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Job Creation through Infrastructure Investment in the Middle East and North Africa

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Abstract

In the next 10 years or so, the infrastructure sector has the potential to generate significant employment. This paper estimates annual job creation of about 2.0 million in direct jobs and 2.5 million in direct, indirect and induced infrastructure-related jobs just by meeting the infrastructure investment needs of about 6.9 percent of gross domestic product (about US$106 billion) for the Middle East and North Africa region on average. The breakdown in expected needs is 11 percent in developing oil exporters, 6 percent in oil importing countries, and 5 percent in the Gulf Cooperation Council oil exporters. Needs are particularly high in electricity and roads. While important, infrastructure job creation will not resolve the region's unemployment problem alone and its job creation potential varies greatly across countries. Moreover, the current ability to finance and hence meet the infrastructure needs varies significantly across countries. Oil importers are likely to fall short under business as usual scenarios. In a region in which the public sector is the main source of infrastructure financing, fiscal choices will thus matter to job creation through infrastructure. But there are more challenges, including the governance of job creation, and the proper targeting and costing of subsidies for job creation and the (re)training programs needed. Managing expectations will also matter, as infrastructure jobs will help but will not solve the region's unemployment and underemployment problems.

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Job creation through infrastructure investment in the Middle East and North Africa

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1. Introduction

Lack of job opportunities, especially for young people, is a well known, major issue in the Middle East and North Africa (MENA).[2] The region's labor force has been growing at a rapid pace – a consequence of relatively high population growth and rising female labor force participation, but job creation has been lagging behind. The need to achieve tangible employment results relatively quickly has become urgent in the context of the Arab Spring events. This paper assesses the potential for job creation through infrastructure investment in the MENA region in an environment in which heightened regional and global uncertainty has temporarily restrained private investment - the traditional source of new jobs in expanding economies.

Because effectively directed and fostered, infrastructure investment has a deep and far reaching impact on economic development, it is often also seen as a potential quick source of jobs. Moreover, it can potentially be designed to help meet social goals. Indeed, improved provision of high-quality basic infrastructure services, such as hospitals, schools, and water supply and sanitation, raises living standards, improves employability of populations and prospects for inclusive growth.

MENA has, in fact, done quite well in using public investment to stimulate growth and jobs, including in infrastructure. For the last 25 years, public investment spending in MENA was higher than in most developing regions (except East Asia) and twice as large as the OECD average, largely because of robust spending in the oil exporting countries which benefited from rising fuel prices. Spending on infrastructure boosted employment in the construction sector, which was a major source of job growth in the 2000s relative to both other sectors and other countries. Construction created about 30% of the jobs in MENA, which was twice the average for fast growing, high investment countries such as Indonesia and Brazil.

The paper shows that maintaining and spreading the momentum in infrastructure will be important to support growth and job creation in the Middle East and North Africa. To do so, policymakers will have to recognize that there are large differences in the initial conditions across the region in terms of stocks, needs, fiscal commitments, private sector participation potential and job creation potential.

The paper is organized as follows. Section 2 explains the sector context and Section 3 the sub-regional context. Section 4 summarizes the data available on the current level of employment in MENA's infrastructure sector. Section 5 discusses the main methods used to assess the job creation potential of the infrastructure sector and explains how we do it for the MENA region. Section 6 concludes with policy recommendations.

[2] For ease of exposition and analysis, throughout the paper we use the following country classification for the Middle East and North Africa. The region is composed of three non-overlapping sub-regions: GCC oil exporters, developing oil exporters and oil importers. The GCC oil exporters consist of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE). The developing oil exporters, also referred to in the paper as other oil exporters, include Algeria, Islamic Republic of Iran, Iraq, Libya, Syria, and Yemen. The oil importers are Egypt, Tunisia, Morocco, Lebanon, Jordan, Djibouti and West Bank and Gaza. Developing MENA is used to refer to the group of developing oil exporters and oil importers.

2. Sector context

While infrastructure investment in the region overall has been strong (Table 1), there is wide variation across countries in the quality and quantity of infrastructure (Table 2). The high-income Gulf Cooperation Council (GCC) group has the best infrastructure endowments and services in the region, reflecting advanced stage of development and commitment to infrastructure investments financed by oil revenues. However, infrastructure deficiencies in developing MENA remain a concern.

Table 1: Infrastructure endowments in the developing world (averages 2005-2008)

Sector	EAP	ECA	LAC	MENA	SA	SSA
Density of paved road network km / 1,000 km2 of arable land	1,128	1,051	2,965	**2,179**	467	1,095
Telephone Density Fixed and mobile subscribers per 1,000 people	400	929	839	**537**	353	273
Electricity generating capacity Million KWh per million people	0.30	0.92	0.44	**0.30**	0.31	0.11
Access to electricity % of population with access	62	NA	86	**91**	48	31
Improved Water % of population with access	81	94	91	**88**	82	67
Improved Sanitation % of population with access	62	90	78	**83**	55	33

Source: World Bank Development Indicators

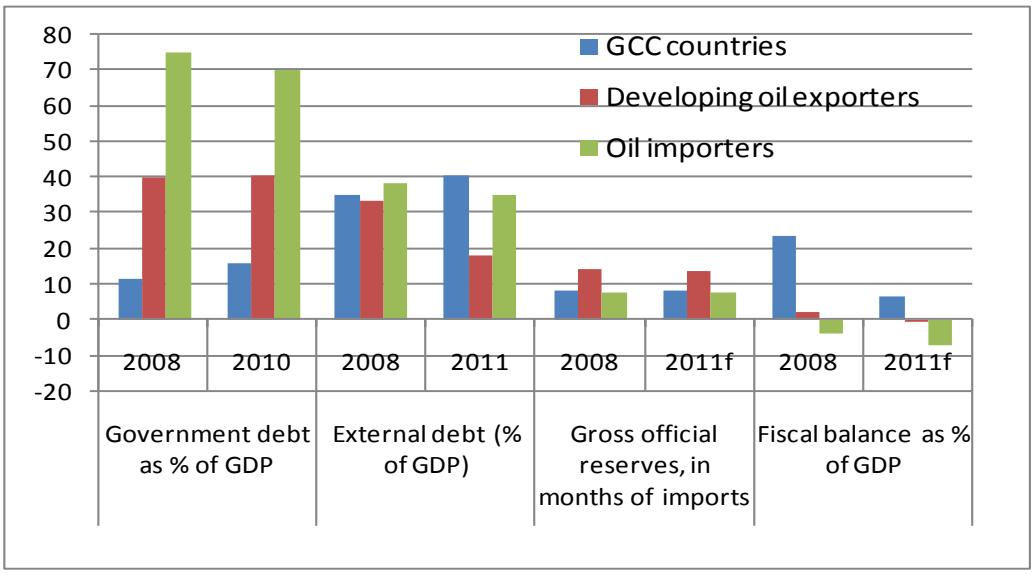
Table 2: Infrastructure endowments in MENA by country grouping (averages 2005-2008)

