62247

Europe & Central Asia

Knowledge Brief

September 2010 ◆ Volume 29

The World Bank

Albania's Energy Sector: Vulnerable to Climate Change

Jane Ebinger

Key Messages

- **Water resources are a national asset for Albania: the river Drin generates about 90% of the electricity used by Albania's local industry and households.**
- **High dependence on hydropower brings challenges: electricity production can vary from almost 6,000 GWh to less than half that amount in very dry years.**
- **Climate change will likely have an adverse effect on hydropower production: by 2050, annual average electricity output from Albania's large hydropower plants could reduce by about 15% and from small hydropower plants by around 20%.**
- **Critical actions taken by Albania now to support optimal use of energy, water resources and operation of hydropower plants will help the country better manage climate variability and build resilience to climate change.**

Introduction

Energy security is a critical concern in Albania which relies on hydropower for about 90% of its electricity production. While renewable energy resources like hydropower play a fundamental role in moving the world towards a low-carbon economy, they can also be vulnerable to climatic conditions. Climate variability already affects Albania's energy production to a considerable extent and climate change is bringing further challenges.

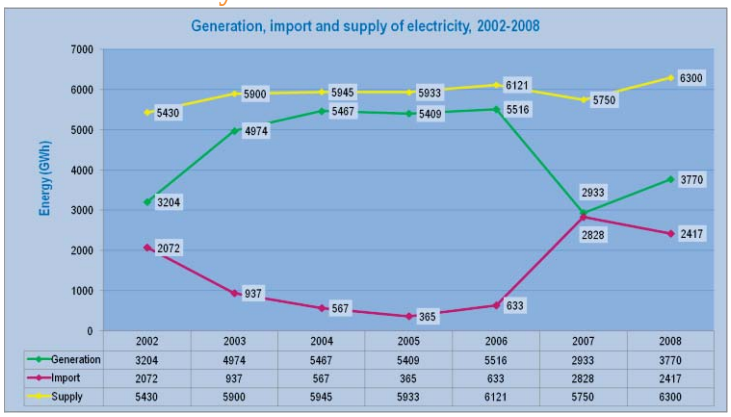
This Knowledge Brief provides an overview of a pilot vulnerability, risk, and adaptation assessment undertaken for Albania's energy sector by the Energy Sector Management Assistance Program (ESMAP), the World Bank and the Trust Fund for Environmentally and Socially Sustainable Development (TFESSD)[1], in partnership with stakeholders in Albania's energy sector. The assessment raised awareness and initiated dialogue on energy sector adaptation. It was aimed at building greater understanding of the climate risks faced by the energy sector and of priority actions that could be taken to reduce vulnerabilities, by addressing the following question: *"How can Albania best manage its future security of energy supply in the face of a changing climate?"*

Hydropower is a National but Variable Asset

The River Drin is the main source of electricity for Albania, delivering power for local industry and households and providing about 90% of domestic electricity generation. However, Albania still finds it difficult to meet energy demand and maintain energy supply due to the fluctuations in the country's rainfall and other precipitation on which hydropower depends. Hydropower production can vary between almost 6,000 GWh in very wet years to less than half that amount in very dry years. In 2007, a drought in the Drin's watershed led to severe electricity shortages and blackouts, affecting businesses and citizens alike. Figure 1 shows lower domestic power production linked to low rainfall in 2002 and again in 2007, with resultant associated high energy imports.

[1] http://web.worldbank.org/external/default/main?sortDesc=DOCDT&theSitePK=301412&cntry=82664&piPK=51189446&pagePK=51187344&menuPK=301440

Figure 1: Generation, Import, and Supply of Electricity in Albania from 2002 to 2008



Source: *Situation of Energy Sector and Activity for ERE for 2008*. Annual report. Energy Regulator of Albania.

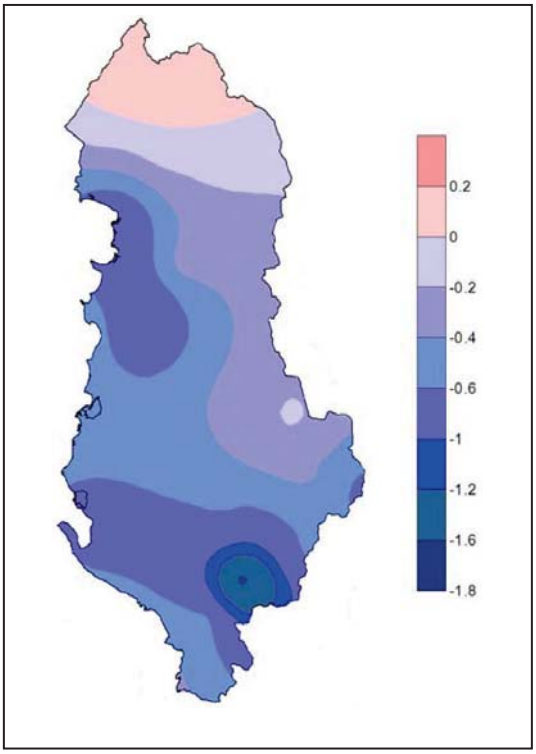
Other factors that constrain Albania's ability to manage energy challenges are limited regional electricity interconnections and inefficiencies in domestic energy supply, demand, and water use. Losses in the electricity distribution system were about 33% in 2008. Together, these factors create frequent load shedding and adversely impact Albania's economic development. Meanwhile, small hydropower plants compete for limited water resources with the irrigation needs of the agriculture sector. This problem is exacerbated during summer when rainfall is at its lowest and agriculture requires greater water supply. Improving the efficiency of water use in Albania's irrigation system, where 10% to 20% of water resources are lost, is an adaptation mechanism that can help both the energy and agriculture sectors.

