Egypt's Future Energy Needs *

By

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Abstract

تلخيص

الاحتياجات المستقبلية من الطاقة فى مصر

تشير جميع التوقعات الخاصة بالاستهلاك العالمى للطاقة إلى أنه بحلول عام ٢٠٢٠ سيفوق استهلاك دول العالم الثالث من الطاقة نصيب الدول الصناعية من هذا الاستهلاك. وتعتبر مصر أكثر تفرداً فى هذا الشأن، فعدد سكان مصر من ٦٠ - ٧٠ مليون نسمة، ومواردها الطبيعية محدودة للغاية سواء من حيث المياه أو التربة أو المعادن. وهذا يعنى أن الطريق الوحيد للنمو هو الصناعة التحويلية.

ومن ناحية أخرى، هبط معدل النمو الإقتصادى فى النصف الأول من التسعينات إلى أقل من معدلات نمو السكان، وهذه المقالة تحلل بإيجاز التنمية الإقتصادية التى حدثت فى مصر خلال الفترة من ١٩٧٢ وحتى ١٩٩٢. وكانت النتيجة النهائية من هذا التحليل هو اكتشاف أن جميع المؤشرات الاقتصادية بما فيها متوسط نصيب الفرد من الناتج المحلى الإجمالى قد انخفضت.

وقد بدأت هذه المقالة باستعراض الوضع الحالى للطلب على مصادر الطاقة الأولية من جميع القطاعات، ثم استخلصت بعد ذلك - إحصائياً - اتجاهات كل من الإنتاج والاستهلاك. ثم تم طرح ثلاثة سيناريوهات :

الأول : هو اسقاط للاتجاهات الحالية للمتغيرات الاقتصادية الكلية لمعرفة الوضع المحتمل فى ٢٠٢٠ . ووفقاً لهذا السيناريو، سيكون إجمالى المطلوب من الطاقة عام ٢٠٢٠ هو ٦٢ مليون طن زيت مكافئ.

الثانى : يفترض هذا السيناريو أن معدل النمو خلال ربع القرن القادم ٦٪ ، وأن معدل التضخم سينخفض من ٩٪ (وهو المعدل السائد فى الفترة ١٩٩٥ - ٢٠٠٠) إلى ٦٪ فى ٢٠٠٥ ، ثم إلى ٣٪ فقط فى الفترة من ٢٠٠٦ إلى ٢٠١٠ ، ويفترض هذا السيناريو أيضاً أن نصيب القيمة المضافة المولدة من التصنيع من الناتج المحلى الإجمالى سينمو بمعدل متوسط قدره ٣٪ سنوياً خلال الـ ٢٥ سنة القادمة. ووفقاً لهذا السيناريو، سيصبح إجمالى الطلب على الطاقة عام ٢٠٢٠ هو ١١٧ مليون طن زيت مكافئ.

ثالثاً : ويفترض أن معدل النمو سيكون ٣٪ فقط (وهو ضعف معدل الزيادة فى السكان ١,٥٪) ووفقاً لهذا السيناريو، سيكون إجمالى الاحتياجات من الطاقة سنة ٢٠٢٠ هو ٨٣ مليون طن زيت مكافئ.

وأخيراً، يمكننا القول بأن احتياجات مصر المستقبلية من الطاقة ستتراوح بين ٦٢ و ١١٧ مليون طن زيت مكافئ عام ٢٠٢٠ .

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* Originally, This paper was prepared to World Energy Council Conference, which was held in TOKYO in October 1995.

** رئيس منتدى العالم الثالث – مكتب الشرق الأوسط.

(I)

Natural Resources

In the year 2000, Egypt's population will be 63 million At first glance the total area being 1,001 thousand square kilometers, population density would be 63 inhabitants per square km, very light indeed. Yet reality is different. In fact, Egyptians live on 4% of the national territory, the remaining area, that is 96% is arid desert. This shows why population density is currently 1574 inhabitants per square km, one of the highest in the World. As the population increase it means more housing and as economic development being more diversified in the structure of the economy, the cultivated area is decreasing, not more than 2.5% of the total area, thus limiting agricultural poduction despite land reclamation and crop multiplication (2 to 3 crops a year).

Fresh water supply is almost all imported. The Nile water covers 97% of the total water consumption. Running in 9 countries of which Egypt is the last, we know in advance that there is a ceiling to Egypt's share defined by an international treaty which is 56 billion of cubic meters per year. Being a dry country without any rain fed agriculture, Egypt lives in a central irrigation system for thousands of years. A sophisticated network of dams, barrages, canals and drains secure perennial irrigation for agriculture around the year and even in years of drought in Central and Eastern Africa. On the other hand, there is no prospect of substantial increase of Egypt's share in the Nile water.

Thus paucity of both soil and water means that Egypt cannot rely on agricultural production unless there is a breakthrough in the technology of water desalination, incremental increase of this production does not offer enough jobs nor exportable products. In fact in 1950, raw cotton represented 85% of our exports, it became 1.5% in 1993 - 1994. The food deficit reached alarming levels. (51% in wheat and 43% in edible oils in FY 1993 - 1994) [1] Egypt has neither forests nor woods nor rangelands.

As for minerals the country has only sizable reserves of iron (estimated value is 2.808 milion dollars). [2] There is some low grade phosphate and manganese, but no other of the major metals.

Primary energy sources are less scarce. Coal is almost inexisting, recoverable reserves of anthracite are : 13 million cubic meters and 40 million cubic meters of lignite coal. The picture is brighter in oil (840 million metric tons of recoverable reserves). Natural gas recoverable reserves are really recomforting, recoverable reserves are estimated at 351 billion cubic meters.

Needless to say that the Nile being almost the sole source of water, hydroelectricity is to be obtained from this river alone. In fact the major source of hydro-electircity is the

Aswan High Dam which has 2,145 megawatt capacity, incremental growth of hydroelectric power is obtained from barrages along the river and its two branches. The High Dam generated 7416.5 million K.W.H. in 1992. The Aswan water seasonal storing dam, now gererates an additional amount of 2787.5 million K.W.H. being down stream of the High Dam, it stores water (at various levels) around the year, This hydro generation amounted to 22.4% of total generation in 1992. (3)

Finally, like most developing countries, Egypt registers a high rate of population growth; it is in a demographic transition. That means it left behind since the late 1940's the balanced population growth typical to poor countries and has not yet reached the one prevailing in industrial developed countries. (4) Indeed from the beginning of the 20th century to 1947 census, the rate of population growth was between 1.6 and 1.7%. The rate of economic growth for the same period as calculated by Bent Hansen was at average 1.7% per year. (5) Anyhow the country attained a maximum rate of 2.6% in 1966. Since then the birth rate started to decline by one per thousand point yearly at average. Naturally this trend went by ups and downs. Yet, it is currently 2.1% and expected to break the bar of 2% by the year 2000; 1.7% by World Bank estimates. (World Development Report 1994).

(II)

Economic Development Performance

(1972 - 1992)

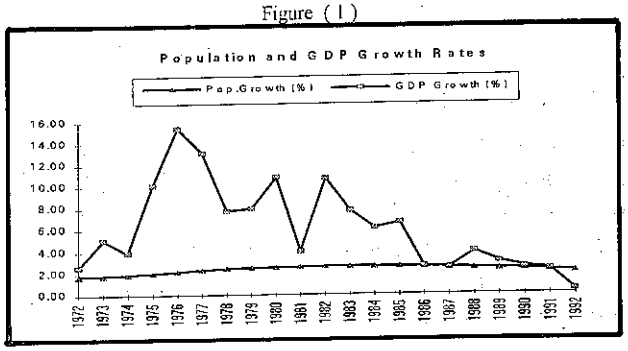
1. Economic Growth :

The rate of growth of the gross domestic product (GDP) has registered sharp ups and downs during this period. The average annual rate of the decade 1960 - 1970 was 4.5% despite the high military expenditure following the military defeat in the June 1987 war. In contrast in the following decade (1970 - 1980) the rate of growth jumped to an average rate of 9.5%. This was consecutive to some factors that occured in the seventies. In the first place there was the spectacular rise of oil price that coincided with new oil discoveries in Egypt. The country became oil exporter, not exporter, not to be compared with OPEC countries but yet a major source of foreign currency. In the second place the Suez Canal, out of use between 1967 and 1974, brought a sudden and sizable source of foreign currencies. Last but not least the massive migration of workers form Egypt to the Arab Gulf countries generated inflows of savings and remittances. Of course remittances originated abroad and they belong in GNP but they were spent largely in Egypt and

contributed in financing invesment and consumption of goods and services provided by the national economy.