Sector	OIC	OEC	GCC
Density of paved road network Km / 1,000 km2 of arable land	3,220	618	16,907
Telephone Density Fixed and mobile subscribers per 1,000 people	535	538	1,351
Electricity generating capacity Million KWh per million people	0.3	0.4	2.9
Access to electricity % of population with access	98	85	98
Improved Water % of population with access	93	79	97
Improved Sanitation % of population with access	84	81	99

Source: World Bank Development Indicators

The infrastructure gap challenge is particularly important for oil importing countries (OIC). In these countries, public investment spending has been following a downward trend and continues to be weak simply because they have much more limited fiscal space than the oil exporters (Figure 1). Growth in public-private partnerships had recently been helping to close the gap in some oil importing countries, but the economic consequences of the Arab uprisings, combined with economic difficulties in Europe, have reduced private investment, with possible negative consequences for infrastructure spending.

Figure 1. Fiscal space indicators



Data sources: World Bank, IMF and Government sources.

Differences in the quality and quantity of infrastructure endowments and services across countries as well as differences in needs within countries and sectors make the identification of infrastructure needs quite complex in the region. Moreover, under a business as usual scenario, the gaps are likely to magnify as demand for infrastructure grows with population and income growth, and countries face challenges related to water and energy conservation, efficiency, and climate change.

When little detailed data are available to conduct a bottom-up approach, the assessment of infrastructure needs can be based on the estimation of econometric models of demand for each infrastructure subsector. Fay and Yepes (2003) and Yepes (2008) are among the best known papers illustrating the method across regions of the world. In this paper, we improve their earlier estimates for the MENA region by: (i) including data on infrastructure stocks for countries of the region from national sources as compared to relying on extrapolations from international databases; (ii) updating the data from original international sources; and (iii) including high income countries (GCC) in the definition of MENA. Demand for infrastructure is assessed by regressing per capita stocks of infrastructure against per capita income, the share of GDP derived from agriculture and manufactures, population growth and density, urbanization rate, and technology (Table 3).

Table 3. Econometric Models of Infrastructure Needs

	Paved Roads	**Total Roads**	**Rails**	**Ports**	**Telephone mainlines**	**Mobile lines**	**Electricity generation**
Method	Probit for grouped data	Fixed Effects	Fixed Effects	Fixed Effects	Logit for grouped data	Logit for grouped data	Fixed Effects
Per capita GDP	-0.261***	0.111*	-0.0107	1.124***	0.983***	0.414***	0.652***
	(0.00188)	(0.0575)	(0.0422)	(0.164)	(0.000166)	(0.000175)	(0.0549)
Share of manufactures in GDP	0.131***	0.00209	-0.0428	0.152	0.0686***	-0.142***	0.199***
	(0.00183)	(0.0435)	(0.0395)	(0.111)	(0.000178)	(0.000197)	(0.0343)
Share of agriculture in GDP	-0.179***	-0.0772	0.0630	-0.202*	0.199***	0.184***	0.147***
	(0.00197)	(0.0491)	(0.0393)	(0.121)	(0.000153)	(0.000186)	(0.0429)
Population density	-0.574***	-0.427***	-0.929***	0.409	-0.00914***	2.133***	-0.00847
	(0.00459)	(0.116)	(0.102)	(0.298)	(0.000294)	(0.000354)	(0.100)
Urbanization	-0.493***	0.377***	-0.0421	0.279	3.361***	1.259***	0.141
	(0.00541)	(0.137)	(0.112)	(0.337)	(0.000515)	(0.000530)	(0.0872)
Population growth					-1.645***	-0.828***	
					(0.00133)	(0.00157)	
Time trend	0.0985***	-5.684	-1.224				0.0697***
	(0.000500)	(4.146)	(1.304)				(0.0126)
Time trend squared		0.00714	0.00155				
		(0.00519)	(0.00164)				
Market age				0.102***	0.107***	0.111***	
				(0.0121)	(1.37e-05)	(1.69e-05)	
Market age squared				-0.00117***	-0.00366***	0.00414***	
				(0.000235)	(3.78e-07)	(5.67e-07)	
Constant	-35.32***	1,128	236.2	-15.28***	-8.373***	-13.74***	-34.94***
	(0.191)	(828.6)	(260.0)	(2.094)	(0.00281)	(0.00287)	(4.722)
Observations	*A*	633	551	496	*a*	*a*	1,034
R-squared		0.119	0.540	0.801			0.459
Number of coefficients		172	109	102			173

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All relevant variables are in logarithms. *a* indicates a large number of observations due to the grouped technique.

Projected levels of infrastructure stocks are valued at the unit costs used in Yepes (2008) and shown in Table 4. Time dummies and country fixed effects are used in order to proxy differences in infrastructure prices. In the case of telecommunications and ports, a market age variable accounts for the speed of technological change across countries. Lagged dependant variables are included to eliminate the structural part of interest. Analysis of spurious regressions have been made as in the literature showing that a structure of lagged variables as in Arellano and Bond estimations can eliminate all variance thus eliminating the structural part of interest (Yepes, Pierce and Foster, 2008).

The models are estimated on a worldwide dataset, although with a partial coverage of regions including MENA. The database used for these estimations is an annual panel data of infrastructure stocks, macroeconomic variables, and demographic characteristics (see for details the data annex). Data for MENA countries covers years up to 2008. The data are taken mainly from the World Bank's World Development Indicators (WDI) complemented with material from

country official statistical offices and other multilateral organizations (see Annex).[3] The annual GDP growth rate for the world as a whole is assumed to be 3.5% per year in the period 2011-2020, while that for MENA is 4.3%. Oil importing countries are assumed to grow at 3.5% per year, while developing oil exporters and GCC countries are assumed to grow at 4.6% and 4.5%, respectively.[4] Demographic trends are taken from the 2009 UN Urbanization Prospects.

