for large consumers that realize energy efficiency improvements, and 31 percent of countries actually publicize the major energy savings of large consumers through a public sector or independent entity dedicated to energy efficiency (for example, on public websites, case studies, or promotional marketing material of the energy efficiency organization).

This indicator generally has lower scores than others. For the high-impact group (see figure 3.15), the share of countries scoring in the green zone (75 percent) was higher than in the total survey population (30 percent). But that means a quarter scored in the lower two brackets, whereas for the four preceding indicators such scoring was a rarity. For income bracket, the difference in results between high- and upper-middle-income countries is smaller than for other indicators (figure 3.15), suggesting that adoption of this approach is not restricted to very wealthy countries, though it may be suitable only for relatively large economies.

**FIGURE 3.15** Distribution of Indicator 5 scores

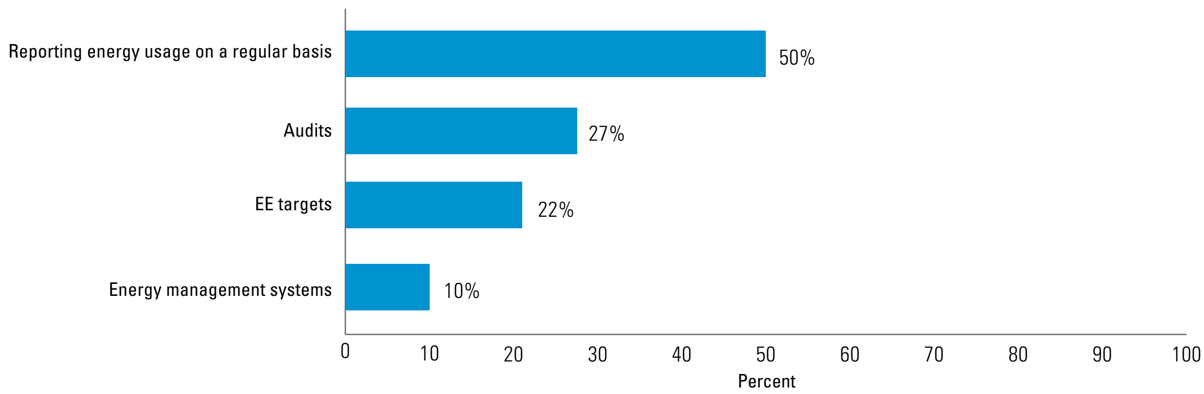


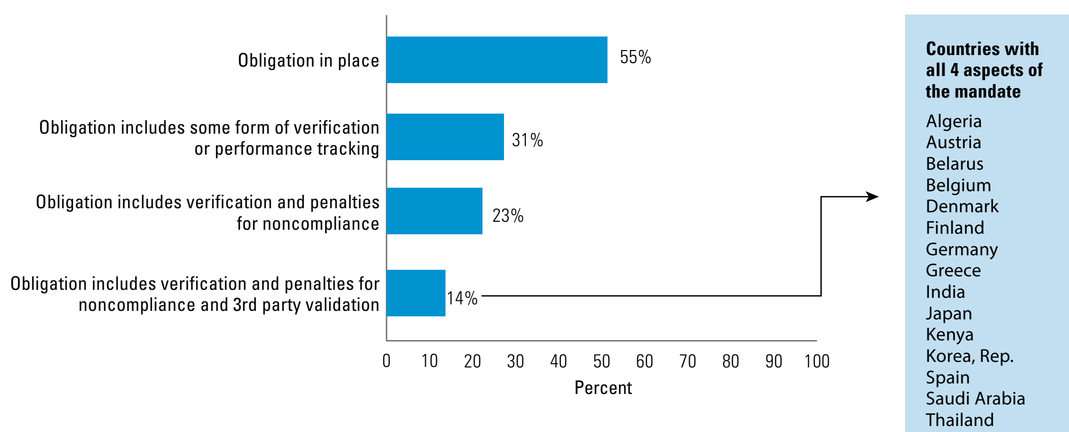

*Source:* RISE database, World Bank.

**FIGURE 3.16** Types of energy efficiency mandates to large consumers




*Source:* RISE database, World Bank.

**FIGURE 3.17** Mandates and implementing measures for large consumers




*Source:* RISE database, World Bank.

## Box 3.4 Sweden's energy-intensive industries program

Energy efficiency can be effectively implemented through market actors with the right incentives in place. In Sweden, the 2005 Energy Efficiency Act has focused on general instruments to create a market for energy efficiency investment rather than mandating actions, as many countries have found to be effective (figure 3.18). The program for improving energy efficiency in energy-intensive industries (PFE) has proven a good example of a market-oriented energy efficiency policy approach.

The PFE is a voluntary program for industrial companies that exceed either of these thresholds:

- Energy product expenditures equivalent to at least 3 percent of its production value; or
- Total energy and carbon dioxide tax for the company amounts to at least 0.5 percent of its added value.

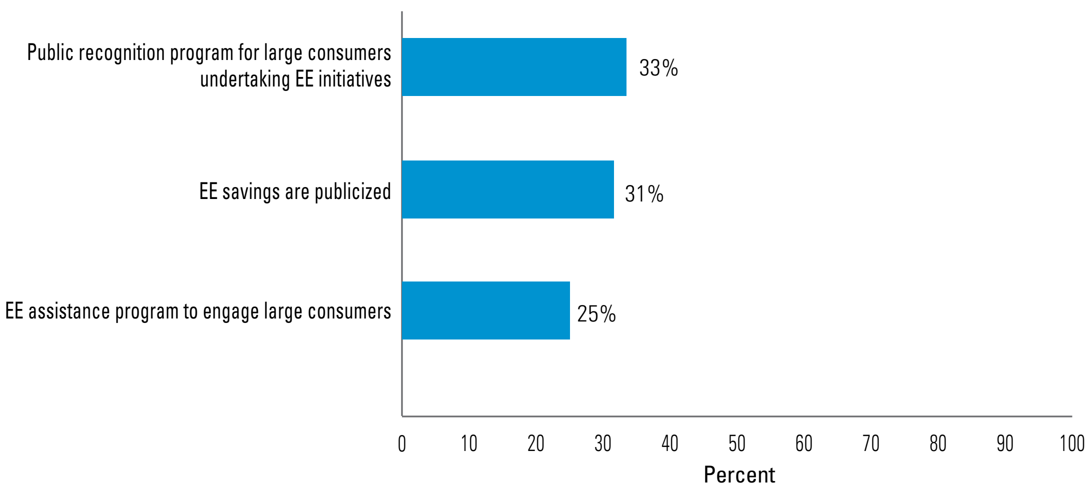
Companies can be exempted from the EU energy tax (an additional tax on industrial process-related electricity consumption) if they demonstrate investments in an energy management system. The intent is that companies should improve their electricity use efficiency without being subject to taxes that could hurt their international competitiveness. The energy efficiency improvement measures taken as a result of the PFE are expected to give the same effect as that of the EU energy tax.

The PFE is in its third and final five-year plan of participation. Since its inception in 2004, the average payback period on investment for each participating company has been under three years, and the PFE has resulted in estimated electricity savings of 1.45 terawatt hours (TWh) annually.

Despite these impressive energy savings, the success of this program lies in its sustainability. Participating companies continue to invest in maintaining their energy management systems even after their five-year participation plan ends. Although the PFE is being discontinued due to a decision by the European Commission that the present structure breaches EU state subsidy rules, participating companies have committed to continue the energy management procedures voluntarily.



**FIGURE 3.18** Mandates and incentives for large consumers: Performance recognition programs




**Countries offering all 3 aspects**

Algeria
Australia
Austria
Canada
Germany
Indonesia
Iran, Islamic Rep.
Kenya
Kuwait
Netherlands
Nicaragua
Tunisia
United States

*Source:* RISE database, World Bank.

### Indicator 6. Mandates and incentives: Public sector

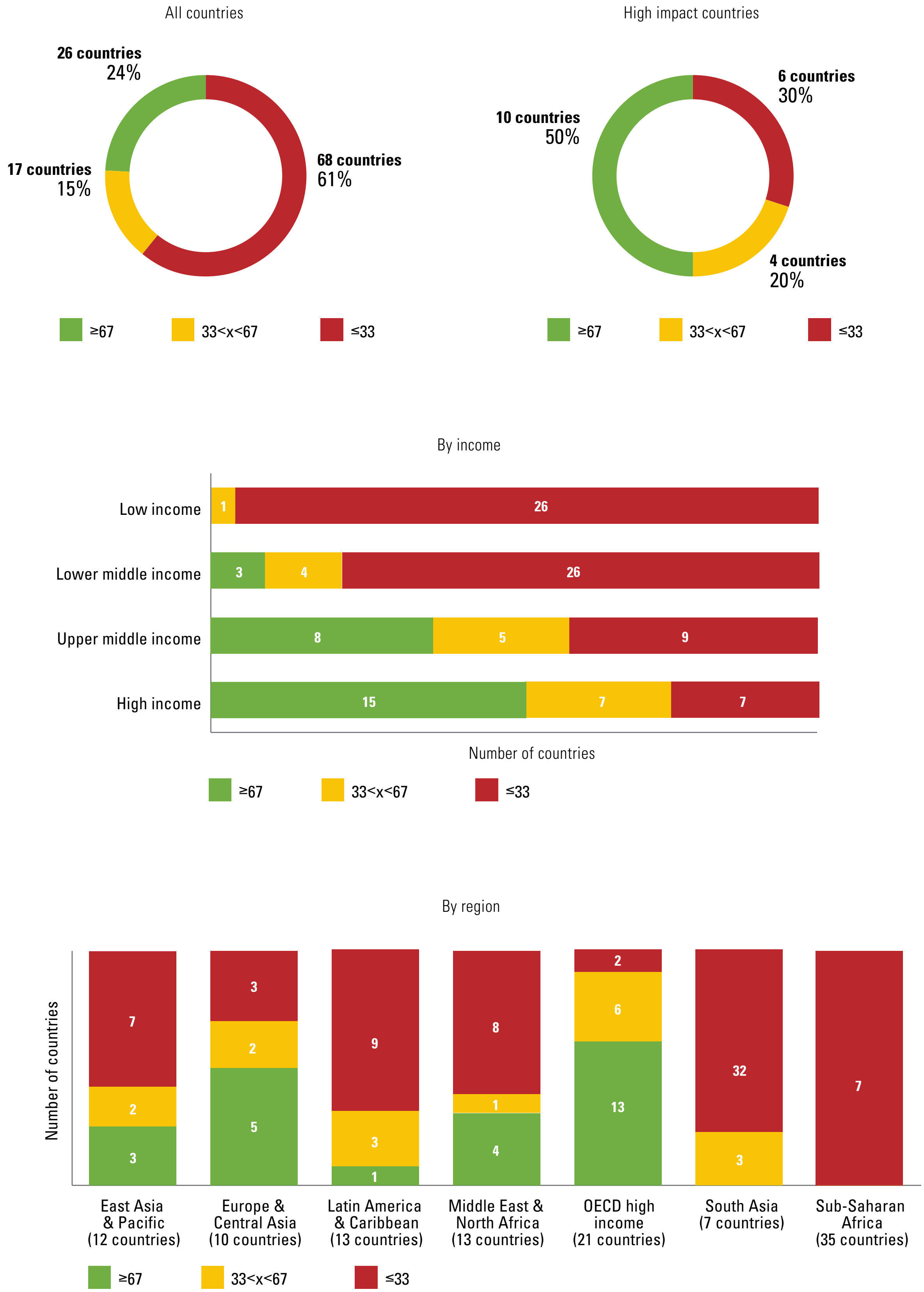
Given the importance of public sector programs to countries' potential energy efficiency portfolios, it is surprising that only two-fifths of countries have adopted them (figure 3.19). About three-quarters of these countries, however, scored in the top third of the possible range, suggesting that once countries decide to adopt this approach they tend toward the range of good practice. Still, this is another area where a large number of countries scored zero, including some in the OECD high-income group, despite the fact that it is an area applicable to all.

While scores are correlated with wealth, similar shares of the lower-income groups have adopted guidelines and incentives for implementation as have adopted a mandate alone—the same as for the higher-income groups. Of the countries surveyed, 36 percent had an energy efficiency mandate applicable to the public sector, 27 percent had such a mandate and guidelines for implementation, and 18 percent had such a mandate with incentive policies (figure 3.20). In other words, a country does not need to be rich to adopt public budgeting rules that allow government offices to retain budgetary savings from efficiency measures.

It is common for public sector rules to refer to actions already taken in other arenas, often performance standards, labels, and codes. Public sector initiatives focused on energy efficiency are being developed based on widely accepted, predefined energy efficiency thresholds. Energy performance standards and labeling systems can guide public procurement programs, public building retrofits, and public infrastructure obligations and incentives. For instance in Australia and Greece, all public entities must rent office space only in buildings that exceed a specified level on the energy efficiency building-rating system. This is a real incentive for building developers and maintenance companies that typically seek security by signing long-term leases with public sector tenants. As might be expected, the scores for the public sector indicator show a strong correlation with those for the MEPS and energy labeling indicators and the building energy codes indicator (figure 3.21).

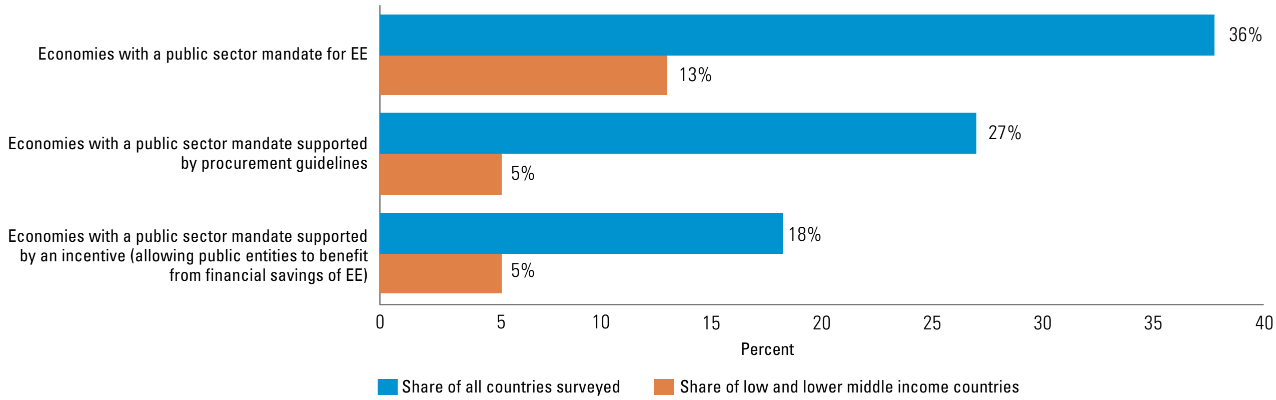
The performance of high-impact countries was higher than the global average, but less markedly than the previous indicator—by about 25 percentage points instead of 50 (figure 3.19). This represents a substantial opportunity for governments in the larger consumer countries that are doing less than others in their cohort.

**FIGURE 3.19** Distribution of Indicator 6 scores



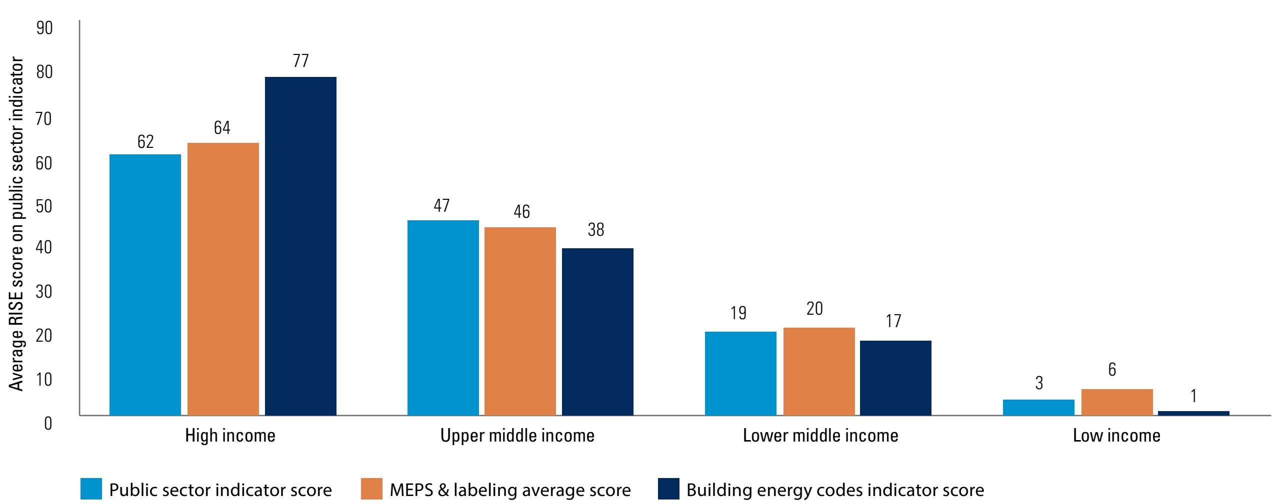

*Source:* RISE database, World Bank.

**FIGURE 3.20** Mandates and incentives for the public sector: Shares by income group




*Source:* RISE database, World Bank.

**FIGURE 3.21** Public sector indicator, labeling, and codes: Average scores by income group




*Source:* RISE database, World Bank.

### Indicator 7. Mandates and incentives: Utilities

As with most indicators, here too the high-impact countries score significantly better than average (figure 3.22). However, there is no single attribute that appears to be associated with high or low adoption.

Though nearly half the countries have taken steps to impose energy efficiency mandates on utilities, very few use this approach to its full potential. This indicator has the lowest average score in the energy efficiency pillar, with just 10 countries attaining scores in the green zone (figure 3.22), and two-fifths receiving no score at all. Top scorers included countries that were early movers in this area, including the North American countries, as well as countries that recently adopted measures, like Bahrain and Romania. This is one of the indicators that is least associated with overall high scores, as four of the overall top scorers in the energy efficiency pillar were in the bottom rank for this indicator. Income is not a determining factor; countries with high or low incomes can choose to take advantage of the privileged access to electricity customers that utilities have in order to develop energy efficiency.

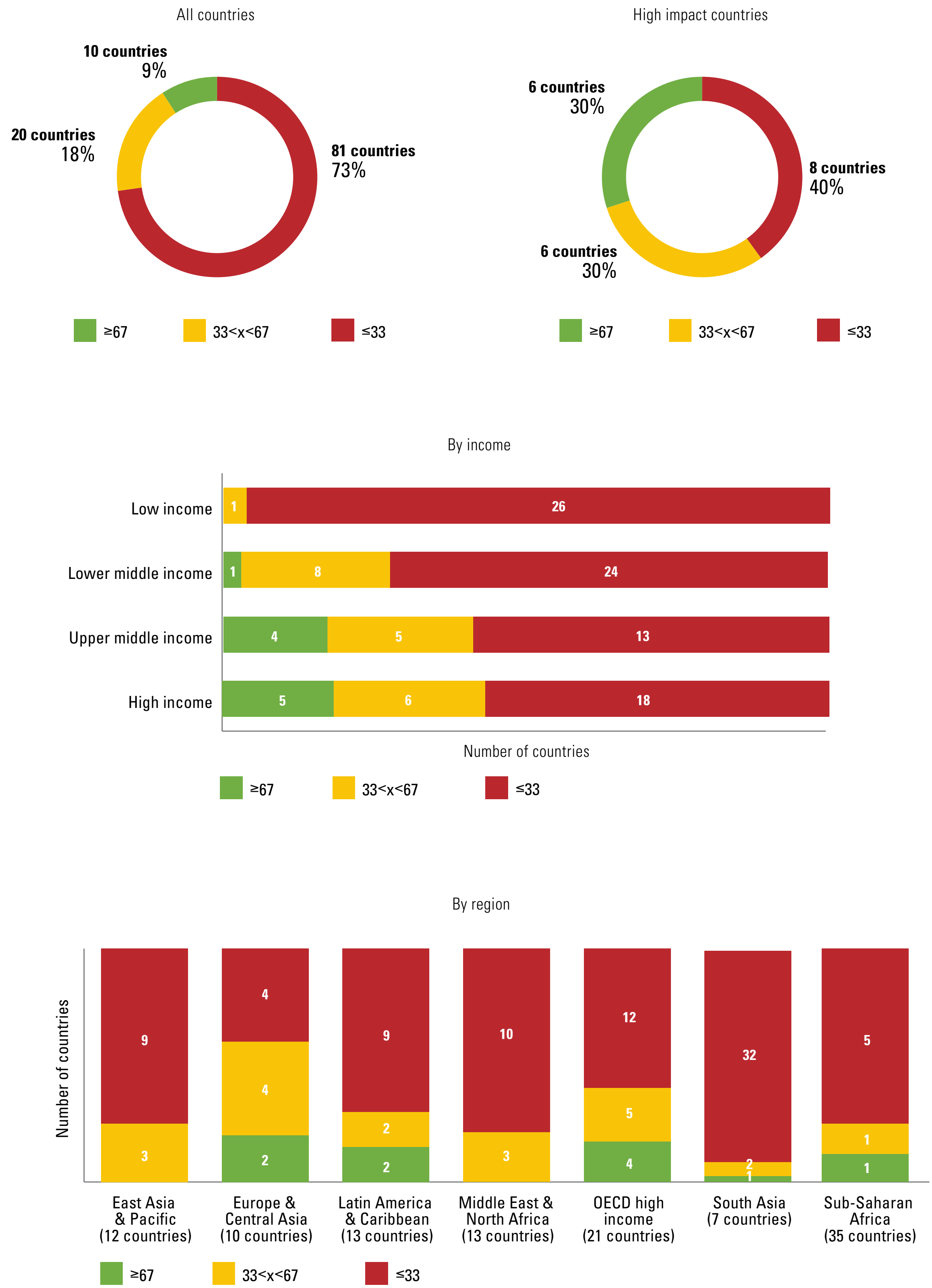
Most countries with mandates in one of the three segments—generation, T&D, and end-use sectors—had mandates in one or both of the others segments as well. Half of the countries surveyed had some energy efficiency mandate on utilities, but 14 percent had mandates only on the supply side (generation and T&D), and 11 percent had mandates only on the demand side. The 18 countries with all three mandates were diverse in geography, level of development, and regulatory approach (figure 3.23). This suggests that utility mandates are applicable across a wide variety of circumstances, and should not be thought of as useful only for wealthy countries.

Relatively few countries use energy performance contracting. Utility mandates on end-user efficiency can be carried out directly by utilities or by units or companies with energy efficiency as their core business. One way to do this is through energy performance contracting, through which energy service companies (ESCOs)—specialized providers of technical and sometimes financial services—implement energy efficiency projects. Such an approach can be effective, but it requires a highly developed legal, institutional, and financial environment. Only 20 of the surveyed countries employed performance contracting, and just over half of those had demand-side mandates.

A primary obstacle to utility energy efficiency mandates is that they reduce electricity sales, which in turn—absent a cost-recovery mechanism—reduce utility revenues. The most common means of cost-recovery for utilities investing in energy efficiency are public budget financing (20); program cost recovery, typically through charges added to electricity bills (11); and on-bill financing (7), where beneficiaries repay the cost of investments through their electricity bills.

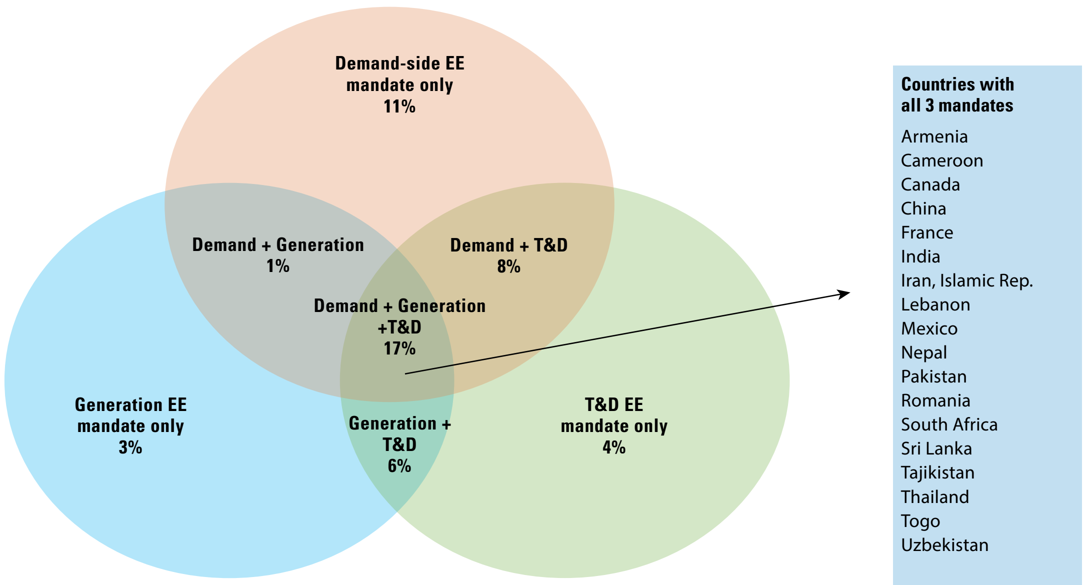
Most countries with utility obligations also track performance, but only half of that subset imposes penalties for noncompliance. Only half of that still-smaller set further requires third-party validation of performance results. The result is that only 11 percent of the surveyed countries have utility energy efficiency programs that encompass this suite of basic structures, which are important to motivate and assure results (figure 3.24). This is an area where much remains to be done, at least for those countries that undertake utility mandates.

**FIGURE 3.22** Distribution of Indicator 7 scores



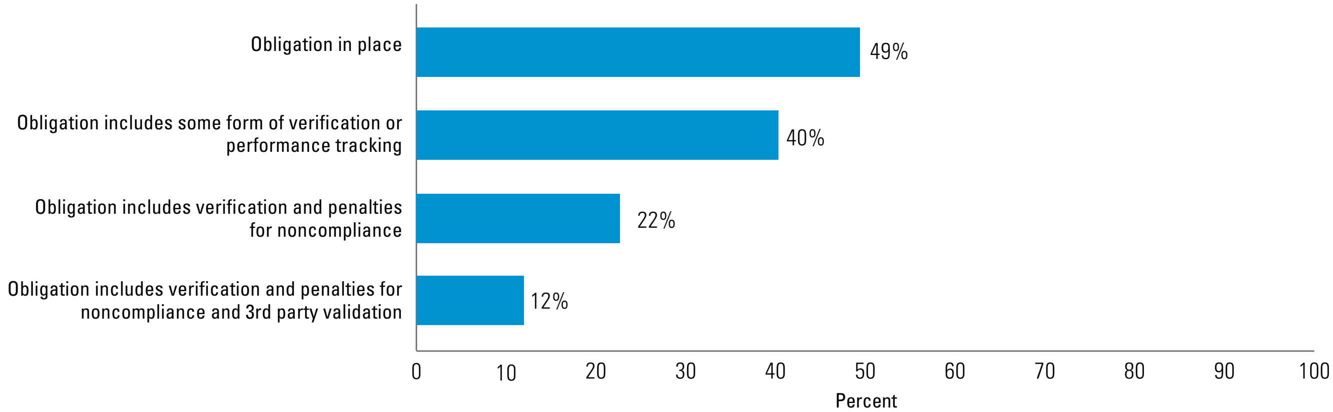

*Source:* RISE database, World Bank.

**FIGURE 3.23** Mandates and incentives for utilities: Countries with mandates




*Source:* RISE database, World Bank.

**FIGURE 3.24** Mandates and incentives for utilities: Obligations and compliance measures




*Source:* RISE database, World Bank.

## Indicator 8. Financing mechanisms for energy efficiency

Countries show little middle ground in adopting energy efficiency financing mechanisms, having either a great deal of activity or very little (figure 3.25). Surveyed countries with financing mechanisms in place achieve scores at the high end of the range. At the other end of the spectrum, just over 40 percent of countries score zero, including some that perform well in other areas and in other RISE pillars. Kenya, for instance, scores in the green zone on the renewable energy pillar indicator for financial and regulatory incentives, but scores zero for financing mechanisms for energy efficiency. The high-impact countries that did not earn scores in the green zone include Brazil, Indonesia, the Islamic Republic of Iran, Nigeria, and Saudi Arabia.

With some exceptions, there is a strong relationship between wealth and deployment of energy efficiency financing mechanisms. While the average scores for high-income and upper middle-income countries are the same (68), upper-middle- and lower-middle-income countries (32) show a large gap that mirrors the gap in the overall scores for energy efficiency. Most low-income countries offer no financing mechanisms for energy efficiency activities, resulting in a low average score of 7.

Europe and Central Asia is the best-scoring region for this indicator. There is a gap between the average scores for Sub-Saharan Africa and OECD high-income countries of 71 points, which is higher than for any energy efficiency indicator except building energy codes. Some countries stand out in other regions, with China, the Dominican Republic, Jordan, Sri Lanka, and Thailand all earning full marks. As with mandates and incentives for utilities, the variety of high-scoring countries for this indicator suggests that doing well is not limited by wealth or underlying political economy, but depends on willingness and ability to execute a policy.

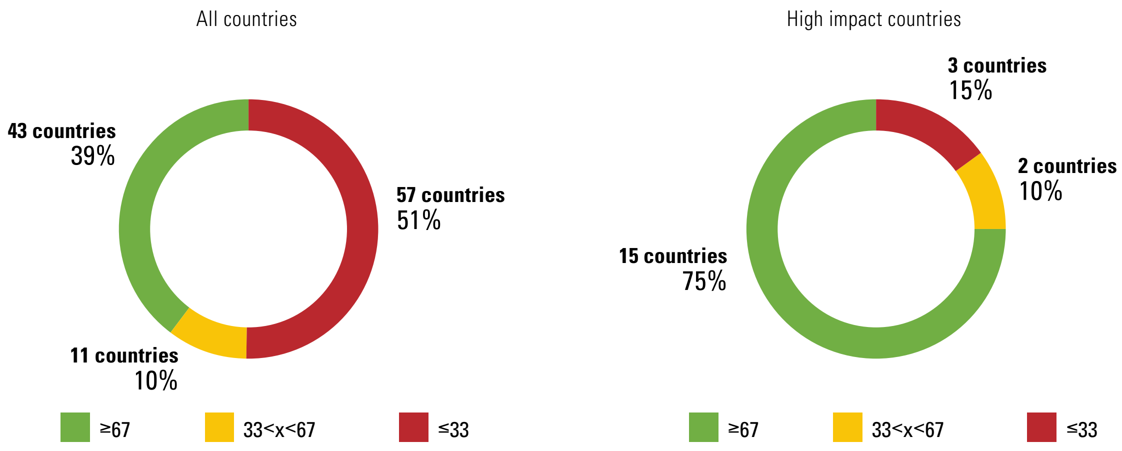
The most prevalent public energy efficiency financing mechanisms among countries are credit lines from banks, energy service agreements, and tax incentives (figure 3.26). Among private energy efficiency financing mechanisms (those operating without the need for government involvement), the most common are credit lines and energy service agreements. Some countries also have vendor credit or leasing, discounted green mortgages, and green or energy efficiency bonds.

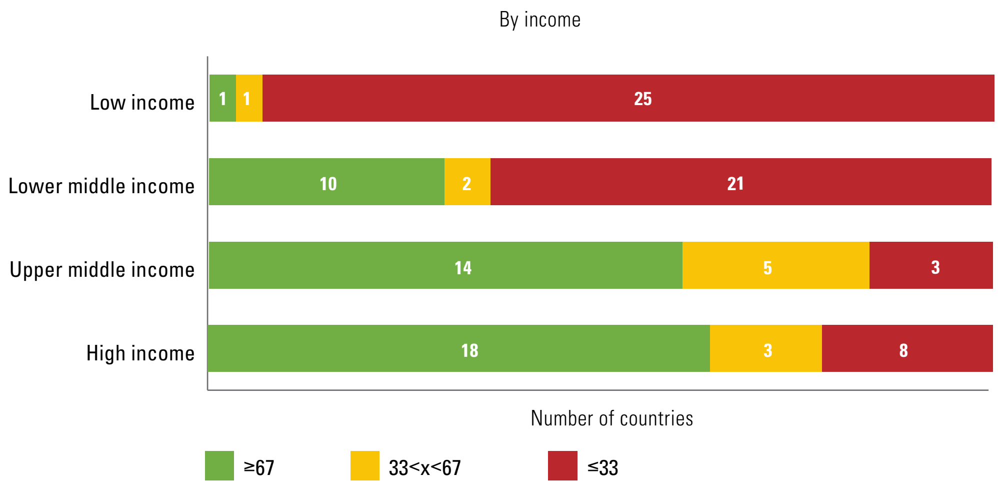
As expected, of the overall number of financing mechanisms in all countries, those in the residential sector tend to be public rather than private. Fifty percent of countries have at least one mechanism available to households, 53 percent at least one for commercial services, and 56 percent at least one for industry.

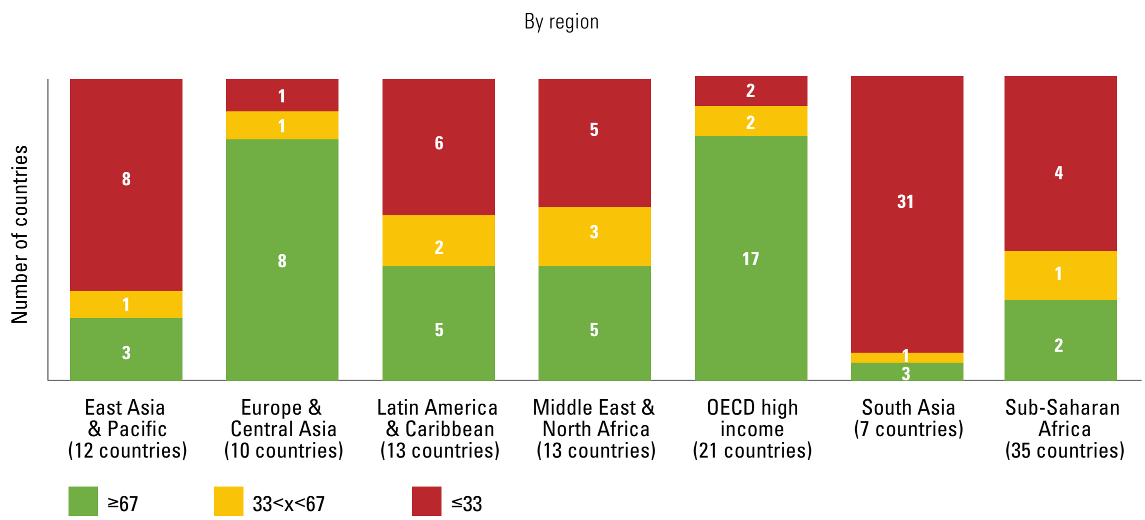
Among low-income countries, only Ethiopia, Haiti, Tanzania, and Uganda offer financing mechanisms for energy efficiency, with all four offering tax or duty incentives across sectors. The only other form of financing mechanism in any low-income country is in Haiti, where a major retailer offers financing options for buying energy-efficient home appliances. Financing options are unavailable for larger commercial or industrial energy-efficient equipment.

The gap in scores between lower-middle- and upper-middle-income countries is due primarily to the larger number of market-oriented financing mechanisms available to those in the latter group (table 3.2). While several lower-middle-income countries offer some public or utility-mediated mechanisms and bank credit lines, they do not offer discounted green mortgages, ESCO financing, green or energy efficiency bonds, or vendor credit or leasing options. India is the only lower-middle-income country where ESCOs offer financing options in all three sectors surveyed (residential, commercial, and industrial), and Sri Lanka is the only lower-middle-income country where vendor credit or leasing is available in all three sectors.

**FIGURE 3.25** Distribution of Indicator 8 scores

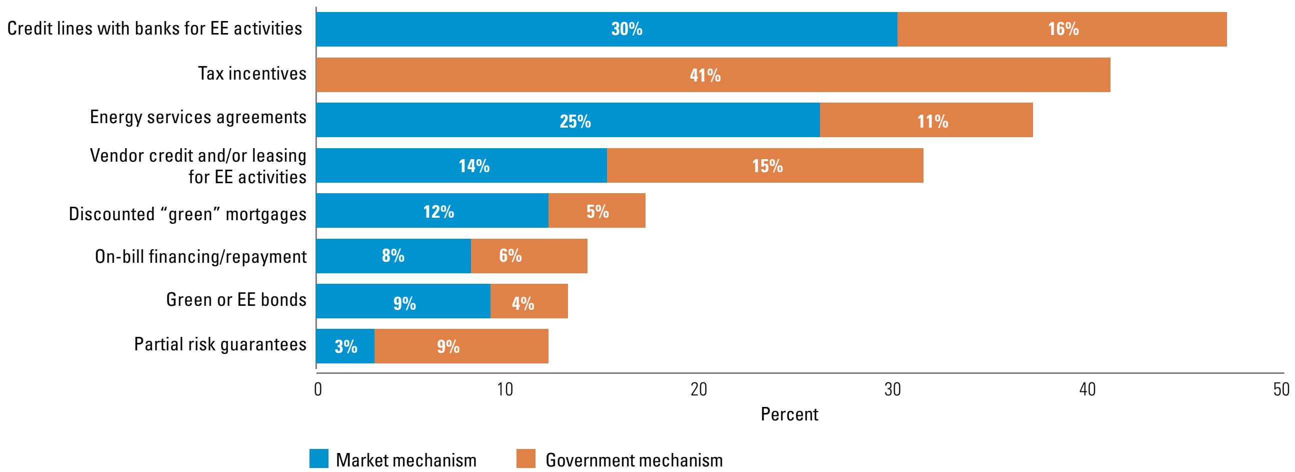


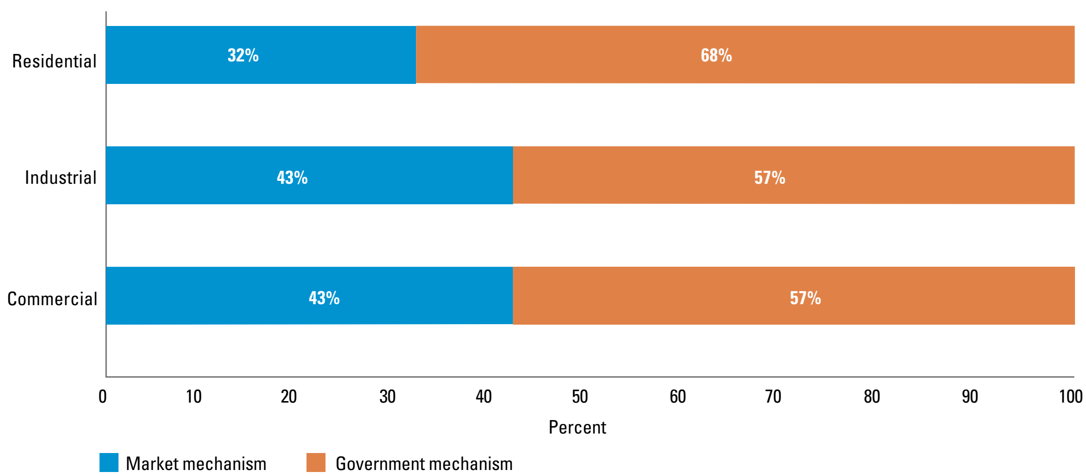

*Source:* RISE database, World Bank.

**FIGURE 3.26** Financing mechanisms for energy efficiency: Shares of countries by mechanism (percentage)




*Source:* RISE database, World Bank.

**FIGURE 3.27** Shares of market-based and government mechanisms among all energy efficiency financing mechanisms (percentage)




*Source:* RISE database, World Bank.

**TABLE 3.2** Financing mechanisms available in any sector: Share of countries in each income group (percentage)

| | Tax/import duty incentives | Discounted green mortgages | On-bill financing/ repayment | Credit lines with banks for energy efficiency activities | Energy service agreements/ performance contracts | Green or energy efficiency bonds | Vendor credit and/or leasing | Partial risk guarantees |
|---|---|---|---|---|---|---|---|---|
| High income | 50 | 39 | 32 | 50 | 57 | 29 | 29 | 21 |
| Upper middle income | 57 | 17 | 13 | 61 | 43 | 9 | 26 | 22 |
| Lower middle income | 27 | 0 | 9 | 39 | 24 | 3 | 15 | 9 |
| Low income | 15 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |

*Source:* RISE database, World Bank.

### Indicator 9. Minimum energy performance standards

Among the most surprising results in the energy efficiency pillar is how few countries have taken advantage of MEPS, by which few resources can produce large and lasting results. Even among countries with relatively high overall scores on this pillar, only a minority had MEPS for even those classes of devices for which standards are most common (figure 3.28)—air conditioners, refrigerators, and lighting.

Among high-impact countries, scores were better than the average for this indicator (figure 3.29). Their scores for MEPS were not as high as their overall energy efficiency pillar scores, but it is encouraging to see that the largest consumers are taking advantage of this approach.

From a global perspective, the scope for action is considerable (figure 3.30). When countries are placed in descending order by their indicator scores from left to right, scores for the MEPS indicator (blue area) fall away rapidly, much more so than for the energy efficiency planning indicator (brown line).

Enforcement regimes are not always attached to MEPS in countries that have implemented them, reducing their effectiveness. All regions have some countries with MEPS that lag in their verification and enforcement systems (figure 3.31). Still, results suggest that at least the design of enforcement measures is incorporated into most existing MEPS programs. One aspect of enforcement—that is, certification that an appliance on the market conforms to the relevant MEPS—is reviewed in chapter 5, and shows this to be an area where many countries could improve.

Air conditioners, refrigerators, and lighting equipment are the products with MEPS in the highest number of countries. The systems are well developed in the wealthier OECD countries, of which no country scores in the red zone. Other regions also have good performers: Brazil, India, Mexico, and Vietnam score very well, for instance, as does China, the world's biggest exporter of electrical equipment, and the biggest car market. This is encouraging since demand for these products is growing in developing countries. However, nearly half of countries have no MEPS at all. In the Middle East and North Africa region, with a growing population and demand for air conditioners forecast to drive up energy consumption, action will be highly beneficial.

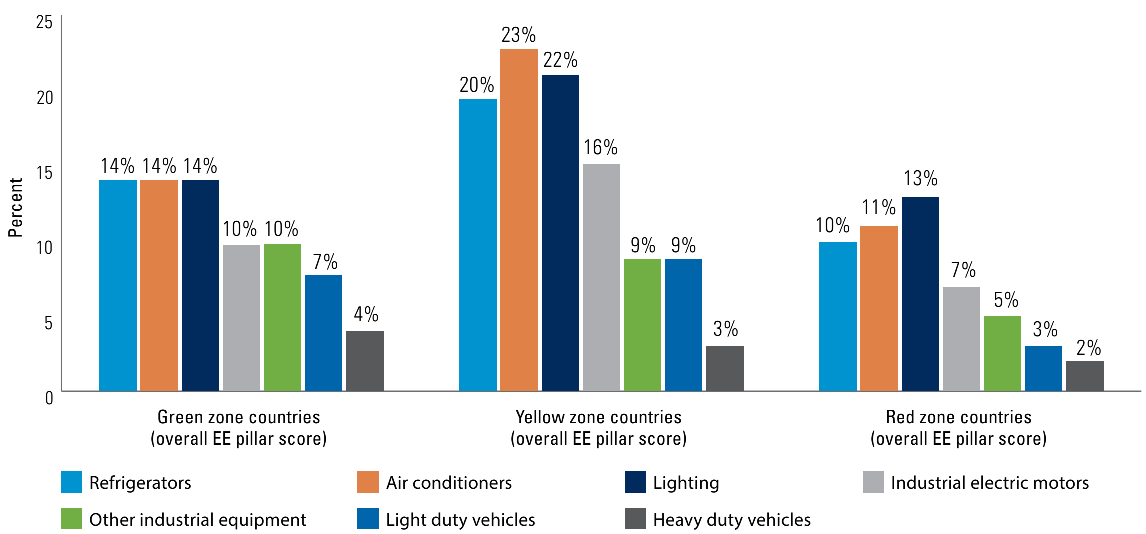
For the product categories surveyed, monitoring and compliance systems are less robust than the standards in every instance (figure 3.32). The scores are highest for lighting and the two appliance categories—often the first to be regulated. Industrial electric motors score significantly lower (and other industrial equipment still lower), but this is in part due to the survey's inclusion of countries with small industrial sectors. This highlights an action area of priority, since this is the equipment category consuming the greatest amount of energy worldwide.

Lowest scoring on this indicator are vehicles. This is a new area for many countries, most of which import vehicles. Even among countries with large vehicle-manufacturing sectors, heavy-duty vehicle standards are quite new. With increasing motorization of passenger and freight travel in developing countries, and with most growth in transport demand expected to come from them, fuel economy standards and oversight mechanisms are a clear opportunity.

Among income groups, the largest scoring difference is between the lower-middle- and upper-middle-income groups (figure 3.29). The causes for this bear investigation in order to accelerate global deployment of this very cost-effective approach.



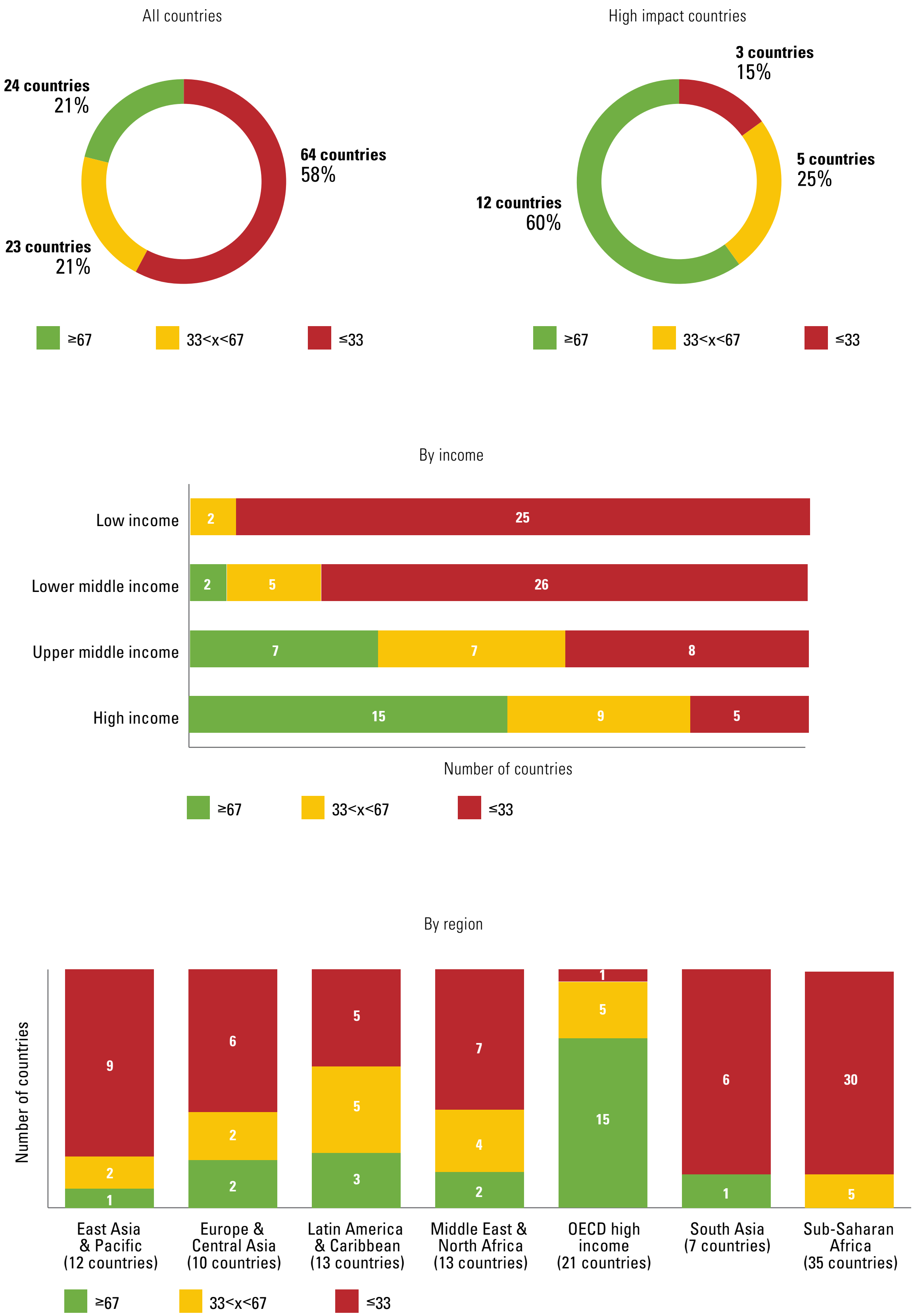
**FIGURE 3.28** MEPS: Average scores by product category for each zone of energy efficiency overall pillar scores*




*Source:* RISE database, World Bank.

