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Report No: 37687-EG

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED GRANT FROM THE

GLOBAL ENVIRONMENT FACILITY TRUST FUND

IN THE AMOUNT OF US$ 49.8 MILLION

TO THE

ARAB REPUBLIC OF EGYPT

FOR A

KUREIMAT INTEGRATED SOLAR COMBINED CYCLE POWER PROJECT

November 13, 2007

Sustainable Development Department
Middle East and North Africa Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective November 9, 2007)

Currency Unit	=	LE – Egyptian Pound
LE 1	=	US$0.188
US$ 1	=	LE 5.50

FISCAL YEAR
July 1 – June 30

ABBREVIATIONS AND ACRONYMS

BOO	Build Own Operate
BOOT	Build Own Operate and Transfer
BOT	Build Own Transfer
CAA	Competent Administrative Authority
CAO	Central Auditing Organization
CAS	Country Assistance Strategy
CCGT	Combined Cycle Gas Turbine
CSP	Concentrating Solar Power
DSCR	Debt-Service Coverage Ratio
EEHC	Egyptian Electricity Holding Company
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMP	Environmental Monitoring Plan
ENP	European Neighborhood Policy
EPC	Engineer, Procure and Construct
EU	European Union
FM	Financial Management
FMS	Financial Management System
FX	Foreign Exchange
FY	Fiscal Year
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GOE	Government of Egypt
HTF	Heat Transfer Fluid
I&C	Instrumentation and Control
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IPP	Independent Power Producer
IRR	Internal Rate of Return
ISA	International Standards on Auditing
ISCC	Integrated Solar Combined Cycle
ISDS	Integrated Safeguards Data Sheet
JBIC	Japan Bank for International Cooperation
kWh	Kilowatt hour
LEC	Levelized Electricity Costs
m^2	Square meter
m^3	Cubic meter
MEE	Ministry of Electricity and Energy
MENA	Middle East and North Africa
MW	Megawatt
NGO	Non-governmental Organizations
NPV	Net Present Value
NREA	New and Renewable Energy Agency
O&M	Operation and Maintenance
OP7	Operational Program 7
PIE	Project Implementation Entity
PPA	Power Purchase Agreement
PPP	Public Private Partnership
Pt	Piasters (LE 0.01)
PV	Present Value
SBD	Standard Bidding Documents
SFR	Self-Financing Ratio
STAP	Scientific and Technical Advisory Panel
Tcf	Trillion cubic feet
TOR	Terms of Reference
UAS	Unified Accounting System
UNDP	United Nations Development Program
US¢	US cents
WA	Withdrawal Application
EEAA	Egyptian Environmental Affairs Agency

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EGYPT, ARAB REPUBLIC OF
KUREIMAT INTEGRATED SOLAR COMBINED CYCLE PROJECT
PROJECT APPRAISAL DOCUMENT
MIDDLE EAST AND NORTH AFRICA
MNSSD

Date: November 13, 2007	Team Leader: Anna Bjerde
Country Director: Emmanuel Mbi	Sectors: Renewable energy (100%)
Sector Manager: Jonathan D. Walters	Themes: Other environment and natural
Project ID: P050567	resources management (P); Infrastructure
Focal Area: Climate change	services for private sector development (S)
	Environmental screening category: Partial Assessment

Project Financing Data

[ ] Loan [ ] Credit [X] Grant [ ] Guarantee [ ] Other:

For Loans/Credits/Others:
Total Bank financing (US$m.): 0.00
Proposed terms:

Financing Plan (US$m)

Source	Local	Foreign	Total
RECIPIENT	126.48		126.48
GLOBAL ENVIRONMENT FACILITY		49.80	49.80
JAPAN: JAPAN BANK FOR INTERNATIONAL COOPERATION (JBIC)		151.29	151.29
Total:	126.48	201.09	327.57

Recipient:
Arab Republic of Egypt

Responsible Agency:
New and Renewable Energy Agency (NREA)
Arab Republic of Egypt

Estimated disbursements (Bank FY/US$m)

FY (Jul 1 – Jun 30)	07	08	09	10		
Annual	0.00	10.00	29.80	10.00		
Cumulative	0.00	10.00	39.80	49.80		

Project implementation period: Start January 1, 2008 End: June 30, 2011
Expected effectiveness date: February 15, 2008
Expected closing date: October, 31, 2011

Does the project depart from the CAS in content or other significant respects? ***Ref. PAD A.3***	[ ]Yes [X] No
Does the project require any exceptions from Bank policies? ***Ref. PAD D.7***	[ ]Yes [X] No
Have these been approved by Bank management?	[ ]Yes [X] No
Is approval for any policy exception sought from the Board?	[ ]Yes [X] No
Does the project include any critical risks rated "substantial" or "high"? ***Ref. PAD C.5***	[X]Yes [ ] No
Does the project meet the Regional criteria for readiness for implementation? ***Ref. PAD D.7***	[X]Yes [ ] No

Project development objective ***Ref. PAD B.2, Technical Annex 3***
The objective of the project is to increase the share of solar-based electricity in the Egyptian energy generation thereby contributing to the Government's objective of diversifying electric power production.

