Energy conservation indicators in Southern Mediterranean countries

Country report for Jordan

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Plan Bleu
UNEP/MAP Regional Activity Center

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Content

Preface

The design, the implementation and the monitoring of national energy policies require relevant indicators reflecting the energy use performances at macro and sector level. Moreover, for developing countries the implementation of information systems on energy and greenhouse gas emissions indicators will be a key condition for the development of new mitigation financing mechanisms (NAMAs, sectoral mechanism, etc.) currently under negotiations for the new international climate governance regime. In fact these mechanisms will need Measures, Reporting and Verification systems (MRV) to prove the integrity of these actions. Also, for the Arab League States Energy Efficiency Directive, such indicators are crucial for the monitoring and the assessment of the National Energy Efficiency Action Plans (NEEAPs).

For these reasons and based on European experiences (ODYSSEE), PLAN BLEU, in cooperation with RCREEE and with the support of MED-ENEC, has launched the current Energy Efficiency Indicators Project in ten MENA countries, namely: Morocco, Algeria, Egypt, Lebanon, Syria, Jordan, Libya, Palestine, Tunisia and Yemen as a tenth member state of RCREEE. This project is aiming at i) strengthening the capacities of these countries in monitoring their energy policies by using the energy efficiency indicators approach ii) building and interpreting a range of basic common indicators for the region.

The project was carried out according to a two years process based on specific methodology including:

- A Participative approach associating national public and private experts
  - 4 workshops and working sessions held in Tunisia, Egypt, France and Morocco.
  - Selection, by the participants, of the common indicators to be developed in the project, based on the data availability and the relevancy for the country
  - Technical assistance throughout the project provided by the regional coordination
- Capacity building through " learning by doing" and experience exchanges
  - Data collection by the national experts with the support of RCREEE focal points, strengthening the cooperation between public and private experts
  - Common development of a simplified calculation tool for data collection and indicators' calculation used by the experts
  - Development of capacity for analysis and interpretation of energy indicators by national experts
  - Country reports developed by the national teams
- Dissemination of the results and the learned lessons
  - Organization of final seminar for the decision-makers in June 2012
  - Publication and wide dissemination of the results recorded in flyers, national and regional reports.

The project was coordinated by:

- Plan Bleu: Ferdinand Costes, El Habib El Andaloussi
- RCREEE: Amel Bida
- MED-ENEC: Florentine Visser
- ALCOR: Rafik Missaoui, Hassen Ben Hassine, Adel Mourtada

As the national expert in charge of preparing this report for Jordan, I would like to express my gratitude to Plan Blue and RCREEE for supporting this important work which is long overdue and will serve as a first step toward having reliable and comprehensive EE indicators for the region.

I also would like to thank ALCOR for providing the regional expert with the technical support and would also thank Mr. Abdel-Motaleb Al-Nugrush, Head of Statistics and Information Division at the Ministry of Energy and Mineral Resources, the focal point, for his assistance in the data gathering process.

List of abbreviations

GWh	Giga Watt hour
Kg	Kilograms
Mt	million tones
m^3	cubic meter
T	metric ton = tonne = 1000 kg
Toe	tonne of oil equivalent
LPG	Liquefied Petroleum Gas
GDP	gross domestic product
JD	Jordanian Dinar
PPP	purchasing power parity
TFC	total final consumption
TPES	total primary energy supply

I. Country general background

1. Economy and population

Jordan is classified by the World Bank as a "lower middle income country." with a population of 6 million and a per-capita GNI of US$4,350 (2010). Jordan's natural resources are potash and phosphate—agricultural land is limited and water is considerably scarce. The population is urbanized at around 80% and is one of the youngest among upper middle income countries, with 38% under the age of 14. The fertility rate (3.6%) is higher than the average in the Middle East and North Africa (MENA) and lower middle income countries. Jordan's economy is dominated by services, which account for over 70% of GDP and more than 75% of jobs.

Jordan's economy is among the smallest in the Middle East, with insufficient supplies of water, oil, and other natural resources, underlying the government's heavy reliance on foreign assistance. Since assuming the throne in 1999, King Abdullah has implemented significant economic reforms, such as opening the trade regime, privatizing state-owned companies, and eliminating most fuel subsidies, which in the past few years have spurred economic growth by attracting foreign investment and creating some jobs. The global economic slowdown, however, has depressed Jordan's GDP growth and foreign assistance to the government in 2009 plummeted, hampering the government's efforts to bring under control the large budget deficit. Export-oriented sectors such as manufacturing, mining and the transport of re-exports have been hit the hardest. Jordan is currently exploring nuclear power generation to prevent energy shortfalls. The Jordanian economy displayed divergent trends in 2009 under the repercussions of the global financial and economic crisis. According to preliminary estimates of the Department of Statistics, the pace of real growth in the Kingdom decelerated substantially in 2009 to stand at 2.8%; down from 7.8% in the preceding year. This notable slowdown came after a rapid growth averaging more than 8.0% during the period (2004-2008) driven by export expansion, inflows of foreign investments, as well as the efforts of economic reform. Furthermore, the pace of economic growth in the Kingdom as well as the donor community influenced the performance of the general budget in 2009.

The fiscal deficit (including grants) widened exceptionally to stand at 8.9% of Gross Domestic Product (GDP) by the end of 2009. In addition, the outstanding balance of net public debt, domestic and external, as a percent of GDP was up by 2.6 percentage points; totalling JD 9,660.0 million, or 59.4% of GDP in 2009.