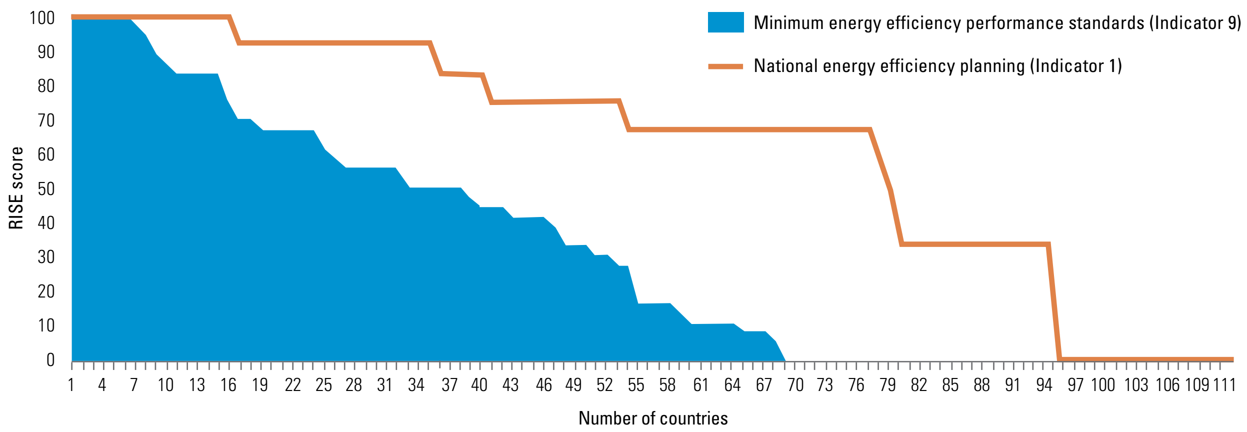
* Percentages in this figure are calculated as follows: $\dfrac{\text{number of countries with a MEPS in that particular product category}}{\text{number of countries with overall energy efficiency pillar scores in that particular zone (green, yellow, or red)}}$

**FIGURE 3.29** Distribution of Indicator 9 scores



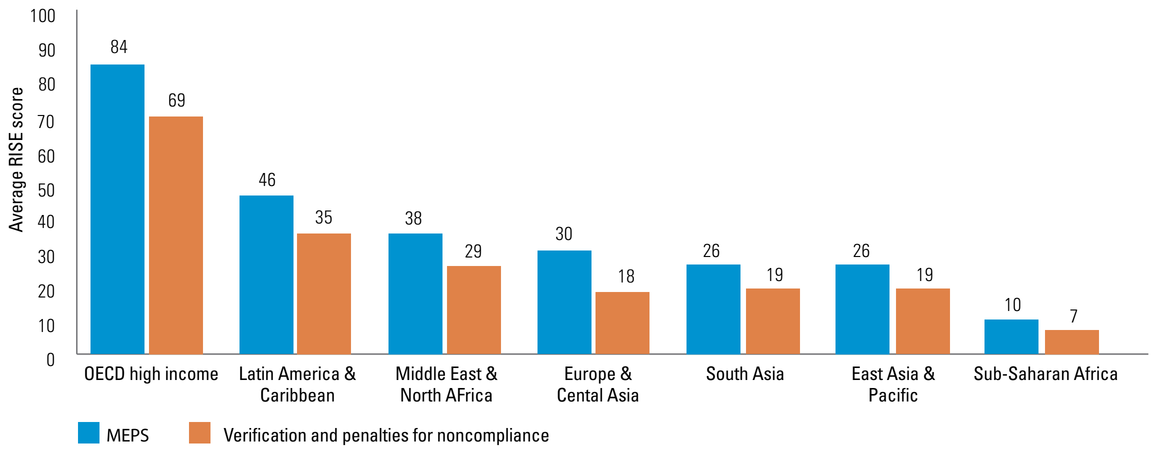

*Source:* RISE database, World Bank.

**FIGURE 3.30** Ordered country scores on national energy efficiency planning and MEPS



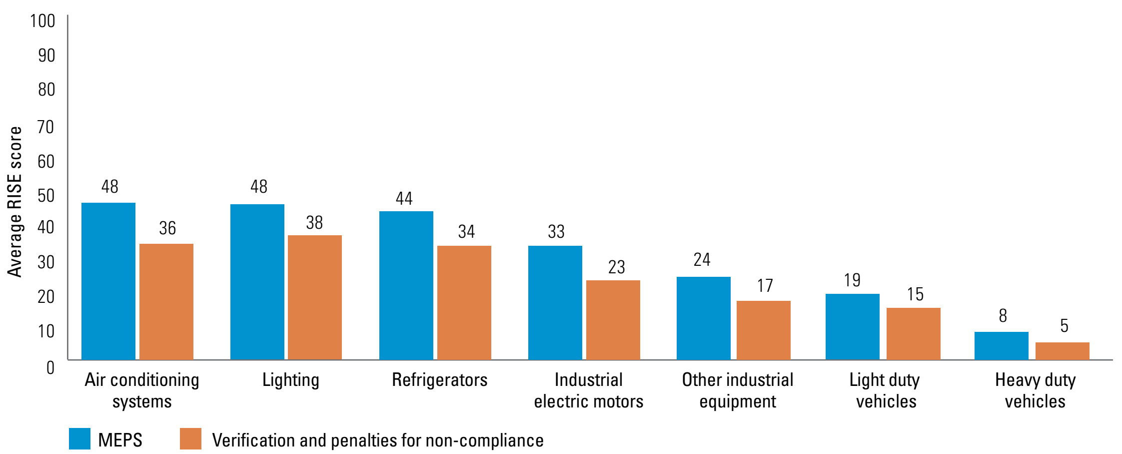

*Source:* RISE database, World Bank.

**FIGURE 3.31** Compliance systems in countries with MEPS, average scores by region




*Source:* RISE database, World Bank.

**FIGURE 3.32** MEPS and compliance systems, average scores by product category




*Source:* RISE database, World Bank.

## Indicator 10. Energy labeling systems

The natural connections between MEPS and energy efficiency labeling mean the results are similar: some countries score quite high but most do not, and many have no energy labeling at all. The results by country and region are similar overall (figure 3.33), with a few variations. India, for instance, is the top scorer in South Asia for standards and labeling, but in Europe and Central Asia the two top scorers for MEPS—Belarus and Romania—are absent from the top tier for labeling. Russia, which does well on labeling, does not have the mandatory standards needed to score as high for MEPS. Tunisia, the Islamic Republic of Iran, and Bahrain are leaders in Middle East and North Africa on standards and labeling. The results for high-impact countries and for income groups are very much in line with those for MEPS above.

As with standards, common household appliances (air conditioners and refrigerators) and lighting products are the most commonly labeled products (figure 3.34). Due to rising demand for these products in developing countries this is encouraging, but there are opportunities to widen the practice. In contrast, most countries do not have fuel economy standards for vehicles—adopting them would benefit a range of consumer classes in most countries.

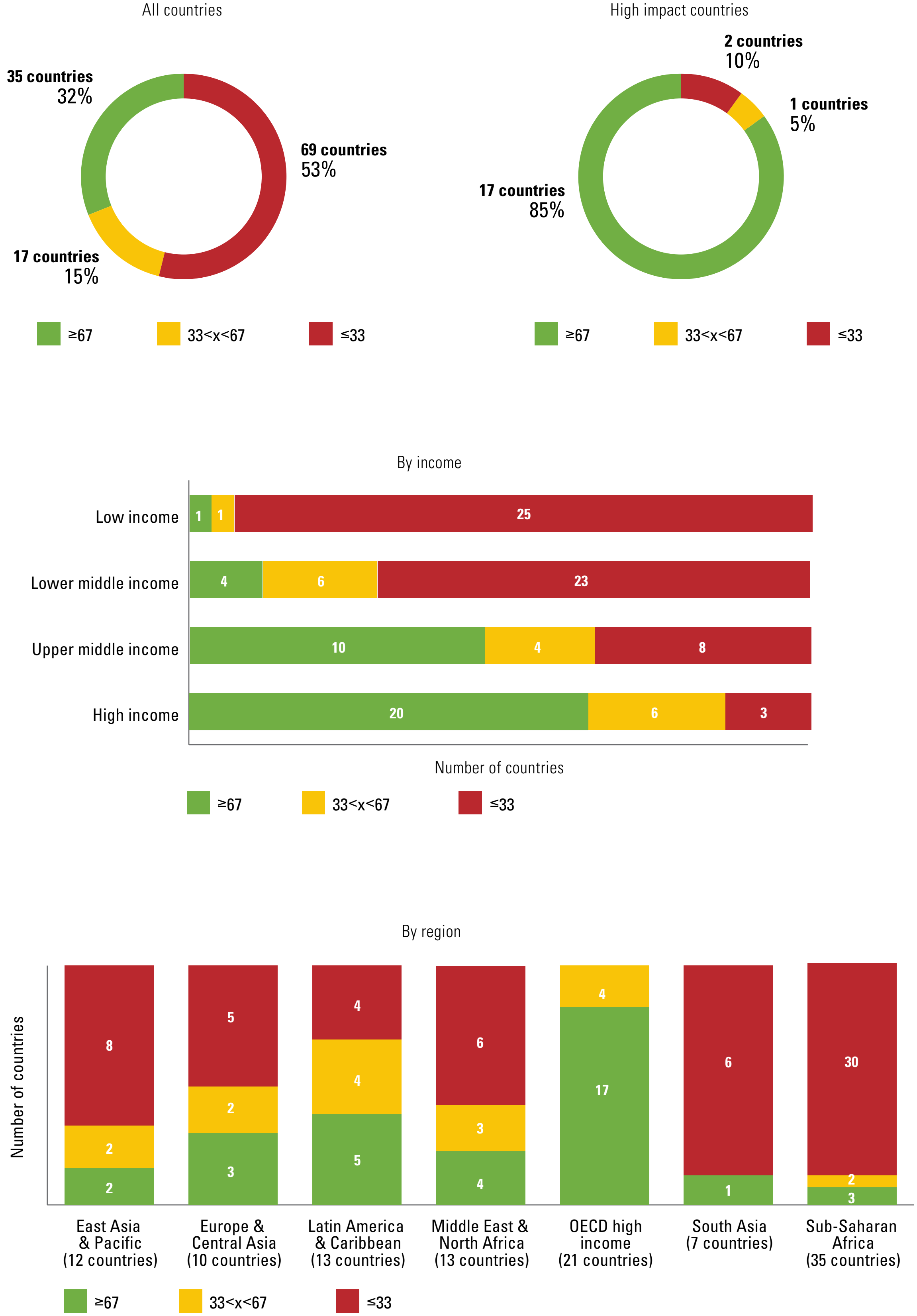
While most countries that have energy labels also have MEPS, 14 with mandatory labels have no mandatory MEPS (table 3.3). For some countries, the labeling scheme refers to voluntary standards. For others, the underlying standards are adopted from another country or region. Several countries base their labels on standards that have been developed but not issued. But not all labeling systems need to be mandatory to be effective: in Japan for example, where manufacturers compete fiercely for market share, energy efficiency is an important feature to consumers. In many other countries, however, a voluntary label may have little effect.

**TABLE 3.3** Countries with mandatory energy efficiency labeling programs but without mandatory MEPS for regulated products

| | Refrigerators | Air conditioners | Lighting |
|---|---|---|---|
| Bolivia | Voluntary standards | Voluntary standards | Voluntary standards |
| Colombia | Mandatory standards | Mandatory standards | Voluntary standards |
| Dominican Republic | No standards | No standards | Voluntary standards |
| Kazakhstan | Labels based on Eurasian Customs Union standards | Labels based on Eurasian Customs Union standards | Mandatory standards |
| Kyrgyz Republic | Labels based on Russian standards | Labels based on Russian standards | Labels based on Russian standards |
| Morocco | Standards developed; not yet in force | Mandatory standards | Standards developed; not yet in force |
| Philippines | Standards developed; not yet in force | Mandatory standards | Mandatory standards |
| Russian Federation | Voluntary standards | Voluntary standards | Mandatory standards |
| Sri Lanka | No standards | No standards | Standards developed; not yet in force |
| Thailand | Mandatory standards | Mandatory standards | Voluntary standards |
| Turkey | Labels based on EU standards | Labels based on EU standards | Labels based on EU standards |
| Ukraine | Mandatory standards | Labels based on EU standards | Labels based on EU standards |
| Uzbekistan | Standards developed; not yet in force | Standards developed; not yet in force | Standards developed; not yet in force |
| Zambia | Standards developed; not yet in force | Standards developed; not yet in force | Standards developed; not yet in force |

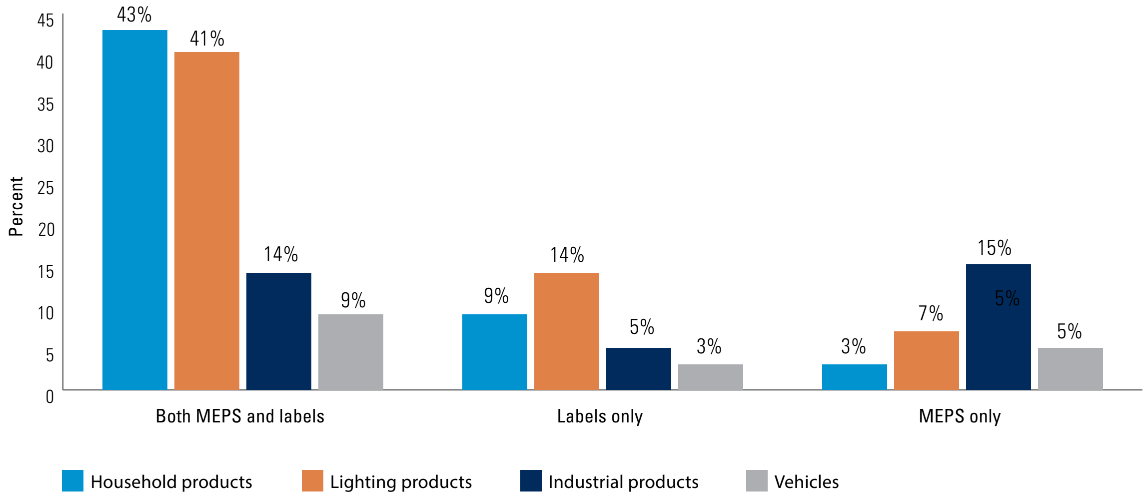
*Source:* RISE database, World Bank.

**FIGURE 3.33** Distribution of Indicator 10 scores




*Source:* RISE database, World Bank.

**FIGURE 3.34** Shares of surveyed countries with MEPS, energy efficiency labels, or both, by product category




*Source:* RISE database, World Bank.

## Indicator 11. Building energy codes

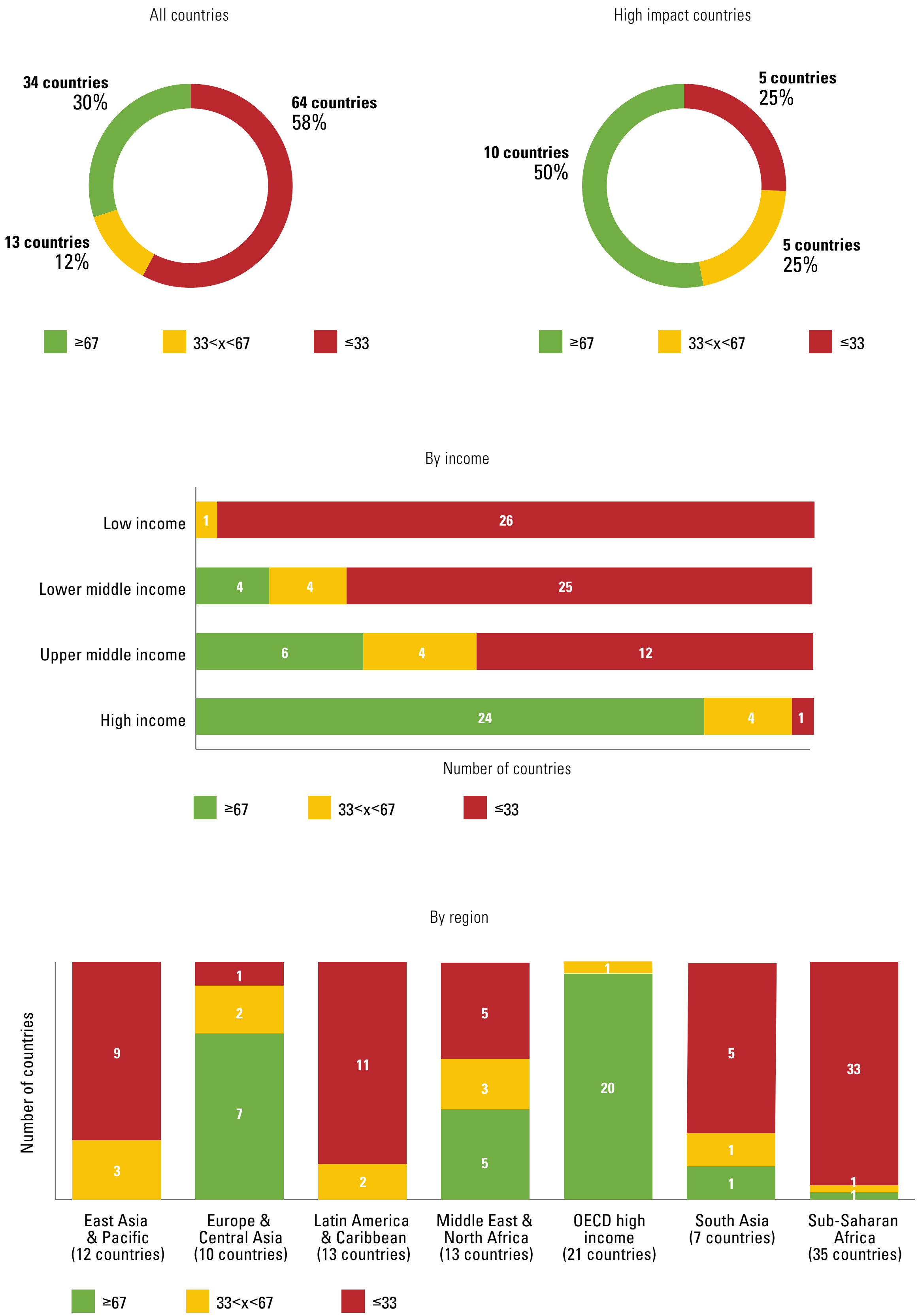
This is another indicator on which countries that have scored higher tend to score in the upper tier, and those scoring in the lower tier generally exhibit no activity (figure 3.35). Nearly all the OECD high-income countries are in the top tier, as are most countries in Europe and Central Asia, but very few countries in other regions achieve such scores. Egypt, Jordan, Kuwait, Pakistan, South Africa, and the United Arab Emirates are the only countries in other regions scoring in the green zone. This makes sense, as building energy codes are complex to design, require a great deal of expertise to apply, and need a high level of capacity among local governments to enforce.

Half the high-impact countries have scores in the red or yellow zones (figure 3.35). This is better than the overall average, and indicates that many of the largest consumers have an opportunity to pursue efficiency in a sector expected to contribute a growing share of energy demand, as global incomes rise and sectoral structures shift toward services. In the two lower-income groups, building codes are not a blank slate, but activity is strikingly low. Only the high-income group has less than half its countries in the red zone.

Most developed countries have adopted measures to improve the energy performance of buildings, but many developing countries have not. This is an important and sobering result, since it reveals that many of the countries that will host the bulk of the world's new construction are not prepared to ensure that their buildings will incorporate available measures for ensuring good energy performance.

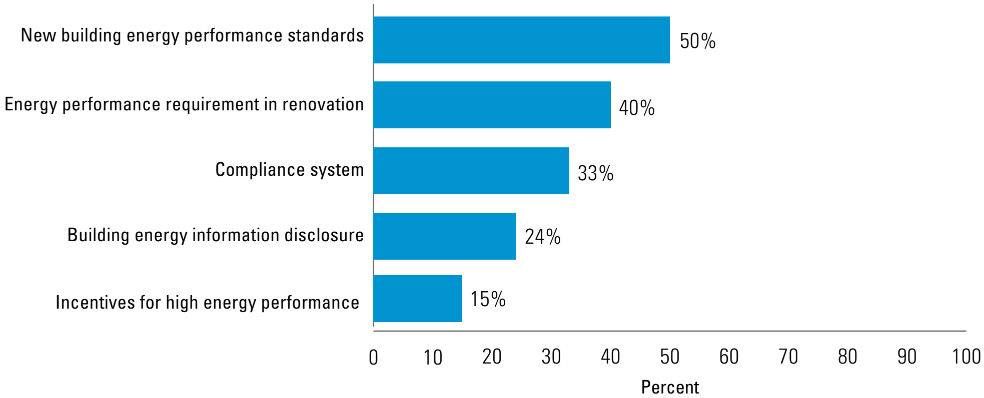
Information on the energy performance standards of new buildings is the most common measure, followed by energy performance requirement in renovation. Compliance or enforcement regimes are less prevalent. Rarer are systems to disclose energy use or incentives, like building labeling goals. Such mechanisms are relatively new, but are important where they are used because market prices are higher for units where the energy costs of operation are lower—green attributes like efficiency (and thus lower energy bills) have a positive influence on sales and rental prices (figure 3.36).

**FIGURE 3.35** Distribution of Indicator 11 scores




*Source:* RISE database, World Bank.

**FIGURE 3.36** Percentage of countries with measures to improve the energy performance of residential and commercial buildings




**Countries with all 5 aspects in their building codes**

Australia
Austria
Belgium
Canada
Czech Republic
Denmark
Finland
France
Germany
Greece
India
Italy
Romania
South Africa
Unted Kindgom
United States

*Source:* RISE database, World Bank.

### Indicator 12. Carbon pricing and monitoring

Just one-fifth of countries have pricing mechanisms that cover at least 30 percent of national GHG emissions and require reporting of emissions. This is not surprising for a politically and institutionally challenging policy. Even fewer countries, 5 percent, are in the yellow zone, with at least 21 percent of GHG emissions covered by a pricing mechanism and mandatory emissions reporting. The remaining countries have neither a pricing mechanism nor mandatory reporting of GHG emissions. Among high-impact countries, the shares in the three different zones are nearly equal (figure 3.37), with some showing great willingness to take on challenging emissions reductions targets and others demonstrating more caution.

Carbon markets primarily have been confined to wealthier countries, but several countries that are less wealthy are taking steps to report carbon in the manner needed to establish a market. Of the 23 countries with some form of carbon pricing mechanism (table 3.4), 15 are party to the EU emissions trading system (EU-ETS). Nine employ more than one type of carbon pricing mechanism. Denmark leads with the highest coverage, 89 percent, and operates the EU-ETS and the Danish carbon tax. The United States has the lowest coverage, at 7 percent, because only 10 out of 50 states participate in the Regional Greenhouse Gas Initiative (RGGI) or the California Cap-and-Trade Program.

All OECD high-income countries operate carbon pricing mechanisms, except Argentina, Australia and Chile. In Australia, a carbon tax introduced in 2012 was repealed by the Senate in 2014. In Chile, a law on carbon tax was passed in 2014 but has not yet come into force. The four non-OECD countries to introduce carbon pricing are China, Kazakhstan, Mexico, and Romania. Most emerging and developing countries face a range of pressing development challenges and typically have low per capita GHG emissions. However, even a nominal carbon price may be useful, as it can send a signal of commitment that makes clean energy investment more attractive.

Carbon pricing and monitoring may function in some countries as alternatives to policy measures directed specifically at promoting efficiency. In general, energy efficiency pillar scores are within the top half of the range for those countries with carbon pricing mechanisms, but within that group there is variation. Carbon market indicator scores compared with energy efficiency pillar scores show four groups of countries that represent different approaches (figure 3.38):

1. High-income countries, such as Denmark, the Republic of Korea, and France, which have strong energy efficiency policies and well-enforced carbon pricing mechanisms with high coverage;
2. High-income countries, such as Finland, Japan, and Sweden, which have sound carbon pricing mechanisms but have somewhat lower energy efficiency scores;
3. High-income countries, such as Canada and the United States, which have strong energy efficiency scores but low scores on carbon markets; and
4. Developing countries that seem to be concentrating efforts more on carbon pricing than building energy efficiency policies, namely Armenia, Ghana, Indonesia, Morocco, Peru, Rwanda, and Ukraine.

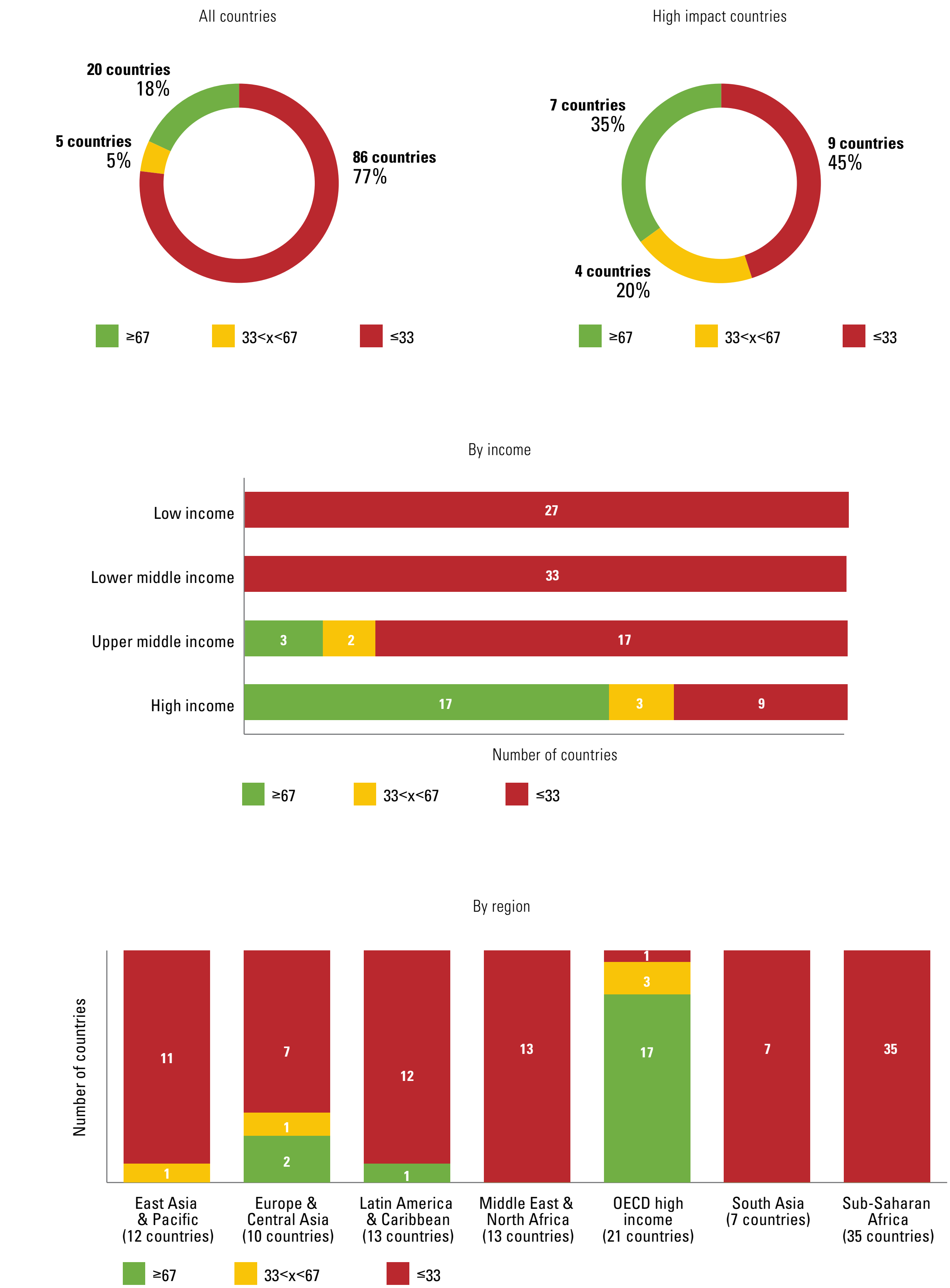
The first group is taking a comprehensive approach, connecting a strong overall market approach to targeted energy efficiency policies. The other three groups are employing policy frameworks that emphasize one approach over another.

In the second and fourth groups, strong price signals are the preferred policy lever. These groups have adopted carbon emissions trading schemes that cover more than two-thirds of their annual emissions. On other efficiency indicators, they score high on information to consumers, rate structures, and mandates and incentives for large consumers, but score low on mandates and incentives for utilities and the public sector and on energy efficiency targets on end-use sectors.

The third group comprises the two top-scoring countries in the energy efficiency pillar. Their scores on the carbon pricing and monitoring indicator are far lower than their scores on the other energy efficiency indicator scores. This may represent a practical approach to energy efficiency where national consensus on climate change is lacking.

As climate policy is developing rapidly, scores on the carbon markets indicator are expected to improve quickly. For instance, China's newly designed cap and trade system will cover a larger share of emissions as it is rolled out to key industrial sectors when it goes into effect in 2017.

**FIGURE 3.37** Distribution of Indicator 12 scores



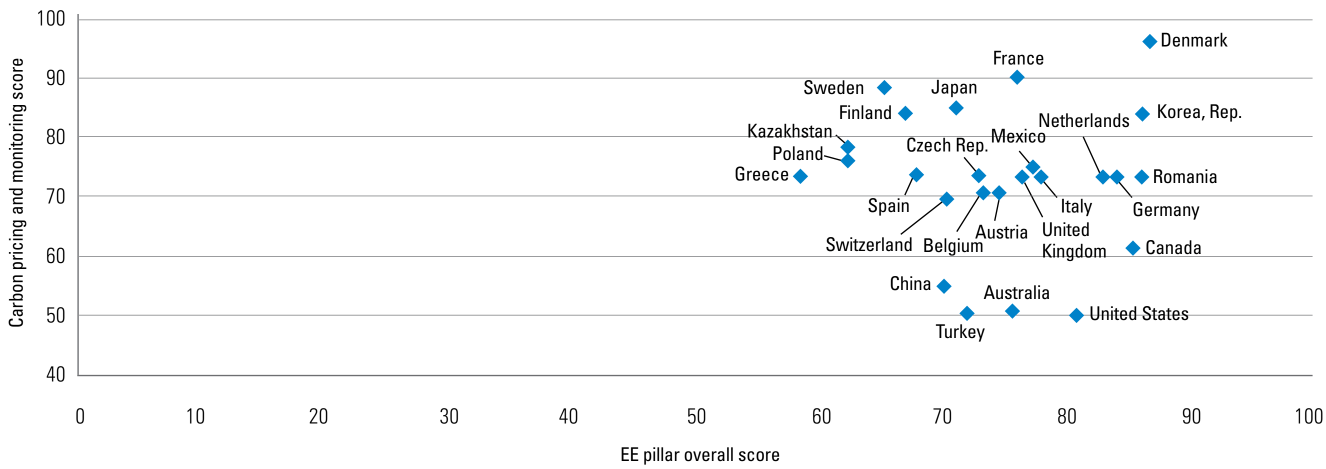

*Source:* RISE database, World Bank.

**TABLE 3.4** Countries with carbon pricing mechanisms

| Country | Carbon pricing mechanism(s) | Share of national GHG emissions covered by mechanism(s) (%) |
|---|---|---|
| Austria | EU-ETS | 40 |
| Belgium | EU-ETS | 40 |
| Canada | Quebec—Western Climate Initiative ETS, Alberta— provincial ETS, British Columbia—provincial tax | 21 |
| China | Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, Tianjin—ETS | 8 |
| Czech Republic | EU-ETS | 45 |
| Denmark | EU-ETS + tax | 89 |
| Finland | EU-ETS + tax | 66 |
| France | EU-ETS + tax | 80 |
| Germany | EU-ETS | 45 |
| Greece | EU-ETS | 45 |
| Italy | EU-ETS | 45 |
| Japan | National tax + Kyoto, Saitama, Tokyo—ETS | 68 |
| Kazakhstan | ETS | 55 |
| Mexico | Tax | 48 |
| Netherlands | EU-ETS | 45 |
| Poland | EU-ETS + tax | 50 |
| Korea, Rep. | ETS | 66 |
| Romania | EU-ETS | 45 |
| Spain | EU-ETS | 45 |
| Sweden | EU-ETS + tax | 77 |
| Switzerland | ETS + tax | 38 |
| United Kingdom | EU-ETS + tax | 45 |
| United States | RGGI ETS, California—Western Climate Initiative ETS | 7 |

*Source:* RISE database, World Bank.

**FIGURE 3.38** Carbon pricing and monitoring indicator scores vs. overall energy efficiency pillar scores




*Source:* RISE database, World Bank.

## NOTES

1. See the subindicators and questions for the relevant indicator in chapter 1.


PRACTICE
PRACTICE

### CHAPTER 4

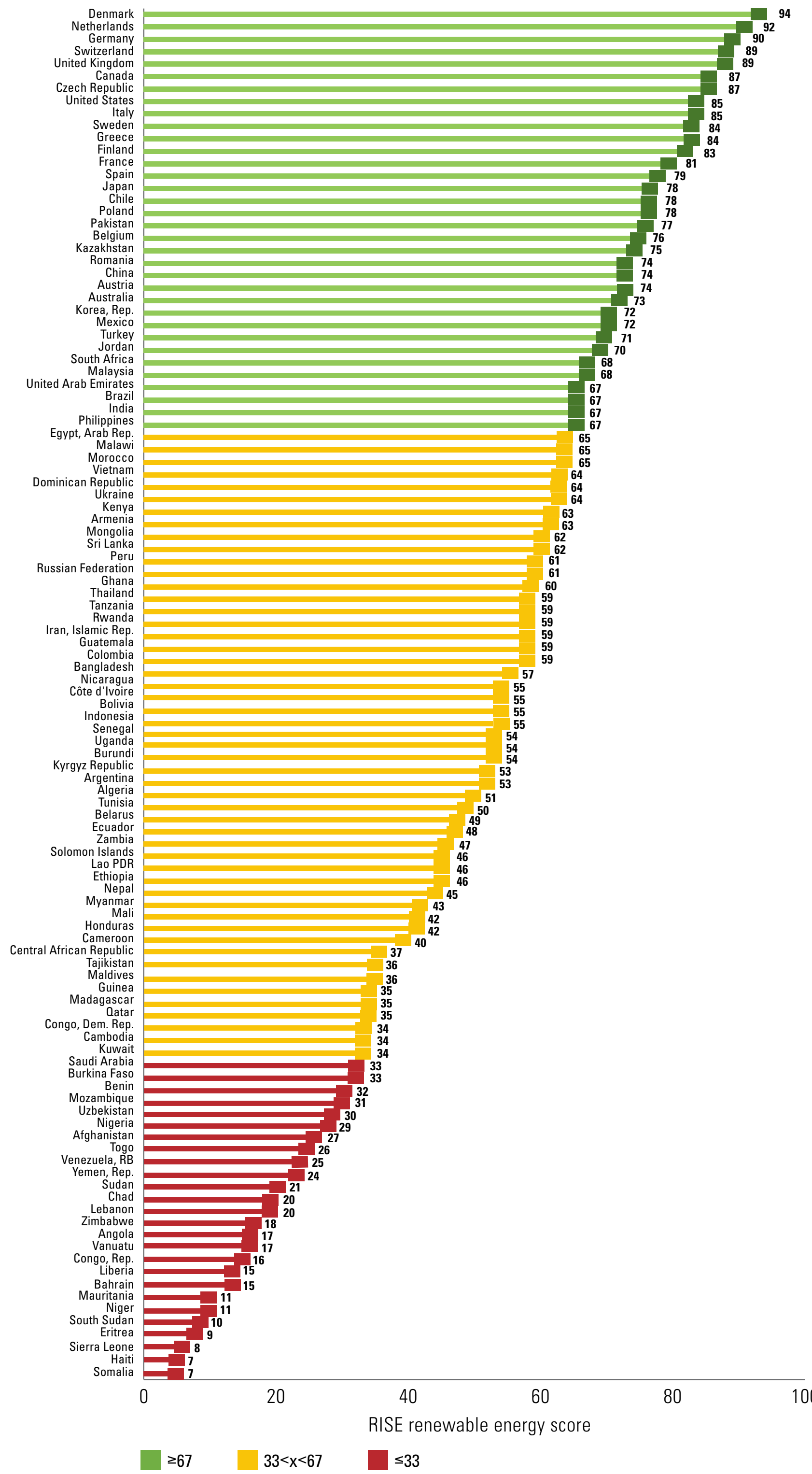
# RENEWABLE ENERGY

## PILLAR OVERVIEW AND KEY MESSAGES

Strong legal and regulatory frameworks for renewable energy are more likely in wealthier countries, but can be found in every part of the world. High RISE renewable energy scores are more common in high-income countries than middle-income countries, and are rare in both lower-middle and low-income countries (figure 4.2). Very low scores—those in the red zone—are more frequent among low- and lower-middle-income countries than their upper-middle- and high-income counterparts. The only high-income countries scoring in the red zone are Bahrain, Saudi Arabia, and Venezuela, and no low-income countries score in the green zone. However, at least one country in each geographic region scores in the green zone. Of the six World Bank regions, Europe and Central Asia and South Asia see the most countries with high scores on the renewable energy pillar (figure 4.2) (OECD high income is not an official World Bank region). Countries in the Middle East and North Africa as a group score well below the global average, and the lowest level of policy support is in Sub-Saharan Africa. East Asia and the Pacific and Latin America and the Caribbean are near the global average.

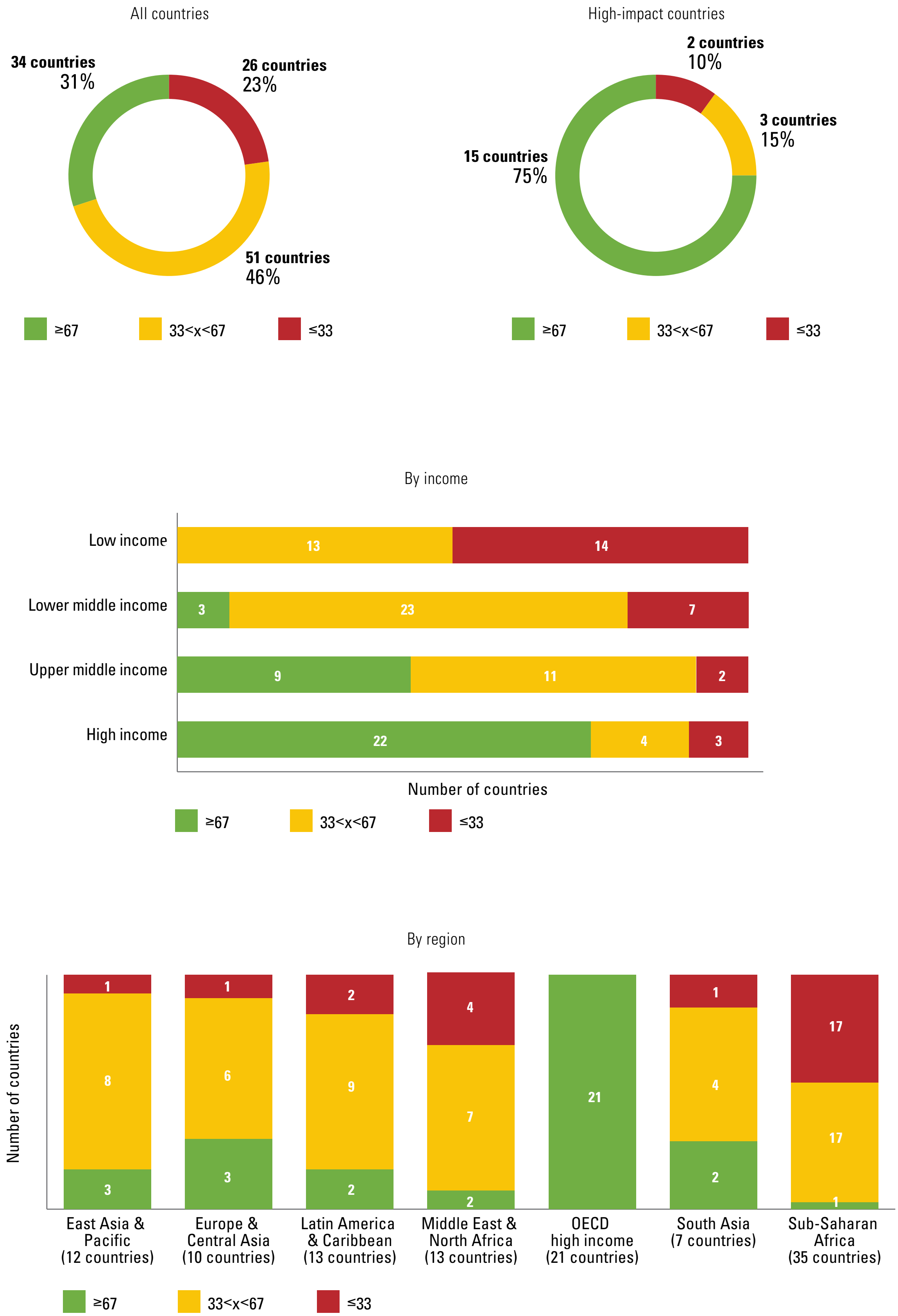
Basic policy measures to support renewables typically are in place, with more technical or costly measures far less common. Many important elements of policy support for renewable energy are common across all regions and incomes, including renewable energy targets and action plans, primary legislation and legal private ownership of generation, and financial and regulatory incentives like feed-in tariffs or competitive tenders. But no country outside of the high-income OECD members scored in the green zone on all seven RISE renewable energy indicators.

**FIGURE 4.1** Distribution of renewable energy pillar scores




*Source:* RISE database, World Bank.

**FIGURE 4.2** Distribution of renewable energy scores



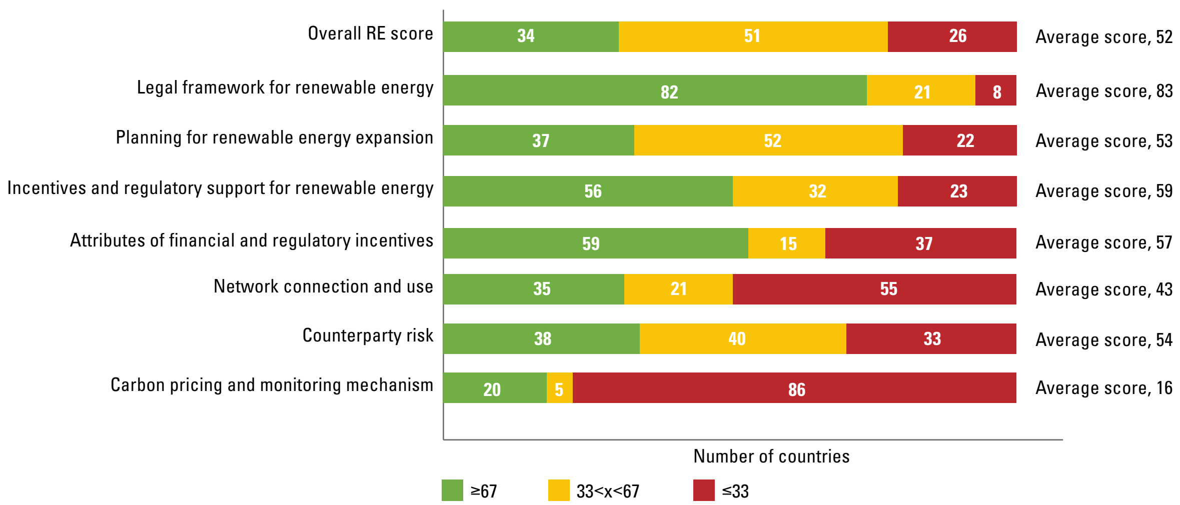

*Source:* RISE database, World Bank.

Countries score highest for legal frameworks and lowest for network policies and carbon pricing (figure 4.3). Nearly three-quarters of RISE countries receive a perfect score for Indicator 1, confirming the presence of both primary legislation governing renewable energy and legally authorized private sector ownership of power generation. Yet less than one-third score in the green zone for policies supporting grid connection and use of T&D networks for renewable energy projects, and almost half score in the red zone. Less than one-quarter of all RISE countries have a carbon pricing mechanism in place.

Supportive policies for renewable energy are more common in countries that have attracted renewable energy investment, but these policies do not guarantee such investment. Countries that have developed the most renewable energy since 2000 typically score higher on RISE renewable energy indicators, and higher scoring countries are more likely to have higher levels of per capita investment in renewable energy as well (figure 4.4). But a number of countries with high RISE scores nevertheless have yet to attract significant investment in the sector. This is to be expected, due to various investment factors beyond a RISE score, and even a perfect RISE score will have little effect if economy-wide policies discourage investment, or if other risks are high.

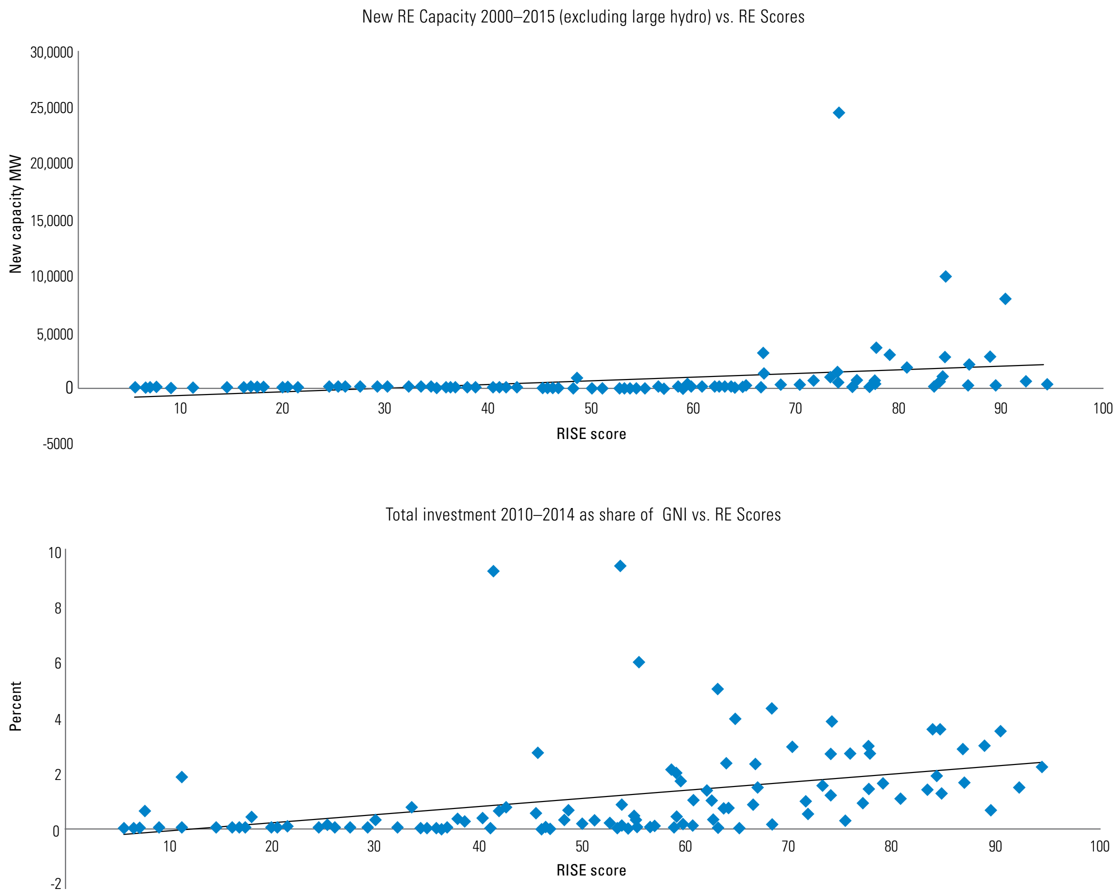
Certain types of policy support are more common—and more important—as renewable energy becomes a larger share of the generation mix. Some elements measured by RISE, variable integration studies, for example, are more common in countries with a higher share of renewables in the power generation mix, particularly variable renewable sources such as wind and solar power. This is understandable, as some measures are important at all stages of deployment—that is, if they are not present, deployment at any scale is unlikely—while other measures address issues that are less critical in countries where the renewable energy sector is in its initial stages.

**FIGURE 4.3** Renewable energy score distribution by indicator, number of countries




*Source:* RISE database, World Bank.

**FIGURE 4.4** New renewable energy capacity and total investment as a share of GNI versus RISE renewable energy score




*Source:* RISE database, World Bank; IRENA; Bloomberg New Energy Finance.
*Note*: Excluding large hydro and pumped storage.

## INDICATOR SCORES[1]

### Indicator 1. Legal framework for renewable energy

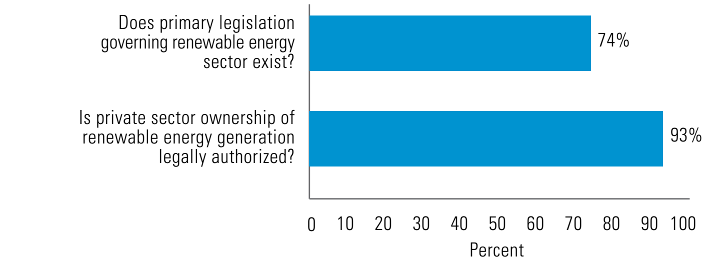
Most RISE countries have primary legislation governing renewable energy and allow privately owned renewable energy projects (figure 4.5). Eighty-two countries (74 percent) have enacted primary legislation governing the renewable energy sector—37 through laws specific to renewable energy (or a particular renewable technology), and 45 more that explicitly mention renewable energy in broader power sector or energy laws. Quite a few more have laws that currently are in draft form but are not yet officially in force (box 4.1). Support for private sector investment in renewable energy is even more widespread: only eight RISE countries legally do not allow private ownership of generation, including Angola, Eritrea, Haiti, Mauritania, Niger, Sierra Leone, Somalia, and South Sudan.

Primary legislation is less common in the Sub-Saharan Africa and Middle East and North Africa regions. All OECD high-income countries and Europe and Central Asia countries in RISE have laws governing renewable energy, as does every country in Latin America and the Caribbean, except Haiti, and in South Asia, except the Maldives. (Figure 4.6; all countries scoring in either the yellow or green zone have primary legislation in place.) More than half the countries without such laws are in Sub-Saharan Africa, including seven of the eight that have neither laws nor any other means for authorizing private investment (the eighth is Haiti). Six of the 13 RISE countries in the Middle East and North Africa region also have no laws governing renewables, including four of five high-income Gulf Cooperation Council countries.

In many countries without official legislative authorization, the government has signaled approval of private investment through other means. Twenty-one countries without primary legislation provide clear legal authorization, for example through regulations allowing private entities to receive a generation license, or through a competitive bidding process designed to procure private projects. This group includes all nine countries without primary legislation in the Middle East and North Africa and East Asia and the Pacific regions.

Primary legislation governing renewable energy by no means guarantees a strong policy framework. Of the countries with primary legislation, 60 percent have

**FIGURE 4.5** Percentage of countries answering yes to each Indicator 1 question




*Source:* RISE database, World Bank.

not followed up with sufficient policy support to score in the green zone, and five—the Democratic Republic of Congo, Madagascar, Nigeria, Uzbekistan, and Venezuela—score in the red zone. This also is the case in several West African common law countries, where laws may require subsequent official decrees before they become officially operational. In other cases, a law may authorize an activity or a policy but fail to provide the means to ensure it is undertaken.

### Box 4.1 Draft laws and regulations

RISE considers only laws and regulations that have been passed and are in force. Many RISE countries have laws in draft form that will alter the landscape for renewable energy development. In India, the proposed Renewable Energy Act under consideration would mandate additional activities measured by RISE, including more detailed resource data collection and renewable energy obligation. In Morocco, a drafted bill amending and supplementing existing Law 13-09 on renewable energy would allow renewable energy generators to sell power directly to high-voltage customers. And in Kenya, the draft energy bill before parliament would reform the entire electricity sector and lead to fully competitive markets. In some cases, regulations rather than laws are in draft form: in Zambia, draft rules outlining the country's new renewable energy feed-in tariff program (REFIT), along with a draft generation license and PPA, have gone through three stakeholders' validation workshops and have been disseminated to the private sector to encourage proposals.

