PAPER TITLE

The Impact of Phasing Out Energy Subsidies on Developing Countries

"A Case Study on Egypt"

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Abstract

Energy policy in general and energy subsidies in particular have direct and indirect impact on the sustainable development path in both developed and developing countries. The need to reform energy subsidies was one of the major issues addressed at the World Summit on Sustainable Development held in Johannesburg in September 2002. While a proven long list of both environmental benefits and economic gains from reforming or phasing out subsidies was affirmed both in theory and through international experience, still social and political consequences especially in developing countries is surrounded by uncertainty. This fact is clearly reflected in the case of Egypt as one of the developing countries. Where despite clear evidence of the negative implications on the environmental and economic dimensions, energy subsidies was growing in both absolute and relative terms until 2010.

Recently many developing countries - among which is Egypt- has either announced or initiated energy price reforms, this trend was called for by and is expected to be welcomed by the international community.

This paper argues that phasing out fossil fuel subsidies by developing countries is economically motivated, especially in the light of budget deficits accumulated after the global economic crisis. Consequently price reform policies and strategies may be biased towards the economic dimension of sustainable development with no or even negative impact on the social and environmental dimensions.

In light of the above the primary objective of this paper is evaluates the relative weight of the energy sector in Egypt sustainable development path. The secondary objective is to evaluate the possible impacts of phasing out fossil fuel subsidies on the three dimensions of sustainable development in Egypt as one of the "developing countries" with special emphasis on the social and environmental dimensions. The final objective is to develop policy recommendations for phasing out fossil fuel subsidies to have a balanced impact on the three dimensions of sustainable development in Egypt.

Introduction

Energy policy –regarded as the way energy services are produced, distributed and consumed – affects the social, environmental and economical dimensions needed to the existence of human life in general and the process of sustainable development in particular, this is true for both developed and developing countries. ***Since*** the market alone cannot be expected to meet the needs of the most vulnerable groups, to protect the environment, to ensure energy security, and to support other public goods, competitive and efficient energy markets together with suitable governmental regulations was considered in literature and practice as a prerequisite for energy policy to be compatible with any/all of the sustainable development dimensions. ***But*** this does not go without limitations; public policy no less than the private policy can err or can be inefficient and hence continuous revising of the process of policy formulation, application, and evaluation is required.

In this context the joint report[1] prepared by the IEA, OECD, the World Bank, and the OPEC for submission to the G20 summit meeting in Toronto in June 2010 has identified fossil fuel subsidies as one of the most important public policy instruments that must be subject to revision and reform by both developed and developing countries.

Based on the facts that; the international call for phasing out fossil fuel subsidies is environmentally motivated, and that the developed nations shoulder the greatest responsibility for taking action against climate change because historically they have contributed the most carbon emissions to the atmosphere ('legacy carbon') and continue to contribute to rising levels of greenhouse gases through high per capita emissions ***on one hand***, and given that the global atmosphere is probably the ultimate expression of a common good ***on the other hand,*** the process of phasing out subsidies should be based on the principle of equity and common but differentiated responsibilities and respective capabilities, as well as the provision that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties[2], a principle that was established in Kyoto, and fortunately reaffirmed in Copenhagen.

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[1] Analysis of the scope of energy subsidies and suggestions for the G-20 initiative, report prepared for submission to the G-20 Summit Meeting, Toronto (Canada), June 2010. http://www.worldenergyoutlook.org/docs/G20_Subsidy_Joint_Report.pdf, accessed at 2010-09-15.

[2] If subsidy phase-out is justified on the grounds of climate change mitigation provisions of the United Nations Framework Convention on Climate Change (UNF

In the last decade, Increasing calls from numerous international organizations have been directed for developing countries to participate meaningfully and voluntarily in the implementation of the Kyoto Protocol. Phasing out energy subsidies[3] was recognized as a prime area that could enable developing countries to reduce their total emissions of carbon while enhancing overall economic efficiency and freeing up scarce funds for pressing spending needs in other areas.

But again this argument does not go without limitation, phasing out energy subsides has a number of serious social consequences that are linked to the many distinctive characteristics of developing – Poor - countries. Social unrest was a common response: violence and protests followed price rises in Egypt (1977), Morocco (1981, 1984), Tunisia (1984), and Jordan (1989, 1996). In many cases (Tunisia 1983, Morocco 1981, Egypt 1977), price increases had to be reduced or rescinded[4]. These experiences represent a part of today policy making collective memory in developing countries and pressure them to take far more care in addressing this issue.

In light of the above the primary objective of this paper is evaluates the relative weight of the energy sector in Egypt sustainable development path. The secondary objective is to evaluate the possible impacts of phasing out fossil fuel subsidies on the three dimensions of sustainable development in Egypt as one of the "developing countries" with special emphasis on the social and environmental dimensions. The final objective is to develop policy requirements for phasing out energy subsidies to have a balanced impact on the three dimensions of sustainable development in Egypt.

The paper will be divided into three main sections; the first section will be devoted to analyze relative weight and impact of the energy policy on the sustainable development path in Egypt, next it will provide a quantitative and qualitative assessment of energy production, consumption and subsidy structure in Egypt. The second section will be devoted to gather and review literature on the possible impacts of phasing out energy subsidies in Egypt on the three dimensions of sustainable development. The final section will develop policy recommendations for phasing out energy subsidies to be balance with the three dimensions of SD in Egypt.

[3] In relation to developing countries, the term "Energy subsidies" represent fossil f

[4] Analysis of the scope of energy subsidies and suggestions for the G-20 initiative,
submission to the G-20 Summit Meeting, Toronto (Canada), June 2010. P.37

Section 1

Energy and sustainable development in Egypt

Introduction

This section will start by identifying the relative weight and impact of energy policy on the sustainable development path of Egypt in general; to this end the paper will utilize the adjusted net saving approach developed by the World Bank in 1997[5], next it will provide a quantitative and qualitative assessment of energy production, consumption and subsidy structure in Egypt.

1. The need for a comprehensive measure for sustainable development

In the past, economic growth measured in terms of GDP, GNP, GNI, and other derivative standard indicators was the only measures explicitly recognized by nearly all nations and international organizations as a reflection of wealth of nations and its well-being. ***But recently*** comprehensive investigations provide strong evidence that the growth of the global economy is not sustainable because it consumes many of the environmental services that underpin the production of goods and services[6]. In addition economic growth does not necessarily mean growth in the well-being of people and do not reflect the growing disparity between rich and poor in most nations, or the environmental degradation which diminishes the health of people, communities, ecosystems, and the economy[7].

That's why correction of standard indicators was elevated on the international agenda especially after the brutland report. Since then, the discussion was dominated by a major problem which was; "how to quantify well-being in a comprehensive manner". An appropriate measure of well-being ***should not only*** include all factors that determine well-being such as the environment, health aspects, skills, knowledge and income of the present generation ***but*** also consider the future ones.

[5] Comprehensive investigation about the approach the way of measurement, assumptions and limitations can be found at http://www.worldbank.org.

[6] Vitousek, P. M., Mooney, H. A., Lubchenco, J. and Melillo, J. M. 1997. Human domination of earth's ecosystems. Science, 277: 494-499.

[7] Daly, H. E. and Cobb, J. B., 1989. For the Common Good. Beacon Press, Boston. Dasgupta, P. S. and Heal, G. M., 1979. Economic Theory and Exhaustible Resources.
Cambridge University Press, Oxford. de Groot, R. S., 1992. Functions of Nature.
Amsterdam, 315 pp.

Agenda 21 has stressed explicitly the weakness of commonly used indicators such as GNP or other aggregate indicators. Indicators of sustainable development need to be developed to provide solid bases for decision making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems[8].
Several responses have followed the agenda. Three main important approaches that have been applied internationally are: (1) United Nations Commission on Sustainable Development (UNCSD) indicators developed in 1995, (2) Correction of System of National Account (SNA) developed by United Nations Statistical Division (UNSD) in 1993, and (3) The World Bank's measure of the wealth of nations in 1997[9].