Table 4: Unit costs of infrastructure by sector (US$)

Sector	Cost per unit	Unit	Depreciation rate (%)
Electricity generation	2,000	kW	4
Paved roads	410,000	Kilometer	4.7
Unpaved roads	50,000	Kilometer	7.2
Rails	900,000	Kilometer	4
Rural water and sanitation	150	person	3
Urban sanitation	150	person	3
Rural sanitation	130	person	3
Urban water	80	person	3
Main telephone lines*	127-580	line	8
Mobile lines*	127-451	line	8
Access to electricity	195	person	4
Ports	348	TEU	4
Wastewater treatment	120	person	3

Source: Yepes (2008). *Varies by region.

In order to assess the full budgetary allocation needed by the various sectors, estimates of the associated maintenance needs are included as well. Maintenance is needed for any investment to meet its assumed lifetime so a commitment to maintenance is built into the cost-benefit analysis and the calculation of the social rate of return of the investments. In this paper, maintenance costs are estimated by multiplying the stock value in the previous period by a depreciation rate. A fixed annual depreciation rate is assumed for each sector and shown in Table 4. Estimates of total annual expenditure needs by sector, sub-group and region are presented in Table 5. In the absence of data for a sector or subsector in a country, regional averages of investment were imputed to obtain total investment needs.[5]

[3] In some cases recent trends of annual growth of the same series are used to fill in missing values. United Nations National Accounts Main Aggregates Database is used for historical GDP and for the value added components of agriculture and manufacturing. Additional data on container port traffic is taken from the Containerization International Yearbook (1970-2006). Extra information on roads and paved roads is available for Oman. GDP projections are from the World Bank.

[4] When past growth rates were not available, a Hodrick-Prescott filter (with a smoothing factor of 100) was used to obtain the long-run growth rate trend of the past ten years (1999-2009) resulting in an implied annual growth rate equivalent to that of the World Bank projections. Growth rates are then used to obtain 2010-2020 GDP scenarios.

[5] Regional averages of investment as a share of GDP were used in the following cases: roads in Syria, electricity in West Bank and Gaza, water and sanitation in Bahrain, sanitation in Saudi Arabia and Ports in Bahrain, Iraq, Libya, Qatar, Syria and West Bank and Gaza.

Table 5. Annual expenditure needs for infrastructure in the MENA region

Sector	OIC	OEC	GCC	TOTAL
		Percent of GDP		
Transport	**2.2**	**5.1**	**2.0**	**3.0**
Paved Roads	1.4	2.7	0.6	1.4
Unpaved Roads	0.6	2.1	1.3	1.4
Rails	0.1	0.1	0.0	0.1
Ports	0.1	0.1	0.1	0.1
ICT	**0.8**	**1.1**	**0.2**	**0.6**
Telephone mainlines	0.2	0.3	0.0	0.2
Mobile lines	0.6	0.7	0.2	0.4
Electricity	**2.5**	**4.2**	**2.5**	**3.0**
Electricity generation	2.1	3.7	2.4	2.7
Electricity Access	0.4	0.5	0.1	0.3
Water and Sanitation	**0.5**	**0.6**	**0.1**	**0.3**
Water	0.2	0.2	0.0	0.13
Sanitation	0.3	0.3	0.1	0.19
Total needs	**6.0**	**10.9**	**4.8**	**6.9**
Total financing	**4.3**	**12.2**	**8.3**	**8.8**
		Amount (in 2005 US$ million)		
Transport	**8,575**	**22,492**	**14,453**	**45,519**
Paved Roads	5,448	12,088	3,956	21,492
Unpaved Roads	2,246	9,497	9,461	21,204
Rails	428	639	75	1,143
Ports	452	268	960	1,680
ICT	**3,021**	**4,707**	**1,559**	**9,287**
Telephone mainlines	696	1,464	259	2,419
Mobile lines	2,325	3,243	1,300	6,868
Electricity	**9,894**	**18,607**	**17,602**	**46,103**
Electricity generation	8,214	16,467	17,139	41,820
Electricity Access	1,680	2,140	463	4,283
Water and Sanitation	**1,764**	**2,497**	**647**	**4,908**
Water	745	1,040	190	1,975
Sanitation	1,019	1,458	457	2,934
TOTAL	**23,254**	**48,303**	**34,261**	**105,818**
Share by country group	*22%*	*46%*	*32%*	*100%*
Investment	**10,261**	**20,739**	**15,786**	**46,786**
Maintenance	**12,992**	**27,564**	**18,475**	**59,032**

Source: Authors' calculations. Note: Total financing is estimated based on IMF/IFS investment data and World Bank Private Participation Infrastructure database.

3. Sub-regional context

The overall infrastructure and maintenance needs are quite large and assessed at about 106 billion dollars per year or 6.9% of the annual regional GDP through 2020. The estimated differences in needs across sub-regions are just as impressive. Developing oil exporting countries (OEC) are expected to have to commit almost 11% of their GDP annually ($48 billion) on improving and maintaining their national infrastructure endowments, while the oil importing countries (OIC) and the GCC oil exporters will need approximately 6% and 5% of their GDP, respectively, to ensure enough infrastructure to meet their growth and poverty reduction targets.

Investment and rehabilitation needs are likely to be especially high in the electricity and transport sectors, particularly roads. Electricity and transport are each estimated to account for about 43% of total infrastructure needs in MENA, followed by ICT (9%) and water and sanitation (5%). Fulfilling the electricity need alone would require approximately 3% of the annual, regional GDP or $46 billion, of which 10 billion will be spent in oil importing countries, and around 36 billion in the oil exporting countries. During the next decade developing oil importers in MENA will need to spend about $86 billion dollars on upgrading their transport networks, while the developing and GCC oil exporters will need $225 billion and $145 billion, respectively. Rehabilitation needs are expected to account for slightly more than half of total infrastructure needs.

While oil exporters will be able to meet their national infrastructure needs if they maintain investment spending at rates prevailing in the 2000s, oil importers will fall short. Since the vast majority of funding for infrastructure comes from public budgets, it will be critical to protect public investment budgets and try to increase resources going to the sector in the case of oil importers. Doing so will be a smart choice for governments looking to create jobs and growth. The fiscal challenge will be the toughest for the poorest countries of the region since they are the least likely to be able to attract private financing for infrastructures required to meet population's needs.

