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FACULTY OF ENGINEERING
CAIRO UNIVERSITY

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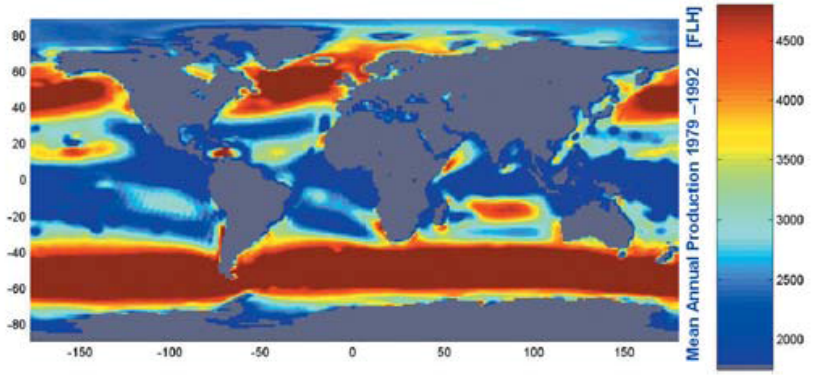
ANNEX I: GLOBAL REVIEW DATA

Table 1: World Energy Consumption by Country Grouping, 2003-2030
(Quadrillion Btu)

Region	2003	2010	2015	2020	2025	2030	Average Annual %, 2003-2030
OECD	**234.3**	**256.1**	**269.9**	**281.6**	**294.5**	**308.8**	**1.0**
North America	118.3	131.4	139.9	148.4	157.0	166.2	1.3
Europe	78.9	84.4	87.2	88.7	91.3	94.5	0.7
Asia.	37.1	40.3	42.8	44.4	46.1	48.0	1.0
Non-OECD	**186.4**	**253.6**	**293.5**	**331.5**	**371.0**	**412.8**	**3.0**
Europe and Eurasia	48.5	56.5	62.8	68.7	74.0	79.0	1.8
Asia	83.1	126.2	149.4	172.8	197.1	223.6	3.7
Middle East	19.6	25.0	28.2	31.2	34.3	37.7	2.4
Africa	13.3	17.7	20.5	22.3	24.3	26.8	2.6
Central and South America	21.9	28.2	32.5	36.5	41.2	45.7	2.8
Total World	**420.7**	**509.7**	**563.4**	**613.0**	**665.4**	**721.6**	**2.0**

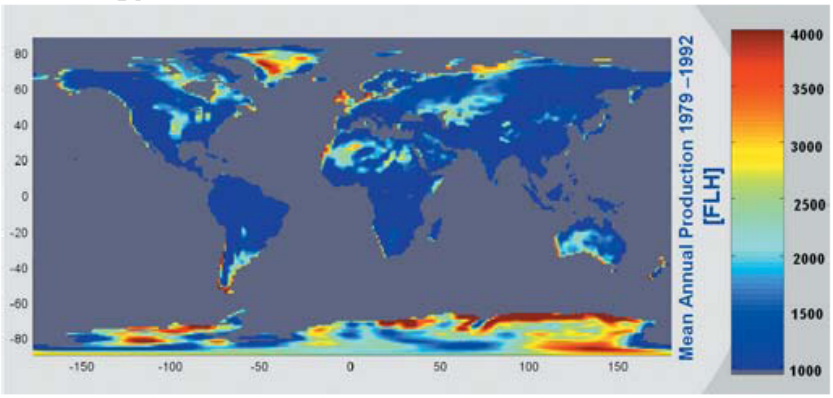
Offshore Wind Energy Resource Potential



Note: Values are calculated in Full Load Hours based on meteorological data from 1979 to 1992.
Sources: Meteorological data from European Centre for Medium Range Weather Forecast (ECMWF). Data processing and mapping by G. Czisch, ISET / IPP, 1999.

Figure 1: Offshore wind potential

Onshore Wind Energy Resource Potential

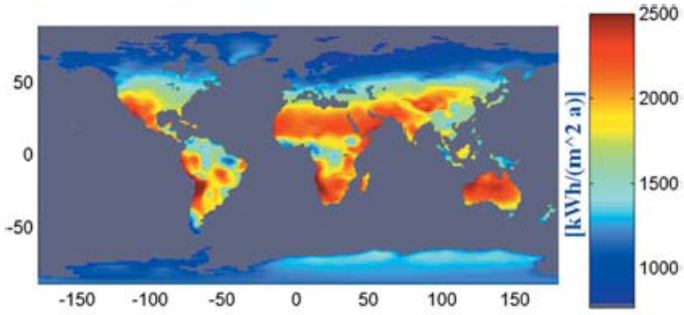


Note: Values are calculated in Full Load Hours based on meteorological data from 1979 to 1992.

Sources: Meteorological data from European Centre for Medium Range Weather Forecast (ECMWF). Data processing and mapping G. Czisch, ISET / IPP, 1999.

Figure 2: Onshore wind potential

Solar Photovoltaic Power Resource Potential

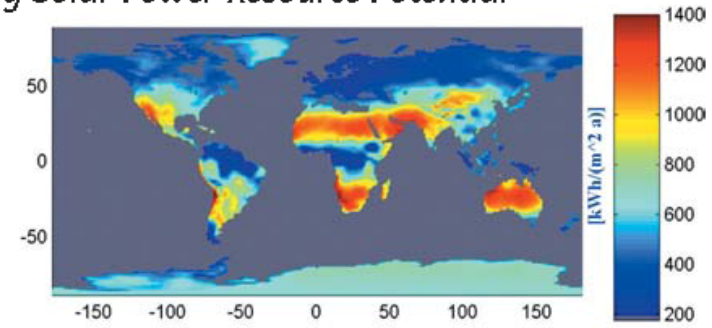


Note: Values (in kWh per m² and year) are given in terms of global horizontal irradiation (data measured from 1983 to 1992).

Sources: Meteorological data from European Centre for Medium Range Weather Forecast (ECMWF). Data

Figure 3: Photovoltaics potential

Concentrating Solar Power Resource Potential

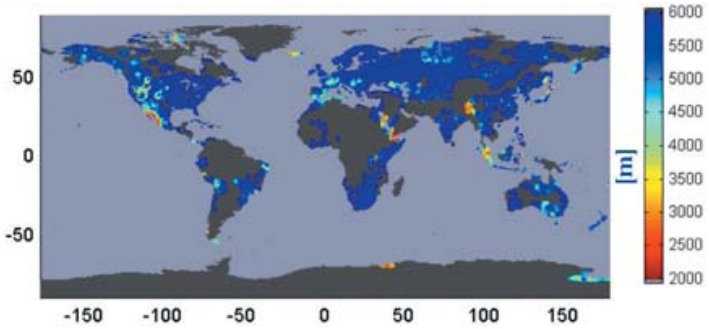


Note: Values are given for the heat output of solar fields SEGS (taking into account wind and ambient temperature)

Sources: Meteorological data from European Centre for Medium Range Weather Forecast (ECMWF) and National Centre for Environmental Prediction (NCEP). Data processing and mapping by G. Czisch, ISET, IPP, 2000.

Figure 4: Concentrating Solar Power potential

Geothermal Resource Potential



Note: The level of enthalpy is given for a temperature difference of 170K at various depths (in metres). The grey land regions are regions where the next measurement registered is more than 300 km away. The darkest blue indicates regions where the depth of the 170K layer is below 6,000 m.

Sources: Data from International Heat Flow Commission (IHFC). Data processing and mapping by G. Czisch, ISET / IPP, 2000 (assisted by B. Lehner, USF)

Figure 5: Geothermal potential

Hydropower Resource Potential

Note: Values (in GWh per year and cells of each 0.5° in latitude and longitude) are calculated by means of differences in altitude and water flow.

Sources: Data on water flow from WaterGAP, Center for Environmental Systems Research, University of Kassel.

Figure 6: Hydropower potential

Table 2: Exports of RES and RET as of 2004 and the Applied Tariff for Importers

Source: OECD UN Comtrade (trade flows), WTO Integrated Database (IDB)

Product	Exporters	Value (1,000 USD)	Importers with Highest Level of Duties	Applied Tariff (%)	Data Year	Bound Rate (%)
Fuel Wood						
	World	151,058	China	70	2004	7
	OECD countries	90,689	Romania	30	1999	30
			Ghana	20	2002	--
	Latvia	10,064	Malaysia	20	2001	20
	Croatia	8,662	Mexico	20	2004	35
	Estonia	8,145	Papua New Guinea	20	2004	90
	South Africa	5,884	Sierra Leone	20	2004	50
	Russian Federation	4,314	United States	20	2004	0
	Slovenia	3,494	Belarus	15	2001	--
	Bulgaria	3,281	Maldives	15	2002	30
	Belarus	3,210	Nigeria	15	2003	--
	Lithuania	2,919	Russian	15	2001	--
	Romania	2,857	Federation			
			Jamaica	10	2001	50
			Sri Lanka	10	2001	--
Wood Charcoal						
	World	259,312	China	70	2004	10.5
	OECD countries of which	119,736	Cameroon	30	2001	--
	Mexico	5,895	Gabon	30	2000	15
			Morocco	25	2002	40
	China	39,067	Maldives	25	2002	30
	Argentina	18,576	Zambia	25	2001	--
	South Africa	16,646	Egypt	24	1997	20
	Malaysia	11,450	Malaysia	20	2001	20
	Bulgaria	8,955	Mexico	20	2004	35
	Paraguay	7,047	Papua New Guinea	20	2004	90
	Singapore	6,171				
	Brazil	5,523				
	Romania	4,817				
	Latvia	4,261				
Hydraulic Turbines <1 MW						
	World	33,793	Bangladesh	60	1999	50
	OECD countries of which	31,050	China	35	2004	10
	Turkey	90	United States	27.5	2004	3.8
	Mexico	61	India	25	2002	25

Product	Exporters	Value (1,000 USD)	Importers with Highest Level of Duties	Applied Tariff (%)	Data Year	Bound Rate (%)
			Egypt	24	1997	20
	China	721	Gambia, The	18	2003	--
	India	653	Slovenia	16	2003	27
	Slovenia	430	Belarus	15	2001	--
	Argentina	241	Romania	15	1999	35
	Aruba	150	Russian	15	2001	--
	Brazil	112	Federation	15	2003	35
			Venezuela			
	Russian Federation	80	Colombia	15	2004	35
	Ecuador	76	Slovak Republic	15	2003	7
	Peru	62				
	Estonia	44				
Hydraulic Turbines >1 MW<10 MW						
	World	28,470	Djibouti	33	1999	40
	OECD countries of which	21,434	United States	27.5	2004	3.8
	Mexico	2	India	25	2002	25
			Egypt	24	1997	20
	Slovenia	3,006	Slovak Republic	24	2003	7
	China	1,452	Venezuela	15	2003	35
	Brazil	857	Colombia	15	2004	35
	India	794	Cameroon	10	2001	--
	Peru	557	European Union	10	2004	8.25
	El Salvador	303	Nigeria	10	2003	--
	Bulgaria	64	Poland	9	2003	9
	Malaysia	3				
	Singapore	0				
Hydraulic Turbines >10 MW						
	World	23,250	China	35	2004	10
	OECD countries of which	19,663	Rwanda	30	2003	100
	Mexico	218	United States	27.5	2004	3.8
			India	25	2002	25
	India	962	Egypt	24	1997	20
	Russian Federation	669	Slovak Republic	24	2003	7
	China	605	Venezuela	15	2003	35
	Slovenia	520	Nigeria	10	2003	--

Product	Exporters	Value (1,000 USD)	Importers with Highest Level of Duties	Applied Tariff (%)	Data Year	Bound Rate (%)
	Bulgaria	470	Poland	9	2003	9
	Brazil	265	European Union	8	2004	8.6
	Peru	32	Czech Republic	7	2003	7
	Singapore	24				
	Turkey	3				
	South Africa	0				
Parts for Hydraulic Turbines						
	World	427,833	Bangladesh	60	1999	--
	OECD countries of which	331,061	China	35	2004	6
	Mexico	3,773	Djibouti	33	1999	40
			United States	27.5	2004	3.8
	Slovenia	22,797	India	25	2002	25
	Brazil	15,084	Egypt	24	1997	20
	Russian Federation	13,584	Slovak Republic	24	2003	4.8
	China	12,695	Maldives	20	2002	30
	Romania	9,938	Gambia, The	18	2003	--
	Israel	3,399	Belarus	15	2001	--
	Singapore	3,163	Romania	15	1999	15
	India	2,841	Russian	15	2001	--
	Malaysia	2,813	Federation			
	Argentina	2,580	Rwanda	15	2003	100
Heat Pumps including refrigeration units						
	World	1,451,632	China	110	2004	17.5
	OECD countries of which	1,013,320	Bangladesh	100	1999	--
	Turkey	61,530	Egypt	64	1997	60
	Korea	4,834	Nigeria	45	2003	--
			Solomon Islands	40	1998	80
	China	384,855	United States	35	2004	0.5
	Singapore	20,644	Djibouti	33	1999	40
	Hong Kong, China	5,516	Tunisia	32.25	2004	--
	Malta	5,355	Cameroon	30	2001	--
	Oman	4,126	Gabon	30	2000	15
	Tunisia	3,434	St. Kitts and Nevis	30	2002	70
	Malaysia	3,210	Rwanda	30	2003	6
	India	2,349	Thailand	30	1999	30

Product	Exporters	Value (1,000 USD)	Importers with Highest Level of Duties	Applied Tariff (%)	Data Year	Bound Rate (%)
	Russian Federation	1,981	Cuba	30	2004	--
	Slovenia	880	India	30	2002	40
			Jordan	30	2004	20
			Malawi	30	2003	65
			Sierra Leone	30	2004	50
Heat Pump, Compression Type						
	World	3,615,381	China	110	2004	10
	OECD countries of which	3,177,101	Bangladesh	60	1999	--
	Korea	6,336	Nigeria	45	2003	--
			Tunisia	43	2004	--
	China	368,954	Zimbabwe	42.5	2002	--
	Brazil	17,850	United States	35	2004	0
	Hong Kong, China	16,113	Djibouti	33	1999	40
	Singapore	8,710	St. Kitts and Nevis	30	2002	70
	Belarus	3,420	Malaysia	30	2001	30
	Russian Federation	3,355	Thailand	30	1999	30
	Lithuania	3,263	Sierra Leone	30	2004	50
	Chinese Taipei	3,236				
	Slovenia	2,815				
	Malaysia	2,798				
Storage Water Heaters, non electric or gas						
	World	939,384	China	100	2004	35
	OECD countries of which	893,613	Bangladesh	80	1999	--
	Mexico	223,501	Egypt	59	1997	55
	Turkey	3,411	United States	45	2004	0
	Korea	2,936	Tunisia	34.75	2004	--
			Djibouti	33	1999	40
	Israel	18,201	St. Kitts and Nevis	30	2002	81.5
	China	10,148	Rwanda	30	2003	100
	New Caledonia	5,366	St. Lucia	27.5	2002	71.5
	India	2,461	Morocco	26.25	2002	40
	Slovenia	2,323				
	Singapore	1,617				
	Malaysia	1,309				
	Argentina	872				

Product	Exporters	Value (1,000 USD)	Importers with Highest Level of Duties	Applied Tariff (%)	Data Year	Bound Rate (%)
	Chinese Taipei	727				
	South Africa	614				
Wind Powered Generators						
	World	1,106,471	United States	35	2004	1.25
	OECD countries of which	1,102,186	China	30	2004	8
	Denmark	888,221	India	25	2002	25
	Mexico	160	Thailand	20	1999	--
			Slovak Republic	17	2003	4
	Brazil	1,185	Nigeria	15	2003	--
	India	1,174	Romania	15	1999	35
	Malaysia	918	Cameroon	10	2001	--
	Singapore	591	Egypt	10	1997	10
	China	197	Chinese Taipei	10	2003	10
	South Africa	79	Venezuela	10	2003	20
	Senegal	42	Cuba	10	2004	11
	Russian Federation	29	Indonesia	10	2002	40
	New Caledonia	14	Malawi	10	2003	--
	Hong Kong, China	13	Tunisia	10	2004	43
Photo-sensitive semiconductor devices, including photovoltaic cells, light emitting diodes						
	World	12,826,249	Bangladesh	100	1999	--
	OECD countries of which	8,820,912	Djibouti	33	1999	40
	Korea	317,324	United States	32	2004	0
	Mexico	81,645	Rwanda	30	2003	100
			China	30	2004	0
	Chinese Taipei	1,175,287	Maldives	25	2002	30
	Hong Kong, China	895,463	Egypt	24	1997	0
	Malaysia	792,974	Belarus	20	2001	--
	China	644,213	Russian Federation	20	2001	--
	Singapore	316,252	Sierra Leone	20	2004	50
	India	85,036				
	South Africa	57,810				
	Russian	10,692				

Product	Exporters	Value (1,000 USD)	Importers with Highest Level of Duties	Applied Tariff (%)	Data Year	Bound Rate (%)
	Federation					
	Cyprus	8,935				
	Croatia	6,044				

ANNEX II: MIDDLE EAST AND NORTH AFRICA (MENA) REVIEW

INTRODUCTION

In order to maintain the energy availability for sustainable development in MENA region, many influential factors govern such availability at significant reliability level. These factors are; 1) equality of access, 2) social compatibility, 3) conservation of resources, 4) low risks tools, 5) compatibility with environment, climate, and health, 6) comprehensive economic efficiency, 7) bilateral and multilateral cooperation, and 8) availability of supply on demand. Therefore, some deficits in MENA's energy sector were raised due to the aforementioned constraints of sustainable development. These deficits of energy sector are:

1. Excessive consumption of limited energy resources.
2. Induced global climate change.
3. Extremely large differences in energy consumption between the industrialised countries and developing countries.
4. Risks associated with using nuclear power.

In this regard, this section will present the demand on energy in MENA region, the potentials of renewables, and the existing policies and strategies framework.

MENA REGION – ENERGY DEMAND OVERVIEW

The demand side potential for electricity for each country of the region was comprehensively assessed via existing programs of EU with the countries of MENA in order to discuss the possible scenarios for proven economic potentials of energy generation.

The growth of population and economy will lead to a considerable growth of energy demand in the MENA countries. By 2050, the MENA countries will achieve an electricity demand in the same order of magnitude as Europe (3500 TWh/y). Reference to the previous studies conducted by MED-CSP Program, electricity demand will almost triple from shortly 1500 TWh/y today to 4100 TWh/y in 2050. This is moderate considering that electricity demand has also tripled in the past 20 years. The projected energy consumption for MENA region countries and North Mediterranean European countries is presented in figure 1.