Global Environment objective ***Ref. PAD B.2, Technical Annex 3***
The global development objective of the project is to reduce greenhouse gas emissions from anthropogenic sources by increasing the market share of low greenhouse gas emitting technologies.

Project description *[one-sentence summary of each component]* ***Ref. PAD B.3.a, Technical Annex 4***

The project has three components:

1. The design, construction and operation of the Integrated Solar Combined Cycle Plant;

2. Capacity building to NREA through construction management services during project implementation to ensure the smooth integration between the solar and the combined cycle portions of the plant; and

3. The implementation of the environmental monitoring plan.

Which safeguard policies are triggered, if any? ***Ref. PAD D.6, Technical Annex 10***
Environmental Assessment (OP/BP 4.01) is triggered by this project. A comprehensive Environmental Impact Assessment (EIA) has been completed and disclosed in InfoShop and in-country. It includes an assessment of air quality, aquatic environment, noise, flora and fauna, soils and hydrology, traffic and transport, socio-economic, archeological, natural disasters, solid waste management and occupational health and safety.

Significant, non-standard conditions, **if any**, for:
Ref. PAD C.7
Board presentation:
Not applicable

Grant effectiveness:
- Subsidiary grant agreement between the Recipient and NREA.

Covenants applicable to project implementation:
- Establish the Project Implementation Entity no later than three months after project effectiveness.

A. STRATEGIC CONTEXT AND RATIONALE

1. Country and sector issues

Country Issues

1. A comprehensive economic reform program was adopted in Egypt in 2004, when significant change took place in the cabinet and several new officials were appointed to key ministerial positions. This new government has made economic reform its key objective, notably in areas such as finance, investment, trade and industry. It has also stated its keen interest to enhance the provision of public goods and services, including physical and social infrastructure. The latter includes the power sector.

2. The investment needs in infrastructure remain substantial. It is estimated that approximately 4-6% of Gross Domestic Product (GDP) needs to be invested annually in infrastructure sectors in the Middle East and North Africa (MENA) region to satisfy new investment requirements as well as maintenance and replacement spending.[1] The decline in investment in the MENA region, including in Egypt, is reported to have compromised the infrastructure base, which is further challenged by the high growth in demand for modern infrastructure services. To ensure adequate provision of electricity, the Egyptian Electricity Holding Company (EEHC) - responsible for generation, transmission and distribution of electricity in Egypt - requires on average about 1,500 MW of new capacity each year. Promotion of renewable energy projects plays a key part in Egypt's generation plan. Indeed, to date 225 MW of wind-turbines have been installed and are operational, performing well at an average capacity factor of 42%.

3. While investment is required to ensure adequate infrastructure, the Government of Egypt (GOE) is increasingly concerned with the rising fiscal deficit and public debt, which rose from 3.9% in FY00 to 9.6% in FY05. To counter this, the GOE has been implementing several measures to reduce the deficit over the medium term by restraining public expenditures and increasing public revenues. As a result, the deficit as a percentage of GDP for FY06 dropped to 8.6% and the GOE plans to reduce it further by 1% per year for the next five years. The key measures that the GOE has adopted include redesigning of subsidies, controlling growth in public sector employment and cutting unnecessary expenditures. Some reforms already underway include:

- Increasing retail utility prices, including increases in electricity and gas prices.
- Reducing custom tariffs.
- Reducing price controls and subsidies on basic products, including diesel-fuel.
- Increasing interest in the potential for public-private partnerships (PPPs).
- Strengthening and reorganizing the privatization program under the Ministry of Investment established in June 2004.

4. Against these reforms, the GOE remains committed to providing a public safety net comprising of various subsidies, employment programs and cash transfers and agrees that there

[1] Cited in internal Bank report on "Arab Republic of Egypt: A Short Infrastructure Assessment," December 2004.

is much room for improving the cost-effectiveness of the safety net currently in place and its coverage of the poor. Assistance to do this is included in the Country Assistance Strategy (CAS).