4. Current infrastructure employment

A comparison of employment shares by sector and country to international benchmarks provides a first-round assessment of the extent to which infrastructure activities could play a role in speeding up job creation in MENA. The shares are computed using ILO data that disaggregate employment into industrial sectors at the 1-digit ISIC level allowing an identification of electricity and water sector jobs as well as jobs in transport and communications. Data on construction is included as an important element of infrastructure investment. The construction category encompasses housing and building construction. These two activities are likely to be the main drivers of job creation, but other infrastructure investments are still likely to account for a significant share of employment creation.

Table 6 shows that MENA's infrastructure sectors, including construction and infrastructure services, employ close to one-fifth of the regional workforce, or 18.2 million people. About 11 million workers are employed in construction while the remaining 7.5 million provide infrastructure services. Within infrastructure services, the transport and communication sectors are the biggest employers, representing jointly about 7% of total employment, while workers employed in energy and water represent approximately 1%. These aggregate numbers

hide significant variation across countries, as Iran for example employs more than 40% of the country's workforce in the construction and infrastructure sectors, while Egypt and Yemen employ just around 11%.

Table 6 Employment shares by sector
(% of all employed in 2009)

	Total	Construction	Infrastructure
GCC oil exporters	**18**	**12**	**6**
UAE	19	13	6
Saudi Arabia	18	7	11
Qatar	18	10	8
Oman	21	11	10
Kuwait	19	13	6
Bahrain	18	15	3
Developing oil exporters	**23**	**13**	**10**
Yemen	11	7	5
Iraq	15	9	6
Iran	42	37	5
Algeria	15	9	6
Syria	15	8	7
Oil importers	**17**	**9**	**7**
Tunisia	16	11	5
WB&G	23	15	8
Morocco	25	14	11
Jordan	21	13	8
Egypt	11	3	8
MENA	**19**	**11**	**8**
World Average	**16**	**8**	**8**
Developed countries	**15**	**8**	**7**
Developing countries	**16**	**9**	**8**

Source: ILO

Developing oil exporting countries have a higher share of jobs in the infrastructure and construction sectors, not only relative to other groups in the region, but also relative to international benchmarks. In contrast, oil importers' employment shares are more in line with international averages, although their employment in infrastructure is below various international benchmarks (Table 6). It is worth noting that many of the infrastructure and construction jobs in the GCC economies are performed by migrant workers, although lack of data precludes separating out the impact of infrastructure investments on employment of migrant and national workers.

Assuming that world benchmarks gauge the normal size of employment in the infrastructure sector (Table 6), we conclude that in general the scope for increasing the relative size of employment in the sector is limited. The same is the case for employment in construction in all sub-regions and the region as a whole, although there is some scope to expand the relative

size of employment in infrastructure services in oil importing and GCC countries where infrastructure's employment share is below world norms.

5. Assessing the employment effects of infrastructure investment in MENA

This section distinguishes between direct and indirect jobs as well as between short term and long term effects. These differences have important policy and political dimensions as discussed below.

Short-term employment effects

The short-term employment generated by infrastructure spending is typically assessed in two steps. First, direct employment is estimated using information on the nature of infrastructure spending and the amount of different types of labor required by financed projects. Second, indirect and induced employment effects are estimated using multipliers from past experience that link these types of employment to direct employment. In order to estimate how much direct employment a given investment project would create, it is necessary to start with actual data from an infrastructure project that is similar to the project in question. This is typically done by using country-specific Input-Output (IO) tables. This direct employment effect understates, in some instances significantly, the total employment generated by infrastructure spending. A survey of the literature[6] indicates an actual employment multiplier effects in the range of 1.2 to 3.5.

The availability of non-OECD countries' IO tables with employment and multiplier data is limited, restricting the use of this methodology in the case of the countries in the Middle East and North Africa region. Hybrid methods, such as those pioneered by Schwartz, Andres, and Dragoiu (2009) and by LECG (2009), can be adapted to address transferability across countries at different times and stages of development. The hybrid approaches work best in those cases when economies have similar structures and are at similar levels of development. A study on Egypt (ILO 2010) provides information from the most recent Egyptian IO table which includes 22 sectors based on ILO data for 2007/08 and the calculation of multipliers for all sectors. This information is relevant to the oil importing MENA countries whose IO structures are similar to Egypt's. However, the GCC and developing oil exporters were judged to be too different in terms of economic structure and GDP per capita levels to make extrapolation from the Egyptian case reliable. For this reason we follow Schwartz et al. (2009) and employ an alternative method for assessing the employment effects of investment spending in MENA.

Schwartz et al. (2009) investigated the employment effects of a stimulus package of spending in various infrastructure sectors in the Latin America and Caribbean (LAC). They used project data from a number of World Bank studies to derive the share of investment expenditure on labor, and the share going to imports, in the main infrastructure sectors. Combining the expenditure share on labor with data on region-wide average wages (plus benefits) allowed them to compute the direct employment per US$ billion. The authors used data from the US highway sector to derive type I and type II multipliers and calculate indirect and induced employment. Taking a weighted average portfolio of infrastructure sectors allowed them to estimate the employment created by a representative basket of infrastructure investments.

[6] Studies include Tregenna (2007), Bekhet (2011), DIT (2007), SEME (2010), Vesin (2011), Ishihara and Bennett (2010), and Schwartz et al. (2009).

We made a number of extensions and changes to adapt the approach in Schwartz et al. (2009) for LAC to MENA. First, wage levels were changed to reflect the fact that they are heterogeneous across and within MENA countries, and different from those in LAC. Following the idea of Schwartz et al. (2009), hourly wage costs for construction work were estimated for the three sub-regions of MENA as given in Table 7.[7] Computing hourly wages is crucial for all the estimates and is subject to potential underestimation, specifically for the GCC and the developing oil exporting countries. To build our reference values, we take data from Gardiner and Theobald[8] (2007) for Lebanon, Qatar and UAE and data from Tong (2010) for the UAE.[9] Those data correspond to the actual cost of labor, as they encompass the various compensation schemes and not only the direct cash transfers. We need to provide homogenous wage estimates within sub-regions as the investment needs applied later are aggregated values. To do so, we compute regional wage averages, based on the ILO Key Indicators of the Labor Market in 2011 and assume constant difference between the ILO indicators and the total compensation in the selected countries. Our estimates have to be considered carefully as they do not reflect the intensive use of migrant workers in the infrastructure and construction sectors and the high variance of wages in developing oil exporters and GCC economies.