2. Energy demand and energy supply

Jordan lacks indigenous energy recourses. Approximately 96% of Jordan's energy needs are imported. Jordan is a net energy importer with very limited resources of its own. Energy invoice forms a heavy burden on Jordan economy. In 2008 Jordan energy imports reached 1.7 billion JD, which accounts for 17.3% of total imports, and 17% of gross domestic income. Jordan's growth rate of primary energy demand was around 4% in 2006 and is expected to increase at least at a rate of 5% up to 2020, taking into consideration that the annual growth rate of the economy is approximately 3.0% in 2009, this would indicate a trend towards a less energy productive economy and most likely less energy efficient.

In 2009, the local oil and natural gas production was around 161,000toe which forms only 3.0% of the country's total energy needs. Remaining energy needs are imported. These reached almost 4,557,000toe of oil and its products and 2,923 million m^3 of natural gas imported (from Egypt). Imported

electricity (from Egypt and Syria) reached almost 383GWh. These translated into a total cost of energy imports in 2009, of 1916 million JDs equivalent to around 11.8% of national GDP.

In 2009, the overall demand for primary energy was about 7739 thousand toe thereby posting a growth rate of 5.5% compared to demand in 2008. The total demand for final energy which is the energy available to consumers was nearly 5021 thousand toe with a growth rate of 6.6% compared to the 2008 demand levels. On the other hand, the amount of demand for oil products was 3873 thousand toe, and the quantity of electricity generated in 2009 in the Kingdom was 14272GWh posting a growth rate of 3.1 % in 2008. The quantity of electricity consumption was 11956GWh, realizing a growth rate of 3.9% above that of 2008. Yet, the peak load of the Kingdom reached 2320MW posting a growth rate of 2.7% as opposed to the peak load recorded in 2008.

3. Major issues of the energy sector

The future of energy supply in Jordan is a high priority on the Government's agenda. The energy sector is facing essential challenges, especially the reliance on energy markets for direct imports; the rising cost of crude oil and oil product imports (estimated at 17.6% of GDP in 2008); a growing demand for oil products expected to exceed 5% growth per year, and electricity consumption maintaining an upward trend (expected to exceed 7% growth per year).

Other challenges include the provision of necessary funding for investment in the development of the energy industry and its installations in time to meet energy needs, promoting an efficient use of energy in all sectors and upgrading oil derivatives products specifications in line with international standards in order to ensure safety and environmental protection.

4. Energy efficiency and Renewable energy strategy

Improving energy efficiency is an integral part of the 2007-2020 Energy Strategy which aim is to reduce the impact of future increases in energy prices, to support security of supply in view of the rapidly growing demand, and to create a green economy around energy efficiency services. The Strategy called for a 20% improvement in energy efficiency in all sectors. Energy efficiency also facilitates reaching the 10% renewable energy target in the total energy mix by 2020 as it reduces the overall demand for energy. It is also a common policy theme advanced by international organizations and Arab nations where work on the Arab EE Guideline/Directive started about two years ago under the umbrella of the Council of Arab Electricity Ministers of the League of Arab states.

II. Data collection process

1. Main sources of data

The required data was collected from relevant official institutions that have record of the needed date. For example, the Jordanian Department of statistics was the major source of information that is related to the population and number of dwellings. The information was available in the 60th issue of the "Statistical Yearbook 2009" which contained information on tourism, trade, industry, etc. Another major source of information was the annual reports of the Ministry of Energy and Mineral resources for the years 2003-2010 where the energy balance for the corresponding years were available in addition to some other needed important information.

Information on generation and distribution and capacities/types of power stations were obtained mainly from the annual reports of the National Electric Power Company annual reports for the years 2003-2010 and the annual reports of the Electricity Regulatory Commission and the Distribution Companies (JEPCO, EDCO, IDECO) for the same period.

Jordan's Second National Communication (SNC) to the United Nations Framework Convention on Climate Change (UNFCCC) 2009 was the main source of information on CO_2 emissions for the different activities in Jordan in addition to the CO_2 emission calculation tool provided by ALCOR.

Table 1 - Major reference documentations used for the preparation of this report

	Document	Organization
1	Statistical Yearbook 2009	Jordan Department of Statistics
2	Annual Reports 2003-2010	Ministry of Energy & Mineral Resources
3	Annual Reports 2006-2010	Electricity Regulatory Commission
4	Annual Reports 2003-2010	National Electric Power Company
5	Jordan's Second National Communication (SNC) 2009	Ministry of Environment
6	Annual Reports 2003-2010	Central Electricity Generating Company
7	Monthly Statistical Bulletin, Various issues.	Central Bank of Jordan

The following organizations are the major source of information for this report. They constitute the bulk of the supplied information. Some other institutions like the traffic department, Ministry of transport, Ministry of agriculture were also consulted on data collections for the relevant subjects like the number of vehicles, agricultural land usage and so on:

Table 2 - Major Institutions holding data and information

Institution name	Address	Tel and fax	Email and Website
Jordan Department of Statistics	P.O. Box 2015, Amman 11181- Jordan	Tel: 962 6 530 0700 Fax: 962 6 530 0710	stat@dos.gov.jo www.dos.gov.jo
Ministry of Energy & Mineral resources	P.O. Box 140027, Amman 11814, Jordan	Tel: 962 6 580 3060 Fax: 962 6 586 5714	memr@memr.gov.jo www.memr.gov.jo
Electricity Regulatory Commission	P.O. Box 1865, Amman 11821- Jordan	Tel: 962 6 580 5000 Fax: 962 6 580 5003	info@erc.gov.jo www.erc.gov.jo
National Electric Power Company	P.O. Box 2310-Amman-11181-Jordan	Tel: 962 6 5858615 Fax: 962 6 5818336	info@nepco.com.jo www.nepco.gov.jo
Central Bank of Jordan	P.O. Box (37) Amman-11118-Jordan	Tel: 962 64630301/10 Fax: 962 64638889	info@cbj.gov.jo www.cbj.gov.jo

2. Data availability

Table 3 – Data availability

Sector	Energy data			Socio-economic data			Environmental data		
	Total* number of data	Available data**		Total number of data	Available data		Total number of data	Available data	
		Number	%		Number	%		Number	%
Macro	56	56	100	42	42	100	7	7	100
Transformation sector	98	98	100						
Transport sector	49	42	85.7	105	88	83.8	21	21	100
Tertiary sector	28	24	85.7	35	28	80.0	7	7	100
Residential sector	21	21	100	49	45	91.8	7	7	100
Industry sector	56	51	91	91	68	74.7	7	7	100
Agriculture & fishing	14	5	35.7	56	34	60.7	7	7	100
Total	322	297	92.2%	378	305	80.7%	56	56	100%

*: Total number of data expected by the sheet "Energy & socioeconomic data"
**: Total number of data (collected or estimated) filled in the sheet "Energy & socioeconomic data". One value for one year is considered as a data.

The table shows that the availability of energy data was excellent (92.2%). This is mainly due to the fact the energy sector in Jordan is well developed and organized. Some of the unavailable date; energy consumption of trains for example, was unavailable because there is no trains used for transportation system in Jordan even though there is some trains used for recreation trips only but no records are kept for the number of passengers or the consumption.

The same thing can be said for the Socio-economic data where good data availability was obtained on the macro level. The agriculture & fishing sectors' data was the scarcest because these two sectors are not well developed specially the fishing sector since it is a very small sector and no data is available regarding the energy consumption or the contribution of this sector to the local economy.

Furthermore, the environmental data scored 100% on the availability scale and all needed data was available mainly because Jordan just completed "Jordan's Second National Communication (SNC)" report to the United Nations Framework Convention on Climate Change (UNFCCC).

The overall availability of data was 87% where a total 658 data item out of a total of 756 were collected.

3. Major difficulties met during the data collection

In collecting the needed data, some difficulties were encountered such as:

- Discrepancies in data collected from different organizations. The data published by the National Electric Power Company (NEPCO) is somewhat different than that published by the Central Generating Electric Company (CEGCO). In this case the source of the data is the one that was reported here.
- Some information was not public knowledge such as fuel subsidies and thus personal contacts were utilized to obtain such data. This data was verified by published numbers by the Central Bank of Jordan.
- Not knowing which organization is responsible for the needed data.
- Some data didn't exist or was not found.

It is worth mentioning that the presence of the focal point working with the expert has facilitated the data collection specially that the focal point is the Head of Statistics and Information Division at the Ministry of Energy and Mineral Resources.

III. Indicator's calculation

1. Macro level indicators

Table 4 – Energy and GHG emissions at macro level

Indicators	Unit	2003	2004	2005	2006	2007	2008	2009
Energy dependence Ratio	%	95%	95%	96%	96%	96%	96%	96%
Intensity of Primary Energy	toe/1000 LC	0,92	0,95	0,95	0,90	0,86	0,79	0,81
Intensity of Final Energy	toe/1000 LC	0,61	0,63	0,63	0,59	0,56	0,49	0,51
Ratio of final energy consumption to primary energy	%	67%	67%	66%	66%	66%	62%	62%
Ratio of National Energy Bill to GDP	%	13%	16%	21%	20%	19%	19%	12%
Ratio of public subsidies for energy to GDP	%	0%	0%	3%	2%	1%	1%	0%
Average emission factor	teCO2/toe	2,82	2,79	2,78	2,76	2,77	2,72	2,69
Intensity of CO2	teCO2 / 1000 LC	2,595	2,653	2,646	2,493	2,386	2,145	2,191
Average Primary Energy Consumption per habitant	ktoe/1000 hab	1,104	1,213	1,284	1,283	1,300	1,254	1,294
Average Electricity Consumption per habitant	MWh/hab	1,404	1,512	1,589	1,711	1,841	1,967	1,999

It is clear from the table that Jordan is almost entirely dependent on imported energy (96%). This is particularly why the Jordanian government is trying to reduce the dependence of imported energy through the utilization of local sources of energy like renewable energy and the abundantly available oil shale. The intensity of primary energy is showing improvement where it dropped from 0.95 in 2004 to as low as 0.79 in 2008 due to the slowdown in the rate of increase of energy consumption, probably due to the increase in international energy prices while the GDB continued increasing at the same rate for the same period (bigger economy).

The same is true for the Ratio of National Energy Bill to GDP where the energy bill reached around 21% of GDB in 2005 because of the high energy prices during that time. It also evident from the table that the government has started the gradual elimination of fuel subsidies starting in 2005 where it stood by 2009 at 0% .what is interesting is that the average energy consumption per habitant almost remained steady throughout the study period (2003-2009) while the annual electrical energy consumption per habitant have increased from around 1.4MWh/hab to about 2MWh/hab and this is due to the increase of the standard of living of Jordanians and more people are using electrical appliance specially air-conditioning.