Sector Issues and Government Strategy

5. Access to electricity is high in Egypt (98%). However, the fast growing demand puts significant pressure on the sector's ability to provide reliable and reasonably priced electricity; challenging both its ability to contribute to higher growth and poverty alleviation. To ensure sustainable service delivery, the GOE is implementing reforms in electricity pricing, diversification of supply and improved efficiency through the development of a market for electricity trade.

6. Electricity pricing: In October 2004, the GOE approved an increase in electricity tariffs, the first increase in 12 years, and a subsequent tariff increase was approved in 2005 in which the average tariff changed to 14.86 Pt/kWh (2.5 US¢/kWh).[2] Further increases to industries were announced in August, 2007. Still, Egyptian electricity prices are low by international standards and when compared to a number of other countries in the region, since prices have declined substantially in real terms over the 12 year period of no price changes and, with the depreciation of the Egyptian pound, in foreign currency terms as well.

7. In addition to subsidized overall tariffs, there are also substantial cross-subsidies which are not very well targeted. An inclining block tariff is used to subsidize residential customers who use the least electricity. The GOE is fully aware of cross-subsidization in the sector and, although the overall electricity retail tariff has increased, subsidies continue to prevail for politically sensitive customer segments. The GOE is keen to eventually reduce the level of cross-subsidization in the sector and the subsidies in general, but recognizes that this will take time. Bank assistance is being provided under the El Tebbin Power Project (Loan No. 7359-EGT) to design and implement time of use tariffs and load management schemes, which would assist in improving overall cost recovery, as well as sending signals for increased energy efficiency by reducing demand for electricity at peak periods.

8. Egypt's significant reserves of natural gas play a key role in electricity production. Current proven reserves are estimated at 67.2 trillion cubic feet (Tcf), with an additional 120 Tcf identified as probable and possible reserves.[3] To meet projected domestic demand (industrial, commercial and residential) and export demand (via pipelines and liquefied natural gas terminals) over the next 20 years, about 15 Tcf is estimated to be required. This leaves Egypt with a proven Reserves/Production (R/P) ratio of over 80 years. Domestic gas consumption is dominated by the power sector at 65%, followed by the fertilizer industry, petrochemicals and other industrial sectors. The price of natural gas to industries as well as the power sector has been set at 21 Pt/m^3 (US$1/mmbtu), but an increase over a 3 year period was recently announced for the industrial sector which will see the gas price increase to US$2.65/mmbtu by the third year.

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[2] The 2004 increase was of 8% on average, in 2005 a further 5% average increase was approved, and the government plans further annual increases of 5% for the next 4 years.

[3] Source: Ministry of Petroleum, July 2005.

9. As natural gas is becoming increasingly important to Egypt's economy, particularly with the growing potential for exports, moving towards cost-based pricing of gas is becoming increasingly important. As a result, the GOE has undertaken a study to determine the cost of gas, which the Bank has assisted through ESMAP (Energy Sector Management Assistance Program). The study has been disseminated among key governmental stakeholders and provided the basis for the recent increase in gas price to industry and is informing the GOE's longer-term gas pricing policy and strategy.

10. Diversification of supply: As stated above, the fast growing demand for electricity requires significant investment in generation capacity each year (the increase in demand for electricity in Egypt averaged about 7% during 1997/98–2003/04 and is expected to remain in the 6%–7% range over the next 10 years). Installed capacity of electric power was 20,452 MW in 2005/2006, of which 85% comprised thermal power (10% of which is provided by the private sector through 3 Independent Power Producers, IPPs). The remaining capacity was attributed to hydropower (14%) and wind (1%). Peak load reached 17,300 MW in 2005/2006, and about 90% of the thermal power production was based on natural gas. Initiatives are underway to better understand customer consumption patterns and loads to ultimately implement demand-side management measures to reduce the overall consumption and the growth in demand.[4] World Bank assistance is being provided to this effort.

11. The GOE's strategy is to continue to implement gas fired power plants, with a long-term view to increase the share of combined cycle gas turbine technology in the generation mix. In addition, the GOE has a target of meeting 3% of its electricity needs from renewable energy sources by 2010; and 20% by 2020 (including hydro which today comprises 13% of the 20% target). Bank technical assistance was recently requested to help in the development and achievement of this plan. The New and Renewable Energy Authority (NREA) has the responsibility to develop renewable resources in Egypt and implement the government's strategy on renewable energy. Until 2001, most of NREA's activities have been in the research and development field, and since then its activities have increasingly turned to the production of renewable energy. NREA has in recent years successfully augmented its revenues with income from the sale of carbon reduction credits under the clean development mechanism. Indeed, agreements have already been signed with the Japanese, the Danish and the German governments.