Table 7 Estimated hourly wages (in 2010 US$) in infrastructure works

Region	**US$ per hour: Qualified workers**	**US$ per hour: Non-qualified workers**
GCC oil exporters	4.5	3.0
Oil importing countries	1.5	1.0
Developing oil exporters	3.0	2.0

Source: Authors' estimates

Second, we adopted more conservative multipliers than the estimated multiplier of 4 proposed by Schwartz et al. (2009).[10] In this adaptation we use the multipliers for 2007/08 in the Egyptian IO table. The type II multiplier (the ratio of all jobs created to the number of direct jobs) varies between 1.09 and 1.82. Those multipliers suggest that the transport and communication sectors, for instance, have far greater potential to create induced and indirect job effects than the roads and bridges construction sector. This indicates that when investment decisions are made with the objective of creating jobs, consideration should be given to both direct and indirect employment effects as well as the type of skills required to implement projects.

Third, this adaptation also estimates and accounts for the share of each input factor for infrastructure projects relevant for MENA countries and based on standard technologies for each subsector that were not considered in the LAC estimates.[11] The shares, presented in Appendix Table 1, indicate that labor accounts for a much larger share of costs in water and sanitation than in roads, ports and electricity generation and access. The sanitation sector is most promising as

[7] Schwartz et al. (2009) assume hourly wages gross of benefits to be respectively US$6 and US$3 for qualified and non-qualified workers in LAC.

[8] The data in Gardiner and Theobald (2007) for Latin America are consistent with the ones used in Schwartz et al. (2009), allowing us to use a similar methodology.

[9] Converting to US$ hourly wage, the median wage in construction is approximately US$3.7.

[10] Such a multiplier implies one indirect job per one direct job, one induced job per one direct and one indirect job.

[11] The percentages for railways are adapted from Heintz et al. (2009). The estimates for telecommunication are adapted from Foreman and Beauvais (1999).

an employer of unskilled workers. This sector spends nearly 60% of total costs on nonqualified workers' salaries (Annex Table 1). Fourth, this assessment relies on the estimates of investment needs for infrastructure in the MENA region and its three subregions, presented in Table 5. Thus, we link the demand for infrastructure with the supply side effects of infrastructure provision on employment and bring realism into the projections.

Table 8 illustrates our methodology for the oil importing countries. The detailed results for the two other subregions are provided in Appendix Tables 2 and 3. The direct job per billion $ in the sector presented in column (1) is obtained by combining the shares of qualified and non-qualified labor inputs in Appendix Table 1 and the wages in Table 7.[12] The share of each sector in the infrastructure needs of the region in column (2) is taken from Table 5. From (1) and (2) we derive the number of direct jobs created in each sector by US$ 1 billion of infrastructure investment (3). We use the type 2 multipliers of the Egyptian IO table (4) to estimate the total job creation in each subsector (5).

Table 8 Estimated, potential job creation in OIC

	Direct job / billion $ in the sector (1)	Share of investment needs (2)	Direct job / billion $ in infrastructure (3)	Type II multiplier (4)	Total jobs (5)
Paved Roads	95000	0.24	22353	1.09	24359
Roads	45000	0.10	4538	1.09	4945
Rails	68333	0.02	1148	1.82	2090
Ports	83333	0.02	1401	1.61	2255
Telephone mainlines	125000	0.03	3782	1.34	5067
Mobile lines	125000	0.10	12395	1.34	16609
Electricity generation	50000	0.35	17647	1.35	23826
Electricity Access	93333	0.07	6745	1.49	10050
Water	208333	0.03	6653	1.21	8050
Sanitation	226667	0.04	9905	1.21	11985
Total		**1.00**	**86566**		**109236**

Source: Schwartz et al. (2009), Tong (2010), ILO (2011), Foreman and Beauvais (1999), Gardiner and Theobald (2007), Note 3, Bacon and Kojima (2011) and own computations.

[12] Following Schwartz (2009), we consider a yearly average of 2000 hours per worker.

The results by country grouping suggest that the infrastructure sector has the potential to contribute to employment creation in MENA, although it alone will not resolve the region's unemployment problem. In the short-run every one billion of US$ invested in infrastructure has the potential of generating, on average, around 110,000 infrastructure-related jobs in the oil importing countries, 49,000 jobs in the developing oil exporting countries, and 26,000 jobs in the GCC economies (Table 9).

The region could therefore generate 2.0 million direct jobs and 2.5 million direct, indirect and induced infrastructure-related jobs just by meeting estimated, annual investment needs, but the potential varies greatly across countries,[13] and these jobs account for less than 2% of the labor force in the region. Put differently, these jobs would be foregone if countries decide to trim their public investment rates going forward. Infrastructure investments could provide a quick response and be part of the solution to the unemployment challenge, but infrastructure alone will not resolve this problem.

Table 9 Estimated, potential job creation in response to meeting infrastructure needs in MENA

	Infrastructure needs (billions)	Direct jobs/billion	Total jobs*/billion	Labor force (000) in 2009	Direct jobs as a share of the labor force	Total jobs as a share of the labor force
GCC	15.8	20859	26194	16387	2.01%	2.53%
OIC	10.3	86566	109236	61598	1.45%	1.83%
OEC	20.7	39454	48573	52884	1.54%	1.90%
Total	**46.8**	**2 037 900****	**2 544 457****	**130 869**	**1.56%**	**1.94%**

Source: Authors' estimates. Notes: *Total jobs include direct, indirect and induced jobs created per billion US$ in the short-run. **The estimate of total direct jobs in the last row of the table refers to the jobs created by meeting annual infrastructure needs. This estimate is obtained by multiplying the estimated infrastructure needs for a particular group with the corresponding direct jobs estimated per US billion, and then summing up across groups.

Long-term employment effects

The long-term employment effect of infrastructure investment in MENA could be significant. The study finds that the employment response induced by infrastructure investment resulting in 1% point additional growth is expected to be 9 million additional jobs in the course of ten years in MENA, or a little less than 1 million jobs per year. Such a response is significant as it accounts for approximately 30% of the jobs created in the region during the 2000s, and is based on assessments using employment-growth elasticities from ILO for 2009. Had these jobs been created during the last decade, the unemployment rate would be substantially lower than the 10% registered in 2009.