Anyhow, the average rate of growth dropped in the eighties to 4.5%, that is less than half of the previous decade. Some of the causes of this dramatic fall are obvious. At the origin lies the decline of world oil prices. The value of oil and oil products exports as share of total exports, declined from a maximum of 66.3% in 1982 to only 48.9% (Central Bank of Egypt, July 1994). On the other hand, the debt service and reimbursement outgrew the new inflows of capital. The financial crisis triggered by the decline of oil revenues in constant dollars and the cost of the second Gulf war had its impact on Egypt. The countries classified earlier by World Bank as " Capital surplus " are currently in deficit and went into the World financial market as borrowers. They scaled down their develoment projects and reduced welfare, in Saudi Arabia and Kuwait were tough. The impact on other Arab countries both as shrinking ODA and labour remittances has been negative. According to the Ministry of Planning the GDP grew at 2.5% in fiscal year 1992 - 1993 and was expected to reach 3.6% in FY 1993 - 1994. (6) Beyond these figures, what is really disquieting is the fact that the rate of domestic investment has fallen from a maximum of 30% of the GDP in 1981 to 18% in 1992. More serious yet is the decline in rates of domestic savings which dropped for the same years from 17% to only 7% According to World Development Report (1994) data, private consumption rose by 7.4% per annum as average between 1970 - 1980 and 3.1% between 1980 - 1992. Gross domestic investment in the seventies rose at rate of 18.7%, it went down to minus 0.6% as average of the following 12 years.

Figure (1)

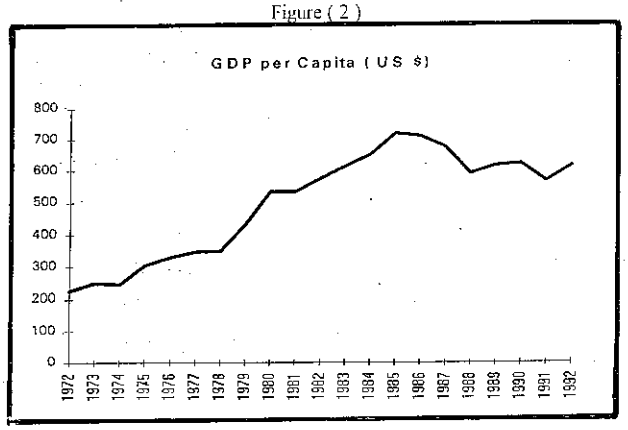


2. Per Capita GDP :

The curve of population growth during the 20 years was less erratic than that of per capita GDP. It shows a clear trend downward. The high level of 2.4% average in the eighties is hard to explain. However the decline is evident again in the nineties. The World Bank confirms this fact since it forecasts it to be 1.7% by the end of the century.

The effect will be seen somewhere between 2005 and 2010. Egypt has to support those who are already born and will join the labour force during the forthcoming years. The decisive indicator of the stability of the decline is the drop in fertility rates from 5.9 in 1970 to 3.8 in 1992. The comparison of the two curves shows a margin of increase in per capita GDP estimated by WB at average rate 1.8% for the period 1980 - 1992. This figure explains the fact that Egypt is now included in the Bank classification among the group of low income while it used to be in the lower middle - income. Anyhow, it is obvious that these countries require much higher rate of growth of their GDP as quick and sustainable as possible. The bearing of such growth on energy demand is obvious.

Figure (2)

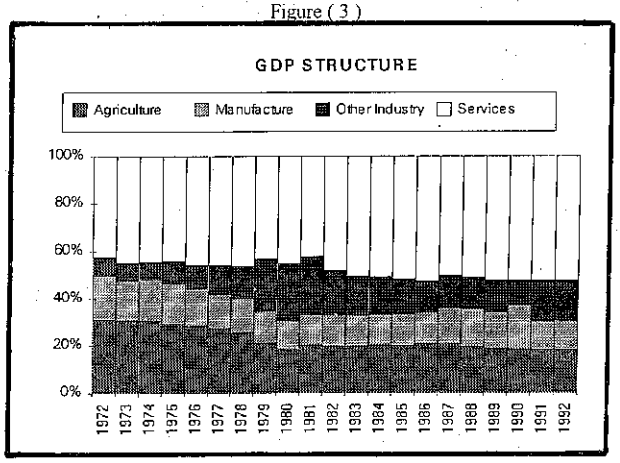


3. Structure of Production :

In the 20 years under study there has been no significant change in the structure of the GDP. The share of agriculture decreased from 29% (1970) to 18% (1992). That of industry increased from 28% to 30% respectively. The main beneficiary was the services sector : from 42% to 52% respectively; 10 percentage points growth. The data provided by the Ministry of Planning for the last two fiscal years are more detailed. The "industry" sector includes value added in mining, manufacturing, construction and electricity, water and gas.

This leaves manufactures share with 15% only as it is mentioned in MOP data. Elsewhere the W.B gives 12% only for 1992. Whatever available data might be, this share of manufactures is obviously low in the light of available natural resources and in particular, water and metals. A last note in this respect is that the commodity producing sectors (agriculture, industry lato senso) contribute to GDP by 48.9% only. MOP data show that the share of industry in the GDP fluctuated between 19.3 in FY 1985 - 86 and 27% in 1993 (excluding " electricity " and " oil products ").

Figure (3)



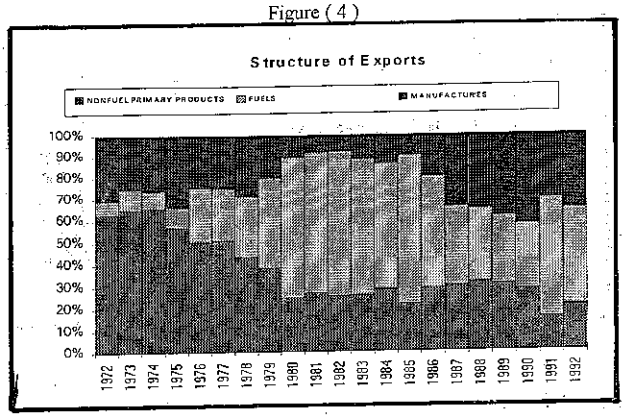
4. Foreign trade :

The salient feature in Egypt's foreign trade is the persistence of a large deficit in the balance of trade. Merchandise exports in 1992 covered only 37% of the value of imports. Adding to this there is rigidity and/or uncertainty on both sides. On the imports side, food products cannot be reduced substantially in the short term particularly in the cases of wheat (51% deficit) and edible oils (43%). On the side of exports, oil and oil products amount to almost half of the total exports (48% in FY 1993-94). Needless to say that Egypt could never influence the World oil prices. Moreover its oil reserves are rather modest. The only way to substantially improve this picture is the growth of competitive manufactured products. So far Egypt manages its balance of payments basically by labour remittances : 6.2 billion US $ in FY 1993-94, that is to say 229% of the value of the total merchandise exports. Worth mention is the fact that the net inflow of capital was in the same year 317.2 million US dollar (Central Bank of Egypt). Nothing allows us to predict that the inflow of remittances will remain at the present high level for many years to come. On the contrary some factors observed currently hint to the probability of a decline. Namely the drop of oil prices in US dollars of 1973, (the barrel today is sold at $ 5.2 only) as well as oil revenues. (7)

It is in order to refer to a WB Discussion Paper because it provides estimates that differ from World Development and World Tables : Economic Development and cooperation in the Middle East and North Africa (November 1993) The authors (L. Squire and I. Diwan) produced this study at the request of the " Working Group on Regional Economic Cooperation " an off shot of the Madrid Conference. Taking the period at four years average, the study gives a rate of real growth as follows : 1970-74 5.14%, 1975-79 0.3%. Focusing on financial aspects the authors think that Egypt should

raise domestic investment from the current 18% to 27%. This proposition looks sound in the light of the declining of GDP per capita since the rate of growth was 0.3% while that of population growth was in the same year 2.1%. (in 1992).

