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EGYPT COUNTRY PAPER
"POWER FOR TODAY – VISION FOR TOMORROW"
THE EGYPTIAN ELECTRICITY AND ENERGY SECTOR

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1. Introduction

The energy is the prime mover for development and poverty alleviation. The present and future vision of energy production, transmission and distributions is very important to face the rapid energy demand growth for the short and long term missions and to face the challenges for achieving the sustainable development with:

- Securing energy supply for the end users without discrimination between rural and urban areas,
- Providing reliable and affordable energy resources,
- Changing the unsustainable patterns of production and consumption which lead to loss of natural resources,
- Mitigating the negative impact of energy production on the local and global environment and atmosphere,
- Raising the efficiency of energy production and rationalizing its uses.

The contribution of the energy sector to the Growth Domestic Product (GDP) reached 9.9% in 2003/2004, 8.1 from petroleum and 1.8 from electricity.

2. The Egyptian Electricity and Energy sector has a main strategy of **“Maintaining sustainable energy to satisfy the needs of the end users in a quantitative and qualitative manner”**.

This strategy is implemented from the beginning of the last two decades with a continuous and adequate improvement through the following policies:

2.1 Upgrading the Energy Efficiency

2.1.1 Energy Production Development

- Using the units rates of 300,600 & 750 MW for its low fuel consumption.
- Simulating the operation of the power plants to be on line with their performance.
- Using the modern technologies of fuel injection and burning.
- Insulating the steam pipelines and using more advanced insulating materials.
- Maximizing the use of the natural gas as a primary fuel with the low NOx burners.
- Applying the routine and protective maintenance programs.
- Diversifying the energy resources generation with more combined cycle and wind energy applications.

Table 1: Energy resources generation for the year 2006 , 2001 & 1981

Energy Resource Generation	Percentage 2006 (%)	Percentage 2001 (%)	Percentage 1981 (%)
Steam generation	54.2	61.6	35.9
Gas turbine	4.3	4.5	14.3
Combined Cycle	27.5	16.3	-
Hydro generation	12.9	17.2	49.8
Wind generation	1.1	0.4	-

Note: The total generated power is 21300 MW.

2.1.2 Energy Transmission & Distribution Development

- Installation of the capacitors to improve the reactive power.
- Replacing the consumed parts.
- Applying maintenance under operation.
- Applying the routine and protective maintenance programs.
- Reloading the transformers to get more efficient operation.

The above mentioned formalities for generations, transmission and distribution of electrical energy have led to get the following improvements.

- 36% reduction of fuel consumption (from 336 gm/KWH to 223 gm/KWH).
- 45% reduction of CO2 emissions (from 1 Kg/KWH to 0.55 Kg/KWH).
- 33% losses reduction for T & D networks (from 18% to 12%).
- Achieving 89% availability of the power plants.
- Achieving 98% availability of the transmission networks.

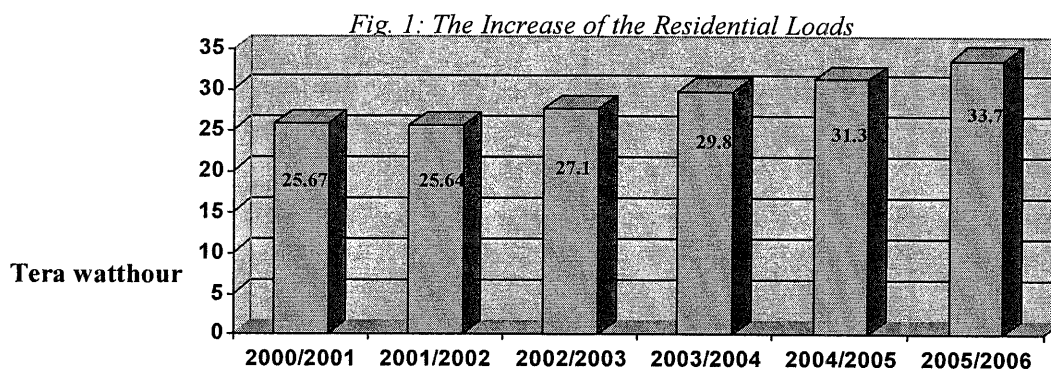
2.2 Applying Energy Conservation Programs

2.2.1 Energy Loads for the Different Sectors

Table 2: Energy Loads for the Different Sectors for the year 2006

The Sector	Percentage of the total Loads (%)
Residential	37.0
Industrial	35.6
Governmental + others	16.8
Commercial	6.8
Agricultural	3.8