12. NREA's strategy is to capitalize on Egypt's abundant wind and solar natural resources to meet the renewable energy target set by the Government. For this purpose it plans to install an additional 850 MW of wind by 2010 and considers the construction of the proposed Integrated Solar Combined Cycle Power Plant (150 MWe) a key development towards improving and diversifying its institutional and technical capacity in the area of renewable energy.

13. Finally, as an incentive to the development of renewable energy, the GOE has established a mechanism (the 'Petroleum Fund'), where producers of non-fossil fuel electricity receive 2

[4] Energy intensity in Egypt in 2004, defined as the energy consumption per unit of GDP was equal to 0.22 toe / 000' 95 US$, which is comparable to other oil producing countries in the region (Algeria: 0.20) and lower than others (Iran: 0.33), but higher than Western European countries such as Germany (0.18) and France (0.19).

Pt/kWh. This mechanism is intended to accelerate development of renewable energy by sharing with developers the additional export revenue generated from fuel savings derived.

14. Electricity Market Development: Following the 2001 unbundling of the electricity sector in Egypt, further reform of the sector includes market development, such as liberalization and greater regional integration. The Ministry of Electricity and Energy is in the process of developing a plan for the introduction of competition in the sector consistent with the implementation of further tariff increases and on-going improvement in the efficiency of the subsidiary companies. This plan will see gradual opening of the sector, starting with the generation segment. To facilitate reform, a regulatory agency has been established and an electricity law is under formulation. A Higher Energy Council was recently established under the chairmanship of the Prime Minister and with members represented by the ministers of electricity, petroleum, finance, planning and economic development. This council reviews energy alternatives, their economics as well as overall energy policy and planning.

15. Egypt's plans are consistent with - and supported by - its participation in the European Neighborhood Policy (ENP) partnership, which was developed in the context of the European Unions' (EU) 2004 enlargement with the objective of avoiding the emergence of new dividing lines between the enlarged EU and its neighbors. A key feature of the ENP is the bilateral ENP Action Plans mutually agreed between the EU and each partner country. These action plans set out an agenda of political and economic reforms with short and medium-term priorities. In the case of Egypt, the action plan is under discussion and includes market liberalization (in principle by 2010) and continued price reform in both the electricity and gas sectors.

16. Meeting the reform targets in the action plan will require far-reaching reforms of the Egyptian power sector. Some assistance on how to achieve this is being provided through the EU. The European Investment Bank also has significant grant funds available to Egypt for technical assistance. Nevertheless, significant work remains on the detailed steps required to meet the liberalization objective, as well as Government policy on how to finance sector investments in the longer term, including the respective roles of the public and private sectors. On the latter, the GOE remains open to private sector participation, although the pressure on the financial status of the sector has led to the GOE opting for public sector financing for the time being. Clearly, tariff/subsidy reform would need to accompany any large-scale re-engagement with private participation, as well as and as mentioned earlier; reform of the social safety net, which is a key priority of the GOE. The Bank is providing the Government with assistance to formulate an energy pricing strategy including reforms to social safety nets and social protection in order to support the implementation of tariff/subsidy reforms.

2. Rationale for Bank involvement

17. The proposed project integrates conventional combined cycle gas turbines with solar thermal technology. It will contribute to an important global test of a new approach to renewable energy. As noted in the Bank's report to the Development Committee on the Clean Energy Investment Framework, incentives are needed to induce technological change to a low carbon economy. The proposed project would demonstrate how de-carbonizing of the power sector could be facilitated by the large-scale development of new energy production technologies.

18. The proposed project is strategic for the achievement of the objectives of GEF's Operational Program 7 (OP7), which aims to reduce, over the long-term, the costs of energy technologies with low greenhouse gas emissions, and which are currently not cost-competitive (see below under "Higher level objectives and Rationale for GEF funding"). The Bank fully supports that pioneering objective. The proposed Egypt project is one of a series of similar projects, which together will contribute to learning about such technologies, and dissemination of that learning. In this way, Egypt, GEF, and the Bank are jointly participating in a very promising global experiment.