Figure (4)



(III)

Energy Production and Consumption

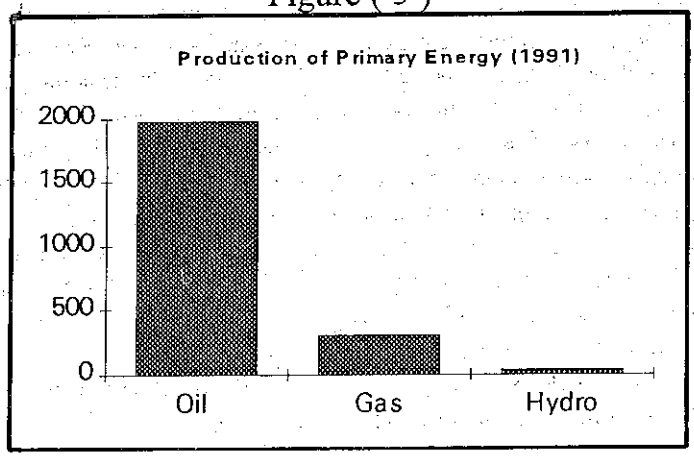
1. The Global Picture

According to " World Resources 1991-1995 " published by the World Resources Institute (in cooperation with UNSTAT, UNEP and UNDP), production of primary energies in Egypt in 1991 was as follows :

Oil and Oil products	1981
Natural Gas	303
Hydro	36
Total	2320

(in petajoules)

Figure (5)



The same publication provides also basic data on energy consumption :

Total consumption (Pj)	1.122
Consmption per capita (Giga joules)	21
Per one constant US $ (1982), (megajoules)	31

But it adds for the first time (for this author at least) an estimation of traditional enerly : 45 Pj, and per capita at megajoules 846 which means that traditional energy (mainly plant and animal waste is around 4% of the total consumption).

All figures mentioned above had greatly improved during the 20 years period 1971-1991. Total commercial energy production rose by 73% of which oil contributed by 59% while hydro-electricity increased by 96%.

On the consumption side the total increased by 275%, per capita rose by 136%, and per one constant US $ went up by 18%. To complete this global picture imports dropped, as percentage of total consumption: -120% in 1991, and -93% in 1992.

2. Energy Production :

Undoubtedly, this increase in the production of energy has been achieved through sizable investment, basically public. Over the same twenty years this study is concerned with, the share of investment in energy went from 12.6% of total domestic investment, to a maximum of 19.1% in 1979. But it declined to 10.7% in FY 1984-85. Following years show a trend towards modest rates. But according to the Ministry of Planning, most recent data available, this rate jumped again to 20.1% in FY 1993-94. This means that the energy sector has more or less escaped from the drastic cut inflicted on other sectors, since the total domestic investment fell in this FY to 18% only. Furthermore the issue of calculation of oil investment yearly is not easy because of the share of foreign companies.

As a general rule, a company gets a concession for exploration in a determined area for a medium term (5-9 years) against the mandatory investment of a certain amount of capital divided into annual installments. During this time Egypt contributes nothing to the cost of exploration, and nothing at all if no oil is discovered or the company relinquishes the contract. But in the case of discovery, the government would reimburse its share in the cost of exploration and development of the new oil field in kind over a certain period after which the company gets only about 15% of the output. From the national accounts point of view, Egypt could (and could not) pay its share in investment. From foreign trade angle oil exports, the value of crude oil, should be broken down to the respective shares in ownership. Thus in FY 1993-94 exports of of crude oil were 20.5 million tons of which 15 million (that is 53%) was owned by the foreign partners. Investment in electricity generation and distribution knew far less fluctuations mostly increasing but also decreasing in particular in the second half of the 1980's.

These last 20 years knew a steady trend of increase in oil production : from 8.5 million tons in 1973 up to 43.2 million in 1985. Then it reached a plateau with incremental growth : between 43.2 and 45.2 tons FY 1993-1994.

The surge of natural gas production in the period remarkable : from 33000 t.o.e in 1975 to 10.1 million t.o.e in FY 1993-94.

Electricity generation went up from 7384.2 million k.w.h in 1972 to 46289 million in 1992. Hydro-electricity counts for 10344.3 in 1992 generation (Egyptian Electricity Authority figures). Thermal generation covers 35944 million. In total, energy generation increased more than six fold during the period.

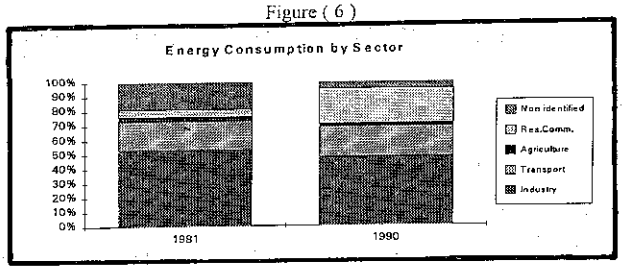
3. Energy Consumption :

In 1975 total energy consumption was 9.5 million t.o.e and became 30 million in FY 1990/91 and is expected to reach about 28.3 million in 1995. The per capita consumption of commercial energy rose during the same period from 0.262 t.o.e to 0.598 t.o.e. (in 1990). Oil and oil products supplied 54% of the total consumption, natural gas 9% and hydroelectricity another 8%. Thermal electricity 28% and used 21.5% from oil and oil products and 33% of natural gas. On the other hand, oil refinering used 5.1% of the share of the whole industrial sector estimated at 47.5% of the total electricity consumption in 1990.

In fact and according to the data available at hand, the sectoral breakdown of the total energy consusmption in early 1990's is as follows;

Sector	1981 %	1990 %
Industry	53	48
Transport	20	21
Agriculture	3	2
Residential, Commerce	5	24
Non identified	19	5

Figure (6)



The evolution of sectoral shares is quite interesting. Unexpectedly, the share of industry declined by 5 percentage points between 1981 and 1990. Yet it is due to the fact that even in years of peak growth rates of the GDP the share of industry was receding. The rather spectacular increase in the residential and commercial sector can be explained by two factors. Firstly, the growth activities finance, foreign trade and internal commerce, residential building and related activities : from 3.3 million US $ in 1972 to 17.5 million in 1992 (more than five times). In the second place, a remarkable change in life styles of the middle classes characterized by intense use of household durables and in particular air conditioning devices, full automatic washing machines, deep freezing refrigerators ... etc. The slight decline of the share of agriculture is quite understandable. The abundance of manpower in rural areas and the very small holdings of land has always been a disincentive regarding mechanization. the massive departure of labour to the Gulf countries between 1975 and 1985 provoked a rise in wages that pushed some owners to buy tractors, water pumps ... etc. The labour market returned to its structural characteristics in Egypt : shortage of available land and large supply of labour.