The infrastructure investment required to boost growth by 1% point depends on the output elasticity with respect to infrastructure. The lower the growth elasticity with respect to infrastructure, the higher the required increase in the stock of infrastructure. In a recent meta-

[13] Because of per capita income differences, a given level of spending would generate more jobs in a sector in low-income Djibouti than in upper middle-income Lebanon, but the latter would find it easier to finance investment expenditure.

analysis of over 100 studies, Estache and Garsous (2011) find that the effect of infrastructure on growth depends on three main factors: (i) the specific indicators used to approximate infrastructure;[14] (ii) the time period analyzed;[15] and (iii) the level of development of the country in question.[16]

Since there are no specific growth elasticities with respect to infrastructure for the MENA region or countries, it is necessary to rely on a survey of international experience in developing countries to obtain an estimate of the output elasticity with respect to infrastructure. Although there is quite a large literature on the topic, relatively few studies cover developing countries. The basic average elasticity used for the MENA sample, and an associated confidence interval, draw on the estimation results from ten studies focusing on developing countries presented in Table 10. These are relatively high elasticities when compared to those used for developed countries – a fact consistent with one of the lessons in Estache and Garsous (2011). The variance is however large enough to be concerned about the reliability of the average elasticity derived from this sample.

Table 10 Output elasticities with respect to infrastructure for developing countries

Authors	**Estimated Elasticity**
Dessus & Herrera (2000)	0.13
Gwartney, Helcombe & Lawson (2006)	0.17
Khan & Kumar (1997) (Africa)	0.32
Khan & Kumar (1997) (Asia)	0.26
Nazmi & Ramirez (1997)	0.129
Odedokun(1997)	0.033
Ram(1986)	0.372
Ram(1996)	0.299
Ramirez (1998)	0.58
Sanchez-Robles (1998)	0.003
Sridhar & Sridhar (2004)	0.098

To assess the robustness of the elasticity, we build a confidence interval for the mean μ of this sample. The empirical mean and the standard error of this sample are respectively given by $\bar{x}$=0.22 and *s=0.17*. Therefore, assuming normality, we have:

$$P\left(-1.96 \leq \frac{0.22-\mu}{\frac{0.17}{\sqrt{n-1}}} \leq 1.96\right) = 0.95.$$

Consequently, there is only a 5% chance that μ does not fall into the following interval:

$$0.115 \leq \mu \leq 0.325.$$

[14] Using energy as a proxy guarantees a much stronger impact than using water or even telecoms, and a synthetic indicator provides an intermediate level of impact as expected.
[15] The impact was stronger in the 1950s and 1960s than in the last two decades.
[16] The less developed the country, the higher the likely impact. However, this result is not as statistically robust as expected.

The boundaries of this interval define reasonably robust lower and upper bounds for the output elasticity with respect to infrastructure in developing countries. The lower bound of the elasticity suggests that an increase of 8.7% in the stock of infrastructure is required to add a percentage point to growth in the MENA region. This is the more likely scenario in high-income MENA, comprised of the GCC economies and some upper middle-income MENA countries, since the growth impact of an additional unit of infrastructure investment tends to be smaller in the more developed countries. With the upper bound elasticity, the required increase in infrastructure stock is just 3.1%.

6. Policy implications and concluding remarks

Infrastructure investment has the potential to create jobs quickly, while providing a foundation for future growth. This is especially important in the oil importing countries, where the infrastructure gap is large and employment needs are growing. However, it is also likely to be most difficult in these countries because of strained finances. Going forward, government decisions on what types of spending to expand and what to downsize in order to achieve balanced budgets will have important implications for jobs. In designing country specific solutions, governments will have to take on predictable challenges: the governance of job creation, the proper targeting and fiscal costs assessment of subsidies needed to create jobs, the design and fiscal costs of the (re)training programs needed and the expectations on the job creation effects of infrastructure.

The governance challenge

Prudent infrastructure development will be critical for short and long term growth and job creation because the greatest risk to using infrastructure as part of an employment and growth strategy in MENA countries is poor governance. A recent report on investment in MENA (World Bank, 2011) shows that in economies with weak rule of law there is no evidence that public investment stimulates private investment and growth. In contrast, in countries with an adequate level of property rights protection, accountability and legal institutions, public investment is strongly linked to growth. In addition, good rule of law helps attract private investment and countries with good rule of law show higher levels of investment efficiency.

Not all jobs are equal in terms of skills and not all infrastructure investments are equal in terms of ability to create jobs of different skills. This means that investments in infrastructure will need to be prioritized based on the employment and infrastructure needs and opportunities of the country. For example, road and bridge construction projects will have direct impact on creation of relatively low-skilled jobs. These types of projects will be especially effective in addressing job-related concerns in countries where there is a large pool of relatively unskilled and unemployed nationals. This is the case in most MENA countries where the majority of the unemployed do not have tertiary education. By contrast, projects in transport and communication services have large indirect effects, and therefore the ability to create a diverse set of jobs for workers with different skill levels. These projects will appeal to policy makers in countries where the unemployed have the ability to acquire specialized skills relatively quickly.

The subsidy targeting challenge

Public works and different types of subsidized employment programs have been used widely to make it easier for people who cannot find unsubsidized jobs to find employment and acquire on the job skills. These programs are necessary, for instance, to address structural issues which will not be addressed through market forces alone as economies grow bigger and can be particularly effective when dealing with unemployment issues in a regional context. Subsidies to job creation in infrastructure and construction will have to be designed to make the most of employment opportunities for low-skilled workers. The design of the targeting will also have to address the pressing nature of the need to create job. Indeed, boosting short-term job creation in developing MENA is desirable, particularly in the context of recent political developments. But subsidized employment programs are costly and should be designed to ensure a positive spillover to long-run employment and employability.

Different types of job subsidy targeting strategies involve different types of implementation and monitoring costs as well as different degrees of effectiveness (Amin et al., 2008). There are relatively easy solutions to minimizing these costs but they take time to put in place. In MENA, vouchers may be considered to minimize the costs of targeting as they are more efficient than direct subsidies, and targeting the long-term unemployed is more efficient than the less qualified (Brown et al. 2011).