1.1 The world bank measure of wealth of nations "Adjusted Net Saving Approach"[10]

The starting point for the calculation of ***ANS*** is gross national saving (***GNS***), which is calculated as the difference between gross national income and public and private consumption. From this, consumption of fixed capital (***CFC***), which is defined as the value of physical capital consumed in the process of production, is subtracted.

This yields net national saving (***NNS***) expressed as a percentage of gross national income (***GNI***). Only current expenditures on education such as wages and salaries are added as a proxy for the lower bound of investments in human capital.

The next step is the deduction of depletion of ***natural capital***. Forms of natural resource depletion that are taken into account are net forest depletion (NFD), energy depletion (END) and mineral depletion (MID). The value of resource depletion is calculated by subtracting local extraction costs from world market resource prices.

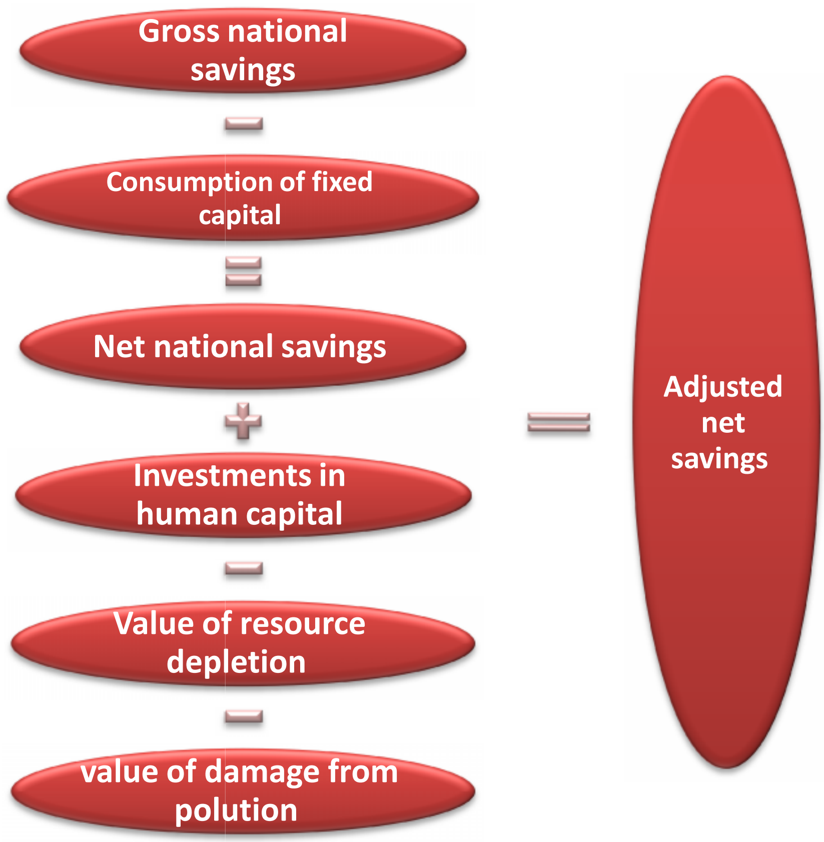
The final step is the deduction of pollution costs from carbon dioxide emissions and particulate matter.

[8] United Nations Conference on Environment & Development, (1992) Rio de Janerio, Brazil. (Agenda 21, 1992, section 40.4)

[9] Armida S. Alisjahbana,, Arief Anshory, Yusuf and Budiono, EADN working paper no.20 (2003), measuring sustainable development in Indonesia: genuine savings and change in wealth percapita . P.2

[10] A comprehensive analysis for the approach , its assumption and limitations can l Worldbank.org.

Fig 1; adjusted net savings calculation parameters



1.3.1 Adjusted net savings parameters for Egypt as a percentage of GNI

Table (1) shows the adjusted net saving parameters of the Egypt, slandered conventional indicators such as gross national savings and net national saving for the years 2000-2008 provides a positive picture about the economy, CO2 emission as a proxy for the environment shows fluctuation between increase from 2000 to 2006 to decrease 2006-to 2008, a possible reason for this trend may be the governmental policy that was adopted to shift electricity generation from oil to natural gas. In regard to energy degradation it is clear that it is increasing at increasing rates as a percentage of GNI. As regard to education which was used by the model as a proxy for the social dimension it is constant as a percentage of GNI, but taking into account the relati[illegible] population growth in Egypt this fact may be altered.

Table 1 adjusted net savings parameters for Egypt as a percentage of GNI

Year	*GNS*	*CFC*	*NNS*	*CO2*	*EE*	*ED**	*MD***	*ANS*
2000	17.94	6.13	11.81	0.83	4.41	5.94	0.01	8.50
2001	18.19	4.80	13.39	0.77	4.41	5.15	0.02	10.89
2002	19.26	5.28	13.97	0.97	4.41	5.59	0.02	10.79
2003	18.72	4.81	13.91	1.06	4.41	8.24	0.03	8.22
2004	21.28	5.92	15.37	1.26	4.41	10.69	0.04	6.99
2005	21.94	6.32	15.61	1.30	4.41	16.34	0.10	1.52
2006	22.86	5.90	16.96	1.07	4.41	14.99	0.11	4.45
2007	23.34	9.05	14.29	0.99	4.41	12.80	0.12	4.11
2008	23.51	9.35	14.61	0.87	4.41	14.48	0.50	2.06

ED* Energy depletion

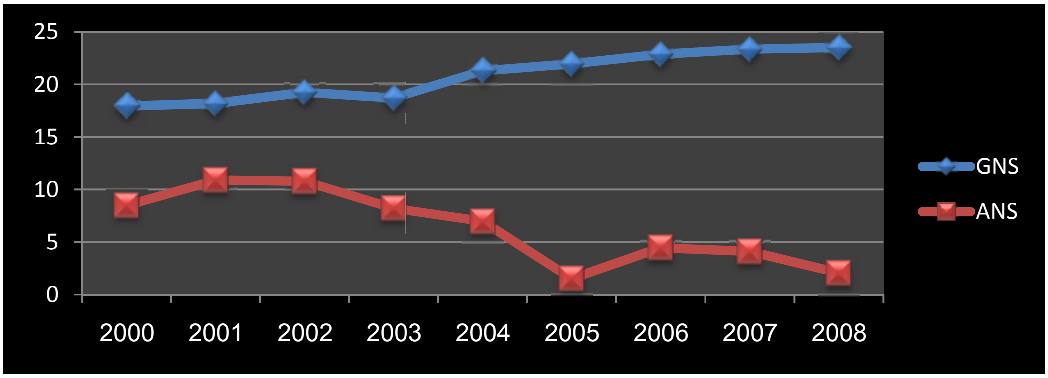
MD* Mineral depletion

Source: Compilation from the World Bank data for different years[11]

Is Egypt growing in a sustainable way?

Figure 2 shows that despite standard indicators such as gross national savings are implying that Egypt is growing in absolute and relative terms from 2000 to 2008, adjusted net savings is decreasing for the same period. What this implies is that Egypt is not growing in a sustainable way. WHY?

Figure 2: Gross national savings and adjusted net savings for Egypt.