Finally, the energy intensity is 0.42 which happens to be the average World rate according to WEC calculation. (8) This rate is ambiguous. A low intensity could be the result of energy conservation and the introduction of energy saving technology. Yet it could be caused by medium rate of industrialization and energy waste. Anyhow, the relevant energy authorities have started making energy audits of some major industrial enterprises and introducing energy conservation measures.

(IV)

The Industrialization Imperative

1. Redeployment and Strengthening Development Efforts

All the development indicators show a slow down trend. One such decline is most welcome, it is the rate of population increase. On the other hand, the rate of GDP growth is most worrying, close to zero or even negative and obviously the per capita GDP growth at average between 1980 and 1992 was only 1.8% while the population growth was 2.4% for the same period (W.B. World Development Report). This state of affairs can be explained by several reasons. First there are the difficulties that accompany any major reorientation of development strategy. Shift from state active role not only as policy maker but also owner of major productive assets (with the exception of agricultural land) and provider of subsidies with a say in prices fixing to a full scale free market forces can never be achieved in a couple of years or so. During the unavoidable transition this is simply impossible. Liberalization and privatization and the shrinking area left for government intervention need socio-economic change and ways and means. To give a simple example, when a group of business people buy a publicly owned enterprise instead of the establishment of a new enterprise, this will be detrimental to the growth of domestic savings and investment since change in ownership is not included as investment in national accounts; and low rates of investment produce low rates of GDP growth. This is a matter of fact and is not a political judgement. In the second place, Egypt signed a "Structural adjustment programme" with W.B. and a "Stabilization Programme" with IMF in 1991. These programmes are supposed to help the country economic growth in the near future, but in the short term they are "disinflationary", in other words they are contractional of economic activities and produce job losses. The Bank now recognizes these few negative aspects and it helped Egypt in establishing a Social Fund to take care of those hit directly by privatization and abolition of consumer subsidies. Foreign capital flows either DFI or loans from North to South in these times of recession and unemployment in all industrialized countries is no more a salable concept to the puplic opinion in democratic societies. In the same time, invesment in developed countries by citizens of developing countries rose dramatically since the late 1970's. Egypt is not excepted from this drive. (9) Once financial balances are reestablished, the government is bound to give economic growth a serious push with volumes of investment and fixed capital formation to reap the fruits of the "economic reform policy". Moreover, high growth rates on several years to come is the only guarantee against falling back to imbalances (Mexico has had to swallow the medicine three times 1970's, 1980; and 1995).

Beyond short and medium term the choice of the sector of production that should be, or would be, the engine of over all growth. Given the physical constraints on the agricultural sector and the absence of paramount important significant mineral resources, the chances in the primary sector will be very limited. Hence comes the choice between the secondary sector (manufacturing) and an economy based on services. Some circles are pushing forward tourism and financial and other trade related services. Obviously Egypt is rich in huge number activities that attract tourists and potentially by tens of millions with the remnant of great civilization ; Ancient Egypt, Copt and Hellenistic, and finally Arab Islamic. These remains from a glorious past are scattered all over the country. In order to realize fully what a tourist sees for the first time is an appetizer to second and third visit. The countries shores of the Mediterranean and the Red Sea present beautiful beaches for summer vacationers. Yet, tourism will never bring enough resources that would put sixty million people over the poverty line. On the other hand, tourism economics underline the fact often overlooked that the multiplying effect materialises only when tourists consume and buy domestic products .. and when the country needs not to import food and beverages for its visitors. As for banking and insurance services and open out stock exchanges, the area counts several countries that would compete successfully in this area.

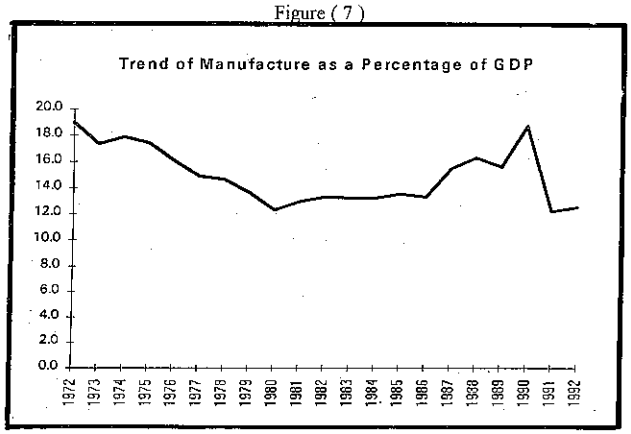
This leaves us with one feasible option : manufacturing. The rationale of this option is the fact that in modern products raw materials count often for less than 10% of the final price paid by the final consumer. This value added by the processes of production and marketing. It is the outcome of the work of men and women in various levels of qualification, this was the experience of countries like Japan and the so-called Asian Tigers. The term industrialization has been linked in many minds with pollution. Having to build up new factories, Egypt should study the recent change in structure of modern plants. Most of polluting large industries are today out of the fashion, relegating from 19th and first half of 20th centuries. Economies of scope are replacing economies of scale. Modern plants are of modest size, clean and " green ". Today's means of transport and communication make Marshall\s law " industry attracts industry " completely obsolete. In the case of Egypt, this fact allows establishment of factories outside the cultivated or reclaimed land. Furthermore the new look of the industrial sector is the factory producing one or more components of the final product, or carrying one of the production processes only. Industrial structure became more flexible than any time.

Qualified labour is a sine qua non condition in this context. Despite the high percentage of illiterates (49% of population over 10 years), Egypt has currently about one and half million young educated unemployed. If one adds the number of qualified Egyptians working in the Gulf countries it becomes clear that Egypt has a stock of skilled educated people who would be easily employed to meet the requirements of new industries.

Unfortunately, this manufactures preference did not prevail during the period 1972 - 1992. Some figures may illustrate what is said in the first place : the share of

manufacturing dropped from 19% to 12.4%. In the second place its growth average rate in the 1970's was 8.9% keeping pace with GDP growth rate in that decade : 9.5%. The slow down in the years 1980-92 in average was 2.4% of GDP and 3.9% in manufacturing. Thus these rates give the impression that industrial sector was growing by inertia rather than by willful design (figures from W.B.). (10) Industrial investment as percentage of total domestic investment practically stagnated around 25% with some ups e.g. 29.9% in 1977 and downs like 19.3% in FY 1985-86 (MOP data). Manufactures exports as percentage from total exports vacillated between 31% and 35% (see figure 7). This should be verified as agriculture exports were diminishing through these twenty years; which explains to some extent the relative big share of manufacturing. One should retain that the two main exports were food and beverage and textiles and cloth; together they amount to 42% of total manufactures exports.

Figure (7)



This weak manufactures sector is not a common phenomenon to all developing countries. In India, with a per capita GDP of US $ 310 only, manufactures exports reach 71% of the total exports. In South Korea " a well celebrated tiger " this share is 93%. In Tunisia it is 64%. Historically the shift from commodities to manufactures has been a good indicator for development performance. When a country has low potential for agricultural growth, like Egypt, manufacturing is a must.