2.2.2 The Increase of the Residential Loads and the Applied Energy Conservation Programs

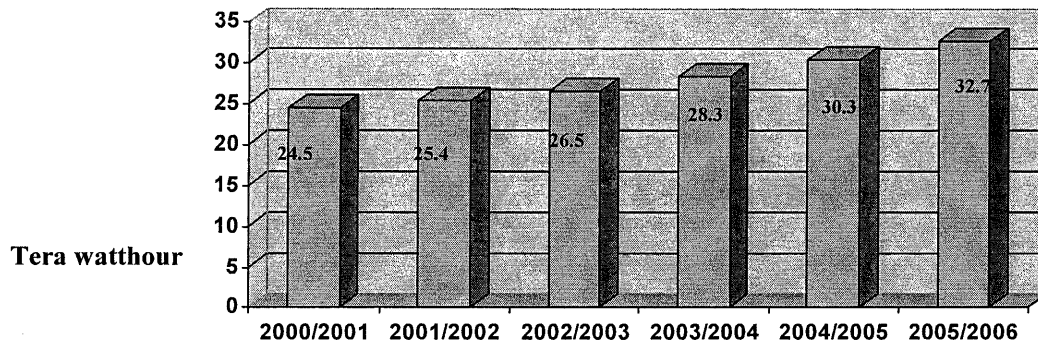


The energy conservation programs for the residential loads:

- The conserved energy lightning.
- Code for the residential buildings has been issued to use the most efficient building materials and to get the better benefit of the natural lighting and ventilation.
- Adding guidelines of the energy consumption for many of the residential equipments (Fridges, washing machines and air conditioning).

2.2.3 The Increase of the Industrial Loads and the Applied energy Conservation programs

Fig. 2: The Increase of the Industrial Loads



The Energy conservation programs for the industrial loads:

- Installation of capacitors on the main feeders.
- Shifting the loads out of the peak load.
- Cogeneration applications.
- Applying energy auditing programs.
- Using the conserved energy lightning.

2.3 Enhancing Access To Energy Services

2.3.1 Dispatching Centres

- The national control centre to work on the extra high voltage transmission lines. and the networks connected to the neighbouring countries.
- The regional control centres in Alexandria, Nag Hamaadi, Canal and Cairo to work on high voltage transmission lines.
- Many control centres working on the medium voltage transmission lines.

2.3.2 The main and Submain Service Centres

- Development of the main service centres through reengineering the formalities, improvement the GIS systems, upgrading the staff's level of experience and using guidepannels for the introduced services.
- Construction of submain service centres to improve the quality of services in the rural areas.
- 1239 service centres in the cities and villages.

2.3.3 Rural Electrification

Starting from 1970 the Egyptian Electricity and Energy sector started its programs to cover the rural areas with electricity through installation and operation of the substations and the 66 KV transmission lines.

Currently, the work is going on with the isolating wires to ensure the safety for the people in the rural areas.

2.3.4 Development of Slum Areas

Citizens in the slum areas are permitted to submit their requests for electricity supply. About 1.4 millions customers got benefit from this service.

2.4 Promoting the Use of Renewable energy

2.4.1 Hydropower

- The total generated power is 2745 MW from High Dam, ASWAN and Isna power plants.
- Save of fuel is 3 Million ton of equivalent fuel and 7.2 Million ton of CO2 every year.
- Under implementation is Nag Hamadi power plant (64 M), many mini hydro projects (18.5 MW) are under construction and feasibility study for Assuit P.P. (32 MW). Rehabilitation programs are executed to increase the life time.

2.4.2 Wind Energy

- Wind Atlas has been issued and indicated that the potential of wind energy is 20000 MW in Suez Gulf area.
- The present generation is 230 MW, saves 195 thousand (ton of equivalent fuel) and 450 thousands ton of CO2 emissions every year.
- It is planned to have 350 MW in 2007.
- It is planned to have 850 MW by the year 2010 represents 3% of total production. It will save 750 thousand ton of equivalent fuel and 1.8 Million ton of CO2 every year.
- Many Clean Development Mechanism (CDM) applications in Zafarana area.

2.4.3 Solar Energy

- Solar water heaters.
- Photovoltaic applications for lightning, water pumping, village electrification and telecommunication systems.
- Solar thermal Power Plant (150 MW) is under implementation to be on operation by 2009.

2.4.4 Biomass Energy

The Egyptian Electricity Sector is participating in many pilot projects with cooperation of international institutes aiming at encouraging the local manufacturing of some biomass equipment, enhancing the economic return, improving environmental conditions, and maximizing the benefits from all organic wastes by producing different types of biofuels.

2.5 Applying Environmental Protection Policies

2.5.1 The Laws

- The world Bank Guidelines
- law No 4 for the year 1994.
- Law No 48 for the year 1982 for the Nile river protection.
- Law No 63 for the year 1974 upgraded in 2000 for the transmission lines safe distances.
- Law No 102 for the year 1983 concerning the natural protectorates.