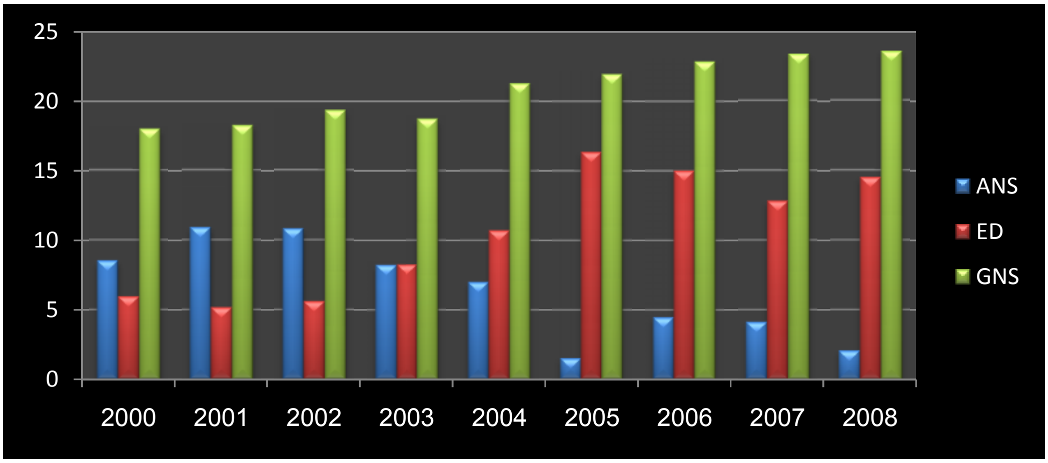


Source: table 1

[11] http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT. accesse
2010.

Figure 3 shows that gross national savings are highly dependent on environmental depletion, which represents in the case of Egypt more than 96% energy depletion. In 2008 gross national savings shows more than 61% dependency rate on energy depletion. In terms of net national savings this ratio grows to 99 %, emphasizing the fact that Egypt growth rates are completely dependent on the depletion of non renewable energy resources.

Figure 3: gross national savings, adjusted net national savings and environmental depletion.



Source: *table 1*

Conclusion:

The calculation of ANS in Egypt for the year 2008 as shown in figure 3 shows positive number for gross national saving (23.51%) as well as for net national saving (14.6), when educational expenditures are added as investment in human capital, this yields a preliminary positive result of 19.02% for saving including physical and human capital. These numbers change dramatically when changes in natural capital are included. The depletion of natural capital and namely "energy depletion" (14.4) is the driving force behind the resulting ANS rate of 2%. This rate is particularly very low if allowance for population growth rates is taken into account.

Two important facts worth highlighting in this respect, the first is the high relative weight of the energy sector as a percentage of GNI, the second is that growth rates in GNI in Egypt is not sustainable, High dependence on depletion of non renewable energy resources shows that energy policy is not addressed in an appropriate manner especially when future generations are taken into account.

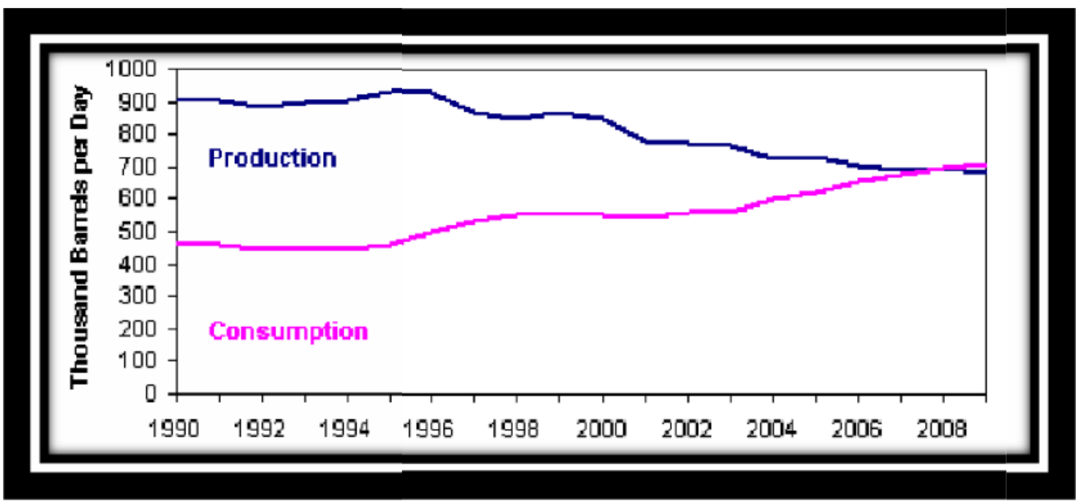
2. Egypt energy profile[12]

Oil and gas sector fulfills around 94% of Egypt's energy requirements, distributed between oil (52%) and natural gas (42%), less than 1 % coal and the remaining consist mainly from hydropower with less than 0.5 % share of wind energy[13].

2.1 Oil and natural gas production and consumption in Egypt

Egypt was the first Arab country in which oil was discovered on the coasts of the red sea in 1886, but exploration on commercial basis started in the 30's when the government allowed foreign exploration companies in Egypt. Egypt has traditionally been a net exporter of oil. Its peak export point was 500 barrels in 1993. Production declined at an average of 3 per cent/year over the period 1995–2005, while domestic demand has continued to grow. Despite the huge efforts in the field of oil discovery and enhanced oil recovery techniques at matured fields, oil production was declining in the last decade in both absolute and relative terms. In 2009, Egypt total oil production was averaged between 685,000 (bbl/d), of which approximately 440,000 (bbl/d) was crude oil. In 2010 Egypt oil reserves stand at 3.7 billion barrels. Egypt share in production of crude oil is 62% while the rest goes to the foreign partner. On the other hand Egypt oil consumption has been rising rapidly with an average of 6 % per year due to many factors during the last decade, in 2009 consumption was 710,000 (bbl/d), slightly higher than the production.

Figure 4; Egypt total oil production and consumption 1990-2009



Source: EIA and international energy agency

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[12] This section is based on data provided by the US energy information administration unless otherwise provided. http://tonto.eia.doe.gov/country/country_energy_data.cfm on 15 September 20101.

[13] IEA & EIA (2010).

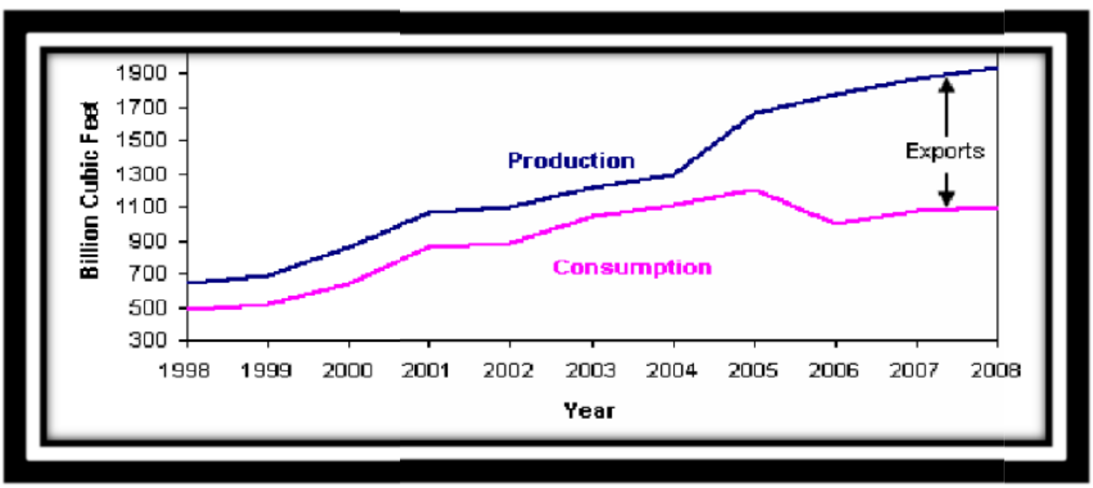
Decrease in crude oil exports was matched by increase in natural gas reserves. Production more than quadrupled over the period 1995–2007. Contracts with foreign exploration companies allowed a share of 50% of the discovered gas on a take or pay basis.

In 2008, Egypt produced roughly 1.9 trillion cubic feet (Tcf) and consumed 1.1 Tcf. According to the Oil and Gas Journal , Egypt's estimated proven gas reserves stand at 58.5 Tcf, the third highest in Africa after Nigeria (185 Tcf) and Algeria (159 Tcf). With the ongoing expansion of the Arab Gas Pipeline, and liquefied natural gas (LNG) facilities, Egypt will continue to be an important supplier of natural gas to Europe and the Mediterranean region. Egypt's proved gas reserves continue to grow; the IEA projects that both production and exports of natural gas will double between 2005 and 2030 (IEA, 2005).