For all these reasons, Egypt would resume economic growth up to at least the double of the rate of growth of its population i.e. average of 4-5% a year. Only a strong drive aiming at industrialization could be the right path. This emphasis on producing and exporting more manufactures does not mean neglecting other sectors of the national economy and the Society at large. It would be redundancy to stress that modern future industry will need only well qualified workers : advanced education, formal and informal, recurrent education, retraining and recycling on a constant basis are necessary in order to compete with reasonable chances in a World Economy of highly competitive

corporations. The academic neo-classical theory teaches us that market forces will always shun down marginal producers, those who make no profit and allow the rent to the most competitive. The so-called tigers have managed to reduce costs to " conquer " World markets by keeping wages increases at a fraction of the rise in labour productivity. Rejecting the concept of reproducing any kind of passi par tout development model, there are always some lessons to learn from the path of success and failure of development strategy. Sure enough this labour productivity sustained growth calls other aspects of life : health care, social housing, increasing labour mobility, people participation in the making of any decision affecting their life and labour. Economic development cannot be sustained without democracy and social equity. Returning to economics, it will be important to study and amplify the multiplier effect of new manufacturing enterprises and profit from the establishment and straightening inter and intera sectoral links. Many people in this country want to do what the tigers do. Also it is in order to stress here the fundamental factors of success. In a recent World Bank publication these factors are enumerated as follows. (11)

- Human Capital Formation
- High rates of savings and investment
- The right allocation of investment

That means that Egypt must encourage domestic savings, try to raise domestic investment to at least 25% of its GDP, set right national priorities among which industrialization takes a prominent place. Within such strategy due care would be given to rational uses of scarce natural recource (water, arable land, primary energies) and to bring pollution under control. It is much better to avoid the cost of pullution and abatement. Establishing new eterprises should give preference parameters for the cost-benefit analysis so that preference would be to projects with clean technology, energy saving, water saving, location selected in conformity with public policy favouring sub-national socio-economic regions. In the area of sustainable development the late comers have advantages in comparison with already industrial countries.

2. Energy Requirements :

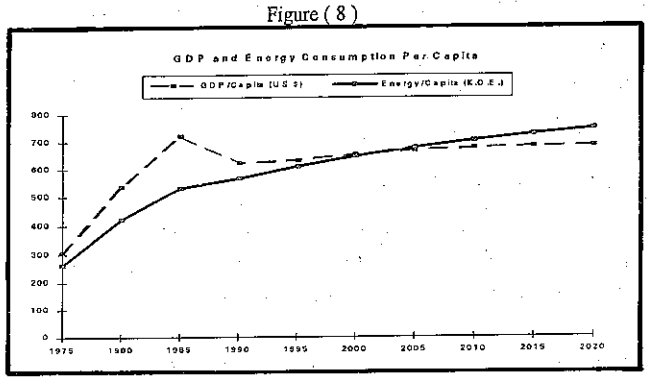
Any significant and steady GDP growth will need more energy consumption from primary energy sources. The above analysis reveals the existence of linkage between rates of economic growth and demand on energy. When the rate of growth was (9.5% 1970-1980) energy consumption increased by 8.9% and when the economic growth rate slowed (1980-1992, 4.4%) energy consumption rose at average by 6.1%. With very low rate of economic growth in the first three years of the 1990's, per capita energy consumption went down from a maximum of 0.560 t.o.e to 0.534. Now the energy demand is submitted to 3 factors pushing the ceiling up. In the first place the population growth. then comes the potential rise of the GDP growth to 5 or 6%. Thirdly focus on the growth of manufacturing the main user of energy presently is a must.

To face the growing demand, the supply should be increased. There are three tools that should be put to action simultaneously : Energy conservation (recuperation of wasted energy in the present day consumption), policies for a general preference for energy saving technology, and the production of more energy.

Let us now go over the scenarios of energy demand before addressing supply-side in a more detailed manner.

Scenario A : Extrapolation of present trends up to 2020. Figure 8 shows the behaviour of GDP per capita and energy consumption per capita. The first would be in 2000 only US $ 600 and the second would be toe 0.600. In 2005 these indicators would almost be the same. In 2010 the stagnation of GDP per capita would persist while energy consumption per capita would increase slightly. This stagnation and low increments will continue respectively till 2020.

Figure (8)



As the population will grow at an average rate of 1.5% and the rate of GDP growth will be around 0.7% the increments of per capita energy consumption might occur in the " residential and commerce " sectors. The addditional energy consumption would be rather modest : from 35 million t.o.e. currently to 62 million in 2020, a 76% growth over more than a quarter of a century. In this scenario the manufactures share in GDP will be if any thing stagnant around 14% (in US dollars).

Scenario B: 6% average growth of GDP, allowing declining rate of inflation from 9% (1995 - 2000), to 6% in 2005, and only 3% for the period of 2006 to 2010. A most important assumption is that value added by the manufactures share in GDP grows at an average 3% per year all over the period of extrapolation. In this scenario the GDP per capita would rise to US $ 775 in 2000, 960 in 2005 and 1195 in 2010. Manufactures share in GDP would increase to reach 16.3% in 2000, 18.9% in 2005, 22% in 2010 and 29.5% in 2020. This implies a rapid revision of socio-enconomic policies as soon as

possible with target of 6% by the end of this century. The curve of population growth will continue to slide down through the coming 25 years. Figure 9 illustrates the evolution of economic growth and population increase.

Figure 9

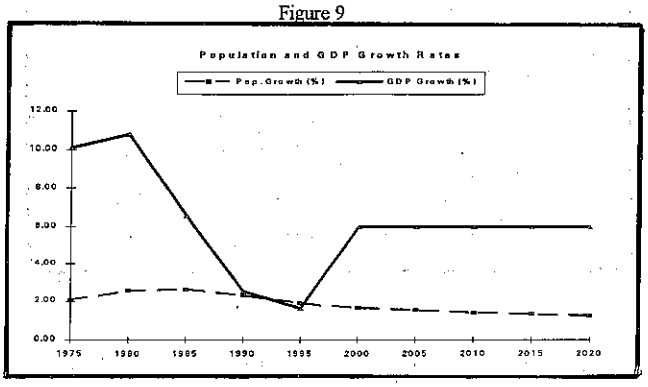
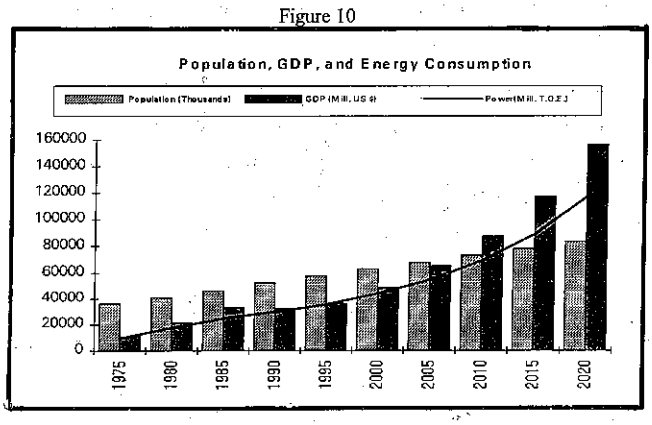
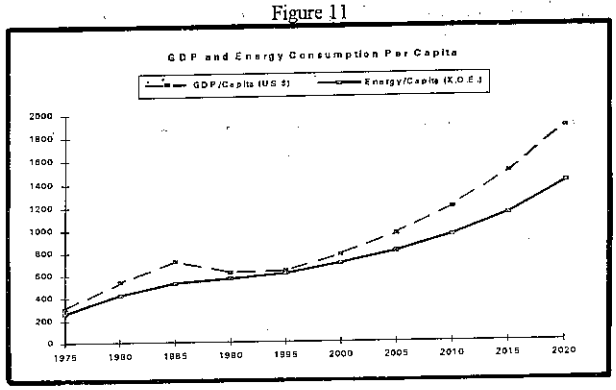


Figure 10



Naturally, this means considerable increase of energy demand. In fact, calculations demonstrate that consumption would go up to about 44 million toe in 2000, 55 million in 2005, 89 million in 2010 and finally 117 million by 2020. This cumulated increase of demand means more than 3 times the quantity consumed presently. Figure 11 reveals that in this scenario the rise of per capita GDP would take the lead on per capita energy consumption. This is understandable for two reasons : Usually demand preceeds supply since producers try to face unsatisfied demand actual or expected. On the other hand, the measures of any conservation and energy saving must show a real impact on actual consumption during the period.