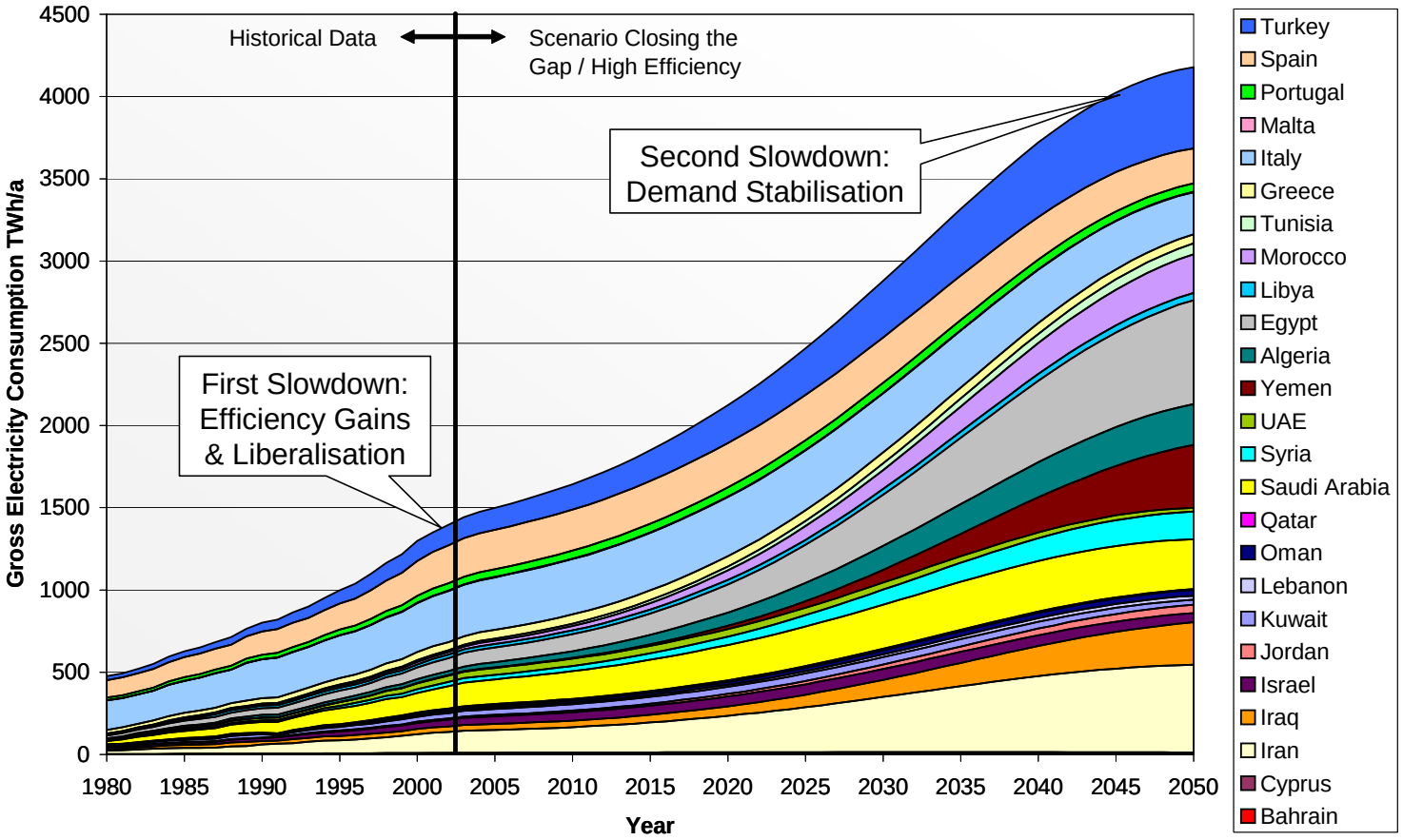


Figure 1. Projected Energy Consumption in MENA Countries and North Mediterranean European Countries

The figure shows a slight slowdown of electricity demand in the coming decade. This could be interpreted as result of the coming liberalisation of the power market in most countries, efficiency gains and reduced losses due to uncontrolled extraction of electricity from the grid. The European countries and the OPEC countries of the Arabian Peninsula show a clear saturation of electricity demand after 2030; most other MENA countries will have a strongly growing electricity demand, with Egypt, Turkey and Iran becoming the biggest centres of demand by the middle of the century.

Moreover, the projected annual electricity consumption per capita in different MENA countries and North Mediterranean European countries is presented in the following figure.

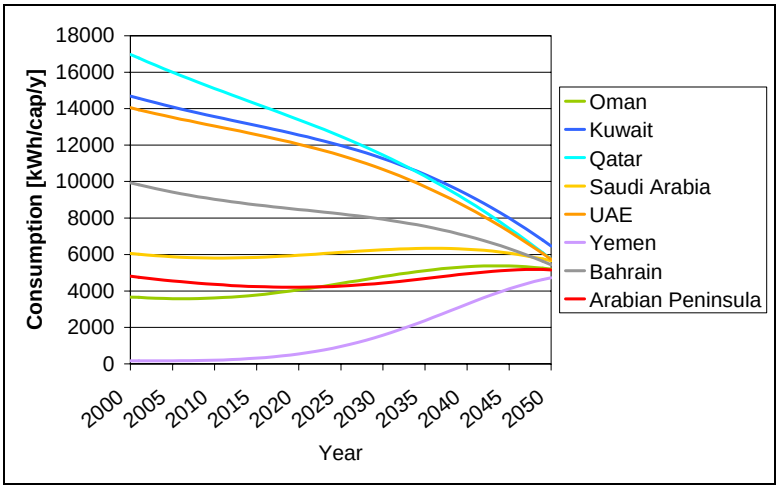


Figure 2.a. Projected Energy Consumption in Arabian Peninsula

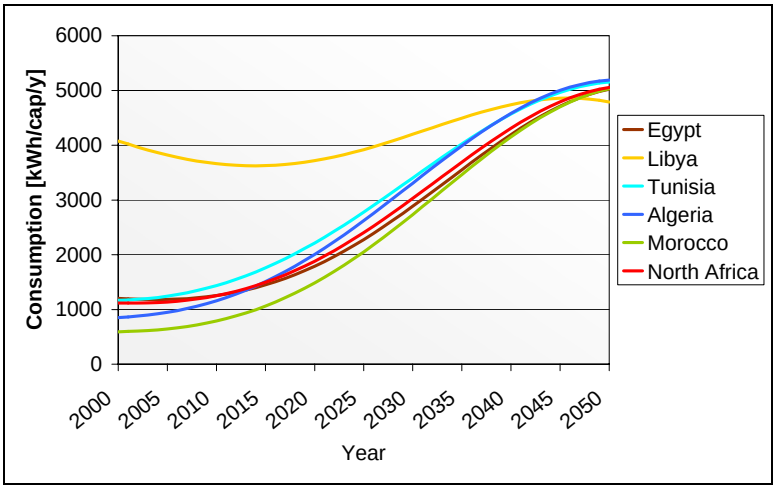


Figure 2.b. Projected Energy Consumption in North Africa

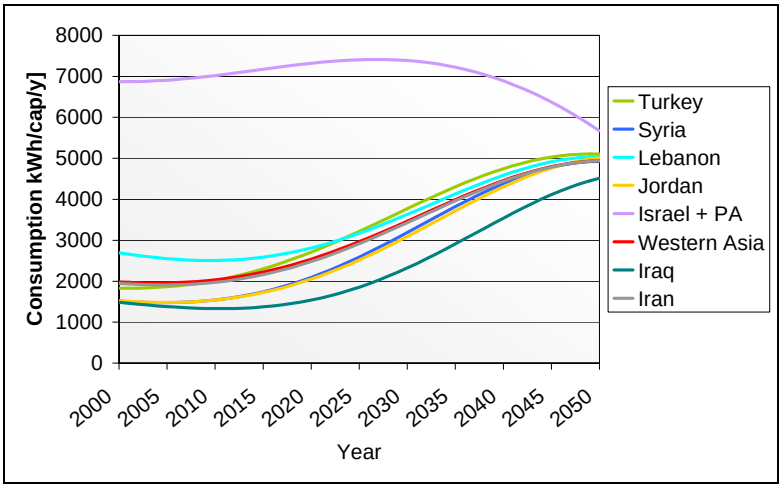


Figure 2.c. Projected Energy Consumption in Western Asia

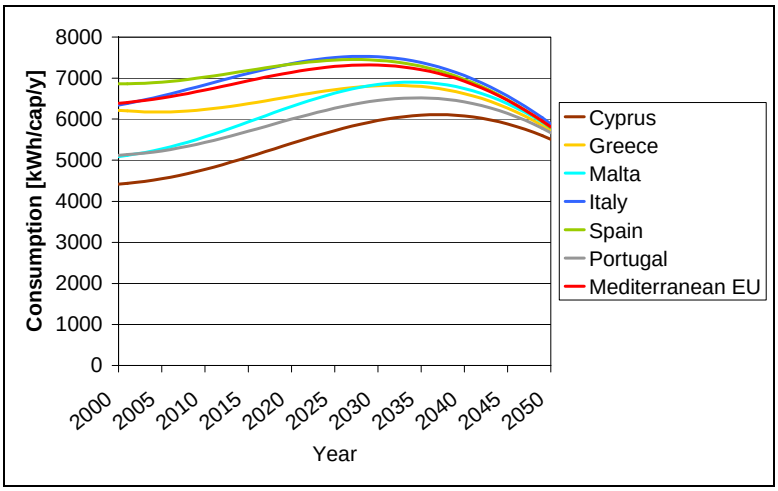


Figure 2.d. Projected Energy Consumption in Southern Europe

RET POTENTIAL MARKET

With respect to the projected energy demand in MENA region and the constraints for sustainable development that have to be taken into consideration, the technical and economical availability of renewable energy resources were assessed to present the potential market for different technologies at MENA region. The accuracy of resources assessment cannot be better than ± 30 % for individual sites as it depends on many assumptions and simplifications. However it gives a first estimate of the order of magnitude of the renewable energy treasures available in Europe and MENA. This estimate is presented in table 16. Therefore, this table shows also that the economic wind, biomass, geothermal and hydropower resources amount each to about 400 TWh/y. Those resources are more or less locally concentrated and not available everywhere, but can be distributed through the electricity grid, which will be enforced in the future in line with the growing electricity demand of this region. However, the biggest resource in MENA is solar irradiance, with a potential that is by several orders of magnitude larger than the total world electricity demand. The solar energy irradiated on the ground equals 1 – 2 barrels of fuel oil per square meter and year. This huge resource can be used both in distributed photovoltaic systems and in large central solar thermal power stations. Thus, both distributed rural and centralized urban demand can be covered by renewable energy technologies.

Moreover, the future perspective for RET implementation plays an important role in decision making for introducing the technology in the market. The implementation perspective is mainly dependent on how much the technology investment is near to commercialization basis compared to the power generation by fossil fuels. In this context, the demands concentrating solar power technology will be high by year 2020 where the wind technology does have high potential nowadays because it is matured and be commercialized. The demand on RET over the next 35 years for electricity generation is presented in figure 19 showing the share per each RET.

Table 1. Technical and Economic Renewable Electricity Supply Side Potentials in TWh/year

	Hydro		Geo		Bio		CSP		Wind		PV		Wa/Ti	
	Tech.	Econ.	Tech.	Econ.	Tech.	Econ.	Tech.	Econ.	Tech.	Econ.	Tech.	Econ.	Tech.	Econ.
Bahrain	5.0	n.a.	n.a.	n.a.	n.a.	0.2	36	33	n.a.	0.1	n.a.	0.3	n.a.	n.a.
Cyprus	24.0	1.0	n.a.	n.a.	n.a.	0.5	23	20	10.0	0.5	n.a.	0.2	n.a.	0.2
Iran	88.0	48.0	n.a.	11.3	n.a.	23.7	>	20000	n.a.	8.0	n.a.	16.0	n.a.	n.a.
Iraq	90.0	67.0	n.a.	n.a.	n.a.	8.6	30806	28647	300.0	10.0	n.a.	6.8	n.a.	n.a.
Israel	44.0	7.0	n.a.	n.a.	n.a.	2.2	318	318	22.0	0.5	n.a.	4.0	n.a.	n.a.
Jordan	n.a.	0.1	n.a.	n.a.	n.a.	1.6	6434	6429	109.0	2.0	n.a.	4.5	n.a.	n.a.
Kuwait	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	1525	1525	n.a.	n.a.	n.a.	2.5	n.a.	n.a.
Lebanon	2.0	1.0	n.a.	n.a.	n.a.	0.8	19	14	9.0	0.2	n.a.	1.5	n.a.	n.a.
Oman	n.a.	n.a.	n.a.	n.a.	n.a.	1.1	20611	19404	44.0	8.0	n.a.	4.1	n.a.	n.a.
Qatar	n.a.	n.a.	n.a.	n.a.	n.a.	0.1	823	792	n.a.	n.a.	n.a.	1.0	n.a.	n.a.
Saudi Arabia	n.a.	n.a.	n.a.	70.9	n.a.	9.9	125260	124560	300.0	20.0	n.a.	13.9	n.a.	n.a.
Syria	7.0	4.0	n.a.	n.a.	n.a.	4.7	10777	10210	98.0	12.0	n.a.	8.5	n.a.	n.a.
UAE	n.a.	n.a.	n.a.	n.a.	n.a.	0.7	2078	1988	n.a.	n.a.	n.a.	3.0	n.a.	n.a.
Yemen	n.a.	n.a.	n.a.	107.0	n.a.	9.1	5143	5100	8.0	3.0	n.a.	25.8	n.a.	n.a.
Algeria	5.0	0.5	n.a.	4.7	n.a.	12.1	169440	168972	7278	35.0	n.a.	13.9	n.a.	n.a.
Egypt	80.0	50.0	n.a.	25.7	n.a.	15.3	73656	73656	7650	90.0	n.a.	36.0	n.a.	n.a.
Libya	n.a.	n.a.	n.a.	n.a.	n.a.	1.7	139600	139477	5363	15.0	n.a.	3.9	n.a.	n.a.
Morocco	5.0	4.0	n.a.	10.0	n.a.	14.3	20151	20146	1188	25.0	n.a.	17.0	n.a.	n.a.
Tunisia	1.0	0.5	n.a.	3.2	n.a.	3.2	9815	9244	50.0	8.0	n.a.	5.0	n.a.	n.a.
Greece	25.0	12.0	n.a.	4.7	n.a.	11.8	44	4	136.0	15.0	n.a.	4.0	n.a.	4.0
Italy	105.0	54.0	n.a.	9.8	n.a.	86.4	88	7	223.0	60.0	n.a.	10.0	n.a.	3.0
Malta	n.a.	n.a.	n.a.	n.a.	n.a.	0.2	2	2	n.a.	0.2	n.a.	0.1	n.a.	0.1
Portugal	33.0	20.0	n.a.	7.0	n.a.	26.6	436	142	63.0	20.0	n.a.	3.0	n.a.	7.0
Spain	70.0	41.0	n.a.	9.4	n.a.	111.1	1646	1278	226.0	60.0	n.a.	5.0	n.a.	13.0
Turkey	216.0	122.0	n.a.	150.0	n.a.	55.0	405	131	200.0	55.0	n.a.	28.6	n.a.	n.a.
Total		**432**		**414**		**402**		**632099**		**447**		**218**		**27**
Remarks:	well documented resource taken from literature		from 5000 m temperature map considering areas with T>180°C as economic		from agricultural (bagasse) and municipal waste and renewable solid biomass potentials		from DNI and CSP site mapping taking sites with DNI > 2000 kWh/m²/y as economic		from wind speed and site mapping taking sites with a yield > 14 GWh/y and from literature (EU)		No information except for EU. General PV growth rates used for calculation		No information except for EU mid term economic potentials	

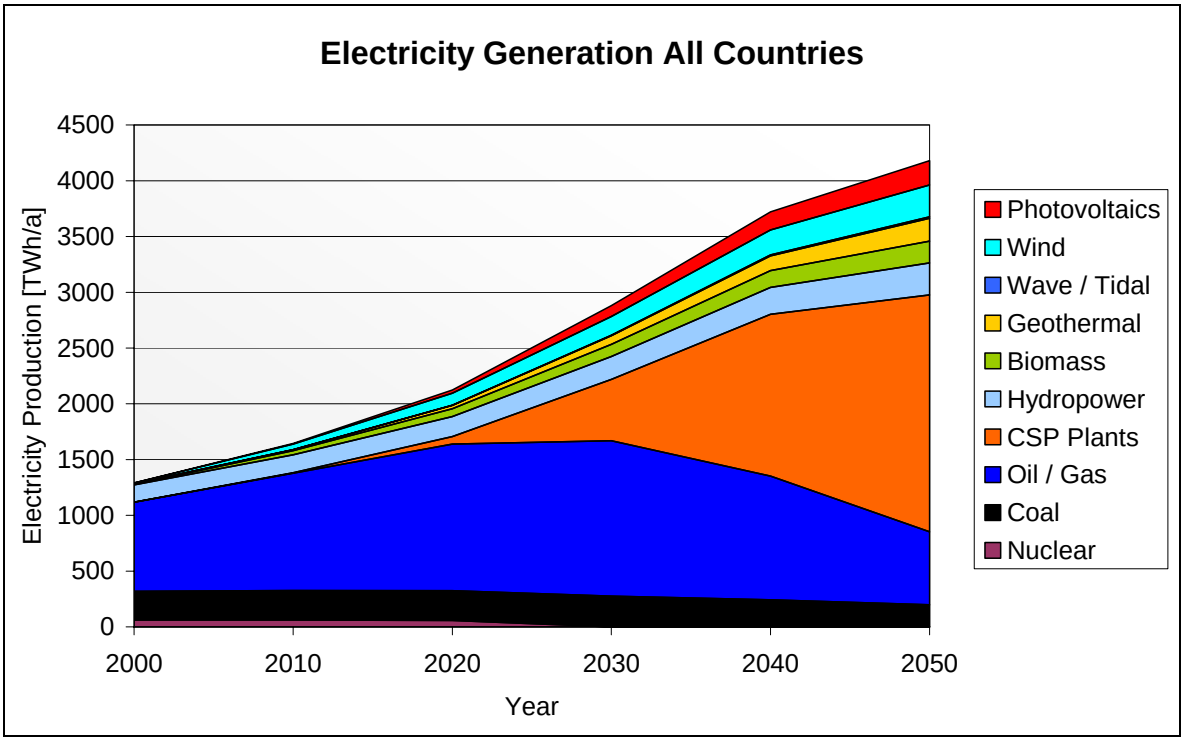


Figure 3. Annual Electricity Generation By RET in MENA and North Mediterranean Countries

POLICY AND STRATEGY FOR RET IN MENA REGION

The existing regulations and policies with the associated financial indicators for energy prices deploy a significant obstacle against the economical viability of the RET implementation. However, the worldwide agreements and initiatives concerning the global environment, trade liberation, fuel oil reserves and projected prices, economic reforming, and energy authorities restructuring, lead to emphasis on new policies and strategies to enhance the exiting ones. The setup for new policies and strategies with specific objectives needs comprehensive elaboration on the existing regulatory bodies and energy sectors structure in order to overcome the barriers that are currently imposed.

In light of setting up the new strategies, the existing policies in MENA countries could be considered significantly weak because of the following facts that are available in the energy sector:

1. Monopoly in different segments of energy sector starting from generation till the distribution for end users.

2. Energy prices subsidy rates that range from heavily to almost beyond medium.

3. Absence of competition between governmental and private sector energy providers because of regulations imposed on BOT "Buy-Own-Transfer", BOOT "Buy-Own-Operate-Transfer", and IPP "Independent Power Provider".

4. Economy transition and low growth rates in economy restructuring.

5. High demand on energy because of; a) high growth rate in population, b) booming in development plans, and c) electrification programs for rural areas.

Reference to the above mentioned facts that are imposed on energy sector, the current policies in different MENA countries are summarized in table 17. With respect to this table, the followings can express some of the conclusions that might be drawn for the beneficiary of the different countries in MENA region:

1. Due to the different regulations of the electricity sector it is appropriate to use different policy instruments adapted to the different countries (e.g. a specific instrument should not be mandatory in the agreement).

2. The policy instruments within a country should be specifically related to technologies or technology-bundles. In addition to all instruments a concerted grid expansion and a fair grid access is mandatory.

3. Support by financial institutions will be complementary to other instruments and will be project-dependent. It will not cover the whole deployment strategy (the same is true for development assistance grants).

4. As an international agreement is required to introduce RES-technologies there seems to be a case to found a special financial institution or to change the duty of an existing financial institution to handle financial flows between states or to offer special credits.

5. In project planning true opportunity costs for fossil fuels – typically derived from world market prices – have to be used, also in countries where fossil fuels are subsidized.

6. Policy instruments have to include transparent market conditions in order to encourage the investors for RET implementations.

7. The bilateral and multilateral agreements for funding RET have to be supported as well as funding via financial institutions at low rates of interest and guaranteed loans.