Gas was first used as an alternative fuel in Egypt for power generation, via the conversion of oil fired thermal cycle plants. Around 90 per cent of thermal Egyptian generation currently uses natural gas. Egypt has dealt with its expanding gas resources by adopting, since 2000, a gas strategy comprising: One-third for local needs; One-third for medium-term export commitments; One-third for long-term strategic requirements.

Given increasing domestic demand, combined with popular pressures in recent years against LNG and gas export contracts (particularly with Israel), the oil minister declared in mid-2008 that no new gas export contracts would be made.

Figure 5; Egypt natural gas production and consumption 1998-2008



Source: EIA and international energy agency

3. **Wight and structure of energy subsidy in Egypt**

Introduction

According to the IEA, Consumer subsidies – which are used primarily by developing countries – amounted to US$ 557 billion in 2008, showing a massive increase over 2007 figure of 342 billion. Numerous factors were behind this trend including fluctuation in the world prices, shifts in demand, and domestic pricing policy changes[14]. Consumption of oil products and natural gas were commonly subsidized, totaling US$ 312 billion and US$ 204 billion, respectively, in 2008. The IEA reports US$ 40 billion in subsidies for coal, mostly provided indirectly through subsidized electricity prices.

3.1 Energy subsidies in Egypt[15]

Subsidies on energy petroleum products in Egypt increased from around LE40bn (US$7bn) in 2005/06 to LE 60bn (US$10.8bn) in 2007/08. These estimates are based upon domestic costs rather than world prices. This number hit more than LE 66 bn (US$ 12 billion) in 2010[16]. Fossil fuel subsidies are by far receiving the highest share in the government budget. These subsidies impose a heavy burden on the government budget and lead to excessive consumption of energy products. The Egyptian government decided revising the system of energy pricing to ensure efficient resource allocation, reduce budget deficits, and reduce the rate of depletion of these increasingly scarce resources.

A break down for energy subsidies shows that; Diesel oil receives the highest share of subsidies at 39.1 per cent, although it accounts for only 19.2 per cent of total consumption. Natural gas has the highest share in consumption at 42.6 per cent, but receives only 20 per cent of subsidies. Liquefied petroleum gas (LPG) is very heavily subsidized at 21.8 per cent, but in terms of consumption it only represents 8.1 per cent. Fuel oil accounts for 24 per cent of consumption and 10 per cent of subsidies. Gasoline receives the smallest share of subsidies at nine per cent, being the least consumed petroleum product at six per cent of total consumption.

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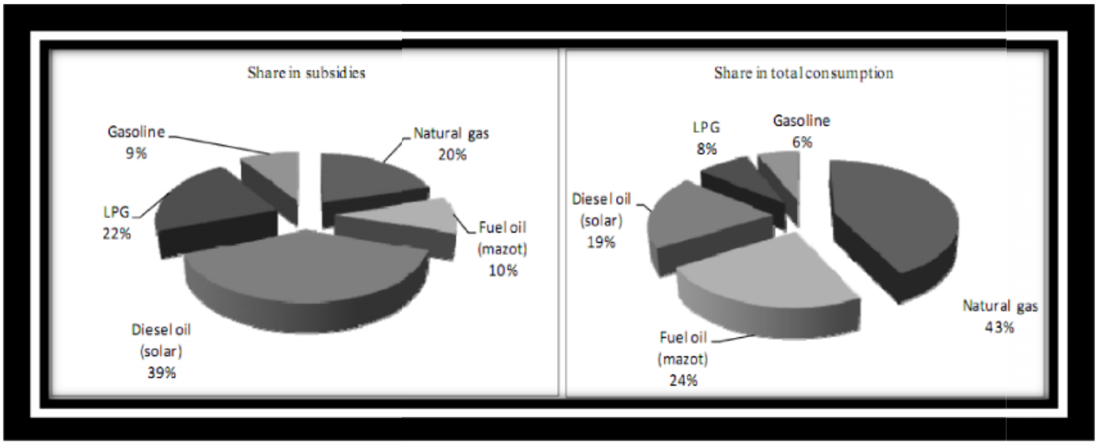
[14] It is estimated that the 37 countries surveyed in the IEA dataset, including both OECD and non-OECD countries collectively represent over 95% of global subsidized fossil-fuel consumption. Revised estimates of consumer subsidies for 2009 will be available in time for the Korean G20 Summit in November 2010, once data for the full year becomes available for all countries in the IEA energy subsidy database.

[15] This section is based on a study conducted by the Egyptian center for economic studies; the impact of phasing out subsidies of petroleum energy products in egypt, Soheir Abouleinein, Heba El Laithy and Hanaa Kheir-El-Din. Working Paper No. 145 April 2009.

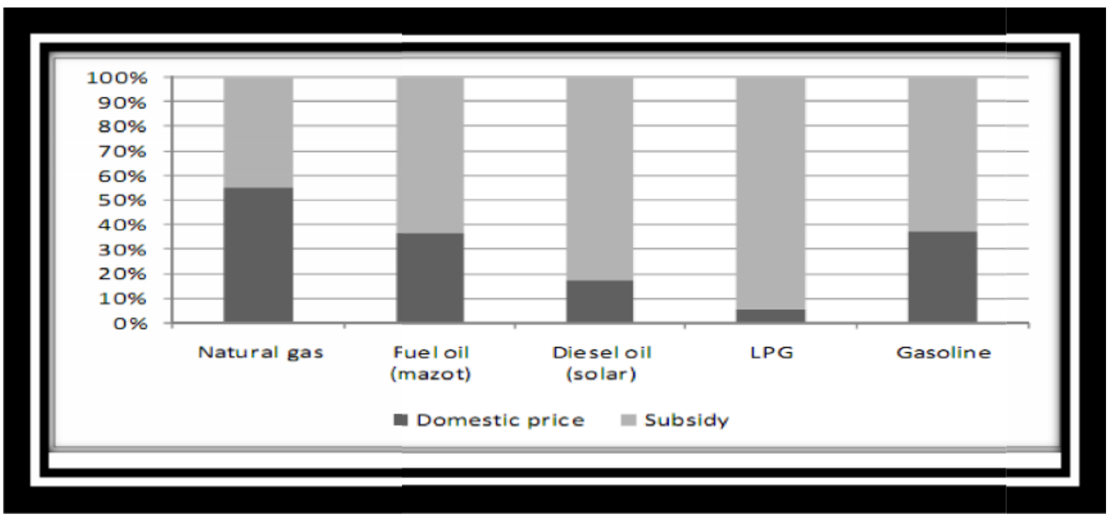
[16] Yousef Butrus Ghaly, elmasry alyoum news paper, September 20, 2010

Figure 6; Structure of subsidies and consumption of petroleum products



Source; Share in subsidies is calculated from data in detailed government budget 2006/2007.

Figure 7; ratio of domestic prices and subsidies to actual cost of petroleum products in 2007/2008



Source; EZZ (2008)[17]

[17] Ezz. Ahmed. 2008. Government budget: Reality and challenges. Lecture deliverec Economics and Political Sciences, Cairo University, Egypt.

Conclusion;

A number of important facts can be concluded from the preceding analysis. The first is the high relative weight of the energy sector as a percentage of GNI, the second is that growth rates in GNI in Egypt is not sustainable, High dependence on depletion of non renewable energy resources shows that energy policy is not addressed in an appropriate manner especially when future generations are taken into account. The second is that with current production and consumption rates, Egypt will soon turn to be a net oil and natural gas importer, and hence the economy will lose the contributions of the energy sector needed for domestic growth and development. Third, Energy subsidies increased to (US$ 12 bn) in 2010[18]. This subsidies is not sustainable, it imposes a huge burden on the balance of payment. Recent estimates shows that budget deficit hit (US$ 19 bn) in 2010, and is subject to further increase with expectations of rising energy prices worldwide.