Figure 11



Scenario C : The target here is only 3% rate of increase as average of annual rate during the coming 25 years, which is much less ambitious. Here per capita GDP would be 672 i n 2000, 720 in 2005, 842 in 2010 and 916 in 2020 (all calculated in current US dollars). Figure 12 represents the comparative curves of growth in population and GDP.

As for per capita energy consumption, it would reach 0.672 in 2000, 0.738 in 2005, 0.812 in 2010 and 0.995 in 2020. By the end of period (2020) total energy would reach 83 million toe against 117 in scenario B. The percentage of increase is 136% of the present consumption against 232% in B. Certainly actual increase in energy demand would be inferior to these estimates because of more rational energy consumption. The energy intensity may rise in a first phase, but must go down.

Figure (12)

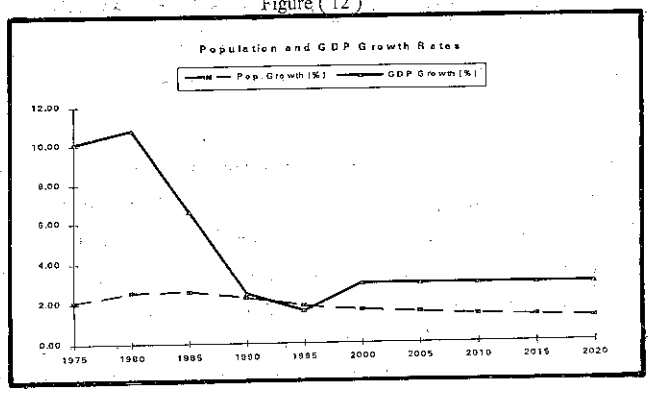
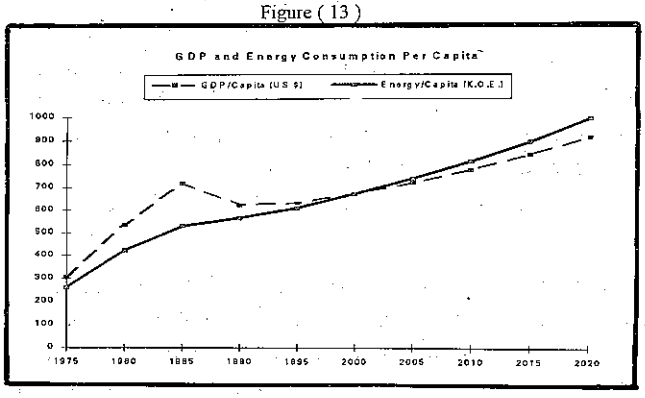


Figure (13)



In all scenarios Egypt will need more energy than what it consumed in 1994. Yet the magnitude will differ greatly. On the other hand nobody is entirely satisfied with rates of economic growth of the last two years. Some hope that the success in implementation of the current Structural Adjustment and Stabilization programmes will produce large flows of investment from the private sector and foreign direct investment (FDI). Others remain skeptical towards market forces left to their interplay untill they bring expansion and sustained growth, not to refer to socio-economic development. However, there remains, beyond theoretical quarrels, the object of reaching a societal consensus around a certain shared vision outlining the features of Egypt in 2020. Such a consensus would necessarily give birth to a variety of debates and conflicts, focus on the ways and means of materialization of the " national vision " of the future. Political pluralism and people's participation are absolute requirements for minimizing mistakes and maximizing the chances of success.

Providing the needed energy calls for optimizing the use of available energy sources. But if the rate of economic growth rises substantially, Egypt will need additional sources. (12) Egypt has already embarked on implementing measures of energy conservation. In 1993 an autonomous agency was established, the Organization for Energy Conservation and Planning (OECP) to deal with all aspects of conservation in the country as a whole as well as at the micro level that could be an enterprise or even a factory or services unit. (13) It has a research agenda of its own and acts as a consultant that carries out energy audits in light of which alternative patterns of energy consumption are deemed more energy efficiency. The mandate of OECP includes; monitoring demand on energy and its effective use. In this respect enterprises are motivated to ask for consultancy by the desire to reduce costs of production. This is much more effective than resorting to laws and bureaucratic control. In the same time new discoveries of natural gas provide the opportunity of using fossil energy cheaper than oil and by less polluting. Electricity generation is the largest beneficiary by shifting from oil to natural gas. Almost

half of the generated power is from natural gas. Non energy industries are interested in substituting gas for oil and electricity, e.g. using natural gas instead of electric power in the prodution of fertilizers. Natural gas is already supplied for residential and commerce. Major cities will be covered by the network of gas distribution. As mentioned above proven recoverable reserves of NG justify this shift. Remains to bo done is preference to be given in creating new development projects to energy saving and water saving technologies. It is expected that the " Supreme Council of Energy " will push in this direction with persistence.

Despite all these efforts for conservation and efficiency, Egypt's needs will outgrow the primary energies on its territory and risks to become energy importer in the near future (before 2020). Relevant authorities are aware of this risk, and try to formulate policies conducing to more electricity generation. The Ministry of Electricity and Energy has been woking for many years on nuclear generation. This enabled the Ministry to go as far as preparing a blue print and exploring the possibility of foreign or multilateral financing given the high costs involved. As in many countries the nuclear issue is divisive. While energy experts are generally in favour a good part of the public opinion and politicians have reservations either because of threats to safety or huge investment that could incur considerable opportunity costs. After Chernobil and the widespread awe it ispired, the Egyptian Government postponed sine die the nulcear option. In the meantime the MEE has established the " New and Renewable Energy Authority " (NREA) in 1986 to promote the development and spread the use of energy produced by wind, sun and biomass. It has built three wind farms on the Western shore of the Red Sea where the level of annual average wind speed is 10 m/sc. The capacity of these demonstrating farms is 100 KW. It established a " wind energy technology center " in this area and tries to rely on industrial sectors for fabrication of components of windmills.

Passive solar energy has been used in Egypt since the times of Pharo's : in making bread with solar heat. This kind of bread is still appreciated in particular in the southern part of the country where it is known as " Solar Bread ". Solar heat was used also in making half baked bricks largely used in house building for thousands of years. Last example is sun dried vegetables and fruits. Now the NREA estimates more than 40 thousand solar heaters (mainly hot water) are already installed in the country, and demand is growing fast. Nine industrial enterprises are currently involved in solar heater production. Being without forests, woods or rangeland, biomass energy is limited to agricultural animal and human wastes. Processing and virtual transportation would be costly; the ideal use would be local and in rural areas. Anyhow the country is far from neglecting new and renewable energy.

The NREA has a target of producing 5% of the total energy supply in 2005.

V. Conclusions

Drawing on the facts and figures cited in this paper one can sum up the outcome of the analysis of Egypt's future energy needs in a few points :

(1) Egypt must reverse the trend apparent in the last few of slowing growth. the ambition and true challenge would be the return to 9.5% rate of growth in the late 1970's and the first years of the 1980's. But understanding the domestic problems and the World recession that ended in industrial countries with growth rates between 2 and 4% without creating new jobs one has to be realistic and aims at 6% rate of growth in average up to 2020, accompanied by a set of measures to alleviate poverty.

(2) The open path to rapid economic growth is manufacturing products at costs that make them competitive both at home and in international trade. This preference requires more energy than most of financial or commercial services.

(3) In all scenarios Egypt needs are much higher than the total consumption in 1994. In the simple extrapolation of current trends consumption of energy would rise by 67% in 2020. At a 6% rate of economic growth this consumption would rise by 232%.

(4) Egypt must intensify efforts aiming at energy conservation and optimal use and expansion in the share of new and renewable energies. Yet it needs new sources of energy unless it is capable of exporting massively (in manufacture mainly) and earn the costs of importing primary energies.

Appendix (A)

Supplementary Data Tables

Table A1 : Population, GDP, GDP and Energy Consumption Per Capita Trends.