Climate Change Could Make Matters Worse

Climate forecasters project an increase in droughts resulting from global warming and changing hydrology. These changes could reduce annual average electricity output from Albania's large hydropower plants (LHPPs) by about 15% and from small hydropower plants (SHPPs) by around 20% by 2050. Most of the country has already seen decreases in precipitation (Figure 2).

Other energy assets are not immune from climate impacts. Rising temperatures can reduce the efficiency of transmission and distribution lines, as well as the power produced by thermal power plants (TPPs) by about 1% each by 2050. If river-water cooled TPPs were developed in the future, they would be affected by changes in river flows and higher river temperatures, further reducing their efficiency. Solar energy production in Albania may, however, benefit from projected decreases in cloudiness as it is estimated that output from solar power could increase by 5% by 2050.

Figure 2: Annual Precipitation Trends (%) over Albania, 1961-1990



Source: Bruci, E. (2008). *Climate Variability and Trends in Albania.* Institute of Energy, Water and Environment, Tirana Polytechnic University, Tirana, Albania.
Note: Blue colors are areas that become drier.

Higher temperatures due to climate change may reduce the demand for heating in winter but will increase demand for air conditioning and refrigeration in the summer. The seasonality of Albania's supply-demand imbalance raises this problem: summer temperatures increase the demand for cooling and refrigeration at the same time that hydropower production is most constrained by reduced rainfall. Summer temperatures also coincide with greater irrigation needs in agriculture, which may compete directly with small hydropower plants for limited water supplies.

Current Efforts to Support Increased Energy Security

Efforts are underway to address these challenges and improve resource use efficiency. In 2008, for the first time, no electricity load shedding was programmed. Along with reductions in electricity losses from the transmission system, losses from the distribution system were reduced by 5.5% in 2008 compared to 2007.

Management actions were also taken to improve water use efficiency in electricity generation. In 2007 and 2008, inflows to the Fierze Reservoir were similar (approximately 4,120,000,000 m^3) but power generation in 2008 was 29.4% higher than in 2007. This was because high water levels were maintained in the reservoir in 2008 and there was better optimization between electricity import and domestic production. This improvement is reflected in a metric known as *specific consumption* (m^3 of water consumed per kWh of electricity generated). Specific consumption in 2007 was 1.40 m^3/kWh, whereas in 2008 it improved to 1.04 m^3/kWh. Through a new Energy Community of South East Europe – Albania Dam Safety Project that aims to safeguard the major hydroelectric dams of Albania, the Government will also support improvements in the operational efficiency of dams and enhance the stability of power supply for the regional electricity market. Overall, this will assist Albania to maximize its benefits from existing hydropower and regional interconnections, thus increasing energy security.

Adapting to Climate Variability is Crucial for Albania's Energy Sector

Adapting to climate variability and change is becoming increasingly important for the Albanian energy sector. The country's recent draft National Energy Strategy (NES) sets out a so-called *active scenario* which aims to improve energy security. This *active scenario* looks out to the medium term (the year 2019) and describes plans to diversify Albania's energy system by encouraging the development of renewable energy generation assets (solar, small hydropower plants, wind, and biomass) and thermal power plants. It does not consider climate change impacts on energy security in this timescale. Yet, over the longer time horizons of the ESMAP, World Bank and TFESSD study mentioned earlier (out to the year 2050), these assets will be increasingly affected by climate change.

The draft NES' *active scenario* notes the importance of new electricity interconnection lines to facilitate Albania's active participation in the southeast European energy market. The wider region will also be affected by climate change—about one quarter of the region's electricity is generated by hydropower plants; regional summer energy demand will rise along with temperatures and due to economic development. This could increase import prices and reduce supply unless region-wide coping strategies are devised.