In some countries, draft policies and laws can be under consideration for many years without adoption, sending investors mixed signals and creating uncertainty. For example, a renewable energy policy was drafted in 2010 in Eritrea but never passed; Afghanistan has been updating its national renewable energy policy every year without full adoption; even the law in Kenya noted above has been before parliament since 2008, in one form or another. In Somalia, the country's first electricity act was drafted in April 2013, but remains under discussion by members of parliament.

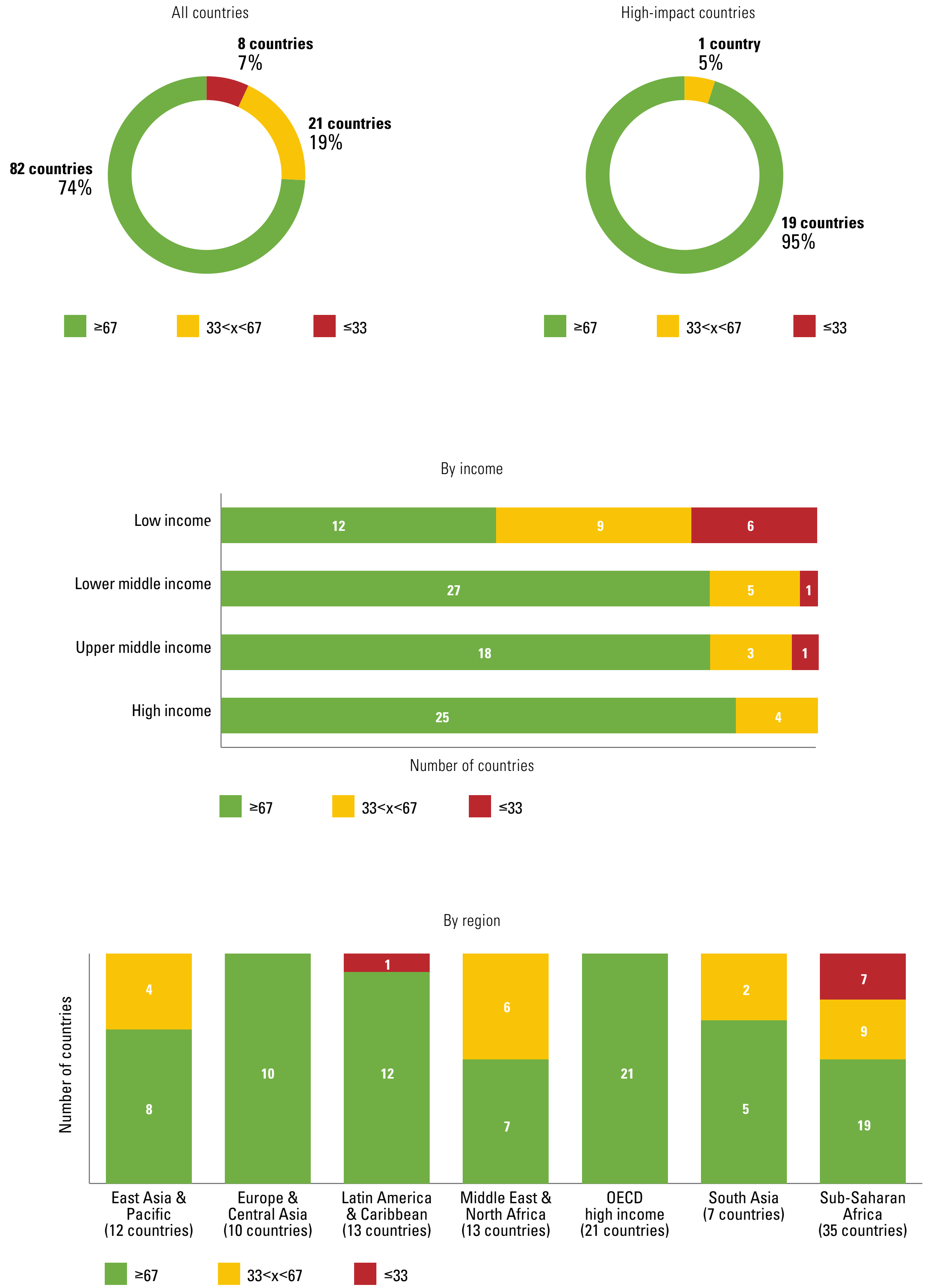
While the laws noted here do not count toward this year's scores, future editions of RISE will capture them as they are enacted, and as RISE progresses it will track changes in countries' legal frameworks. The following are some of the draft laws and regulations under consideration as of March 2016.

**BOX TABLE** Selected draft laws and regulations, March 2016

| Country | Country |
|---|---|
| Afghanistan: National renewable energy policy 2014 | Kazakhstan: Green Economy law |
| Bangladesh: Feed-in tariff for wind and solar electricity regulations 2015 | Nigeria: Renewable energy masterplan |
| Brazil: Proposed law PL 634 2015 | Sierra Leone: National renewable energy action plan |
| Eritrea: National renewable energy policy 2010 | United States: 2015 New York State Energy Plan |
| Ethiopia: Energy Operation Regulation 2015 | Uzbekistan: Presidential decree No. PP-2343 |
| India: National Renewable Energy Act 2015 | Thailand: Alternative Energy Act |
| Islamic Republic of Iran: The 6th five-year development plan | Zambia: Draft REFIT rules |
| Kenya: National Energy Bill 2015 | |

*Source:* RISE database, World Bank.

**FIGURE 4.6** Distribution of Indicator 1 scores




*Source:* RISE database, World Bank.

However, It is unlikely that a country has developed a strong policy framework without primary legislation on renewables. Of the 29 countries without such laws, over 75 percent have overall renewable energy scores in the red zone (table 4.1). Not one scores in the top half of RISE countries and only Thailand scores above the global average for renewable energy. Nearly all have the lowest scores in their regions, including the five lowest total scores in Middle East and North Africa and 16 of the 17 lowest in Sub-Saharan Africa. This includes those countries that allow private investment through means other than legislation. While it may be possible to develop reasonable policy support without primary legislation, as Thailand has done, such an approach does not appear to be widely replicable.

**TABLE 4.1 Countries without primary legislation governing renewable energy and overall RISE renewable energy score**

| | Economy | Overall RISE renewable energy score |
|---|---|---|
| No primary legislation for renewables but private participation allowed through other means | Thailand | 59 |
| | Myanmar | 43 |
| | Mali | 42 |
| | Maldives | 36 |
| | Qatar | 35 |
| | Cambodia | 34 |
| | Kuwait | 34 |
| | Saudi Arabia | 33 |
| | Benin | 32 |
| | Mozambique | 31 |
| | Afghanistan | 27 |
| | Togo | 26 |
| | Yemen, Rep. | 24 |
| | Sudan | 21 |
| | Chad | 20 |
| | Lebanon | 20 |
| | Zimbabwe | 18 |
| | Vanuatu | 17 |
| | Congo, Rep. | 16 |
| | Liberia | 15 |
| | Bahrain | 15 |
| No primary legislation for renewables or other means to allow private participation | Angola | 17 |
| | Mauritania | 11 |
| | Niger | 11 |
| | South Sudan | 10 |
| | Eritrea | 9 |
| | Sierra Leone | 8 |
| | Haiti | 7 |
| | Somalia | 7 |

*Source:* RISE database, World Bank.

## Indicator 2. Planning for renewable energy expansion

Across the world, countries consistently have implemented basic elements of renewable energy planning. Official renewable energy targets have become nearly universal, with some form of public commitment in 93 percent of RISE countries (figure 4.7). A majority also have drafted official strategies or action plans detailing how to meet targets, designated institutions to monitor progress in renewable energy development, incorporated renewable energy in generation and transmission planning and published or endorsed at least one official renewable resource map.

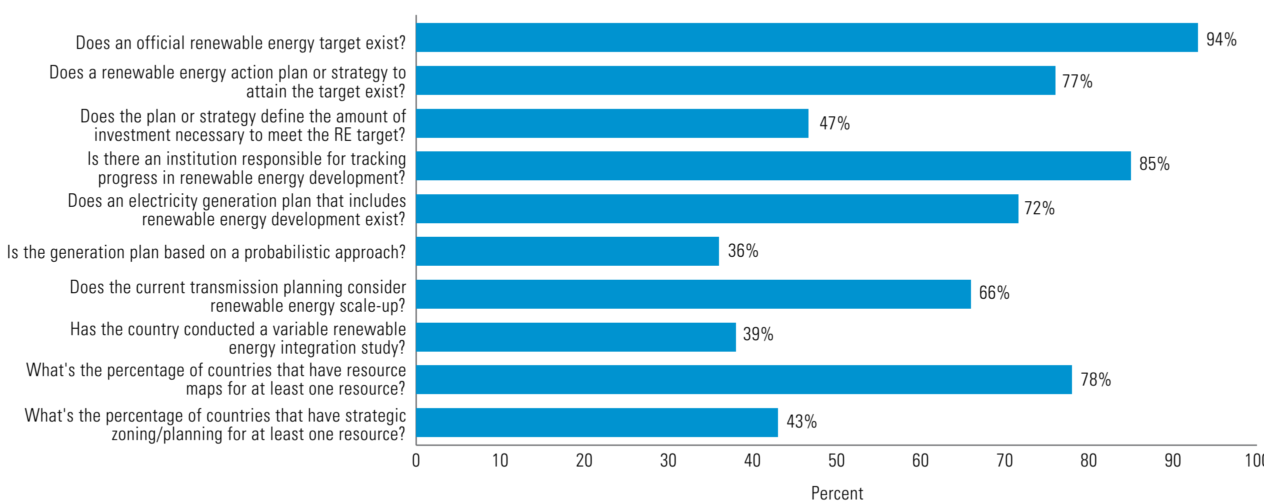
Far fewer have undertaken the more costly or technically sophisticated steps to integrate renewable energy into the power system. Only 38 percent, for example, have conducted a variable renewable integration study, and similarly few have incorporated probabilistic methods into their generation planning. Forty-three percent have carried out strategic planning or produced zoning guidance to inform the development of at least one relevant renewable energy resource, and less than half indicate the amount of investment required to reach national targets in their action plans or strategies (figure 4.7).

Renewable energy resource maps are common, but are not always developed or made available according to international best practices. A significant majority of governments have published or endorsed at least one official renewable resource map; over half the RISE countries have wind or solar maps alone (figure 4.8, top bars in each panel). However, of the published maps, many are not developed with the level of precision and transparency that would represent current best practice, such as basing data on ground based measurements taken over at least a year, and providing an explanation of the methodology and instrument used (figure 4.8, bottom four bars in each panel).

Strategic planning and zoning guidance for renewables differs widely by region. While more than 50 percent of countries in the OECD, Latin America and the Caribbean, and Middle East and North Africa regions have conducted such planning and guidance for at least one resource, one-third or fewer have done so in the East Asia and the Pacific, Europe and Central Asia, and Sub-Saharan Africa regions (figure 4.9). And, with the exception of high-income OECD countries, only a small portion of countries in all regions have developed such guidance as part of a comprehensive social and environmental assessment and have made the output publicly available.

The sophistication of system planning for renewables varies widely by income and region. Of the OECD high-income countries, 62 percent score in the green zone for planning, as do roughly half of the RISE countries in Latin America and the Caribbean and Middle East and North Africa. But only two countries in both the Europe and Central Asia and East Asia and the Pacific regions score in the green zone (Romania and Ukraine, Malaysia and Thailand), and only four—of 35 total—in Sub-Saharan Africa (Ethiopia, Kenya, Mauritania, and South Africa) score in the green zone. High- and upper-middle-income countries are more likely to score well on Indicator 2 than their lower-middle- or low-income counterparts: Ethiopia is the only low-income country to score in the green zone. Five high-income countries, however, score in the red zone: Bahrain, Japan, Poland, Russia, and Saudi Arabia.

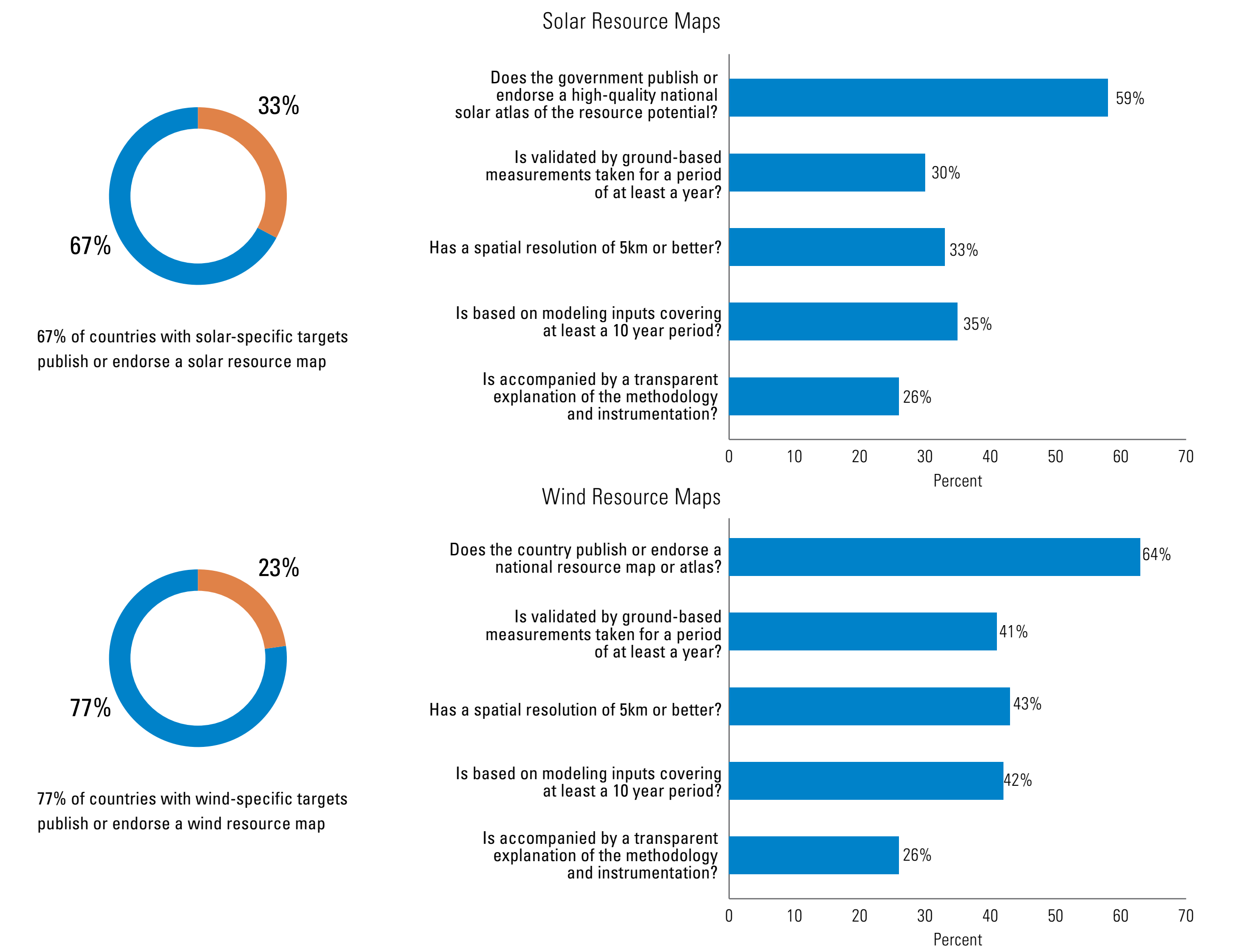
**FIGURE 4.7** Percentage of countries answering yes to each Indicator 2 question




*Source:* RISE database, World Bank.

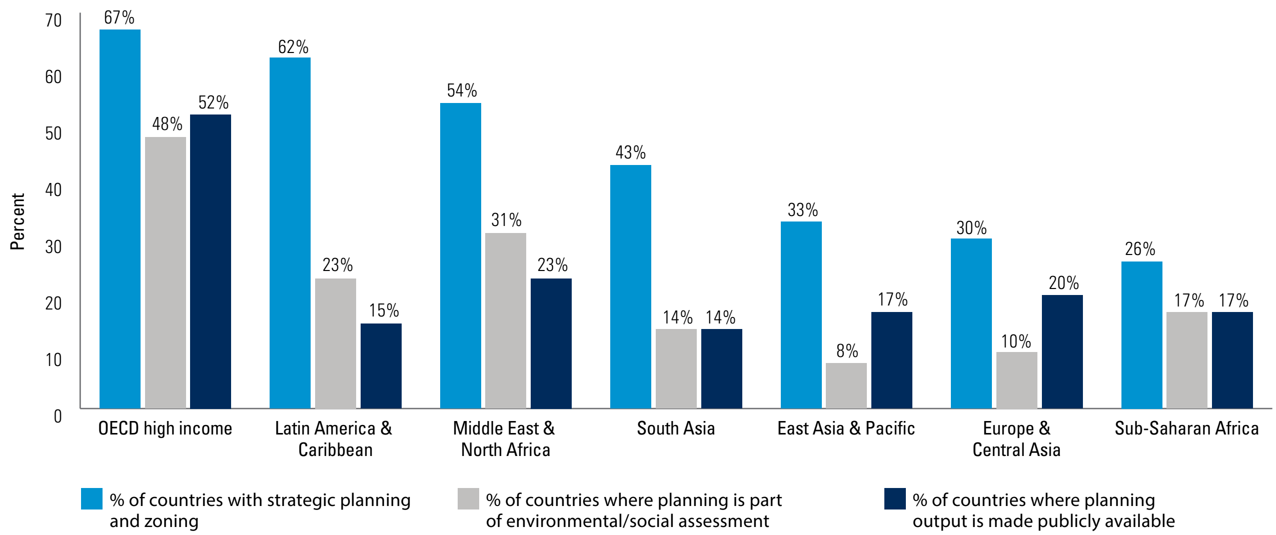
Countries with high penetration of variable renewable energy tend to score well on Indicator 2, and are more likely to have probabilistic planning or a variable integration study. Elements of a sophisticated, best-practice planning regime for renewable energy appear more likely as the share of renewables increases in a given power system. Seventy-five percent of countries where wind and solar power accounted for at least 5 percent of total electricity generated in 2014 score in the green zone for this indicator. Far more have completed a variable integration study (81 percent, compared with 38 percent of all countries), and the government or selected utility uses probabilistic generation planning in over half (compared to 36 percent in all countries).[2] Figure 4.10 shows the answers to the generation and transmission planning questions for those countries where wind and solar power combine constitute at least 5 percent of total generation (2012–14, based on RISE data).

**FIGURE 4.8** Wind and solar maps and their common characteristics



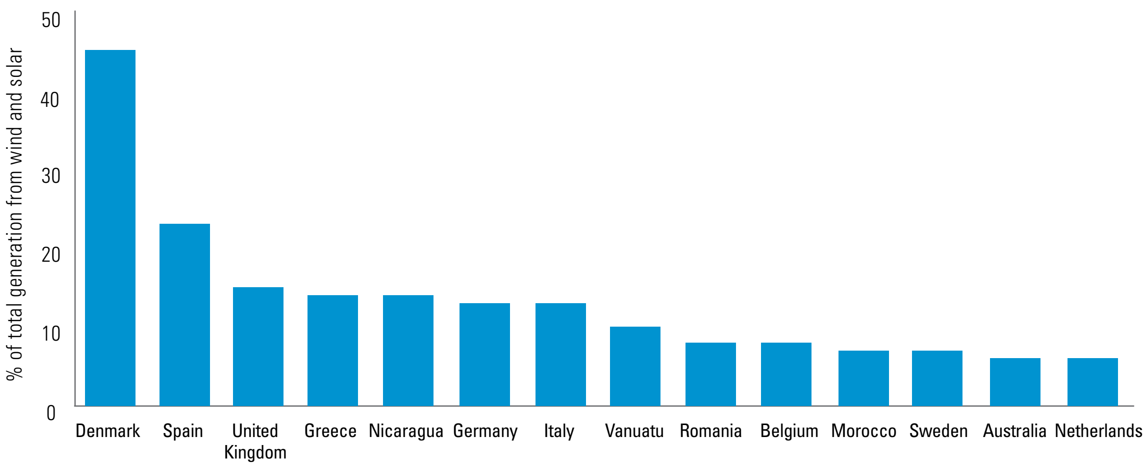

*Source:* RISE database, World Bank.

**FIGURE 4.9** Zoning and strategic planning, by region




*Source:* RISE database, World Bank.

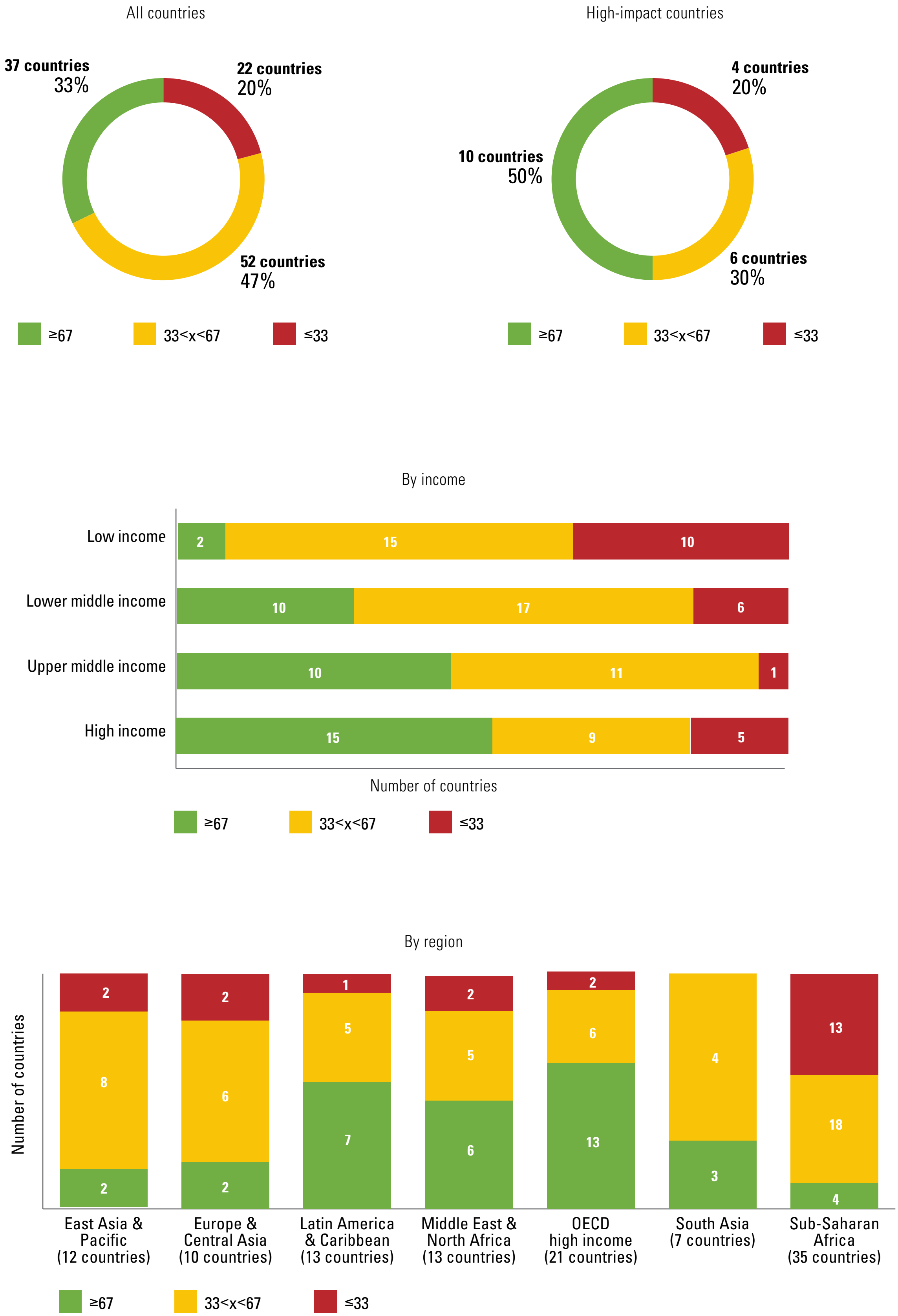
**FIGURE 4.10** Generation and transmission planning in countries with over 5 percent of wind and solar power in the generation mix 2012—2014




| | Denmark | Spain | United Kingdom | Greece | Nicaragua | Germany | Italy | Vanuatu | Romania | Belgium | Morocco | Sweden | Australia | Netherlands |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Generation plan includes RE | √ | √ | √ | ☐ | √ | √ | √ | ☐ | √ | √ | √ | √ | √ | √ |
| Generation plan probabilistic | √ | ☐ | √ | ☐ | √ | √ | √ | ☐ | √ | ☐ | ☐ | ☐ | √ | √ |
| Transmission plan includes RE | √ | √ | √ | √ | ☐ | √ | √ | ☐ | √ | √ | √ | √ | √ | √ |
| Integration study complete | √ | √ | √ | √ | √ | √ | ☐ | ☐ | √ | √ | √ | ☐ | √ | √ |

*Source:* RISE database, World Bank.

**FIGURE 4.11** Distribution of Indicator 2 scores




*Source:* RISE database, World Bank.

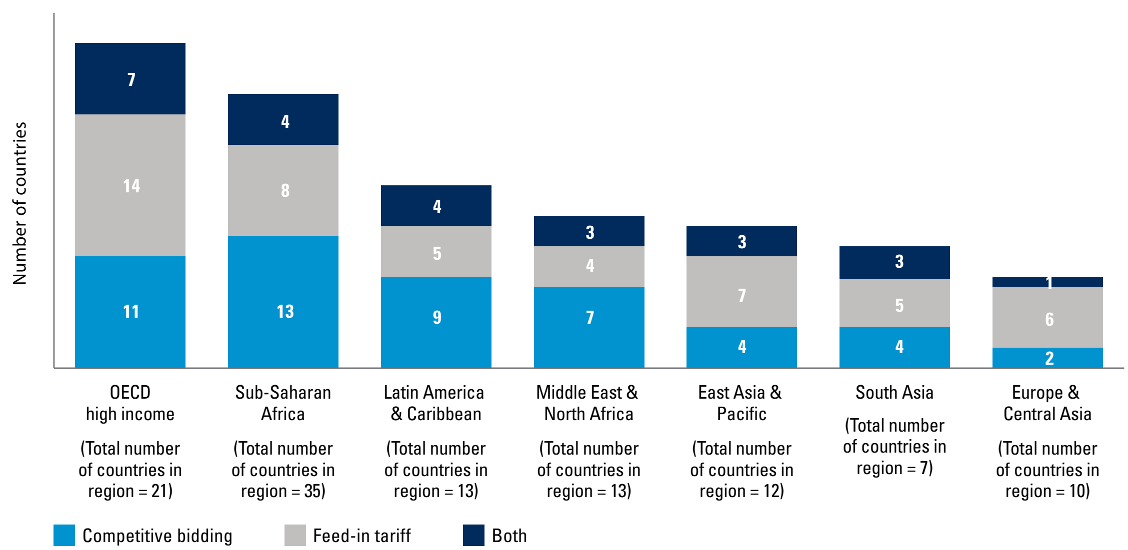
## Indicator 3. Incentives and regulatory support

Basic regulatory or financial incentives supporting renewable energy development are common in RISE countries. As with targets and legal frameworks, generation-based incentives like feed-in tariffs, competitive bidding, and renewable energy obligations are common worldwide (figure 4.12). About three-quarters of RISE countries have at least one regulatory instrument or financial incentive supporting revenue per unit of generation, and many employ multiple policies targeted at different types of projects. A majority of countries provide renewable energy generation with guaranteed or prioritized access to the grid and dispatch, an important measure of confidence to investors that there will be a market for the power they generate.

The forms of support mechanisms differ across countries and regions. Feed-in tariffs are most common in OECD high-income countries (where 14 of the 21 RISE countries use them), Europe and Central Asia (6 of 10), and East Asia and the Pacific (7 of 12) (figure 4.12). Competitive bidding is more common in Latin America, where nine of the 13 RISE countries have carried out auctions or project-specific tenders over the last five years, and in the Middle East and North Africa. Other, less frequently used instruments: purchase obligations, such as the United Kingdom's renewable obligation, are imposed by just 18 countries surveyed; price premiums that add revenue to a standard wholesale price, such as India's generation-based incentive, or the generation premium in China, are used by just 10 RISE countries. Priority in access and dispatch (box 4.2) generally run hand in hand, although 27 countries have one without the other. They are common in Europe and Central Asia and Latin America and the Caribbean, but over half the countries in Sub-Saharan Africa offer neither.

Many countries use multiple support mechanisms simultaneously, or create hybrid approaches with elements of different incentives. Thirty-eight RISE countries offer more than one incentive for renewable energy generation, including 25 that employ both a feed-in tariff and competitive bidding. All but three of the 17 countries with a renewable energy mandate also offer another parallel incentive. Many countries combine elements of different incentives within the same program: for example, while a feed-in tariff typically is considered to be a guaranteed price, in 11 countries the feed-in tariff level establishes a price ceiling, leaving open the possibility of lower tariffs through negotiation, competitive bidding, or other mechanisms. In Jordan and Thailand, reference tariffs are considered the feed-in tariff, but are combined with competitive bidding and function as price ceilings under which developers can compete. In other countries, certain mechanisms are effectively a combination of two programs. For example, in the United States, the New York State Energy Research and Development Authority (NYSERDA) is responsible for procuring the tradable renewable energy certificates used to meet the state's renewable energy portfolio standard. NYSERDA then holds annual auctions where qualifying renewable energy projects can submit proposals. Auction winners then sell the clean energy benefits to NYSERDA over a fixed period.

**FIGURE 4.12** Competitive bidding and feed-in tariff mechanism, by region




*Source:* RISE database, World Bank.

**Box 4.2 Priority dispatch**

RISE scoring does not distinguish between the 53 countries offering guaranteed take-or-pay provisions and those prioritizing dispatch of renewables through other means (such as marginal cost dispatching or curtailment procedures).

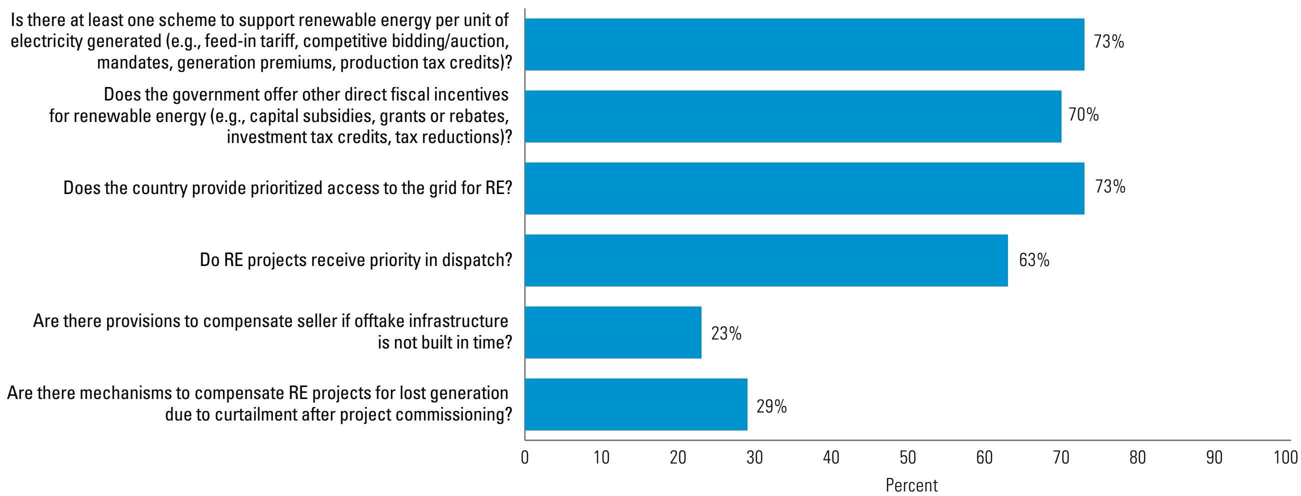
In countries with take-or-pay contracts, the offtaker guarantees to pay for all the electricity that a renewable energy plant can deliver. But such contracts can impose a burden on the offtaker or government, particularly for large plants or when renewables reach a large portion of the market. For this reason, RISE looks at other ways that the dispatch of renewables can be prioritized even if not fully guaranteed.

For example, some countries follow an economic merit dispatch rule directly linking the dispatch to the marginal or variable (operating) cost. Renewable energy fuel typically is low cost or free, so in these cases it usually is dispatched first. In Chile, for instance, the power economic dispatch center regulates dispatch into the grid according to the lowest cost and the hourly demand. Similarly, Denmark, Finland, and Sweden are integrated into the Nordic electricity wholesale market, which bases dispatch on the principle of marginal pricing and supply and demand. Mexico uses a different approach: its renewable energy generators receive a preferential rate for power transmission of $0.14 pesos/kWh against $0.30–$0.40 pesos for electricity generated by conventional fuels. Japan uses a prioritized curtailment order under which geothermal and hydropower are not subject to any curtailment, and solar and wind are the last resources to be curtailed. All these are considered a form of prioritized dispatch for renewables.

In Australia, all intermittent generation previously was automatically classified as nonscheduled, and thus all intermittent generation effectively had dispatch priority over scheduled generation. With the increase of intermittent renewable generation, in 2010 the country started implementing semi-dispatch arrangements where intermittent generation is required to participate in central dispatch and must comply with dispatch instructions to control output below a dispatch cap, defined as the generating unit's maximum generation limit.

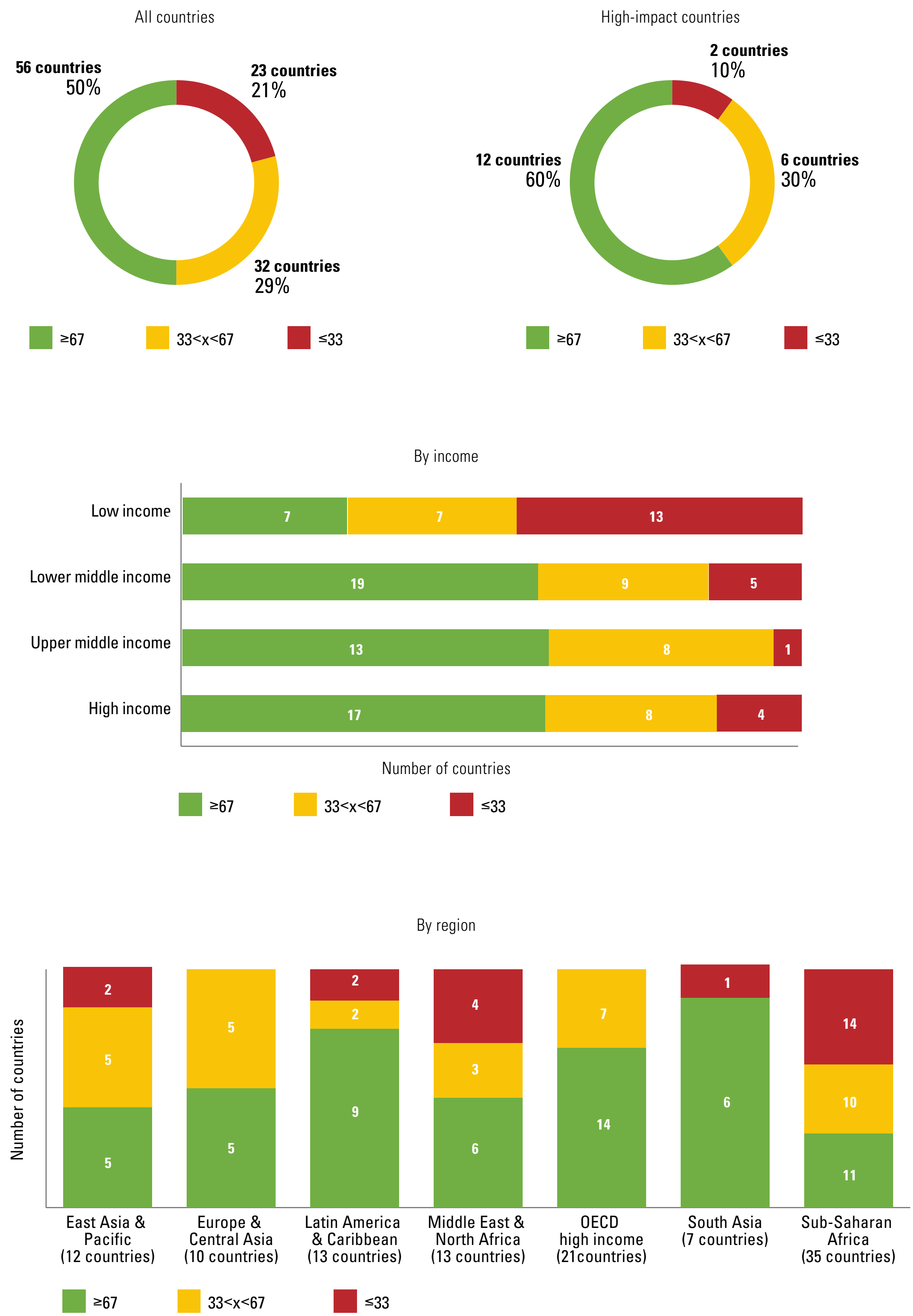
*Source:* RISE database, World Bank.

**FIGURE 4.13 Percentage of countries answering yes to each Indicator 3 question**




*Source:* RISE database, World Bank.

**FIGURE 4.14** Distribution of Indicator 3 scores




*Source:* RISE database, World Bank.

The prevalence of seller compensation mechanisms for offtake delays and curtailment varies sharply by region, but countries where they are in place typically have strong overall policy support. In Europe and Central Asia and East Asia and the Pacific, even those countries with the strongest policy support rarely have mechanisms to compensate renewable energy generators, either for revenue lost due to delays in building offtake infrastructure, or for any type of curtailment. In East Asia and the Pacific, the only countries to report either type of incentive are Myanmar and the Philippines. None were reported in Europe and Central Asia.[3] Yet each of the six highest-scoring countries in Middle East and North Africa provide one or both forms of compensation, as do five of the six highest scorers in Latin America and the Caribbean. Few countries in Sub-Saharan Africa have either, but those that do have among the highest RISE renewable energy scores for the region. While the absence of compensation for delays or curtailment may not preclude large investments in otherwise attractive markets, it can pose a real risk to investors if offtakers are on shaky financial ground or the system faces technical constraints (box 4.3).

### Box 4.3 Curtailment policies in China

China has invested more in renewable energy than any other country in the world. Over 2010–15, investment (including solar, wind, geothermal, small hydro, and biomass) reached US$377 billion (Bloomberg New Energy Finance), more than the next two countries combined, the United States and Germany. But while China's RISE renewable energy score is quite high—and highest among middle-income countries in East Asia—many countries across the world score higher. What explains this discrepancy?

In part the discrepancy is due to endowments beyond what energy policy can control. China has the second-largest economy in the world, with dramatically expanding power demand that creates opportunities for new generation. A large and skilled labor force and supply chain allows cost-effective wind turbines or solar plants to be built locally. The government also has taken steps to mobilize private investment across the economy.

Some elements of the policy framework might, if strengthened, lead to even greater utilization of the country's renewable energy resources. Many renewable energy projects have seen lower revenues than expected because of widespread generation curtailment. As China does not transparently integrate renewable energy into its generation and transmission planning, the network infrastructure is not always adequate to offtake power from renewable energy projects. Thermal power plants enjoy guaranteed utilization hours, leading to curtailment of renewables, in particular wind power. And because utilities are not required to provide compensation for any form of curtailment, or where the required offtake infrastructure is not built, the risk falls entirely on the project developers. While this is not enough to limit all investment, it can lead to greater uncertainty and fewer financially viable projects.

The score for each indicator in China is in the box table. Note the yellow light for indicators 2 and 3, which include questions on transmission planning and compensation for curtailment, respectively.

**BOX TABLE**

| Total RE score | Indicator 1: Legal framework | Indicator 2: Planning | Indicator 3: Incentives | Indicator 4: Attributes | Indicator 5: Network policies | Indicator 6: Counterparty risk | Indicator 7: Carbon pricing |
|---|---|---|---|---|---|---|---|
| 74 | 100 | 36 | 63 | 78 | 89 | 100 | 54 |

*Source:* RISE database, World Bank.

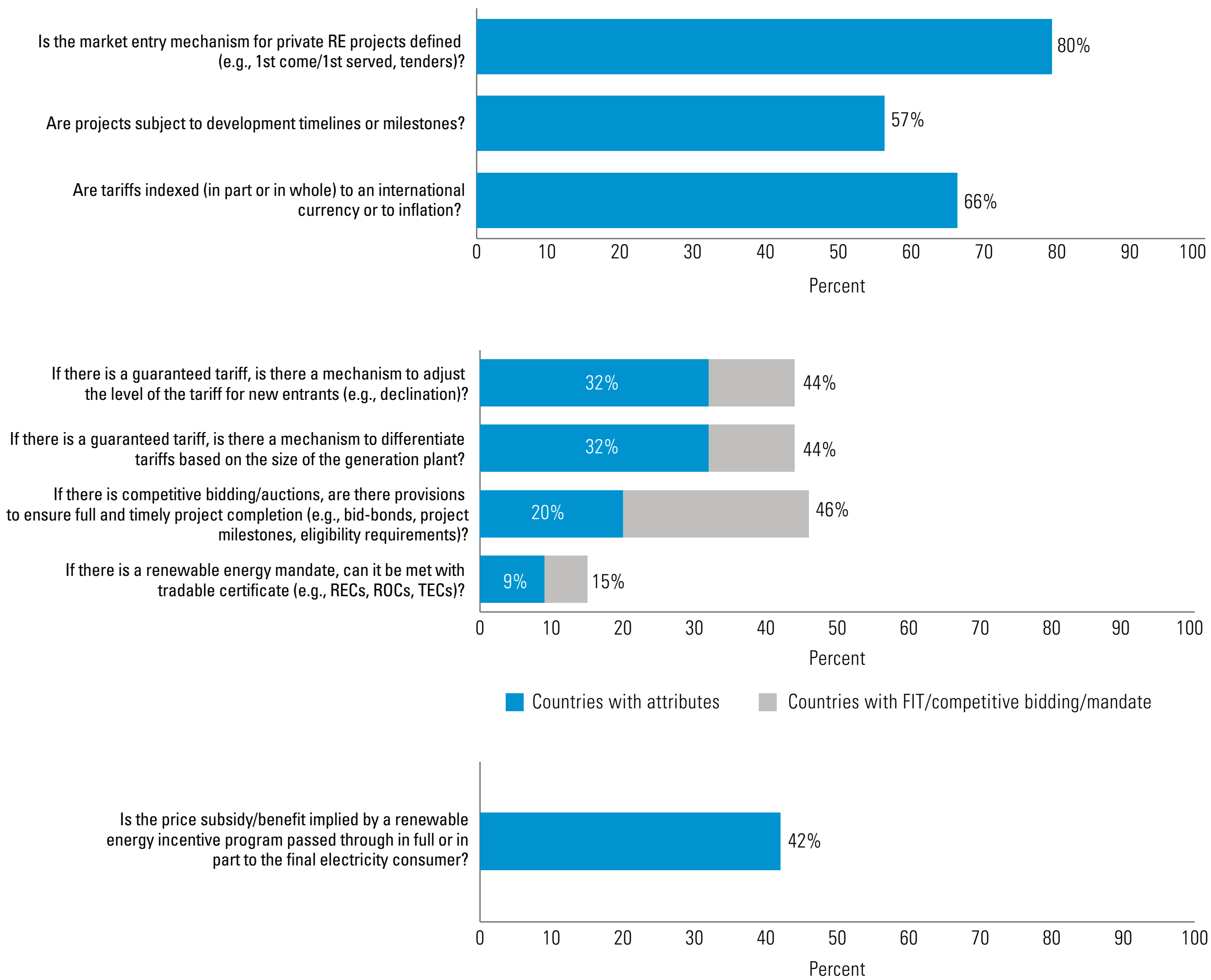
RENEWABLE ENERGY

## Indicator 4. Attributes of financial and regulatory incentives

Most countries provide basic information on how private renewable energy projects can enter the market, but measures designed to increase the predictability and efficiency of development are less common. As with the previous indicators, the simplest and most fundamental elements often are in place. Seventy-nine percent of RISE countries have defined mechanisms for private projects to enter the market, for example through an open competitive process or a first-come, first-served license (figure 4.15). Of the 23 that do not, 14 are in Sub-Saharan Africa. However, in over half of all RISE countries developers are required to build projects in a timely fashion or else relinquish their rights to the resource. Sixty-six percent provide foreign investors with a degree of revenue certainty by indexing payments to a recognized international currency,[4] including 55 percent of those where such a currency is not the official national currency.[5]

The less common attributes are correlated to higher RISE renewable energy scores. Requirements for project timelines or milestones, indexation of power payments, and pass-through to end-users of at least part of the costs of renewable energy incentive schemes may be less common, but they occur more often in countries with strong overall policy frameworks (figure 4.16). Every country in the green zone, except Brazil and Malaysia, either indexes its payments or uses an international

**FIGURE 4.15** Percentage of countries answering yes to Indicator 4 questions

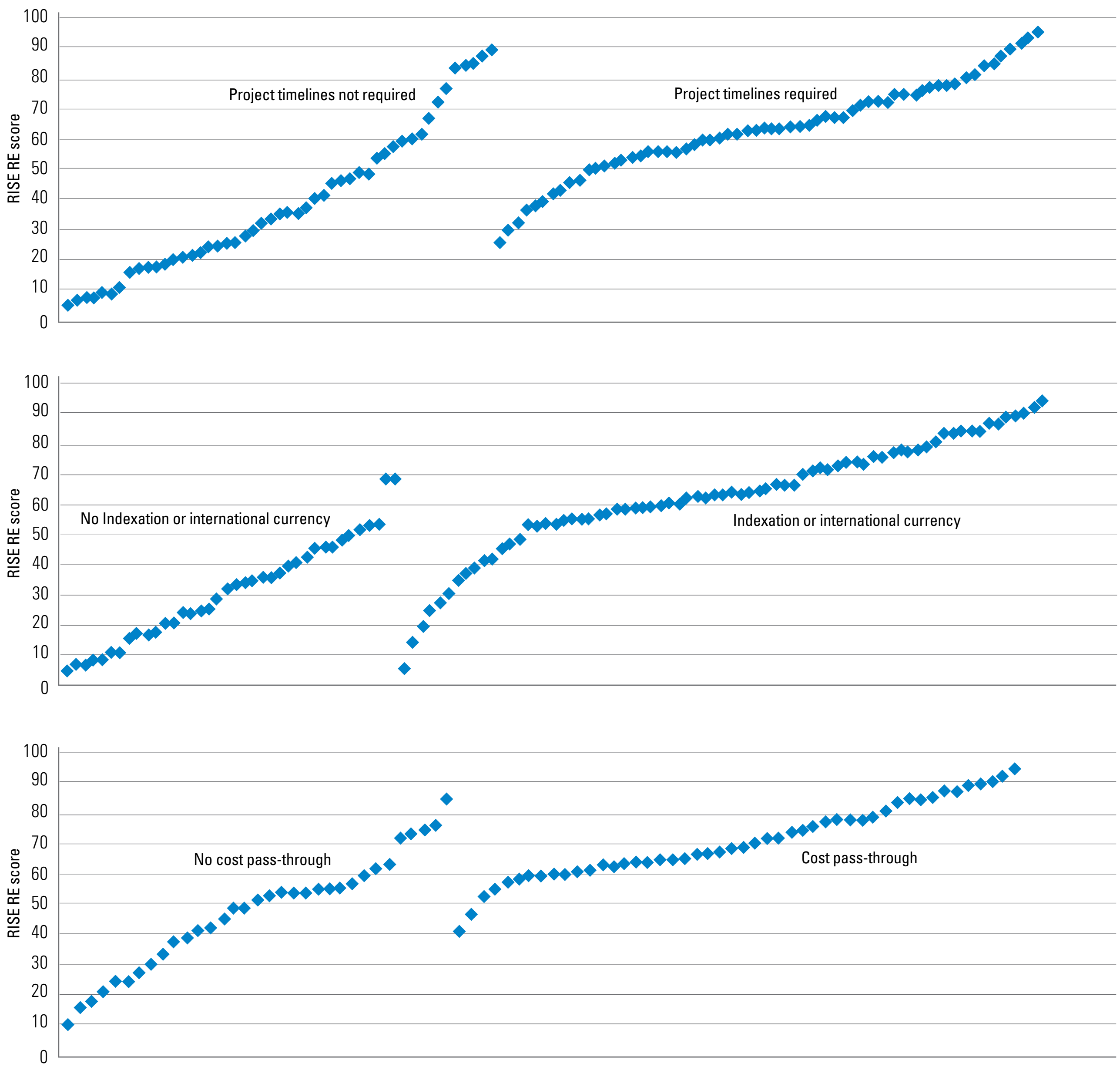



*Source:* RISE database, World Bank.
*Note:* The long bars represent the percentage of countries with support scheme relevant to each question.

currency, while 84 percent pass through costs and 75 percent require timelines or milestones. Notably, indexation is found in only 28 percent of those countries with RISE renewable energy scores below 50.