19. The proposed project is also strategic for the Bank in Egypt, now that the Bank has regained a high-level of partnership in the country's energy sector after a gap of some years. The project will contribute to the goals, articulated in the CAS for Egypt, which include enhancing the provision of public goods through, inter alia, modernized infrastructure services to achieve higher growth. The GOE and the Bank are engaged in an intensive policy dialogue in this key sector, and a comprehensive program of financial and technical support has developed. Reliability and long-term involvement are the foundation of this relationship.

20. The Bank's current direct involvement in investment and advisory services across the energy sector in Egypt provides a good basis for development of sustainable energy solutions, including renewable energy. It allows for substantial dialogue on the policy framework and implementation arrangements associated with and required for this project's implementation, as well as larger scale development and replication of similar projects. Finally, Bank involvement will also help attract strong bidders by ensuring the use of transparent and competitive procurement processes, as well as appropriate management of environmental and social impacts.

3. Higher level objectives to which the project contributes

21. In 1996, the GEF's Scientific and Technical Advisory Panel (STAP) recommended high temperature solar thermal power technologies as one of the renewable energy technologies that had significant cost reduction potential. The GEF support for solar thermal technology was identified as a means to increase market awareness through limited scale demonstration projects in solar resource rich developing countries.

22. GEF Operational Program Number 7 ("Reducing the Long-term Costs of Low Greenhouse Gas-Emitting Technologies") emphasized certain limited technologies including parabolic trough based solar thermal electric technologies to be cost-effective. "For cost-effectiveness, the scope of the technologies covered by the operational program needs to be limited to those whose costs will drop significantly with economies of scale in manufacture and application."

23. The selection of technologies for OP 7 was made based on certain criteria; extent to which basic research and development has already been done (for technologies where the markets are both in recipient and developed countries) or significant prior operational experience exists; size of remaining technological barriers and risks; technology's current cost; prospects for reduction in costs of the technologies in question (steep learning curves); contribution that GEF financing can make to cost reductions; and the primary market is in the recipient countries

because of resource endowment and potential for that technology, when commercial, to reduce greenhouse gas emissions.

24. Large-scale solar-based power plants are still a long way from being cost-competitive with fossil-fuel based plants. However, within the range of solar thermal electric generation options, the integration of solar and combined cycle (ISCC) technology is the most promising in the long-term as a reliable and cost-effective source of power supply. For developing countries especially, where the primary need is electricity (not necessarily green electricity), the combination of solar energy with a large-scale fossil fuel power plant can, in the technology introduction stage, be more attractive than stand-alone solar plants. For this reason, the technology is consistent with the objectives of GEF OP7, which justifies GEF grant support in pursuit of the global program objective of increasing the market share of low greenhouse-gas emitting technologies that have not yet become widespread least-cost alternatives.

25. OP7 states that "the objective will be achieved by GEF's promotion of such technologies so that, through learning and economies of scale, the levelized energy costs will decline to commercially competitive levels. A project leads to reduction in GHG emissions not only directly, but also indirectly by being one of series of projects that induce cost reductions in the technology. The direct outputs of the technology are the amount of energy generated, the amount of GHG emissions avoided, etc. The indirect project output, of greater programmatic interest, is the reduction in cost that it caused and the time horizon for the achievement of program objectives will typically be on the order of decades. The technologies identified under this program will require the security of funding and long-term commitment of GEF support."

26. Consequently, GEF and the Bank agreed to pursue solar thermal projects in India, Mexico, Morocco and Egypt as part of a strategy to facilitate the commercialization of solar thermal technology. The India project (later dropped) entered the work program in 1996, followed by the Mexico and Morocco projects in 1999 and finally the Egypt project in 2004. The Mexico and Morocco projects have already been approved by the GEF and the Bank while the financing for the Egypt project has been negotiated, and the procurement process has been concluded. After eight years of preparation, construction is ready to start - pending approval of the GEF grant by the GEF and the World Bank's Board of Directors.

27. In essence, the GEF participation in the project is intended to support primarily global program objectives, and Egyptian national development objectives only secondarily.[5] That is the rationale for substantial grant financing from the international community through GEF. However, about half of the financing for the solar component of the project will come from NREA's equity and borrowings which is a testimony to the fact that the global environmental objectives are closely linked to the Egypts's national sustainable energy development strategy.