The design of targeting practices is essential to the effectiveness of the program. When targeting is not direct, firms will potentially select beneficiaries that would have been more likely to find a job without the transfer policy (Marx 2001). This increases the risk of deadweight loss through substitution effects. There is also a risk that, if the measures have not been designed to target a sufficiently large range of potential beneficiaries, some employers will not take the time and energy to use them. Finally, the real risk is that only large and public firms will benefit from these programs because these firms have the capacity to mobilize the resources needed to capture the subsidies. There is thus a tradeoff between the fact that generous measures generate a greater response but also a greater burden.[17]

A way to avoid the risks and costs of direct targeting is to design subsidies such that workers self-select for the subsidized jobs. The objective of self-targeting policies is to ensure that certain categories of workers, the poor or women for instance, self-select into the subsidized jobs, while the non-targeted groups choose regular jobs. The subsidies must therefore be such that targeted workers are willing to accept the job (participation constraint) and do not have a better job opportunity (incentive compatibility). Similarly, incentive compatibility must be such that non-targeted groups refuse the subsidized jobs. However, if the resulting wage is too low, this self-targeting subsidy can tend precisely to emphasize the wage gaps and stigmatize a category of workers (Devereux and Solomon, 2006).

The employment subsidies costing and financing challenge

The net costs of subsidizing job creation are difficult to estimate, although the temporary nature of the subsidies, which last only during the investment phase of an infrastructure project,

[17] We assume that: (i) equal incremental increases in taxes lead to progressively larger welfare losses; and (ii) equal incremental increases in each employment subsidy leads to progressively smaller incremental increases in employment and social welfare, and a progressively larger government budgetary outlay (Brown et al. 2011).

minimizes any potential losses. In addition to the direct fiscal costs of providing the subsidies and any associated training and program management, there are less obvious costs in the form of deadweight loss, substitution and displacement effects. The costs would also be overestimated if the induced formalization of the labor market and hence the potential revenue from labor taxes are ignored, and underestimated if this formalization leads fast to added expenses in unemployment benefits and other indirect related costs. There is also the opportunity cost of how the funds are spent. In an economy with poor institutional quality and high levels of rent-seeking behavior public spending on infrastructure could lead to projects with low value added and cost overruns. Thus, good governance is a key complement to infrastructure spending.

When considering the option of subsidizing the creation of jobs, governments invariably face the challenge of determining the optimal duration of subsidizing infrastructure. In case of a temporary economic downturn, short-term wage subsidies are a good option to avoid hysteresis. A short term policy of wage subsidies increases the probability that the beneficiaries will be employed (Bell and Orr, 1994; Betcherman et al., 2010; Forslund et al., 2004; Kangasharju, 2007; Katz, 1996; Marx, 2001; Sianesi, 2002).

In poor countries infrastructure subsidies bring an additional concern arising from the potentially perverse incentive that entices people away from agricultural jobs. A way to minimize such a risk could be to support infrastructure in the off-season for farming. But the impact of short-term infrastructure subsidies could also lead to competition for workers from other sectors and an upward pressure on wages, with potentially negative consequences for competitiveness. The poverty reduction impact of such higher wages is also questionable, as they may not translate into higher purchasing power because the prices of key goods and services consumed by the poor could increase as well. Targeting of short-term, relatively specialized, infrastructure jobs may reduce substitution effects. However, if the wage elasticity is lower in the sector, total job creation from a given short term budget may end up being lower than hoped for (Bucher, 2010; Gerfin et al., 2005; Sianesi, 2002).

Long-term subsidized programs are typically considered in response to mass lay-offs from a major economic restructuring. The main challenge in these cases is to avoid sustaining sectors or activities which have no prospects for future development (ILO/IMF, 2011). In the case of infrastructure, subsidized work programs can contribute two types of jobs – (i) those that support the investment components of the sector (known as CAPEX) in the short term and (ii) longer lasting jobs created to operate and maintain the long lived assets (these expenditure are known as OPEX) in the industry.

When committing to support jobs over a longer period of time, the risk of generating perverse incentives would potentially increase as there might be a sense that subsidies would be permanent. One such perverse incentive is the effect that long-term wage subsidies have on displacement costs, i.e. job losses in non-subsidized firms through distortion of competition (Marx, 2001). Also, if job subsidies permit people to keep rights to generous unemployment benefits, people might switch from relying on benefits to relying on subsidized jobs instead of entering the labor market (Sianesi, 2002), and some categories of workers might be locked in temporary and subsidized jobs (Van Ours, 2004).

There are some positive aspects too. Subsidies can compensate for the implicit tax on severance imposed by employment protection and avoid displacement costs if the value of the subsidy is higher than severance costs (Mortensen and Pissarides 2003, Galasso et al. 2004).

Experience from Finland shows that no displacement costs were observed because subsidized jobs had to be new, and only one-third of the wage was being subsidized (Kangasharju 2007). Finally, it is important to keep in mind that long term programs can be seen as a redistribution device (Brown et al. 2011), but that the odds of generating a lot of perverse incentives in the process are quite high.

In sum, short-term subsidized work programs can be used more efficiently than long-term programs to facilitate inclusion in the labor market. Wage subsidies in infrastructure works can be designed to limit perverse incentives but the design requires a serious diagnostic of the local labor market characteristics.

The training challenge

Experience shows that the long term payoffs of employment subsidies can be achieved only if subsidized employment programs are combined with training and counseling. Therefore, the design of these programs should be given as much attention as the design of the subsidized employment programs. Specific training should be considered only if there is market demand for these qualifications or if there is a need to buy time in a labor market restructuring transition. Often general training supporting labor market flexibility will be sufficient and more efficient in increasing productivity than specialized training. Data from Ireland confirms that general training raises productivity, but the same cannot be said about specialized training (Estache et al. 2000).

In theory, workers are more likely to acquire general training when markets are competitive and the turnover is high (Wasmer 2006). However, subsidized jobs for low-skilled workers may reduce incentives to become skilled – an effect amplified by the fact that taxes used to pay for subsidies may result in an additional tax burden for skilled workers (Oskamp and Snower 2006). There is also no reason to provide training specific to the infrastructure sector if the subsidized job is temporary and the objective of the training is to facilitate inclusion into the general labor market, and not in the infrastructure sector.