Oil and natural gas prices was kept constant in Egypt from 1991 to 2004 , this shows that the social dimension was a high priority on the policy making agenda. But with the current energy situation, and under the current economic pressures, international experience shows that countries become more motivated to phase out energy subsidy.

Since domestically the economic motive represents -at least- the major motive for phasing out energy subsidies, there are fears that policies planed and implemented may be biased against the social and environmental dimensions of sustainable development, especially with the upward trend of poverty rates after the economic crisis in developing countries[19].

[19] United nation development programme, Human development report, Egypt 2010 http://www.undp.org.eg/Default.aspx?tabid=227. Acceded on 16 September 2010.

Section 2

The impact of phasing out energy subsides on the environmental and social dimensions of sustainable development in Egypt

This section will be divided into three parts; part 1 will deal with environmental dimension of sustainable development in Egypt. Part two will address the social dimension of sustainable development in Egypt. The final part will show the impact of phasing out energy subsidies on both dimensions.

1. Environmental dimension

The argument that phasing out energy subsidies has a positive impact on the environmental dimension is based on two assumptions; the first is that phasing out energy subsidies will enhance energy efficiency, and the second is that it will lead to better exploitation to renewable energy resources. Both of those assumptions will be tested in the case of Egypt.

1.1 Egypt "Environmental Outlook"[20]

The first GHG inventory of Egypt was developed for the year 1990/91 based on the 1995 IPCC guidelines and default emission factors. The inventory was estimated for the main three GHGs, namely CO, CH4 and N2O. CO2 is the main Greenhouse Gas in Egypt.

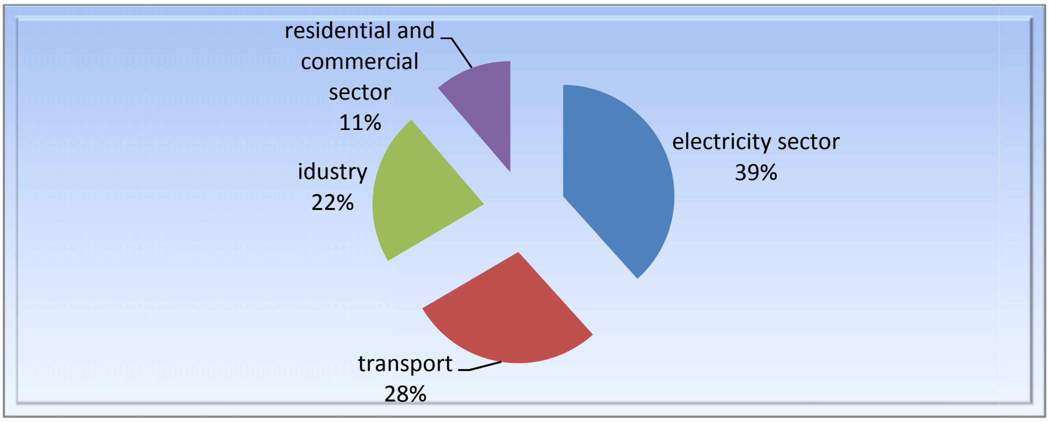
With 92% dependence on fossil fuels, the energy sector is the major source of GHG emissions, contributing about 71% of the national total. Egypt's contribution to the world CO2 emission is currently at about 3.3 t CO2 eq. per capita that is less than the world's average but much more than Africa's average.

[20] United nation environmental programme, MAP, and plan blue, Mediterranean and National Strategies for Sustainable Development for Energy and Climate Change. Energy Efficiency and Renewable Energy Egypt - National study, march 2007.

CO emissions from the consumption of fossil fuels for energy purposes has increased from 83070 Gg of CO for the year 1995/96 to 137110 Gg of CO equivalent by the year 2004/05 with an annual average growth rate of 5.7%.

As shown if figure 8, During the year 2004/05, the contribution of the main sectors in GHG emissions was the electricity sector share of 35.35% followed by the transport with the share of 26%, the industry with 20.45%, and the residential and commercial sector with 10.42%.

Figure 8; percentage share of different sectors in green house gas for year 2004/2005



Source: IEA 2005

According the IEA, Egypt can move towards a less GHG-intensive path, mainly by becoming a more energy efficient economy. Nevertheless, the onerous energy price subsidy is constraining investment in the energy sector while the potential for GHG reduction is far from being exploited. In recent years, the Government has adopted several measures to increase both rational use of energy, and renewable energy contribution in energy supply. Recently the World Bank estimated that the number of deaths due to air pollution in Egypt exceeded 20000 with a total cost of more than 2% of GDP (for 1999).

1.2 Energy efficiency

Energy efficiency -measured in terms of energy intensity- in Egypt is far from the international average. The Egyptian economy uses 0.51 tons of petroleum equivalents for every $1000 of GDP; this figure is 147% higher than Tunisia and turkey, 182% higher than Mexico, 300% higher than Greece, and 364 % higher than UK[21].

[21] IEA 2005, Egypt, country profile

1.3 Renewable energy potential

1.3.1 Hydropower

Most of the available hydropower energy resources in Egypt are mainly located on the River Nile. They were largely exploited with the construction of the Aswan Reservoir, the High Dam, and the Esna Barrage Hydropower Station, with installed capacity of 592 MW, 2100 MW, and 91 MW respectively and representing a total installed capacitis of 2783 MW. There are 109 MW hydropower projects at Nagah Hamady and Assiut Barrages under construction on the main river. Small capacities of another 60 MW in total are also available at main canals and branches of the river. These capacities which sum up to a grand total of 2952 MW represent most of the available potential. In 2007, Egypt generated 17 Bkwh from hydroelectric resources, almost all of which came from the Aswan High Dam and the Aswan Reservoir Dams. Hydropower represents covers 6% of Egypt total energy consumption[22].

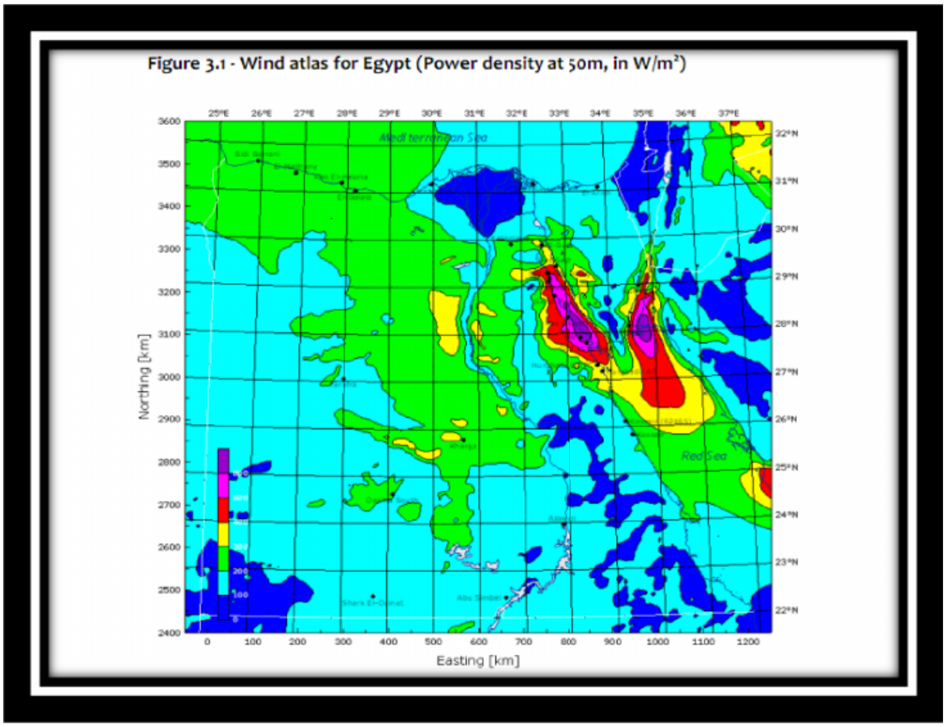
1.3.2 Wind energy [23]

Wind energy strategy in Egypt was developed gradually in an ordered manner where success in each phase led to the following one. As a prerequisite for wind energy development, in 1987, Egypt developed its first annual map for wind potential. A Wind Atlas for the Gulf of Suez West Coast was issued in 1996. A more detailed one was issued in 2003 concluding that the region can host about 20.000 MW of wind farms. The Atlas was being extended to cover the whole territory of Egypt.