Table 2. Overview of Regulatory Regimes in MENA

COUNTRY	TYPE OF CURRENT REGULATION	GOAL: TYPE OF REGULATORY	PRIVATE/ FOREIGN OWNERSHIP	CONCENTRATION OF GENERATION /TYPE OF UNBUNDLING	ELECTRICITY PRICES
MOROCCO	ONGOING RESTRUCTURING FROM MONOPOLY	RETAIL COM-PETITION; ONE REGULATED AND ONE FREE SYSTEM IN PARALLEL	IPPS AND FOREIGN INVESTMENT	A COMPANY (ONE) WILL BE RESPONSIBLE FOR SYSTEM OPERATION, TRANSMISSION AND DISTRIBUTION	
ALGERIA	RECENT RESTRUCTURING FROM MONOPOLY; PRIVATISATION STALLED AT THE MOMENT	GOAL SYSTEM NOT CLEAR, PERHAPS RETAIL COMPETITION	IPPS	SOME VERTICAL INTEGRATION WILL REMAIN	
TUNISIA	PORTFOLIO MANAGER	NO GENERAL CHANGES	IPPS (BOT)	ONE COMPANY 90% MARKET SHARE	
LIBYA	STATE OWNED MONOPOLY	NO GENERAL CHANGES			STRONGLY SUBSIDIZED
EGYPT	STATE OWNED MONOPOLY	FUTURE DIRECTION IS UNCLEAR	BOT (NO NEW BOT PROJECTS LIKELY IN THE NEAR FUTURE		PARTIALLY SUBSIDIZED

Country	Type of current regulation	Goal: Type of regulatory	Private/ Foreign ownership	Concentration of Generation /Type of unbundling	Electricity prices
Israel	Monopoly	No company shall control more than 50% of production or transmission, gradual liberalisation, privatisation prepared	IPPs	No company shall control more than 50% of production or transmission by 2010	
Jordan	Portfolio Manager	Retail competition	Above 5 MW bid invitation	Generation, Transmission and supply unbundled	partially subsidized
Lebanon	Monopoly	Privatisation stopped			
Syria	Monopoly	No general changes	No consideration		NA
Turkey	Ongoing restructuring	Retail competition	Due to restructuring unclear, probably IPPs in the near term	One company 91 % of power generation / vertical divestiture	
	Type of current regulation	Goal: Type of regulatory	Private/ Foreign ownership	Concentration of Generation /Type of unbundling	Electricity prices
Iraq			BOT, BOO		NA
Iran	Monopoly		BOT, BOO (not available)		strongly subsidized
Saudi-Arabia	Monopoly	Restructuring on the way; partial privatisation; Framework for private sector involvement		One power generation company/ unbundling power generation, transmission & distribution	Artificially low prices

COUNTRY	TYPE OF CURRENT REGULATION	GOAL: TYPE OF REGULATORY	PRIVATE/ FOREIGN OWNERSHIP	CONCENTRATION OF GENERATION /TYPE OF UNBUNDLING	ELECTRICITY PRICES
KUWAIT	MONOPOLY	IPPS FUTURE UNCERTAIN		ONE POWER GENERATION COMPANY	ARTIFICIALLY LOW PRICES
BAHRAIN	MONOPOLY	PRIVATISATION UNDER CONSIDERATION		ONE POWER GENERATION COMPANY	ARTIFICIALLY LOW PRICES
QATAR	MONOPOLY	NO GENERAL CHANGES		ONE POWER GENERATION COMPANY	ARTIFICIALLY LOW PRICES
UAE	MONOPOLY	PERHAPS GRADUALLY PRIVATISATION	ACTUAL PROJECTS PARTIALLY WITH FOREIGN OWNERSHIP		ARTIFICIALLY LOW PRICES
OMAN	MONOPOLY	PRIVATISATION, UNBUNDLING ANNOUNCED		IPP	ARTIFICIALLY LOW PRICES
YEMEN	MONOPOLY		PRIVATE POWER GENERATION POSSIBLE AND WELCOMED		ARTIFICIALLY LOW PRICES

ANNEX III: NATIONAL ENERGY SECTOR SETUP

A variety of institutions operates in the Egyptian energy sector. Some of these have direct influence on the governance while others more indirectly influence activities and decisions. In this section a brief overview of the majority of the institutions present in the energy sector and their responsibilities are provided. The fields of electricity and of petroleum and natural gas are basically taken care of by two ministries, MOEE, and MOP, and their relevant authorities and organizations. In addition to both ministries, a Supreme Council of Energy has been established. In the following sub-sections, the role of each entity that draws impact on energy will be presented.

MINISTRY OF ELECTRICITY AND ENERGY (MOEE)

The MOEE is responsible for planning, generating, transmitting and distribution of electricity. However, this role is being conducted through the hereafter listed authorities or organizations that directly generate their policies based on the general policy of MOEE. The authorities/organization of MOEE is:

1. **The Egyptian Electricity Holding Company (EEHC)** established by law 164/2000 is mainly responsible for system studies and planning, power plants projects, HV/ UHV transmission, network projects and operation and maintenance.

2. **Regulatory Body for the Electricity Sector** is being established as part of the privatization process on the basis of the Presidential Decree **No. 339 / 2000**. The purpose of Agency is to oversee all issues related to the electricity sector in the field of production, transmission, distribution and consumption and it is chaired by the Minister of Electricity and Energy .

3. **Rural Electrification Authority (REA)** is responsible for planning and construction of the HV transmission, medium voltage and low voltage networks in the rural towns and villages.

4. **Hydropower Project Authority** is responsible for the studies, design and construction of hydropower plants projects.

5. **Nuclear Power Plants Authority** is responsible for all aspects of the projects of nuclear power plants. So far the authority has been concerned with studies of sites, appropriate types of plants, preparing tender documents for the first nuclear power plant as well as bidding, and negotiation.

6. **The New and Renewable Energy Development and Utilization Authority (NREA)** have appeared in the national energy plan since 1980, but NREA activity began with the establishment of the New and Renewable Energy Authority in 1986 by the government through law 102/1986 with a focus on

solar, wind and biomass resources. Its aim is to identify and evaluate new and renewable energy sources and to plan for their development. NREA has the right to certify and provide guarantee for renewable energy (RE) products and to implement RE projects, either alone or in cooperation with others, including overseas governments and authorities**.**

7. **Atomic Energy Authority** is responsible for conducting research of different peaceful applications to fields of interest such as medicine, agriculture, radiation technology, control of radiation levels, regulatory procedures and training of personnel.

8. **Nuclear Materials Authority** is responsible for the studies to determine the potential of nuclear fuel materials in the country in addition to processing of these nuclear materials.

MINISTRY OF PETROLEUM AND MINERAL RESOURCES (MOP)

The ministry is one of the main key energy players in Egypt responsible for setting up and monitoring the implementation of various energy polices related to the petroleum sector activities. A main authority in the petroleum sector under MOP that is responsible for handling all the petroleum activities in Egypt is the General Egyptian Petroleum Corporation (EGPC). Egyptian gas holding company (EGAS) was established to cover all gas activities from upstream to down stream.

SUPREME COUNCIL OF ENERGY (SCE)

The SCE was established by a prime minister's decree in 1979 as the highest policy making authority in the energy sector in Egypt. The decree defines SCE responsibility as short and long-term energy planning, with direct reporting to president. It was first chaired by Deputy Prime Minister and Minister of Petroleum, then the Deputy Prime Minister and Minister of Planning since 1985. Membership of the council includes ministers of petroleum, electricity, industry, water supply, transportation and housing. The council undertakes very limited activities and has thus presently no importance for the decisions in the energy sector. This is likely due to the high active role of both the MOEE and MOP. The direct cooperative relation between these two ministries has reduced the need for the SCE.

ENERGY EFFICIENCY COUNCIL (EEC)

The EEC is a voluntary consortium of public and private sector organizations associated with the generation, distribution, and use of energy resources in Egypt. The Council currently includes 12 organizations representing seven Ministries (Electricity and Energy, Petroleum, Environment, Industry, Transportation, Water Resources, and Planning) and two organizations representing the views and interests of the private sector. These two organizations are the Federation of Egyptian Industries: a forum representing most Egyptian industries, and the Egyptian Energy Service Business Association: a non-

government organization representing providers of energy efficiency products and services. The main vision of the Council is to create an enabling framework that allows a wide adoption of energy efficiency in Egypt. Its aim is to oversee the development of a national energy efficiency strategy that will be used as a roadmap to increase Egypt's efficient use of its natural resources.

MINISTRY OF ENVIRONMENT (MOE)

The ministry is responsible for establishing and monitoring all environmental polices in Egypt. The main executing agency under the ministry is the Egyptian Environmental Affairs Agency (EEAA). The EEAA was established by the presidential decree in 1982 as a cabinet department. The principal functions of the agency are to formulate environmental policies and prepare the necessary plans for environmental protection and environmental development projects, following up their implementation and undertaking pilot projects.

A first unified Egyptian Law on Environmental protection was passed in February 1994. The law defines an increased role of EEAA, which consequently expanded in size and influence. The objectives of EEAA with respect to the energy sector include:

- Promote better energy efficiency in Egyptian industry.
- Reduce the overall consumption of fossil fuels and promote the conservation.
- Promote the utilization of natural gas.
- Support the use of new and renewable sources of energy.

MINISTRY OF STATE FOR PLANNING

From the energy activities point of view, Organization of Energy Planning (OEP) was established since 1983 and currently belongs to the ministry of planning. OEP's mission is to support and take part in the national effort required by decision makers, concerned authorities, and the public to ensure a safe and effective energy supply to meet energy demands efficiently through integrated energy planning, development of technical expertise, and the dissemination of energy information in cooperation and coordination with other concerned bodies in order to serve national sustainable development.

OTHER MINISTRIES AND INSTITUTIONS RELEVANT TO ENERGY SECTOR

Other Ministries relevant to the Energy Sector include Ministries of : Foreign Trade and Industry, International cooperation, Housing and New Communities, Communication and Information Technology, Public Enterprise, Investment, Irrigation and Water Resources, Tourism, Local Community Development, Information, Transport, Civil Aviation.

National Investment Bank (NIB) is an organisation attached to the Ministry of State for Planning and International Co-operation which disburses investment allocations under

the five-year plan. Its responsibilities include appraising and monitoring the implementation of investment projects and funds.

Parliamentary and Governmental Committees, there are two committees under the parliament and the Senate related to industry and energy issues responsible for implementation within the legislative framework. The parliamentary committee for industry and energy is consulted in connection to major decisions in the energy sector regarding energy policy and strategy and the committee should approve them before further procedure.

Research, Development and Educational Institutions, Much of the research, development and education in the energy sector are taking place through organisations previously described in this section. In addition, the Academy of Scientific Research and Technology and Egyptian Universities are important institutions within the field of research, development and education.

Academy of Scientific Research and Technology (ASRT) consists of several institutions and research centres which are dealing with many activities such as social studies, applied science, energy, etc. There are three institutions that are playing important part in the field of energy. The academy provides a great amount of its budget annually to finance the research in the field of energy and make a great emphasise in energy efficiency and renewable energy.

Company Organizations; The Federation of Egyptian Industries (FEI) organises the industries in Egypt. The organisation is active within the energy field. Another organisation for the industry, General Organization for Industrialization, (GOFI), is mainly dealing with public industries. A newly established organisation, Egyptian Energy Service Business Association (EESBA) organises private companies that offer energy efficiency products and services, including ESCOs (Energy Service Companies).

Non-Governmental Organizations do not play an important role in the governance of the energy sector. Two NGOs are involved in the various energy and environment issues: the Egyptian National Committee of the World Energy Council and the Arab Office for Youth and Environment (AOYE).

Donors and Financing Agencies in the energy field include USAID, EUROPE AID, KFW, DANIDA, CIDA, JAICA, UNDP, and GEF. Some of the donors, energy conservation and renewable energy are considered as part of the environmental protection area, while the energy area covers infrastructural projects such as major power plants and transmission and distribution lines. Within the donor assistance group, a donor subgroup on environment and energy exists, however, during recent years, the activities have mainly been focusing on the environmental activities.

ANNEX IV: ELECTRICITY GENERATION COSTS VIA THERMAL POWER PLANTS (TPP) IN EGYPT

The power generation costs are calculated based on the actual data stated in the annual report of MOEE, year 2005. The demonstrated data shows the followings:

- The fuel mix utilization in thermal power plants is 76.41%, 23.04%, and 0.55% for natural gas, heavy fuel oil, and light fuel oil respectively.
- The average specific fuel consumption is 228.4 gram oil equivalent per kWh generated.

However, the economic model for computing the energy generated costs is based on the following assumptions:

8. The fuel costs are 1.25 US$/1000 ft^3 of natural gas, EGP 500 per ton of heavy fuel oil, and EGP 0.75 per liter of light fuel oil.
9. The investment cost is 425 US$ per kW for turn key power generation projects.
10. The operation and maintenance (O&M) cost represents 55% out of the sum of O&M and fuel costs. The O&M costs include the manpower, spare parts, overheads, and any other consumables.
11. The discount rate is 7% on which the cost of capital (COC) for investment is calculated.
12. Full depreciation for power plant along its life time, straight line approach and no salvage value.
13. The power plant lifetime is 30 years.

In this line, the computed cost of generated kWh is presented in the following table.

Cost Item	**US$/kWh**
Fuel	0.0136
O&M	0.0166
Sub-total	**0.0302**
COC	0.0031
Depreciation	0.0022
Total	**0.0354**

Moreover, the sensitivity analysis considering the change in fuel costs is calculated in order to properly measure the generation costs versus the costs of RETs implementation in power generation sector of Egypt. The costs of generation in thermal power plants considering the existing fuel mix as per the annual report, year 2005, of MOEE –

considered as base fuel mix case- are tabulated in the following table as well as the costs associated in case of fuel mix composed of 90%, 9.5%, and 0.5% for natural gas, heavy fuel oil and light fuel oil respectively –considered as anticipated fuel mix case.

Fuel Cost Changes and Fuel Mix Cost Subject To Base Case (EGP 5.75/US$)*

Fuel Type	Fuel Cost									
HFO EGP/kg	0.275	0.350	0.500	0.550	0.600	0.650	0.700	0.800	0.850	0.920
LFO EGP/lit	0.4	0.6	0.75	0.8	0.85	0.9	0.95	1	1.05	1.1
NG $/1000 ft^3	0.850	1.000	1.250	1.500	2.000	3.000	4.500	5.500	6.000	7.000
HFO $/ton	0.048	0.061	0.087	0.096	0.104	0.113	0.122	0.139	0.148	0.160
LFO $/lit	0.070	0.104	0.130	0.139	0.148	0.157	0.165	0.174	0.183	0.191
NG US$/million Btu	0.88	1.04	1.29**	1.55	2.07	3.11	4.66	5.70	6.21	7.25
HFO US$/million Btu	1.169	1.488	2.125	2.338	2.550	2.763	2.975	3.401	3.613	3.911
LFO US$/million Btu	1.901	2.852	3.565	3.803	4.040	4.278	4.516	4.753	4.991	5.229
Fuel Mix US$/million Btu	0.952	1.150	1.498	1.746	2.192	3.034	4.271	5.161	5.607	6.468

*Fuel mix – **Base Case** is composed of 76.41%, 23.04%, and 0.55% for natural gas, heavy fuel oil, and light fuel oil respectively.
**Base Year 2006

Impact of Fuel Cost Changes on Electricity Generation Costs –Base Case

Cost Item	US$/kWh									
Fuel	0.0086	0.0104	0.0136**	0.0158	0.0199	0.0275	0.0387	0.0468	0.0508	0.0586
O&M	0.0106	0.0127	0.0166	0.0193	0.0243	0.0336	0.0473	0.0572	0.0621	0.0717
Sub-total	**0.0192**	**0.0232**	**0.0302**	**0.0352**	**0.0442**	**0.0611**	**0.0860**	**0.1040**	**0.1130**	**0.1303**
COC	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031
Depreciation	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Total	**0.0244**	**0.0284**	**0.0354**	**0.0404**	**0.0494**	**0.0664**	**0.0913**	**0.1092**	**0.1182**	**0.1355**

**Base Year 2006

Impact of Fuel Cost Changes on Electricity Generation Costs –Anticipated Case

Cost Item	US$/kWh									
Fuel	0.0083	0.0099	0.0126**	0.0149	0.0193	0.0279	0.0408	0.0496	0.0540	0.0627
O&M	0.0101	0.0120	0.0153	0.0182	0.0236	0.0341	0.0498	0.0606	0.0660	0.0767
Sub-total	0.0184	0.0219	0.0279	0.0330	0.0428	0.0620	0.0906	0.1102	0.1201	0.1394
COC	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031
Depreciation	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
Total	0.0236	0.0272	0.0331	0.0383	0.0481	0.0673	0.0959	0.1155	0.1253	0.1447

**Base Year 2006

The sensitivity analysis for generated kWh costs can help in setting the power generation scenarios of this study in order to assess the anticipated savings subject to the subsidy imposed on fuel costs for the power generation sector in Egypt. The costs of energy generated via the TPP are calculated and tabulated considering the followings:

1. An adopted regime for liberating the existing fuel prices to be included in proactive energy policy is set.

2. Generated kWh cost calculations are subject to the base case fuel mix ratio.

3. Gradual avoidance of fuel subsidy is considered to close the subsidy gap by meeting the international fuel prices by year 2022.

Generated KWh Costs Subject To Fuel Prices Liberation

Item	2006	2010	2015	2020	2022
Fuel Mix Cost (US$/million Btu)	1.4984	3.0339	4.2710	5.6073	6.4684
TPP Cost (US$/kWh)	0.0354	0.0664	0.0913	0.1182	0.1355

ELECTRICITY GENERATION COSTS VIA RETS IN EGYPT

Investment by Government of Egypt

The main governance factor for implementing the renewable energy technologies in the sector of power generation is the cost of generated power versus generation via fossil fuels. The cost of production is calculated for different RETs based on the investment cost per installed power considering the learning curve per each technology. The investment curve per each technology is tabulated in the following table.

Investment Learning curve for different RETs

Technology Summary Cost ($/kW)	2006	2010	2015	2020	2022
Wind Technology (WT)	1400	1200	1100	1000	900
CSP Technology	4500	4200	4000	3800	3200
Hydropower (HYP)	950	850	800	750	750
PV	6000	5500	5000	4300	4000

Reference to the above investment costs, the cost of production is calculated based on the following assumptions:

1. The financial structure is 1:1 equity to debt ratio.

2. The debt is loan with 10 years repayment period and 14% interest rate.

3. The cost of capital is calculated at 7% discount rate.

4. The non fuel O&M are based on 7% escalation rate.

The calculated costs for generated kWh are presented in the following table.

Costs of Generated kWh via RETs (US$/kWh)

Technology	2006	2010	2015	2020	2022
WT	0.0405	0.0348	0.0319	0.0284	0.0256
CSP	0.1610	0.1562	0.1492	0.1403	0.1207
PV	0.2757	0.2529	0.2299	0.1949	0.1813
Hydro	0.0245	0.0220	0.0207	0.0189	0.0189

The above calculated costs give indication to which domain of commercialization that the technology will be commercially viable besides its technological viability. However, it has to be noted that although the hydropower plants are significantly attractive in commercial basis but the limitations on resources availability is a milestone.

Investment by Independent Power Providers (IPPs)

The assessment for the production costs by private sector as IPPs is analyzed in order to properly assess the most suitable feed in tariff and to avoid the required investment on government burden to meet the future expansion in the power generation sector. The assessment is based on the following assumptions.

1. The financial structure is 1:1 equity to debt ratio.
2. The debt is loan with 5 years repayment period and 14% interest rate.
3. The minimum attractive internal rate of return (MAIRR) is 15% on equity.
4. The non fuel O&M are based on 7% escalation rate.
5. The investment cost considers the learning curve applied in the previous section.

The cost of generation is tabulated in the following table:

Costs of Generated kWh via RETs (US$/kWh)

Technology	2006	2010	2015	2020	2022
WT	0.0300	0.0257	0.0236	0.0206	0.0186
CSP	0.1195	0.1176	0.1125	0.1041	0.0902
PV	0.1976	0.1814	0.1649	0.1375	0.1279
Hydro	0.0188	0.0168	0.0159	0.0142	0.0142

Having the calculated MAIRR for investors, the estimated selling price for generated kWh on the grid is tabulated in the following table.