2. Energy transformation sector indicators

The Jordan Petroleum Refinery Company (JPRC) is responsible for all downstream phases of petroleum activities such as oil refining, storage, transportation and distribution. It was established in 1960 as a private company with the exclusive right to invest in and operate petroleum refining and derivative industries, including the right to market, store and distribute all such products. JPRC's operations are regulated by MEMR in accordance with a

concession agreement. JPRC operates the only refinery in the country, located at Zarqa, 30 km north-east of Amman. The rated nominal output is about 4-5 million tons per year.

The electricity sector experienced many changes in its framework ever since the issuing of Electricity Law number 64 in 2002, including the orientation towards privatization and encouragement of the private sector investment both in the generation sector and the distribution sector. As a result of these changes, the electricity system in Jordan is now divided according to activities into three categories: Generation represented by Central Electricity Generation Company (CEGCO), Al-Samra Electric Power Generating Company (SEPGCO) and AES Jordan; transmission through high-voltage lines which is done by the Jordan National Electric Power Company (NEPCO), which is also responsible of the interconnection with Egypt and Syria, and the operation of the electric system; and finally distribution of electricity through medium and low voltage lines to supply end consumers which is done by Jordan Electric Power Company (JEPCO), Irbid District Electricity Company (IDECO) and Electricity Distribution Company (EDCO), each according to their area. An independent regulatory body was established with authority to monitor standards of services, issue producers licenses and establish Tariffs.

The power system has an installed nominal capacity of about 3273 MW in 2010 of which 1706 MW is owned and operated by Central Electricity Generation Company (CEGCO) and the peak demand was 2670 MW. Several independent power producers (IPPs) own and operate the rest of the system capacity. Total electricity generated in 2010 was 14777 GWh consuming around 3431 T.T.O.E and the total electricity consumption was about 12843 GWh and losses were 17.47%.

Table 5 - Energy and GHG emissions in transformation sector

Abbreviation	Indicators	Unit	2003	2004	2005	2006	2007	2008	2009
SREC	Share of installed RE electricity capacity	%	0,08%	0,07%	0,06%	0,06%	0,05%	0,05%	0,05%
URIC	Usage rate of the installed power generation capacity	%	51%	51%	50%	55%	57%	59%	59%
AETS	Apparent Efficiency of Energy Transformation Sector	%	78%	77%	77%	74%	72%	70%	68%
PGEFF	Power generation efficiency of thermal plants	%	34%	34%	34%	35%	37%	36%	36%
SCFFP	Specific Consumption of thermal power plants	toe/GWh	250,00	252,88	249,56	246,30	234,09	237,94	241,66
PGF	Power generation efficiency	%	35%	34%	35%	35%	37%	36%	36%
SCPG	Specific Consumption of Power Generation	toe/GWh	248,44	251,13	247,88	244,97	232,76	236,67	240,40
TDEE	Transmission and Distribution Electricity system Efficiency	%	0,81	0,82	0,82	0,83	0,81	0,82	0,83
PGEF	Power Generation Emission Factor	teCO2/GWh	750,81	687,26	664,59	630,05	510,44	591,84	574,35
ESEF	Electricity Sector Emission Factor	teCO2/GWh	854,86	790,94	762,27	729,64	618,74	692,19	677,72

The most obvious indicator is the share of renewable energy in the total energy mix. This figure stands at only 0.05% (excluding Hydro & Biogas Energy). This is despite the government efforts to boost the penetration of RE both for Domestic use and electricity generation. The high initial cost of RE equipment is one of the main reasons why such efforts are not fruitful.

Apparent Efficiency of Energy Transformation Sector has degraded by about 10% in the study period while Power generation efficiency of thermal plants improved by 1% for the same period due to the increased awareness of energy efficiency in this sector.

The electricity losses measured from the generating stations to consumers are large and account for about the 17% of the supplied energy. The transmission and distribution losses are 9%-10% and the auxiliary losses about 6%-7%. This underperformance is the result of the use of inefficient and aging systems. Increasing inefficiencies of the energy utilization is the characteristic of the Jordanian energy sector mainly due to aged and obsolete systems as well as poor energy management. Significant potential for rational use of energy exist in power generation, refining, industry processes, households and transportation. Up to 10% of consumed energy in transportation, 10%-30% in industry and around 20% in households can be saved by employing no or low cost measures. Energy efficiency measures are hindered by the lack of know-how, inadequate incentives, little governmental support and funding and poor public awareness.

It is also evident from the table that the Electricity Sector Emission Factor has been improving during the period 2003-2009. This is because of more and more electricity is being generated with the natural gas imported from Egypt.

3. Industry sector indicators

The industrial sector, which includes mining, manufacturing, construction, and power, accounted for approximately 27.6% of gross domestic product in 2009 (including manufacturing, 19.7%; construction, 6.2%; and mining, 1.7%). More than 20% of the country's labor force was reported to be employed in this sector in 2009. The mining sector is one of the pillars of the Jordanian economy. The major mining exports of Jordan include potash and phosphates. It is the largest producer of raw phosphates in the world. The main industrial products are potash, phosphates, pharmaceuticals, cement, clothes, and fertilizers. The manufacturing sector has grown as well (to nearly 20% of GDP by 2009), in large part as a result of the United States–Jordan Free Trade Agreement (ratified in 2001 by the U.S. Senate); the agreement has led to the establishment of approximately 13 qualifying industrial zones (QIZs) throughout the country. The QIZs, which provide duty-free access to the U.S. market, produce mostly light industrial products, especially ready-made garments. By 2004 the QIZs accounted for nearly US$1.1 billion in exports according to the Jordanian government.