The 20 high-impact countries (listed in table 1.3) score considerably above the RISE average on the attributes of policy stability and efficiency. Nineteen of the top 20 (excluding Saudi Arabia) have a mechanism in place for new renewable energy projects to enter the market, and 80 percent impose certain timelines or project development milestones. Over three-quarters of high-impact countries with feed-in tariffs have rules in place that govern how prices for new entrants will be adjusted over time and that differentiate prices by the size of the generation plant, while 72 percent of those with recent competitive bidding take steps to discourage unrealistically low bids. Five of the seven countries with renewables obligations allow them to be met with tradable certificates: Australia, India, the Republic of Korea, Switzerland, and the United Kingdom (Indonesia and Mexico do not). Fourteen

**FIGURE 4.16** RISE renewable energy scores for countries without a project timeline requirement, without indexation of power payments, and without at least partial pass-through of costs (left) versus those of countries with each attribute (right)

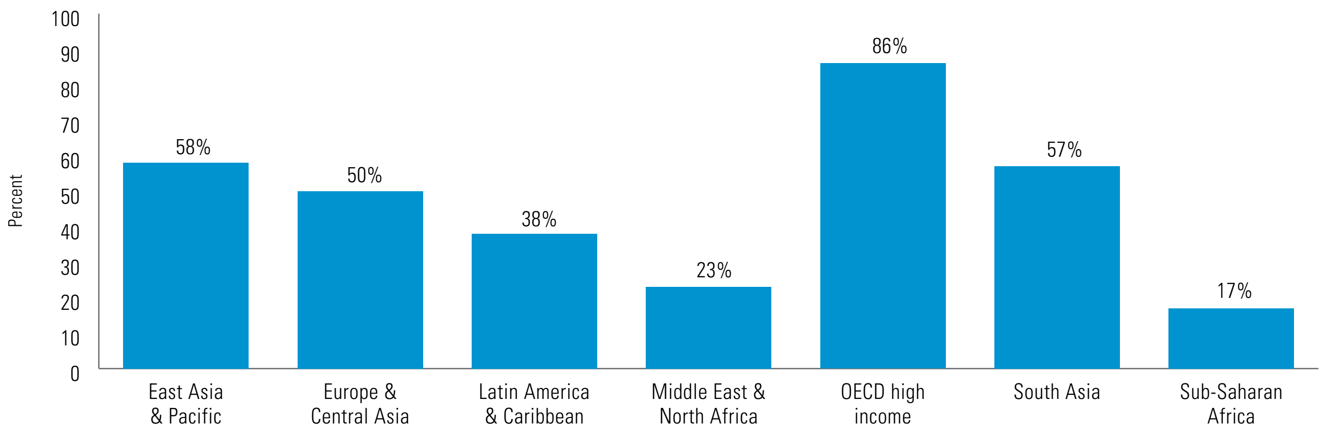



*Source:* RISE database, World Bank.

of the 19 with generation-based incentives allow the costs of renewables to be passed through to the final consumer.

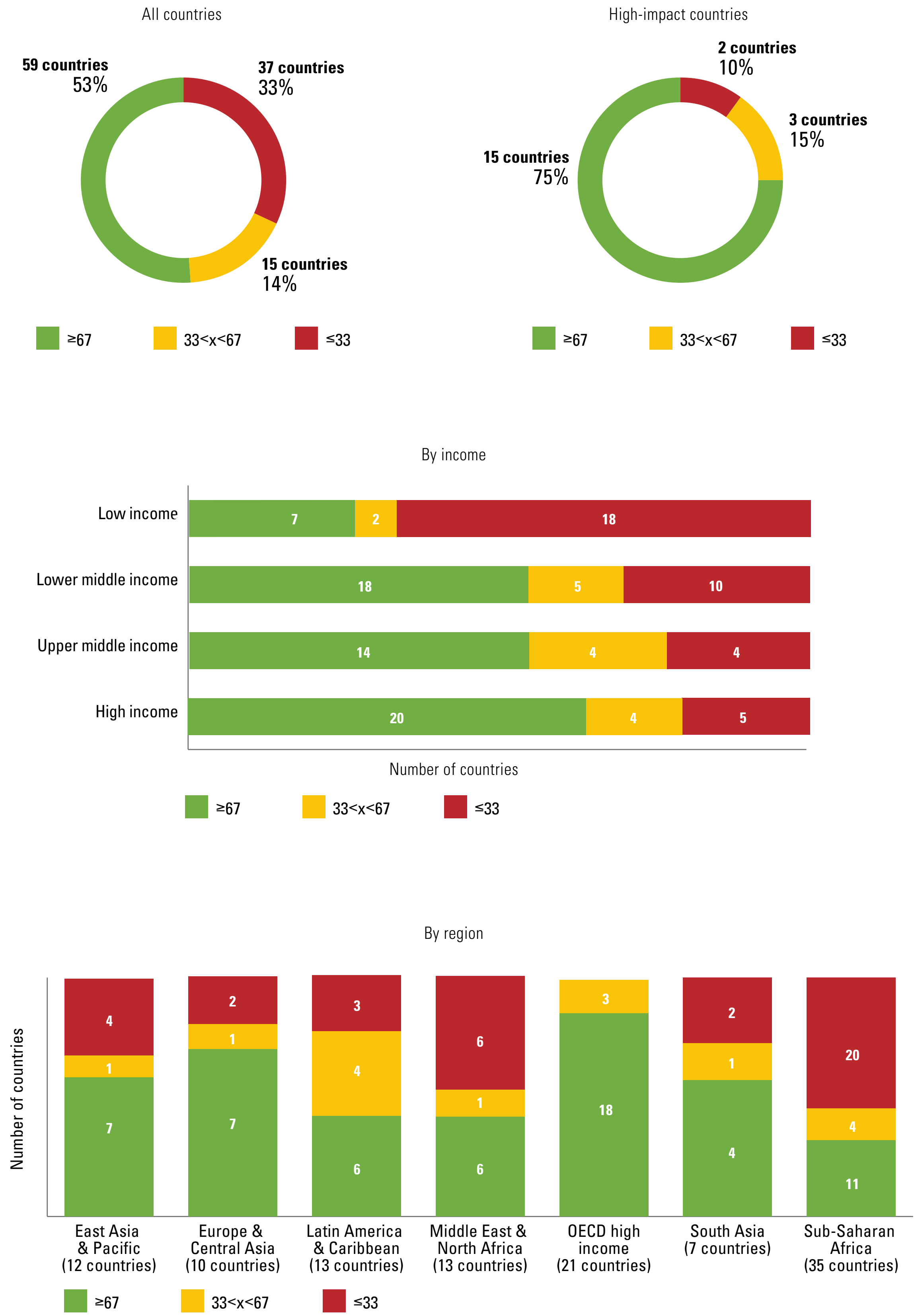
Pass-through costs to customers varies by region. Though high-scoring RISE countries are more likely to ensure that part of the costs of adding renewable energy is reflected in prices paid by the consumer, this does not hold true equally across all regions. While close to 90 percent of OECD high-income countries pass through costs, those in the Middle East and North Africa, Sub-Saharan Africa, and South Asia typically pay for any and all additional costs associated with renewables from government or utility budgets (figure 4.17). In the Middle East and North Africa, only Jordan, Egypt, and the United Arab Emirates pass through their costs to the final consumer.

**FIGURE 4.17** Pass-through of costs, by region




*Source:* RISE database, World Bank.

**FIGURE 4.18** Distribution of Indicator 4 scores




*Source:* RISE database, World Bank.

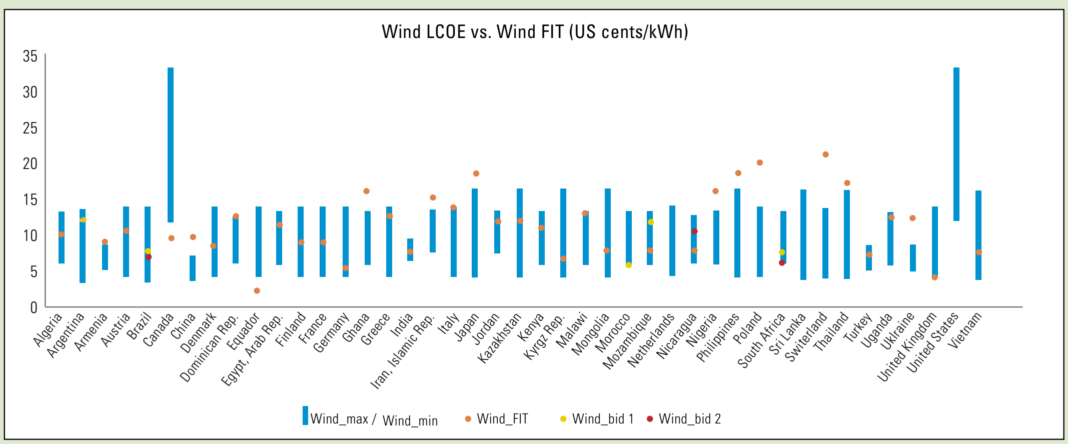
## Box 4.4 Renewable energy prices

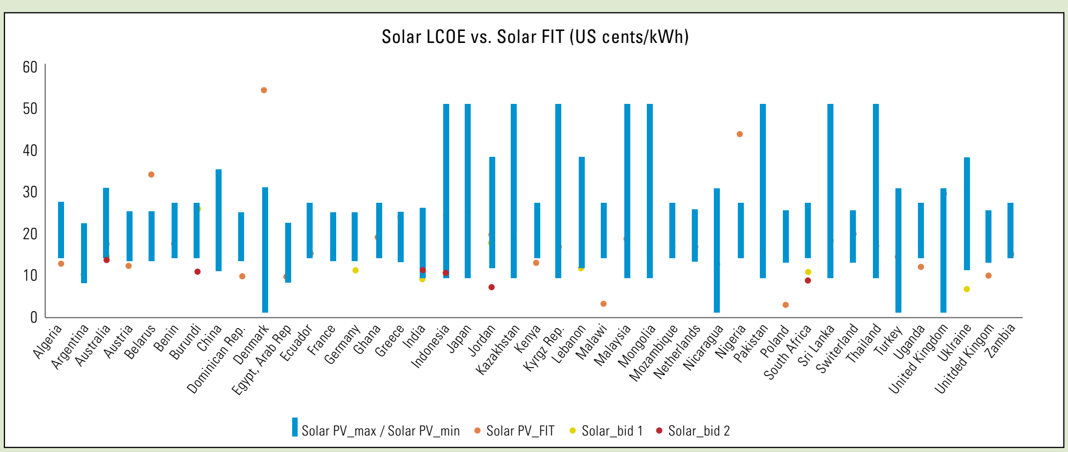
The most important attribute determining whether a renewable energy incentive scheme attracts investment is the level of support it provides and the resulting effect on a project's revenues or costs. Incentive prices or support levels are not calculated as part of RISE scores since the appropriate level differs widely among countries based on a range of technical and political considerations, from the quality of natural resources to the cost of capital. There is no data establishing what an appropriate price range would be for many RISE countries. However, it inarguably is a best practice to ensure prices are high enough that the targeted projects or capacity are developed, and low enough to be an efficient use of resources.

Given the importance of this to developers and policymakers, RISE compared feed-in tariff prices and winning bids from recent auctions and tenders for wind and solar power with the projected LCOE for the relevant technology in the region, as calculated by IRENA (box figure). Some feed-in tariffs are noticeably higher than the expected cost range: for example, guaranteed prices for solar PV projects in the Dominican Republic exceed US$0.50 per kWh, far above the upper bound of the LCOE range of US$0.22 per kWh. Comparatively, recent solar PV tenders in the United Arab Emirates have seen winning bids below US$0.06 per kWh, the lowest solar power costs in the world (and, as of early 2016, bid prices dropped below US$0.03).

Jordan entertained bids of just over US$0.06 per kWh for the second round of its 200 MW solar tender directed at independent power producers in May, 2015. However, the proposed prices are so low that some have questioned if enough revenue will be provided for the projects to be built. The bidding process in Jordan did not include any mechanisms—such as bid bonds or mandated project development milestones—to discourage unrealistically low bids (reflected in Jordan's score for Indicator 4). While the proposed projects may represent important advances in the cost efficiency of solar power, it is too early to determine if the resulting margins will be enough to carry the projects to fruition.

**BOX FIGURE** Feed-in tariff and winning bid prices for wind and solar power against IRENA-calculated LCOE (as of 2015)




*Source:* RISE database, World Bank.

*(continued)*

**Box 4.4 Renewable energy prices** *(continued)*

Conversely, higher prices will not always attract more investment than lower prices if other risks remain unaddressed. For example, until recently Nigeria's feed-in tariff for solar power offered US$0.56 per kWh, one of the highest prices in the world, second among all RISE countries save the Dominican Republic. Yet, with the program in place (since 2008), no PPAs have been signed. Yes, the tariff is high, but the program offers little predictability: the prices are in naira, and the program includes no incentives for offtakers to connect renewable generators to the grid and dispatch their power. In 2015, the Nigerian government took steps to reform the program, passing the National Renewable Energy and Energy Efficiency Policy. It prioritizes competitive bidding for projects over 30 MW, fixes the duration of the PPA term at 20 years, denominates the feed-in tariff in dollars, and sets caps on project size and technology types. Though rates are lower under the new program, more certainty is provided for investors and government finances alike. Through the new regulations, Nigeria hopes to add 1GW of renewable energy capacity by the end of 2018, and another 1GW by 2020.

*Source:* RISE database, World Bank.

## Indicator 5. Network connection and access

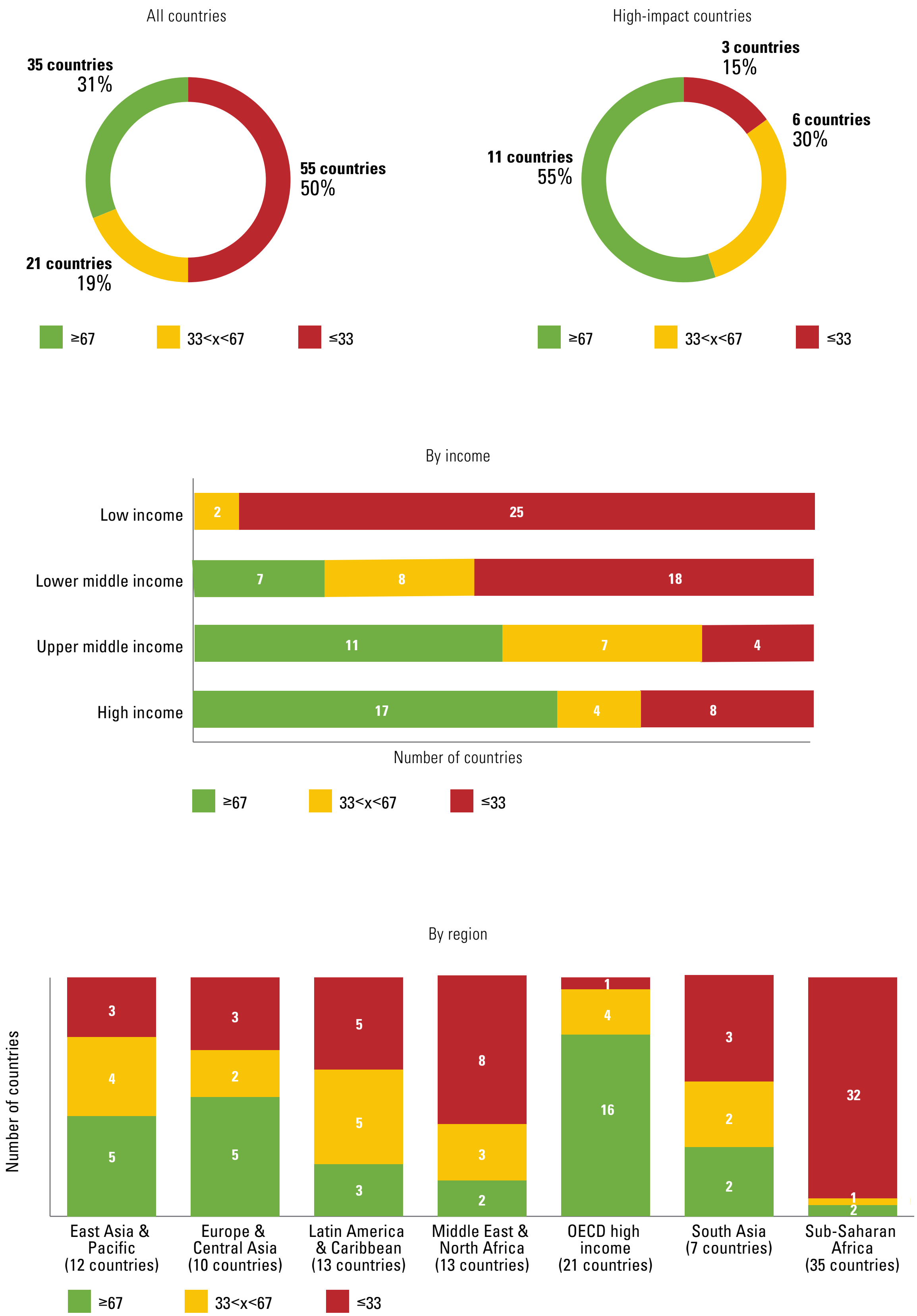
Strong network policies and regulations are common in OECD high-income countries, but far less so elsewhere. Over three-quarters of OECD high-income countries score in the green zone (figure 4.19). Among them, only Australia has no regulations specifying the costs of connecting generators to the grid, and only the Republic of Korea does not allow nondiscriminatory access to the T&D system. Eighty percent have a grid code with standards addressing variable renewable power generation. Just 19 countries outside the OECD high-income group score in the green zone. Nearly half of the countries outside the OECD high-income group are in the red zone, including eight of 13 in the Middle East and North Africa and the majority of those in Sub-Saharan Africa. Of the 20 high-impact countries, the only five that do not have rules specifying the costs of connecting generators to the grid are the Gulf Cooperation Council countries in RISE (Bahrain, Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates). Afghanistan and Rwanda are the only two low-income countries in the yellow zone.

The prevalence of each type of network policy and regulation varies widely by region (figure 4.20). Rules establishing connection costs are present in the majority of RISE countries in Europe and Central Asia, Latin America and the Caribbean, and East Asia and the Pacific, but are in fewer than half of RISE countries in South Asia, Middle East and North Africa, and Sub-Saharan Africa. Where such rules exist, they most typically require deep connection costs in Europe and Central Asia and Latin America and the Caribbean, but allow shallow costs in East Asia and the Pacific and South Asia. Third-party access to the T&D system is more common than not in South Asia, Europe and Central Asia, and Latin America and the Caribbean, but less so in East Asia and the Pacific, Middle East and North Africa, and Sub-Saharan Africa. Fewer than half of RISE countries in South Asia, Latin America and the Caribbean, and Sub-Saharan Africa have grid codes that include provisions for renewable energy, yet such provisions are in more than two-thirds of East Asia and the Pacific countries. Rules governing connection costs, third-party access, and grid codes are rare in Sub-Saharan Africa, appearing in only 17 percent, 29 percent, and 14 percent, respectively, of the region's countries.

Network policies are more common in countries with strong overall policy frameworks and in those that have successfully attracted renewable energy development. Every RISE country with renewable energy scores in the green zone, with the exception of Australia, has clear rules governing connection costs, and all but Jordan, the Republic of Korea, and Malaysia allow third-party access to the T&D grid. Among high-scoring countries, however, there are regional differences: many of the highest-scoring countries in Sub-Saharan Africa and Middle East and North Africa do not allow third-party access, and even fewer have a legally binding grid code with provisions for renewable energy generators.

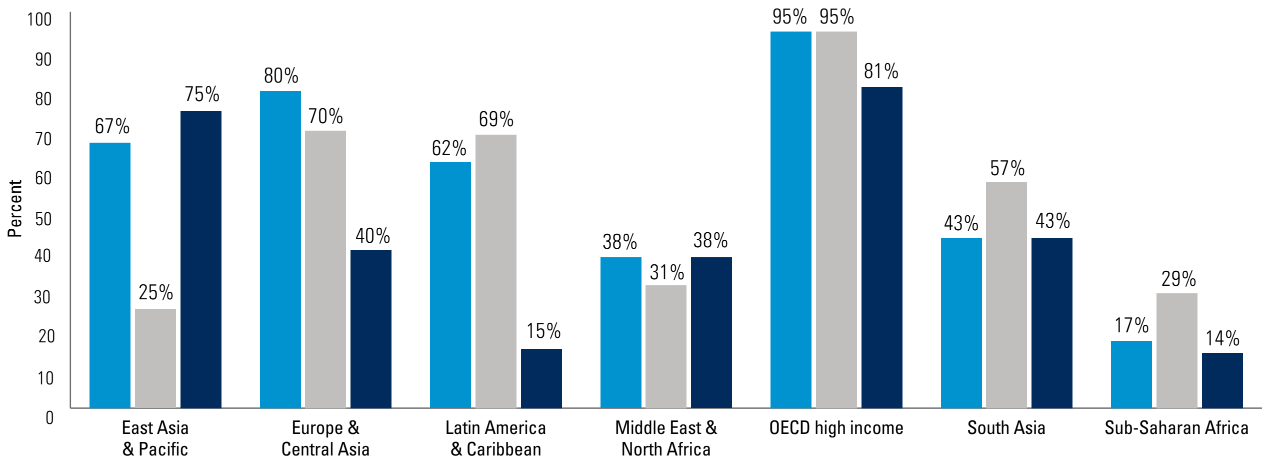
Supportive network policies and regulations are more common in countries where significant renewable energy generation capacity has been developed over the past 15 years (figure 4.22). More than 50 percent of countries that have added at least 100 MW of renewable power capacity since 2000 (excluding large hydropower), and over 80 percent with at least 1,000 MW, have rules defining connection costs and allow third-party access to the T&D system. Grid codes addressing variable renewable energy are more common where more renewable energy development has occurred: such codes are found in over 80 percent of countries that added at least 1,000 MW in the same time frame. However, all three elements are far less common in countries where little to no renewable energy development has occurred, present in 20 percent or fewer countries that added less than 10 MW.

**FIGURE 4.19** Distribution of Indicator 5 scores



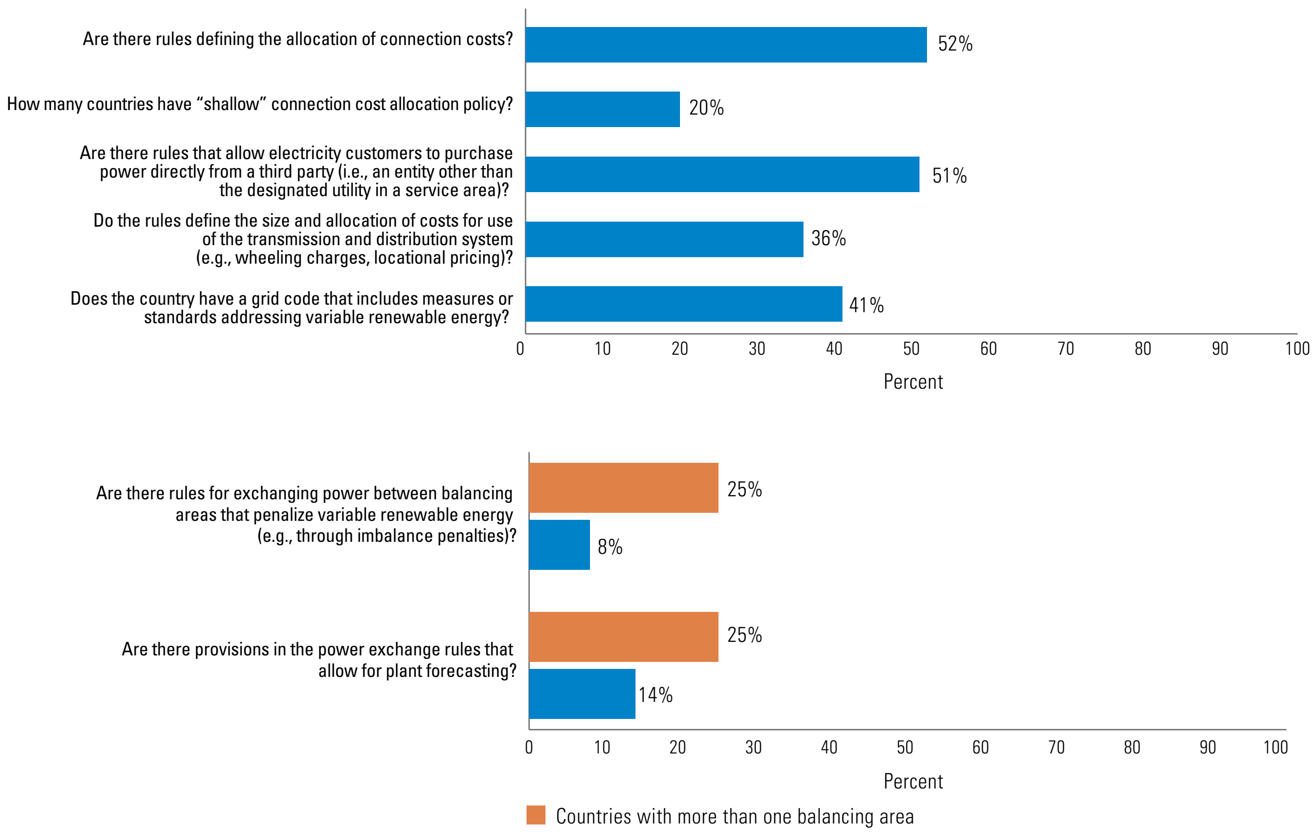

*Source:* RISE database, World Bank.

**FIGURE 4.20** Network policies distribution by region



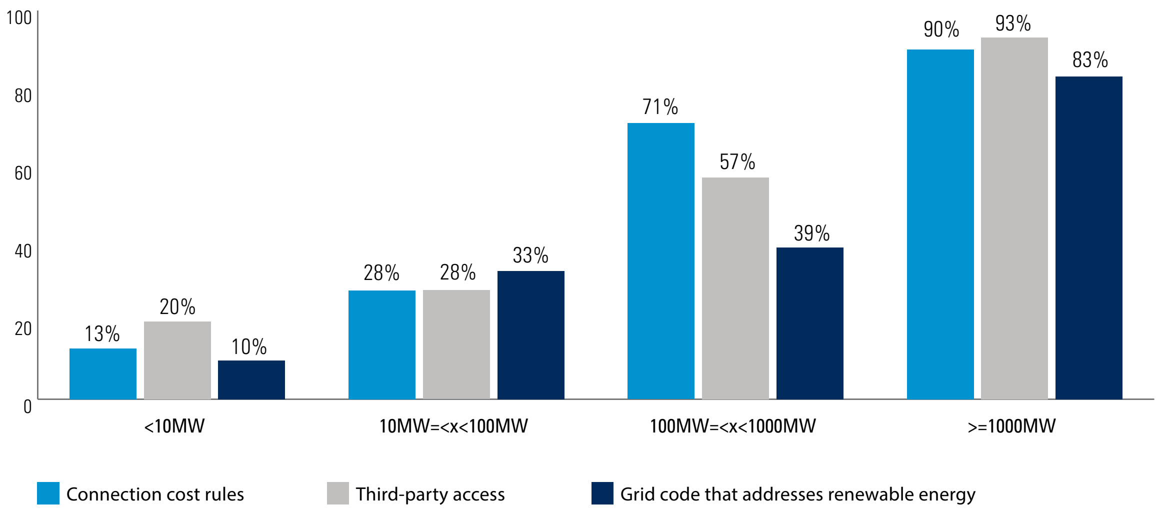

*Source:* RISE database, World Bank.

**FIGURE 4.21** Percentage of countries answering yes to each Indicator 5 question




*Source:* RISE database, World Bank..

**FIGURE 4.22** Percentage of countries with each type of policy in place, by MW of renewable energy installed since 2000




*Source:* IRENA.
*Note:* Exlcluding large hydropower and pumped storage.

### Indicator 6. Counterparty risk

Counterparty risk, as measured by RISE, is a minor issue for high-income countries but more so for lower-middle- and low-income countries. Unsurprisingly, high-income countries score highest on this indicator (figure 4.23). The majority of high-income countries are considered low risk due to their high credit rating,[6] but of those where scores are calculated (Argentina, Bahrain, Chile, Greece, Italy, Spain, and Venezuela), all but Bahrain and Venezuela score in the green zone based on the performance of the selected utility. Among low- and middle-income countries, the story is quite different: only 19 percent of middle-income and 11 percent of low-income countries score in the green zone, and 44 percent of the latter score in the red zone.

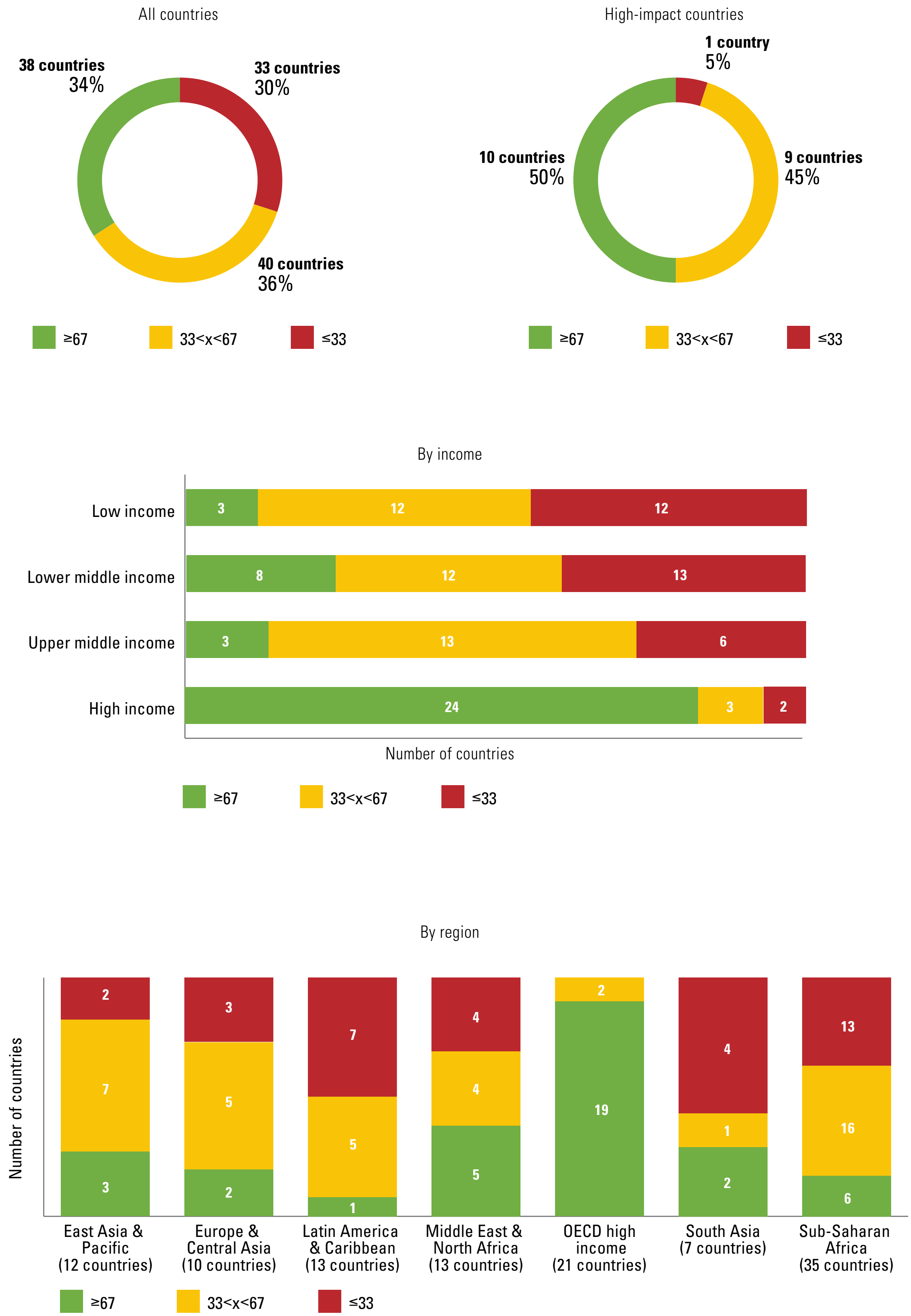
Mechanisms to reduce payment risk are not particularly common, but are present in some low- and lower-middle-income countries that have high RISE scores. Thirty-six countries offer some form of publicly financed mechanism to reduce the risk of payment delays or defaults (figure 4.26). These include sovereign guarantees, escrow accounts, letters of credit, and other mechanisms. At least one mechanism is present in only 35 percent of lower-middle-income and 37 percent of low-income countries—about on par with the overall RISE sample, though these shares include some of the highest-scoring countries in each region. For example, risk reduction mechanisms are reported in each of the five highest-scoring countries in the Middle East and North Africa: Egypt, the Islamic Republic of Iran, Jordan, Morocco, and the United Arab Emirates.

Utility information typically is audited and made public, except in Sub-Saharan Africa and Middle East and North Africa. The selected power sector utilities (including generation, transmission, distribution, and retail sales functions, whether combined in one or multiple companies) make their financial statements publicly available in 58–63 percent of RISE countries, depending on the function, and the statements are audited by an independent auditor in 54–59 percent of RISE countries (figure 4.25). This includes a majority of countries in East Asia and the Pacific, South Asia, and the high-income OECD group, and a similar ratio of generation and transmission companies (but just half of the distribution utilities) in Europe and Central Asia and Latin America and the Caribbean. But financial statements for companies in each subsector are publicly available in only 42 percent of countries in Sub-Saharan Africa and only three of the 13 RISE countries in Middle East and North Africa (the Kingdom of Saudi Arabia, Jordan, and Tunisia). Technical performance measures are more likely to be made public, with T&D loss rates and total electricity available for sale numbers publicly accessible for about 70 percent of selected utilities. Public disclosure of bill collection rates is somewhat less common, influenced by a low rate of 33 percent in high-income countries, where it may be less relevant to their operations because of higher consumer credibility and effective revenue collection.

Most utilities monitor reliability, but many do not make this data public. Of the selected distribution and retail sales utilities, 79 percent operate a SCADA/EMS or other system to record incidents and outages of electricity service. Among those, 88 percent use SAIDI and/or SAIFI, while 10 countries use other metrics, such as the customer average interruption duration index (Solomon Islands and Sudan), frequency of interruptions for installed kVA (Ecuador and Guatemala), or minutes per interruption (Benin). Whatever the metric, 70 percent of utilities report the resulting measurement to the regulatory body, while only 55 percent disclose this information to the public (figure 4.25).

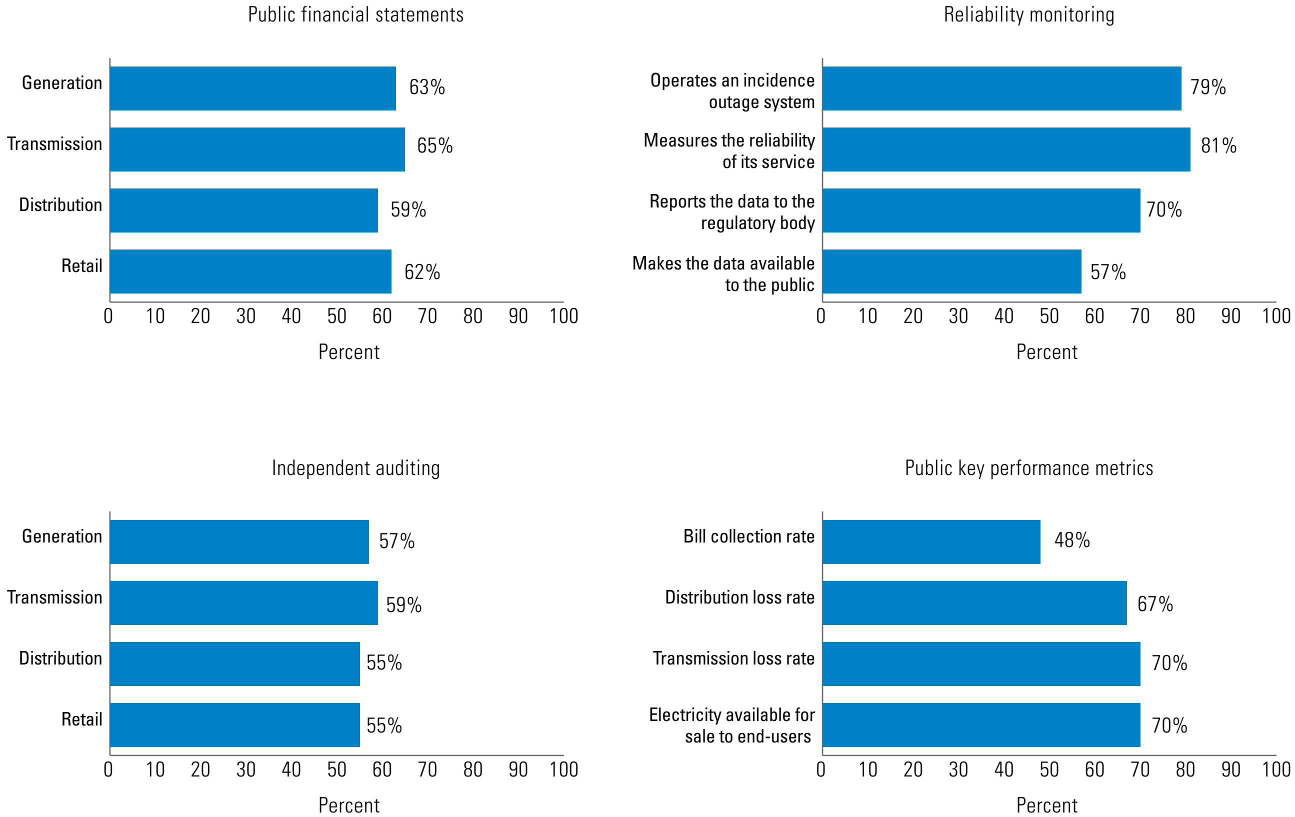
Few utilities score well on all aspects of creditworthiness, although data are limited in many countries. While 54 percent of the selected utilities surpass recommended thresholds for at least one of the four financial metrics that constitute the creditworthiness subindicator, only 8 percent exceed the recommended thresholds (see chapter 3) for all four metrics. Selected utilities score the lowest on their days payable outstanding and current ratio, as only 25 percent and 26 percent of the countries receive the full score. However, RISE was unable to collect data for at least one question in 44 percent of countries, and for all questions in 37 percent of countries. This does not mean that these utilities are not creditworthy, but simply that RISE does not have enough information to make a determination. Such missing information likely will not deter investment in countries where investors have history of being paid on time and there is little risk of default, but for other countries, such missing information may deter investment as much as information revealing a company on shaky ground might.

**FIGURE 4.23** Distribution of Indicator 6 scores



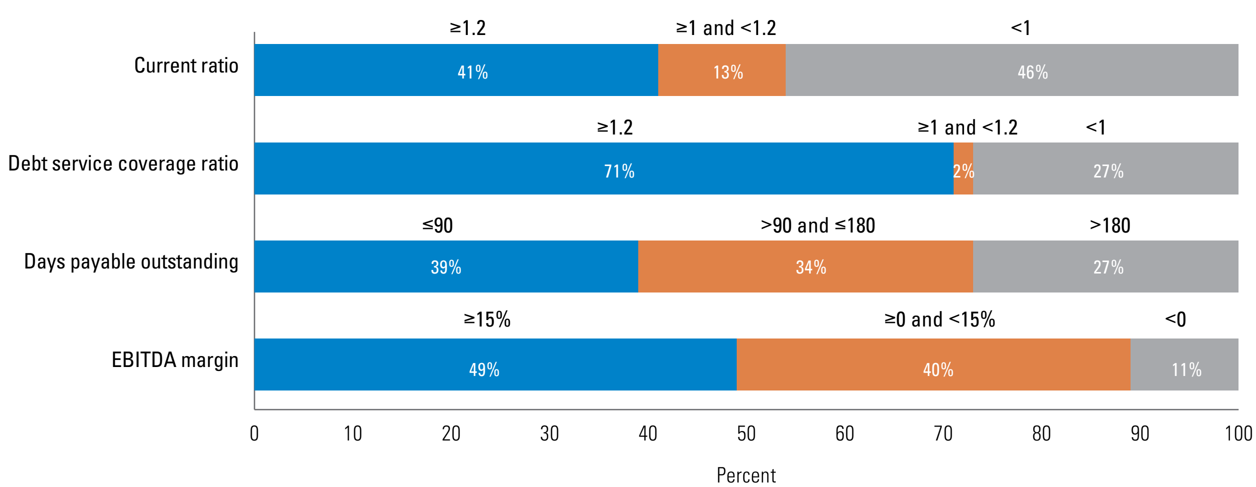

*Source:* RISE database, World Bank.
*Note:* Subindicator scores for all countries are included, even where Indicator 6 is not calculated due to low credit risk.

**FIGURE 4.24** Utility transparency and monitoring: Percentage of countries by question



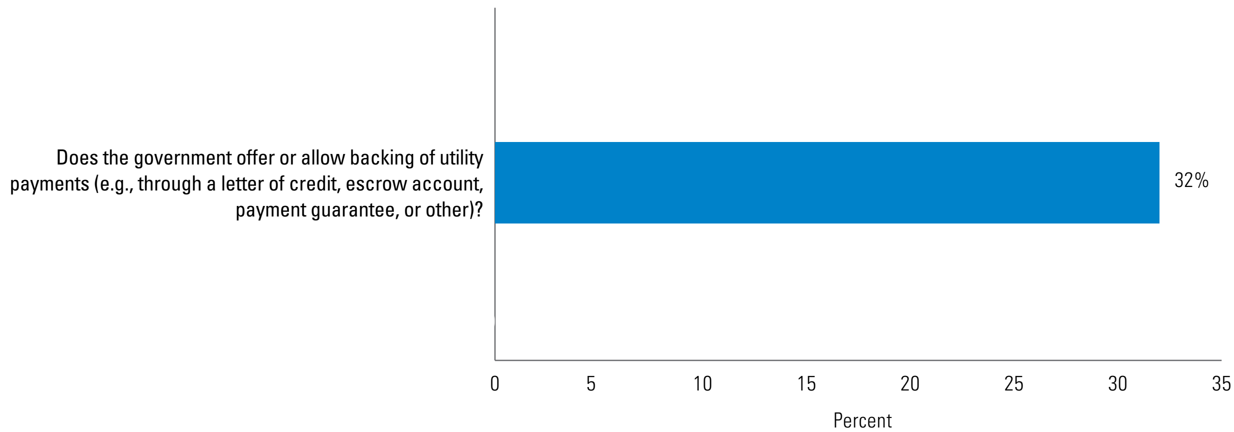

*Source:* RISE database, World Bank.

**FIGURE 4.25** Utility creditworthiness, percentage of countries by four financial metrics




*Source:* RISE database, World Bank.

**FIGURE 4.26** Percentage of countries with at least one mechanism in place to back utility payments




*Source:* RISE database, World Bank.

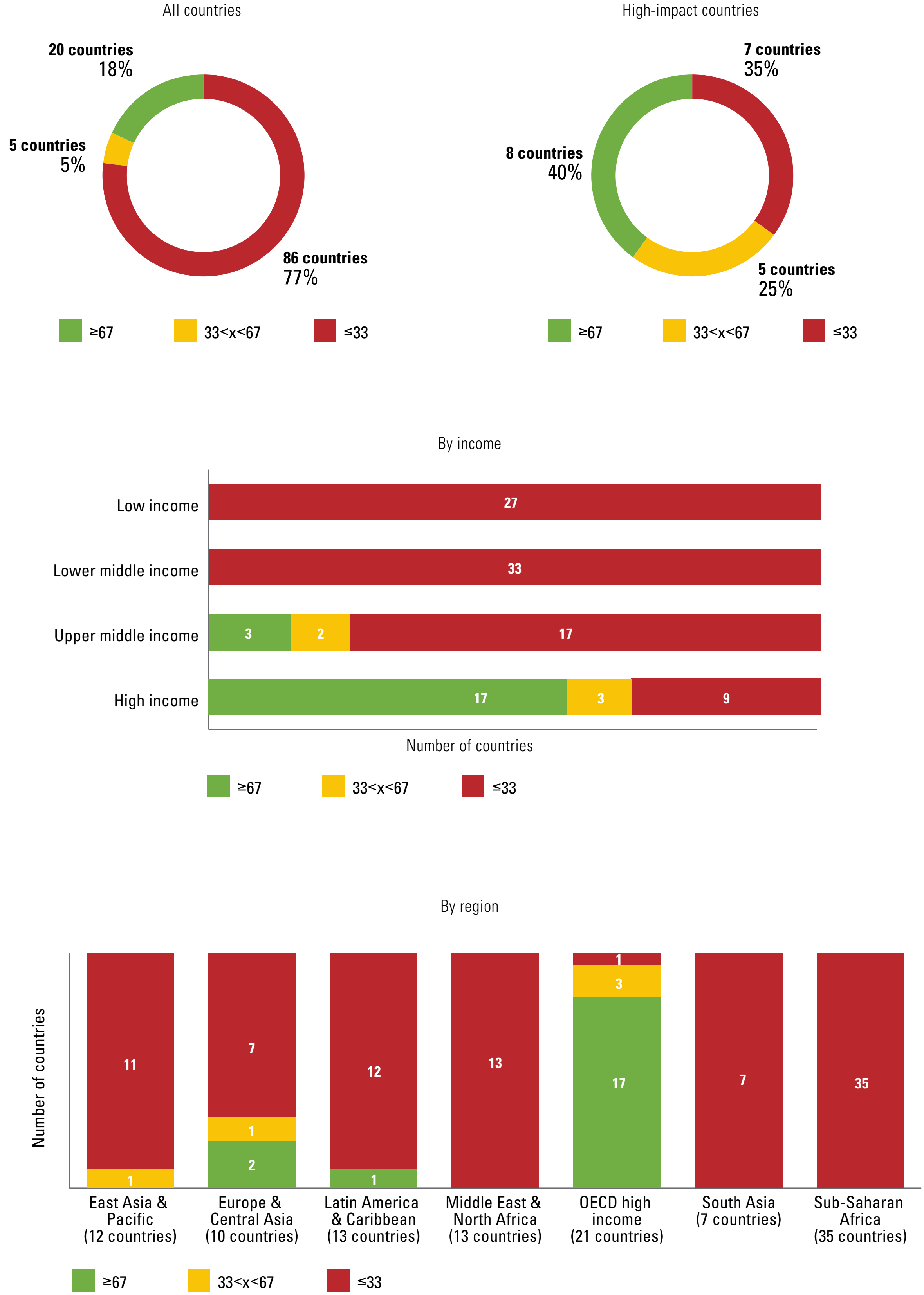
### Indicator 7. Carbon pricing and monitoring

Carbon pricing mechanisms are rare, and usually complement other forms of policy support for renewable energy. Only 18 percent of RISE countries score in the green zone for this indicator (figure 4.27), having adopted carbon pricing mechanisms that cover at least 30 percent of national GHG emissions and require regular reporting of GHG emissions. Another 5 percent have a carbon pricing mechanism with only a small coverage of GHG emissions or no carbon pricing mechanism, but a mandatory reporting scheme for GHG emissions by emitters. Seventy-seven percent are in the red zone, having no carbon pricing mechanism or mandatory reporting of GHG emissions. Australia and Turkey are the only countries that have introduced a mandatory reporting requirement of GHG emissions by emitters without a carbon pricing mechanism.

Carbon pricing typically is limited to developed countries. Of the 23 countries with a carbon pricing mechanism, 19 are high-income—including 15 that subscribe to the EU-ETS (table 4.2). Only two OECD high-income countries do not put a price on carbon (Australia and Chile). China, Kazakhstan, Mexico, and Romania are the only middle- or low-income countries with such a mechanism, and all four are in the upper-middle-income bracket. Denmark leads all RISE countries with the highest coverage of its carbon pricing mechanism, 89 percent, by operating both the EU-ETS and the Danish carbon tax. The United States has the lowest coverage, at 7 percent, because only 10 out of 50 states are participating in the Regional Greenhouse Gas Initiative or the California Cap-and-Trade Program.

Where carbon pricing exists, it almost always is part of a strong policy framework for renewable energy. While carbon pricing mechanisms tend to be relatively uncommon in RISE countries, every country that has such a mechanism scores in the green zone for its overall renewable energy policies, and many are among the highest global RISE renewable energy scorers (figure 4.28). Many countries without carbon prices nevertheless have established strong policy support for renewable energy, including 11 countries with total renewable energy scores in the green zone—Chile, Pakistan, Jordan, Vietnam, Malaysia, Kenya, Sri Lanka, Malawi, South Africa, India, and the Philippines (in order of their renewable energy score).

**FIGURE 4.27** Distribution of Indicator 7 scores



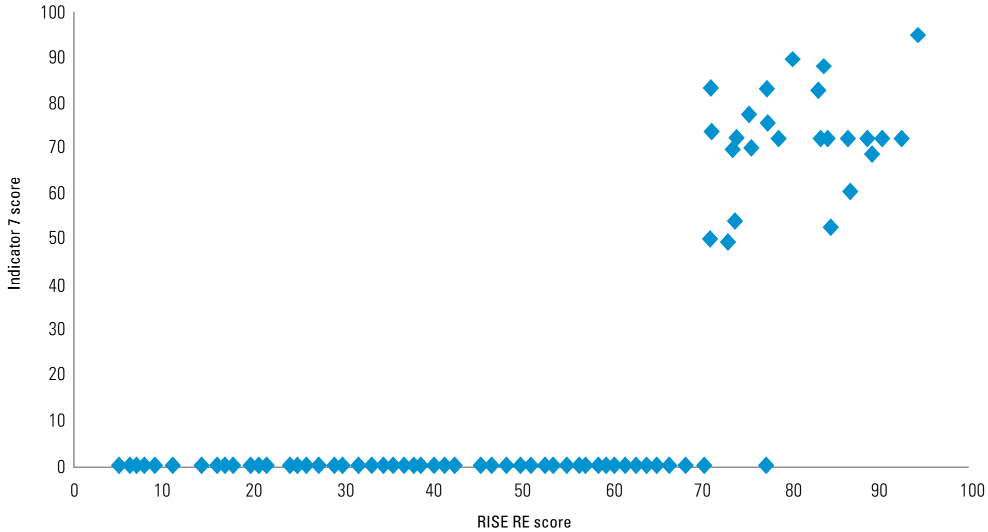

*Source:* RISE database, World Bank.

**TABLE 4.2** Countries with a carbon pricing mechanism in place and the percentage of total national emissions covered

| Country | Carbon pricing mechanism | GHG coverage (%) |
|---|---|---|
| Austria | EU-ETS | 40 |
| Belgium | EU-ETS | 40 |
| Canada | Quebec—Western Climate Initiative ETS, Alberta— provincial ETS, British Columbia—provincial tax | 21 |
| China | Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, Tianjin—ETS | 8 |
| Czech Republic | EU-ETS | 45 |
| Denmark | EU-ETS + tax | 89 |
| Finland | EU-ETS + tax | 66 |
| France | EU-ETS + tax | 80 |
| Germany | EU-ETS | 45 |
| Greece | EU-ETS | 45 |
| Italy | EU-ETS | 45 |
| Japan | National tax + Kyoto, Saitama, Tokyo—ETS | 68 |
| Kazakhstan | ETS | 55 |
| Mexico | Tax | 48 |
| Netherlands | EU-ETS | 45 |
| Poland | EU-ETS + tax | 50 |
| Korea, Rep. | ETS | 66 |
| Romania | EU-ETS | 45 |
| Spain | EU-ETS | 45 |
| Sweden | EU-ETS + tax | 77 |
| Switzerland | ETS + tax | 38 |
| United Kingdom | EU-ETS + tax | 45 |
| United States | RGGI ETS, California—Western Climate Initiative ETS | 7 |

*Source:* RISE database, World Bank.