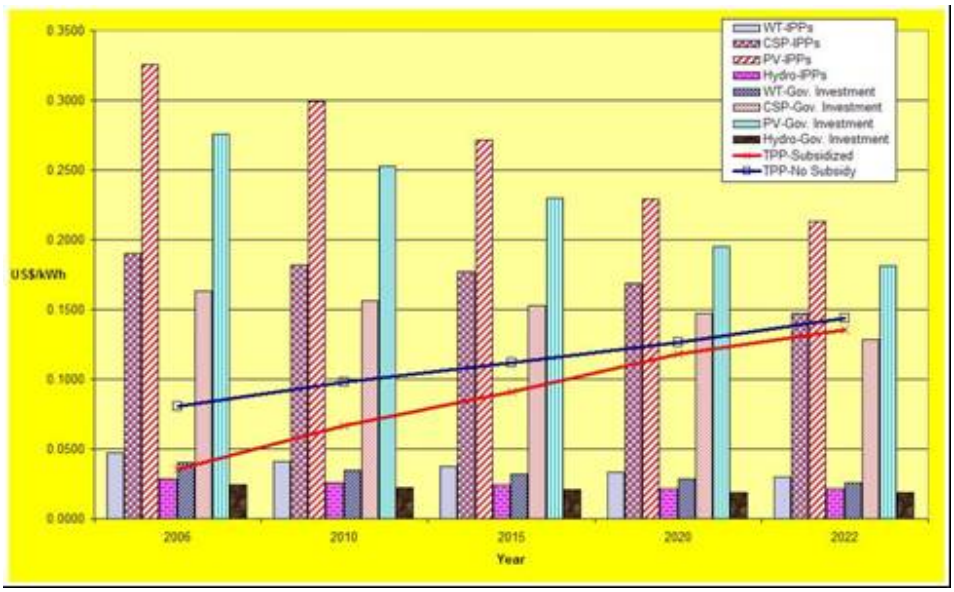
Estimated Selling Price for Generated kWh via RETs to the Grid (US$/kWh)

Technology	2006	2010	2015	2020	2022
WT	0.0475	0.0408	0.0374	0.0332	0.0298
CSP	0.1883	0.1818	0.1736	0.1621	0.1391
PV	0.3259	0.2990	0.2718	0.2295	0.2135
Hydro	0.0284	0.0255	0.0240	0.0218	0.0218

In this context, the feed tariff to the utility grid has to meet the above tabulated figures for the supplied kWh by the IPPs to the utility grid.

Comparison of Generated kWh by TPP to Costs of RETs

The generation costs via the RETs, either by the government or IPPs, are presented in the following figure taking into consideration the anticipated increase in fuel costs that are previously presented and its impact on cost of generation via TPP. Moreover, the cost of generation via TPP considering the International fuel prices is demonstrated.



Consequently, the hereafter remarks could be concluded:

- The more the liberation in fuel prices in power generation sector, the more attractiveness for renewable technologies as well as reduction in subsidy.
- The wind technology is nearly commercialized where the concentrating solar power technology is still far beyond the commercialization.

- The concentrating solar power and photovoltaic technologies could be applicable by year 2015 since their feed in tariff is still significantly high.
- The gap between the fuel costs regime and the international costs could be closed over the next fifteen years.
- The narrower that gap of costs, the high the potential for implementing the CSP and PV technologies.
- The implementation of WT via private sector partnership business (IPPs) over proactive policy will add more avoided investment for the government in power generation sector.

The anticipated savings due to the implementation of RETs in power generation sector of Egypt are calculated based on the following assumptions.

1. The anticipated saving in fossil fuel is 228.4 kg oil equivalent per kWh and the cost saving is computed subject to the opportunity cost for export, 6.5 US$/million Btu.
2. The anticipated reduction in CO_2 is 0.609 kg/kWh which is calculated based on the existing specific fuel consumption in power generation and the fuel mix ratio.
3. The anticipated savings in investment is based on the equivalent installed TPP that generates the estimated generated energy by the RETs considering the RETs capacity factor and the average load factor of the TPP.
4. The avoided subsidy on fuel is calculated based on the difference between the opportunity cost for export, 6.5 US$/million Btu, and the fuel costs regime that is proposed for power generation sector.

The resultant savings are tabulated in the following table subject to the change in fossil fuel costs.

Sensitivity Analysis for Generate d Energy via WT (High Scenario)

Fuel Mix Cost (US$/million Btu)	Electricity Cost via TPP (US$/kWh)	Generated Energy via WT (million kWh)	Anticipated Savings		Anticipated Cost Savings (million US$)		Avoided Subsidy (million US$)
			TOE (million)	CO2 (million tons)	Opportunity Cost for Export	CER	
0.95	0.0244	293,608	67.06	179	17,299	1,789	14,765
1.15	0.0284	293,608					14,239
1.50	0.0354	293,608					13,311
1.75	0.0404	293,608					12,651
2.19	0.0494	293,608					11,464
3.03	0.0664	293,608					9,225
4.27	0.0913	293,608					5,932
5.16	0.1092	293,608					3,562
5.61	0.1182	293,608					2,376

*****Avoided investment in TPP is 2,204 million US$

Sensitivity Analysis for Generated Energy via CSP (High Scenario)

Fuel Mix Cost (US$/million Btu)	Electricity Cost via TPP (US$/kWh)	Generated Energy via WT (million kWh)	Anticipated Savings		Anticipated Cost Savings (million US$)		Avoided Subsidy (million US$)
			TOE (million)	CO2 (million tons)	Opportunity Cost for Export	CER	
0.95	0.0244	45,070	10.29	27.5	2,656	275	2,266
1.15	0.0284	45,070					2,186
1.50	0.0354	45,070					2,043
1.75	0.0404	45,070					1,942
2.19	0.0494	45,070					1,760
3.03	0.0664	45,070					1,416
4.27	0.0913	45,070					911
5.16	0.1092	45,070					547
5.61	0.1182	45,070					365

*****Avoided investment in TPP is 446 million US$

Sensitivity Analysis for Generated Energy via PV (High Scenario)

Fuel Mix Cost (US$/million Btu)	Electricity Cost via TPP (US$/kWh)	Generated Energy via WT (million kWh)	Anticipated Savings		Anticipated Cost Savings (million US$)		Avoided Subsidy (million US$)
			TOE (million)	CO2 (million tons)	Opportunity Cost for Export	CER	
0.95	0.0244	4,380	1.00	2.7	258	27	220
1.15	0.0284	4,380					212
1.50	0.0354	4,380					199
1.75	0.0404	4,380					189
2.19	0.0494	4,380					171
3.03	0.0664	4,380					138
4.27	0.0913	4,380					88
5.16	0.1092	4,380					53
5.61	0.1182	4,380					35

*****Avoided investment in TPP is 63 million US$

Referring to the above tables, it could be concluded that the WT is very close to the commercialization level since its energy cost by IPPs is 4.75 cents/kWh which is equivalent to fuel mix cost of about 2.22 US$/million Btu. This equivalent cost is higher than the current implemented cost in Egypt (1.49 US$/million Btu) and far beyond the internal cost of 6.5 US$/million Btu. In contrary, the CSP and PV technologies do

possess high equivalent fuel mix cost which amounts to 9.1 and 16.12 US$/million Btu respectively. This proves that both technologies are still beyond commercialization.

In power generation sector of Egypt, the sensitivity analysis was previously calculated in order to assess the proper decision for the inclusion of RETs in the high scenario plan of this study. Hence, the feed in tariff can be set subject to the level of subsidy avoided and the compensation for high costs of generated energy by RETs. Based on this, the analysis for proposed feed in tariff structure is set in order to compute for the equivalent fuel mix cost that the TPP should apply. The results of the analysis are tabulated in the following table.

Assumed Feed in Tariff for RETs and Equivalent Fuel Mix Cost for TPP

Feed in Tariff			**Equivalent Fuel Mix Cost for TPP (US$/million Btu)**		
WT	**CSP**	**PV**	**WT**	**CSP**	**PV**
0.0500	0.188	0.33	2.2216	9.0725	16.1219
0.0475	0.17	0.31	2.0975	8.1789	15.1290
0.0450	0.16	0.29	1.9734	7.6824	14.1362
0.0425	0.15	0.27	1.8493	7.1860	13.1433
0.0400	0.14	0.25	1.7252	6.6896	12.1504
0.0375	0.13	0.23	1.6011	6.1931	11.1575
0.0350	0.12	0.21	1.4770	5.6967	10.1646
0.0325	0.11	0.19	1.3528	5.2003	9.1718
0.0300	0.1	0.17	1.2287	4.7038	8.1789

However, the feed in tariff for WT at 0.05 US$/kWh reflects the high opportunity for avoiding subsidy by about 23% and with further decline in feed in tariff in the future subject to the anticipated learning curves, the higher avoided subsidy. On the other hand, the CSP technology could be feasible when the fuel mix cost reaches the boarder of 6 US$/million Btu and at this level the implementation of PV will be still in need for subsidy to be implemented.

ANNEX V: FEED IN LAW AND FEED IN TARIFF

FIXING RE-QUANTITY OR RE-PRICE

"Electricity consumer pays" support schemes for grid-connected renewable energy systems fall into three main categories, of which one is price-based and two quantity-based in their approach:

1. Feed-in tariffs, used in Denmark, Germany, Spain, and France since 2001.
2. Bidding for long-term PPAs with the system operator / national transmission company, such as Ireland's "Alternative Energy Requirement" Scheme.
3. Tradable green certificates schemes, used in U.K., Italy, Netherlands, Denmark, Belgium, Austria, Sweden, where electricity suppliers are obliged to supply a certain quota of renewable energy.

Each category has a number of sub-categories:

- Among *feed-in-tariffs* one can distinguish between "fixed price/uniform tariff", "declining scale tariff" and the Spanish "hybrid feed-in-tariff / kWh-subsidy" schemes.
- *Tender schemes* differ with regard to the mechanism used to fix the PPA price (marginal bid price given to all or each bidder is paid his bid price) and with regard to how the contracted quantity is established: the tender can fix the quantity to contract (bid prices define the financial cost of the tender) or the subsidy amount (bids establish by how many MW(h) can be bought with the price support).
- *Tradable green certificates schemes* can be stand-alone (windfarm revenue = electricity sales + TGC-sales) or coexist with a separate CO_2-certificate market (windfarm revenue = electricity sales + TGC-sales + CO_2-sales).

COMPARISON OF THE THREE APPROACHES UNDER PERFECT INFORMATION

In figure 1, Government RE-policy has fixed a RE-supply target of Q1 (MW or GWh) to be reached in period 1 and of QN for period N. When (i) all parties are in possession of perfect information, (ii) the transaction costs of the schemes are identical, (iii) the perceived risks are the same for investors and (iv) there is no technological progress or we look at one period only, then price-based and quantity-based schemes produce similar results. To reach the quantity Q1, the Government can either introduce a feed-in tariff of P1 or fix a quota of Q1 - the tradable green certificate (TGC) scheme leads to a market clearing "green electricity price" (market price of electricity + market price of green certificates) of P1, which is also the "marginal quota fulfilling price" of a bidding process.

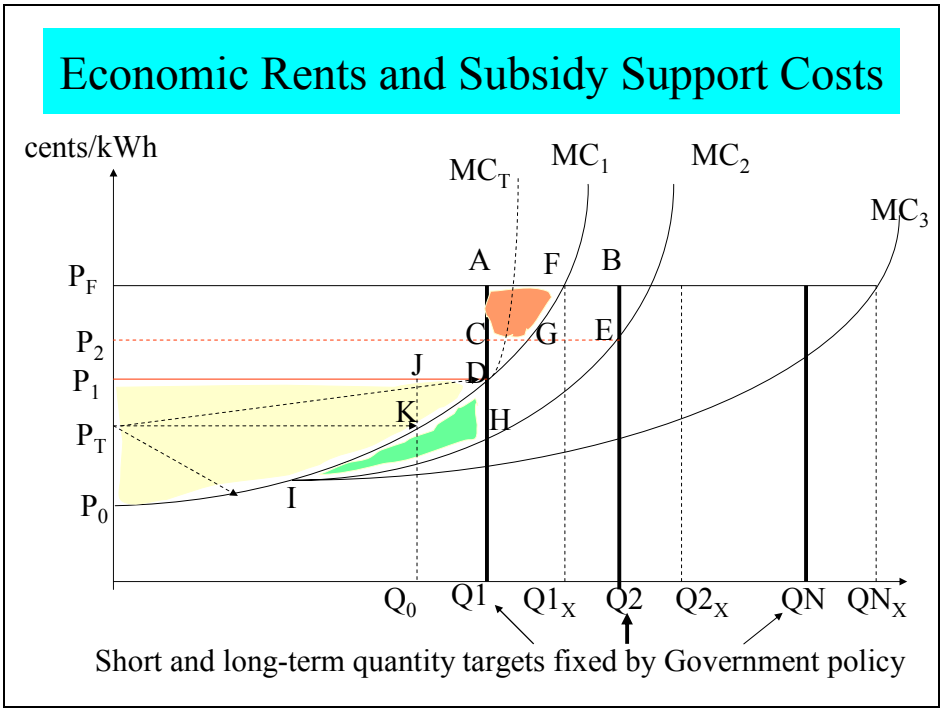


Figure 1: Economic Rents and Subsidy Costs under Price and Quantity based Market Approaches

As long as we look at one period only, the producer surplus is identical for feed-in-tariff and TGC-schemes: P1P0D. In the real life case of pluri-annual programs with step-wise increasing penetration targets and long-term PPAs/TGC-purchases, the subsidy burden of the TGC-scheme is lower – if the supply side reacts efficiently. Let Q0 represent the TGC-market for year 1 and Q1, the target for year 2 and let the three arrows indicate the position of the three least-cost RE-projects on the RE-supply curve. In the feed-in-tariff scheme, all three projects are paid the tariff P1, in the TGC-scheme the first two projects are paid the tariff PT. The producer surplus/subsidy cost is reduced by the rectangle P1PTKJ compared with the feed-in tariff scenario.

The producer's surplus of the tender scheme depends on the pricing procedure. If all accepted bids up to the quota are paid the marginal quota fulfilling bid price, the tender scheme yields the same result as the TGC scheme: a tariff of PT in year 1 and of P1 in year 2. If each bidder is paid his specific bid price, the result is the average price PT for the mandated quantity Q1, on the "ignorant bidder assumption" that each producer bids the tariff reflecting his specific position on the supply curve. The tender scheme, in that case, totally eliminates the producers' surplus. Under perfect competition, thus, the feed-in-tariff imposes the highest subsidy burden, the "bidded price = tariff paid"-variant of the tender scheme results in the lowest subsidy burden, while the TGC-scheme falls in-between the two.

FEED-IN-TARIFFS WITH VARIABLE RATES ACCORDING TO GWH-PRODUCTION PER MW

In order to reduce the producer surplus/subsidy cost of the feed-in-tariff, in real life schemes, the "uniform tariff" is replaced by tariff rates that decline with the GWh-output per MW. The variable feed-in-tariff reduces the "wind resource producer surplus" of the best sites, yet, still expands the market by paying windfarms located at less attractive sites a higher average rate per kWh produced. Two variants can be seen:

1. In Denmark in the late 1990s, the high feed-in-tariff was paid for the first 25,000 GWh per installed MW, after which windfarms had to sell their power into the power pool at the lower market prices.
2. Germany went a step further in 2003. Eligible projects are classified into three categories according to the quality of the wind resource at the project site. Windfarms located at sites having a "category 1" wind resource are paid the lowest tariff, which is valid during the first five years only. Projects at the other sites get their – higher - feed-in-tariff tariff until a defined GWh/MW production has been attained. Projects producing less than 60% of the "standard output" for a "category 3" wind resource site are not eligible for a subsidized feed-in-tariff at all.

IMPACT OF INSUFFICIENT INFORMATION ON MARKET SIZE

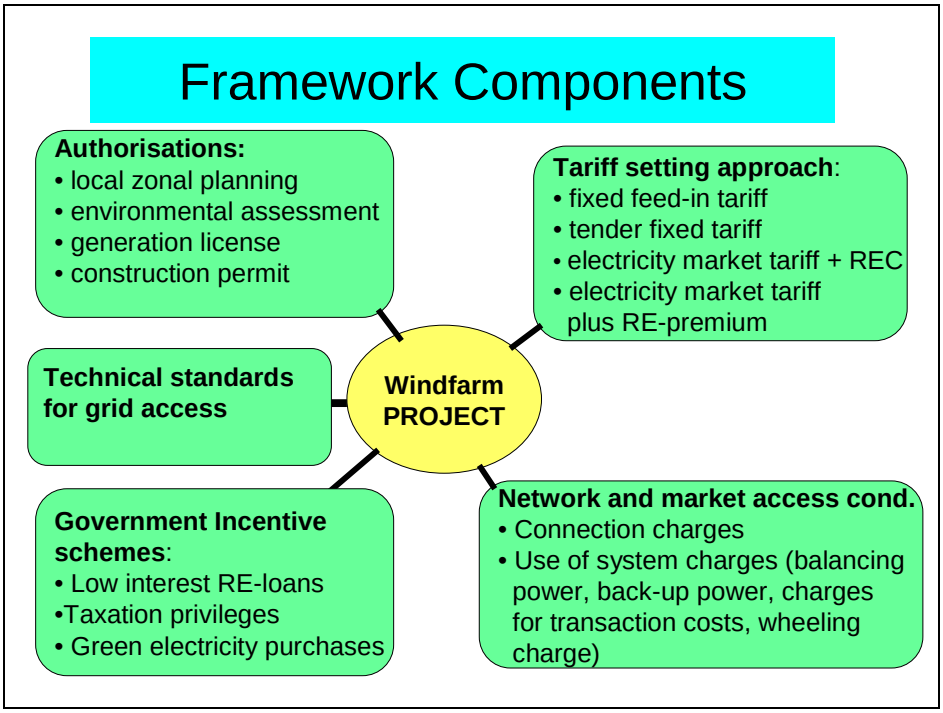
When information is less than perfect, policy makers may set the feed-in tariff too low to reach the quantitative target – a price of PT results in the low quantity of Q0. Or, the price may be set too high: the price of PF leads to an over-supply of Q1-Q1X, meaning, that a larger than expected financial burden for electricity consumers. The positive, "other side of the coin", aspect of overshooting is the fast development of the market for windenergy, which is why policy makers who want a rapid penetration of renewable energy prefer the feed-in-tariff.

IMPACT OF REGULATORY VOIDS ON MARKET SIZE

The tender scheme has the reputation of providing new RE-supply at low-priced PPAs. However, a main reason for this is the smaller market size normally associated with the scheme: the tender scheme is primarily used by countries that are stingy with subsidies and renewable energy ambitions. The low demand from the tenders for RE allows windfarm investments to stay on the low-cost end of the supply curve, at least during the initial years; while the tender procedure enables only the least-cost projects to be implemented during early years: in order to win, projects are done in the windiest areas only. The problem with this is the high geographic concentration of projects on-land, which leads to resistance by the local population in the area against the implementation of new projects.

The tender and TGC-schemes only generate their subsidy savings if the supply side is efficient; which it is not if the procedures for site approvals and construction permits are wanting. The tariff policy for RE-generators is only one of five major components that

together make up the regulatory framework for RE-investments. As always, the chain is not stronger than its weakest element.



Due to a near-absence of adequate planning and approval guidelines for the local authorization of windfarm projects, the UK's NFFO-scheme resulted in a large number of "virtual reality" windfarm projects: most winning bids did not afterwards pass the local site approval process for the project; hence, only a fraction of approved MW were implemented. The risk of undershooting is addressed in the design of the Irish Renewables Obligation scheme: only projects having all required permits in place can bid.

The introduction of the RO-scheme in the UK in 2002/03 was accompanied by the publication of developer-friendly planning guidelines for regional and local authorities. Yet, due to uncertainty about the fate of the scheme beyond 2012, RE-projects faced difficulties in reaching financial closure as the financial community looked unfavorably at the long-term regulatory risk.

INSUFFICIENT INFORMATION AND THE LEVEL OF THE SUBSIDY BURDEN

Due to the inability of planners to set the feed-in-tariff at the "correct" price of P1 for reaching the targeted quantity of Q1, the adopted tariff PF leads in period 1 to a producer's surplus of P0PFAD (for quantity Q1) + AFCG (for the "overshoot quantity" Q1Q1X). Compared with the TGC-option, the feed-in-tariff increases the subsidy cost of

RE by the amount of P1PFAD for quantity Q1 plus an "over-payment" of ACFG for the overshoot quantity Q1Q1X - a TGC-scheme would in period 2 have provided the quantity Q1Q1X at the lower price of P2. Overshooting (impact on market size) is one reason why feed-in-tariffs gained the reputation for being expensive; the other, associated reason, is the financial burden of the high "producer' surplus / incremental rent" which producers reap under the uniform (fixed price) feed-in-tariff scheme.