2.5.2 *The Egyptian Electricity and Energy sector has its role in many of the national environmental plans as:*

- The national environmental action plan till 2017.
- Clean development mechanism strategy.
- Energy efficiency strategy.
- Solid waste management strategy.
- National climate change strategy.
- The national plan for the organic persistent pollutants.

2.5.3 *More environmental formalities*

- Environmental impact assessment studies should be prepared for the new power plants.
- Complying the old power plants with the environmental laws.
- Self monitoring units in the power plants.
- Following up the environmental condition through organized teams work in the sites.

2.6 *Upgrading the Electrical Interconnection Projects*

2.6.1 *The Benefits are:*

- Save more generation and save more CO2 emissions
- Emergency assistance
- Wheeling of electrical power and energy through the parties systems.
- Purchase and sale of energy.
- Long and short term transactions of power and energy.
- Getting benefit that the peak loads is not the same for all countries.

2.6.2 *The Achieved interconnection Projects*

- Connection between Egypt, Libya, Jordan and Syria is implemented under the seven countries interconnection Egypt, Iraq, Jordan, Lebanon, Libya, Syria and Turkey (EIJLLST).
- Connection between Syria and Turkey is waiting for the approval of the Union for Coordination of Transmission of Electricity (UCTE).
- Connection between Libya / Tunisia is under test by the supervision of UCTE to be sure that the existing (Spain / Morocco / Algeria / Tunisia) is working properly.
- Starting the implementation of the Connection between (kingdom of Saudi Arabia / Kuwait / Bahrain / Qatar) as a first stage and (Republic of Emirates / Oman) as a second stage.
- A feasibility study is under implementation to connect between Egypt and kingdom of Saudi Arabia.

2.6.3 *The Coordination Control Centre (CCC)*

(CCC) has a vision of establishing a powerful integrated transmission system between the region countries (Egypt / Iraq, Jordan, Lebanon, Syria, Turkey, Libya, Tunisia, Algeria, and Morocco) through:

- Monitoring the power transfers and voltages.
- Frequency control, network control, Reactive power control.
- Settling the trade between the countries.

2.6.4 The Future Criteria of the Interconnection Projects

- Upgrading the voltage transmission to get more affordable networks.
- More stable power systems.
- Getting benefit of the available energy resources in the parties countries.

2.7 Maximizing the Localization Programs

2.7.1 The Benefits Are:

- Save importing.
- Save foreign currency.
- Reduction of the projects cost.
- Open market for more labour.
- Technology transfer.

2.7.2 The Achievements

250 thousand Labour and more than 10 Billion Egyptian pounds to have:

Table 3: Local Manufacturing Achievements by the Years 2006

Components	Percentage of Local Manufacturing (%)
1. All distribution & transmission till 66 KV	100%
2. Transmission of 220 KV	80%
3. Power generation	42%

- 2.7.3** In the Beginning of the Year 2006 **The Arab Union of Producers, Transmitters and Distributors of Electricity** has issued a unified specification for the Arab power systems components matching with the international standards to be added to the IEEE specifications.

2.8 Upgrading the Communication & Information Technology

- Simulation rooms for the power plants.
- Control and monitor transmission and distribution networks with the fiber optics and the microwave technology.
- Development of the Dispatching Centres.
- Global Geographical Information System (GIS).
- Monitoring pollutants in the power stations.
- Financial and administrative applications to improve the performance.
- Under implementation is a project to link between the companies, the authorities, the Egyptian Electricity Holding Company and the Ministry of Electricity and Energy.
- In the future, cooperation will be promoted between the dispatching Centres in Egypt and Coordination Control Centre.
- Establishing sites for Holding Company and the affiliated companies on the internet to provide information and services for the clients.

2.9 Achieving More Capacity Building and Technology Transfer

2.9.1 Training

- 19 training centres for the technical, financial and administrative aspects.
- One training centre for the supervising capabilities.
- These centres are able to train 19000 trainees per year.

2.9.2 Research Centres

- For the conventional generation, we have the Extra high voltage research centre, the central chemical laboratories and Laboratories for protection, tests and measurements.
- For non conventional generation we have the renewable research centre for the solar and Biomass energy, wind research energy centre, under cooperation with Germany an advanced renewable research centre will be constructed.

2.9.3 We Also Have Cooperation with the Egyptian universities to get higher degrees and more training fields with the cooperation of the international institutes and universities.

2.10 Fields of the regional Integration Projects

- Technical Assistance.
- Training.
- Localization Program.
- Interconnection Projects.