Table A2 : GDP by Sector and GDP Structure at Factor Costs.

Table A3 : Exports and Exports Structure - FOB.

Table A4 : Electricity production and Consumption (Mill. KW/h).

Table A5 : Oil and Gas Production and Consumption (1000 M.T.).

Table A6 : Power Consumption (Millions T.O.E).

Remarks ;

1. (..) means that data is not available.

2. Values in shaded cells are averages of two consecutive fiscal years

Table (A 1)
Population, GDP, GDP and Energy Consumption Per Capita Trends

Year	Population		GDP at Factor Costs US $		GDP/CAPITA	Energy Consumption
	Total (Thousands)	Pop.Growth (%)	Total (Millions)	GDP Growth (%)	US $	Per Capita
1972	34253	1.79	7752	2.6	226	..
1973	34886	1.85	8737	5.1	250	..
1974	35561	1.93	8732	3.9	246	..
1975	36289	2.05	11096	10.1	306	0.256
1976	37080	2.18	12242	15.4	330	..
1977	37945	2.33	13211	13.1	348	..
1978	38874	2.45	13667	7.7	352	..
1979	39855	2.52	17286	7.9	434	..
1980	40875	2.56	21861	10.8	535	..
1981	41936	2.60	22365	4.0	533	..
1982	43036	2.62	24741	10.7	575	0.444
1983	44169	2.63	27055	7.7	613	0.478
1984	45330	2.63	29452	6.1	650	0.504
1985	46511	2.61	33455	6.6	719	0.516
1986	47694	2.54	33891	2.6	711	0.522
1987	48879	2.48	33016	2.5	675	0.529
1988	50064	2.42	29557	3.9	590	0.528
1989	51246	2.36	31518	3.0	615	0.530
1990	52426	2.30	32593	2.5	622	0.598
1991	53571	2.18	30266	2.3	565	0.594
1992	54679	2.07	33557	0.3	614	0.586

Sources : 1- World Bank, World Tables,1994
2- World Development Reports, Several Years

Table (A 2)
GDP by Sector and GDP Strucure at Factor Costs

Year	Millions US $					GDP Structure (%)			
	Total	Agriculture	Manufactures	Other Industry	Services	Agriculture	Manufactures	Other Industry	Services
1972	7752	2403	1473	594	3282	31.0	19.0	7.7	42.3
1973	8737	2677	1515	631	3914	30.6	17.3	7.2	44.8
1974	8732	2661	1559	624	3888	30.5	17.9	7.1	44.5
1975	11096	3224	1930	1053	4890	29.1	17.4	9.5	44.1
1976	12242	3452	1964	1250	5575	28.2	16.0	10.2	45.5
1977	13211	3579	1965	1632	6035	27.1	14.9	12.4	45.7
1978	13667	3470	2000	1909	6288	25.4	14.6	14.0	46.0
1979	17286	3614	2357	3843	7471	20.9	13.6	22.2	43.2
1980	21861	3986	2681	5361	9833	18.2	12.3	24.5	45.0
1981	22365	4500	2892	5541	9432	20.1	12.9	24.8	42.2
1982	24741	4840	3288	4741	11872	19.6	13.3	19.2	48.0
1983	27055	5308	3574	4540	13632	19.6	13.2	16.8	50.4
1984	29452	5903	3892	4731	14925	20.0	13.2	16.1	50.7
1985	33455	6691	4524	5026	17215	20.0	13.5	15.0	51.5
1986	33891	7044	4500	4584	17764	20.8	13.3	13.5	52.4
1987	33016	6787	5106	4580	16544	20.6	15.5	13.9	50.1
1988	29557	5707	4815	4049	14986	19.3	16.3	13.7	50.7
1989	31518	5860	4920	4399	16340	18.6	15.6	14.0	51.8
1990	32593	5976	6110	3513	16994	18.3	18.7	10.8	52.1
1991	30266	5490	3669	5334	15773	18.1	12.1	17.6	52.1
1992	33557	6079	4177	5832	17469	18.1	12.4	17.4	52.1

Source : World Bank, World Tables,1994

Table (A 3)
Exports and Exports Structure - Fob

YEAR	Millions US $				Structure (%)		
	TOTAL	NONFUEL PRIMARY PRODUCTS	FUELS	MANUFACTURES	NONFUEL PRIMARY PRODUCTS	FUELS	MANUFACTURES
1972	826	516	54	256	62.5	6.5	31.0
1973	1117	721	113	283	64.5	10.1	25.3
1974	1516	988	129	399	65.2	8.5	26.3
1975	1402	792	132	478	56.5	9.4	34.1
1976	1522	761	381	380	50.0	25.0	25.0
1977	1708	866	413	429	50.7	24.2	25.1
1978	1738	752	482	504	43.3	27.7	29.0
1979	1840	702	765	373	38.2	41.6	20.3
1980	3047	756	1957	334	24.8	64.2	11.0
1981	3233	870	2087	276	26.9	64.6	8.5
1982	3119	795	2068	256	25.5	66.3	8.2
1983	3215	830	2005	380	25.8	62.4	11.8
1984	3140	895	1808	437	28.5	57.6	13.9
1985	1839	400	1253	186	21.8	68.2	10.1
1986	2214	636	1134	444	28.7	51.2	20.1
1987	2037	609	728	700	29.9	35.7	34.4
1988	2120	668	703	749	31.5	33.2	35.3
1989	2648	809	807	1032	30.6	30.5	39.0
1990	2582	725	759	1098	28.1	29.4	42.5
1991	3694	569	1992	1133	15.4	53.9	30.7
1992	3051	637	1334	1080	20.9	43.7	35.4

Source : World Bank, World Tables,1994

Table (A 4)
Electricity Production and Consumption (Mill. Kw/h)

	Production			Consumption by Sector				
YEAR	Thermal	Hydro	Total	Industry	Agriculture	Res.&Comm.	Others	Total
1972	2224.8	5159.4	7384.2	3598.0	637.0	689.0	1245.0	6169.0
1973	2279.2	5155.6	7434.8	3349.0	685.0	759.0	1385.0	6178.0
1974	2397.3	6121.8	8519.1	3789.0	684.0	840.0	1582.0	6895.0
1975	3009.3	6790.3	9799.6	4805.0	677.0	987.0	1839.0	8308.0
1976	3642.7	8002.8	11645.5	5850.0	670.0	1000.0	2140.0	9660.0
1977	4479.1	9037.5	13516.6	7180.0	698.0	1110.0	2501.0	11489.0
1978	5077.6	9935.1	15012.7	7553.0	697.0	1348.0	3125.0	12723.0
1979	6750.7	9608.3	16359.0	7995.1	704.0	2703.0	1793.0	13193.9
1980	8628.8	9801.3	18430.1	9185.7	776.0	3583.0	2045.2	15589.9
1981	10532.4	10215.1	20747.5	9416.3	839.3	4232.4	1964.4	16452.3
1982	12868.6	10484.2	23352.8	9980.6	889.6	5174.2	2357.6	18402.0
1983	16062.8	9816.5	25879.3	10891.3	971.2	6456.4	2584.5	20903.4
1984	19416.4	9632.6	29049.0	11637.0	1076.4	7660.8	2635.5	23009.7
1985	22795.1	8662.7	31457.8	12321.6	1147.8	8726.1	2802.8	24998.2
1986	24183.2	9280.6	33463.8	13382.4	1168.0	9751.0	3056.4	27357.8
1987	28237.0	8657.6	36894.6	14357.6	1184.5	10761.5	3229.6	29533.1
1988	30156.8	8412.7	38569.5	15156.4	1325.0	11636.8	3310.8	31429.0
1989	31065.5	9822.8	40888.4	16085.6	1363.9	12438.2	3498.4	33386.0
1990	32710.1	9853.3	42563.4	16896.9	1332.7	13387.6	3763.8	35380.9
1991	34511.8	9968.2	44480.0	17368.0	1302.7	14238.2	4065.9	36974.7
1992	35944.1	10344.9	46289.0	17838.6	1482.3	14445.1	4526.2	38292.1

Source : Egyptian Electricity Authority

Table (A 5)
Oil and Gas Production and Consumption (1000 M.T.)