**FIGURE 4.28** Scores on Indicator 7 vs. overall RISE renewable energy scores




*Source:* RISE database, World Bank.

## NOTES

1. See the subindicators and questions in the relevant indicator in chapter 1.
2. This is understandable, as certain elements of a sophisticated, best-practice planning regime typically become more important as the share of renewables increases in a given power system. Integration studies, for example, may provide valuable input into long-term planning in countries with little or no variable renewable energy at the moment, but typically are not essential until variable renewables like wind and solar reach 5–10 percent of generation in a system. As deployment levels rise, however, a formal integration study may become a critical tool to assess system flexibility and to identify cost-effective steps to increase it. Likewise, highly detailed national resource maps can help policymakers understand the potential for their country's renewable energy resources and how they are likely to be developed, as well as showcase that potential to interested developers. But most renewable energy developers—particularly those using wind, geothermal, and hydropower—generate their own site-specific data before committing to a project, and the lack of national maps is unlikely to prevent them from moving forward.
3. As discussed in chapter 3, such compensation may be built into individual PPAs or project contracts, which often are not publicly available. This may be more common in certain regions, which could help explain some of the regional discrepancies. More research on the details of PPAs would be required to determine the extent of this effect.
4. RISE considers the following international currencies: U.S. dollar, euro, pound sterling, Australian dollar, Japanese yen, Chinese RMB, UAE dirham, Swiss franc, and other currencies pegged to these currencies.
5. Currency indexation addresses only the risk related to fluctuations in official exchange rates, however; if hard currency is difficult to obtain or revenue to repatriate, no amount of indexation will provide comfort to investors. This situation has arisen in Egypt, for example, and was a concern during the design of its recently adopted feed-in tariff program.
6. RISE does not independently calculate counterparty risk in the 26 countries with a sovereign credit rating of A-/A3 or above, as they are considered low risk and given a score of 100.

## CHAPTER 5

# ADMINISTRATIVE PROCEDURES

## DESCRIPTION OF INDICATORS

The administrative procedures indicators measure whether the processes adopted to develop sustainable energy are executed within reasonable time and cost, and capture the administrative ease of doing business. There are four indicators: two in energy access, and one each in energy efficiency and renewable energy (table 5.1). They go beyond the framework for policies and regulations in chapters 2–4 and provide some information about implementation, reality on the ground, and practice. Following the standard methodological approach for time and motion studies developed by *Doing Business*,[1] the indicators break down each process or transaction into separate steps for a better estimate of time and cost.

These indicators are illustrative only and are not included in the RISE scores due to the subjective nature of recording and reporting time and costs incurred in the past, as well as the physical differences between countries and cases that make comparisons difficult. The difficulties in data collection, particularly comparability, make it difficult to find numbers that represent the reality in each country. The administrative procedures data reflect the experiences of certain customers, developers, and manufacturers, and should not be used to infer an overall assessment of the quality of the implementation of laws in each country.

The time and cost estimate for each step is given by end-users—consumers, developers, manufacturers, and importers—who have completed the transaction in the last five years (2011–15). The data were collected through interviews conducted by local World Bank Group experts hired to collect RISE data (appendix 6). The experts were instructed to interview five people per question and to ask each interviewee the same question (table 5.1).

The small sample size of interviews does not allow statistically meaningful conclusions. For the minigrid and renewable energy indicators, lengthy interviews are required with each project developer to understand the process as they experienced it, and the practicality of data collection limited the sample to five projects per country. In many RISE countries there are fewer than five relevant projects, and developers often are unwilling to share information or have not recorded it in a way that enables meaningful comparison. As a result, it is impossible to know with certainty how well their data represent the permitting process faced by all new projects, and whether those countries that appear to have particularly long or costly processes do in fact impose onerous barriers to developing the renewable energy sector.

**TABLE 5.1** Administrative procedures: Questions and interviewees

| Pillar | Questions | Interviewees |
|---|---|---|
| **Energy access** | | |
| Grid connection | List all procedures necessary for residential customers in urban and rural areas to establish a new household connection to the main grid. | At least 5 residential customers in rural areas and 5 in urban areas who have established a new household connection to the grid. |
| Minigrid | List all procedures necessary for a minigrid developer to start operating a minigrid based on renewable energy or other sources. | At least 5 private minigrid developers that started operating a minigrid based fully or in part on renewable energy sources. |
| **Energy efficiency** | List all procedures necessary for a business entity to bring a refrigerator to the market as certified by energy efficiency performance standards. This question also tracks the type of MV&E regime employed. | At least 5 manufacturers or importers who submitted refrigerators to meet national energy efficient appliance standards. |
| **Renewable energy** | List all procedures necessary for a renewable energy developer to bring a project to financial close. | At least 5 renewable energy developers who have completed commissioning grid-connected renewable energy generation facilities. |

*Source:* RISE database, World Bank.

Additionally, variations in connection methods should be noted. While data have been collected from domestic customers in urban and rural areas in each country, variances among the type of connection (underground or overhead), distance from nearest grid connection point, and connection load all affect the number of procedures and the time and cost to connect. Similarly, in the rural areas of some countries, electrified communities were surveyed, while in others, unelectrified areas were surveyed.

Furthermore, data collected for different renewable energy technologies make comparison difficult. Not all countries reported the mix of solar, wind, and hydropower projects requested in the renewable energy question. Since permitting costs and time often differ substantially among technologies due to, for example, varying land-use patterns and environmental concerns, countries are compared not only with the full sample but also with those countries where similar projects have been assessed. Countries are grouped according to the technology that includes the majority of projects assessed by RISE: solar, wind, or hydropower. Thus, if a country reported three solar and two wind projects, it is classified as a solar country. Countries with no majority—for example, two wind and two solar projects—technologies are categorized as mixed. Where enough time and cost information are available for both technologies, separate lists of common procedures for those two technologies are aggregated. In some cases, reported individual projects were discarded since they do not contribute to the aggregate time, cost, or list of common procedures due to missing information or differences in the procedural process, such as competitive bidding versus commercial project development. Countries where only one project is reported—typically countries with a nascent renewable energy market with only one project having reached financial close over 2011–15—were excluded from the comparative analysis, but may be discussed descriptively.

Countries are compared with those that have projects of similar size. For countries categorized by technology group, the average project size is calculated based on the capacity of the projects of that technology. Thus, a country reporting three solar projects and one wind project is categorized as a solar country. The average of the three solar projects is used to determine the country's average capacity; the wind project is excluded from this calculation. However, the wind project still contributes to the aggregated time, cost, and number of common procedures (figure 5.1). The average project size of a mixed country is based on all projects.

A final caveat to be noted is data inconsistency. While RISE provided interview guidelines, the results are dependent upon the developer's ability to disaggregate—and remember—the details of the development process. As a result, the data have inconsistencies. Developers sometimes included the preparation time of documents despite being instructed to include only the waiting time for approvals, in part because they had sporadic engagement with a government body during the preparation phase. Moreover, the processing time after a permit application is submitted depends not only on the agency: incomplete or low-quality documents submitted by developers require follow-up, increasing permitting time. Procedure times were excluded from the analysis where it was obvious that the timeframe was, in part, the developer's fault. Given this lack of information and the wide variability in costs based on project technology, aggregate cost data for grid-connected renewable energy projects are not presented in this chapter.

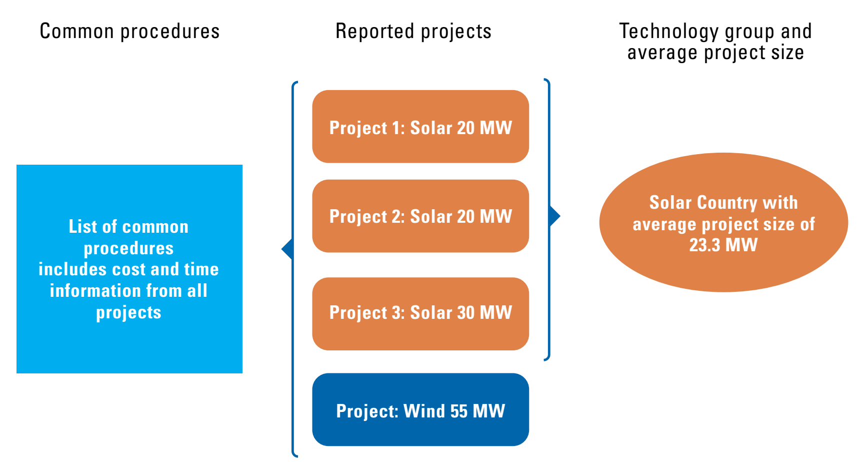
Differences also were observed in the way the development process was disaggregated into individual steps. While a certain procedure may have been reported across countries, the individual steps in this procedure may differ. For example, while an environmental permit may be a stand-alone procedure in one country, it may be part of the zoning permission or the building permit in another, weakening comparability of the procedure types.

## KEY RESULTS

### Energy access indicator: Establishing a new household electricity connection in urban and rural areas[2]

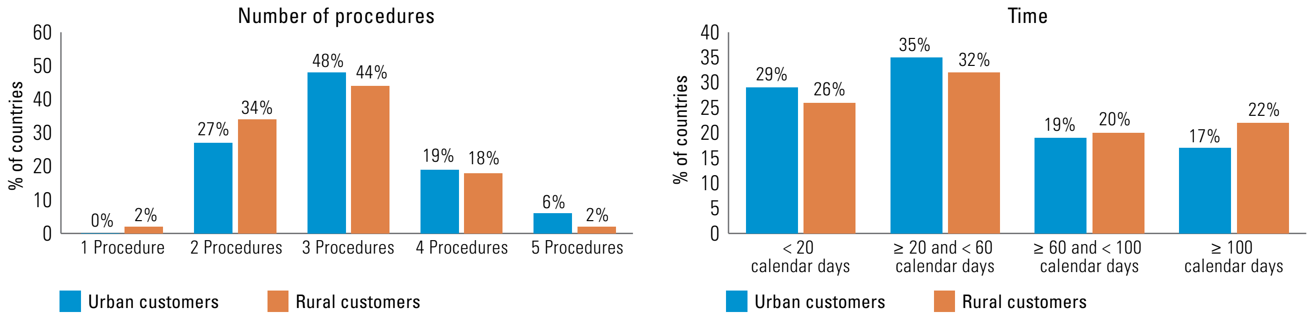
The average—and most common—number of procedures required to get a grid connection is three (figure 5.2). In four economies, customers must undergo five interactions with public agencies to get connected to the grid. The average time to get a grid connection is longer in rural areas (82 calendar days) than in urban areas (69). In urban areas, it ranges from three days (Guinea) to 323 days (Eritrea). In rural areas, the range is wider: three days (Sierra Leone) to 589 days (Myanmar). In East Asia and the Pacific, the process takes three times as long for rural than urban end users. In Sub-Saharan Africa, waiting times in urban and rural areas are about the same, averaging 2.5 months. Connection delays

**FIGURE 5.1** Deriving the common list of procedures and average project size




*Source:* RISE database, World Bank.

**FIGURE 5.2** Number of procedures and time required to get a grid connection




*Source:* RISE database, World Bank.

are caused by a range of factors, including shortages of materials and staff at utilities.

Connection charges for small residential consumers vary greatly: in urban areas, from US$22 in Bangladesh to US$2,732 in South Africa; in rural areas, from US$19 in Mali to US$3,426 in South Africa. In countries with low connection costs, connection to the grid usually involves a simple hook-up to the nearest distribution pole, and the customer bears none of the costs of additional external connection works. The biggest element in connection costs is the purchase of materials, including poles, cables, and transformers. For the 10 economies with the lowest income per capita, the average connection cost is 17 percent of annual GNI per household.

Some procedures are more common than others. Typical procedures include application for connection, which entails submitting an application and waiting for a site visit from a utility technician; site visit conducted by that technician, who conducts a site survey and prepares a cost quote; and grid connection after the customer makes the payment. Some procedures are less common, such as hiring private technicians to conduct internal wiring of house (various countries), getting approval to apply for an electricity connection from neighborhood authority (Mozambique), having the utility conduct a compliance check of internal wiring—Benin (urban) and India (Maharashtra)—and submitting a certificate of final electricity inspection to the local authority (the Philippines).

Most countries do not have a different number of procedures for urban and rural customers (except those in italics in table 5.2). In some countries, customers undergo a process that can be quite cumbersome (box 5.1).

The average time to get a new connection is 69 days in urban areas (among 52 countries surveyed) and 82 days in rural areas (among 50 countries surveyed). Urban-rural

### Box 5.1 Examples of cumbersome procedures

In the Democratic Republic of Congo, an urban-area customer first submits an application for connection to the distribution utility, SNEL, and receives a notice of connection indicating that she or he is now a potential candidate for connection. Next, the customer applies to SNEL for a favorable acceptance notice indicating that the utility accepts the customer for a grid connection. On receiving this notice, the customer then submits both documents to the utility and requests a quote. On receiving the quote, the customer makes payment and awaits SNEL staff to complete connection to the grid.

In Mozambique, before submitting an application for connection—urban or rural—to the utility, a customer must obtain a clearance from the local district administration confirming that he or she lives in the neighborhood where the connection is sought. To obtain this district level clearance, the customer must obtain declarations from the heads of 10 households living in the neighborhood along with a declaration from the head of the neighborhood.

In Sri Lanka, a customer first obtains a certification of land ownership or residence from the divisional secretary. The customer also must get an installation test report certifying the quality of internal wiring from a chartered engineer registered with the utility. The customer then has to take the usual steps of application submission, site visit, payment, entering into a supply contract, and finally, connection.

In some countries, the process is made more unwieldy by customers' interactions with third-party agencies for safety inspections. In Niger's urban areas, for instance, a customer first submits an application for connection to the distribution utility, NIGELEC, and then waits around two weeks for a technician to conduct a site survey. Next, the customer waits another two and a half weeks for the technician to prepare a quote. On receipt of the quote, the customer must request an internal wiring inspection from Sécurité des Installations Électriques Intérieures du Niger, a government agency. Once that agency's inspector provides a certificate of compliance, the customer submits that certificate along with payment to NIGELEC, which then carries out the necessary grid-connection work.

**TABLE 5.2** Procedures and time to obtain a new electricity connection in urban and rural households

| Country | Average number of procedures—urban | Average number of procedures—rural | Average number of days—urban | Average number of days—rural |
|---|---|---|---|---|
| Afghanistan | 4 | 4 | 16 | 13 |
| Angola | 2 | 2 | 19 | 33 |
| Bangladesh | 3 | 3 | 25 | 185 |
| *Benin* | 4 | 3 | 17 | 220 |
| *Burkina Faso* | 4 | 2 | 92 | 39 |
| Burundi | 3 | 3 | 17 | 10 |
| Cambodia | 2 | 2 | 31 | 79 |
| Cameroon | 3 | 3 | 34 | 84 |
| *Central African Republic* | 5 | 4 | 33 | 49 |
| Chad | 3 | 3 | 11 | 28 |
| Congo, Dem. Rep. | 4 | 4 | 52 | 25 |
| *Congo, Rep.* | 3 | 2 | 56 | 26 |
| Côte d'Ivoire | 2 | 2 | 24 | 26 |
| Eritrea | 2 | 2 | 323 | 147 |
| Ethiopia | 3 | 3 | 64 | 44 |
| Ghana | 3 | 3 | 26 | 60 |
| Guatemala | 3 | 3 | 8 | 13 |
| Guinea | 3 | 3 | 3 | 4 |
| Haiti | 2 | 2 | 91 | 91 |
| *Honduras* | 5 | 4 | 58 | 25 |
| India—Maharashtra | 4 | 4 | 65 | 65 |
| Indonesia | 2 | 2 | 21 | 48 |
| Kenya | 3 | 3 | 128 | 98 |
| Lao PDR | 3 | 3 | 38 | 11 |
| Liberia | 3 | 3 | 97 | 134 |
| Madagascar | 3 | 3 | 257 | 253 |
| Malawi | 3 | 3 | 314 | 261 |

**TABLE 5.2** Procedures and time to obtain a new electricity connection in urban and rural households

| Country | Average number of procedures—urban | Average number of procedures—rural | Average number of days—urban | Average number of days—rural |
|---|---|---|---|---|
| *Mali* | 3 | 1 | 72 | 13 |
| Mauritania | 3 | 3 | 24 | 27 |
| Mongolia | 2 | 2 | 22 | 42 |
| Mozambique | 4 | 4 | 49 | 68 |
| Myanmar | 2 | 2 | 40 | 589 |
| Nepal | 4 | 4 | 17 | 139 |
| *Niger* | 4 | 2 | 81 | 85 |
| *Nigeria* | 2 | 3 | 220 | 19 |
| *Philippines* | 4 | 5 | 21 | 9 |
| Rwanda | 2 | 2 | 6 | 5 |
| Senegal | 2 | 2 | 13 | 25 |
| Sierra Leone | 2 | 2 | 250 | 3 |
| Solomon Islands | 3 | — | 19 | n/a |
| Somalia | 2 | 2 | 3 | 3 |
| South Africa | 3 | 3 | 107 | 180 |
| South Sudan | 3 | — | 10 | — |
| *Sri Lanka* | 5 | 4 | 28 | 24 |
| Sudan | 2 | 2 | 75 | 75 |
| Tanzania | 3 | 3 | 74 | 74 |
| Togo | 3 | 3 | 30 | 17 |
| Uganda | 3 | 3 | 16 | 25 |
| *Vanuatu* | 3 | 2 | 91 | 25 |
| Yemen, Rep. | 3 | 3 | 5 | 7 |
| Zambia | 4 | 4 | 115 | 233 |
| Zimbabwe | 3 | 3 | 277 | 321 |

*Source:* RISE database, World Bank.
*Note:* Countries in italics have a different number of procedures for urban and rural customers.

disparities are particularly wide in Sub-Saharan Africa, East Asia and the Pacific, and South Asia (boxes 5.2 and 5.3). Among the 10 countries with the widest range, it takes three times as long for rural customers to get electricity as urban end-users. In 48 percent of surveyed countries, it takes more time to get a connection in rural than urban areas. However, in Haiti, India, Somalia, Sudan, and Tanzania, there is no disparity.

Among the 10 countries with the lowest electrification rate, Malawi stands out with 314 days in urban areas and 261 days in rural areas for consumers to get a new grid connection (figure 5.3). Sierra Leone reports a huge number of days for urban consumers but an almost immediate response to a connection request in rural areas. Among the 10 countries with the highest access deficit, Nigeria has the best results in rural areas—19 days to respond—but about 220 days in urban areas.

Connection charges for residential customers vary considerably across regions, countries, and (usually) between rural and urban areas. Charges range from the very modest (US$22 in urban Bangladesh and US$19 in rural Mali) to the exorbitant (US$2,731 in urban South Africa and US$3,427 in that country's rural areas). Most connection charges differ between rural and urban areas (figure 5.4). For about one-third of countries, connection charges vary between US$100 and US$200, with a median of US$177 in urban areas and US$142 in rural areas. For the countries with cost differences between urban and rural customers, the median cost difference is US$76. Sixty-five percent of rural customers pay lower connection charges than urban customers, mainly due to financial subsidies aimed at increasing rural electrification rates. Afghanistan, Côte d'Ivoire, Ghana, India, Nepal, Rwanda, and Sudan charge the same for connecting urban and rural customers. Connection charges are highest in Sub-Saharan Africa (table 5.3). Countries in Latin America and the Caribbean and in South Asia average the lowest connection charges in both urban and rural areas.

In most countries with low connection costs, grid connection involves a simple hook-up to the closest distribution pole, and the customer bears no further external connection costs. In countries where it is more expensive to connect to the grid, the biggest driver of connection costs is capital investment—purchase of materials, including poles, cables, and transformers. In addition to the standard connection fee, most customers also must shoulder the costs of labor and materials, which vary

### Box 5.2 Challenges in Myanmar's unelectrified rural areas

Myanmar's urban customers can get a new connection in just over a month, but their rural counterparts in unelectrified communities are not as fortunate: they may need to wait for over a year and a half and pay US$568 (44 times per capita income).

To bring electricity to their rural community, village leaders first must establish a village electricity committee (VEC), develop an electrification plan, submit it for approval to the township office of the Electricity Supply Enterprise (ESE)—the electricity distribution utility serving Myanmar's rural areas—and pay the connection fee. The village monk frequently forms the 12-person VEC, which then persuades households to take part in the electrification. Collecting a list of participating households can take upward of one year. The VEC also works to secure loans to help finance the operation.

The committee submits its collective application for electricity to the ESE township office, which reviews and endorses the application. The application is then endorsed by the ESE regional office, and finally is approved by the national-level Ministry of Electric Power.

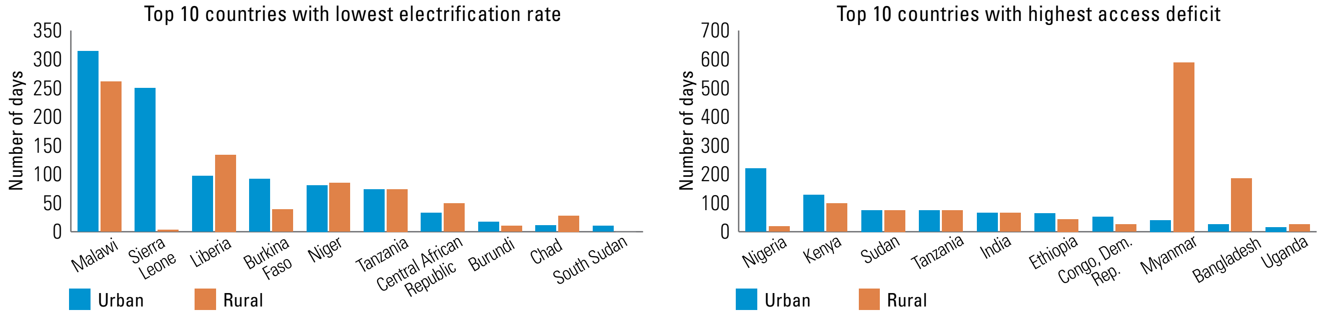
After final approval from the ministry, VEC subcontracts the electrical work, receives certification from the ministry, and gets connected to the grid. The electrical work and final connection usually take six months.

### Box 5.3 Details on the urban-rural discrepancy for obtaining a connection in Bangladesh

In Bangladesh's urban areas, customers can get a new connection in less than a month. The process begins with the submission of an application to the distribution utility, Dhaka Power Distribution Company Ltd, along with supporting paperwork. The supporting paperwork includes a copy of land ownership and a building drawing approved by the City Development Authority; information on the demand load; details of the building construction company; and a notarized copy issued by the city corporation with the property's holding number. The utility then prepares a demand report that includes the approved load demand in kW and voltage level as well as a quote for the connection. The customer then makes the necessary payment, purchases a meter from the utility, and obtains final grid connection.

A customer living in an unelectrified rural community, however, must wait nearly six months before getting an electrical connection. The customer begins the process by becoming a member of a local rural electricity society—Palli Bidyut Samity—and making the payment for connection fees and the cost of poles and materials. The construction of the electricity network in the whole village is done according to the master plan of the rural electricity board.

**FIGURE 5.3** Connection time for the 10 countries with lowest electrification rate and highest access deficit




*Source:* RISE batabase, World Bank.

with each connection. Customers pay these costs to the utility or to a private contractor, depending on who is completing the connection work.

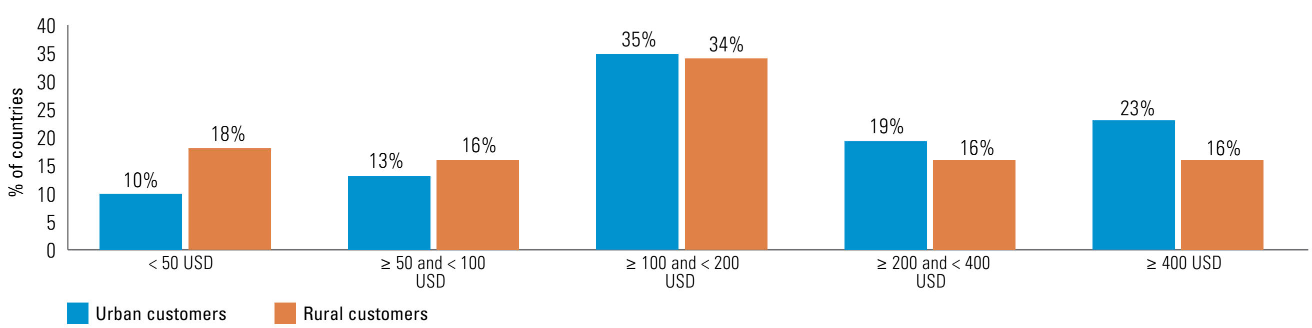
About 38 percent of countries have funding mechanisms to support the connection fee payment, either through subsidies or consumer-financing mechanisms such as on-bill financing or consumer loans. In India, the cost of connection for households below the poverty line is supported in full under DDUGJY, the electrification program. In Uganda, a revolving fund provides utilities with connection materials procured by the Rural Electrification Agency, and connection costs are recovered from the consumer over a set period.

In many African countries, households seeking a grid connection pay a fee and have to buy connection materials, which can be expensive. In urban Niger, for example, connection materials can cost US$1,643—a startling 65 percent of annual GNI per household. Also, in urban South Sudan, excessive connection costs (US$1,570) can lead to delays while the customer finds the funds to buy the connection materials. Delays also stem from lack of materials on the utility's side. And in Sudan, although the fee for a new connection is negligible, customers have to pay a fee of US$330 for single-phase meters and are required to buy cables and poles—increasing connection costs to US$1,153 in rural areas. In the case of South Africa, respondents in rural and urban areas reported higher material and labor costs, including the cost of a distribution transformer, which varies from the official costs charged by the utility for low-voltage connections, but more in line with the medium-voltage official connection costs of the utility.

A study[3] conducted by the World Bank has collected official costs charged by utilities to customers, which are in line with the costs reported by customers in practice through data collected by RISE (table 5.3). In some countries, differences are seen where customers report buying materials and paying for external connection works that are not included in the utility's costs.

In countries where utilities provide information, including time standards, customers are aware of what to expect and can plan the connection process accordingly. In Uganda, the electricity utility provides information on its website[4] on the process, time to connect, and cost. This information is displayed prominently in all its offices, and is advertised in newspapers and other media. Multiple factors can cause connection delays, including shortages of materials and staff at utilities. In Zimbabwe for instance, an urban connection averages nine months because of the lack of human resources at the distribution utility. In Madagascar, due to a shortage of materials, the distribution utility needs more than eight months to provide a new urban connection.

**FIGURE 5.4** Distribution of connection charges for urban and rural customers (percentage)




*Source:* RISE database, World Bank.

**TABLE 5.3** Connection charges for urban and rural households

| Country | Urban connection charges (US$) | Cost (% of GNI per household) | Rural connection charges (US$) | Cost (% of GNI per household) | Official costs (US$)—one phase[a] | Official costs (US$)—three phase[a] |
|---|---|---|---|---|---|---|
| Afghanistan | 83 | 1.66 | 83 | 1.66 | — | — |
| Angola | 43 | 0.14 | 103 | 0.34 | 52 | 77 |
| Bangladesh | 22 | 0.44 | 187 | 3.77 | — | — |
| Benin | 426 | 10.52 | 185 | 4.57 | 278 | 506 |
| Burkina Faso | 395 | 9.76 | 95 | 2.35 | 270 | 534 |
| Burundi | 302 | 23.30 | 202 | 15.59 | 155 | — |
| Cambodia | 120 | 2.53 | 146 | 3.08 | — | — |
| Cameroon | 355 | 5.26 | 111 | 1.64 | 50 | — |
| Central African Republic | 195 | 12.06 | 323 | 19.94 | — | — |
| Chad | 650 | 11.92 | 163 | 2.98 | — | — |
| Congo, Dem. Rep. | 519 | 23.88 | 470 | 21.62 | — | — |
| Congo, Rep. | 202 | 1.75 | 193 | 1.68 | — | — |
| Côte d'Ivoire | 65 | 0.83 | 65 | 0.83 | 212 | — |
| Eritrea | 396 | 15.56 | 325 | 12.77 | — | — |
| Ethiopia | 62 | 2.45 | 57 | 2.25 | 76 | 254 |
| Ghana | 119 | 1.98 | 119 | 1.98 | 87 | 175 |
| Guatemala | 47 | 0.26 | 139 | 0.76 | — | — |
| Guinea | 70 | 2.32 | 200 | 6.62 | — | — |
| Haiti | 172 | 4.71 | 135 | 3.70 | — | — |
| Honduras | 90 | 0.93 | 78 | 0.81 | — | — |
| India—Maharashtra | 106 | 1.37 | 106 | 1.37 | — | — |
| Indonesia | 181 | 1.24 | 77 | 0.53 | — | — |
| Kenya | 420 | 7.81 | 374 | 6.95 | 171 | 502 |
| Lao PDR | 515 | 5.45 | 434 | 4.60 | — | — |
| Liberia | 120 | 6.00 | 146 | 7.30 | 54 | 375 |
| Madagascar | 643 | 31.11 | 660 | 31.92 | 165 | — |
| Malawi | 221 | 19.19 | 33 | 2.88 | 101 | — |

**TABLE 5.3** Connection charges for urban and rural households

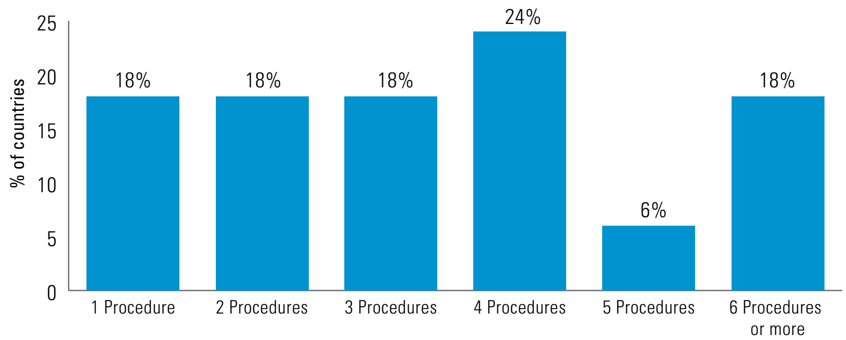
| Country | Urban connection charges (US$) | Cost (% of GNI per household) | Rural connection charges (US$) | Cost (% of GNI per household) | Official costs (US$)—one phase[a] | Official costs (US$)—three phase[a] |
|---|---|---|---|---|---|---|
| Mali | 143 | 3.49 | 19 | 0.46 | 196 | — |
| Mauritania | 24 | 0.33 | 33 | 0.45 | 128 | — |
| Mongolia | 211 | 1.36 | 46 | 0.30 | — | — |
| Mozambique | 117 | 4.23 | 33 | 1.21 | 0 | 6 |
| Myanmar | 167 | 2.63 | 568 | 8.94 | — | — |
| Nepal | 27 | 0.84 | 27 | 0.83 | — | — |
| Niger | 1,643 | 64.75 | 159 | 6.26 | 19 | — |
| Nigeria | 245 | 1.80 | 363 | 2.67 | 0 | — |
| Philippines | 91 | 0.56 | 211 | 1.31 | — | — |
| Rwanda | 83 | 2.92 | 83 | 2.92 | 82 | — |
| Senegal | 88 | 0.90 | 44 | 0.45 | 0 | — |
| Sierra Leone | 195 | 4.60 | 236 | 5.55 | 233 | 421 |
| Solomon Islands | 659 | 6.00 | — | — | — | — |
| Somalia | 110 | 12.43 | 119 | 13.45 | — | — |
| South Africa | 2,732 | 9.56 | 3,427 | 12.00 | 0 | 4,594 |
| South Sudan | 1,570 | 27.26 | — | — | 559 | 0 |
| Sri Lanka | 314 | 2.20 | 180 | 1.26 | — | — |
| Sudan | 1,153 | 9.47 | 1,153 | 9.47 | — | — |
| Tanzania | 33 | 0.70 | 46 | 0.98 | 197 | 552 |
| Togo | 160 | 6.15 | 129 | 4.93 | 244 | |
| Uganda | 147 | 4.56 | 53 | 1.64 | 101 | 244 |
| Vanuatu | 206 | 1.36 | 144 | 0.95 | — | — |
| Yemen, Rep. | 340 | 3.51 | 489 | 5.05 | — | — |
| Zambia | 618 | 6.88 | 1,237 | 13.79 | 125 | — |
| Zimbabwe | 135 | 3.83 | 35 | 0.99 | 95 | 290 |

*Source:* RISE database, World Bank.
a. Kojima et al., 2016.

## Energy access indicator: Permitting a new minigrid

Minigrid developers among the 17 countries that reported information on various nontechnology-specific (common) licenses and permits required to start a minigrid project must typically undergo three procedures on average to obtain the necessary permits (figure 5.5). Depending on the technology and size of minigrid project and the country where it is being developed, a project developer must complete these common procedures and permits. Each step may involve several procedures, and some may run in parallel. Typical procedures include obtaining a generation license, obtaining authorizations from public agencies and municipalities for setting up a minigrid, and submitting an environmental impact assessment (EIA). Less often, procedures might include obtaining land use permits, construction and building permits, indigenous people rights approval, renewable energy incentive subsidy approvals, and PPAs. Senegal allows two models for licensing a minigrid.[5] Regulatory requirements for minigrids can exist but not be implemented (box 5.4), and can vary by project size (box 5.5).

**FIGURE 5.5** Distribution of number of procedures for a minigrid developer to set up a new facility, 17 countries




*Source:* RISE database, World Bank.

A typical minigrid developer must undertake three procedures: obtain authorization from ministries or public agencies; obtain authorization from local entities or municipalities; and procure a license to generate. East Asia and the Pacific averages six procedures, South Asia five, and Sub-Saharan Africa two (table 5.4).

Licenses or permits give nonexclusive rights to generate, distribute, and sell electricity. In some countries all activities for operating a minigrid are included in one license. In others, a license for generation and a separate concession for distribution and electricity sales are required. The owner or operator of the minigrid must have the legal right to exist and to generate, transmit, distribute, and sell electricity services.[6] These rights are granted by the responsible regulator or ministry.[7]

The licensing regime should specify the role and duties of the providers, set

### Box 5.4 Regulation for minigrids exists but is not implemented in Pakistan

Because Pakistan only recently passed its regulation on minigrids (September 2015), the role of the Aga Khan Rural Support Program (AKRSP) is reviewed here.

AKRSP has developed 200 minigrids in Pakistan, and was not required to interact with any government entity. No permits were required. These grids typically are donor-funded projects and are matched with contributions from the local communities. In a few cases, the government's Pakistan Poverty Alleviation Fund has invested. The steps required to establish a minigrid:

1: AKRSP writes a concept note for a minigrid on the basic potential and need in a community, village, or town. The note is written primarily for a donor.

2: If there is donor interest or willingness, AKRSP conducts a prefeasibility study and develops a proposal for donors.

3a: AKRSP conducts a participatory rural appraisal.

3b: A formal request in the form of a letter of intent or commitment is written by or for the community.

4: A detailed feasibility study, including detailed design and cost estimates, is submitted.

5: AKRSP signs an agreement with the community, the terms of which define the roles and responsibilities of stakeholders in the partnership.

6: Construction work begins.

7: Testing and commissioning are conducted.

8: The minigrid is handed over to the community.

*Source:* RISE database, World Bank.

**Box 5.5 Minigrid regulatory requirements can vary depending on size**

Regulatory requirements for minigrids can vary within countries depending on the size of the project. For example, in Tanzania and Kenya, licenses are required only for projects that exceed 1 MW. Smaller projects can register their businesses, a process that does not require the approval of the regulator, rather than apply for a license. Having this option ensures that smaller operators are not deterred by regulatory compliance. Registration is important because it facilitates grid extensions by providing the regulator and other government agencies with information on the enterprise and the services it provides. Other countries that require only registration for projects under a certain capacity include Cameroon (5 MW), Rwanda (50 KW), and Zimbabwe (100 KW).

In some cases, however, minigrid developers may seek a license even if doing so is not required. An optional provisional license secures a site from competition for a limited period of time and communicates the legitimacy of the planned minigrid project to lenders or other key stakeholders.

*Source:* RISE database and Tenenbaum 2016.

**TABLE 5.4 Number of procedures, 17 countries**

| Number of procedures | Countries |
|---|---|
| 1 | Cambodia; Guinea; Madagascar |
| 2 | Burkina Faso; Congo, Dem. Rep.; Senegal |
| 3 | Afghanistan; Malawi; Zambia |
| 4 | Bangladesh; Ethiopia; Mali; Uganda |
| 5 | Nepal |
| 6 or more | Philippines; Solomon Islands; Sri Lanka |

*Source:* RISE database, World Bank.

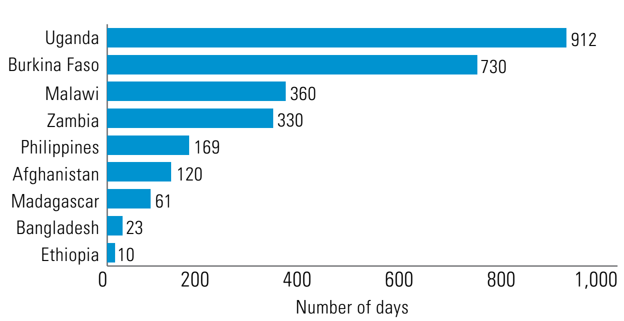
information-filing requirements, and ensure consumer protection mechanisms.[8] Permits and licenses can include detailed preconditions like land leases, permits, or EIAs, and can specify operating conditions, such as service quality and tariffs. The licensing regime should also take into account the rights of generation and distribution asset owners when the main grid connects to the minigrid.[9]

Paperwork requirements vary considerably. The time to secure generation licensing, for example, can vary from 10 days in Ethiopia to nearly three years (912 days) in Uganda, with the cost varying from US$95 in Ethiopia to US$5,081 in Malawi (figure 5.6). Environmental clearances, including EIAs, are required in six countries (figure 5.7). In Sri Lanka, developers must obtain a clearance from the Central Environmental Authority and Forest Department; while this clearance can be obtained in tandem with other licenses, doing so takes nearly a year. In Zambia, developers prepare and submit an environmental project brief to the Zambia Environmental Management Agency for clearance, which is granted in 43 days on average.

Permits from the ministry of energy and specified regulators in the form of no-objection certificates are among the most common procedures, and the time required can range from four days to register a minigrid company with the utility in Ethiopia to one year to obtain tariff approval from the regulator in Senegal (table 5.5). Developers in Ethiopia and the Philippines reported the requirement of a land-use permit. In Ethiopia, this was the hardest part of the licensing process, and in the Philippines it took over nine months to obtain a land-use permit from the local government authority.

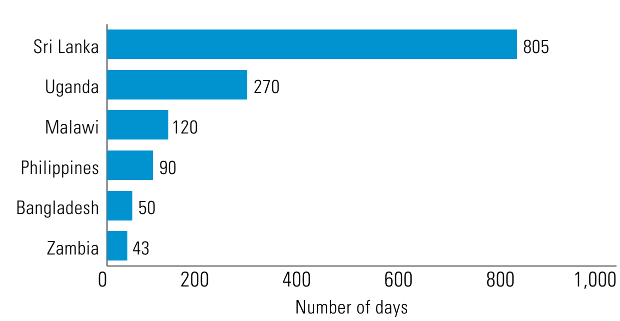
It takes on average 1.2 years to obtain common permits and licenses to build a minigrid facility, with wide disparities from 61 days in Madagascar to over 4.3 years in Sri Lanka (figure 5.8 and table 5.6). Generation licenses take the longest among all common authorizations, averaging 248 days. In Madagascar, a developer needs to obtain a generation license from the Agency for the Development of Rural Electrification to establish a minigrid, which takes on average two months, paying a fee of US$135. In five countries—Afghanistan, Bangladesh, Ethiopia, Madagascar, and the

**FIGURE 5.6 Days to obtain a generation license**




*Source:* RISE database, World Bank.

**FIGURE 5.7 Days to obtain an environmental clearances**




*Source:* RISE database, World Bank.

**TABLE 5.5** Authorizations from ministries, public agencies, local entities, and municipalities

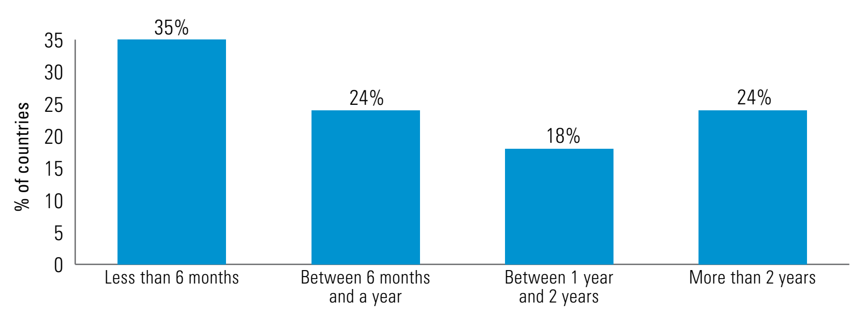
| Country | Authorization | Average duration (days) |
|---|---|---|
| Bangladesh | No-objection certificate from local government authority | 10 |
| | No-objection certificate from the water development board | 9 |
| Congo, Dem. Rep. | Authorization from the Ministry of Energy and Hydraulic Resources | 20 |
| | Business license from the Ministry of Energy and Hydraulic Resources | 81 |
| Ethiopia | Company registration with the Ethiopian Energy Authority | 4 |
| | Investment license | 8 |
| Guinea | Permit from the Ministry of Energy | 90 |
| Mali | Preliminary license and final approval from energy agency AMADER | 165 |
| | Lease for land from local municipality | 30 |
| Nepal | Prefeasibility study from Alternative Energy Promotion Center (AEPC) and regional service centers | 1 |
| | Project approval by RSC technical review committee | 30 |
| | Final approval from the Central Renewable Energy Fund | 30 |
| | Power output verification from AEPC | 1 |
| Philippines | The Department of Energy issues certificate of endorsement to the Energy Regulatory Commission for the issuance of the certificate of compliance | 165 |
| | Developer signs Energy Regulation 1–94 memorandum of agreement with Department of the Environment | 60 |
| Senegal | A concession contract and technical specifications from the Agence sénégalaise d'électrification rurale and the Ministry of Energy | 47 |
| | Tariff approval after developer submits documents to La Commission de Régulation du Secteur de l'Electricité | 365 |
| Sri Lanka | Registration with the Electricity Customers Society | 58 |
| | A non-objection certificate (required for off-grid renewable energy projects) from SLSEA | 31 |
| | Registration with the local government | 10 |
| Uganda | A notice of intention to apply for power permits (from developer) | 1 |
| Zambia | Tariff approval from the energy regulatory board | 270 |

*Source:* RISE database, World Bank.

Philippines—the generation license takes less than six months to obtain.

The average cost of permits across 17 countries is US$1,982, ranging from negligible in Burkina Faso, Senegal, and Guinea to US$15,082 in Malawi (figure 5.9), with a median of US$135. As it was for length of time, the biggest cost driver is obtaining the generation license. In Uganda the entire permitting cost is for the generation license. In Madagascar, the generation license is charged as a fixed fee per kilowatt.

**FIGURE 5.8** Distribution of average time to set up a minigrid facility, 17 countries




*Source:* RISE database, World Bank.

**TABLE 5.6** Time to obtain common permits to set up a minigrid facility, 17 countries

| | |
|---|---|
| Less than 6 months | Bangladesh; Congo, Dem. Rep.; Ethiopia; Guinea; Madagascar; Nepal |
| Between 6 months and a year | Afghanistan; Cambodia; Mali; Solomon Islands |
| Between 1 and 2 years | Malawi; Senegal; Zambia |
| More than 2 years | Burkina Faso; Philippines; Sri Lanka; Uganda |

*Source:* RISE database, World Bank.

## Energy efficiency indicator: Obtaining energy efficient appliance certification

Appliance standards and labeling (S&L) programs establish market rules designed to stimulate the production and purchase of products with greater energy efficiency. They assure manufacturers of a fair market, with consistent rules that encourage investment in innovation. Governments with S&L programs realize reduced energy costs and improved products, and consumers can see lower energy bills and higher levels of service.[10] Key components of successful S&L programs are robust monitoring, verification, and enforcement (MV&E) programs, which provide the structure for ensuring that appliance manufacturers' products comply with program requirements.

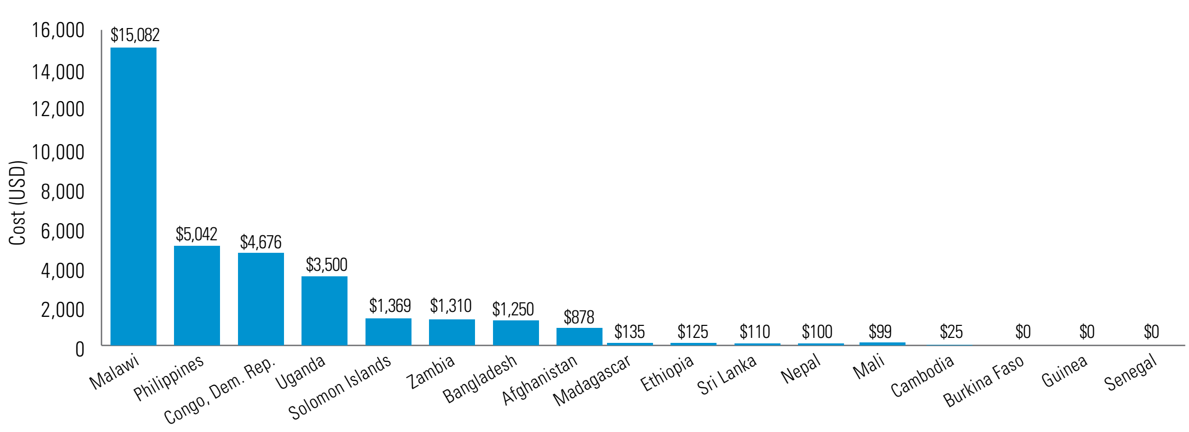
The strength of national S&L programs is scored in the RISE energy efficiency pillar (Indicator 10), which identifies the basic building blocks for a strong S&L program. This indicator is designed to complement them by closely examining facets of implementation that are common across countries. This approach is important because when an MV&E program does not fit a country's market or is poorly implemented, it can burden manufacturers with logistical challenges and disruptions to their product cycle. However, the diversity of approaches does not allow direct comparison of the performance of countries on a single process that is relatively uniform across countries (boxes 5.7, 5.8, and 5.9 below illustrate some of the different testing regimes).

Rather, the survey results offer an appreciation of how MV&E processes function. What emerges is not a single prescription for best practice, but a step toward quantifying the variety of practices that countries undertake (with an overview of common characteristics in box 5.6).

Of the 23 countries that RISE gathered data on regarding how national refrigerator S&L programs function, about half have product registration systems, and half (overlapping) conduct spot testing. Ghana is the only Sub-Saharan Africa country to report MV&E activities. About half the countries have government or third-party certified labs conducting pre- or post-market testing. Only two countries—Australia and the United States—have all categories of monitoring and verification activities (table 5.7).

Ten countries have product registration systems that track appliance testing data and documentation (table 5.8). In India, manufacturers submit testing documentation to Energy Efficiency Services Limited (EESL), an entity under the Bureau of Energy Efficiency. It takes 25 days on average to obtain approval from EESL. In Australia, manufacturers upload appliance data, test reports, and energy label applications to the Department of Industry and Science online database. The cost is US$515 per application and takes on average 14 days (but up to 30 days) to receive approval. In Canada, manufacturers send test results to the

**FIGURE 5.9** Total cost of obtaining permits to set up a minigrid facility in the 17 surveyed countries



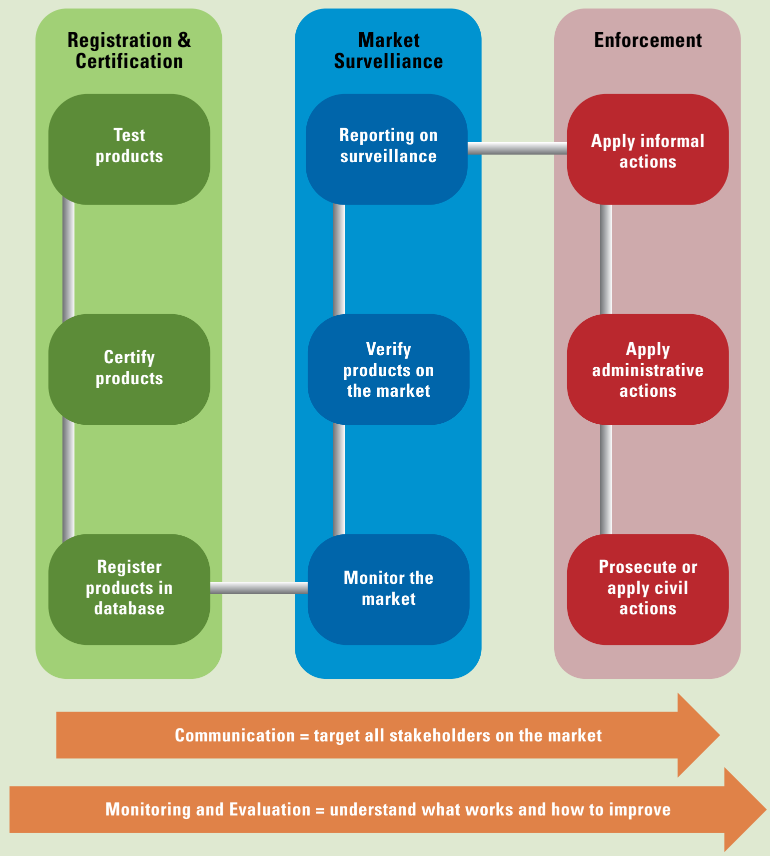

*Source:* RISE database, World Bank.

### Box 5.6 Monitoring, verification, and enforcement of appliance standards and labeling programs

The characteristics of strong S&L programs include related aspects of the legal and administrative framework; mechanisms to facilitate compliance; entry conditions; market surveillance; verification testing; enforcement; communication, reporting, and feedback; budget and resource allocation; and evaluation.[a] Selecting particular options affect other choices as well as the distribution of compliance costs among governments, industry participants, and consumers.