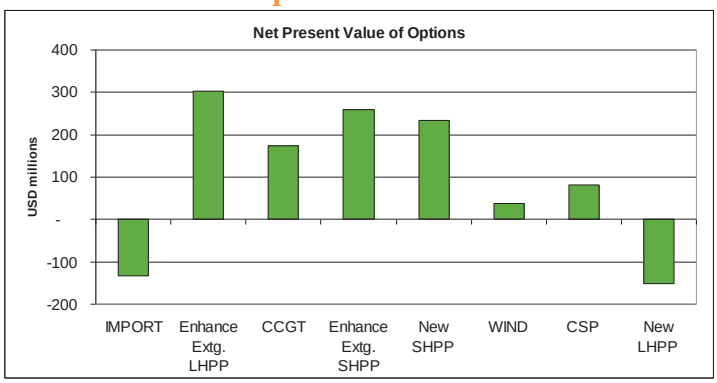
The draft NES' *active scenario* also emphasizes the need for improved energy efficiency through greater use of domestic solar water heating, improved building standards, lower-energy appliances, and alternative heating sources other than electricity. These energy-efficiency measures are increasingly critical as the climate changes and Albania must provide financial incentives to promote their use. However, based on experience from other countries, implementing these measures in a timely manner will be a significant challenge.

Climate Vulnerability Assessment Study Reveals Energy Shortfall by 2030 in Albania

Together with Albanian energy practitioners, the Climate Vulnerability and Adaptation Assessment team at the World Bank extrapolated the energy planning scenarios to 2050, as outlined in the draft NES' *active scenario*, to illustrate potential longer term impacts of climate change on energy supply and demand. Assuming full implementation of the measures already identified in the extrapolated *active scenario*, the potential supply-demand gap would grow to an estimated 350 GWh per year by 2030, equivalent to a power generation facility of 50 MW. By 2050, the shortfall would rise to 740 GWh per year (105MW), or 3% of total demand. Embedded within these figures are the more significant seasonal impacts on energy security due to changing demand and production over each year, with summer peak demand increasing when hydropower production is at its lowest.

A high-level cost benefit analysis (CBA) was undertaken to estimate the relative costs and benefits to Albania of supplying the shortfall in its electricity production attributed to climate change impacts. Using financial (capital and operational costs), environmental (water value, greenhouse gas and other emissions, and ecosystem values), and social (disturbance to people and property) parameters identified by Albanian stakeholders, the CBA ranked the sustainability of the options, such as increased energy trade and different types of domestic energy generation (Figure 3).

Figure 3: Net Present Value of Diversification Options to 2030



Source: *An Assessment of Climate Change Vulnerability, Risk, and Adaptation in Albania's Power Sector*. World Bank. 2009.

Figure 3 presents the Net Present Value results in current (2010) US$ terms for each of the options tested, under a *base case* set of assumptions for the period to 2030. Based on this analysis, the most economic options for Albania would be to upgrade existing LHPPs and SHPPs in the medium term, followed by development of new SHPPs and TPPs (shown in Figure 3 as combined cycle gas turbine, CCGT). Sensitivity analyses explored how assumptions about discount rates[2] and the value placed on greenhouse gas emissions could impact the priority placed on these options. The analyses confirmed that upgrading existing LHPPS and SHPPs were the most economic options under a broad range of assumptions.

Options for Building Climate Resilience in the Energy Sector

There are several critical actions that Albania could take now to support optimal use of energy, water resources, and operation of hydropower plants. Taking these steps now will help Albania better manage climate variability and build resilience to climate change:

- *Improving the way hydro-meteorological institutions monitor, forecast, and disseminate information on meteorological and hydro-meteorological conditions*. Albania could develop in-country or obtain from elsewhere, weather and climate forecasts appropriate for energy sector planning. These would cover short-range forecasts (1-3 days), medium-range forecasts (3-10 days), seasonal forecasts, and regional downscaled climate change projections. The information could help energy sector stakeholders undertake joint climate risk assessments on shared water resources and regional energy networks, and devise agreed strategies to manage identified climate vulnerabilities and risks.

- *Improving energy efficiency by reducing system losses and encouraging and helping end users to manage their demand for power.*

- *Upgrading Emergency Contingency Plans (ECPs) for hydropower plants* where needed, to account for expected increases in precipitation intensity due to climate change. Power producers and local authorities may also need to improve their capacity to implement ECPs, ensuring that they provide sound mechanisms for monitoring weather and its influence on river flows and reservoir levels. They would also need to improve their communication with downstream communities and contingency plans for evacuation.

- *Ensuring the management and development of water resources is integrated across all sectors--energy, agriculture, water supply, and sanitation--and takes into account cross-border concerns, along with environmental and social concerns.*

- *Exploring further adaptation opportunities.* Climate change makes it imperative that Albania should diversify its energy supplies through increased regional energy trade and more diverse portfolio of domestic generation assets. With the country considering major investments in upgrading new energy assets and the privatization of assets, the earlier climate risks are considered, the greater the opportunities to identify and implement solutions that make the energy system more robust and resilient for coming decades.

About the Authors

Jane Ebinger is a Senior Energy Specialist in the Energy Sector Management Assistance Program of the Energy Transport and Water Department of the World Bank.