2.11 The Egyptian Electricity and Energy Sector Reform

- Unbundling the generation, transmission and distribution activities into 15 Companies followed to the Egyptian Electricity Holding Company (EEHC).
- Construction of the "Egyptian Utility and Consumer Protection Regulatory Agency".
- Three (BOOT) projects have been implemented in Sidi Krir, Port Said East and Suez Gulf with total capacity of about 2000 MW.
- The Electricity Sector is formulating a new electricity law matching with the international policies.
- A Guide book for supplying the investment projects with electricity in a transparent manner, has been issued.
- Many licences have been issued for invertors working on distribution of electrical energy.
- Now, the energy market is open for the investors working on generation of electrical energy and selling directly to the consumers.

3. The Progress Indicators

Table 4: The Progress Indicators

The Item	1981	2006	Rate of Multiplication
The available energy (TWH)	18	150	8.3
Generated power (MW)	4900	21300	4.3
Peak load (MW)	3240	18160	5.6
No of subscribers (million)	4.5	22	4.9
Energy percapita (KWH)	430	1450	3.4
Capacities of substations on H.V. & E.H.V. (MVA)	12470	82750	6.6
Length of networks for all voltages (km)	87600	428000	4.9

4. The Future Plans

4.1 The Criteria of the Future Plans

- Meeting the future energy demand.
- Diversifying the generation sources.
- The reliability of the networks.
- Using the most advanced technologies.
- The available investments.

4.2 The Fast Track Plan (2002-2007) is as follows:

Table 5: The Fast Track Plan (2002-2007)

The Power Plant	Type	Capacity by 2007 (MW)
El-Zafarana	Wind	360
Suez Gulf (1, 2)	Steam	682
Port Said East (1, 2)	Steam	682
Cairo North	Combined Cycle	1500
El-Nubaria	Combined Cycle	1500
Talkha	Combined Cycle	750
El-Kurimat	Combined Cycle	750

Combined Cycle has a great share in the fast track plan because of:

- Getting benefit of hot gasses from the Gas turbine Stage to operate Heat Recovery Boiler and share the reduction of climate change.
- Getting the third of the total power without burning fuels with less CO2 emissions.
- The rate of fuel consumption is 156 gm/KWH since it is 218 gm/KWH for steam generation.
- One of the better applications for the Natural Gas fuel.
- Applity of facing the peak loads in a proper and efficient manner.

4.3 The Estimated Future Plans Till 2027

Table 6: The Future Plans Till 2027

The Duration	Power Stations Rating (MW)	Substations Rating (MVA)	Network Length (Km)
2002-2007	6081	27650	62700
2007-2012	7172	19320	51000
2012-2017	12082	18125	60410
2017-2022	12400	18600	62000
2022-2027	14150	21225	70750
Total	51885	104920	306860

4.4 The Improvement of the Kilowatthour Production Cost

(Ex: El-Nubaria Power Plant)

The international average cost = 429 \$/ Kilowatthour

El-Nubaria cost = 291 \$/ Kilowatthour.

The reasons:

- Implementing the project with the packages concept.
- Sharing of the local manufacturing.
- Design and consultancy services achieved with Egyptian experience.
- Implementation has achieved with Egyptian experience.
- The past experience of the Egyptian Electricity sector.

5. Closing of the Country Paper

Energy resources are plentiful and not expected to be the limiting factor in global economic growth so, their regional development is a must to satisfy the present and future needs, that is why we should keep all energy options open, ensure the necessary investment for energy infrastructure, place priority on the measures needed to ensure reliability of supply, adopt a pragmatic approach to market reform and promote regional integration of energy supply systems.

The Egyptian Electricity and Energy Sector is still working on its policies to have more energy efficiency and conservation, more satisfaction for the clients, more renewable energy, more environmental protection, more regional integration through technical assistance, training, interconnection projects, local components manufacturing and technology transfer to provide sustainable electricity supply to the different Sectors of economy according to the international standards and achieve economical, social and environmental standards in addition to special regulations of the Regulatory Body for Electric Utilities and Consumer Protection.

Besides, the sector coordinates and cooperates with the Egyptian Utilities to maximize the local contribution in the different projects plan. Since the sector is looking for a larger market for its services. It cooperates with the Arab and African Companies and institutions by forming joint companies in the electric energy engineering consultation field, or by marketing the Egyptian experience in this field. The electric interconnection projects and the joint companies with Syria and Libya are examples of the mentioned Arab Cooperation.

The Sector also cooperates with the international companies and organizations to gain knowledge from the advanced experiences and participating in the international conferences to follow up the most recent progress.

Finally, ESCWA efforts are appreciated for the will to have a stable regional energy market for the parties countries through their varieties of energy resources. These resources could be more utilized through bilateral relations in the fields of **technical assistance, human resources management, Interconnection projects, localization programs and technology transfer.**

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