IMPACT OF TRANSACTION COSTS AND RISKS

The feed-in-tariff is ideal for investors: there is no market risk, the project can be implemented any time during the year as soon as financial closure has been secured, and the formal procedure for signing the PPA with the system operator / local utility is simple. The feed-in-tariff scheme, therefore, is capable of attracting a broader scope (small and large, professional project developers and ad-hoc project developers, utilities and IPPs) than the tender scheme. This "agent" impact is another reason for the faster expansion of the market that takes place under a feed-in-tariff: due to the larger number of investors, more projects get implemented. The tender scheme is at the opposite end: it attracts major players only. Thus, if you want to get small projects developed as well – the situation in Germany and Denmark where small stand-alone or mini-windfarms are scattered across the landscapes – the tender scheme is not the way to go.

Due to the inclusion of small players, at identical tariffs (feed-in-tariff = PPA of tender = total price for electricity under TGC), the potential size of the market developed by a feed-in-tariff scheme is larger than for the other two schemes. The assumption, usually seen in graphic analysis, that the three schemes have identical supply curves is wrong: each scheme has its own unique MC-curve. The higher market risks of the TGC-scheme increase the cost of project finance, and thereby, the RE-cost of production; whereas higher transaction costs push up the cost of production of the tender scheme. In figure 1, MC1 is the MC-curve of the feed-in-tariff scheme, while MCT represents the MC-curve for the tender scheme. The position of the two is more or less identical at the low-cost end, which are large sites located at windy locations. But the MCT-curve is steeper due to increase in transaction costs per kWh when small marginal sites are developed. Due to the higher cost of production, the least attractive sites, which are still doable under a feed-in-tariff scheme, are not commercially viable under a tender scheme. The quantity, which a tender PPA-scheme can develop, if the maximum tariff is fixed at PF, is below Q1X.

Table 1: Impact of Market Scheme on Costs of Transaction and on Risks for Investor

Type of Scheme	Transaction Costs	Investor Risk	MC-Curve
Feed-in-tariff	*Low*:	*Low*: no market risk	*Low-cost*
Tradable Green-Certificate	*Medium*: fees for TGC-dealers and brokers; costs for negotiated long-term PPA-prices or for day-	*Medium*: risk of fluctuating market prices for electricity	*Small inward-shift*

Type of Scheme	Transaction Costs	Investor Risk	MC-Curve
	to-day power pool sales	and for TGCs	*in position*
Tender	*Medium/High* for Government (organization and implementation of tender) and for investor (preparation of bidding documents and time in waiting for tender to take place)	*Medium/High*: risk that project implementation is delayed several years until tender prices have gone up	*Small initial inward-shift turning steep for marginal sites*

IMPACT OF TECHNOLOGICAL PROGRESS ON MARKET SIZE AND PRODUCER RENT

Technological progress, shown by the outward shift of the marginal cost curve MC1 to MC2 and later to MC3 in figure 1, reinforces the strong market dynamic as well as the "additional subsidy cost" of the uniform (fixed price) feed-in-tariff scheme. The increase in productivity during period 1 from MC1 to MC2 affects the three schemes as follows:

- In the *TGC-scheme*, the "green electricity" price for the mandated market Q1 is reduced to P_T and the producer surplus as well as the subsidy burden is reduced by P_1P_TDH.
- In the *tender scheme*, the marginal bid price is reduced from P_1 to P_T, while the average bid price falls below P_T, as all bid prices now fall within the P_0-P_T range.
- In the *uniform feed-in-tariff scheme*, the price paid to the producer is not changed. The decline in the cost of production makes a number of previously unviable windfarm sites commercially viable. This expands the windfarm market and leads to an *"overshooting"* beyond Q2. The *producer surplus* for Q1 is increased by the amount IHD, while the difference between the subsidy cost of the feed-in-tariff scheme and the TGC-scheme is increased by the amount P_1P_TDH.

The above mechanism explains the high price elasticity of demand for turbines witnessed in the markets using the uniform feed-in-tariff: the "explosion" of the German, Danish and Spanish markets for windenergy. Cost reductions made less attractive windsites financially viable expanding the scope (geographic location) and the size of the potential market. A costly, but productive, interaction took place between the demand side (reacting to cost decreases with a high price elasticity) and the supply side (reacting to the economies of scale generated by the increase in demand with further cost reductions). According to the premises of "learning curve theory", the level of the impressive productivity improvements / cost reductions in windenergy technology during the 1980s and 1990s would not have been attained had Spain, Germany and Denmark not applied the fixed feed-in-tariff approach.

A side effect of the higher producer surplus was an "explosion" in the prices for the lease of land for windturbines. A high share of the higher rent did not benefit windfarm

developers, but went into the pockets of land-owners and speculators, who were fast in seeing the profit opportunities created by the uniform tariff and purchased early on lease rights at low prices from owners of "windy" lands.

DECLINING SCALE FEED-IN-TARIFF: IMPACT ON PRODUCER RENT AND MARKET SIZE

Feed-in-tariffs with pre-announced declining scales each year for investments in new windfarms have two subsidy-reducing impacts: they reduce the "incremental producer rent from technological progress", and keep the annual market expansion below the level, which would be reached under a fixed feed-in-tariff.

These changes, without affecting the *cost of transaction* and *low market risk* advantages of the feed-in-tariff, reduce the producer rent and subsidy cost of the feed-in-tariff scheme down to the low levels of the tender and TGC-schemes.

Neither the "declining scale feed-in-tariff" nor the "PPA-tender" come out as a clear winner if the objective is to minimize the subsidy burden per installed MW: the feed-in-tariff minimizes the *financial cost of production* of windfarms, the PPA-tender minimizes the *producer's surplus*, and through this, the tariff and subsidy level.

That the TGC-scheme is gaining ground in the EU – as witnessed by the support given to the pilot RECS-scheme and the replacement of the NFFO in the UK by a TGC-scheme – has little to do with any superior allocative efficiency or higher cost effectiveness of the TGC-approach. It has to do with three political factors. One is the political incapability of introducing cost-effective and timely adjustments to the feed-in-tariff in the three pioneer countries, Germany, Denmark and Spain- the vested interests in the existing feed-in-tariff scheme were too strong. The other is the promotion by the EU Commission of the TGC-scheme. The Commission never liked the feed-in-tariff scheme – by reducing the amount of free competitive thermal power supply on the national markets – it limits the potential for cross-border electricity trading, the size of which is a success benchmark for the Commission's internal market policy. The third is the fact that the TGC-scheme fits better into the free-market logic of the liberalized power markets.

IMPACT OF SUPPLY SIDE CONDITIONS

The graphic analysis assumes that markets are efficient and have the ability to react instantaneously to changes in market conditions: at the end of the period, prices and quantities have settled at the expected equilibrium levels.

Markets, however, need *time to adjust*, and the *effectiveness of different schemes depends on the quality of the supply side:*

- A tender scheme operating under quasi-monopoly conditions will not generate the low prices of a fiercely contested tender.

- When there is an objective short-term scarcity of green power, prices under a TGC-scheme will hit the ceiling established by the "penalty-payment escape clause".

TYPE OF APPROACH AND DEVELOPMENT OF THE MARKET OVER TIME

Figure 2 illustrates the difference in market dynamics over time of four different market schemes: (i) uniform feed-in tariff, (ii) declining scale feed-in tariff, (iii) mandated market scheme, (implemented as a *TGC-scheme* when there are many competing retailers on the market and as a *tender scheme* when there is a single buyer on the bulk market), (iv) set-aside scheme, where a specific politically determined amount of renewable energy is purchased each year by a tender.

Market development under the *uniform feed-in-tariff* is fast, the major reason being its generous level: it must make good as well as mediocre sites commercially viable. The wind resource potential in the country is, therefore, exploited very quickly as witnessed in Denmark, where the majority of potential on-land sites have been developed. Since 2001, investment in new windfarm capacity on-land is mainly in the form of replacement of old small windturbines by large turbines.

Under the *declining scale feed-in-tariff* the development of the market is more gradual. Yet, it may be less predictable and more fluctuating than the development under a mandated market scheme.

The *mandated market scheme* imposes on electricity retailers the obligation to secure a fixed percentage of their supply from renewable energy systems. The quota grows each year until its politically fixed plateau is reached, making contracts for new investments each year a necessity. Growth in national power demand adds further demand for annual investments in renewables.

Under a *set-aside scheme*, the Government may use a fixed MW(h) quantity for new annual RE-supply, or let the contracted quantity increase steadily each year. The latter case is shown in figure 2.

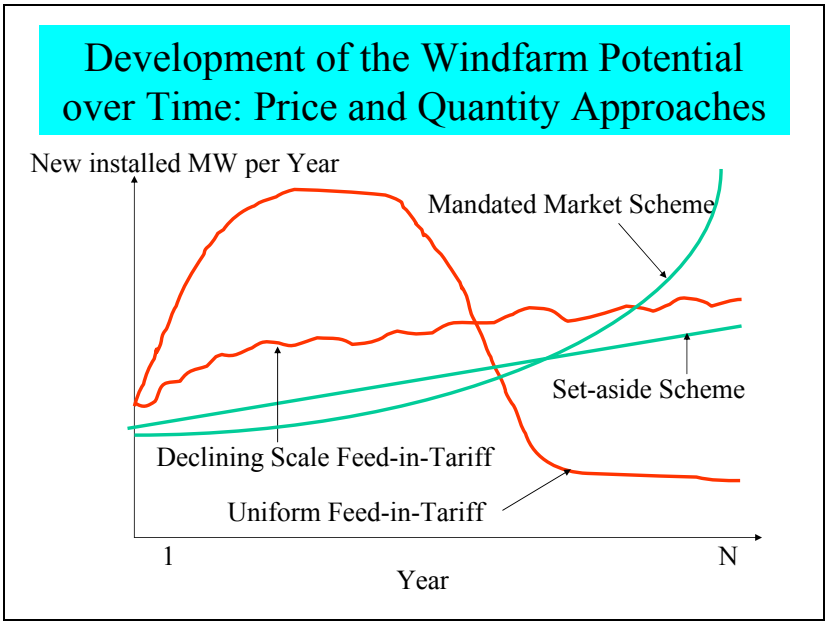


Figure 2: Market Scheme and Profile for Market Development over Time

There is no doubt that the adoption of the feed-in-tariff adopted in Germany, Spain and Germany was a major determinant for the spectacular improvements in windfarm technology during the 1980s and 1990s; none of the alternative schemes could have accelerated the technology equally fast. There are two reasons for this:

1. Ceteris paribus, a fast growing market attracts more players than a lower growing market. The scheme, in fact, provided an incredibly competitive supply side with many turbine manufacturers fiercely competing for orders.
2. The fast expansion of the *international market* for windenergy drove down the costs of windenergy, confirming the "rule of thumb" from learning curve theory that each doubling of market size for a new technology leads to a 30% reduction in unit costs.

Yet, because the contribution of the *domestic market* of a individual country to the expansion of the international market is small – with the exception of Germany, Spain, USA, Denmark and, now the UK, – an individual country can neglect the "learning-curve-effects" in manufacturing. If it believes its national industry can be internationally competitive, the national market is of less importance except for providing an initially half-protected niche for building up national manufacturing capabilities.

However, there are also drawbacks associated with being an early mover when the technology still has substantial cost reduction potential: *a fast exhaustion of the national wind resource potential for windfarms, leads to a large portion of installed capacity being high-cost. Wind turbines installed today will, not benefit from the cost reductions which technological progress brings to later investments*. Therefore, if the political target is to reach "X" MW of installed capacity by the year "Y", it pays to wait until the later years with installing a high part of that.

In addition, a rapid market development has a negative impact on the *capacity value of windfarms* - if the speed in the growth of installed windfarm capacity is faster than expected!. Windfarm capacity has a thermal power capacity replacement value only if the availability of windfarm capacity is taken into account in thermal power expansion planning. Otherwise, the impact is over-capacity in installed generation. In Denmark, for example, investments in new windfarm capacity during the 1990s had a capacity value close to zero; or, seen from a different angle: the new thermal capacity installed during the 1990s had a capacity value of zero.

ANNEX VI: FINANCIAL FRAMEWORK AND INSTRUMENTS

CAPITAL MARKET IN EGYPT

At present, the *national capital market* does not offer project financing on terms, which are internationally competitive:

- The typical private investor insists on *20%-25% after-tax rate of return on equity (RORE)*.
- Investors have to rely on *bank loans* for their debt finance. Under the best of conditions, a private investor would be offered (i) interest rate of 13%; (ii) loan maturity of 8 years; (iii) 30% equity-self-finance. Non-recourse lending is unlikely.
- The *bond market* is almost non-existent in Egypt. There are a few corporate bonds of double-A rated companies with a maximum maturity of eight years. The turn-over of bonds is very low; leading to a highly illiquid market. Attempts have been made for several years to launch 20-year bonds for housing mortgages; but so far, without success.
- The *equity market* is small. There are few listed companies and turn-over of equity is low.
- *Securitisation* is not offered in Egypt.
- *Maturities on bank loans are maximum 10 years*
- *Hedging instruments against foreign exchange risks are not offered on the market*

The absence of adequate financing condition undermines the price competitiveness of private investments in windfarms in Egypt. Without a better financing framework, the case for promoting private investments in windfarms is not strong: private project developers are unable to offer the single buyer / distribution company wind-generated electricity at attractive prices. The weakness of the capital market in Egypt is caused by a vicious circle of "no supply of bonds and equity because there is no demand, and no demand for bonds and equity because there is no supply". The proposed marketing of windfarm revenue bonds and of windfarm ownership certificates will, if successful, have *a cross-cutting importance for the economy, which goes far beyond the windfarm sector*.

The 20-25% RORE expectation of the "private investor-class" in Egypt for investing in a project is a rational position for investors in an emerging market economy. But, it is not compatible with the reality of windfarm economics if applied to a 30% equity co-financing share.

There are two main ways to reduce rate of return expectations. One is to reduce risks, the other to increase competition in supply. The proposed financing reform attempts to do both:

- The *new financing instruments lower the barriers to entry in large scale investment projects* by reducing the equity share which the project developer must come up with. This may make it possible *to attract a new class of entrepreneurs that accept a 15% after-tax-rate-of-return-on-equity for low-risk projects* ("increase in supply effect").
- Another, more realistic, expectation is that the required rate of return on equity and on long-term debt (bonds) is reduced as financial closure for long-term finance is postponed until commissioning ("construction risk eliminated"). The *passive equity investors, providing supplementary equity* up to the bank-dictated level, might *accept a 15% rate of return*, while the active investor gets a 20-25% RORE on his equity investment in project development.

The financing framework for private investment in windfarms involves four agents, as shown in figure 1.

The *active investor's* - the *project developer's* - main financial contribution is the time and money spent on project development. A larger equity portion up to the full co-financing share required by the debt-financing bank is a possibility, and, in fact, the rule when the project developer is a power utility, which invests in a windfarm as a portfolio-investment.

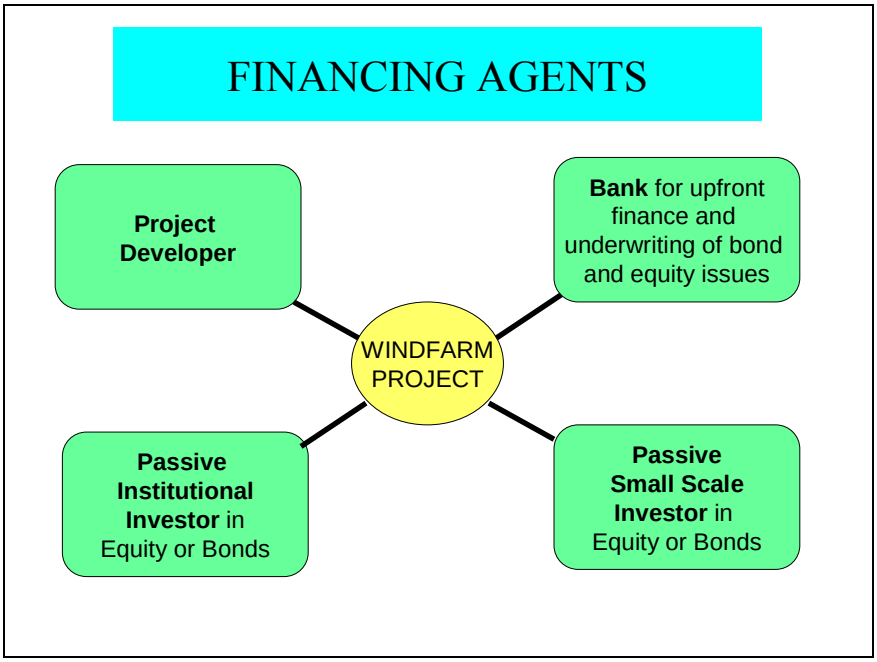


Figure 1: Financing Agents

The developer needs to ally him/herself with a *private bank* having an active interest in taking on the specialised activity of windfarm finance. To bid, the project developer must have pre-arranged finance facilities for the project. The key to win a tender for a windfarm PPA – the key success factor for project development - is to get the least-cost financing package for the project. The bank has two crucial functions in this:

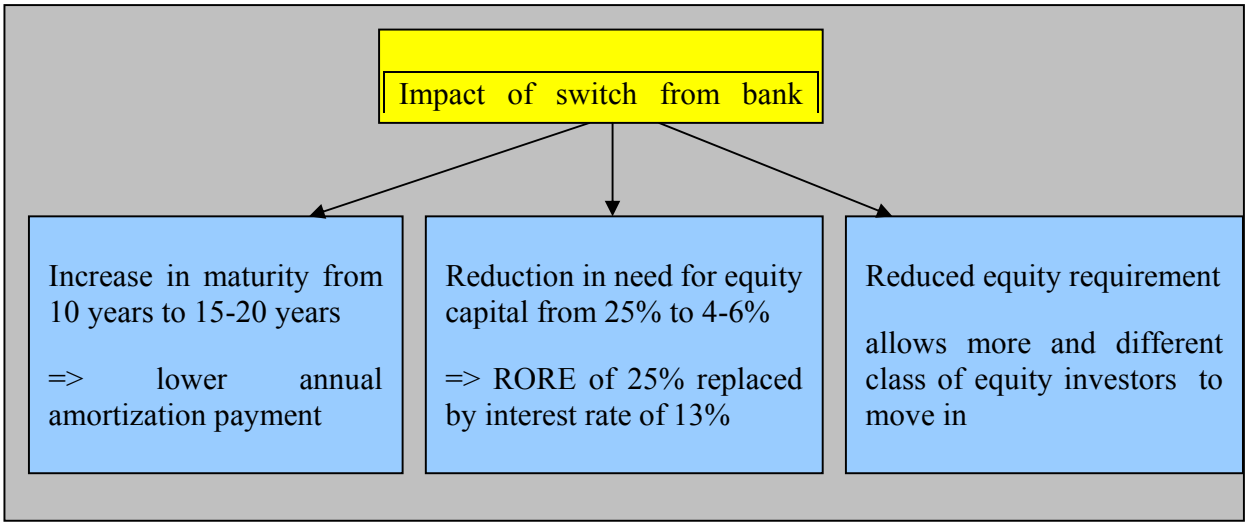
- One is to co-finance the project up to the time of commissioning. During the "non-commercial" period it will for this receive the soft credit which it on-lends to the developer.
- The other is to structure the financing package, which at decommissioning repays the soft loan. The bank would help in issuing, and possibly underwrite, the bond or equity issue for the project, or put together a syndicate of banks to provide long-term loans to the project.

The bond or equity issue is sold to the *passive investors*, either institutional investors and/or small household-investors.