Jordan's free trade agreement (FTA) with the US – the first in the Arab world – has already made the US one of Jordan's most significant markets. By 2010 it will have barrier-free export access in almost all sectors. A number of trade agreements with countries in the Middle Eastern and North African regions and beyond should also reap increasing benefits, not in the least the Agadir Agreement, which is seen as a precursor to an FTA with the EU. Jordan also recently signed an FTA with Canada. Furthermore, Jordan's plethora of industrial zones offering tax incentives, low utility costs and improved infrastructure links are helping incubate new developments. The relatively high skills level is also a key factor in promoting investment and stimulating the economy, particularly in value-added sectors. Despite the fact that Jordan has few natural resources it does benefit from abundant reserves of potash and phosphates, which are widely used in the production of fertilizers. Exports by these industries had a combined worth of $1bn in 2008. Other important

industries include pharmaceuticals, which exported around $435m in 2007 and $260m in the first half of 2008 alone, as well as textiles, which were worth $1.19bn in 2007. Although the value of Jordan's industrial sector is high, the kingdom faces a number of challenges. Because the country is dependent on importing raw materials, it is vulnerable to price volatility. Shortages in water and power also make consistent development difficult. Despite these challenges, Jordan's economic openness and long-standing fertilizer and pharmaceutical industries should continue to provide a solid source of foreign currency.

Table 6 - Energy and GHG emissions in industry sector

Abbreviation	Indicators	Unit	2003	2004	2005	2006	2007	2008	2009
BSEC	*Specific energy consumption for the Cement*	toe/t	0,044	0,049	0,029	0,029	0,022	0,023	0,000
	Specific energy consumption for the Phosphate		0,01	0,01	0,01	0,00	0,00	0,01	0,00
	Specific energy consumption for the Phosphoric acid		0,034	0,03	0,03	0,03	0,04	0,05	0,00
	Specific energy consumption for the T. Super Phosphate		na	na	na	na	na	na	na
	Specific energy consumption for the Steel		0,25	0,20	0,13	0,11	0,07	na	na
	Specific energy consumption for the Paper		0,07	0,08	0,07	0,08	0,06	na	na
	Specific energy consumption for the Sugar		na	na	na	na	na	na	na
FEIIS	Final Energy Intensity of Industry Sector	toe/1000 LC	0,550	0,573	0,600	0,562	0,523	0,443	0,437
IEBR	Ratio of Industry sector Energy Bill to Added Value	%	10%	13%	19%	24%	23%	18%	14%
IESR	Ratio of public subsidies to added value	%	0%	0%	1%	0%	0%	0%	0%
IESRGB	Ratio of public subsidies for energy to Government Budget	%	0%	0%	0%	0%	0%	0%	0%
IELSR	Ratio of public subsidies for electricity to added value	%	0%	0%	1%	2%	1%	2%	0%
IICO2	CO2 Intensity of industry sector	teCO2/ 1000 LC	2,5	2,4	2,4	2,3	2,0	1,8	1,8
IAEF	Average emission factor of industry sector	teCO2/toe	4,5	4,2	4,1	4,0	3,8	4,2	4,1

It is obvious from the table that the specific energy consumption (SEC) of the steel, phosphate and cement production has been improving. This means less energy is needed to produce one tone of product. This is in line with the industrial sector in Jordan working on improving their energy efficiency especially after the sharp increase in energy prices after the invasion of Iraq. The only exception is the phosphoric acid industry where SEC has been getting higher. This is also reflected in the Final Energy Intensity of Industry Sector **(FEIIS)** where we can see that this number has been dropping from as high as 60 toe/1000 JD in 2005 to as low as 44toe/1000 JD in 2009, a decrease by more than 26%. Over the same period of time, the value added at constant price within the industrial sector increased by 26.4 %, at an annual average rate of 5.3 %, which explains the improvement of the FEIIS indicator coupled with the improved efficiency of the industrial sector. The improvement in energy intensity is therefore mainly due to a decoupling of energy consumption from the gross value added, which implies an achievement in energy efficiency in the industry.

Public subsidy in Jordan is a political issue which is not publicized. The government used to subsidize imported energy in general without distinguishing between the different sectors and this is why it is not known how much each sector's share of subsidy is.

The CO_2 intensity of the industrial sector in Jordan has been steadily dropping from 1.1 teCO_2/1000 JD in 2003 to around 0.7 teCO_2/1000 JD-36% reduction, which is again a sign of improved energy efficiency within the industrial sector and the same thing applies for the Average Emission Factor of Industry which dropped by about 20% for the same period and the use of Natural Gas for electricity generation.

4. Tertiary sector indicators

The most prominent sector in the economy is the tertiary (service) sector, which comprises 65% of the GDP. The Jordanian economy is overwhelmingly services oriented.. 77.4% of the workforce are employed in this sector, 20% in industry and 2.6% in agriculture. The sector consumes around 7.3% of the total final energy consumption for the country. The high (and growing) contribution of services to GDP is due to a large extent to the historical paths of economic development in the country. Since its inception, Jordanian policymakers have attached high priority to developing the financial sector (in a bid to accommodate large inflows of workers' remittances). The same holds true for tourism, which is an important source of foreign exchange earnings. The high ratio of services to GDP is also a direct result of the high level of state-led economic development.