The challenge of managing expectations

The study shows that infrastructure investments could provide a relatively quick short term response to MENA's unemployment challenge. As such, it is part of the solution, but infrastructure alone will not resolve the problem. Infrastructure and construction jobs represent less than 20% of the jobs in most countries of the region. Even a dramatic increase in labor intensive infrastructure investments and maintenance would not be able to address the very large unemployment rate of the region. Countries should press on with reforms that improve the business environment, and especially, business regulations and governance. The importance of a sound regulatory environment and good governance for inclusive growth has been underscored in numerous studies. This particular one focused on estimating the employment impact of infrastructure investment in MENA. In the future, more work needs to be done to assess the impact of infrastructure investment on different types of labor, e.g. skilled vs. unskilled, young vs. old and domestic vs. migrant workers. The latter is particularly important because if unskilled positions are largely filled with migrant workers, the job creation effects of infrastructure investment may result in increased immigration, not lower unemployment.

The following caveats should also be kept in mind. The estimations assume that wages are fixed. This is not unrealistic given that only very large infrastructure projects relative to the size of the economy could impact the level of wages. Still, large investment projects could have an impact on wages, implying that the lower bound for the marginal impact of US$ 1 billion investment may be an overestimate of the employment impact. The estimates do not consider several types of costs that could reduce the job creation effect, including the cost to the private sector due to labor substitution effects, opportunity cost of capital, costs due to crowding out, environmental costs, and cost related to governance issues. Last but not least, the possibility of leakages from imports of goods and services associated with infrastructure investment is serious but hard to estimate.

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Appendix Table 1

Estimated shares of inputs in different types of infrastructure

	Qualified workers	Non qualified workers	Domestic material inputs	Imported inputs	Other inputs
Paved Roads	0.15	0.06	0.49	0.16	0.14
Roads	0.03	0.09	0.22	0.63	0.03
Rails	0.13	0.01	0.52	0.24	0.10
Ports	0.10	0.10	0.80		
Telephone mainlines	0.15	0.15	0.30	0.24	0.16
Mobile lines	0.15	0.15	0.30	0.24	0.16
Electricity generation	0.10		0.90		
Electricity Access	0.14	0.07	0.26	0.53	
Water	0.25	0.25	0.40	0.10	
Sanitation	0.08	0.56	0.32	0.04	

Source: Schwartz et al. (2009) and authors' estimates.

Appendix Table 2

Job creation potential in the GCC countries

	Direct job / billion $ in the sector (1)	Share of investment needs (2)	Direct job / billion $ in infrastructure (3)	Type II multiplier (4)	Total jobs (5)
Paved Roads	31667	0.12	3800	1.09	4141
Roads	15000	0.28	4200	1.09	4577
Rails	22778	0.00	0	1.82	0
Ports	27778	0.04	1111	1.61	1789
Telephone mainlines	41667	0.01	333	1.34	447
Mobile lines	41667	0.04	1500	1.34	2010
Electricity generation	16667	0.48	8067	1.35	10891
Electricity Access	31111	0.01	373	1.49	556
Water	69444	0.01	417	1.21	504
Sanitation	75556	0.01	1058	1.21	1280
Total		**1.00**	**20859**		**26194**

Source: Schwartz et al. (2009), Tong (2010), ILO (2011), Foreman and Beauvais (1999), Gardiner and Theobald (2007), Note 3, Bacon and Kojima (2011) and own computations.

Appendix Table 3

Job creation potential in the Developing Oil Exporting Countries

	Direct job / billion $ in the sector (1)	Share of investment needs (2)	Direct job / billion $ in infrastructure (3)	Type II multiplier (4)	Total jobs (5)
Paved Roads	47500	0.25	11952	1.09	13025
Roads	22500	0.20	4404	1.09	4799
Rails	34167	0.01	318	1.82	579
Ports	41667	0.00	0	1.61	0
Telephone mainlines	62500	0.03	1922	1.34	2576
Mobile lines	62500	0.07	4310	1.34	5776
Electricity generation	25000	0.35	8644	1.35	11670
Electricity Access	46667	0.04	2088	1.49	3110
Water	104167	0.02	2330	1.21	2819
Sanitation	113333	0.03	3486	1.21	4218
Total		**1.00**	**39454**		**48573**

Source: Schwartz et al. (2009), Tong (2010), ILO (2011), Foreman and Beauvais (1999), Gardiner and Theobald (2007), Note 3, Bacon and Kojima (2011) and own computations.

Annex

Data sources and description used for model of investment requirements

- GDP in constant 2000 USD is taken from the World Development Indicators (WDI) of the World Bank (http://data.worldbank.org/) and UN National Accounts Main Aggregates Database (http://unstats.un.org/unsd/snaama/selbasicFast.asp). GDP projections for all MENA countries except for West Bank and Gaza come from The World Bank Growth Forecasting Tool described in Ianchovichina and Kacker (2005).
- Shares of value added in agriculture and manufacturing come from the WDI database of The World Bank (http://data.worldbank.org/) and UN National Accounts Main Aggregates Database (http://unstats.un.org/unsd/snaama/selbasicFast.asp).
- Total and urban population data are taken from the WDI database of The World Bank (http://data.worldbank.org/). Projections are obtained from the United Nations World Urbanization Prospects (2009 Revision). (http://esa.un.org/unpd/wup/index.htm)
- Containerization, measured as the total number of trafficking containers, is obtained from the World Development Indicators (WDI) of the World Bank (http://data.worldbank.org/) and harmonized with the Containerization International Yearbook (1970-2006), published by Containerization International (http://www.ci-online.co.uk).
- Telephone lines, mobile phones (in subscribers per 1000 inhabitants), paved and total roads, and rails (in thousands of kilometers), come from the WDI database of The World Bank (http://data.worldbank.org/)
- Electricity generating capacity, in millions of kilowatts, is taken from the US Energy Information Administration, (http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=12).
- Electrification rate, measured as the fraction of population with access to electricity, is obtained from World Energy Outlook 2006, 2009 and 2010 published by the International Energy Agency (http://www.worldenergyoutlook.org/).
- Access to improved water and sanitation in urban and rural areas is defined as the fraction of total population with access to these services. It is taken from the WDI database of The World Bank (http://data.worldbank.org/)
- Waste water treatment, measured as the fraction of the population connected to public waste water treatment plants, is obtained from the United Nations Statistical Division (http://unstats.un.org/unsd/environment/wastewater.htm)
- Kilometers of total and paved roads and port traffic in tons for Oman are obtained from the Ministry of National Economy (http://www.moneoman.gov.om/Stat_Online_desp.aspx).
- Electrification rate for Djibouti is taken from the Energy Survey carried out by the Government and the World Bank. (http://www.ministere-finances.dj/statistiques/Projets/rapportfinalenergie.pdf)