The box figure shows what is involved in the MV&E of an appliance efficiency standard, both before and after market release of a product. The process can begin with a developer registering test results and product information in a product database. At the market surveillance stage, regulators may check to ensure that products carry appropriate labels and, in some cases, whether the products meet market standards. Verification refers to a market surveillance authority (MSA) selecting products to be tested for compliance. In some jurisdictions, this is done pre-market in a certified lab. If a product is noncompliant at any stage, the MSA may enforce penalties. The severity of the penalty usually is proportionate to the degree that the rules have been violated, and can vary from informal actions to legal action.

**ELEMENTS OF A SUCCESSFUL MV&E FRAMEWORK**




Monitoring involves the collection and analysis of data to track compliance. Ideally, it serves as the foundation for identifying and acting on implementation issues and for providing data for program evaluation. It often is continuous, and requires the monitoring of a range of requirements to determine whether all of the program's rules are being met. Two primary mechanisms for monitoring are entry conditions and market surveillance.

Verification involves testing the accuracy of energy performance claims made by the manufacturer and confirms whether a product meets program rules. The specifics of verification testing vary by the design of the MV&E regime. If entry conditions do not require certification, or require self-certification without testing, verification testing is the main method for checking performance. If products are required to undergo verification and certification before entering the program, the rigor of the certification process—not testing—is the focus of verification for authorities.[b] There are three main forms of verification testing: screening, full procedure verification, and third-party certification. These methods can be done before or after a product enters the market, depending on the MV&E regime.

Once a product is on the market, it can be subject to off-the-shelf testing, also known as spot testing. The process differs among jurisdictions, but typically the enforcement agency selects a refrigerator, buys it on the market, and tests it in a lab. If it passes, there is no follow-up with the manufacturer and they are unaware that the test has taken place. If it fails, the regulator—which may be required to submit documentation of the testing for a registry—will notify the manufacturer and may apply a fine.

*Source:* CLASP 2016.
a. Ellis 2010.
b. Ellis 2010.

**TABLE 5.7** Compliance mechanisms for appliance energy efficiency standards

| Country | Monitoring | Verification |
|---|---|---|
| | Product registration system | Lab testing—third party (ILAC or government certified) |
| Australia | Y | Y |
| Austria | N | N/A |
| Belarus | Y | N/A |
| Belgium | N | N/A |
| Canada | Y | Y |
| Chile | N | Y |
| China | Y | Y |
| Denmark | N | N/A |
| Germany | N | N/A |
| Ghana | N | N/A |
| India | Y | N/A |
| Iran, Islamic Rep. | N | Y |
| Japan | Y | N/A |
| Republic of Korea | N | Y |
| Malaysia | Y | Y |
| Netherlands | N | N/A |
| Poland | N | N/A |
| Sweden | N | N/A |
| Thailand | Y | Y |
| Tunisia | N | Y |
| United Kingdom | N | N/A |
| United States | Y | Y |
| Vietnam | Y | Y |

*Source:* RISE database and industry sources.

Canadian Standards Association (CSA). A certification engineer, usually the same one that certified the lab where the refrigerator was tested, reviews the data and issues approval in roughly seven days.

RISE interviewed manufacturers to gather data on the time and costs of testing a refrigerator for energy efficiency certification in a third party lab, and found that testing can be done in under 30 days (table 5.9). The time and cost data reveal that third-party testing does not represent a burden to the manufacturer, and in some cases the testing is done for internal testing purposes rather than to demonstrate compliance. In Chile, China, Denmark, and the United States, testing time exceeds 30 days.

A demonstration of the different possibilities for demonstrating compliance is found in the Republic of Korea, where the Korean Energy Agency (KEA) certifies the major refrigerator manufacturers' in-house labs. Manufacturers can then send products directly to market after testing. This is efficient because manufacturers are required to test their product only once, through which they gain internal data while demonstrating compliance with energy standards, and it can be done on-site. Importers, however, must test products in one of the six KEA-certified third-party labs, which can take an average of 21 days.

In Chile, manufacturers have to pay a US$1,700 one-time fee for each shipment of refrigerators. Once testing is complete, there is an additional cost of US$4 per unit for the energy efficiency certification, which is valid for two years. This system places a greater financial burden on the manufacturer than in other countries' systems, though the implications for effectiveness remain a topic for investigation.

Some countries carry out spot testing, including Australia, Denmark, Germany, Ghana, India, Poland, Sweden, Tunisia, the United Kingdom, and the United States. This imposes the least burden on the manufacturer: it does not disrupt the product design process and imposes no fees, unless the product is found noncompliant. One challenge of spot testing is that it is

**TABLE 5.8 Prevalence of online product registration systems**

| Country | Product registration system | Website |
|---|---|---|
| Australia | Energy rating products lists | http://reg.energyrating.gov.au/comparator/product_types/28/search/ |
| Canada | Searchable product list | http://oee.nrcan.gc.ca/pml-lmp/ |
| China | Energy label product database | http://www.energylabel.gov.cn:9000/productsearch |
| India | Star label product database | https://beestarlabel.com/Home/Searchcompare |
| Japan | Product database | https://seihinjyoho.go.jp/ |
| Thailand | Label No. 5 products database | http://labelno5.egat.co.th/index.php?lang=th |
| United States—Department of Energy (DOE) | Compliance certification database | https://www.regulations.doe.gov/certification-data/ |
| United States—Environmental Protection Agency (EPA) | Energy Star qualified product finder | https://www.energystar.gov/productfinder/ |

*Source:* industry sources and Super-Efficient Equipment and Appliance Deployment Initiative.[11]

expensive for the government and program administrator. The MSA might not have the capacity to perform this testing with sufficient rigor. RISE was unable to gather data on the frequency of testing and how many tests result in failure because such information is considered confidential by regulators. One exception is Australia, which publishes its testing activities and compliance rates.

A regulatory agency's budget should be consistent with its MV&E program's ambition. Each monitoring and verification method allocates costs to stakeholders (government, industry, and consumers) in different proportions (table 5.10). A program designed with low compliance costs to industry requires governments to provide the public funding necessary to ensure the integrity of the program.[12] This is important context for this section—a country may appear to place no regulatory burdens on a manufacturer, but this is only good practice if the program includes robust market surveillance. For example, EU countries require manufacturers only to self-declare their conformity, and such a system works only if the market surveillance by designated agencies is rigorous enough to deter noncompliance—this is very sensitive matter, presenting a challenge to data collection. Also, investment in MV&E is cost-effective; the cost of a successful program is estimated at less than 1 percent of the savings gained from an S&L program. Moreover, a robust program safeguards all future savings that would not be realized with higher rates of noncompliance. The costs of running the program can be lowered through education,

### Box 5.7 U.S. EPA Energy Star labeling program

Energy Star is a voluntary labeling program created to identify and promote energy efficient products. This national voluntary program administered by the U.S. EPA sets energy performance specifications for more than 70 product categories, including refrigerators. These products must adhere to Energy Star specifications in order to bear its label. The EPA maintains a registration system for certified products.

The EPA also entered into agreements with eight governments or entities to promote Energy Star–qualified products in their markets. These countries and economies—Australia; Canada; the EU; Japan; New Zealand; Switzerland; Taiwan, China; and the European Free Trade Association (Iceland, Liechtenstein, Norway, and Switzerland)—have partnership agreements with the EPA designed to unify voluntary energy efficiency labeling programs. The agreements provide a single set of energy efficiency specifications in several major global markets.

### Box 5.8 Market surveillance in the EU

As a common market, the EU presents a unique case for the enforcement of refrigerator energy efficiency standards. There are two pieces of energy efficiency legislation for refrigerators: Ecodesign MEPS and energy labeling. Ecodesign provides consistent EU-wide rules for improving the environmental performance of products, and is overseen by the European Commission.

Ecodesign requires self-testing and self-declaration by the manufacturer before it places a product on the market.[a] Since there is no registration or certification requirement, manufacturers can self-declare that their product meets ecodesign standards by placing the CE mark[b] on them.

Ecodesign requires EU member states to establish an MSA that must conduct market surveillance, request relevant testing information from manufacturers, and enforce penalties. Ecodesign also establishes standardized verification test procedures. However, market surveillance activities are sovereign to MSAs at the national level and are not performed consistently across countries.[c] RISE surveyed 15 EU countries, all of which are under Ecodesign.[d]

Challenges to stronger compliance programs in the EU include weak penalties that fail to provide deterrence; insufficient financial resources; insufficiently staffed programs (for the entire EU there are just 80 full-time staff members working on energy labeling compliance); and inadequate testing infrastructure.[e]

a. 2000/125/EC: Council Decision of 31 January 2000 concerning the conclusion of the agreement concerning the establishing of global technical regulations for wheeled vehicles, equipment and parts that can be fitted and/or be used on wheeled vehicles (parallel agreement).
b. The letters CE on a product in the EU signifies that the product has been assessed to meet the safety, health, and environmental protection requirements.
c. Industry sources.
d. Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Poland, Spain, Sweden, Switzerland, and the UK.
e. Jairaj 2013.

### Box 5.9 Japan's Top Runner Program

Japan's unique Top Runner program enforces the country's energy efficiency standards. Top Runner is not an MEPS program. Instead, it requires manufacturers to meet a target set by the fleet average. Manufacturers simply test their refrigerators in-house and then label it with the ratio of energy efficiency scoring against the top performing refrigerator in the Top Runner program. This means that if the weighted average of energy efficiencies for all refrigerators on the market collectively meet the target established by Top Runner, every manufacturer is deemed to have met the standards. A manufacturer can sell a refrigerator that does not meet the target percentage established by Top Runner if the weighted average, which includes the minimum product and all other refrigerators in the category, clears the target. The Ministry of Economy, Trade, and Industry (METI) essentially lets the market lead the way on energy efficiency, and the certification process for refrigerators is treated as voluntary. This clearly is different from the use of MEPS, which require all products in the market to clear a certain target.[a]

In practice the program works because of the competitive refrigerator market in Japan. Consumers in Japan place value on an appliance's energy efficiency, and the five main manufacturers in Japan place more than 80 new refrigerator products on the market each year. Third-party certification testing, which takes around a month, would add significant delay to the arrival of new products and would not meet market expectations. The competition and fast product cycle also help ensure that the products meet and further the standards.[b]

There are forms of market surveillance, however. The Japanese Electrical Manufacturer's Association, of which all five manufacturers are members, voluntarily purchases refrigerators placed on the market each year and contracts with the Japan Quality Assurance Organization to test the products. Test results are submitted to METI. Submission is voluntary and not mandated; the manufacturers do not submit any data to any government organization.[c]

a. Industry sources.
b. Industry sources.
c. Industry sources.

**TABLE 5.9** Third-party testing of appliances for energy efficiency certification, as reported by manufacturers

| Country | Procedures | Time (days) | Cost (US$) | Standards agency | No. of certified labs | Comments |
|---|---|---|---|---|---|---|
| Australia | 3 | 16 | 0 | Department of Industry and Science/National Association of Testing Authorities | No data | Manufacturers may select to test domestically or abroad; process is different for new suppliers. |
| Canada | 2 | 28 | 0 | Canadian Standards Association (CSA) | 6 | Test labs must be certified annually by the CSA, at a cost of CAD 5,000–8,000 and requiring 3–4 weeks |
| Chile | 1 | 89 | 1,700 | Superintendencia de Electricidad y Combustibles | 1 | In addition to the one-time fee listed here, the energy efficiency certificate costs US$4 per unit. |
| China | 2 | 90 | 0 | China National Institute of Standardization (CNIS) | 1 | CNIS has one laboratory for certification. Other third-party-certified labs are active. |
| Denmark | 3 | 68 | 88 | Danish Technological Institute | 1 | Results are for selection of appliances by the MSA for spot testing. |
| Iran, Islamic Rep. | 3 | 27 | 0 | Institute of Standards of Iran | No data | |
| Korea, Rep. | 2 | 21 | 0 | Korean Energy Agency (KEA) | 6 | The 4 companies that dominate the refrigerator market have KEA-certified testing labs. These results reflect independent test lab procedures that importers must go through. |
| Malaysia | 4 | 7 | 103 | SIRIM QAS International Sdn. Bhd | No data | |
| Tunisia | 1 | 21 | 175 | Centre Technique des Industries Mecaniques et Electriques | 1 | |
| United States | 2 | 90 | 0 | Department of Energy | No data | See box 5.7 for more details |
| Vietnam | 3 | 25 | 546 | Ministry of Industry and Trade | No data | |

*Source:* RISE database, World Bank.

**TABLE 5.10** Distribution of costs based on entry requirements

| Entry condition | Distribution of costs | | |
|---|---|---|---|
| | Government/program | Industry participant | Consumers |
| In-house testing, calculation, or self-declaration allowed | High cost in market surveillance & verification testing | Low compliance costs | None |
| Independent tests required | Medium cost in market surveillance & verification testing | Medium initial compliance costs | May fund compliance costs in price of equipment |
| Third-party verification and/or certification required | Low cost in market surveillance & verification testing | High initial compliance costs | May fund compliance costs in price of equipment |

*Source:* Ellis 2010.

clear rules, publicizing the program, and timely responses to noncompliance.[13]

### Renewable energy indicator: Permitting a new renewable energy project

The RISE database on renewable energy projects spans 190 projects in 47 countries: 72 based on solar power, 53 on wind, 41 on hydropower, and 24 on biomass. Projects range in size from 9 kW solar rooftop projects to wind projects of over 100 MW. The goal was to collect data from at least 5 projects per country but the full complement of 5 projects was reached only in 15 countries; 14 collected information on 4 projects, 12 on 3, and 6 on 2. Those countries that reported only one project were dropped from the database.[14] Some countries were removed from the database for other reasons: Chad was excluded because the reported projects have not been constructed; Greece was dropped because its projects were developed before 2010, when the country implemented a substantial policy change to accelerate the licensing process (box 5.10), but due to the financial crisis project development stalled.

A country is grouped according to the technology that constitutes the majority of projects assessed by RISE—solar, wind, or hydropower (table 5.11). In 14 countries primarily solar projects were reported. The average capacity of the projects in this group ranges from 0.1 MW in the Philippines and 0.2 MW in Ukraine to 40 MW in Thailand and 46 MW in India. The group with predominantly wind projects encompasses eight countries, ranging in average size from 8.7 MW in Belgium to 178 MW in Poland. Nine countries are classified as hydropower countries. Projects here have an average size from 1 MW in Ecuador to 26 MW in Guatemala. Seventeen countries with projects from various technologies fall into the mixed category. Average capacity in this group ranges from 1.2 MW in Belarus to 41 MW in Australia and 400 MW in Brazil. India appears separately in the solar and wind groups because it provided enough information for such analysis.

Permitting time ranged from 34 days in Ukraine to over five years in Honduras. This huge difference is explained by the nature of the projects surveyed: the projects in Ukraine are solar, averaged 0.2 MW, and completed seven procedures, while the hydro projects in Honduras averaged 4.5 MW and had four procedural steps. The average permitting time for all countries is 502 days (around 1.4 years); half of all countries range between 194 and 646 days.

The number of procedures recorded ranges from two in the Netherlands to 17 in Russia (figure 5.10). Reporting five to seven procedures was most common: 52 percent of countries reported within this range, while 88 percent of countries reported three to nine procedures. Over half of all countries, in all size and technology groups, reported five to seven total procedures (table 5.12), and 88 percent had from three

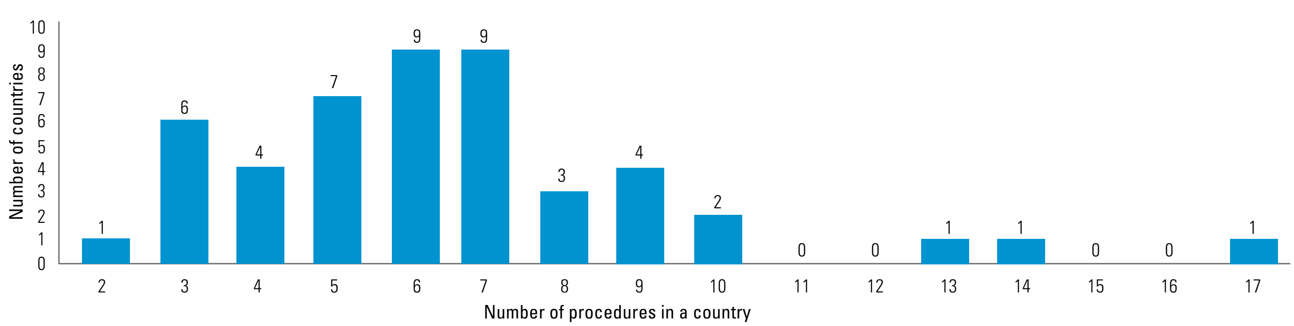
**Box 5.10 How policy change is reducing Greece's permitting time**

The Greek government adopted a national renewable energy action plan in 2010 that led to the establishment of a one-stop shop to accelerate the licensing procedure, called the Renewables Investment Facilitation Service, a part of the new Ministry for the Environment, Energy, and Climate Change. Before this policy change, the average licensing procedure time was reportedly more than five years, and in some cases, even 10. The International Energy Agency reported that the policy change led to a reduction in the average duration for a procedure to 8–10 months in some cases, although the Hellenic Wind Industry Association notes that many areas for improvement remain.[a]

The data RISE collected for Greece is on projects that were brought to financial close around the time of the reforms of 2010 and related to the financial crisis. It is difficult to obtain more recent data because only a few projects have been developed since.

a. IRENA 2012.

**FIGURE 5.10 Frequency of number of procedures**




*Source:* RISE database, World Bank.

**TABLE 5.11 Overview of RISE data**

| Dominant Technology | Average Project Size (MW) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0–3 MW | | 3–10 MW | | 10–40 MW | | 40+ MW | |
| Solar | Dominican Republic | 0.6 | Czech Republic | 3.5 | China | 23 | India—Solar | 46 |
| | Italy | 1.1 | Russian Federation | 5.0 | Jordan | 16 | Thailand | 40 |
| | Korea, Rep. | 0.3 | | | United States | 11 | | |
| | Kuwait | 1.0 | | | | | | |
| | Malaysia | 1.1 | | | | | | |
| | Philippines | 0.1 | | | | | | |
| | Ukraine | 0.2 | | | | | | |
| Wind | | | Belgium | 8.7 | Denmark | 13 | Inda—Wind | 75 |
| | | | | | Finland | 27 | Poland | 178 |
| | | | | | France | 10 | Romania | 130 |
| | | | | | | | South Africa | 113 |
| Hydro | Ecuador | 1.0 | Armenia | 3.0 | Colombia | 21 | | |
| | Kenya | 1.9 | Chile | 4.3 | Guatemala | 26 | | |
| | | | Honduras | 4.5 | Tajikistan | 11 | | |
| | | | Rwanda | 3.5 | | | | |
| Mixed | Belarus | 1.2 | Austria | 7.5 | Argentina | 17 | Australia | 41 |
| | Iran, Islamic Rep. | 1.5 | Bolivia | 5.7 | Benin | 10 | Brazil | 400 |
| | | | Indonesia | 5.7 | Mongolia | 13 | | |
| | | | Japan | 4.9 | Nicaragua | 23 | | |
| | | | Netherlands | 5.6 | Spain | 19 | | |
| | | | Sri Lanka | 4.8 | Turkey | 20 | | |
| | | | | | Vietnam | 23 | | |

*Source:* RISE database, World Bank.

**TABLE 5.12 Number of procedures by technology and size**

| Technology | Size | | | | |
|---|---|---|---|---|---|
| | 0–3 MW | 3–10 MW | 10–40 MW | 40+ MW | Overall |
| Solar | 5 | 11 | 6 | 5 | 6 |
| Wind | N/A | 7 | 7 | 7 | 7 |
| Hydro | 5 | 7 | 7 | N/A | 6 |
| Overall (including countries with no dominant technology) | 5 | 7 | 7 | 6 | 7 |

*Source:* RISE database, World Bank.

to nine. There is little relationship between the number of procedures and either the size of projects or the technologies on which they are based. Nor does the duration of the permitting process necessarily correspond with the number of procedures. While a developer in Spain waits on average 814 days for 14 different permits and approvals, one in Russia needs only 281 days to obtain 17 different approvals—the highest number of approvals required among RISE countries.

At the other end of the spectrum, in the Dominican Republic it took the reported projects 50 days to obtain three approvals, and in the Netherlands 210 days to complete two procedures—the lowest number of individual procedural steps, mainly because nearly all permits are combined into the all-in-one Wabo permit. Wabo has three main components: a building permit, a land-use and zoning permit, and environmental approval. Depending on the circumstances, fewer or additional permissions may be required by the Wabo process. This process involves a single decision-making period and a single appeal procedure.

Some of the differences in country results for permitting time are due to variations in common technology types and project sizes. Countries with predominantly solar projects had far faster permitting times than wind and hydropower countries. Solar countries reported a permitting time of 274 days on average while hydropower countries—the group with the longest average permitting time—reported 755 days.

The relative effect of project size on permitting time seems less clear. Table 5.13 shows the average permitting time for countries with different average project sizes and for all technology types. For all technology types, countries with the smallest projects experience the fastest permitting times; however, once a certain size threshold is met, permitting time increases gradually for ever-larger projects. The countries with an average project size of 0–3 MW see an average duration of 234 days per project, less than half the 589 days for countries with projects in the 3–10 MW range. Countries with 10–40 MW projects, on the other hand, take slightly less time (539 days), and those with 40 MW or greater, 670 days.

Project size seems to matter more for wind than for solar: while larger wind projects appear to take longer to permit than their smaller counterparts, solar projects see no particular increase in permitting time above 3 MW.

This trend is less obvious for hydropower projects. Medium hydropower projects in the range of 3–10 MW appear to take the longest. But this is driven primarily by one outlier, Honduras. If the data on Honduras, which averages 2,039 days, is excluded from this group, the permitting time drops to 468 days. The driver behind the high permitting time in Honduras is the time to get an environmental permit from the Secretariat for Environment and Natural Resources, which developers report takes 1,040 days—almost 70 percent of the project's duration.

While some differences in permitting time are driven by variations in technologies and project size, disparities are present even among those countries with similar projects. As discussed above, clearly some of this is due to the small sample size and difficulties in standardizing reporting; some could be due to changes in government policy, as in Greece in 2010. Nevertheless, there are significant differences in how countries approach and carry out renewable energy project permitting, and those differences can translate into substantial delays, expenses, and risks for project developers.

Countries with solar projects show lower variability than countries with wind or hydropower projects. The Republic of Korea's processing time is long relative to countries with solar projects of a similar size. At 108 days it is more than twice that of the Dominican Republic, which has the second longest time with 50 days, and almost three times as long as the Philippines' 39 days. Seven discrete processes were reported in the Republic of Korea, as in Ukraine, while in the Dominican Republic and the Philippines developers need to complete only three and four steps, respectively. In the Republic of Korea, obtaining an authorization from the Ministry of Trade, Industry, and Energy and the municipal government is the main time driver at 51 days, or around half the project's total time.

The figures for countries with large projects (40 MW and more) also vary. In India, developers reported obtaining the necessary permits within 64 days. In Thailand, on the other hand, permitting took 917 days on average.

Solar projects in China reported an average permitting time of over 134 days. Developers in China reported seven separate steps, although four of them run simultaneously. This may be the reason that China's permitting time is below the average for projects of 10–40 MW. In Chad, a number of large solar projects are under development (box 5.11).

For countries with wind projects, reported permitting times range from 119 days in India to well over three years in Poland. The range of the number of procedures is equally wide: developers completed as few as four steps in India to as many as 13 in Romania.

In Belgium and Denmark, the process took only 539 and 538 days, respectively. With average project capacity of 9 MW and 13 MW, the two countries had among the smallest reported wind projects.

Within the group of countries with the largest wind projects—averaging more than 40 MW—India's short procedure time of 119 days stands out (box 5.12). The country with the next shortest permitting times is almost five times as long—Romania with 599 days. Poland is the largest wind country, with an average capacity of 178 MW and five procedures to complete. It is also the

**TABLE 5.13** Procedure time by technology and size, in days

| Technology | Size | | | | |
|---|---|---|---|---|---|
| | 0–3 MW | 3–10 MW | 10–40 MW | 40+ MW | Overall |
| Solar | 125 | 470 | 344 | 491 | 274 |
| Wind | N/A | 539 | 708 | 828 | 747 |
| Hydro | 774 | 924 | 518 | N/A | 755 |
| Overall (including countries with no dominant technology) | 234 | 589 | 531 | 670 | 502 |

*Source:* RISE database, World Bank.

**Box 5.11 Pioneering solar power in Chad**

The government is keen to develop its abundant solar resources. It has set up the Renewable Energy Agency of Chad and tasked it with mobilizing investment for renewables.

Various large solar projects are under development, and RISE gathered information on the procedural steps for two projects in the range of 40–60 MW. However, as they have not been constructed, they are excluded from the comparison with other countries. So far, these projects have completed four procedures, including signing a memorandum of understanding with the Ministry of Energy, submitting a feasibility study to the Ministry and the local utility, conducting an EIA, and signing a PPA. Completing these procedures took the developers 541 days on average.

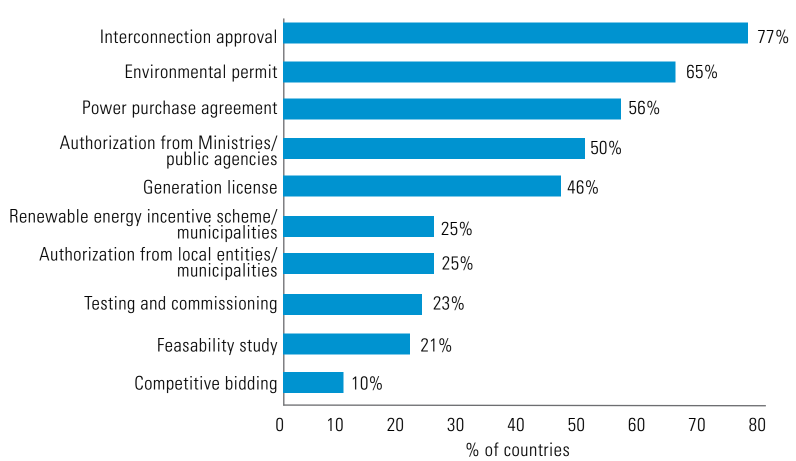
**Box 5.12 Streamlining the permitting process in India**

The use of one-stop shops to expedite licensing is common among India's states; they are modeled on the Commission of Industries under the new industrial policy. The two portals in the Indian states RISE surveyed—the New and Renewable Energy Development Corporation of Andhra Pradesh and Maharashtra Energy Development Agency—are similar in conception. The developer submits documents for various permits (such as environmental, land, transmission, and project clearances) to the portal and the documents are distributed to the relevant agencies, which in theory have 21–30 days to issue approval (durations run longer than this, as RISE data indicate, possibly because further information was requested from the developer). Andhra Pradesh uses an online system for project registration and managing records, but Maharashtra does not. Andhra Pradesh also reports shorter durations for issuing clearances.

most time-demanding, at 1,163 days. The time driver in Poland is the environmental permit, which took on average 997 days (350–1,640 days) to obtain. However, developers were partly responsible for the long permitting time because they changed certain aspects after starting the environmental permitting process, requiring the Regional Directorate for Environmental Protection to reevaluate the project.

Countries with hydropower projects show the largest variability, with permitting time ranging from as low as 159 days in Tajikistan to 2,039 days in Honduras for projects averaging 11 MW and 4.5 MW, respectively. The recorded procedures range from only three in Ecuador to 10 in Rwanda. In Ecuador, only a generation license, an authorization from the municipality to qualify as a nonconventional power producer, and testing and commissioning by the Electricity Corporation of Ecuador is required. Rwanda's 10 procedures include an array of additional permits, including an EIA and a PPA. With 3.5 MW, Rwanda's average project is larger than that of Ecuador, with 1 MW.

**FIGURE 5.11 Procedure types by frequency (percentage of countries)**




*Source:* RISE database, World Bank.

While Ecuador requires the lowest number of procedures, this does not translate to reduced time. That country's total permitting time for hydropower projects under 3 MW is 440 days. At the other extreme stands Kenya, at 1,110 days.

Processes vary widely among the countries with larger projects. In Armenia, projects averaging 3 MW reported average permitting times of 193 days, while in Chile, slightly larger projects averaged 1,032 days. For even larger projects, Colombia granted all required permits for projects averaging 20.5 MW in 543 days, while Guatemala's 26 MW projects took on average 853 days. The environmental permit, taking 459 days, is the largest contributor to Guatemala's waiting time.

## Types of renewable energy procedures

The procedures for obtaining the required approval differ by country, project size, and technology, but a few procedure types were common (figure 5.11, and defined in box 5.13). Interconnection approvals, environmental permits, PPAs, and generation licenses are four of the five of the most common procedures across countries, and

### Box 5.13 Definitions of procedure types

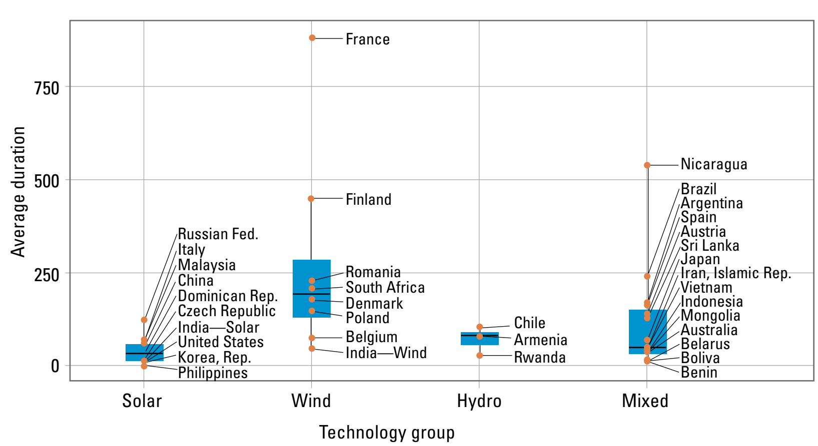
- **Interconnection approval.** All authorizations required to physically connect a generator to the distribution or transmission grid. This includes approvals of technical feasibility studies (such as power system studies, load flow analysis), obtaining technical conditions for connection from the grid operator, and final permission to interconnect.
- **Environmental permit.** Authorizations required under environmental law. This includes the approval of EIAs and can be granted at municipal, regional, or national level.
- **PPAs.** Agreements between the project developer and the offtaker (usually a utility) to purchase the produced electricity for a specified number of years.
- **Authorization from ministries or public agencies.** All administrative approvals not listed separately that need to be obtained at the national level. This includes expressions of interest and memorandums of understanding.
- **Generation license.** Authorization to produce electricity. Energy concessions also are included in this category.
- **Renewable energy incentive scheme or subsidy.** Applications and approvals necessary to receive the most important support schemes for renewable energy, such as feed-in tariffs and green certificates.
- **Authorization from local entities or municipalities.** All other administrative approvals that need to be obtained at the municipal or regional level.
- **Testing and commissioning.** Verification that the generator complies with the technical standards and operational requirements set out by the grid operator.
- **Feasibility study.** Assessment of the viability of the proposed project, taking into account legal, economic, technological, scheduling, and other factors. While completing a feasibility study is a common aspect of project development, submission for approval at local or national level is what RISE records. It is required in only a few economies. This often is equivalent to a general project approval.
- **Competitive bidding.** Application to participate in public tenders, auctions, or other forms of public procurement of energy (not applicable in all countries).

the following sections discuss them and their application in depth. The category of authorization from ministries or public agencies encompasses administrative approvals that must be obtained at the national level and that are not included in the other categories. Since these procedures vary greatly, this group is not analyzed in detail.

## Interconnection approval

Thirty-seven[15] of the 47 surveyed economies require an interconnection approval. The time to complete this procedure ranges from 3 days in the Philippines and 7 days in Benin to 540 days in Nicaragua and 881 days in France. The average reported time was 127 days. While the interconnection process covers only one permit in many countries, Spain has four

**FIGURE 5.12** Interconnection approval (days required)




*Source:* RISE database, World Bank.

and Ukraine and Russia have five approvals in this category.

The box plots in figure 5.12 provide an overview of the distribution of data grouped by technology. The line inside the box indicates the median and the bottom and top of the box show the 25th and 75th percentile of the data. This means that 50 percent of the data points fall into this range. Countries that lie on the lines extending out of each box are located no further than 1.5 times the length of the box from the median (or 1.5 times the interquartile range—a common statistical measure). Outliers are plotted as individual points.

The interconnection process in the group of solar countries was the fastest, ranging from 3 days for 0.2 MW in the Philippines to 125 days for 5 MW in Russia (figure 5.12), and averaging 43 days. The group of wind countries shows the largest variation and the highest average maximum duration, with a waiting time of 48 days (35–60 days) for 75 MW in India to 881 days (285–1,740 days) in France to connect projects averaging 10 MW. The data obtained for France is a clear outlier in this respect. The average duration for the group of wind countries was 278 days. Hydropower countries averaged 72 days, ranging from 31 days in Rwanda to 105 days in Chile. The mixed technology group—the group with the largest number of countries—shows relatively little variation compared with the other groups. Fifty percent of countries take between 31 and 161 days, with an average of 113 days.

Eight economies reported completing more than one procedure that falls into this category during project development. The interconnection approval usually requires continued interaction with the utility or regulatory body. Romania reported the connection process in detail, over five steps. First, the developer completes a preliminary registration for the interconnection point from the distribution company; then requests the specification of the technical connection conditions; next shows compliance with the technical conditions; subsequently signs a contract for dispatch management with the transmission system operator; and last, finalizes the registration of the interconnection point with the trading system administrator. With a cumulative 230 days, this country's process is slightly above average.

Several countries do not have separate procedures for interconnection approval, but include it as part of the PPA process. In Honduras, for example, the PPA includes approval of the water contract, operation contract, environmental license, and interconnection approval.

## Environmental permits

Environmental permits include any authorization required under environmental law, including approval of EIAs and other environmental permits, and can be granted at the municipal, regional, or national level. Environmental permits are common procedures, with 65 percent of economies requiring either an EIA or another environmental permit. EIAs usually are required for larger projects that have a substantial effect on the landscape or nature. Developers of smaller projects may be exempt from completing an EIA, but usually will have to request an exemption from a government body. In six countries, more than one environmental permit had to be obtained, or the permitting process involved multiple steps.

With an average of 23 days (15–30 days), China has the shortest approval time. China reported predominantly solar projects (averaging 23 MW). The environmental permit is the most time heavy in Honduras and Poland. In Poland, a country dominated by wind projects (178 MW), getting a permit takes on average 997 days (350–1,640 days). While Honduras' value is very high with 1,400 days, this estimate is only based on one value. On average, obtaining an environmental permit took 280 days.

While the environmental permit is a stand-alone permit in many countries, some combine it with other procedures. In 2010 the Netherlands passed legislation that combined the environmental, building, and zoning permits in one application (the Wabo permit), which averages only 165 days to obtain (150–360 days). In Jordan, the EIA is part of the technical and financial proposal (and not included in the environmental permit analysis), taking on average 150 days. (120–180 days).

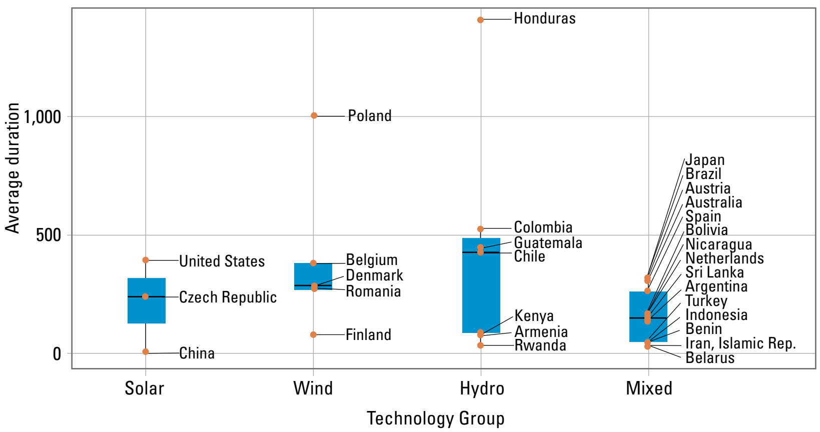
Figure 5.13 breaks down the time for environmental permits by technology group. Countries in the mixed group report the lowest permitting time on average for environmental licenses, 172 days. Hydropower has the highest average permitting time as well as the largest range, even when excluding Honduras. India is among the countries not requiring an EIA or separate environmental permit for renewable energy projects.

EU member states are required to follow the minimum requirements for EIA regimes set out by the EIA Directive of 2014, under which the developer must inform and consult with environmental authorities and the public about the results of an EIA. The directive also gives the public concerned the right to access environmental information and to participate actively in the administrative procedure evaluating the project, and it guarantees conditional access to the courts.

Only four of 14 solar countries report requiring an environmental permit, which reflects the small size of solar projects (50 percent of all solar projects are below 1.5 MW). China has the shortest approval time. In the United States, the process takes the longest, averaging 408 days (90–635 days).

In five of the 11 countries where wind is the dominant technology, developers report having to obtain an environmental permit. Obtaining it is quickest in Finland, averaging 92 days, and the longest in Poland, at 997 days (360–1,540 days). Belgium (395 days) reports the second-longest time, and requires an EIA and a further environmental permit. Developers there must first submit the EIA for approval to the municipal council, which takes on average 115 days (80–150 days), and after obtaining approval, developers then apply for the environmental permit. This is granted after public consultations, which last a minimum of 30 days, to give local citizens affected by the project the chance to raise their concerns. Appeals from citizens are quite common. Denmark—where the EIA takes 298 days (150–500 days)—also conducts public consultations, including a four-week pre-hearing period and public

**FIGURE 5.13** Environmental permits by technology group (days required)




*Source:* RISE database, World Bank.

consultations of at least eight weeks. In the case of complaints, there must be further investigation. Such consultations in many OECD countries are one reason why it is quicker to get an environmental permit outside the OECD (box 5.14).

Seven out of nine countries with surveys predominantly on hydro projects report needing an environmental permit. With only 45 days needed to secure approval of the EIA, Rwanda is the quickest. Besides the oft-mentioned outlier Honduras, Columbia is the slowest: obtaining approval averages 541 days (360–718 days) and includes three steps.

Within the group of mixed countries, 15 out of 17 countries report that an environmental permit is required (only Turkey and Vietnam do not require one). Project developers in Belarus record the shortest waiting time, at only 36 days on average (30–60 days). After Japan with 334 days, Brazil has the longest waiting time, at 327 days on average (278–376 days). That country's environmental license comes in three stages: the preliminary license, the license for installation, and the license for operation.

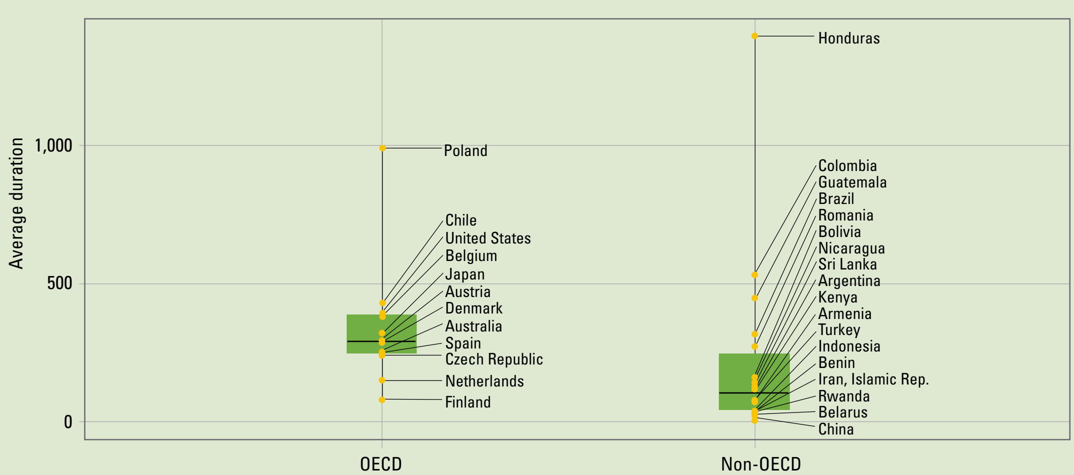
## Power purchase agreements

Negotiating and signing PPAs—reported in 27[16] countries (figure 5.14)—often impose a substantial time burden. Hydropower countries see the widest range of negotiation times. Developers in Kenya negotiate on average for 917 days (365—1,290 days), their counterparts in Honduras for 638 days (180–1,095 days). Both countries

### Box 5.14 Non-OECD countries process environmental permits faster than OECD countries

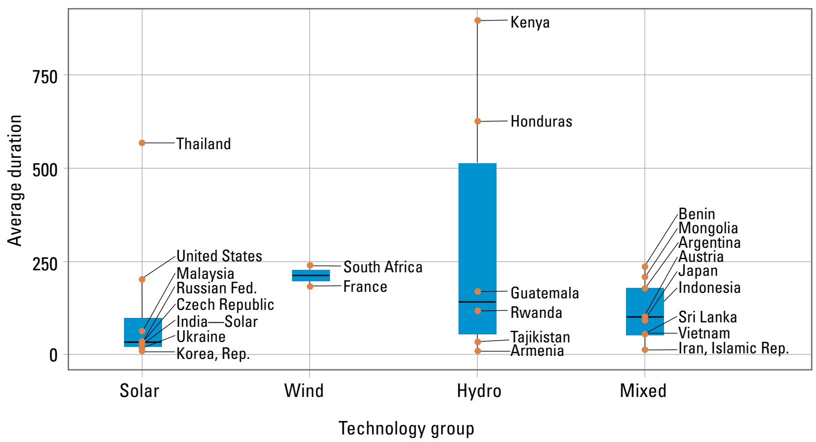
Wide ranges in the time it takes to secure an environmental permit are seen between non-OECD and OECD countries. Seventy-five percent of non-OECD projects were approved in the same time period that the bottom 25 percent of OECD projects were approved (box figure). A driving factor is the requirement in many OECD countries for a public consultation, which can be lengthy, as seen in Denmark. It is also possible that EIA procedures are more rigorous in OECD countries.

**EIA PROCEDURE TIMES (DAYS)**




*Source:* RISE database, World Bank.

**FIGURE 5.14** Power purchase agreements (days required)




*Source:* RISE database, World Bank.

report mainly hydropower projects. At the other extreme are Armenia and the Islamic Republic of Iran, where the PPA process on average takes five days (2–7 days) and eight days (1–20 days), respectively.

Usually the developer signs a PPA with a utility as the offtaker. In Armenia, Benin, Kenya, Rwanda, and Thailand, however, the utility and the regulator are involved. In France, the developer is required to first obtain a power purchase obligation certificate from the Regional Directorate of Environment, Planning, and Housing before signing the PPA with the utility. In Thailand, prior to signing a PPA, the developer must obtain a letter of intent from the utility indicating its intention to enter into a PPA; the next step is signing the agreement.

Renewable energy projects do not necessarily require a PPA. In countries that have a wholesale electricity market, a feed-in tariff may take the place of a PPA (box 5.15).

## Generation licenses and energy concessions

Twenty-two[17] countries require a generation license. The time required for the approving government agency to issue the license is as low as nine days in Indonesia and 14 days in Armenia and Poland. While Indonesia has projects across a range of technologies, Armenia is a hydropower and Poland a wind country. At the upper end of the time spectrum are Kenya with an average of 885 days (270–1,290 days) and Chile with 485 days (240–730 days), both of which primarily have hydropower projects.

Figure 5.15 breaks down permitting time by technology group. Obtaining a generation license is the quickest for predominantly wind and solar countries. Hydropower-dominated countries experience both the longest minimum time (210 days) and the longest overall range (13–885 days). Wind projects are the fastest (65 days) and have the smallest range (14–115 days).

The procedure for obtaining a generation license or energy concession can involve several steps. For large solar projects in Malaysia, a developer first obtains a provisional generation license valid for 60 days, which is replaced by a permanent license after an additional 90 days. Payments are required for both. In Romania, a renewable

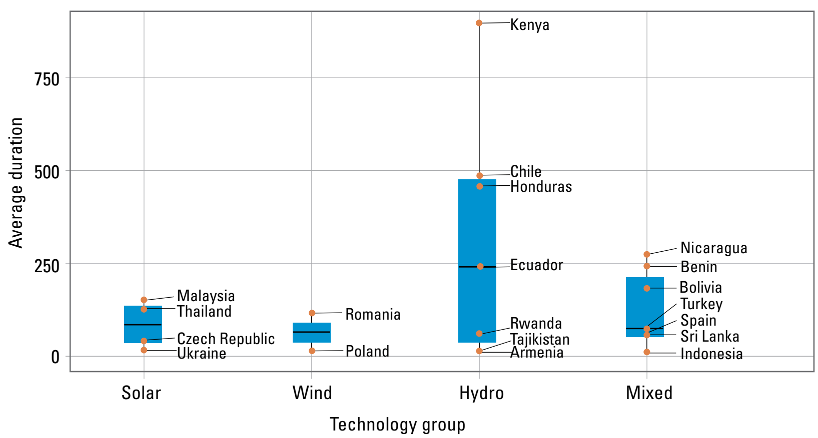
### Box 5.15 Renewable energy incentives and subsidies

Procedures for renewable energy incentives and subsidies range from registering for feed-in tariffs (Austria, Finland, Japan, Malaysia, and Ukraine), net metering (the Philippines), and price premiums (Denmark and the Netherlands), to qualifying for obtaining tradable green certificates (Belgium and Romania), to obtaining special financing terms (Australia). In Russia a project must be registered as a renewable energy installation to take part in the capacity-based renewable energy support scheme.

Gaining access to the local incentive program usually is not associated with steep costs, and can be as easy as completing an online feed-in tariff application and paying the application fee within seven days in Malaysia or obtaining Austria's eco-electricity plan decree approval to qualify for feed-in tariff support within 10 days. In other countries, this procedure creates long waiting times. In Japan, obtaining the feed-in tariff certification from the Ministry of Economy, Trade, and Industry takes on average 62 days.

To receive the price premium in Denmark, a wind energy project has to register with two different programs under the Promotion of Renewable Energy Act. First, a loss of value program compensates citizens for reduced property value due to a wind energy project in their vicinity (4.5 km or less from the nearest turbine). Second, project developers have to offer 20 percent of a project's shares to local residents. The offers must be made available for a minimum of eight weeks and must take place before grid connection of the project. If any shares are left, they must be offered for sale to residents of the municipality where the turbine is located (or with a coastline closest to the turbine). This approval is necessary to receive price premiums, but cannot stop a project. Both these programs increase local buy-in for renewable energy solutions and help cut project delays stemming from local opposition.

**FIGURE 5.15** Generation licenses (days required)




*Source:* RISE database, World Bank.

energy project operator has to obtain a generation license and a supplier license, together taking about 115 days. In Sri Lanka, an energy permit is issued by the Sri Lanka Sustainable Energy Authority, followed by a generation license issued by the Public Utilities Commission of Sri Lanka. It takes 58 days to get these two permits.

Slightly less than half the countries require generation licenses. In the United States, for example, the Federal Energy Regulatory Commission approves hydropower only. Other power plants do not require federal electricity generation licenses, but are regulated through environmental and land-use permits (though some states and cities have additional local regulations akin to generation licenses). In other countries, the generation license is considered part of the interconnection license or PPA processes, and no separate procedure is observed.

## NOTES

1. *Doing Business 2013*.
2. Of the 55 energy access-deficit countries surveyed, data for procedures, time, and cost to connect to the grid were obtained in urban areas of 52 countries and rural areas in 50 countries.
3. Kojima et al. 2016.
4. http://www.umeme.co.ug/about-umeme/yaka/new-connection.html.
5. Minigrids can be developed under the concession model and the ERIL model (the French acronym for local initiative for rural electrification). Through the first model the minigrid can be developed anywhere in the concession with the same tariff, which is approved once by the regulator. Through ERIL, each project must be approved by the regulator. The developer submits a tariff proposal and then obtains clearance for the business model as well as subsides.
6. Franz, Michael, Nico Peterschmidt, Michael Rohrer, and Bozhil Kondev 2014.
7. Tenenbaum et al. 2014.
8. Bhattacharyya 2013.
9. Tenenbaum et al. 2014.
10. Ellis 2010.
11. Super-efficient e quipment and Appliance Deployment (SEAD) Initiative, http://www.superefficient.org/Tools/Product-Certification-Databases.
12. Ellis 2010.
13. Kearney 2016.
14. One exception: Russia was not dropped as only one project in the country had completed the new permitting process for renewable energy sources at the time data were collected.
15. Colombia did report an interconnection approval but provided no time data, and is excluded from the comparison.
16. India and Nicaragua reported PPAs but did not specify the time, and are excluded from the following analysis.
17. Belgium and Jordan did report generation licenses but are excluded in the following analysis since the time was not specified.

# REFERENCES AND APPENDICES

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# APPENDIX 1.
# INDICATOR RESULTS BY COUNTRY

## OVERALL RISE SCORE

| Country | Overall score | Energy Access score | Renewable Energy score | Energy Efficiency score |
|---|---|---|---|---|
| Afghanistan | **23** | 24 | 27 | 18 |
| Algeria | **69** | 100 | 51 | 55 |
| Angola | **28** | 48 | 17 | 19 |
| Argentina | **66** | 100 | 53 | 44 |
| Armenia | **68** | 100 | 63 | 42 |
| Australia | **81** | 100 | 73 | 71 |
| Austria | **83** | 100 | 74 | 74 |
| Bahrain | **47** | 100 | 15 | 27 |
| Bangladesh | **49** | 68 | 57 | 23 |
| Belarus | **70** | 100 | 49 | 61 |
| Belgium | **84** | 100 | 76 | 78 |
| Benin | **35** | 49 | 32 | 24 |
| Bolivia | **64** | 100 | 55 | 37 |
| Brazil | **72** | 100 | 67 | 51 |
| Burkina Faso | **31** | 40 | 33 | 20 |
| Burundi | **37** | 45 | 54 | 12 |
| Cambodia | **42** | 70 | 34 | 21 |
| Cameroon | **49** | 69 | 40 | 38 |
| Canada | **90** | 100 | 87 | 84 |
| Central African Republic | **20** | 11 | 37 | 12 |
| Chad | **14** | 14 | 20 | 7 |
| Chile | **76** | 100 | 78 | 50 |
| China | **81** | 100 | 74 | 68 |
| Colombia | **70** | 100 | 59 | 51 |
| Congo, Dem. Rep. | **34** | 46 | 34 | 20 |
| Congo, Rep. | **17** | 26 | 16 | 10 |

*Note:* The averages were calculated before the scores were rounded for presentation in the report. For full scores, including decimals, please see the results online at http://rise.worldbank.org.