Table 7 - Energy and GHG emissions in tertiary sector

Abbreviation	Indicators	Unit	2003	2004	2005	2006	2007	2008	2009
FEITS	Final Energy Intensity of Tertiary Sector	toe/1000 LC	0,078	0,082	0,081	0,081	0,076	0,068	0,070
TDRSHR	Diffusion Rate of Solar Water Heaters in tertiary sector	m²/1000 hab	-	-	-	-	0,197	0,856	0,661
TEBR	Ratio of energy bill to added value in tertiary sector	%	1,7%	2,0%	2,6%	2,6%	2,5%	2,7%	1,7%
TELSR	Ratio of public subsidies for energy to added value	%	0,00%	0,00%	0,21%	0,14%	0,05%	0,23%	0,00%
TESRGB	Ratio of public subsidies for energy to Government Budget	%	0,0%	0,0%	0,3%	0,2%	0,1%	0,4%	0,0%
HECNG	Energy Consumption per night guest	kgoe/Nigh Guest	18,211	15,563	13,696	18,491	15,858	13,674	14,241
TICO2	CO2 Intensity of tertiary sector	teCO2/ 1000 LC	0,396	0,401	0,391	0,393	0,351	0,358	0,352
TAEF	Average emission factor	teCO2/toe	5,1	4,9	4,9	4,9	4,6	5,2	5,1

The diffusion rate of solar water heaters in tertiary sector is very limited in Jordan despite the fact that Jordan introduced SWH back in the early 70's and the penetration rate of the residential sector reached 20% in the 90's. The reason could be the lack of roof space available in addition to the historically low energy prices in Jordan before the invasion of Iraq in 2003 and the absence of regulations and incentives by the Jordanian government.

Energy consumption per night guest in Jordanian hotels is higher than the middle east average (10 kgoe/ Night Guest) and the European benchmark of 5 kgoe/ Night Guest. This number has a lot to do with the occupancy rate of the hotels and as can be seen 2006 has a low occupancy rate because the HECNG went up. Otherwise we can notice a decrease in HECNG down by around 22% in 2009 compared to 2003 which is again a sign of improved efficiency of the sector.

5. Residential sector indicators

The residential sector in Jordan is divided into two main sub-sectors: rural and urban. The latter, forms almost 82.6% of the total inhabitants at present. In 1994, the average family sizes were 6.65 and 7.49 members for urban and rural sub-sectors, respectively, while in 2004 these dropped to about 5 and 6, respectively, with an average of 5.4 for whole of the country and as of 2009 it stands at 5.2 {DOS} . More than 80% of the population lives in dwellings that range from 50 to 200 m^2 and 99.9% of houses are supplied with electricity. The average monthly income per family is approximately 250– 350 JD and the average spending of household on energy was 14% in 2008 (2.8 JD/m^2). As in most developing countries, substantial energy losses exist in a large number of houses in Jordan. Reduction of such losses would improve energy efficiency significantly, which means less reliance on energy imports, and less CO_2 emissions. In 2009, electricity and final energy consumptions reached nearly 11956 GWh and 5021 ton oil equivalent (toe), respectively; of these the residential sector had shares equal to 41% and 21% of the total electricity and final energy consumptions, respectively. Electricity, diesel, and LPG are the main energy sources used for water heating in Jordan. Despite the fact that 11% of dwellings in Jordan use SWH systems, water heaters are major energy consumers for Jordan's residential sector. Fortunately, Jordan enjoys high average of solar radiation and about 300 sunny days per annum; therefore, the potential for utilizing solar water heaters is high.

Table 8 - Energy and GHG emissions in residential sector

Abbreviation	Indicators	Unit	2003	2004	2005	2006	2007	2008	2009
UCED	Unit Consumption of Energy per Dwelling	kgoe/Dw	990,16	1032,55	1083,40	1062,63	1046,88	966,62	1014,93
SCEM²	Specific Consumption of Energy per area unit	kgoe/m²	4,94	5,23	5,46	5,44	5,43	5,08	5,40
UEICD	Unit Consumption of Electricity per Dwelling	kWh/Dw	2587,71	2814,38	3055,28	3428,95	3913,47	4269,58	4617,64
SCEIM²	Specific Consumption of Electricity per m²	kWh/m²	12,922	14,246	15,395	17,554	20,300	22,456	24,569
RIPE	Intensity of Residential Sector	toe/ 1000 LC	0,211	0,206	0,189	0,180	0,165	0,144	0,150
RELSR	Ratio of public subsidies for energy to private consumption	%	0,00%	0,00%	0,28%	0,13%	0,00%	0,26%	0,00%
RESRGB	Ratio of public subsidies for energy to Government Budget	%	0,00%	0,00%	0,61%	0,30%	0,00%	0,60%	0,00%
RAEF	Average emission factor	teCO2/toe	4,3	4,2	4,2	4,2	4,0	4,6	4,6
RICO2	CO2 Intensity of residential sector	teCO2/ 1000 LC	0,907	0,866	0,791	0,758	0,667	0,658	0,687
RDRSHR	Diffusion Rate of Solar Water Heaters in Residential sector	m2/1000 hab	89,1	108,9	118,3	136,0	147,9	151,8	155,3
ERACR	Equipment Rate of Air conditioning in Residential sector	Unit/Dw	0,00	0,00	0,00	0,00	0,09	0,11	0,16
ERFR	Equipment Rate of refrigerator in Residential sector	Unit/Dw	0,978	0,978	0,978	0,978	0,978	0,978	0,978
SEPC	Share of energy expenses in household private consumption	%	4,9%	4,6%	4,7%	4,9%	4,6%	4,9%	4,5%