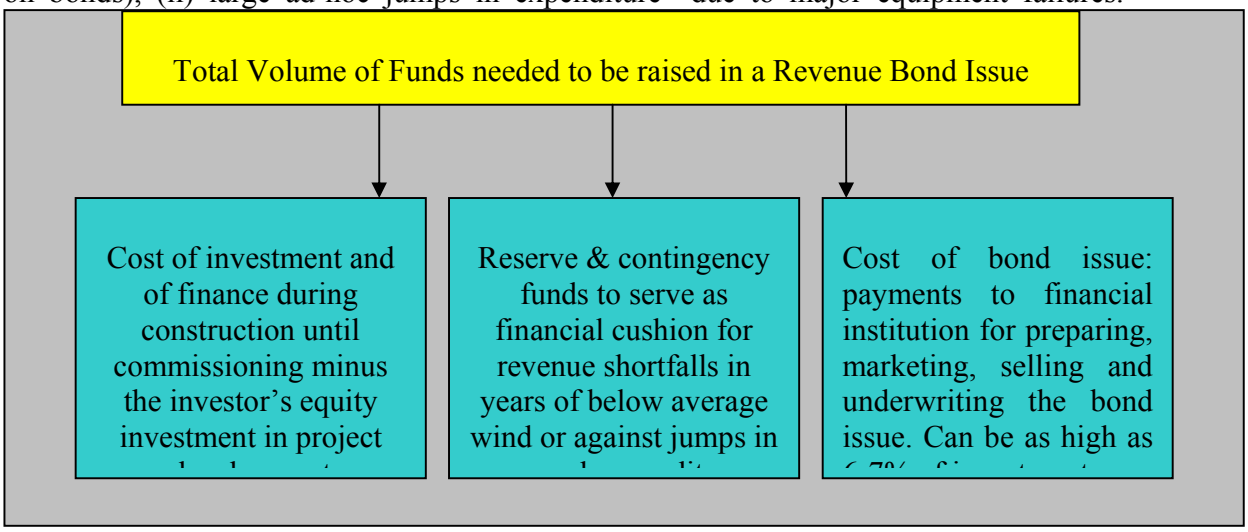
Pension funds and insurance companies are potentially interested *institutional investors*. The characteristics of windfarms - long lifetime, secure revenue flows and relatively low operating costs - match the investment profile of pension funds and insurance companies. Due to the relatively low commercial risk of windfarms, a 15% RORE on issued equity and a 10-12% rate of return on bonds may be an attractive investment option. Another target group for the marketing of windfarm equity and revenue bonds are the *small-scale passive equity investors*, middle-class households looking for safe, long-term assets to invest in. At present, term accounts in banks are the best alternative financial placement option for households. The interest rate for bank deposit is up to 9%, which in view of the 2.5% long-term inflation rate is remarkably high by international standards.

REVENUE BOND FINANCE

Private investment in windfarms is not a price-competitive option if **bank-loans** are used for debt finance. The **revenue bond** finance option has three major attractions. (i) It increases maturity of debt to 15-20 years, versus the 10 years of a bank loan. (ii) It reduces the need for expensive equity, which reduces the cost of capital: finance at 13% rate of interest replaced finance at 20-25%. (iii) By reducing the need for securing equity capital, it makes it possible for a new generation of project developers to enter the market, which brings dynamism in terms of investment volume and offers the prospect of a reduction in RORE.



The *revenue bond* differs from normal *company bonds* in having "project finance" rather than "balance sheet finance" characteristics. It is ring-fenced finance, totally linked to the revenue stream from the specific windfarm, which it finances. The equity contribution by the developer-investor is small, normally limited to the cost of project development (4-6% of cost of investment). Security for the fixed volume of annual payments is provided in the form of a cushion of reserve funds with clearly defined purposes, such as (i) protection against fluctuations in annual electricity production due to fluctuating wind regimes (safeguarding the ability to make the fixed annual payments on bonds), (ii) large ad-hoc jumps in expenditure due to major equipment failures.



The larger need for reserve and contingency funds raises the *volume of funds* to be raised by the revenue bond issue beyond the level needed in the alternative case of bank loans. The investment bank's fees for preparing, marketing and underwriting the bond issue are higher than fees for bank loans to projects. The cost of the bond issue of the investment bank underwriting the project normally amounts to 6-7% of the revenue which needs to be raised for the investment. A prudent assumption is that investors in bonds will ask for a 13% rate of return; meaning that the cost of debt capital for the bond issuer will be higher than that due to the additional costs of transaction and higher funding requirements. Yet, because it provides longer maturities than bank loans and replaces higher-cost equity capital in project funding, the bond issue reduces the cost-coverage tariff.

The tariff is still not competitive with the tariff of the soft loan option even if the elimination of the foreign exchange risk is taken into account. But it gets closer. *The modality for using "revenue-bond"* finance for windfarms is as follows:

- The windfarm developer, supported by a bank, finances initial project preparation through a mixture of bank loans and personal equity. Project development costs are 3-5% of the cost of construction, meaning that little equity is needed. Interest during construction would add an additional 4% to the EPC-contract.
- Construction is financed by a mixture of suppliers credits and short term bank loans.
- While construction takes place, the bank prepares a revenue bond issue for the investor, based on the future net revenue that is generated by the windfarm, and secured by the physical assets of the wind project and a financial buffer. The bonds are sold upon commissioning of the windfarm, replacing all debt finance.
- The windfarm developer operates the windfarm as owner.

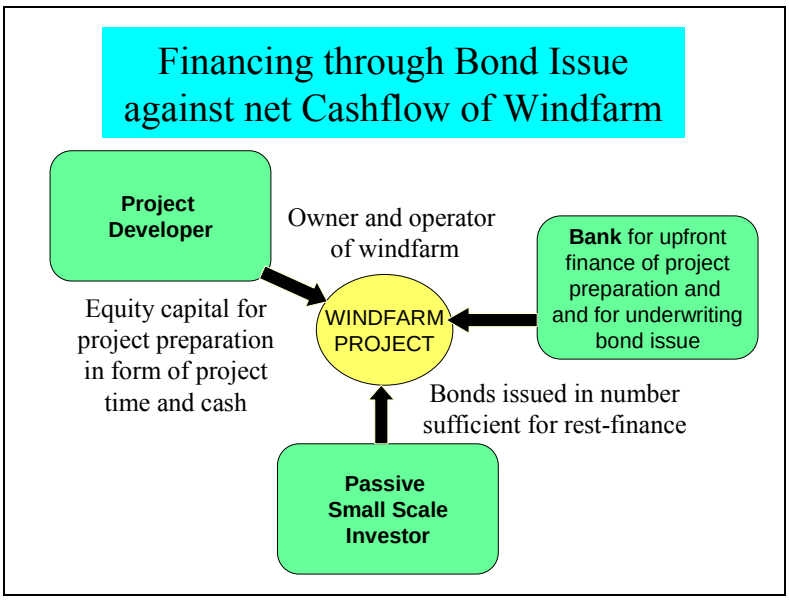


Figure 2: The Revenue Bond Financing Option

The revenue bonds are secured by various accounts established upon bond issuance. Some of these are risks prior to commercial operation (if the bond issue takes place before construction), others safeguard the ability to pay the fixed annual dividend amounts also in years with below average wind conditions. The total amount of project finance to be raised by the bond issue, is, therefore, larger than in the institutional investor model.

If market demand requires it, a series of bonds can be issued, with maturities from as early as 2 years to as late as 20 years. A real life example of a bond issue for the financing of a windfarm are the revenue bonds issued by Energy Northwest, a publicly owned utility in Washington, for a 48 MW wind project in 2001.

Table 1: Energy Northwest Bond Issue for 48 MW Windfarm. Use of Funds

	US$	In % of total
Bond Proceeds Account	53,657,708	76%
Debt Service Account	6,151,933	9%
Reserve Account	5,960,200	8%
Reserve and Contingency Account	800,000	1%
Operating Reserve Account	200,000	0.3%
Indemnity Contract Fees	2,872,356	4%
Cost of Issuance	1,041,426	1%
TOTAL	70,683,623	100%

The *Bond Proceeds Account* covers project constructions costs. The *Debt Service Account* is created to help pay off interest and principal on the bonds. The *Reserve Account* is created to provide further security to bondholders. The *Reserve and Contingency Account* is established for major capital improvements, repairs, and replacements. The *Operating Reserve Account* will initially be used to cover any O&M costs, and later used to level out costs from year to year.

The revenue from the sale of the bonds thus covers three categories of expenditure:

1. Development and construction of the wind project and related T&D and interconnection investments. (76%)
2. The build up of initial financial buffers, which represent genuine financial assets belonging to the bond holders. (19%)
3. Two "sunk cost" items of no future value for investors - the indemnity contract fee and the cost of issuance. (5%)

THE WINDFARM OWNERSHIP CERTIFICATE FORM OF PROJECT FINANCE

In "Windfarm Ownership Certificate" form of project finance, or the multiple small equity investor model, a project developer with financial assistance from a bank develops a project to bid in the tender. Having won the bid and having signed the EPC-contract with the wind-turbine supplier, a prospect for the project is published and a marketing campaign is initiated aimed at small individual investors. The capital cost of the project is divided into a large number of small individual shares or ownership certificates, and the price per share is fixed to cover the total required amount of project finance. The advertising campaign indicates, referring to the information in the prospect, the expected after-tax-dividend or rate of return on the shares; and that the windfarm developer will get a management contract for the operation and maintenance of the plant.

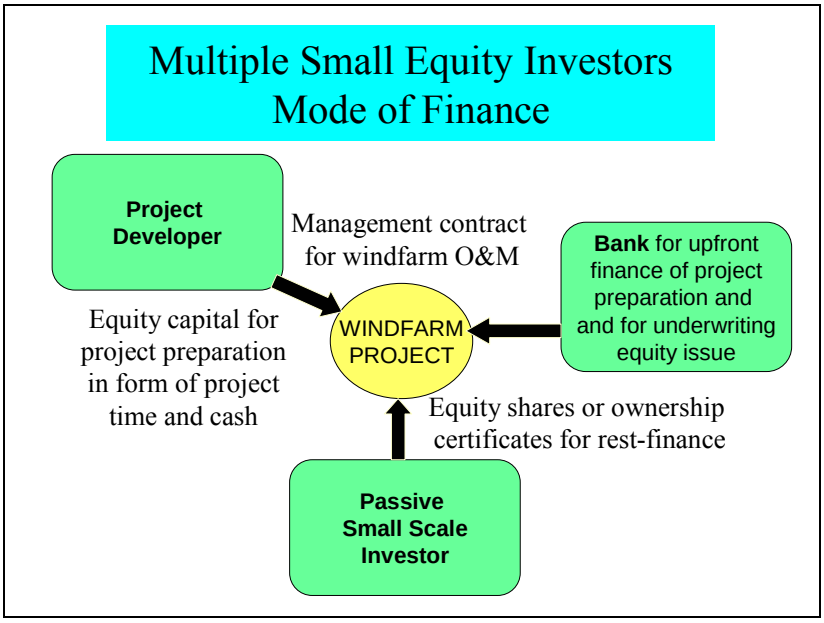


Figure 3: Mulitple Small Equity Investors Financing Model

Alternatively, the ownership certificates will be issued upon commissioning, and the project till then be financed by a combination of bank loans and supplier credits.

The project is 100% equity financed. The reason why the cost of capital is competitive despite the 100% equity share, is that small family-household investors have smaller RoE expectations than professional project investors in Egypt. For households a RORE of 10-12% may look attractive compared with alternative low-risk placements such as term bank accounts. Alternative equity investments in public companies would normally yield a higher RORE, but carry a higher risk.

FINANCING INNOVATIONS ON THE DONOR SIDE: 1-YEAR SOFT LOANS

Presently, donor soft loans are given as long-term loans. The national capital market is bypassed in the funding of windfarm investments with the result that no capacity and institution building takes place on the financing side. The national banks channelling the soft loans to investors (NREA) are simple administrators for the process of making disbursements and collecting annual amortization payments. Neither they, nor any other national financial institution have an active role to play in project finance.

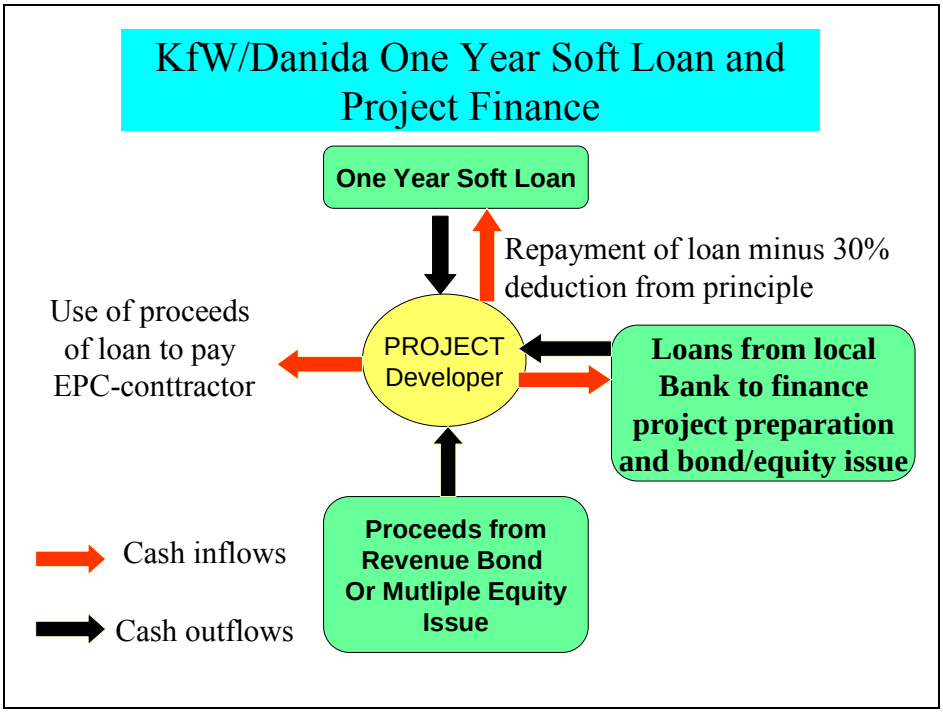


Figure 4: Scheme for making Use of One Year Soft Loans

The 35% grant element of the soft loans is essential to reduce the economic cost-benefit gap and make windfarm investments economically as well as commercially viable in Egypt. But unless the modality for the funding of windfarms is changed to actively incorporate the national capital market in providing long-term finance on commercial terms, the projects do little in terms of preparing the future. Neither on the developer side – where NREA, being financially insolvent, is not a credible commercial operator. Nor on the funding side, where Bank of Egypt onlends soft loans to NREA, although the

PPAs are written in a language, which does not guarantee sufficient revenue for debt-service-cover.

According to the so-called Helsinki agreement for the approval of OECD's Committee for soft loans (mixed credits), soft loans for low-middle income countries have a grant element of 35%.The grant element is the difference in the NPV of the amortization streams of a commercial export credit and a soft loan for the project. Borrowers can chose between a credit with a long maturity (e.g. 10-20 years) but a positive interest rate, or a loan with a shorter maturity (e.g. seven years) with a zero or negative interest rate: if a zero interest rate on a loan with a short maturity does not result in a 35% grant, a deduction is made in the principal of the loan; meaning that not all of the loan is repaid. Recalling that the objective of donors is to assist the development of a large-scale market for windenergy in Egypt, the recommendation to donors is to provide their soft credits in the form of one-year loans; to reach the 35% grant, only about 70% of the principal would be repaid.

Except for the grant element, such a soft loan has the characteristics of a traditional short-term supplier's credit, allowing project developers to finance the cost of investment until commissioning, at which time the financial closure for the domestic long-term finance must be in place. At commissioning all costs of project preparation and construction are known, and the windfarm is operating. This reduces the risk for domestic financiers and facilitates financial closure. For donors, the proposed one-year soft loan would be a new financial product in their portfolio – maturities of present Danida, KfW, Spanish and Japanese soft loans range from 7 years to 30 years.

The introduction of the one-year loan may not be politically and practically feasible for donors as two hurdles would have to be overcome. (i) One is a *change in thinking or self-perception of the organisations providing the soft-loans*. Their function has been to give long-term loans at concessional rates to capital-intensive projects in countries, where it is difficult or impossible to raise long-term loans on the national capital market. The idea of giving one-year loans as part of a longer-term strategy to strengthen the capital market in the recipient country, means moving into a TA-area, which more naturally belongs to the realm of their colleagues in the bilateral development aid departments. (ii) The introduction of the one-year loan requires a *change in the formal mandate of the organisation* – not necessarily of the statutes (that would be impossible) but a formal approval by the Board to engage in such kinds of activities.

DEVELOPING RE PROJECTS AS CDM-PROJECTS

Egypt has ratified the Kyoto Protocol and will, in accordance with the Marrakech accords set-up a Designated National Authority (DNA) for the national approval of CDM-projects. Once the DNA is in place, new windfarm projects in Egypt can be submitted as CDM-projects to the DNA with request for approval. To be approved as a CDM-project by the CDM-Board, the project must fulfil the additionality criterion: that the project cannot be implemented without the CER-revenue. This criterion is certain to be fulfilled if ERA, as a matter of pricing principle, fixes the PPA-tariff at the avoided cost of

thermal power production. Because then even with soft loan-finance, windfarms will not for many years be commercially viable without CER-revenue.

CDM project developers can chose between: (i) a crediting period for a maximum of seven years, which may be renewed at most two times or (ii) a maximum crediting period of ten years with no option for renewal. For wind farm projects the obvious choice of crediting period is three times seven years. Although it is not 100% clear at project start how many emissions per kWh can be claimed during the second and third periods, as the baseline is reconsidered after each seven years, the long term power expansion plan of EEHC provides good guidance.

At an assumed price of about US$10/ton CO_2 in 2006, the emissions of 0.50 kg CO_2/kWh give a *CO_2-revenue of 3 piaster/kWh*. The payment falls each year, due to improved thermal power plant efficiency. In 2024, the average emission in steam turbine plants of 0.43 kg/CO_2 triggers a payment of 2.5 Piaster/kWh.

The Kyoto Protocol states that *public funding of a project should not result in a diversion of ODA (Official Development Assistance) from Annex-1 parties*. Any funding for the CDM is to be additional to- and not substituting for funds flowing from Annex 1 countries. This suggests that Certified Emission Reductions cannot be earned in a case of such a diversion of ODA. A letter from the government stating that the funds are not being diverted form other sources must certify that this is the case and the *CDM-Board* as final approval authority must accept that the additionality criterion is fulfilled.

A crucial question for donors, therefore, is whether it is possible to *give soft loans to CDM-projects and still get the grant element approved as ODA by DAC* (Development Assistance Committee) at the OCED in Paris. Some experts have interpreted the non-diversion clause to mean that ODA funds cannot be used to co-finance the cost of investment in a CDM project. ODA-funds may, however, be used for CDM capacity building, technology transfer or other activities not directly related to project implementation. This is too hard an interpretation, and short of logic.

- Donors have for many years used ODA-funds to support renewable energy projects in developing countries. Egypt has for several years received mixed credits from Denmark and Germany for windenergy projects. Being the continuation of a long tradition of soft-credit funding, the financing of CDM-windfarm projects in Egypt by Spanish, Japanese, German and Danish sot loans does not represent a diversion of ODA-money.
- Allowing traditionally ODA-financed projects to be eligible as CDM-projects reduces the amount of ODA-funding, needed to make the projects commercially viable. ODA-funds are saved that can be used for other purposes. Disallowing a "classical ODA-financed" type of projects to be accepted as CDM-project, instead, imposes a diversion of ODA-funds, as additional ODA-money must be channelled to the project to cover the revenue shortfall!

As long as there is a clear separation between the co-funding of a windfarm project by a soft loan (giving no entitlement to the project-CERs), and the purchase of the CERs by

another party under separate contract with the developer, it may be possible to comply with the non-diversion criterion.