≥67 33<x<67 ≤33

### OVERALL RISE SCORE

| Country | Overall score | Energy Access score | Renewable Energy score | Energy Efficiency score |
|---|---|---|---|---|
| Côte d'Ivoire | **41** | 46 | 55 | 22 |
| Czech Republic | **85** | 100 | 87 | 69 |
| Denmark | **94** | 100 | 94 | 86 |
| Dominican Republic | **64** | 100 | 64 | 28 |
| Ecuador | **68** | 100 | 48 | 55 |
| Egypt, Arab Rep. | **71** | 100 | 65 | 48 |
| Eritrea | **20** | 29 | 9 | 22 |
| Ethiopia | **36** | 28 | 46 | 35 |
| Finland | **82** | 100 | 83 | 63 |
| France | **85** | 100 | 81 | 75 |
| Germany | **89** | 100 | 90 | 77 |
| Ghana | **55** | 63 | 60 | 42 |
| Greece | **80** | 100 | 84 | 56 |
| Guatemala | **50** | 68 | 59 | 23 |
| Guinea | **43** | 57 | 35 | 37 |
| Haiti | **11** | 13 | 7 | 14 |
| Honduras | **33** | 37 | 42 | 22 |
| India | **70** | 84 | 67 | 60 |
| Indonesia | **50** | 61 | 55 | 34 |
| Iran, Islamic Rep. | **74** | 100 | 59 | 62 |
| Italy | **86** | 100 | 85 | 73 |
| Japan | **82** | 100 | 78 | 68 |
| Jordan | **75** | 100 | 70 | 55 |
| Kazakhstan | **78** | 100 | 75 | 59 |
| Kenya | **64** | 82 | 63 | 47 |
| Korea, Rep. | **85** | 100 | 72 | 83 |
| Kuwait | **55** | 100 | 34 | 30 |

## OVERALL RISE SCORE

| Country | Overall score | Energy Access score | Renewable Energy score | Energy Efficiency score |
|---|---|---|---|---|
| Kyrgyz Republic | **64** | 100 | 53 | 38 |
| Lao PDR | **33** | 47 | 46 | 8 |
| Lebanon | **52** | 100 | 20 | 35 |
| Liberia | **15** | 20 | 15 | 11 |
| Madagascar | **26** | 27 | 35 | 17 |
| Malawi | **51** | 64 | 65 | 26 |
| Malaysia | **73** | 100 | 68 | 52 |
| Maldives | **50** | 100 | 36 | 14 |
| Mali | **30** | 39 | 42 | 8 |
| Mauritania | **13** | 19 | 11 | 9 |
| Mexico | **83** | 100 | 72 | 78 |
| Mongolia | **43** | 39 | 62 | 28 |
| Morocco | **69** | 100 | 65 | 42 |
| Mozambique | **25** | 38 | 31 | 6 |
| Myanmar | **38** | 59 | 43 | 13 |
| Nepal | **36** | 43 | 45 | 20 |
| Netherlands | **90** | 100 | 92 | 76 |
| Nicaragua | **55** | 68 | 55 | 40 |
| Niger | **17** | 29 | 11 | 12 |
| Nigeria | **20** | 22 | 29 | 11 |
| Pakistan | **58** | 59 | 77 | 38 |
| Peru | **53** | 67 | 61 | 31 |
| Philippines | **64** | 82 | 67 | 42 |
| Poland | **78** | 100 | 78 | 57 |
| Qatar | **62** | 100 | 35 | 50 |
| Romania | **87** | 100 | 74 | 86 |
| Russian Federation | **77** | 100 | 61 | 70 |
| Rwanda | **40** | 41 | 59 | 21 |
| Saudi Arabia | **61** | 100 | 33 | 50 |

## OVERALL RISE SCORE

| Country | Overall score | Energy Access score | Renewable Energy score | Energy Efficiency score |
|---|---|---|---|---|
| Senegal | **48** | 69 | 54 | 19 |
| Sierra Leone | **14** | 17 | 8 | 18 |
| Solomon Islands | **33** | 40 | 46 | 12 |
| Somalia | **5** | 3 | 7 | 6 |
| South Africa | **70** | 71 | 68 | 69 |
| South Sudan | **15** | 18 | 10 | 16 |
| Spain | **82** | 100 | 79 | 68 |
| Sri Lanka | **61** | 67 | 62 | 54 |
| Sudan | **25** | 35 | 21 | 19 |
| Sweden | **82** | 100 | 84 | 60 |
| Switzerland | **85** | 100 | 89 | 67 |
| Tajikistan | **60** | 100 | 36 | 44 |
| Tanzania | **55** | 75 | 59 | 29 |
| Thailand | **74** | 100 | 59 | 63 |
| Togo | **28** | 32 | 26 | 25 |
| Tunisia | **72** | 100 | 50 | 68 |
| Turkey | **79** | 100 | 71 | 65 |
| Uganda | **55** | 78 | 54 | 35 |
| Ukraine | **67** | 100 | 64 | 37 |
| United Arab Emirates | **77** | 100 | 67 | 63 |
| United Kingdom | **88** | 100 | 89 | 77 |
| United States | **90** | 100 | 85 | 87 |
| Uzbekistan | **61** | 100 | 30 | 52 |
| Vanuatu | **25** | 48 | 17 | 11 |
| Venezuela, RB | **56** | 100 | 25 | 42 |
| Vietnam | **78** | 100 | 64 | 70 |
| Yemen, Rep. | **19** | 19 | 24 | 13 |
| Zambia | **43** | 61 | 47 | 21 |
| Zimbabwe | **25** | 42 | 18 | 14 |

*Source:* RISE database, World Bank.

## ENERGY ACCESS SCORE

| Country | EA score | Existence and monitoring of officially approved electrification plan | Scope of officially approved electrification plan | Framework for grid electrification | Framework for minigrids | Framework for stand-alone systems | Consumer affordability of electricity | Utility transparency and monitoring | Utility creditworthiness |
|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | 24 | 0 | 0 | 33 | 35 | 44 | 50 | 29 | 0 |
| Algeria | 100 | | | | | | | | |
| Angola | 48 | 80 | 50 | 33 | 53 | 62 | 100 | 8 | 0 |
| Argentina | 100 | | | | | | | | |
| Armenia | 100 | | | | | | | | |
| Australia | 100 | | | | | | | | |
| Austria | 100 | | | | | | | | |
| Bahrain | 100 | | | | | | | | |
| Bangladesh | 68 | 80 | 25 | 33 | 74 | 80 | 100 | 100 | 54 |
| Belarus | 100 | | | | | | | | |
| Belgium | 100 | | | | | | | | |
| Benin | 49 | 80 | 50 | 33 | 68 | 36 | 75 | 37 | 16 |
| Bolivia | 100 | | | | | | | | |
| Brazil | 100 | | | | | | | | |
| Burkina Faso | 40 | 80 | 50 | 33 | 58 | 22 | 0 | 42 | 34 |
| Burundi | 45 | 0 | 0 | 17 | 48 | 11 | 100 | 87 | 100 |
| Cambodia | 70 | 80 | 38 | 100 | 65 | 93 | 50 | 46 | 90 |
| Cameroon | 69 | 80 | 88 | 33 | 65 | 73 | 100 | 67 | 50 |
| Canada | 100 | | | | | | | | |
| Central African Republic | 11 | 0 | 0 | 0 | 10 | 11 | 0 | 17 | 50 |
| Chad | 14 | 0 | 0 | 17 | 30 | 11 | 50 | 4 | 0 |
| Chile | 100 | | | | | | | | |
| China | 100 | | | | | | | | |
| Colombia | 100 | | | | | | | | |
| Congo, Dem. Rep. | 46 | 0 | 0 | 33 | 53 | 82 | 100 | 42 | 60 |
| Congo, Rep. | 26 | 60 | 0 | 33 | 10 | 11 | 50 | 42 | 0 |
| Côte d'Ivoire | 46 | 40 | 0 | 50 | 23 | 36 | 100 | 87 | 34 |
| Czech Republic | 100 | | | | | | | | |

≥67 33<x<67 ≤33

## ENERGY ACCESS SCORE

| Country | EA score | Existence and monitoring of officially approved electrification plan | Scope of officially approved electrification plan | Framework for grid electrification | Framework for minigrids | Framework for stand-alone systems | Consumer affordability of electricity | Utility transparency and monitoring | Utility creditworthiness |
|---|---|---|---|---|---|---|---|---|---|
| Denmark | 100 | | | | | | | | |
| Dominican Republic | 100 | | | | | | | | |
| Ecuador | 100 | | | | | | | | |
| Egypt, Arab Rep. | 100 | | | | | | | | |
| Eritrea | 29 | 60 | 50 | 33 | 5 | 18 | 48 | 17 | 0 |
| Ethiopia | 28 | 0 | 0 | 50 | 40 | 69 | 50 | 17 | 0 |
| Finland | 100 | | | | | | | | |
| France | 100 | | | | | | | | |
| Germany | 100 | | | | | | | | |
| Ghana | 63 | 80 | 50 | 33 | 30 | 93 | 100 | 100 | 14 |
| Greece | 100 | | | | | | | | |
| Guatemala | 68 | 100 | 75 | 50 | 39 | 33 | 100 | 62 | 87 |
| Guinea | 57 | 80 | 75 | 17 | 68 | 18 | 100 | 67 | 35 |
| Haiti | 13 | 0 | 0 | 0 | 43 | 11 | 50 | 0 | 0 |
| Honduras | 37 | 60 | 50 | 50 | 43 | 22 | 50 | 21 | 0 |
| India | 84 | 80 | 75 | 100 | 77 | 69 | 100 | 96 | 76 |
| Indonesia | 61 | 100 | 75 | 33 | 23 | 11 | 100 | 100 | 50 |
| Iran, Islamic Rep. | 100 | | | | | | | | |
| Italy | 100 | | | | | | | | |
| Japan | 100 | | | | | | | | |
| Jordan | 100 | | | | | | | | |
| Kazakhstan | 100 | | | | | | | | |
| Kenya | 82 | 100 | 50 | 67 | 66 | 93 | 100 | 96 | 86 |
| Korea, Rep. | 100 | | | | | | | | |
| Kuwait | 100 | | | | | | | | |
| Kyrgyz Republic | 100 | | | | | | | | |
| Lao PDR | 47 | 60 | 50 | 17 | 39 | 11 | 100 | 71 | 25 |
| Lebanon | 100 | | | | | | | | |

## ENERGY ACCESS SCORE

| Country | EA score | Existence and monitoring of officially approved electrification plan | Scope of officially approved electrification plan | Framework for grid electrification | Framework for minigrids | Framework for stand-alone systems | Consumer affordability of electricity | Utility transparency and monitoring | Utility creditworthiness |
|---|---|---|---|---|---|---|---|---|---|
| Liberia | 20 | 0 | 0 | 17 | 30 | 56 | 0 | 25 | 36 |
| Madagascar | 27 | 0 | 0 | 33 | 78 | 22 | 50 | 33 | 0 |
| Malawi | 64 | 80 | 38 | 33 | 74 | 76 | 29 | 83 | 100 |
| Malaysia | 100 | | | | | | | | |
| Maldives | 100 | | | | | | | | |
| Mali | 39 | 0 | 0 | 33 | 56 | 11 | 100 | 62 | 50 |
| Mauritania | 19 | 0 | 0 | 33 | 48 | 11 | 50 | 8 | 0 |
| Mexico | 100 | | | | | | | | |
| Mongolia | 39 | 0 | 0 | 100 | 52 | 22 | 50 | 87 | 0 |
| Morocco | 100 | | | | | | | | |
| Mozambique | 38 | 0 | 0 | 17 | 35 | 11 | 100 | 83 | 59 |
| Myanmar | 59 | 100 | 38 | 33 | 48 | 67 | 100 | 8 | 75 |
| Nepal | 43 | 0 | 0 | 33 | 57 | 89 | 95 | 67 | 0 |
| Netherlands | 100 | | | | | | | | |
| Nicaragua | 68 | 100 | 50 | 100 | 82 | 56 | 100 | 58 | 0 |
| Niger | 29 | 0 | 0 | 17 | 48 | 22 | 45 | 67 | 34 |
| Nigeria | 22 | 0 | 0 | 17 | 35 | 22 | 100 | 0 | 0 |
| Pakistan | 59 | 0 | 0 | 83 | 74 | 73 | 100 | 96 | 45 |
| Peru | 67 | 80 | 63 | 83 | 10 | 44 | 100 | 92 | 63 |
| Philippines | 82 | 100 | 75 | 67 | 85 | 62 | 100 | 87 | 82 |
| Poland | 100 | | | | | | | | |
| Qatar | 100 | | | | | | | | |
| Romania | 100 | | | | | | | | |
| Russian Federation | 100 | | | | | | | | |
| Rwanda | 41 | 80 | 50 | 67 | 66 | 44 | 0 | 21 | 0 |
| Saudi Arabia | 100 | | | | | | | | |
| Senegal | 69 | 100 | 88 | 100 | 72 | 36 | 50 | 96 | 15 |
| Sierra Leone | 17 | 0 | 0 | 0 | 35 | 44 | 50 | 8 | 0 |

## ENERGY ACCESS SCORE

| Country | EA score | Existence and monitoring of officially approved electrification plan | Scope of officially approved electrification plan | Framework for grid electrification | Framework for minigrids | Framework for stand-alone systems | Consumer affordability of electricity | Utility transparency and monitoring | Utility creditworthiness |
|---|---|---|---|---|---|---|---|---|---|
| Solomon Islands | 40 | 0 | 0 | 33 | 56 | 22 | 17 | 87 | 100 |
| Somalia | 3 | 0 | 0 | 0 | 5 | 22 | 0 | 0 | 0 |
| South Africa | 71 | 100 | 38 | 100 | 10 | 76 | 100 | 96 | 51 |
| South Sudan | 18 | 0 | 0 | 0 | 30 | 11 | 42 | 62 | 0 |
| Spain | 100 | | | | | | | | |
| Sri Lanka | 67 | 80 | 88 | 67 | 59 | 49 | 100 | 87 | 9 |
| Sudan | 35 | 0 | 0 | 100 | 35 | 11 | 50 | 50 | 38 |
| Sweden | 100 | | | | | | | | |
| Switzerland | 100 | | | | | | | | |
| Tajikistan | 100 | | | | | | | | |
| Tanzania | 75 | 100 | 50 | 100 | 96 | 73 | 100 | 83 | 0 |
| Thailand | 100 | | | | | | | | |
| Togo | 32 | 0 | 0 | 67 | 10 | 11 | 50 | 50 | 68 |
| Tunisia | 100 | | | | | | | | |
| Turkey | 100 | | | | | | | | |
| Uganda | 78 | 100 | 63 | 67 | 64 | 93 | 100 | 79 | 59 |
| Ukraine | 100 | | | | | | | | |
| United Arab Emirates | 100 | | | | | | | | |
| United Kingdom | 100 | | | | | | | | |
| United States | 100 | | | | | | | | |
| Uzbekistan | 100 | | | | | | | | |
| Vanuatu | 48 | 80 | 50 | 67 | 48 | 62 | 50 | 25 | 0 |
| Venezuela, RB | 100 | | | | | | | | |
| Vietnam | 100 | | | | | | | | |
| Yemen, Rep. | 19 | 0 | 0 | 33 | 19 | 22 | 50 | 29 | 0 |
| Zambia | 61 | 80 | 75 | 67 | 43 | 29 | 50 | 67 | 82 |
| Zimbabwe | 42 | 40 | 50 | 17 | 69 | 22 | 50 | 83 | 7 |

*Source:* RISE database, World Bank.

## RENEWABLE ENERGY SCORE

| Country | RE score | Legal framework for renewable energy | Planning for renewable energy expansion | Incentives and regulatory support for renewable energy | Attributes of financial and regulatory incentives | Network connection and pricing | Counterparty risk | Carbon pricing and monitoring mechanism |
|---|---|---|---|---|---|---|---|---|
| Afghanistan | 27 | 50 | 68 | 0 | 0 | 61 | 10 | 0 |
| Algeria | 51 | 100 | 87 | 88 | 56 | 17 | 11 | 0 |
| Angola | 17 | 0 | 31 | 38 | 0 | 17 | 36 | 0 |
| Argentina | 53 | 100 | 37 | 75 | 56 | 33 | 69 | 0 |
| Armenia | 63 | 100 | 60 | 75 | 100 | 33 | 73 | 0 |
| Australia | 73 | 100 | 74 | 50 | 83 | 56 | 100 | 50 |
| Austria | 74 | 100 | 44 | 63 | 83 | 58 | 100 | 70 |
| Bahrain | 15 | 50 | 13 | 0 | 33 | 0 | 11 | 0 |
| Bangladesh | 57 | 100 | 51 | 75 | 56 | 33 | 85 | 0 |
| Belarus | 49 | 100 | 44 | 63 | 50 | 75 | 10 | 0 |
| Belgium | 76 | 100 | 60 | 63 | 56 | 83 | 100 | 70 |
| Benin | 32 | 50 | 63 | 50 | 11 | 33 | 18 | 0 |
| Bolivia | 55 | 100 | 68 | 75 | 67 | 47 | 29 | 0 |
| Brazil | 67 | 100 | 86 | 50 | 89 | 89 | 54 | 0 |
| Burkina Faso | 33 | 100 | 50 | 25 | 0 | 0 | 59 | 0 |
| Burundi | 54 | 100 | 49 | 75 | 89 | 0 | 62 | 0 |
| Cambodia | 34 | 50 | 27 | 63 | 33 | 22 | 45 | 0 |
| Cameroon | 40 | 100 | 40 | 38 | 33 | 33 | 39 | 0 |
| Canada | 87 | 100 | 70 | 100 | 89 | 89 | 100 | 61 |
| Central African Republic | 37 | 100 | 61 | 25 | 33 | 17 | 22 | 0 |
| Chad | 20 | 50 | 0 | 25 | 33 | 0 | 35 | 0 |
| Chile | 78 | 100 | 65 | 88 | 100 | 92 | 100 | 0 |
| China | 74 | 100 | 36 | 63 | 78 | 89 | 100 | 54 |
| Colombia | 59 | 100 | 58 | 75 | 67 | 58 | 51 | 0 |
| Congo, Dem. Rep. | 34 | 100 | 36 | 38 | 33 | 0 | 34 | 0 |
| Congo, Rep. | 16 | 50 | 0 | 38 | 11 | 0 | 14 | 0 |
| Côte d'Ivoire | 55 | 100 | 47 | 100 | 67 | 0 | 74 | 0 |
| Czech Republic | 87 | 100 | 71 | 75 | 89 | 100 | 100 | 73 |

≥67 | 33<x<67 | ≤33

## RENEWABLE ENERGY SCORE

| Country | RE score | Legal framework for renewable energy | Planning for renewable energy expansion | Incentives and regulatory support for renewable energy | Attributes of financial and regulatory incentives | Network connection and pricing | Counterparty risk | Carbon pricing and monitoring mechanism |
|---|---|---|---|---|---|---|---|---|
| Denmark | 94 | 100 | 100 | 100 | 78 | 89 | 100 | 95 |
| Dominican Republic | 64 | 100 | 70 | 75 | 89 | 92 | 21 | 0 |
| Ecuador | 48 | 100 | 77 | 50 | 28 | 67 | 17 | 0 |
| Egypt, Arab Rep. | 65 | 100 | 75 | 75 | 89 | 75 | 42 | 0 |
| Eritrea | 9 | 0 | 58 | 0 | 0 | 0 | 6 | 0 |
| Ethiopia | 46 | 100 | 77 | 38 | 67 | 33 | 6 | 0 |
| Finland | 83 | 100 | 75 | 88 | 39 | 100 | 100 | 83 |
| France | 81 | 100 | 66 | 63 | 89 | 58 | 100 | 90 |
| Germany | 90 | 100 | 97 | 75 | 100 | 89 | 100 | 73 |
| Ghana | 60 | 100 | 28 | 50 | 78 | 92 | 71 | 0 |
| Greece | 84 | 100 | 74 | 88 | 83 | 92 | 79 | 73 |
| Guatemala | 59 | 100 | 67 | 88 | 89 | 17 | 50 | 0 |
| Guinea | 35 | 100 | 53 | 25 | 0 | 0 | 67 | 0 |
| Haiti | 7 | 0 | 16 | 0 | 0 | 0 | 33 | 0 |
| Honduras | 42 | 100 | 59 | 75 | 50 | 0 | 7 | 0 |
| India | 67 | 100 | 68 | 75 | 100 | 67 | 57 | 0 |
| Indonesia | 55 | 100 | 60 | 75 | 50 | 50 | 50 | 0 |
| Iran, Islamic Rep. | 59 | 100 | 39 | 100 | 67 | 58 | 49 | 0 |
| Italy | 85 | 100 | 79 | 100 | 100 | 100 | 40 | 73 |
| Japan | 78 | 100 | 23 | 75 | 100 | 64 | 100 | 84 |
| Jordan | 70 | 100 | 91 | 88 | 78 | 67 | 70 | 0 |
| Kazakhstan | 75 | 100 | 65 | 75 | 83 | 92 | 36 | 78 |
| Kenya | 63 | 100 | 69 | 88 | 100 | 25 | 60 | 0 |
| Korea, Rep. | 72 | 100 | 63 | 75 | 56 | 25 | 100 | 83 |
| Kuwait | 34 | 50 | 41 | 38 | 11 | 0 | 100 | 0 |
| Kyrgyz Republic | 53 | 100 | 43 | 75 | 33 | 58 | 64 | 0 |
| Lao PDR | 46 | 100 | 53 | 38 | 33 | 67 | 32 | 0 |
| Lebanon | 20 | 50 | 62 | 25 | 0 | 0 | 3 | 0 |

## RENEWABLE ENERGY SCORE

| Country | RE score | Legal framework for renewable energy | Planning for renewable energy expansion | Incentives and regulatory support for renewable energy | Attributes of financial and regulatory incentives | Network connection and pricing | Counterparty risk | Carbon pricing and monitoring mechanism |
|---|---|---|---|---|---|---|---|---|
| Liberia | 15 | 50 | 6 | 25 | 0 | 0 | 20 | 0 |
| Madagascar | 35 | 100 | 40 | 50 | 11 | 0 | 44 | 0 |
| Malawi | 65 | 100 | 50 | 75 | 100 | 33 | 94 | 0 |
| Malaysia | 68 | 100 | 67 | 75 | 78 | 58 | 100 | 0 |
| Maldives | 36 | 50 | 63 | 100 | 33 | 0 | 3 | 0 |
| Mali | 42 | 50 | 48 | 75 | 50 | 0 | 71 | 0 |
| Mauritania | 11 | 0 | 75 | 0 | 0 | 0 | 3 | 0 |
| Mexico | 72 | 100 | 73 | 88 | 50 | 61 | 56 | 74 |
| Mongolia | 62 | 100 | 50 | 75 | 83 | 67 | 62 | 0 |
| Morocco | 65 | 100 | 73 | 100 | 67 | 50 | 62 | 0 |
| Mozambique | 31 | 50 | 28 | 50 | 44 | 0 | 47 | 0 |
| Myanmar | 43 | 50 | 40 | 50 | 100 | 0 | 61 | 0 |
| Nepal | 45 | 100 | 43 | 75 | 67 | 11 | 22 | 0 |
| Netherlands | 92 | 100 | 82 | 100 | 100 | 92 | 100 | 73 |
| Nicaragua | 55 | 100 | 73 | 100 | 42 | 53 | 19 | 0 |
| Niger | 11 | 0 | 19 | 25 | 0 | 0 | 34 | 0 |
| Nigeria | 29 | 100 | 13 | 25 | 50 | 17 | 0 | 0 |
| Pakistan | 77 | 100 | 59 | 100 | 100 | 100 | 80 | 0 |
| Peru | 61 | 100 | 39 | 88 | 89 | 58 | 52 | 0 |
| Philippines | 67 | 100 | 55 | 88 | 75 | 58 | 90 | 0 |
| Poland | 78 | 100 | 19 | 50 | 100 | 100 | 100 | 75 |
| Qatar | 35 | 50 | 69 | 25 | 0 | 0 | 100 | 0 |
| Romania | 74 | 100 | 91 | 38 | 67 | 92 | 60 | 73 |
| Russian Federation | 61 | 100 | 31 | 75 | 100 | 69 | 49 | 0 |
| Rwanda | 59 | 100 | 56 | 100 | 67 | 50 | 40 | 0 |
| Saudi Arabia | 33 | 50 | 29 | 0 | 33 | 22 | 100 | 0 |
| Senegal | 54 | 100 | 44 | 75 | 67 | 25 | 70 | 0 |
| Sierra Leone | 8 | 0 | 25 | 25 | 0 | 0 | 3 | 0 |

## RENEWABLE ENERGY SCORE

| Country | RE score | Legal framework for renewable energy | Planning for renewable energy expansion | Incentives and regulatory support for renewable energy | Attributes of financial and regulatory incentives | Network connection and pricing | Counterparty risk | Carbon pricing and monitoring mechanism |
|---|---|---|---|---|---|---|---|---|
| Solomon Islands | 46 | 100 | 38 | 25 | 33 | 67 | 62 | 0 |
| Somalia | 7 | 0 | 0 | 13 | 33 | 0 | 0 | 0 |
| South Africa | 68 | 100 | 74 | 100 | 56 | 100 | 49 | 0 |
| South Sudan | 10 | 0 | 34 | 0 | 0 | 17 | 21 | 0 |
| Spain | 79 | 100 | 84 | 63 | 100 | 81 | 54 | 73 |
| Sri Lanka | 62 | 100 | 85 | 75 | 83 | 58 | 32 | 0 |
| Sudan | 21 | 50 | 38 | 0 | 0 | 33 | 29 | 0 |
| Sweden | 84 | 100 | 57 | 75 | 89 | 81 | 100 | 88 |
| Switzerland | 89 | 100 | 83 | 75 | 100 | 100 | 100 | 68 |
| Tajikistan | 36 | 100 | 38 | 38 | 67 | 0 | 12 | 0 |
| Tanzania | 59 | 100 | 61 | 75 | 100 | 17 | 61 | 0 |
| Thailand | 59 | 50 | 82 | 63 | 100 | 58 | 64 | 0 |
| Togo | 26 | 50 | 19 | 63 | 11 | 0 | 39 | 0 |
| Tunisia | 50 | 100 | 41 | 50 | 67 | 58 | 34 | 0 |
| Turkey | 71 | 100 | 50 | 75 | 67 | 100 | 58 | 50 |
| Uganda | 54 | 100 | 63 | 100 | 67 | 0 | 46 | 0 |
| Ukraine | 64 | 100 | 69 | 50 | 100 | 58 | 69 | 0 |
| United Arab Emirates | 67 | 100 | 86 | 75 | 89 | 22 | 100 | 0 |
| United Kingdom | 89 | 100 | 82 | 88 | 81 | 100 | 100 | 73 |
| United States | 85 | 100 | 96 | 63 | 89 | 92 | 100 | 53 |
| Uzbekistan | 30 | 100 | 31 | 38 | 33 | 0 | 8 | 0 |
| Vanuatu | 17 | 50 | 27 | 0 | 33 | 0 | 8 | 0 |
| Venezuela, RB | 25 | 100 | 42 | 13 | 0 | 0 | 18 | 0 |
| Vietnam | 64 | 100 | 60 | 75 | 100 | 67 | 47 | 0 |
| Yemen, Rep. | 24 | 50 | 63 | 38 | 11 | 0 | 10 | 0 |
| Zambia | 47 | 100 | 19 | 75 | 67 | 17 | 50 | 0 |
| Zimbabwe | 18 | 50 | 0 | 13 | 33 | 0 | 30 | 0 |

*Source:* RISE database, World Bank.

## ENERGY EFFICIENCY

| Country | EE score | National energy efficiency planning | Energy efficiency entities | Information provided to electricity consumers | Incentives from electricity rate structures | Incentives & mandates: large consumers | Incentives & mandates: public sector | Incentives & mandates: utilities | Financing mechanisms for energy efficiency | Minimum energy efficiency performance standards | Energy labeling systems | Building energy codes | Carbon pricing and monitoring |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | 18 | 33 | 57 | 60 | 33 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 0 |
| Algeria | 55 | 83 | 100 | 58 | 69 | 100 | 38 | 58 | 50 | 17 | 67 | 20 | 0 |
| Angola | 19 | 33 | 43 | 56 | 50 | 0 | 38 | 0 | 0 | 6 | 0 | 0 | 0 |
| Argentina | 44 | 33 | 71 | 29 | 54 | 56 | 63 | 42 | 33 | 33 | 67 | 47 | 0 |
| Armenia | 42 | 67 | 57 | 63 | 67 | 0 | 50 | 42 | 92 | 0 | 0 | 67 | 0 |
| Australia | 71 | 67 | 71 | 58 | 96 | 67 | 88 | 17 | 92 | 83 | 67 | 93 | 50 |
| Austria | 74 | 75 | 57 | 51 | 67 | 94 | 88 | 63 | 92 | 86 | 67 | 83 | 70 |
| Bahrain | 27 | 0 | 100 | 60 | 44 | 11 | 0 | 0 | 0 | 28 | 17 | 60 | 0 |
| Bangladesh | 23 | 67 | 71 | 33 | 54 | 0 | 0 | 13 | 33 | 0 | 0 | 0 | 0 |
| Belarus | 61 | 92 | 100 | 56 | 59 | 33 | 88 | 50 | 75 | 69 | 42 | 67 | 0 |
| Belgium | 78 | 67 | 100 | 61 | 89 | 89 | 63 | 75 | 92 | 67 | 67 | 93 | 70 |
| Benin | 24 | 75 | 71 | 42 | 81 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bolivia | 37 | 33 | 71 | 57 | 56 | 22 | 0 | 50 | 83 | 17 | 50 | 0 | 0 |
| Brazil | 51 | 75 | 100 | 63 | 67 | 0 | 25 | 29 | 50 | 89 | 83 | 27 | 0 |
| Burkina Faso | 20 | 100 | 14 | 42 | 85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Burundi | 12 | 33 | 14 | 53 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cambodia | 21 | 33 | 100 | 75 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cameroon | 38 | 100 | 100 | 42 | 89 | 17 | 25 | 17 | 67 | 0 | 0 | 0 | 0 |
| Canada | 84 | 92 | 86 | 69 | 74 | 89 | 88 | 88 | 100 | 97 | 83 | 87 | 61 |
| Central African Republic | 12 | 33 | 0 | 54 | 44 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chad | 7 | 0 | 0 | 40 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chile | 50 | 100 | 71 | 63 | 100 | 22 | 25 | 0 | 50 | 33 | 83 | 53 | 0 |
| China | 68 | 92 | 86 | 42 | 78 | 89 | 50 | 50 | 100 | 58 | 83 | 40 | 54 |
| Colombia | 51 | 92 | 86 | 63 | 37 | 78 | 0 | 17 | 92 | 42 | 83 | 20 | 0 |
| Congo, Dem. Rep. | 20 | 100 | 14 | 60 | 67 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| Congo, Rep. | 10 | 0 | 0 | 33 | 76 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 |

≥67   33<x<67   ≤33

## ENERGY EFFICIENCY

| Country | EE score | National energy efficiency planning | Energy efficiency entities | Information provided to electricity consumers | Incentives from electricity rate structures | Incentives & mandates: large consumers | Incentives & mandates: public sector | Incentives & mandates: utilities | Financing mechanisms for energy efficiency | Minimum energy efficiency performance standards | Energy labeling systems | Building energy codes | Carbon pricing and monitoring |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Côte d'Ivoire | 22 | 33 | 100 | 41 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Czech Republic | 69 | 67 | 86 | 60 | 78 | 50 | 88 | 25 | 92 | 67 | 50 | 93 | 73 |
| Denmark | 86 | 75 | 100 | 94 | 78 | 78 | 100 | 83 | 83 | 100 | 67 | 83 | 95 |
| Dominican Republic | 28 | 33 | 14 | 63 | 63 | 28 | 13 | 0 | 100 | 11 | 8 | 0 | 0 |
| Ecuador | 55 | 67 | 86 | 63 | 67 | 61 | 25 | 71 | 83 | 67 | 67 | 0 | 0 |
| Egypt, Arab Rep. | 48 | 100 | 71 | 42 | 57 | 61 | 13 | 17 | 67 | 50 | 33 | 67 | 0 |
| Eritrea | 22 | 67 | 100 | 54 | 33 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ethiopia | 35 | 100 | 100 | 54 | 44 | 22 | 0 | 25 | 67 | 8 | 0 | 0 | 0 |
| Finland | 63 | 92 | 100 | 63 | 67 | 33 | 50 | 25 | 50 | 56 | 50 | 93 | 83 |
| France | 75 | 92 | 86 | 75 | 78 | 56 | 63 | 63 | 75 | 61 | 67 | 93 | 90 |
| Germany | 77 | 83 | 100 | 50 | 59 | 100 | 75 | 0 | 92 | 100 | 100 | 93 | 73 |
| Ghana | 42 | 75 | 86 | 48 | 67 | 67 | 38 | 25 | 0 | 50 | 50 | 0 | 0 |
| Greece | 56 | 67 | 86 | 40 | 48 | 28 | 63 | 29 | 25 | 56 | 67 | 93 | 73 |
| Guatemala | 23 | 50 | 14 | 69 | 22 | 17 | 38 | 0 | 50 | 0 | 0 | 20 | 0 |
| Guinea | 37 | 92 | 71 | 53 | 52 | 78 | 0 | 0 | 0 | 50 | 50 | 0 | 0 |
| Haiti | 14 | 33 | 14 | 54 | 52 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 |
| Honduras | 22 | 0 | 71 | 46 | 57 | 0 | 0 | 0 | 0 | 42 | 42 | 0 | 0 |
| India | 60 | 83 | 86 | 63 | 78 | 89 | 25 | 67 | 92 | 67 | 75 | 0 | 0 |
| Indonesia | 34 | 67 | 86 | 63 | 44 | 94 | 0 | 0 | 17 | 11 | 25 | 0 | 0 |
| Iran, Islamic Rep. | 62 | 75 | 86 | 52 | 61 | 100 | 63 | 63 | 50 | 67 | 100 | 30 | 0 |
| Italy | 73 | 92 | 71 | 61 | 93 | 61 | 63 | 25 | 100 | 83 | 67 | 93 | 73 |
| Japan | 68 | 75 | 71 | 69 | 81 | 89 | 0 | 17 | 92 | 83 | 83 | 67 | 84 |
| Jordan | 55 | 92 | 86 | 63 | 56 | 50 | 63 | 0 | 100 | 28 | 50 | 80 | 0 |
| Kazakhstan | 59 | 100 | 100 | 33 | 78 | 67 | 13 | 25 | 75 | 39 | 33 | 70 | 78 |
| Kenya | 47 | 67 | 100 | 60 | 48 | 67 | 38 | 58 | 0 | 56 | 67 | 0 | 0 |
| Korea, Rep. | 83 | 67 | 100 | 79 | 81 | 89 | 100 | 50 | 83 | 100 | 83 | 80 | 83 |

## ENERGY EFFICIENCY

| Country | EE score | National energy efficiency planning | Energy efficiency entities | Information provided to electricity consumers | Incentives from electricity rate structures | Incentives & mandates: large consumers | Incentives & mandates: public sector | Incentives & mandates: utilities | Financing mechanisms for energy efficiency | Minimum energy efficiency performance standards | Energy labeling systems | Building energy codes | Carbon pricing and monitoring |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kuwait | 30 | 100 | 29 | 54 | 44 | 33 | 25 | 0 | 0 | 8 | 0 | 70 | 0 |
| Kyrgyz Republic | 38 | 75 | 100 | 50 | 37 | 17 | 0 | 25 | 50 | 0 | 25 | 73 | 0 |
| Lao PDR | 8 | 0 | 29 | 28 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lebanon | 35 | 100 | 86 | 40 | 57 | 33 | 0 | 13 | 67 | 0 | 0 | 27 | 0 |
| Liberia | 11 | 33 | 0 | 60 | 33 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 |
| Madagascar | 17 | 75 | 14 | 38 | 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Malawi | 26 | 33 | 86 | 42 | 44 | 33 | 0 | 8 | 50 | 11 | 0 | 0 | 0 |
| Malaysia | 52 | 67 | 86 | 50 | 78 | 72 | 75 | 29 | 50 | 50 | 33 | 30 | 0 |
| Maldives | 14 | 0 | 0 | 63 | 44 | 0 | 0 | 8 | 50 | 0 | 0 | 0 | 0 |
| Mali | 8 | 0 | 14 | 54 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mauritania | 9 | 0 | 14 | 63 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mexico | 78 | 67 | 100 | 58 | 81 | 100 | 75 | 88 | 83 | 94 | 83 | 37 | 74 |
| Mongolia | 28 | 67 | 29 | 75 | 78 | 11 | 13 | 8 | 33 | 0 | 0 | 20 | 0 |
| Morocco | 42 | 92 | 57 | 54 | 74 | 17 | 0 | 42 | 83 | 11 | 50 | 27 | 0 |
| Mozambique | 6 | 0 | 0 | 42 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Myanmar | 13 | 33 | 29 | 42 | 44 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nepal | 20 | 0 | 43 | 46 | 78 | 17 | 0 | 21 | 0 | 31 | 0 | 0 | 0 |
| Netherlands | 76 | 100 | 100 | 94 | 67 | 89 | 88 | 0 | 100 | 83 | 50 | 73 | 73 |
| Nicaragua | 40 | 67 | 71 | 63 | 63 | 33 | 38 | 0 | 33 | 44 | 42 | 30 | 0 |
| Niger | 12 | 0 | 29 | 42 | 44 | 0 | 13 | 17 | 0 | 0 | 0 | 0 | 0 |
| Nigeria | 11 | 0 | 0 | 94 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pakistan | 38 | 67 | 100 | 63 | 74 | 33 | 0 | 17 | 0 | 17 | 25 | 67 | 0 |
| Peru | 31 | 75 | 57 | 67 | 48 | 33 | 50 | 4 | 0 | 42 | 0 | 0 | 0 |
| Philippines | 42 | 58 | 43 | 67 | 100 | 39 | 75 | 58 | 0 | 17 | 50 | 0 | 0 |
| Poland | 57 | 92 | 71 | 42 | 67 | 22 | 50 | 0 | 75 | 56 | 67 | 70 | 75 |
| Qatar | 50 | 100 | 86 | 54 | 41 | 56 | 100 | 13 | 0 | 56 | 17 | 83 | 0 |

## ENERGY EFFICIENCY

| Country | EE score | National energy efficiency planning | Energy efficiency entities | Information provided to electricity consumers | Incentives from electricity rate structures | Incentives & mandates: large consumers | Incentives & mandates: public sector | Incentives & mandates: utilities | Financing mechanisms for energy efficiency | Minimum energy efficiency performance standards | Energy labeling systems | Building energy codes | Carbon pricing and monitoring |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Romania | 86 | 100 | 100 | 83 | 96 | 94 | 100 | 83 | 83 | 67 | 50 | 100 | 73 |
| Russian Federation | 70 | 92 | 100 | 54 | 89 | 67 | 100 | 75 | 92 | 11 | 67 | 80 | 0 |
| Rwanda | 21 | 67 | 29 | 28 | 44 | 0 | 50 | 0 | 0 | 0 | 0 | 40 | 0 |
| Saudi Arabia | 50 | 83 | 100 | 63 | 80 | 67 | 25 | 17 | 0 | 50 | 67 | 50 | 0 |
| Senegal | 19 | 67 | 29 | 41 | 67 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sierra Leone | 18 | 33 | 43 | 54 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solomon Islands | 12 | 0 | 57 | 52 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Somalia | 6 | 0 | 0 | 33 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| South Africa | 69 | 100 | 100 | 29 | 91 | 72 | 50 | 88 | 100 | 47 | 67 | 87 | 0 |
| South Sudan | 16 | 75 | 0 | 48 | 44 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spain | 68 | 92 | 57 | 62 | 89 | 67 | 50 | 50 | 100 | 42 | 50 | 80 | 73 |
| Sri Lanka | 54 | 100 | 100 | 50 | 81 | 89 | 0 | 46 | 100 | 14 | 17 | 47 | 0 |
| Sudan | 19 | 92 | 43 | 56 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sweden | 60 | 67 | 71 | 75 | 100 | 0 | 63 | 8 | 17 | 100 | 67 | 70 | 88 |
| Switzerland | 67 | 67 | 71 | 61 | 96 | 67 | 63 | 0 | 92 | 83 | 67 | 67 | 68 |
| Tajikistan | 44 | 92 | 100 | 56 | 22 | 39 | 88 | 50 | 33 | 0 | 0 | 50 | 0 |
| Tanzania | 29 | 92 | 71 | 60 | 59 | 17 | 13 | 4 | 33 | 0 | 0 | 0 | 0 |
| Thailand | 63 | 92 | 100 | 63 | 63 | 100 | 38 | 63 | 92 | 33 | 58 | 50 | 0 |
| Togo | 25 | 75 | 29 | 50 | 67 | 33 | 0 | 50 | 0 | 0 | 0 | 0 | 0 |
| Tunisia | 68 | 92 | 100 | 50 | 74 | 72 | 88 | 33 | 83 | 75 | 83 | 60 | 0 |
| Turkey | 65 | 92 | 86 | 63 | 57 | 61 | 100 | 0 | 83 | 44 | 67 | 73 | 50 |
| Uganda | 35 | 0 | 100 | 42 | 59 | 33 | 13 | 13 | 33 | 56 | 67 | 0 | 0 |
| Ukraine | 37 | 67 | 71 | 33 | 70 | 17 | 0 | 25 | 83 | 8 | 25 | 40 | 0 |
| United Arab Emirates | 63 | 75 | 100 | 83 | 100 | 83 | 25 | 33 | 58 | 50 | 50 | 93 | 0 |
| United Kingdom | 77 | 100 | 57 | 75 | 78 | 67 | 75 | 58 | 100 | 69 | 67 | 100 | 73 |
| United States | 87 | 100 | 100 | 75 | 89 | 89 | 63 | 83 | 100 | 100 | 100 | 93 | 53 |

## ENERGY EFFICIENCY

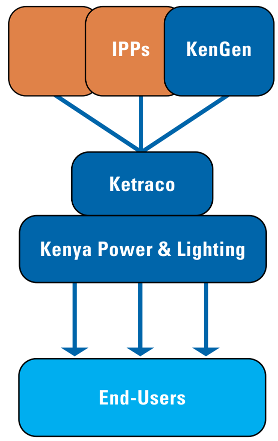
| Country | EE score | National energy efficiency planning | Energy efficiency entities | Information provided to electricity consumers | Incentives from electricity rate structures | Incentives & mandates: large consumers | Incentives & mandates: public sector | Incentives & mandates: utilities | Financing mechanisms for energy efficiency | Minimum energy efficiency performance standards | Energy labeling systems | Building energy codes | Carbon pricing and monitoring |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Uzbekistan | 52 | 67 | 100 | 56 | 48 | 61 | 63 | 54 | 75 | 0 | 100 | 0 | 0 |
| Vanuatu | 11 | 0 | 29 | 60 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Venezuela, RB | 42 | 67 | 71 | 69 | 81 | 56 | 25 | 25 | 17 | 44 | 50 | 0 | 0 |
| Vietnam | 70 | 83 | 100 | 63 | 78 | 67 | 88 | 17 | 83 | 100 | 100 | 57 | 0 |
| Yemen, Rep. | 13 | 67 | 0 | 42 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zambia | 21 | 33 | 43 | 54 | 72 | 0 | 0 | 0 | 0 | 0 | 25 | 20 | 0 |
| Zimbabwe | 14 | 0 | 0 | 63 | 81 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Source:* RISE database, World Bank.