[22] United nation environmental programme, MAP, and plan blue, Mediterranean and National Strategies for Sustainable Development for Energy and Climate Change. Energy Efficiency and Renewable Energy Egypt – National study, march 2007. Pp. 16, 17.

[23] This section was based on a study published by the international institute of sustainable development (iisd), "Clean Energy Investment in Developing Countries": Wind power in Egypt M
Yasser Sherif (Environics, Egypt) and Peter Wooders, October 2009.

Figure 9; wind atlas for Egypt (power density at 50m,{W/M2}



Region	Av. Wind Speed (m/s)
Ras Sedr	7.5
Abu Aldarag	8.8
Zafarana (north)	9.2
Zafarana	9.0
Zafarana (west)	7.5
St. Paul	8.4
Ras Ghareb	10.0
El Tour	5.6
El Zeit Gulf (north)	10.4
El Zeit Gulf (north-west)	10.5
El Zeit Gulf	10.3
El Zeit Gulf (south-west)	10.8
Hurghada	6.7

Source; New and Renewable Energy Authority (NREA)

This figure shows an extract from the atlas, at a typical turbine hub height of 50m above the surface. Areas in red, pink and purple are those where the power density is above 400, 500 and 600 W/m respectively, that is to say, where the wind resource is sufficient to allow the possibility of economic development. The economics of areas in yellow (where the wind power density is 300–400 W/m) are marginal economically. There are very significant wind resources in Egypt, particularly on the Red Sea coast, where mean wind speeds are in the range of 8–10.5 m/s at 25m.

Egypt started its wind energy program in 1993 with a 5.2 MW pilot plant and demonstration wind farm in Hurghada. All following projects have been in the Zafarana area on the coast of the Red Sea; the current total operating capacity is 305 MW, giving a 2007 total for all of Egypt of 310 MW when the turbines at Hurghada are added in. All existing wind farms in Egypt are owned and operated by NREA. The availability rate for the wind farms at Zafarana exceeds 98.5 per cent, in line with international experience.

Figure 10; development of wind farm capacity

Source[24]

Figure 10. Shows an annotated timeline of capacity development. These projects were executed though funds and technical assistance from Denmark (60 MW, 2001–03); Germany (80 MW, 2001– 4); Spain (85 MW, 2006) and Japan (80 MW, 2007). The German, Spanish and Japanese developments have all applied for accreditation under the CDM, using methodology ACM2 (gridconnected electricity generation).

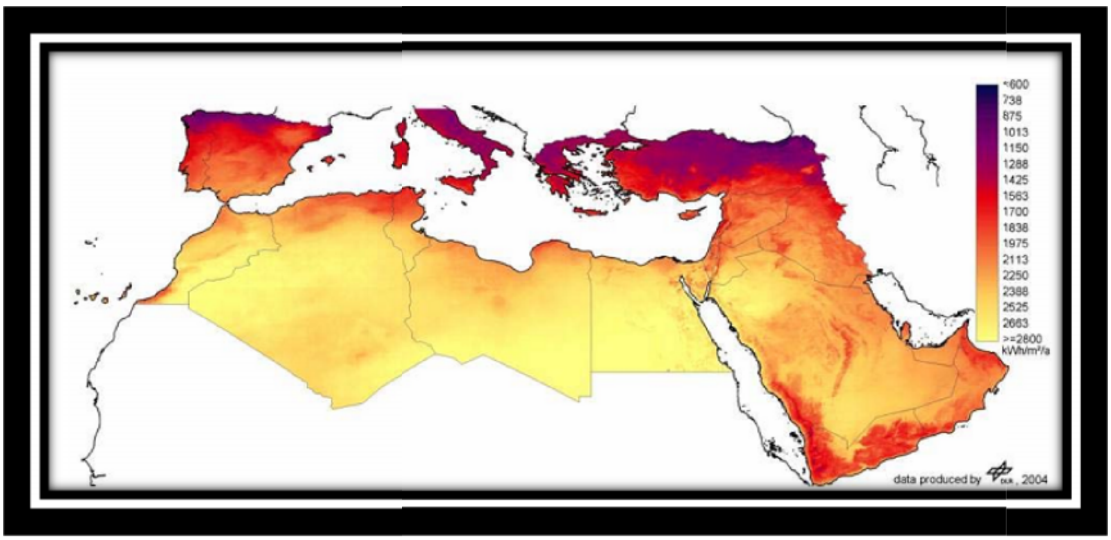
There are a number of political, economical, and geographical impediments; the principal barrier to the large-scale implementation of wind power is the low price paid for wind generation under current arrangements. This low price is itself a function of the Egyptian tariff system: final consumers of electricity pay relatively low prices, which require natural gas prices paid by electricity generators to be held significantly below the opportunity cost Egypt could realize by exporting the gas as LNG.

[24] Ibid, p 13.

1.3.3 Solar energy[25]

Egypt lies among the Sun Belt countries with annual global solar insulation ranging from 1750 to 2680 kwh/m2/year from North to South and annual direct normal solar irradiance ranging from 1970 to 3200 kwh/m2/year also from North to South with relatively steady daily profile and small variations making it very favorable for utilization. Such conditions of favorite solar resource utilization are supported by other conditions of sunshine duration ranging from 9 – 11 hours with few cloudy days over the year making Egypt on the top best location for solar exploitation all over the world.

Figure 11; *annual direct solar irradiation in southern EU-MENA region. The primary energy received by each square meter of land equal 1-2 barrel of oil per year.*



Source: *DLR 2004*

Egypt's first solar plant at El-Koraymat, south of Cairo produces 20MW of solar power alongside 120MW of conventional natural gas power. The Egyptian Electricity Ministry has unveiled plans to build a new $700m 100MW solar power plant between 2012 and 2017 that should further establish the country as one of the leading developers of utility-scale solar plants. The project is part of a five-year plan running from 2012-2017 designed to establish the Egypt as one of the top generators of solar energy in North Africa.

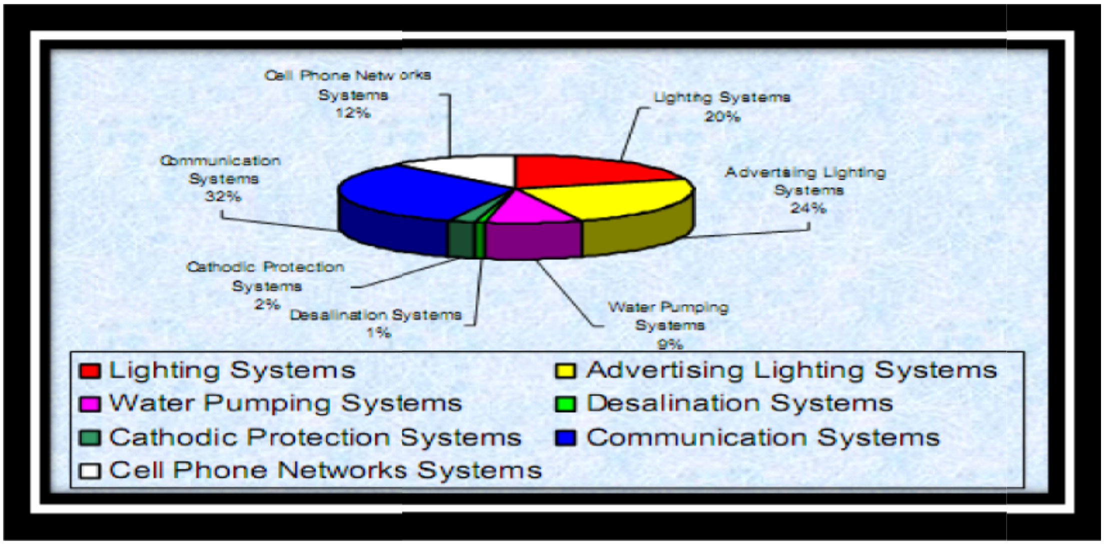
[25] This section is based on "MED-CSPMED-CSP Concentrating Solar Power for the Mediterranean Region" Final Report, conducted by German Aerospace Center (DLR) Institute of Technical Thermodynamics Section Systems Analysis and Technology Assessment, Study commissioned by Federal Ministry for the Environment, Nature Conservation and Nuclear Safety Germany

Solar energy applications did not mature yet in all fields due to the lack of the economical feasibility either for industrial or household use in the light of energy subsidies in Egypt.