The unit consumption of energy per dwelling was increasing starting in 2003 until 2005 where it started to fall down again probably after the big increase in the international energy prices and the lifting of governmental subsidies on oil products. It started to go back up again in 2009 again because of the drop in the international energy prices. The unit consumption of electricity per dwelling on the other hand has shown a steady increase from 2003 to 2008 where the annual increase was around 10% on the average which is consistent of improved standard of living and the increased use of electrical appliances especially Air Conditions. This pattern is also represented in the Specific Consumption of Electricity per m^2 where the annual increase is also consistent with unit consumption of dwellings and most likely for the same reasons.

The energy intensity of the residential sector is decreasing gradually at a rate of 6.7% annually starting in 2003 till 2009. This is due to the fact that Private consumption (households' expenses) at current price have grown at an annual rate of around 20% until 2008 and in 2009 it dropped by about 3%.

The Ratio of public subsidies for energy to private consumption and to Government Budget are only a small negligible values and by end of 2009 all subsidies were eliminated except for subsidy on LPG for household use which remained subsidized by the government.

The diffusion rate of solar water heaters remains a very moderate number despite the fact that Jordan was the first country in the region to introduce solar water heaters and have local manufacturers for the systems this mainly due to the high initial cost, low energy prices and the non existence of regulations and incentives to promote the use of SWH.

6. Transport sector indicators

Jordan features a highly developed transportation system, which is amongst the best in the Middle East. Transportation infrastructure along road, rail and air links is well developed in Jordan with various plans for improvements at an advanced stage. The transportation sector accounts for more than 10% of Jordan's GDP and is growing at an annual rate of 6% and it is responsible for about 38% of total final energy consumption in Jordan. The government developed a national transport strategy to upgrade the country's infrastructure, and to enable Jordan to capitalize on its natural geographical advantages. The transport system is a two-mode system, namely, road, which covers almost all domestic passenger and freight transport and airways. The latter is mainly used for international flights. The average estimated overall energy and efficiency was found as 23.2%. This simply indicates that there is large potential for improvement and efficiency enhancement. A fresh transport strategy was introduced in 2008 by the government to increase privatization in the sector and to modernize the sector further. The outlook for the sector is encouraging due to Iraq's ongoing security crises. It will continue to act as one of the primary transit points for people and products moving to Iraq.

Table 9 - Energy and GHG emissions in transport sector

Abbreviation	Indicators	Unit	2003	2004	2005	2006	2007	2008	2009
TrFEI	Final Energy Intensity of transport sector	toe/1000 LC	0,238	0,248	0,241	0,229	0,221	0,190	0,205
STEHE	Share of household expenditure for transport	%	14%	13%	11%	13%	12%	9%	12%
EUCC	Average Energy Unit Consumption of Cars	kgeo/car/year	1960,15	1960,31	1960,22	1960,08	1960,15	1960,11	1960,11
EUCC G	Average Energy Unit Consumption of gasoline Cars	kgeo/car/year	1960,153	1960,307	1960,222	1960,083	1960,150	1960,115	1960,106
EUCC D	Average Energy Unit Consumption of diesel Cars	kgeo/car/year	na	na	na	na	na	na	na
AEFTS	Average emission factor of transport sector	teCO2/toe	2,910	2,910	2,910	2,910	2,910	2,910	2,910
MR	Motorization rate	persons / Vehicle	15,74	14,81	13,65	12,37	11,29	10,24	9,31
ICO2	CO2 Intensity of transport sector	teCO2/1000 LC	0,69	0,72	0,70	0,67	0,64	0,55	0,60
SCRW	Specific consumption for Rail ways	kgoe/ p.km	na	na	na	na	na	na	na
SCAT	Specific consumption for air transport	kgoe/ p.km	na	1,7112E-06	1,45645E-06	1,27014E-06	1,1241E-06	1,001E-06	9,2273E-07
SCMT	Specific consumption for maritime transport	kgoe/ t.km	na	na	na	na	na	na	na
SEAT	Specific emission factor for air transport	kgeCO2/p.km	na	5,1161E-06	8,06891E-06	4,80956E-06	4,776E-06	4,1654E-06	3,9463E-06
SEMT	Specific emission factor for maritime transport	kgeCO2/t.km	na	na	na	na	na	na	na

The table shows that the energy intensity of the transport sector is decreasing which might indicate a drop of the energy consumption of that sector. The fact is that the GDP for the study period enjoyed a high rate of growth while the energy consumption was growing at a slower rate. The table also shows motorization rate (MR) -the number of passenger/car is steadily going down because of improved level of economic development and also increased numbers of cars because of lower custom duties on imported cars which allowed many individuals to own cars causing a burden on the environment associated with extensive use of energy sources, local and global air pollution as noted in the increase of average emission factor of transport sector indicator (AEFTS). The table doesn't show any value for rail ways because in Jordan the trains are not used for transportation of passengers and goods. Also the specific energy consumption and Specific emission factor for maritime transport is not indicated in the table since it is not kept by any agency in Jordan and most passenger and cargo ships are not Jordanian.