ANNEX VII: DETAILS OF 84 SURVEYED RE COMPANIES

A- SOLAR ENERGY

1- Company: Misr America Group for Investments- Eng. Philip Fayez & Co.:
Activities: solar water heating systems, solar pool heating systems, photovoltaic systems, solar cooking systems.
Contact: El Salam City, Cairo- Industrial Zone Tel: 2817448, Admin: 215, El Hegaz St. Holioplis, Tel: 6799373, 6233996, 6233960 Fax: 6306008 office Hours: Mon-Sat 9:00-16:30 hrs

2- Company: Egyptian Solar Energy Systems Company (ESESC)
Activities: Manufacturers and installs solar water heating systems, solar water heating components.
Contact: 11 El Gamaa St. TelFax: 5737813, Office Hours: Sun-Thu 9:00-17:00 hrs

3- Company: Solar Energy Solutions Or Solar Energy and Environment Technology Company (SE)
Activities: solar water heating systems, solar cooking systems, photovoltaic systems, wind energy systems (small), biomass energy systems.
Contact: 9A 275 St., New Maadi - Cairo – Egypt, Tel. : +202 517 0485
Tel./Fax : +202 517 0486
info@solaregypt.com, http://www.solaregypt.com

4- Company: Lotus Solar
Activities: solar energy systems for heating water (domestic, swimming pools & industrial), steam generation and lighting. Wind energy system components (small).
Contact: Shorook City, Heliopolis, Cairo Egypt 11837
Telephone: +20-2-687 1913 / +20-10-148 0370, FAX: +20-2-290 8917
E-mail: Lotussolar@menanet.net
http://www.jxj.com/suppands/renenerg/search.ph

5- Company: City Pulse - Trade & Marketing
Activities: solar electric power systems, solar garden lights, solar outdoor lighting systems, solar pool heating systems, solar water heating systems, solar water pumping systems, Solar Street Lights, Military Solar Applications, Aviation & Marine Solar Applications.
Contact: 20, Rd.# 213 Degla, Maadi, Cairo, EG Egypt
Telephone: 202-521-2078 / 9 , FAX: 202-521-2076
-http://www.jxj.com/suppands/cogendb/companies/129215.html

6- Company: Helwan Metal Appliances/Factory 360
Activities: Metallic components for mines. Civilian products: Gas rings, gas ovens, solar water heaters, refrigerators, freezers, air conditioners.
Contact: Helwan, Cairo, P.O.Box:11726 –Ein Helwan Tel:5556822/5552561,Telefax: 5552548,Telex: 92737 hmtco un – Admin: Cairo, 23 Talaat Harb St. Down Town, Tel: 3921738/3924158,Fax: 3924158, Office Hours: Sat-Thu 8:00-15:00 hrs.
-http://www.fas.org/nuke/guide/egypt/facility/hulwan-360.htm
-http://www.fas.org/nuke/guide/egypt/facility/mark0033.htm

7- Company: United Company for Light Industries -PILCO
Activities: Supplies solar system.
Contact: Eng. Galal Maamoun, 2 Suliman Abaza, Mohandeseen, Giza.,
Tel. 20-2-3617060
Email: fimco@link.com.eg

B- WIND ENERGY

8- Company: Technological & Electrical Systems Co. T.E.S.
Activities: wind energy towers and structures (large), water storage tanks, heat exchangers, wind energy towers and structures (small).
Contact: 31-Shak ElSoban Street, Industrial Zone Torah, Cairo, Egypt
Telephone: 002-02-7541531
-http://www.manta.com/coms2/dnbcompany_z9wfjp

9- Company: I.M.F
Activities: Whole supplies, installation and maintenance of PV modules, and large-scale wind energy systems.
Contact: 17 A Yehia Ibrahim St., Zamalek, Cairo, Tel. + 20 –2-7369239,
Fax: 20-2-7354346
Web Site: www.imfgroupegypt.com

10- Company: Solar Energy Solutions Or Solar Energy and Environment Technology Company (SE)
Activities: solar water heating systems, solar cooking systems, photovoltaic systems, wind energy systems (small), biomass energy systems.
Contact: 9A 275 St., New Maadi - Cairo – Egypt, Tel. : +202 517 0485
Tel./Fax : +202 517 0486
info@solaregypt.com, Web Site:http://www.solaregypt.com

11- Company: Lotus Solar
Activities: solar energy systems for heating water (domestic, swimming pools & industrial), steam generation and lighting. Wind energy system components (small).
Contact: Shorook City, Heliopolis, Cairo Egypt 11837

Telephone: +20-2-687 1913 / +20-10-148 0370, FAX: +20-2-290 8917
E-mail: Lotussolar@menanet.net
http://www.jxj.com/suppands/renenerg/search.ph

12- Company: TUV Hessen (Egypt)
Activities: water pumps, gas turbine electric generators, wind energy system components (large), water filtering and purification system components, meters and measuring equipment, hybrid power systems.
Contact: 20 El Montazah St., El Zamalek , Cairo, Egypt, Telephone: +(202)7364979 , FAX: +(202)7351031.

13- Company: Industrial Engineering Co., ICON
Activities: The company manufactured the bed-plate, the big machinery foundation in the nacelle of the wind turbine, for the 100 KW model by help of drawings supplied by NREA.
-Metallic Scaffolding & Formwork
-Steel Shelving & Racking
-Heavy & Light Steel Structured
Contact: Wady Houf, Helwan, Cairo, EGYPT.
Telephone: (202) 369-0616 / 369-9976 / 369-0739 / 369- 5700 / 370-6651
Fax: (202) 369-5260
Email: info@acrowmisr.com, Web Site: http://www.acrowmisr.com

14- Company: Minar Engineering Co.
Activities: Supplies and installs solar electric power systems, photovoltaic systems, photovoltaic modules, wind energy systems (small), wind turbines (small), renewable energy system batteries.
Contact: 5 Ahmed Abdel Ghafaar St., Heliopolis West, Cairo.
Tel.& Fax + 20-2-2467261.

C- PHOTOVOLTAIC SYSTEMS

15- Company: IGSR Solar Cells Laboratory, Alexandria University
Activities: Fabrication and assembling photovoltaic cells and modules, photovoltaic energy system.
Contact: 163 Horrya Avenue, P.O.Box 832, Alexandria, Egypt, Tel. + 20 3-5565272, Fax. + 20 3-429624

16- Company: Arabian Solar Energy & Technology Co. (ASET)
Activities: photovoltaic modules (PV modules), nickel cadmium batteries, telecommunication batteries.
Contact: Down Town, Cairo- 11 Sherif St. 6th floor, Tel: 3936463

Telefax: 3929744, Office Hours: Sun-Thu 9:00-17:00 hrs, Mr. Mustafa Ebeed
Emails: Aset@asetegypt.com, www.asetegypt.com

17- Company: BIC for Electronics Environment and Energy
Activities: Manufacturer of PV modules: Design, installation and maintenance of PV System, Solar Powered Hut, Trailer Photovoltaic Generator (PHOTOGENIC), Solar Lighting Pole, Telecommunications, Solar Powered Pumping, Solar Lighting Billboard.
Contact: 11522 Down Town, Cairo, 9 Marouf St. Tel: 5798334, Telefax: 5790744, Office Hours: Sat-Thu 9:00-16:00 hrs.
E-mail: BIC@bicegypt.com, Web Site: http://www.bicegypt.com

18- Company: Minar Engineering Co.
Activities: Supplies and installs solar electric power systems, photovoltaic systems, photovoltaic modules, wind energy systems (small), wind turbines (small),renewable energy system batteries.
Contact: 5 Ahmed Abdel Ghafaar St., Heliopolis West, Cairo.
Tel.& Fax + 20-2-2467261

19- Company: I.M.F
Activities: Whole supplies, installation and maintenance of PV modules, and large-scale wind energy systems.
Contact: 17 A Yehia Ibrahim St., Zamalek, Cairo, Tel. + 20 –2-7369239, Fax: 20-2-7354346
Web Site: www.imfgroupegypt.com

20- Company: Middle East Engineering & Telecommunications (MEET)
Activities: photovoltaic systems, photovoltaic modules, DC to AC power inverters, deep cycle batteries, lead acid batteries, DC lighting.
Contact: 16 Anwar EL-Moufty St. (16 Emad EL-Deen Kamel), Nasr City, Cairo Egypt, Telephone: +2022638123, FAX: +2024016849
Web Site: http://www.MEET-Egypt.com

21- Company: Solenco
Activities: Supplies and installs PV modules
Contact: Down Town, Cairo- 17 Kasr El-Nile St. Tel: 3937678 Telefax: 3939362, Admin: Alex, 281 El-Horreya St. Tel:03-4230607,Fax:03-4244200,Office Hours: Sun-Thu 9:00-17:00 hrs.

22- Company: TUV Hessen (Egypt)
Activities: water pumps, gas turbine electric generators, wind energy system components (large), water filtering and purification system components, meters and measuring equipment, hybrid power systems.

Inspects and certifies PV pumps, generators, PV modules, and hybrid power systems.
Contact: 20 El Montazah St., El Zamalek , Cairo, Egypt
Telephone: +(202)7364979, FAX: +(202)7351031.

23- Company: Misr America Group for Investments- Eng. Philip Fayez & Co.:
Activities: solar water heating systems, solar pool heating systems, photovoltaic systems, solar cooking systems.
Contact: El Salam City, Cairo- Industrial Zone Tel: 2817448, Admin: 215, El Hegaz St. Holioplis, Tel: 6799373 Fax: 6306008 office Hours: Mon-Sat 9:00-16:30 hrs.

24- Company: Solar Energy Solutions Or Solar Energy and Environment Technology Company (SE)
Activities: solar water heating systems, solar cooking systems, photovoltaic systems, wind energy systems (small), biomass energy systems.
System components

-A set of 72 PV modules (75 Watt each).
-A wind generator (1000 Watt).
-An Inverter (DC/AC 50 Hz).
-Two control units.
-Measurement instruments

Contact: 9A 275 St., New Maadi - Cairo – Egypt, Tel. : +202 517 0485
Tel./Fax : +202 517 0486
info@solaregypt.com, Web Site: http://www.solaregypt.com

D- BIOMASS UNITS

25- Company: Arab International Environmental Service (Enviro-Pro)
Activities: Environmental consulting office: energy, water, wastewater, air, training projects.
Biomass, Bio-fuels and Energy from Waste, Equipment, Boilers, Heat Recovery, Services, Product sourcing, Photovoltaics, Applications, Rural electrification, Solar Thermal, Services, Suppliers of equipment and components
Wind Energy, Applications, Grid-connected systems.
Contact: 7 Road 6 Maadi, Cairo 11431, +20 2 359 8588, +20 2 378 2185,
Eng Kamal El Badry, E-mail: envirpro@link.net
http://www.jxj.com/suppands/renenerg/search.php

26- Company: Solar Energy Solutions Or Solar Energy and Environment Technology Company (SE)
Activities: solar water heating systems, solar cooking systems, photovoltaic systems, wind energy systems (small), biomass energy systems.
Contact: 9A 275 St., New Maadi - Cairo – Egypt, Tel. : +202 517 0485

Tel./Fax : +202 517 0486
E-mail: info@solaregypt.com, Web Site: http://www.solaregypt.com

E- COMMERCIAL AGENCIES FOR RE EQUIPMENT

27- Company: Vekla Abees
Activities: Under the regulations and distributor of solar energy equipment
Contact: The Second Indus. Area, Asadat City, Al-Monofya, Tel:0493496833, Fax: 046723662
Mr.: Mohamed Abdel Azez Afefe

28- Company: The Arabian Office for Trading
Activities: Under the regulations and distributor of solar energy equipment
Contact: 11 Mereat St., AL-Tahreer Sq., Cairo, Tel: 025742190, 025744630,
Mr.: Ahmed Atef Abdel Rahman

29- Company: Egypt 2000
Activities: Agencies commercial systems and solar energy equipment
Contact: 6 Al-Alfe St., Midtown, Cairo,Tel: 023936463/025743975, Fax: 023929744
Mr.: Ahmed Shalabe

30- Company: Comag for Engineering
Activities: Agencies commercial systems and solar energy equipment
Contact: 4 Hessan Ahmed Rashad St., Mosadak St., AlGiza
Tel: 02709476,023607458, Fax: 023603490
Mr.: Shawke Shokre Yousef

31- Company: Nesco Union
Activities: Agencies commercial systems and solar energy equipment
Contact: 68 Makram Abad St., Naser City, Tel: 022606023, Fax: 02261015
Mr.: Mahmoud Ahmed Al-Gonde

F- OTHER RELATED COMPANIES

32- Company: Military Factories, Ministry Of Military Production, Egypt
Activities: Military goods produced in Egypt include: Small caliber and heavy ammunition, mortars, mines, grenades and other explosives, antitank rockets, rocket mortars, radars and other electronic equipment, rifles, pistols, smoke and pyrotechnic devices, machine guns, training aircraft including jet aircraft and helicopters, armored vehicles, armored personnel carriers, alpha jet engines, communications equipment,

aircraft communications equipment, gyroscopes, tanks, weapon sights, binoculars, periscopes, and some infrared night vision binoculars, ships, and periscopes.
Contact: 5 Ismail Abaza Street, Dareeh Saad, Cairo, Tel: 2-02-594-1589 & Fax: 20-2-594-1614
-http://www.fas.org/nuke/guide/egypt/agency/mmp.htm
-http://isccnet.iscc.gov.eg/all.htm.htm

33- Company: Egyptian Iron & Steal Company, EISCO
Activities: The company produces semi finished steal products, hot rolled plates and sections, rail and cold sections
Contact: Helwan, Cairo, P.O.Box:746, El-Tebbin, South Helwan, Tel:5011599/5011624.Telefax: 5011608, Branch(s):Cairo, 54,65 Abd ElKhalek Sarwat, Down Town. Tel:3916220/3900622.Fax: 3913526, Office Hours: Sat-Thu 8:00-16:00 hrs, E-mails: ironstl@micor.com.eg, eisc@idsc.net.eg
Web Site: http://www.metalco.com.eg/welcome501.htm

34- Company: Industrial Engineering Co., ICON
Activities: The Company manufactured the bed-plate, the big machinery foundation in the nacelle of the wind turbine, for the 100 KW model by help of drawings supplied by NREA.

Metallic Scaffolding & Formwork
Steel Shelving & Racking
Heavy & Light Steel Structured

Contact: Wady Houf, Helwan, Cairo, EGYPT.
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Fax: (202) 369-5260
Email: info@acrowmisr.com, Web Site: http://www.acrowmisr.com

35- Company: International metal - IMCO Egypt
Activities: Implies importing equipments, accessories, spare parts & complete kits from reputable international brand names and assembling them to cover all our customers needs towards all types of hydro-mechanical utility vehicles & equipments
Contact: 30 Mo'ahda St, Tanta City, Al-Gharbia Governorate, Egypt, Postal Code : 31211, Tel/Fax : +2 040 3354313 / +2 040 3420229,
E-mail : customersupport@imcoegypt.com, Web Site: Imcoegypt.com

36- Company: EI Nasr Castings Co.
Activities: The company is specialized in, casting of steel parts, it is under the same umbrella as is EISCO. The cast steel of wind turbines, such as hub and extenders, could be manufactured by the company.
Contact: Embaba, Giza, Tanash,Tel:02-8510035/8510036,Telefax: 02-8510039, Admin: Cairo,10 El-Kamel Mohamed St. Zamalek, Expected Change in Tel Starting 341 to 736, Tel: 3414172/5060000,Fax: 5063184/3418093, Branch(s): Alex. 34 El-Mahmodia Canal St. Moharam Bey, Tel: 03-4939156/4918728, Factory: Alex., Iron and Steel Rd, Om Zeghio , in Front of Talaat Moustafa, Tel: 03-4306682/4306683/4306679, Office Hours: Sat-Thu 8:00-15:00 hrs.

37- Company: Helwan Machine Tool Co., MF999
Activities: This military factory is affiliated with the Ministry of Military Production. Military products include mortars and rocket launchers. Civilian products include lathes, drilling machines, grinders, wood sawing machines, shapers, milling machines, automatic and semi-automatic bakery lines, agricultural machinery and equipment.
Contact: Helwan, Cairo, P.O.Box:11726 –Ein Helwan-Tel:5556822/5552561,Telefax: 5552548,Telex: 92737 hmtco un – Admin: Cairo, 23 Talaat Harb St. Down Town, Tel: 3921738/3924158,Fax: 3924158, Office Hours: Sat-Thu 8:00-15:00 hrs.
-http://www.fas.org/nuke/guide/egypt/facility/hulwan-999.htm

38- Company: The Egyptian company for Metallic Construction (METALCO)
Activities: Our Company has rarely engineering experiences, which can perform all the strategically projects in the field of steel structures.
Our company has machines and equipment with high technology as cutting, drilling and marking line with computer numerical control for fabricating the electric transmission towers.
we have as special factory for galvanizing the tower angles and all steel structures.
Contact: Delegate of Management of Steel Co., Eng. Abdallah Abdel Aziz El-Sayed, Tel: +(202) 3934337, Fax: +(202) 3937008
Chief of Technical Sector, Eng. M. Salah El-Din El-Abd, Tel: +(202) 3934566, Fax: +(202) 3909800.
Web Site: http://www.metalco.com.eg

39- Company: Benha Company for Electric Industries, MF 144
Activities: The company is qualified in electronic systems and it is capable for manufacture of control systems of WT under license with a foreign company.
Contact: Benha, Kaliubeya, P.O.Box:865 Cairo, El Ashraf St. – Tel: 13-325914/32289, Telefax: 13-323227/224237, Telex: 92360 katel un – Branch(s): Cairo, 7 Tahrir Sq, Down Town. Tel: 5770436/5757413- Office Hours: Sat-Thu 8:00-15:00 hrs.

40- Company: Aircraft Factory & Aircraft Engine Factory
Activities: Military goods produced in Egypt include training aircraft including jet aircraft and helicopters, armored vehicles, armored personnel carriers, alpha jet engines, communications equipment, aircraft communications equipment.
Contact: Helwan Elhammamat – Helwan, P.O Box: 11722 Helwan – Cairo, Tel: 025560114, 025560119, Fax: 025553946, 025562408
E-mail: acf.marketing@aoi.com.eg
http://www.aoi.com.eg/aoi_arab/contact_us/contact.htm

41- Company: Abu Zaabal Engineering Industries, MF 1OO
Activities: This military factory is affiliated with the products include explosives powder, industrial explosives, and dynamite. This facility produces automatic guns and artillery pieces up to 203mm caliber. Projects include the 23mm Nile 23 and Sinai 23 air-defense gun vehicle, and manufacture of 105mm guns for upgrading T-55 tanks. It also produces

the Ramadan 23 indigenous 23mm weapon system , which combines a pair of ZU 23mm fire units with a Contrives Gun King laser/computer firing system. Civilian products include paints, inks, varnish, beauty products, potassium chlorate, and anesthetic ether.
Contact: Abu Zaabal, Kaliubeya, P.O.Box:5888 - Abu Zaabal-Tel:4691208/4691209.Telefax: 4691228/4620872, Office Hours: Sat-Thu 8:00-15:00 hrs.
-http://www.fas.org/nuke/guide/egypt/facility/abu-zaabal-100.htm
-http://www.nti.org/e_research/profiles/Egypt/3426_3446.html

42- Company: El Nasr Steel Pipes and Fittings Company
Activities: The company produces steel pipes which are used for tower manufacture.
Contact: Helwan, Cairo, P.O.Box:6 Helwan –Ein Helwan, Hammamat Helwan-Tel:5553687/5553689,Telefax: 5553683,Telex: 92590 un – Admin: Cairo, 17 Gomhoureya St. Down Town, Tel: 3918387/3915229, Fax: 3915229, Office Hours: Sat-Wed 7:00-15:00 hrs.
Web Site: http://www.metalco.com.eg/welcome05.htm

43- Company: Shubra Company for Engineering Industries, MF27
Activities: The company produces electric motors (up to 18.5 KW under license. The company could also import large motors aiming' at future license production.
Contact: Shubra, Cairo. P.O.Box: 11241 Magd El-Islam- Teraat ElIsmailia, Behind North Cairo Power Station, Tel: 4267709/4267712/4267710, Telefax: 4267710, Telex 93338 macy un, Office Hours: Sat-Wed 7:30-15:30 hrs.

44- Company: Orascom Construction Industries
Activities: As a contractor, we provide engineering, procurement and construction services on industrial, commercial and infrastructure projects for public and private customers primarily in the Middle East, North Africa and Central Asia.
Contact: Mohandessin, Giza, P.O.Box:1911, 160,26th July St. Agouza, Tel:3026930, Telefax: 3030506/3440201, Office Hours: Sun-Thu 9:00-17:00 hrs.
Web Site: http://www.orascomci.com

45- Company: Arabian Organization for Industry (AOI)
Activities: Have 12 different factories and can produce many components in the field of renewable energy (mechanical, electrical, ……. parts)
Contact: 2D AlAbassya Sq. – Cairo, P.O Box: 770/11511 Cairo, Tel:024823377, 025932822, Fax: 024826010, 024012583.
Web Site: http://www.aoi.com.eg/

46- Company: The Port Said Engineering Works
Activities: Ship Building, Steel Structure, Off-Shore Structure, Pipe Lines, Ship Repair, High Way Bridges, Water & Sewage Treatment Plants, Pumping Station, GRP Products and Petroleum Tanks.
Contact: 10th Ramadan, Sharkeya,3nd Zone A1, Plot lva, El-Shadid Salah Hawash St.,Tel:15-410441/410854, Telefax: 15-410711, Admin: Port Said, Gomrok Gate No.56, Port Fouad, Tel: 66-400846/349711,Fax: 66-400845, Office Hours: Sat-Thu 8:00-15:00 hrs.