In a study conducted by the dlr , Egypt has huge solar energy potential recognized in 73.656 trillion watt h/year {economically feasible capacity}. In addition the study has shown that solar thermal applications either on the industrial or the household level have great potential.

In regard to PV Egypt has a small installed capacity of 4 to 4,5 mega watt, while the potential capacity reaches 36 trillion watt hour {economically feasible capacity}.

Figure 12: PV capacity in Egypt



Source[26]

[26] United nation environmental programme, MAP, and plan blue, Mediterranean and National Strategies for Sustainable Development for Energy and Climate Change. Energy Eff Renewable Energy Egypt - National study, march 2007. P. 39

2. Social dimension

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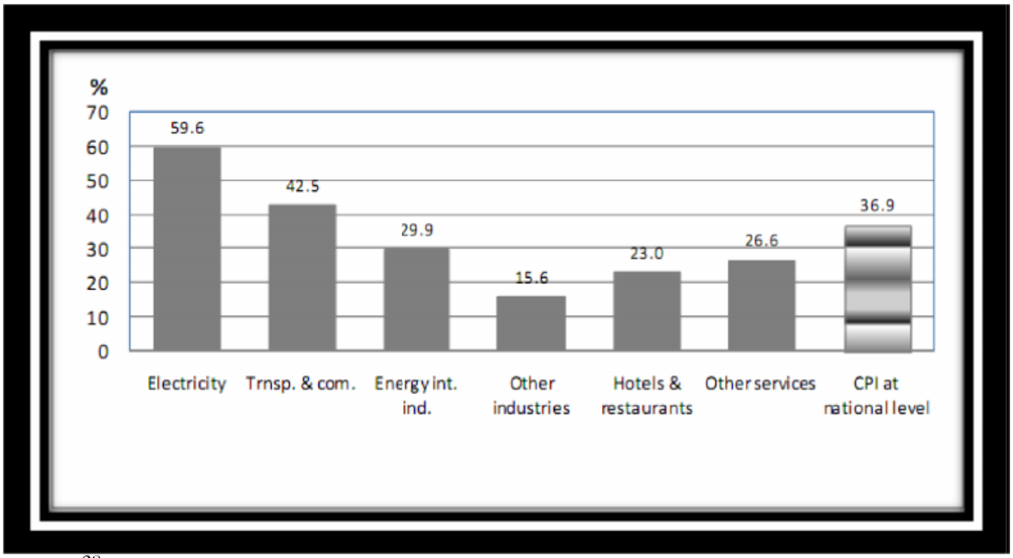
Egypt presents a most effective and exemplary energy equity system according to World Energy and Climate Policy Assessment in 2009[27]. Energy policies provide broad support for low-income households to connect to the electricity grid, and promote small energy-intensive industries. Egypt has existing policies and institutional frameworks that help the country achieve a high standard of energy equity: A rural electrification authority has been established to implement transmission and distribution networks for rural areas and remote communities. There is a subsidies policy for the poor. A natural gas network is available throughout the country. A special tariff exists for low-consumption consumers. The objectives of Egypt's energy equity policy are to: Extend energy infrastructure across the entire country, and ensure energy is available for all at affordable prices.

The impact of phasing out energy subsidies on inflation levels in Egypt was subject to a huge debate. In a recent study conducted by the Egyptian canter for economic studies it was reported that; phasing out all energy subsidies will lead to an increase in the average price level of petroleum products by 831 percent. This induces an increase in CPI at the national level by 36.9 percentage points. The price of energy intensive industries is expected to increase by about 30 percent and contribute 12.9 percentage points to CPI. Prices of transport and communications would increase by 42.5 percent. Price of electricity would rise by 59.6 percent. Adjusting all prices to domestic costs only for producers and not households would reduce subsidies by 75 percent, but increasing the level of consumer prices by 27.6 percentage points, while adjusting prices of petroleum products to their actual cost only for energy intensive industries, is expected to increase the level of consumer prices by 9.9 percentage points, and reduce subsidies by 28 percent. In all scenarios, the aggregated sector of "energy intensive industries" is the highest contributor to the increase in CPI. Within this sector, the food industry has the highest impact on CPI, because of its share in household consumption, which accounts for about 40 percent[28].

[27] World energy council, world energy and climate policy Egypt assessment 2009. P17

[28] Egyptian center for economic studies; the impact of phasing out subsidies of petroleum energy products in egypt, Soheir Abouleinein, Heba El-Laithy and Hanaa Kheir-El-Din. Working Paper No. 145 April 2009. P 18

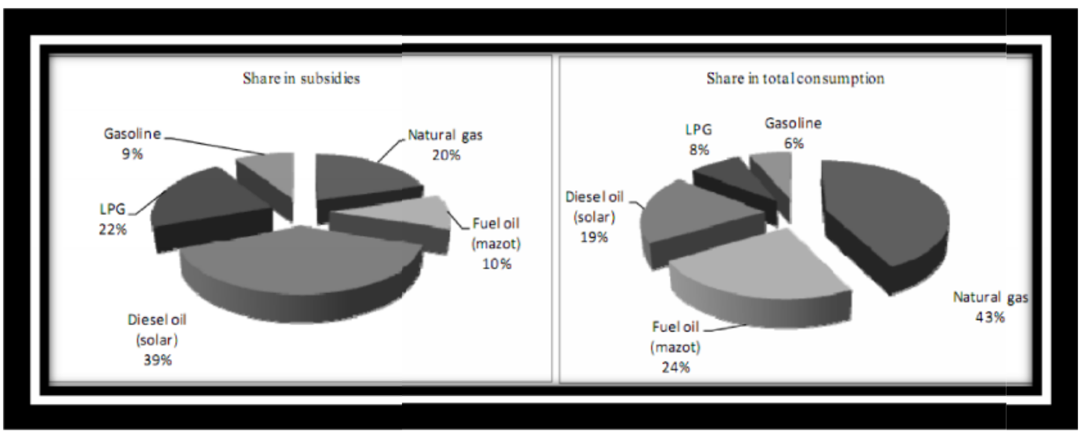
Figure 13; percentage increase in price index in case of removing all subsides



Source[29]

Figure 14 shows that natural gas has the highest share in consumption (42.6 percent) and receives 20 percent of subsidies. Diesel oil receives the highest share of subsidies (39.1 percent), while accounting only for 19.2 percent of total consumption. LPG is heavily subsidized, its price is constant at LE 2.5 per cylinder and its actual cost reaches LE 46 share in total consumption is 8.1 percent, while its share in subsidies is 21.8 percent. Diesel oil and LPG receive about 60 percent of total subsidies. Gasoline is the least subsidized and least consumed petroleum product.

Figure 14; Share of subsidies and consumption of petroleum products.