7. Agriculture and fishing sector indicator

Despite increases in production, the agriculture sector's share of the economy has remained almost constant ranging between 3.5- 4% of gross domestic product since 2003. As of 1996, approximately 6.7% of the Jordanian labor force was employed in agriculture, forestry or fishing. About 2.6% of Jordan's labor force worked in the agricultural sector in 2009. The most profitable segment of Jordan's agriculture is fruit and vegetable production (including tomatoes, cucumbers, citrus fruit, and bananas) in the Jordan Valley. The rest of crop production, especially cereal production, remains volatile because of the lack of consistent rainfall. Fishing and forestry are negligible in terms of the overall domestic economy. The fishing industry is evenly divided between

live capture and aquaculture; the live weight catch totaled just over 1,000 metric tons in 2008. The forestry industry is even smaller in economic terms; approximately 240,000 total cubic meters of roundwood were removed in 2002, the vast majority for fuel wood.

Of Jordan's total land area of about 8 million hectares, only a small portion is suitable for producing crops. It is currently estimated in 2009, that there are only 231,400 hectares of land that may be cultivated (Ministry of Agriculture). Tree crops are planted on about 90,000 hectares, leaving arable land—land that can be used to produce annual crops—at about 4% of the total land base. Less than 40% of cultivatable land is irrigated (Department of Statistics). Most vegetable land is irrigated, one-third of tree crops are produced with the benefit of irrigation, but only seven% of field crop area is irrigated. Thus, variation in rainfall from year to year mostly effects field crops such as wheat, barley, and pulses. The eastern half of Jordan is desert or pre-desert plains with very little rainfall. Rainfall is somewhat higher in the western part of the country—the highlands and the Jordan Valley— but even then, it is highly erratic. The climate favors year-round production of horticultural products and so, where irrigation water is available, vegetables and annual fruits are the primary crops. The agricultural sector grew at a fast pace in 2009; growing by 12.9% at constant basic prices, compared to a growth of merely 1.3% in 2008.

Table 10 - Energy and GHG emissions in agriculture and fishing sector

Abbreviation	Indicators	Unit	2003	2004	2005	2006	2007	2008	2009
FEIA	Final Energy Intensity of agriculture	toe/ 1000 LC	1,124	1,094	1,137	1,064	1,196	1,138	0,982
FEIF	Final Energy Intensity of fishing	toe/ 1000 LC	na	na	na	na	na	na	na
SCF	Specific consumption for fishing	toe/ tone	0	0	0	0	0	0	na
SDCA	Share of Dry cultivated area	%	70%	72%	67%	57%	60%	60%	58%
SICA	Share of Irrigated cultivated area	%	30%	28%	33%	43%	40%	40%	42%
SEWMP	Share of equipped wells with Moto pumps	%	na	na	na	na	na	na	na
SEWElP	Share of equipped wells with electro pumps	%	na	na	na	na	na	na	na

From the table, it seems that the final energy intensity of agriculture is higher than all other sectors. This is because the water pumping which accounts for about 16% of total electricity consumption of Jordan is in general added to the consumption of the agriculture sector. It also noticed that a reduction of about 17% have been achieved from 2005 till 2009 which indicate an improvement in the energy efficiency of the agriculture sector.

The fishing industry is evenly divided between live capture and aquaculture; the live weight catch totaled just over 1,000 metric tons in 2009. The forestry industry is even smaller in economic terms this is why no information on energy consumption for fishing sector.

Another important observation is the decrease in the dry cultivated area by about 17% and the corresponding increase in irrigated cultivated area. This can be explained by the fact that more and more cultivation is taking place outside the rainy season using green houses to plant vegetables off season and also due to the increased scarcity of rainfall.

IV. Conclusion

Main comments on the overall exercise, learned lessons

This project was long overdue since no previous attempts were made before on the regional level. The exercise was well organized and followed a systematic approach in problem solving when they arose. The project utilized national consultants with the support of national focal points. This is the right approach when dealing with local issues where a local consultant will do much better than international one. The project attempted to deal with country specific issues in a regional manner which will make the regional report well integrated and the results easier to compare between the different countries.

Perspectives

The work on this project was challenging and productive. It helped in understanding the different parameters involved in the data collection and analysis process and the problems that is facing such projects and how to overcome them. It showed that things are not as easy than they seem. Knowing where the data is and which agency is responsible for what and what individuals have the needed information relied heavily on personal contacts. One important lesson is that information is power and he who has it has the power.

Recommendations to develop indicators in the country

Energy indicators represent an important element in the national analysis and planning for achieving sustainable development. The indicators will provide a tool for scientists and decision makers at the national level to better understand their national situations and trends, the impacts of recent policies and the potential impacts of policy changes. The flexibility of this system of energy indicators permits specific adaptations to the national and local conditions and needs. As such, it is a versatile and powerful tool that can greatly assist countries by highlighting problems and constraints that may exist at the national level to allow the search for the right possible solutions. From this prospective every country should make a national priority to develop the proper energy indicators which should be harmonized with international standards. It is strongly recommended that the government should establish local indicators with regional standards and build on what was accomplished in the project.

V. References and relevant websites

www.dos.gov.jo

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Table of illustrations