Web Site: http://www.psew.com.eg

47- Company: El Nasr Transformers And Electrical Products (Elmaco)
Activities: Transformers and electric components
Contact: MR. Mohamed El Gharbawy, 3 kablat st. matareya, Cairo,

48 - Company: PETROJET
Activities: Contracting works for sector of industry & petrol, in construction fields – pipelines (row materials - gas-products) – building of refineries, petrochemicals & gas labs – Industrial Buildings - pipes covering- Static equipment manufacturing –navy platforms – welding works – Engineering inspecting works.
Contact: Heliopolis, Cairo, P.O.Box:2048 Horreya, Heliopolis- Joseph Bross Tito St. Highkestep Road- Tel: 2969339,2961213,Telefax: 2969525/2969347, Telex: 92492/20343 petrt un- Branch(s): Cairo, El-Ein El-Sokhnaa Rd, El-Qatamia, Tel:7587751/758688,Fax:7578677, Office Hours: Sun-Thu 7:30-15:00 hrs. http://www.oilegypt.com and http://www.amcham.org.eg/Membership

49- Company: Ferrometalco
Activities: Tank, Pressure Vessels, Structural Steel Work, Pipe Works, Heat Exchangers, Spare Parts, Heavy Weldments & Machining, Construction Works
Contact: Cairo, Ismailia Road, Cairo, P.O.Box:9024 Nasr City- Ind. Zone, Beginning of Cairo/Ismailia Rd, Ind. Zone- Tel: 2978284/2978975.Telefax: 2978143-
Office Hours: Sun-Thu 7:30-16:30 hrs
E-mail: dsdeg@tedata.net.eg_/ Web Site: http://www.ferrometalco.com/index.htm

50- Company: Suez Ship Yard, (S.S.Y)
Activities: Ship Production
Contact: Suez, Ismailia Road. Suez- Km 3 Suez/Ismailia Desert Rd. Tel: 62-564449/577572,Telefax: 62-577573- Factory: Kaliubeya: Shoubra El-Kheima, Front of El-Moahda Bridg ,Mostorod, Tel: 2200814, Fax: 2203139, Office Hours: Sat-Thu 8:00-15:00 hrs..

51- Company: ACETO Industry
Activists: Procurement & Supply, Engineering & Manufacturing, Installation, Commissioning & Start up, Turn Key Projects.
Contact: Sadat City, Beheira,-1St Ind. Zone, Plot 48,Tel:49-603975/600064,Telex:22596 un, E-mail:aceto@link.eg.com,- Admin: Giza, 25 Gaber Ibn Hayan St., Dokki, Expected Change in Tel Starting 348 to 748, Tel:3601457/3480843/3358032, Fax:3497910/3493810,P.O.Box: 593 Cairo, Office Hours: Sat-Thu 8:30-17:00 hrs.
Web Site: http://www.aceto-industries.com

52- Company: Egytrafo engineering establishment for elect. Industries
Activities: Transformers, Nickel - Cadmium Pocket Plate Batteries.
Contact: Head office: 7 EL-Shaheed Ibrahim Salem st. Koliet El Banat, Heliopolis, Cairo. Factory: Badr City- Site 4-33B. Tel: 002-02-4174921\2.Fax: 002-02-4151197
Mails: technical@egytrafo.com, a.moniem@egytrafo.com

Web Site:http://www.egytrafo.com

53- Company: General technical projects Co. "TEPCO"
Activities: Low & Medium Voltage, Switchboards Manufacturer.
Contact: 11Ahmed ElShatoury St, .Dokky – Giza – EGYPT
Tel: +20 (2) 7607972 ,+20 (2) 3374555,Fax:+20 (2) 7605148
Sales.egypt@tepcoegypt.com - Web Site: http://www.tepco.com.eg

54- Company: Fewotck Egyptian micro electronics
Activities: FUTEK was founded in 2003 under the special investment law to manufacture the highest quality products for energy conservation use such as : Electronic ballasts for fluorescent lamps T12~ T8 and T5 ~ T 4 . Electronic transformers , Energy Saving Lamps , Energy management controllers and Power factor correction units
Contact: Sadat City, Beheira- Ind. Zone, Part 13/5/6 – Tel: 49-600392/604200, Admin: Cairo, 3 Michel Lutfallah St., Zamalek, Expected Change in Tel Starting 340 to 735,Tel: 3400228,3400242,3323264, Fax:3400059/3400051, P.O.Box:114 Zamalek, Postal code: 11211- Office Hours: Sun-Thu 9:00-19:00 hrs.
E-mails: sales@futeklighting.com, Info@futeklighting.com
Web Site**:** http://www.futeklighting.com

55- Company: ABB Transformers Co.
Activities: Control Systems, Force Measurement, High Voltage Products, Instrumentation and Analytical , Transformers, Water Utility Products, Turbocharging, Power Generation Products
Contact: 10th of Ramadan, Sharkeya – Ind. Zone B 3, Tel: 15-376645, Telefax: 15-376645, Admin: Cairo, 7 Dr. Mohamed Kamel Hussein St., El-Nozha El-Gedida, Heliopolis, Tel: 2988155/2940199, Fax: 2940198,P.O.Box: 5040 Heliopolis, West Postal Code:11771- Office Hours: Sun-Thu 9:00-17:00 hrs.
Web Site: http://www.eg.abb.com/

56- Company: Tawakol Electrical Establishment/Gila
Activities: Agent; importer & distributor of electric equipment (switches; u.p.s; telephone; pulsar; fire a farm; batteries & panels; transformers. Commercial agencies for U.P.S; contractors; telephone exchange; stabilizer; transformers; panels.
Contact: Down Town,Cairo, P.o. Box 34333; 26th July 51.Tel: +20-2-5784004(10 lines),Telefax: +20-2-5771766,E-Mail: gila@link.com.eg, Branch(s): Alex.:Km.20; 21 AlexJCairo Desert Rd.Tel. +20-3-4701078/4700051,Fax. +2700051
Giza:6th District; Megawra 5; No.12; Comm Center;6th of October.Tel.+20-11-331727,Fax. +20-11-3367 41.
Sharkeya:1 st District Group G; 10th of Ramadan Tel.+20-15-368445,Fax.+20-15-368445
Cairo:Km.18; Cairo Ismailia Desert Rd.; Heliopolis Tel.+20-2-297816212979768 Fax. +20-2-2957026/2978162

Cairo:3 Hassan Basha Sadek SI.; Orouba; Heliopolis Tel.+2Q-2-4185583,Fax.+20-2-4185583, Bank(s): B.Misr;NatSoc.Gnle; Arab B.; EAB, Office Hours: Sat-Thu 0900:1600 hrs.

57- Company: Faik Manufacturing Co.
Activities: The Manufacturing and Preparing the Compactor trucks,porter tipper washing tanks and axle Trailers, Front and Rear Car Suspension, Vehicles spare parts and Automotive feeding industry, Building industry, Cement industry. Petroleum industry, Utilities industries (water and wastewater).
Contact: Badr City, Cairo - 4th Ind. Zone; Plot 45/46
Tel: +20-15-210155/210165/210175, Telefax +20-15-210175- Admin: Cairo:7 Magles EI-Shaab St.; Bab El-Louk,Tel.+20-2-7950487, Fax.+20-2-7922755, P.O. Box 97 Magles EI-Shaab Postal Code: 11461, Bank(s): NBE; B.of Alex.
Office Hours: Sat-Thu 09:00:1600 hrs.
Web Site: http://www.faik.com/
-http://www.badrtp.gov.eg/c24.aspx

58- Company: United industries – El Sewedy
Activities: Production & importer of cables; fiber glass poles & enameled wires
Contact:10th of Ramadan, Sharkeya, Ind. Zone A3, Plot No.7, Tel: +20-15-370637/370638,Telefax: +20-15-370639, Admin.: Cairo: 16 EI-Khartoum Sl; Heliopolis, Tel.+20-2-4144380/4144381,Fax.+20-2-2905844
P.O.Box 388, Bank(s): CIB; Suez Canal; Egypt Gulf;Arab B.-10th Ramadan, Office Hours: Sat-Thu 0900:1700 hrs.

59- Company: Arabian Company For Industrial Batteries (HBL Nife Egypt S.A.E.)
Activities: industrial batteries, UPS, backup power systems, central emergency lighting , nickel cadmium batteries, sealed lead acid batteries, battery chargers, Inverters, power supply, solar systems, motor soft starter, and standby power total solution provider.
Contact: Factory: 10Th Of Ramadan City, 1st Zone A3- Unit 901. Sales: 21 Dr. Omer Desouky St., New Nozha, Heliopolis - Cairo Egypt 11769
Admin: Cairo,68 El-Merghany St. Heliopolis, Tel: 4176229, Fax: 4176223,
Office Hours: Sun -Thu 8:00-17:00 hrs
Telephone: 00202-6239755, 6239757,6247335, MOBILE 002012-2317242
FAX: 00202-6239757.

60- Company: Eagle For Engineering & Trading Co.
Activities: Water Pumps, Sewage Pump, Water Pumping Station, All Type Of Pumps-Valves- Flow Meter - Pipes & Fitting - Penstock
Contact:11321 Helmiet el Zietoun- Po.box 23 - , Cairo - Egypt , Cairo EGYPT 11321, Telephone: 0020 2 4952483, FAX: 0020 2 4952483
E-mail: eagleco@email.lu Web Site: http://www.eagle.azn.nu/

61- Company: Sun Power Company

Activities: solar water heating systems, solar water heating systems, solar air heating system components.
Contact: 17 vector Emanwail Street , Smoha, 2nd floor, Alexandria, Egypt
Telephone: +20 3 4272517 , FAX: +20 3 4272517.

62- Company: Aqua Solar
Activities: New and Renewable Energy Manufacturing
Contact: 6, Hussein Ahmed Rashed St. Dokki, Cairo
Tel. +202 3481687, Fax +202 3613261
Manager: Ahmed Al-Ginde

63- Company: Hetco for Mechanical Importation
Activities: New and Renewable Energy Manufacturing
Contact: 9 Al-Thahabe square, Rockcy – Heilopilice – Cairo
02671047,02673673
Mr. Mohamed Tharwat Sobhe

64- Company: Alfa for Electronic
Activities: New and Renewable Energy Manufacturing
Contact: 5 Building Egypt construction, Al-nzha, Cairo
Tel: 022699881/022690184, Fax: 022690184.

65- Company: Mohamed Abu Sareea Factory
Activities: New and Renewable Energy Manufacturing
Contact: Abu Zabel, behind Arasmco Company – Al-Khnka – Qulobia

66- Company: Alaa Abdel Menam Othman Factory
Activities: New and Renewable Energy Manufacturing
Contact: Balks, Shoubra alkhama, Qulobia

67- Company: Olympic Electric Co.
Activities: New and Renewable Energy Manufacturing
Contact: 4, Fahmy St., El-Geish Sq.,Cairo, Tel. +202 837245, 826882

68- Company: Reefco/Egyptian-French Renewable Energy
Activities: New and Renewable Energy Manufacturing
Contact: 3, El-Kablat St. Matariya, Cairo, Tel. +202 946765 , Tlx 93415 eimaco un
Mr.:Helme Ismail Ateya

69- Company: Systems and Technology Co. / SERFILCO
Activities: Systems and Technology is a supplier of pumps, filters, among other engineering equipment to serve a wide range of industries all over Egypt, Africa, and the Middle East. SAT is the sole distributor for Serfilco Ltd., a manufacturer and supplier of quality equipment for fluid handling and surface finishing applications and industries with over 40 years of experience.

Contact: Dokki,Giza-61 Iran St. Tel:7617150,Telefax:3370597- Office Hours: Sat-Thu 9:00-17:00 hrs, Web Site: www.sat-eng.com

70- Company: El-Sewedy Cables
Activities: Winding Wires, Cables, PVC Compounds, control Cables, Transformers, Electrical Panel Boards.
Contact: Address: 14 Baghdad St. El Korba, Heliopolis, Cairo,
Tel: 2909430, 4187371/2,4187361, Fax: 2917078
E-mail: info@elsewedy.com, k.atabani@elsewedy.com
Web Site:http://www.elsewedycables.com/
Mr. Mohamed Zamzam

71- Company: Engineering Enterprises Company (EEC)
Activities:
1-Steel Structures
2-Towers & Stub-Towers
3-Equipment Shelters
Contact: Address: 98 Osman Ibn Affan Street, Heliopolis, Cairo, Egypt.
Telephone No: 6356669/6358715/6345964, Facsimile: 6359997.
E-mail: info@eecoegypt.com,Web Site**:**http://www.eecoegypt.com

72- Company: Egyptian Solar Energy Society
Activities: Conducting consultation and research in the field of solar energy projects in Egypt.
-Arranging short courses programs in different renewable energy disciplines.
-Issuing its own renewable energy news magazine.
-Participating on several panel discussions on environmental Issues on the Egyptian Broadcasting &Television.
-Writing and publishing in the local press several articles on energy and environment matters
Contact: Dr. Mahmoud Shaban, P.O.Box: 487 Dokki, Egypt.
Tel: (202) 3452850, Fax: (202) 5561236
E-mail: eses@soficom.com.eg, Web Site: http://www.soficom.com.eg/eses/

73- Company: Egyptian Co. for manufacturing insulators (ECMEI)
Activities: Chamber Dryers In ECMEI Egypt, these dryers where designed to dry Ceramic Insulators and utilize cross flow technology and are fully automatically controlled using the PROCESS DESIGNS PDTECHNIC 2000 System.
Contact: 10th Ramadan City, Egypt, Tel: 015-412260.

74- Company: Electric system transformers
Activities: Electric Transformers
Contact: 20 Zakaria Ahmed St., AL-Tawfekia, Midtown, Tel: 025799672

75- Company: Nekhely for transformers & power electronics
Activities: Transformers, Stabilizers, Other electrical components

Contact:176 Al-Tahreer St., Kaser AL-Neil, Tel: 022200470

76- Company: ELCO for engineering industrial Co.
Activities: Transformers, Stabilizers, Stainless steel equipments
Contact: Giza, Giza, PO.Box 244 Embaba - Badr Abd B-Samad St.; EI-Baragil; Embaba- Tel: +20-2-708286017082160120-12-3158808. Telefax: +20-2-7082947 - Office Hours: Sat. Thu 0900:2000 hrs

77- Company: International transformers - MATELEC
Activities: Electric Transformers
Contact: 102 B Al-Mergane St., Al-Shames Building, Holipolice. Tel: 022901795, 024155614.

78- Company: Essam Motors
Activities: Transformers
Contact: Sadat City, Beheira -Industrial Zone - Admin.: Cairo: 3 Bustan Ibn Kuresh St; Bab El-Louk; Abdin, ATTENTION: Expected Change in TEL. Starting (35 to 79), Tel. +20.2-3544135/3561741, Fax. +20.2-3559279,Bank(s): NBE - Office Hours: Man-Sat 10:00:2100 hrs.

79- Company: The general Egyptian Co. for railway wagon and cooches " SEMAF "
Activities: Local Steel Mills - Special Steel, Steel Mills-Agents, Traders - Carbon Steel, Special Steel, Stockiest - Distributor - Carbon Steel, Stainless Steel, Fabrication - Construction - Railway & Train, Design – Engineering.
Contact: Ein Helwan,Cairo ,Egypt. Tel: 20 2 5562716, Fax: 20 2 5550037.

80- Company: International steel – Ancosteel
Activities: Water Pumps, lighting Towers.
Contact: 58 Gamma Dewal AL- Arabia St. Al-Mohamdessan, Tel: 025390081.

81- Company: Gorica Egypt group for industry Co. – kasttor
Activities: Buses**,** Trailers, spare parts, electric Towers.
Contact: 10th of Ramadan, Sharkeya, P.O.Box 101 10th of Ramadan - Heavy Ind. Zone AI; Plot 916; Shedwan St.Tel: +20-15-410032/410031/410033/20-12-3133945,Telefax:15-410031 - Admin.: Cairo:48 Gamal Abd El-Nasser St.; off,Guesr El-Suez Heilopolis, Tel. +20-2-2979809/2965569/297986 Fax.+2O-2-2778966- Bank(s): MIBANK; B.du Cairo-Maadi, Office Hours: Sun-Thu 0900:1700 hrs.

82- Company: Miro for engineering industries
Activities: Rivets and bolts
Contact: 3rd Indus. Area, 6th October City, Tel: 028341634, 028341635.

83- Company: Electronics Research Institute, Photovoltaic Cells Dept
Activities: Consultancy and research on PV systems
Contact: National Research Center Building El Tahrir

84- Company: El-Asher of Ramadan for Glass Products (Greash for Glass)
Activities: Glass products
Contact: El-Asher of Ramadan, 015410013/4 - 015410003

ANNEX VIII: SURVEY QUESTIONNAIRE

كلية الهندسة **جامعة القاهرة**

مركز بحوث الطاقة

إستبيان عن الإنتاج المحلى لوحدات الطاقة الجديدة والمتجددة

إسم الشركة : .....

العنوان الإدارة : ..... ت: .....

عنوان المصنع : ..... ت: .....

الموقع على شبكة المعلومات (إن وجد) : .....

مساحة المصنع : .....

عدد العاملين: .....

الإمكانيات التصنيعية:

1) إنتاج وحدات الطاقة الجديدة والمتجددة:

م	المنتج*	إنتاج كامل/ تجميع	الانتاج السنوى	ملاحظات
1				
2				
3				
4				
5				

* تذكر ايضا الصناعات المغذية لصناعة وحدات الطاقة مثل الزجاج المعالج حراريا (Tempered glass) أو الزعانف المستخدمة فى تصنيع السطح الماص(Absorber Plate) او الانابيب الزجاجية المفرغة (Evaluated tube)

2) **الامكانيات المتاحة لتصنيع معدات تحويل الطاقة الجديدة والمتجددة حاليا ومستقبلاً**:

(استخدم علامة √ أو × وبالنسبة للخطط المستقبلية فيذكر عدد السنوات المتوقع تنفيذ الخطة خلالها)

	التكنولوجيا المستخدمة	حاليا	مستقبلا	عدد السنوات	ملاحظات
1	وحدات توليد الطاقة من الرياح: - أبراج مراوح توليد الطاقة من الرياح. - ريش مراوح (فيبر جلاس). - صناديق التروس/ اليات التوجيه للمراوح - وحدات التحكم				
2	السخانات الشمسية المسطحة				
3	السخانات الشمسية المركزة				
4	الوحدات الشمسية الفوتوفولطية لتوليد الكهرباء				
5	وحدة تحويل النفايات العضوية إلى طاقة وغاز ميثان				
6	وحدات أخرى مساعدة لمعدات الطاقة المتجددة*				

*متل البطاريات والمحولات الكهربائية والكابلات والزجاج والعزل الحرارى والخزانات .... الخ.

3) معدلات تكلفة مكونات المنتج بالنسبة للتكلفة الكلية:

إسم المكون	% من التكلفة الكلية
.1	
.2	
.3	
.4	
.5	
.6	

	.7

4) الجودة: كيف يتم التأكد من جودة المنتج:

1. من خلال المتابعة العامة للانتاج
2. من خلال معامل بالشركة
3. من خلال معامل معتمدة بمصر
4. من خلال معامل معتمدة بالخارج

5) اذا واجهتك مشكله فنيه فكيف تتصرف، ممن تطلب النصيحة:

1. العاملين بالشركة
2. اساتذة الجامعة
3. صناعات اخرى
4. مورد الماكينات
5. جهة استشارية مصرية
6. جهة استشارية اجنبية

6) البحوث والتطوير:

هل لديك قسم بحوث وتطوير لمنتج؟

هل لديك اتصالات مع جهات بحثيه او جامعيه للتطوير المنتج؟

هل لديك خطط للقيام باعمال البحوث والتطوير بالتعاون مع الجهات البحثيه او الجامعية؟

هل تسمح لطلاب الدراسات العليا بعمل بحوث لحل مشاكل فنية او لتطوير المنتج بشركتك؟

7) الخطط المستقبلية

8) المعوقات والمشاكل

9) إقتراحات

من قام بملىء الاستبيان: الاسم : ..... الوظيفة: .....

نشكر سيادتكم على التعاون

ANNEX IX: TERMS OF REFERENCE