YEAR	Production		Consumption	
	Oil	Gas	Oil	Gas
1972	..	0.0	..	..
1973	8479.0	0.0	..	..
1974	7453.0	0.0	..	..
1975	11734.0	33.0	..	..
1976	16641.0	115.0	..	..
1977	20846.0	405.0	..	..
1978	24299.0	748.5	..	..
1979	26327.0	1065.0	..	..
1980	29580.5	2003.0	..	..
1981	31391.0	2288.5	12959.2	1866.5
1982	33111.5	2481.5	14596.2	2049.5
1983	36380.5	2946.5	16334.4	2416.5
1984	40949.0	3548.5	17697.7	2898.7
1985	42607.0	4461.5	17941.1	3666.8
1986	42575.5	5282.5	18220.4	4327.5
1987	43626.5	6931.0	19106.4	4804.0
1988	43360.5	6679.5	19216.9	5324.0
1989	43016.5	7258.5	19408.0	5767.5
1990	43891.0	7848.0	19984.5	6317.5
1991	44098.0	8459.0	..	..
1992	44310.5	9456.5	..	..

Source: Egyptian Energy Planning Authority

Table (A 6)

Power Consumption (Millions T.O.E.)

YEAR	Oil	Gas	Hidro.Ele	Total
1972	..	..	..	..
1973	..	..	..	..
1974	..	..	..	..
1975	7.500	0.040	1.950	9.490
1976	..	..	..	..
1977	..		..	..
1978	..	..	..	..
1979	..	..	..	..
1980/81	..	..	..	..
1981/82	13.700	2.140	2.625	18.465
1982/83	15.600	2.415	2.550	20.565
1983/84	17.211	2.955	2.400	22.566
1984/85	18.427	3.487	2.225	24.139
1985/86	17.746	4.661	2.630	25.037
1986/87	18.994	4.955	2.250	26.199
1987/88	19.515	5.719	2.075	27.309
1988/89	19.234	6.111	2.325	27.670
1989/90	19.892	6.705	2.500	29.097
1990/91	20.325	7.333	2.433	30.091

Source : Egyptian Energy Planning Authority

Appendix (B)

Extrapolation Alternatives

Table B1: Population, GDP, GDP and Energy Consumption Per Capita Trends.

Table B2 : GDP by Sector and GDP Structure at Factor Costs.

Table B3 : Exports and Exports Structure - FOB.

Table B4 : Electricity production and Consumption (Mill. KW/h)..

Table (B1)
The Fitted Regression Equations[1]

Dependent Variables	Equations	F-value
Population	**Pop = (32352) + ((1020.92) * t)** **where: Pop is population in Thousands** **t is time**	13899.8
GDP Growth Rate	**GDPG = 1/ ((0.0872) * (1.0848 ** t))** **where : GDPG is the GDP growth rate (%)** **t is time**	9.58
GDP	**GDP = (5507.21) * (t ** 0.6031)** **where : GDP in Millions US $** **t is time**	197.07
Manufactures as % of GDP	**MANGDPP = (13.8426) + (6.1188/t)** **where: MANGDPP is the Manufactures share in GDP (%)** **t is time**	11.52
Energy Consumption	**ENRCON=(-24062.6379)+(0.8963*Pop)+(1.433*MANGDP)** **where: ENRCON is Energy Consumption in M. toe** **Pop is total population in thousands** **MANGDP is Manufactures GDP in Mill. US $** R^2 = 0.997	7193.3

[1] Regression Equations are fitted by Using SPSS for Windows (Version 6)

Table (B 2)

Extrapolation of Present Trends up to 2020 - Scenario A

Year	Population		GDP		GDP/Capita	Deflator	Manufactures	Energy Consumption	Energy/Capita
	Total (Thousands)	Pop. Growth (%)	US $ (Millions)	GDP Growth (%)	US $	(1987 = 100)	as (%) of GDP	T.O.E. (Millions)	T.O.E.
1975	36289	2.05	11096	10.1	306	0.286	17.4	9490.0	0.262
1980	40875	2.56	21861	10.8	535	0.538	12.3	17229.5	0.422
1985	46511	2.61	33455	6.6	719	0.771	13.5	24588.0	0.529
1990	52426	2.3	32593	2.5	622	1.589	18.7	29594.0	0.564
1995	57875	1.89	36491	1.6	631	2.976	14.1	35181.7	0.608
2000	62979	1.68	41087	1.1	652	5.207	14.1	40659.0	0.646
2005	68084	1.55	45367	0.7	666	9.111	14.0	46076.3	0.677
2010	73189	1.43	49396	0.5	675	15.943	14.0	51445.1	0.703
2015	78293	1.34	53219	0.3	680	27.898	14.0	56773.1	0.725
2020	83399	1.25	56870	0.2	682	48.816	14.0	62069.5	0.744

Table (B 3)

Ambitious Acceleration of Economic Growth - Scenario B

Year	Population		GDP		GDP/Capita	Deflator	Manufactures	Energy Consumption	Energy/Capita
	Total (Thousands)	Pop. Growth (%)	US $ (Millions)	GDP Growth (%)	US $	(1987 = 100)	as (%) of GDP	T.O.E. (Millions)	T.O.E.
1975	36289	2.05	11096	10.1	306	0.286	17.4	9490.0	0.262
1980	40875	2.56	21861	10.8	535	0.538	12.3	17229.5	0.422
1985	46511	2.61	33455	6.6	719	0.771	13.5	24588.0	0.529
1990	52426	2.3	32593	2.5	622	1.589	18.7	29594.0	0.564
1995	57875	1.89	36491	1.6	631	2.976	14.1	35181.7	0.608
2000	62979	1.68	48833	6.0	775	4.578	16.3	43821.3	0.696
2005	68084	1.55	65350	6.0	960	6.127	18.9	54702.1	0.803
2010	73189	1.43	87452	6.0	1195	7.103	22.0	69059.6	0.944
2015	78293	1.34	117031	6.0	1495	7.103	25.5	88810.7	1.134
2020	83399	1.25	156614	6.0	1878	6.099	29.5	116930.5	1.402

Table (B 4)

Modest Acceleration of Economic Growth _ Scenario C

Year	Population		GDP		GDP/Capita	Deflator	Manufacturas	Energy Consumption	Energy/Capita
	Total (Thousands)	Pop. Growth (%)	US $ (Millions)	GDP Growth (%)	US $	(1987 = 100)	as (%) of GDP	T.O.E. (Millions)	T.O.E.
1975	36289	2.05	11096	10.1	306	0.286	17.4	9490.0	0.262
1980	40875	2.56	21861	10.8	535	0.538	12.3	17229.5	0.422
1985	46511	2.61	33455	6.6	719	0.771	13.5	24588.0	0.529
1990	52426	2.30	32593	2.5	622	1.589	18.7	29594.0	0.564
1995	57875	1.89	36491	1.6	631	2.976	14.1	35181.7	0.608
2000	62979	1.68	42303	3.0	672	4.578	16.3	42292.0	0.672
2005	68084	1.55	49041	3.0	720	6.127	18.9	50274.4	0.738
2010	73189	1.43	56852	3.0	777	7.103	22.0	59428.5	0.812
2015	78293	1.34	65906	3.0	842	7.103	25.5	70157.4	0.896
2020	83399	1.25	76404	3.0	916	6.099	29.5	83003.7	0.995

Foot Notes &References

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