Source; Share in subsidies are calculated from data in details government budget 2006/2007[30]

[29] Ibid p 18
[30] Ibid, p12

It is worth noting that the shares of household quintiles in total consumption of energy petroleum products reflect their shares in benefiting from energy petroleum subsidies. The richest urban quintile benefits from 33 percent of these subsidies, while the poorest urban quintile benefits from only 3.8 percent. These figures give strong evidence of inequitable distribution of these energy subsidies. Similarly, in rural areas, the richest quintile benefits from 12.8 percent of petroleum subsidies while the poorest quintile benefits from 5.6 percent. This also indicates inequitable distribution of energy subsidies although to a lower extent.

The impact of increasing prices of all energy petroleum products on high expenditure quintiles slightly exceeds its impact on lower income quintiles, as higher income households allocate a bigger share of their spending to total energy consumption.

However, this is not true when considering the impact of each petroleum product separately. Increasing prices of natural gas and/or fuel oil affects lower expenditure groups more than the higher ones.

The share of spending on food industry products increases in lower income groups. This industry is among the energy intensive industries, which explains why increasing petroleum products only for energy intensive industries—including the food industry—affects lower expenditure quintiles more than the higher ones. The resulting increases in CPI in rural areas are slightly higher than in urban areas in the lowest two quintiles in all petroleum products.

The impact of initial increases in prices of petroleum products and the resulting final increases in prices of all goods and services on the pattern of consumption depends on price and income elasticity of petroleum products as well as of other goods and services.

Conclusion

On the environmental front, According the IEA, Egypt can move towards a less GHG-intensive path, mainly by becoming a more energy efficient economy and by making greater use of its large renewable energy potential.

On the energy efficiency front, Energy efficiency -measured in terms of energy intensity- in Egypt is far from the international average. The Egyptian economy uses 0.51 tons of petroleum equivalents for every $1000 of GDP; this figure is 147% higher than Tunisia and turkey, 182% higher than Mexico, 300% higher than Greece, and 364 % higher than UK. For energy efficiency to be enhanced a modernization strategy should be place before removing out energy subsidies. Without this strategy in place before phasing out subsidies, energy efficiency will not be enhanced, GHG emission will not be reduced, and the only impact will be shifting government budget deficit consumer household budget deficit.

From a social perspective, it was found that the richest urban quintile benefits from 33 percent of these subsidies, while the poorest urban quintile benefits from only 3.8 percent. In rural areas, the richest quintile benefits from 12.8 percent of petroleum subsidies while the poorest quintile benefits from 5.6 percent. This indicates inequitable distribution of energy subsidies. But this does not mean that phasing out energy subsidies will hurt the poor less. Where when considering the impact of each petroleum product separately. Increasing prices of natural gas and/or fuel oil affects lower expenditure groups more than the higher ones. The share of spending on food industry products increases in lower income groups. This industry is among the energy intensive industries, which explains why increasing petroleum products only for energy intensive industries—including the food industry—affects lower expenditure quintiles more than the higher ones.

Finally, a fact that worth mentioning is that; ***from an environmental policy making*** perspective greater attention should be paid to the electricity sector and transport as they combined account for more than 65 % of GHG emissions, while the industry sector and commercial and residential sectors together contribution is less than 35 % of GHG emissions. But ***from a social policy making*** perspective this is not recommended, where phasing out subsidies from the electricity and the transport sector will lead to more than 60% of the increase in the CPI in Egypt, a situation where conflict between different dimensions of sustainable development is clear.

Section 3

Conclusions and Policy recommendations

1. Conclusion

Egypt growth rats are not sustainable, even from a weak sustainability perspective which assumes possible substitution between different forms of capital. The calculation of ANS in Egypt for the year 2008 as shown in figure 3 shows positive number for gross national saving (23.51%) as well as for net national saving (14.6), when educational expenditures are added as investment in human capital, this yields a preliminary positive result of 19.02% for saving including physical and human capital. These numbers change dramatically when changes in natural capital are included. The depletion of natural capital and namely "energy depletion" (14.4) is the driving force behind the resulting ANS rate of 2%. This rate is particularly very low if allowance for population growth rates is taken into account.

Despite GNS was growing from 2000 to 2008, ANS was declining showing that Egypt is not growing in a sustainable manner. The energy sector has the highest weight in Egypt sustainable development path, and energy policy represents a case of public policy failure where high depletion rates on non renewable energy resources mainly oil and natural gas was the basic reason behind declining ANS. This implies that proceeds of energy depletion were not invested in other forms of capital that is more sustainable. Energy policy was socially dominated and biased towards meeting the needs of the present generation and hinders the future generation possibilities to meet their own needs.

With the current production and consumption trends Egypt will turn soon to be a net oil and natural gas importer; this will deprive Egypt from a major source of growth and development, threaten energy security, and leads to social unrest.

Depleted reserves, domestic budget deficit reaching US $12 Bn, projected increase in world petroleum and natural gas prices, together with other factors all suggests that Egypt will phase out fossil fuel subsidies soon. The resulting impact of phasing out energy subsidies on the social and environmental dimension is uncertain.

On the social front, despite that richest quintiles in urban and rural societies benefit from energy subsidies more than the poor, phasing out energy su poorest quintiles in both areas more. Investigations also shows that removing all energy subsidies will have a 39% increase in the CPI which is intolerable in the Egyptian society especially with the rising poverty rates after the economic crisis, the lack of effective social safety networks and the relative high share of the informal sector.

On the environmental front, the impact of phasing out subsides on energy efficiency and exploring the potential of renewable energies is not certain. The Egyptian economy uses 0.51 tons of petroleum equivalents for every $1000 of GDP; this figure is 147% higher than Tunisia and turkey, 182% higher than Mexico, 300% higher than Greece, and 364 % higher than UK. For energy efficiency to be enhanced a modernization strategy should be place before phasing out energy subsidies. Without this strategy in place, energy efficiency will not be enhanced, GHG emission will not be reduced, and the only impact will be shifting government budget deficit to consumer household. On the renewable energy front, despite huge potential affirmed by domestic and international organizations, with the current relatively high initial investment costs, budget deficit, weak technological, regulatory and institutional frameworks, it is not expected that Egypt will be able to realize high exploitation rates.

Finally, a fact that worth mentioning is that; *from an environmental policy making* perspective greater attention should be paid to the electricity sector and transport as they combined account for more than 65 % of GHG emissions, while the industry sector and commercial and residential sectors together contribution is less than 35 % of GHG emissions. But ***from a social policy making*** perspective this is not recommended, where phasing out subsidies from the electricity and the transport sector will lead to more than 60% of the increase in the CPI in Egypt, a situation where conflict between different dimensions of sustainable development is clear.

Policy recommendations

Considerable attention is paid to mitigate the economic and social impact of phasing out energy subsidies by researchers, officials and policy makers. Different recommendations was made starting from the gradual implementations of phasing out energy subsides to the adoption mitigating measures through cash transfers, coupons, and smart cards.

Alternative mitigating mechanism as the name implies are no comprehensive long term solutions, but rather at best, short term sectoral solutions. Alternative mitigating mechanism assumes the presence of effective social safety networks, a condition that is missing in the case of developing countries especially with the presence of considerable informal sector.

On the domestic level, alternative mitigating mechanisms if employed should be a part of a comprehensive reform long term balanced strategic planning process under the umbrella of "National strategy for sustainable development"[31] to secure its balanced long term impact. Long experience of sectoral planning and implementation proved to be inefficient, ineffective unable to achieve the balance between the three dimensions of sustainable development.

On the international level, cooperation ***with and between*** economic, social, and environmental organizations and programmes is desirable for achieving a balanced impact on the three dimensions of sustainable development.

On the regional level, despite partner such as the EU has played a considerable role either in terms of industrial modernization or in terms of renewable energies, as was emphasized before, the current regional cooperation agreement is criticized by both sides on different fronts particularly in the case of Egypt. Three major areas are considered of prime importance when it comes to energy policy, first is diffusion and transferability of policy instruments for greening economy, and capacity building for greening society.

[31] Egypt has not yet developed its national strategy for sustainable development.

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