# APPENDIX 2.
# EXAMPLE OF FULL COUNTRY DATASET: KENYA

## SECTOR OVERVIEW

| Sector structure & institutions | |
|---|---|
| Level of competition | Single Buyer |
| Level of unbundling | Partially vertically unbundled |
| Private sector participation | In generation |
| IPP capacity share | 15% |
| Energy Ministry / Planning Entity | Ministry of Energy and Petroleum |
| Independent electricity regulator | Energy Regulatory Commission |
| Year of establishment | 2006 |
| Agency responsible for energy access | Rural Electrification Agency |
| Agency responsible for renewable energy | Energy Regulatory Commission |
| Agency responsible for energy efficiency strategy | Energy Regulatory Commission |




| Utilities & operators | |
|---|---|
| Largest generation company (national) | KenGen |
| Largest distribution company (national) | Kenya Power and Lighting Co. Ltd. (KPLC) |
| Transmission System Operator | Ketraco, KPLC |
| Independent System Operator | None |
| Wholesale Market Operator | None |

| Electricity system | |
|---|---|
| Annual generation (GWh) | 8059.6 |
| Length of transmission system (km) | 4,500 |
| Length of distribution system (km) | 54,193 |

| Sector performance | |
|---|---|
| T&D loss rate (2-year average where available) | 18% |
| Bill collection rate (2-year average where available) | 99% |
| SAIDI/SAIFI (Doing Business) | 618.3/60.5 |

| Retail data | |
|---|---|
| Selected retail / distribution + retail utility | Kenya Power and Lighting Co. Ltd. |
| Retail electricity tariff (average of all end-users) | 0.12 |
| Retail electricity tariff (residential) | 0.19 |
| Retail electricity tariff (commercial) | 0.15 |
| Retail electricity tariff (industrial) | 0.15 |

## ENERGY ACCESS

| Indicator 1: Existence and monitoring of officially approved electrification plan | Score 100 |
|---|---|
| There is an officially approved national electrification plan | Yes |
| *There is a draft electrification plan that has been prepared but not yet been approved* | *No* |
| Name of the electrification plan & vision | Rural Electrification Master Plan<br>Distribution Master Plan |
| The electrification plan and updates are publicly available | Yes |
| Last update of the electrification plan | 2013 |
| There is an institution responsible for tracking the plan progress | Yes |
| Name of the tracking institution | Rural Electrification Authority |
| There is a defined timeframe for the electrification plan | Yes |
| **Indicator 2: Scope of officially approved electrification plan** | **Score 50** |
| The plan targets a service level | No |
| *Details on service level target* | *N/A* |
| The electrification plan includes both grid and off-grid | Yes |
| The plan includes productive use | Yes |
| The plan includes community facilities | Yes |
| Geo-spatial maps convey the timeframe of planned grid extension | No |
| Geo-spatial maps are made publicly available | No |
| **Indicator 3: Framework for grid electrification** | **Score 67** |
| There is a legal framework on new connections for informally settled people | No |
| *Details on legal framework to electrify informally settled people* | *N/A* |
| The government has a dedicated funding line or budget for electrification | Yes |
| Capital subsidies exist for utilities to provide distribution systems to rural areas/villages | Yes |
| *Details on funding support for grid electrification* | *Funds for last mile connectivity of rural customers* |
| Consumer financing mechanisms and/or direct subsidies are available to support the payment of connection fees by consumers | Yes |
| *Details on mechanisms/subsidies to support the payment of connection fees* | *StimaLoan for low-income families (loans at 5% administration fee—one-off payment)*<br>*Subsidy for rural customers (connection costs of KSh. 15,000)* |
| The government specifies standards of performance on quality of supply | No |

## ENERGY ACCESS

| Indicator 4: Framework for mini-grids | | | Score 66 |
|---|---|---|---|
| A legal framework authorizes the operation of mini-grids in the country | | Yes | |
| *Name of the regulation and date* | | *Electricity Licensing Regulation–2012* | |
| Mini-grids can be owned and operated by private operators | | Yes | |
| Regulations clarify what occurs when the interconnected grid reaches a mini-grid | | No | |
| *Details on the options given to mini-grid developers when the grid reaches a mini-grid* | | *N/A* | |
| Regulations detail procedures for consumers to get connected to mini-grids | | Yes | |
| Regulations differ by size of mini-grids | | Yes | |
| *Details on the difference in regulation depending on mini-grid capacity* | | *Mini-grids with capacity below 3,000 KW only require a permit (notification of intention) and not a license* | |
| Regulations detail a retail electricity tariff schedule for mini-grids | | Yes | |
| Mini-grid operators are legally allowed to charge a different tariff from the national tariff | | Yes | |
| *Name of the regulation on mini-grid tariffs* | | *Electricity Licensing Regulation–2015* | |
| *Examples of mini-grids with different tariffs* | | *Examples among others: Access Energy, PowerHive, Kitonyoni* | |
| Publicly funded mechanisms secure viability gap funding for operators | | No | |
| There are subsidies and/or duty exemptions for mini-grid systems and/or individual components | Whole systems | Energy generators | Other component |
| *Subsidies* | No | No | No |
| *Duty exemptions* | No | Yes | No |
| *Details on subsidies for mini-grids* | | *N/A* | |
| *Name of the regulation on subsidies to support mini-grid development* | | *N/A* | |
| *Details on duty exemptions for mini-grids* | | *N/A* | |
| *Name of the regulation on duty exemptions to support mini-grid development* | | *Value Added Tax Act–2013* | |
| There are technical standards detailing the requirements for mini-grids to connect the grid | | No | |
| The technical standards are made publicly available | | No | |
| *Name of document detailing technical standards* | | *N/A* | |
| There are safety standards for mini-grids (e.g., overcurrent protection, system control, etc.) | | No | |
| Safety standards are made publicly available | | No | |
| *Name of document detailing safety standards* | | *N/A* | |
| The government implements certification programs for mini-grid installers | | Yes | |
| The government implements certification programs for mini-grid equipment | | Yes | |

## ENERGY ACCESS

| Indicator 5: Framework for stand-alone systems | | | Score 93 |
|---|---|---|---|
| National programs promote the deployment of stand-alone systems | | Yes | |
| *Details on national program promoting stand-alone systems* | | *Rural Electrification Program run by REA—Focus on public facilities* | |
| Subsidies and/or duty exemptions support stand-alone home systems | Whole systems | Energy generators | Other component |
| *Subsidies* | No | No | No |
| *Duty exemptions* | No | Yes | No |
| *Details on subsidies for stand-alone systems* | | *N/A* | |
| *Name of the regulation on subsidies to support stand-alone system development* | | *N/A* | |
| *Details on duty exemptions for stand-alone systems* | | *N/A* | |
| *Name of the regulation on duty exemptions to support stand-alone system development* | | *Value Added Tax Amendment Act - 2014* | |
| There are legal price restrictions that limit what stand-alone system retailers or service providers can charge | | No | |
| There are specific market financing facilities to support the development of stand-alone systems | | Yes | |
| There are specific government financing facilities to support the development of stand-alone systems | | No | |
| The government has adopted minimum national quality standards | | Yes | |
| The government has adopted minimum international quality standards | | Yes | |
| *Name of document detailing quality standards* | | *ISO/IEC Guide 21-1: 2005* | |
| The government has adopted international testing methods | | Yes | |
| The regulation accepts testing done elsewhere/in other country (vs in-country testing required) | | No | |
| There is a governmental certified program for solar equipment installers | | Yes | |
| There are environmental regulations on the disposal of pico-PV and SHS products or components | | Yes | |
| *Name of document detailing environmental regulations* | | *Solar PV Regulation 2012* | |

| Indicator 6: Consumer affordability of electricity | | Score 100 |
|---|---|---|
| Annual cost of subsistence consumption (30 kWh/month) as percentage of GNI per household of lowest 20% | 2% | |
| *Tariff schedule taken into account* | *Schedule of tariffs for supply of electrical energy by the Kenya Power and Lighting Company Ltd—The Kenya Gazette, January 2014* | |
| There is a mechanism to support low-volume consumers, for instance, social or lifeline tariff | Yes | |

## ENERGY ACCESS

| Indicator 7: Utility transparency and monitoring | | | | Score 96 |
|---|---|---|---|---|
| Financial statements are publicly available for the largest company/utility providing each service | Generation | Transmission | Distribution | Retail |
| | Yes | Yes | Yes | Yes |
| Key metrics of the company / utility are published in a primary official document | Transmission loss rate | Distribution loss rate | Bill collection rate | Electricity available for sale |
| | Yes | Yes | No | Yes |
| Financial statements are independently audited | Generation | Transmission | Distribution | Retail |
| | Yes | Yes | Yes | Yes |
| The selected distribution utility operates an incidence / outage recording system | | | Yes | |
| The selected distribution utility measures the reliability of its service | | | Yes | |
| The selected distribution utility reports to the regulator | | | Yes | |
| The selected utility makes the data public | | | Yes | |

| Indicator 8: Utility creditworthiness | | Score 86 |
|---|---|---|
| Selected utility's current ratio | 1.22 | |
| Selected utility's EBITDA margin | 0.16 | |
| Selected utility's debt service coverage ratio | 1.65 | |
| Selected utility's days payable outstanding | 123 | |

## ENERGY EFFICIENCY

| Indicator 1: Energy efficiency planning | | Score 67 |
|---|---|---|
| There is a legislation or national action plan to improve EE | Yes | |
| *Name of EE legislation or action plan* | | *Energy Efficiency and Conservation Programme (Energy Act 2006)* |
| There is an EE goal or target at the national level | No | |
| EE targets are defined for the following sub-sectors: | Yes/No | Details |
| Residential sector | Yes | (1) Distribute 2.5 million CFL lamps (2) Install solar water heaters in all qualifying premises |
| Commercial services sector | Yes | Compliance by all building owners with hot water requirement/ importers of electric equipment |
| Industrial sector | Yes | Carry out energy audits |
| Power sector | Yes | System loss reduction |

| Indicator 2: Energy efficiency entities | | Score 100 |
|---|---|---|
| There is an established entity for roles the listed below: | Yes/No | Name |
| Setting EE strategy | Yes | Energy Regulatory Commission |
| Setting EE standards | Yes | Energy Regulatory Commission/Kenya Bureau of Standards |
| Regulating EE activities of energy suppliers | Yes | Energy Regulatory Commission |
| Regulating EE activities of energy consumers | Yes | Energy Regulatory Commission |
| Certifying compliance with equipment EE standards | Yes | Kenya Bureau of Standards |
| Certifying compliance with building EE standards | Yes | Energy Regulatory Commission |
| Managing third party auditors for EE standards | Yes | Energy Regulatory Commission |

| Indicator 3: Information for electricity consumers | | | Score 60 |
|---|---|---|---|
| | Residential | Commercial | Industrial |
| Customers receive electricity reports/bills | Yes | Yes | Yes |
| Intervals at which they receive these reports (times per year) | 12 | 12 | 12 |
| The reports include the price levels per unit of energy | Yes | Yes | Yes |
| The regulator tracks the utility's compliance with laws for providing energy usage information to customers | No | *This question does not differentiate between electricity consumers.* | |
| Customers are provided with comparisons to other users | No | No | No |
| Method of comparing customers | N/A | N/A | N/A |
| The reports show historical information | Yes | Yes | Yes |
| Customers have access to real time feedback on energy usage | Yes | *This question does not differentiate between electricity consumers.* | |

**ENERGY EFFICIENCY**

| | | |
|---|---|---|
| Energy usage can be controlled remotely (e.g., online/mobile apps) | No | *This question does not differentiate between electricity consumers.* |

| Indicator 4: Electricity rate structures | | | Score 48 |
|---|---|---|---|
| Electricity rate structure for each customer type | Residential | Commercial | Industrial |
| Flat fee | Yes | Yes | Yes |
| Constant block rates | No | Yes | Yes |
| Declining block rates | No | No | No |
| Increasing block rates | Yes | No | No |
| The following charges are levied: | Residential | Commercial | Industrial |
| Energy (kWh) | Yes | Yes | Yes |
| Demand (kW) | No | No | No |
| Reactive power (kVar) | No | Yes | Yes |
| Time of use (TOU) tariffs offered for each customer type | Residential | Commercial | Industrial |
| Real-time pricing | No | No | No |
| Variable peak pricing | No | No | No |
| Critical peak pricing | No | No | No |
| Seasonal rate | No | No | No |
| Peak time rebates (including time of day tariffs) | No | No | No |

| Indicator 5: Incentives & mandates: large consumers | | Score 67 |
|---|---|---|
| Threshold to classify large energy consumers | Consumption of over 1,200,000 kWh annually; Consumption of over 4,320,500 Mega Joules of energy annually | |
| Requirements for large consumers: | Yes/No | Details |
| Consumer tracking requirements | Yes | |
| Targets (e.g., kWh savings or lower energy intensity) | Yes | |
| Mandatory audits | Yes | |
| Progress/tracking reports | Yes | Annual |
| Energy-management system | No | |
| *Regulations specifying EE requirements for large users* | | *The Energy Management Regulations 2012* |
| There are penalties for non-compliance with requirements | Yes | |
| There is a verification system to track compliance | Yes | |
| Verification is done by third party | Yes | |
| Incentives are available for EE activities for large consumers: | Yes/No | Details |
| Financial incentives | No | |
| Tax incentives | No | |
| Other incentives (if applicable) | No | |
| There is public recognition/awards for achieving savings | Yes | |
| Energy savings of large consumers are publicized | Yes | |

| | | | |
|---|---|---|---|
| **ENERGY EFFICIENCY** | | | |
| EE assistance program is offered to large consumers | Yes | | |
| **Indicator 6: Incentives & mandates: public sector** | | | **Score 50** |
| There are EE obligations for public buildings | Yes | | |
| EE savings are tracked for public buildings | Yes | | |
| There are EE obligations for other public facilities | Yes | | |
| EE savings are tracked for other public facilities | Yes | | |
| There is public procurement of EE products | No | | |
| Public budgeting regulations and practices allow public entities to retain energy savings | No | | |
| **Indicator 7: Incentives & mandates: utilities** | | | **Score 58** |
| Utilities are required to carry out EE activities in the following areas:<br>Details of requirements | Generation | T&D | DSM |
| | No | Yes | Yes |
| | | *Reduce system losses to 16.8% in year 2013/14, 16.6% in 2014/15, and 16.4% in 2015/16* | *Installation of solar heaters in all qualified premises* |
| *Regulations specifying EE requirements for utilities* | *N/A* | | |
| There is a verification system to track compliance | No | Yes | Yes |
| There are penalties for non-compliance with requirements | No | Yes | Yes |
| Verification is done by third party | No | Yes | Yes |
| There are co-generation incentives and/or policies | No | N/A | N/A |
| There is demand-side management in the selected distribution utility | N/A | N/A | Yes |
| These cost recovery mechanisms are available for EE activities: | G[1] | M[2] | |
| Public budget financing | No | N/A | |
| Compensation via a tracking account | No | No | |
| Revolving funds and/or credit lines for EE activities | No | No | |
| Partial risk guarantees | No | No | |
| Program cost recovery | No | No | |
| Energy service companies | No | No | |
| On-bill financing/pre-payment | No | No | |
| Other | No | No | |

1. Government policy driven mechanisms: financial transactions that require government approval, authorization or other form of direct participation.
2. Market-driven mechanisms: financial transactions that can be proceed without any direct government approval, authorization or other mediation procedure.

## ENERGY EFFICIENCY

| Indicator 8: Financing Mechanims | | | | | | Score 0 |
|---|---|---|---|---|---|---|
| The following are available for EE activities in each sector: | Residential | | Commercial | | Industrial | |
| | M | G | M | G | M | G |
| Tax incentives[3] | N/A | No | N/A | No | N/A | No |
| Discounted "green" mortgages | No | No | No | No | No | No |
| On-bill financing/repayment | No | No | No | No | No | No |
| Credit lines and/or revolving funds with banks | No | No | No | No | No | No |
| Energy services agreements (pay-for-performance) | No | No | No | No | No | No |
| Green or EE bonds | No | No | No | No | No | No |
| Vendor credit and/or leasing for EE activities | No | No | No | No | No | No |
| Partial risk guarantees | No | No | No | No | No | No |
| Other: | No | No | No | No | No | No |

| Indicator 9: Minimum energy efficiency performance standards | | | | | | | Score 56 |
|---|---|---|---|---|---|---|---|
| Products categories:[3] | Ref | AC | Li | IEM | OIE | LDV | HDV |
| MEPS are implemented | Yes | Yes | Yes | Yes | No | No | No |
| MEPS are adopted from external standards | No | No | No | No | No | No | No |
| There is a verification system to track compliance | Yes | Yes | Yes | Yes | No | No | No |
| Verification is done by third party | No | No | No | No | No | No | No |
| There are penalties for non-compliance | Yes | Yes | Yes | Yes | No | No | No |
| *Regulations specifying EE performance standards* | *Kenya Energy Appliances Perfromance and Labelling Regulations (2015)* | | | | | | |

| Indicator 10: Energy labeling systems | | | | | | | Score 67 |
|---|---|---|---|---|---|---|---|
| Products categories: | Ref | AC | Li | IEM | OIE | LDV | HDV |
| Energy labels are implemented | Yes | Yes | Yes | Yes | No | No | No |
| Labels are adopted from external standards | No | No | No | No | No | No | No |
| Energy labels are mandatory | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

3. Ref: refrigerators, AC: air conditioners, Li: lighting products, IEM: industrial electric motors, OIE: other industrial equipment, LDV: light duty vehicles, HDV: heavy duty vehicles

## ENERGY EFFICIENCY

| Indicator 11: Building energy codes | | Score 0 |
|---|---|---|
| | Residential | Commercial |
| There are EE requirements when constructing new buildings | No | No |
| Year it was last updated | | |
| There is an EE code for renovations to each building type | No | No |
| | Yes/No | |
| There is a compliance system for EE codes | No | |
| Compliance is verified by a third party | Yes | |
| There are EE standard ratings or labeling systems for buildings | No | |
| Buildings are required to disclose property energy usage at the point of sale or when leased | No | |
| Buildings are required to disclose property energy usage annually | No | |
| Building EE incentives: Mandates or targets for new building stocks to achieve high quality EE certifications, such as LEED | No | |
| *Details of incentive program(s)* | | |
| LEED building incentives | No | |
| Other or locally designed program details (if applicable) | | |
| Energy efficiency building code(s) | N/A | |

| Indicator 12. Carbon pricing and monitoring | Score 0 |
|---|---|
| GHG emissions coverage under any carbon pricing mechanism | N/A |
| Monitoring, reporting and verification system for greenhouse gas emissions in place | No |

## RENEWABLE ENERGY

| Indicator 1: Legal framework for renewable energy | Score 100 |
|---|---|
| There is primary legislation governing renewable energy | Yes |
| Primary legislation governing renewable energy | Kenya Energy Act |
| Private ownership of generation is legally authorized | Yes |

| Indicator 2: Planning for renewable energy expansion | Score 69 |
|---|---|
| An official renewable energy target exists | Yes |

| Overall target | Solar target | Wind target | Hydro target | Biomass target | Geothermal target |
|---|---|---|---|---|---|
| 53% capacity (moderate load growth scenario) | | 636 MW | 1,320 MW | 44 MW | 2,300 MW |

| | | |
|---|---|---|
| A renewable energy action plan exists | Yes | |
| Name of plan | 10 Year Power Sector Expansion Plan 2014-2024 | |
| The plan defines the required investment to meet the target | Yes | |
| Amount of required investment | US$25.87 billion | |
| An institution is responsible for tracking progress of plan | Yes | |
| Name of institution | The Ministry of Energy and Petroleum (MoEP) | |
| Generation planning includes renewable energy | Yes | |
| Generation planning includes probabilistic methods | Yes | |
| Transmission planning includes renewable energy | Yes | |
| Renewable energy grid integration study conducted | Year: N/A | No |

| | Solar | Wind | Hydro | Biomass | Geothermal |
|---|---|---|---|---|---|
| Government publishes or endorses a resource atlas | Yes | Yes | No | No | Yes |
| Government provides strategic planning / zoning guidance | No | No | No | No | No |
| Strategic planning best practices | | | | | |
| Part of strategic environmental and social assessment | No | No | No | No | No |
| Making the outputs publically available | No | No | No | No | No |

## RENEWABLE ENERGY

| Indicator 3. Incentives and regulatory support for renewable energy | Score 88 |
|---|---|

The following generation support schemes are in place for renewable energy:

| Feed-in tariff | Competitive bidding | Mandates | Generation premium | Production tax credit |
|---|---|---|---|---|
| Yes | Yes | No | No | No |

| Feed-in tariff details | Solar | Wind | Hydro | Biomass | Geothermal |
|---|---|---|---|---|---|
| Technology | Yes | Yes | Yes | Yes | Yes |
| Name of regulation | FiT POLICY 2012 | FiT POLICY 2012 | FiT POLICY 2012 | FiT POLICY 2012 | FiT POLICY 2012 |
| Price (US$ cents/kWh) | 12 | 11 | 8 | 10 | 9 |
| Max. capacity (single) | 10 MW OFFGRID<br>40 MW GRID | 50 MW | 20 MW | 40 MW | 70 MW |
| Max. capacity (total) | 100 MW | 500 MW | 200 MW | 200 MW | 500 MW |
| Closing date | Capacities less than 10 MW stop being eligible when their total capacity equals 10% of overall installed capacity | Capacities less than 10 MW stop being eligible when their total capacity equals 10% of overall installed capacity | Capacities less than 10 MW stop being eligible when their total capacity equals 10% of overal installed capacity | Capacities less than 10 MW stop being eligible when their total capacity equals 10% of overall installed capacity | Capacities less than 10 MW stop being eligible when their total capacity equals 10% of overall installed capacity |
| Projects guaranteed off-take | Yes | | | | |
| Gov. body in charge | Energy Regulatory Commission | | | | |

| Competitive bidding details | Auction 1 | Auction 2 |
|---|---|---|
| Year | 2014 | |
| Technology | Geothermal | |
| Project-specific tender and size (MW) | PHASE 1 MENENGAI GEOTHERMAL FIELD—105 MW | |
| Auction for total and size (MW) | N/A | |
| Standard PPA and Term | 25 years | |
| Price ceiling | Yes | |
| Winning bid (US$ cents/kWh) | | |
| Gov. body in charge | Geothermal Development Company | |
| Winning bid guaranteed off-take | Yes | |

The following fiscal incentives are in place for renewable energy:

| Investment tax credit | Accelerated depreciation | Reduction in import taxes | Reduction in sales tax or other taxes |
|---|---|---|---|
| No | No | Yes | Yes |

| | |
|---|---|
| Prioritized access to the grid for renewable energy | Yes |
| Priority in dispatch for renewable energy | Yes |
| Compensation for offtake delays | No |
| Compensation for curtailments | Yes |

## RENEWABLE ENERGY

| Indicator 4. Attributes of financial and regulatory incentives | | | | Score 100 |
|---|---|---|---|---|
| The means for private generators to enter the market are clearly defined | | | Yes | |
| Type of market entry mechanism | | | Generation license /permit | |
| Generation projects are required to meet development timelines or milestones | | | Yes | |
| Tariffs are indexed to an international currency or to inflation (in part or fully) | | | Yes | |
| If there is a guaranteed tariff, it is adjusted over time for new entrants | | | Yes | |
| If there is a guaranteed tariff, it is differentiated by project size | | | Yes | |
| If there is competitive bidding, it contains performance protection mechanisms (e.g. bid-bonds) | | | Yes | |
| If there is a renewable energy mandate, it can be met with tradable certificates (e.g. RECs, TECs) | | | N/A | |
| The cost of the RE incentive scheme is passed to the final electricity consumer (in part or fully) | | | Yes | |
| **Indicator 5. Network connection and use** | | | | **Score 25** |
| Rules specify the allocation of connection costs | | | Yes | |
| Type of the connection cost allocation policy (i.e. shallow/deep) | | | Deep | |
| Rules allow electricity customers to purchase power directly from a third party | | | No | |
| Rules define the cost of using the system | | | N/A | |
| Grid code that addresses variable renewable energy is legally in force | | | No | |
| If there are multiple balancing areas, there are rules that penalize renewable energy | | | N/A | |
| If there are multiple balancing areas, plant forecasting is considered in power exchange rules | | | N/A | |
| **Indicator 6. Counterparty risk** | | | | **Score 60** |
| Payment risk mitigation (e.g. through a letter of credit, escrow account, payment guarantee) | | | No | |
| | Generation | Transmission | Distribution | Retail |
| Financial statements are publicly available for largest company / utility providing each service | Yes | Yes | Yes | Yes |
| | Transmission loss rate | Distribution loss rate | Bill collection rate | Electricity available for sale |
| Key metrics of the company / utility published in a primary official document | Yes | Yes | No | Yes |
| | Generation | Transmission | Distribution | Retail |
| Financial statements are independently audited | Yes | Yes | Yes | Yes |
| The selected distribution utility operates an incidence/outage recording system | | | Yes | |
| The selected distribution utility measures the reliability of its service | | | Yes | |
| The selected distribution utility reports to the regulator | | | Yes | |
| The selected distribution utility makes the data public | | | Yes | |
| Name of the selected utility | | | Kenya Power and Lighting Co. Ltd. (KPLC or Kenya Power) | |
| Selected utility's current ratio | | | 1.22 | |
| Selected utility's debt service coverage ratio | | | 1.65 | |
| Selected utility's days payable outstanding | | | 123 | |
| Selected utility's EBITDA margin | | | 0.16 | |
| **Indicator 7. Carbon pricing and monitoring** | | | | **Score 0** |
| GHG emissions coverage under any carbon pricing mechanism | | | N/A | |
| Monitoring, reporting and verification system for greenhouse gas emissions in place | | | No | |

*Source:* RISE database, World Bank

# APPENDIX 3. SELECTED UTILITIES AND CITIES IN EACH COUNTRY

| Country | Selected utility | City |
|---|---|---|
| Afghanistan | DABS | Kabul |
| Algeria | SONELGAZ | Algiers |
| Angola | ENDE | Luanda |
| Argentina | EDENOR | Buenos Aires Ciudad |
| Armenia | Electric Networks of Armenia CJSC | Yerevan |
| Australia | AGL Energy | Sydney |
| Austria | Wien Energie (parent company Wiener Stadtwerke) | Vienna |
| Bahrain | Electricity and Water Authority (EWA) | Manama |
| Bangladesh | Dhaka Power Distribution Company | Dhaka |
| Belarus | Minskenergo | Minsk |
| Belgium | Eletrabel (ony retail) | Brussels |
| Benin | SBEE | Cotonou |
| Bolivia | DELAPAZ | La Paz |
| Brazil | ELETROPAULO METROPOLITANA EL.S.PAULO S.A | São Paulo |
| Burkina Faso | SONABEL | Ouagadougou |
| Burundi | Régie de Production et Distribution d'Eau et d'Electricité (Regideso) | Bujumbura |
| Cambodia | Electricité du Cambodge (EDC) | Phnom Penh |
| Cameroon | Eneo Cameroon | Douala |
| Canada | Toronto Hydro Corporation | Toronto |
| Central African Republic | ENERCA | Bangui |
| Chad | Societe National d'Electricite | Ndjamena |
| Chile | Chilectra | Santiago |
| China | State Grid Power Corporation of China | Shanghai |
| Colombia | CONDENSA | Bogota |
| Congo, Dem. Rep. | SNEL | Kinshasa |
| Congo, Rep. | Societe Nationale d'Electricite | Brazzaville |
| Côte d'Ivoire | Compagnie Ivoirienne d'Électricité | Abidjan |
| Czech Republic | PREdistribuce, a.s. | Prague |

| Country | Selected utility | City |
|---|---|---|
| Denmark | DONG Energie | Copenhagen |
| Dominican Republic | EdeSur | Santo Domingo |
| Ecuador | Empresa Electrica Quito | Quito |
| Egypt, Arab Rep. | SCEDC | Cairo |
| Eritrea | Eritrean Electric Corporation (EEC) | Asmara |
| Ethiopia | Ethiopian Electric Utility | Addis Ababa |
| Finland | Helen Oy | Helsinki |
| France | Electricité Réseau Distribution France (distribution) and EDF (retail) | Paris |
| Germany | Vattenfall Europe Distribution Berlin GmbH | Berlin |
| Ghana | ECG | Accra |
| Greece | DEDDIE SA | Athens |
| Guatemala | EEGSA | Guatemala City |
| Guinea | Electricite de Guinea | Conakry |
| Haiti | Electricité d'Haiti (EdH) | Port au Prince |
| Honduras | ENEE | Tegucigalpa |
| India | Reliance Infrastructure Limited | Mumbai |
| Indonesia | Perusahaan Listrik Negara | Jakarta |
| Iran, Islamic Rep. | Great Tehran Electricity Distribution Company (GTEDC) | Tehran |
| Italy | ACEA (individual financial statements) | Rome |
| Japan | TEPCO | Tokyo |
| Jordan | The Jordanian Electric Power Co., Ltd. (JEPCO) | Amman |
| Kazakhstan | Almaty EnergoSgyt | Almaty |
| Kenya | Kenya Power and Lighting Co. Ltd. (KPLC or Kenya Power) | Nairobi |
| Korea, Rep. | Korea Electric Power Corporation (KEPCO) | Seoul |
| Kuwait | Ministry of Electricity and Water | Kuwait City |
| Kyrgyz Republic | SeverElectro | Bishkek |
| Lao PDR | Electricite du Laos | Vientiane |
| Lebanon | Electricité du Liban (EDL) | Beirut |

| Country | Selected utility | City |
|---|---|---|
| Liberia | Liberia Electricity Corporation | Monrovia |
| Madagascar | JIRAMA | Antananarivo |
| Malawi | ESCOM | Blantyre |
| Malaysia | Tenaga Nasional Berhad | Kuala Lumpur |
| Maldives | State Electric Co. Ltd | Male City |
| Mali | Energie du Mali S.A. | Bamako |
| Mauritania | SOMELEC | Nouakchott |
| Mexico | Comisión Federal de Electricidad (CFE) | Mexico City |
| Mongolia | Ulaanbaatar Electricity Distribution Network (UBEDN) | Ulan Bator |
| Morocco | LYDEC | Casablanca |
| Mozambique | Electricidade de Moçambique E.P. (EDM) | Maputo |
| Myanmar | Yangon Electricity Supply Corporation (YESC) | Yangon |
| Nepal | Nepal Electricity Authority | Kathmandu |
| Netherlands | N.V. Nuon Energy (retail) Liander (DISCO) | Amsterdam |
| Nicaragua | DISNORTE - DISSUR | Managua |
| Niger | NIGELEC | Niamey |
| Nigeria | Ikeja Electricity Distribution Company | Lagos |
| Pakistan | Karachi Electric Supply Company Limited | Karachi |
| Peru | Edelnor S.A.A. | Lima |
| Philippines | MERALCO | Quezon city |
| Poland | RWE Stoen | Warsaw |
| Qatar | Kahramaa | Doha |
| Romania | Societatea Electrica Furnizare S.A. | Bucharest |
| Russian Federation | JSC "Mosenergosbyt" | Moscow |
| Rwanda | EUCL | Kigali |
| Saudi Arabia | Saudi Electricity Company (SEC) | Riyadh |
| Senegal | SENELEC | Dakar |
| Sierra Leone | Electricity Distribution and Supply Authority (EDSA) | Freetown |
| Solomon Islands | Solomon Islands Electricity Authority (SIEA) | Honiara |
| Somalia | Mogadishu Power Company | Mogadishu |

| Country | Selected utility | City |
|---|---|---|
| South Africa | Eskom | Johannesburg |
| South Sudan | South Sudan Electricity Corporation (SSEC) | Juba |
| Spain | IBERDROLA | Madrid |
| Sri Lanka | Ceylon Electricity Board (CEB) | Colombo |
| Sudan | SEDC | Khartoum |
| Sweden | Vattenfall AB | Stockholm |
| Switzerland | Elektrizitätswerke des Kantons Zurich (EKZ) | Zurich |
| Tajikistan | Shabakhoi Barki Shari Dushanbe | Dushanbe |
| Tanzania | Tanzania Electric Supply Company Limited (TANESCO) | Dar es Salaam |
| Thailand | Metropolitan Electricity Authority | Bangkok |
| Togo | CEET | Lome |
| Tunisia | Société Tunisienne de l'Electricité et du Gaz (STEG) | Tunis |
| Turkey | AYEDAS (distribution), AYESAS (retail) | Istanbul |
| Uganda | UMEME | Kampala |
| Ukraine | JSC Kievenergo | Kiev |
| United Arab Emirates | Dubai Electricity And Water Authority (DEWA) | Dubai |
| United Kingdom | British Gas | London |
| United States | Consolidated Edison Company of New York, Inc. (CECONY) | New York City |
| Uzbekistan | Uzbekenergo | Tashkent |
| Vanuatu | Unelco | Port Vila |
| Venezuela, RB | CORPOELEC | Caracas |
| Vietnam | Ho Chi Minh City power Corporation | Ho Chi Minh City |
| Yemen, Rep. | Public Electricity Corporation (PEC) | Sanaa |
| Zambia | Zesco | Lusaka |
| Zimbabwe | Zimbabwe Electricity Transmission and Distribution Company Limited (ZETDC) | Harare |

# APPENDIX 4. DEEP DIVE RESULTS

In some countries, particularly those with a federal structure, subnational governments play an important role in policy making. Many RISE indicators can be achieved through state or local policies, and scores based on the policy framework in the largest business city is not necessarily representative of the whole country. Because collecting data on each individual state or city in each country is not an option, RISE is piloting a deep dive component that aims to better represent the policy and regulatory variance in large federal countries.

The three countries selected for the pilot are Brazil, India, and the United States, based on their federal governance structure, large populations, and regional diversity. For each, the survey was completed in three states. Among the three states, one—the state with the country's largest business city—was selected using the standard methodology. The other two states were selected to represent, among the top 10 most populated states, a medium- and a low-income state. For the overall results, only the data for the largest business city were scored (São Paolo, Mumbai, and New York). This appendix presents the results for these three countries across the three different states.

## Deep dive results in energy access

The deep dive for energy access focused on the three Indian states because energy access was not measured in Brazil or the United States. The results show that in India, policies and regulations are harmonized at a national level, and scores varied slightly between states.

Today, 263 million people remain without electricity access in India. In the coming decades, India will be a major driver to the rise in global energy demand—around one-quarter of the total.[1] Central and state-level governments are stepping up efforts to handle this challenge, even though the federal constitutional system makes the implementation of a unified approach more complex. The country's demographic and income heterogeneity adds to this complexity.

The policies and regulations supporting energy access expansion have been designed at the national level, with differences on the state level. The Indian states compared in RISE share the same electrification planning scheme, DDUGJY, and rural electrification is one of its objectives. The Ministry of New and Renewable Energy also has undertaken the remote village electrification program. The Rural Electrification Corporation (REC) is responsible for tracking plan progress and provides, through a national online portal called RE-App, electrification plan and progress reports. The government of India has launched the 24x7 Power for All initiative to complement the DDUGJY scheme to achieve uniform service levels across all states. This online dashboard presents the number of towns to receive 24 x 7 electricity supply over five years (2014-2019). The DDUGJY scheme entails a minimum daily electricity supply of 6–8 hours, delivered via grid or off-grid solutions. The goal is to provide electricity to 12,450 villages through grid and another 2,000 villages through off-grid by 2017. None of the states has designed geospatial mapping.

To support grid electrification, all policies and mechanisms have been designed and provided by the central government. Grants of up to 75 percent of overall cost of the projects are offered to state utilities, funded by central budgetary allocation, and channeled through the REC. The DDUGJY scheme supports the full cost of connection for families below the poverty line.

To develop minigrid solutions, in 2001 the central government launched the Rural Electricity Supply Technology Mission, which introduced the subject of decentralized power generation—including minigrids—to mainstream policymaking. Since then, the Electricity Act of 2003 has provided a strong legal basis for private operators to own and operate minigrids in unelectrified rural areas identified by state governments. The central government also issued the Rural Electrification Policy in 2006, which alleviated stressors faced by off-grid stand-alone power suppliers by exempting operators from tariff approvals by the central or state regulatory commission and to basing retail tariffs on mutual agreements with customers. Operators can benefit from capital subsidies up to 30 percent if they use PV modules made in India under the Off-grid and Decentralized

**TABLE A4.1** Deep dive countries, states, and cities

| Country | State | City |
|---|---|---|
| Brazil | São Paulo | São Paulo |
| | Minas Gerais | Belo Horizonte |
| | Maranhão | São Luis |
| India | Maharashtra | Mumbai |
| | Andhra Pradesh | Visakhapatnam |
| | Bihar | Patna |
| United States | New York | New York |
| | Pennsylvania | Philadelphia |
| | Florida | Jacksonville |

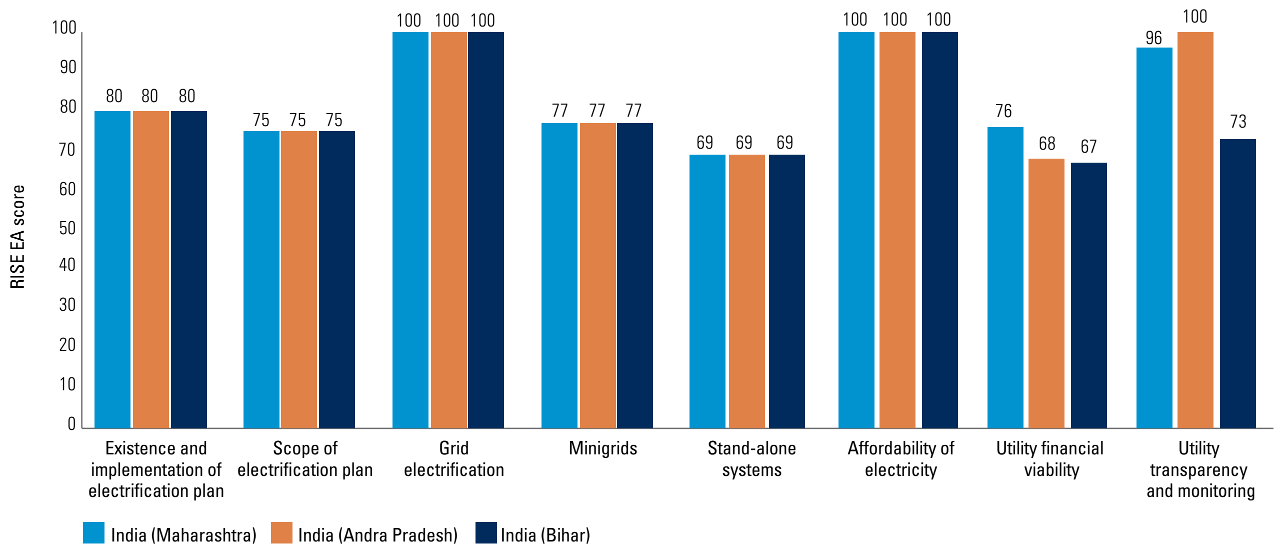
Solar Applications Programme of the Jawaharlal Nehru National Solar Mission.

Stand-alone home systems are developed under a national program called Off-Grid & Decentralized Solar. In terms of quality, the states follow standards adopted by the Ministry of New and Renewable Energy, which are based on international norms.

Although the surveyed states share similar legal and regulatory frameworks, differences emerge in tariffs and management of state utilities (figure A4.1). Although the states are making electricity affordable through lifeline tariffs, the price of electricity varies from 2.3 USc/kWh for 30 kWh monthly consumption in Andhra Pradesh, to 5 USc/kWh in Maharashtra and 5.5 USc/kWh in Bihar.

The RISE results reveal the homogeneity across states of Indian legal framework to support electrification. Considering the criticality of the issue, the government has made the reduction of energy access deficit a national priority.

**FIGURE A4.1** Energy access deep dive results for India




*Source:* RISE database, World Bank.

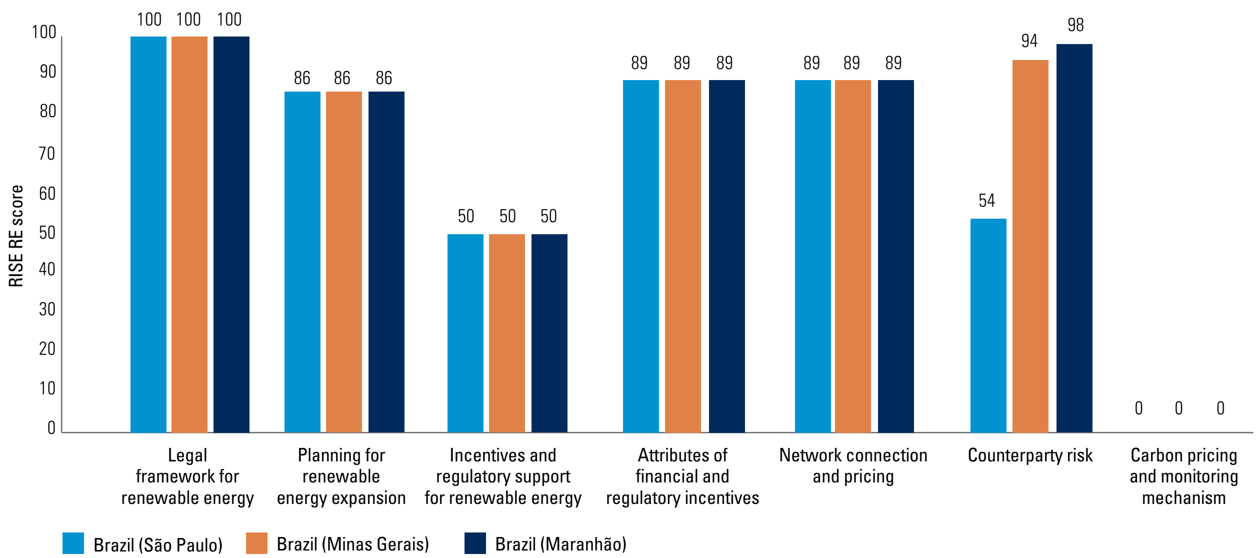
## Deep dive results in renewable energy

Results for the renewable energy pillar reveal that in Brazil, there is little difference across states, as renewable energy and power generation typically are governed by national laws and regulations (figure A4.2).

In India, the three states have similar scores on all indicators except Indicator 5, network connection and pricing, since Andhra Pradesh is the only state where connection cost to the grid is clearly defined. Unlike Brazil, states in India have the flexibility to adopt and design their own policies, although these policies often are based on versions prepared by the national Ministry for New and Renewable Energy (figure A4.3).

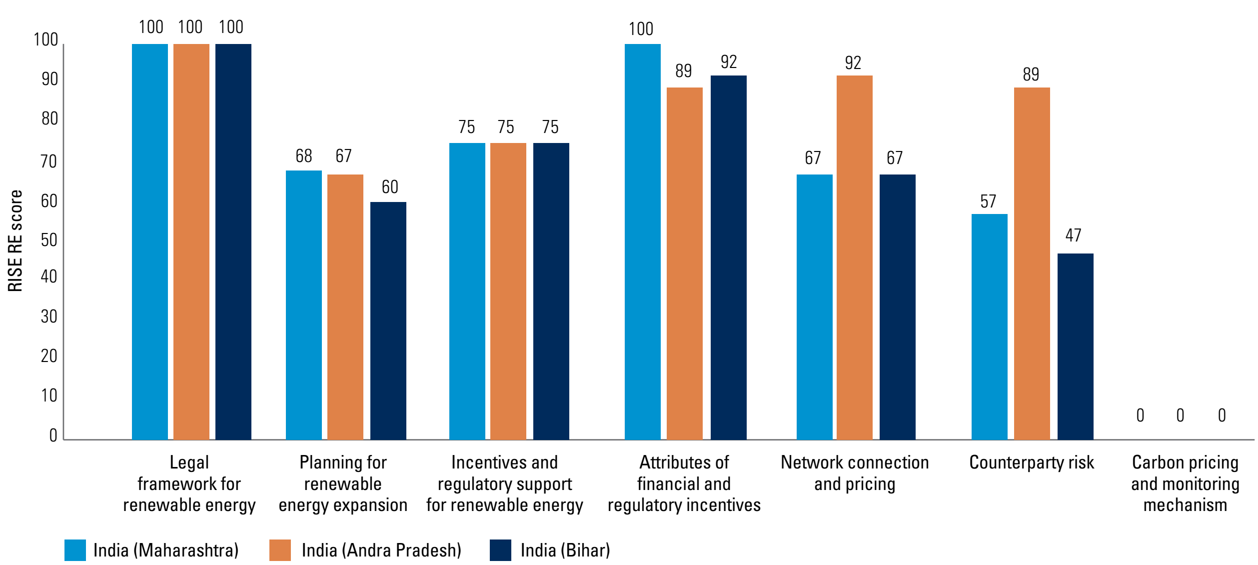
The greatest regional variation was found in the United States, with New York scoring stronger on the planning and attributes indicators than either Pennsylvania or Florida, while New York and Pennsylvania outpace Florida in terms of network connection and pricing (figure A4.4).

**FIGURE A4.2** Renewable energy deep dive results for Brazil



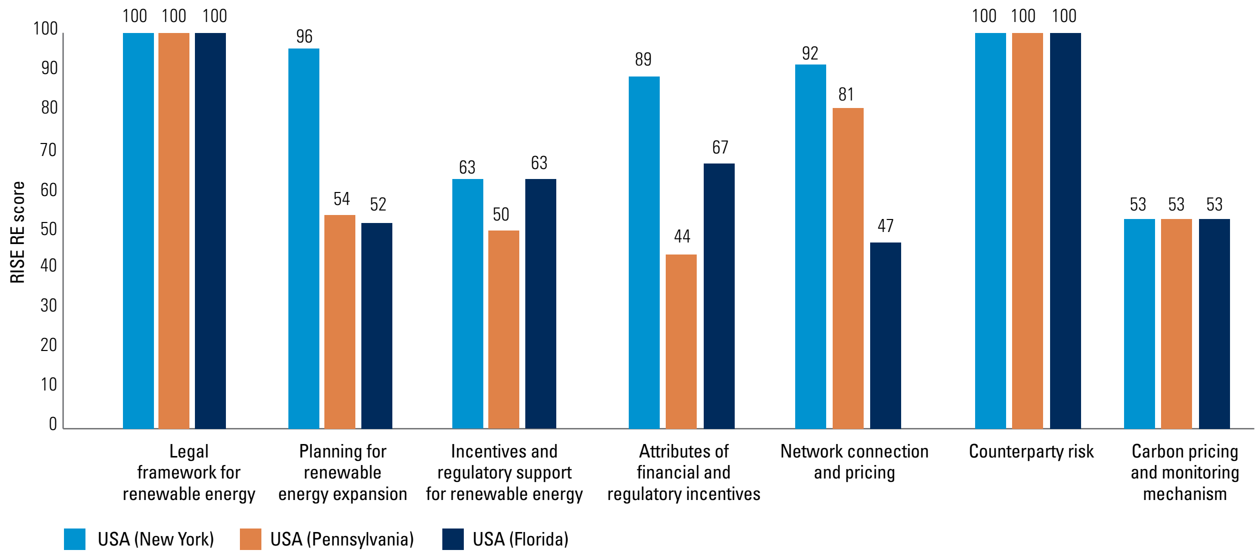

*Source:* RISE database, World Bank.

**FIGURE A4.3** Renewable energy deep dive results for India




*Source:* RISE database, World Bank.

**FIGURE A4.4** Renewable energy deep dive results for the United States



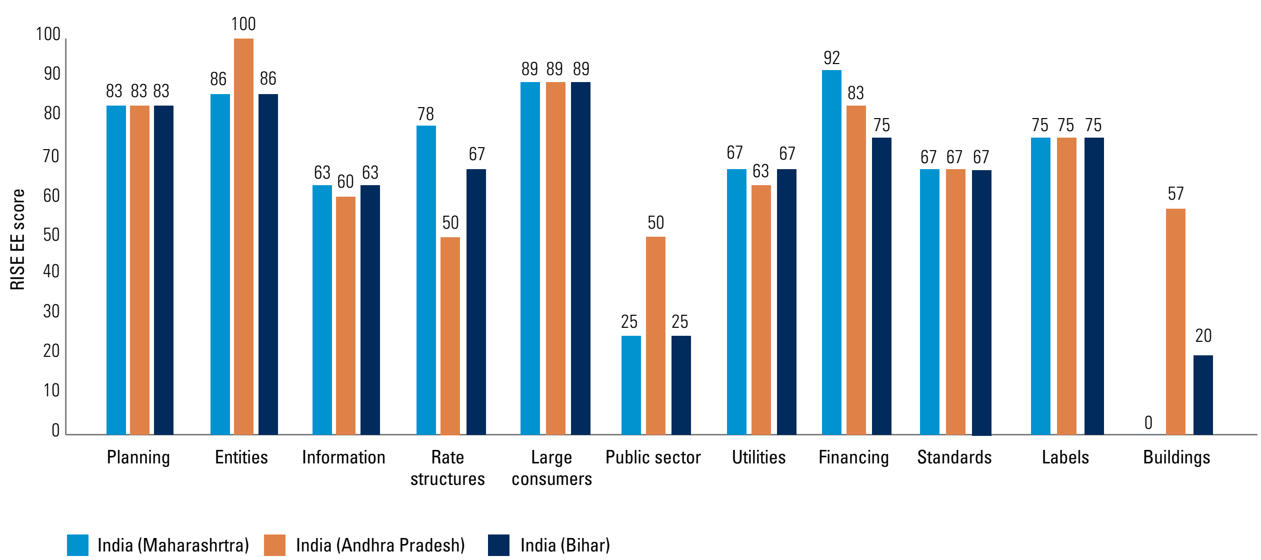

*Source:* RISE database, World Bank.

## Deep dive results in energy efficiency

The deep dive results for the energy efficiency pillar reveal little variation among the three states in each country. In India, the greatest discrepancies are in the building energy codes and public sector energy efficiency indicators, where Andhra Pradesh scores much higher than Bihar and Maharashtra (figure A4.5). Andhra Pradesh also is the only state of the three that has established an agency responsible for certifying building energy efficiency standards, attributing to its higher entities indicator score. India is considered an ideal candidate for a deep dive state precisely due to the difficulty of aligning federal policies with subnational and municipal regulations. Although the federal government has established a national energy conservation building code for commercial and residential buildings based on standards set by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, in Bihar and Maharashtra the federal building code is not fully implemented.

Brazil showed the least variation between states. While all states have implemented energy labeling systems for all products

**FIGURE A4.5** Energy efficiency deep dive results for India




*Source:* RISE database, World Bank.

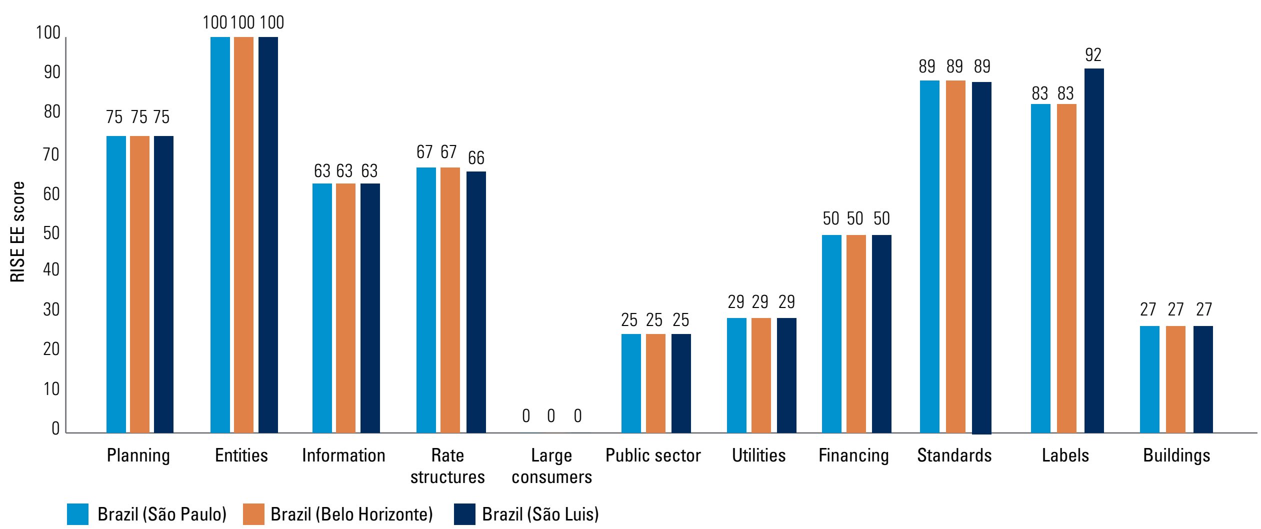
surveyed except for heavy duty vehicles, these systems are voluntary for most products in São Paulo, which yielded the lowest score on this indicator. São Luis, in Maranhão, scores lower on the rates indicator because it does not charge all large consumers for reactive power. All three states currently receive no points for the large consumer indicator; this likely will improve in the near future because ANEEL, the national energy regulator, is collaborating with private sector stakeholders to create a trade association for implementing energy efficiency incentives among large industries.

The United States was the highest scoring country among the three countries surveyed and showed minor variations between the three states across six indicators. The largest variation was in the utilities mandates and incentives indicator, where New York scores much higher than Florida and Pennsylvania (figure A4.7). In 2008, the New York State Public Service Commission established a sophisticated energy efficiency portfolio standard that sets efficiency targets for generation and T&D utilities. This program helped the state achieve its goal of a 15 percent reduction of forecast electricity usage levels by 2015. All three states score in the green zone on all other indicators. The consistency of high scores shows that it is possible to achieve progress on energy efficiency policy even in countries where policy implementation typically is decentralized.

## NOTES

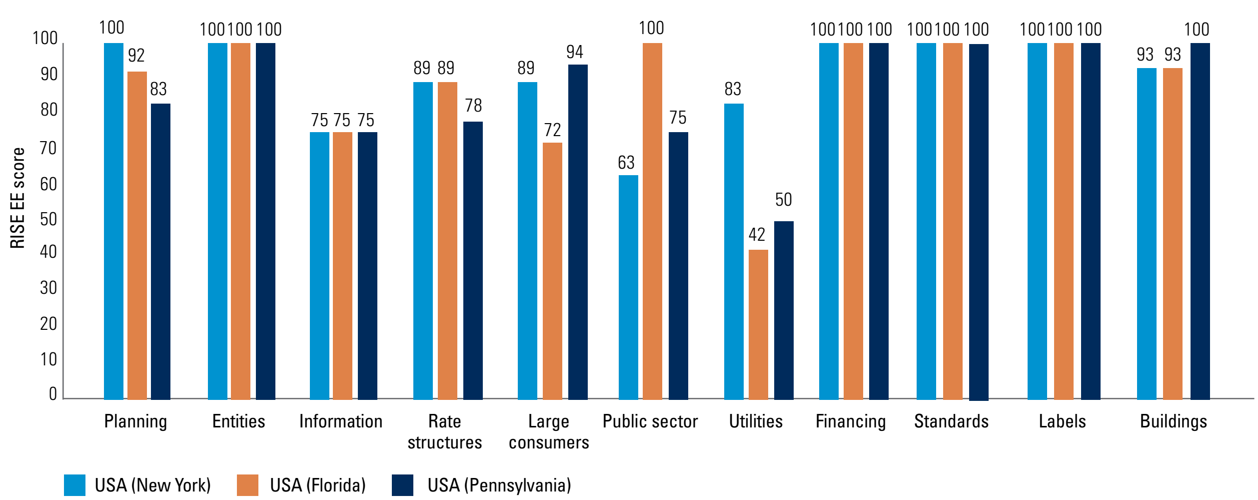
1. India Energy Outlook 2015.

**FIGURE A4.6** Energy efficiency deep dive results for Brazil




*Source:* RISE database, World Bank.

**FIGURE A4.7** Energy efficiency deep dive results for the United States




*Source:* RISE database, World Bank.

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# APPENDIX 7.
# SUSTAINABLE ENERGY INDICATOR INITIATIVES

| Organization | Initiative | Pillar | Number of countries |
|---|---|---|---|
| ACEEE | International Energy Efficiency Scorecard | EE | 16 |
| RCREEE | Arab Future Energy Index | EE, RE | 17 |
| Ernst & Young | Renewable Energy Country Attractiveness Index | RE | 40 |
| BNEF | Climatescope | RE | 55 |
| Innovation for Sustainability | MURE | EE | 28 |
| Castalia-CREF | Renewable Energy Islands Index | RE | 28 |
| Allianz/New Climate Institute/ Germanwatch | Climate and Energy Monitor | RE | 20 |
| IEA-RETD | RE-DELAYS | RE | 6 |

*Note:* RE = renewable energy; EE = energy efficiency.

Many countries share the vision of a secure energy future for all people. For most countries, realizing this vision requires huge investment in sustainable energy and a solid enabling environment of policies, regulations, and institutions. The regulatory indicators for sustainable energy (RISE) is a tool to help countries get to where they want to be. The suite of indicators capture the policy and regulatory landscape in energy access, renewable energy, and energy efficiency and provide a global reference point for policymakers. RISE highlights good practices across countries, supports peer learning, and fosters enabling environment for sustainable energy.

RISE report, customized analyses, datasets, and library of legal and regulatory documents are available in:

**http://RISE.worldbank.org//**

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