28. In the GEF-World Bank portfolio of solar thermal projects, the preferred configuration is the ISCC. This configuration integrates the steam output from a solar field into the steam turbine of a combined cycle gas turbine (CCGT). Given that there is now significant experience relating to combined cycle operation, as well as adequate knowledge of solar field operations, the ISCC

[5] The proposed project will make an important contribution to the Government's renewable energy target of 3% by 2010. The project will also strengthen NREA's capacity as an independent producer of renewable energy.

configuration is sound from a technical standpoint. However, as projects utilizing this integrated configuration have not yet been implemented, the first few projects, including the Egypt project, may face teething problems. However, any problems that arise are not likely to be fundamental in nature but rather related to optimizing energy flows, particularly under transient solar conditions.

29. By integrating the solar field with the combined cycle technology, the ISCC configuration offers several cost reduction and operational advantages over independent solar thermal plants that make them more suitable for introducing solar field based electricity generation in developing countries. In the ISCC configuration, the need for an independent power block for the solar field is offset by utilizing a larger steam turbine in the CCGT plant, thereby reducing the capital costs through economies of scale. Such a configuration also reduces the solar energy losses that occur in an independent solar plant due to daily start-up and shut-down. In addition, the hybrid plant can remain in continuous operation irrespective of solar availability providing much needed generation. The solar field also offers a power boost when CCGTs suffer a reduction in plant output at times of high outdoor temperatures, since that coincides with high solar radiation as well.

30. In 2005, the World Bank commissioned an independent assessment of the World Bank/GEF strategy for the market development of concentrating solar thermal power. The study's conclusions can be summarized as follows:

- Over the last 2 years, the industry has been reinvigorated. Several projects are presently under construction around the world. Nonetheless, these projects have not reached the kind of critical mass to suggest that the industry is now self-sustaining.

- Solar thermal electricity offers a number of advantages when considered as part of a country or region's energy generation options mix. Solar thermal, based on a hot fluid, can integrate well with conventional thermodynamic cycles and power generation equipment.

- In most cases, the ISCC configuration showed lower Levelized Economic Cost (LEC) than the solar electricity generating systems in California. The reason for this is that the incremental cost of a larger steam turbine is much lower than building a stand-alone power block for solar electricity generating systems.

- ISCC is well-suited for market introduction because the additional marginal investment for the conventional plant components is relatively low. There are also areas of overlap, and thus cost-reduction potential, with the plant infrastructure and project implementation costs.

- The technology is not new, but stalled in its development path. There is no fundamental reason why the technology could not follow a similar cost reduction curve to wind energy and eventually be cost-competitive. Cost reductions would require a combination of plant scale-up, increased production volumes and technological innovation.

- Against the thousands of megawatts needed for CSP to reach full cost-effectiveness, the GEF portfolio alone will not lead to a significant reduction in the underlying cost of the technology. However, the plant capacity of projects in the GEF portfolio is not insignificant

compared to the present 300MW or so of possible-to-firm CSP projects in OECD countries. The GEF co-financed plants will help to maintain momentum in the CSP industry and to develop operational experience in developing countries.

- By supporting implementation of the first solar thermal power demonstration plants, the GEF will help create confidence in the technology and institutional learning, thereby reducing the hurdle for subsequent market entry of CSP.

31. Several ISCC projects outside the GEF/Bank portfolio are also being developed in Algeria, Spain, etc. Over the long run, it is expected that the cost of the technology will come down due to technical progress and lessons learned from earlier deployment. In the Northern Mediterranean "sunbelt," several solar-thermal power projects are already being planned in Greece, Spain, and Italy through national programs and the support of the EU. Bulk transmission of electricity from solar-thermal power plants from high insolation sites in Southern Mediterranean countries, such as Algeria, Libya, Egypt, Morocco, and Tunisia, may also open wider opportunities for European utilities to finance solar plants in that region for electricity consumed in Europe, and hence for Southern Mediterranean countries to become a base for electricity exports. Reform of electricity sectors across Europe, the rising demand for "green power," and the possibility of gaining carbon credits are increasing the viability of such projects. Finally, research and development work continues in Europe and the United States to further reduce costs by improving plant components.

B. PROJECT DESCRIPTION

1. Lending instrument

32. A grant from the GEF in the amount of US$49.8 million will contribute to the financing of the solar portion of the ISCC power plant. The remainder of the project cost will be covered by an already-approved loan from the JBIC (for the CCGT component) and by NREA's own resources, including loans from the National Investment Bank of Egypt. Since the incremental cost associated with the solar portion of the ISCC is US$97.2 million, NREA's net contribution to finance incremental cost is $47.4 million[6]. GEF support through the grant, as well as NREA's funding of the project, will contribute to reducing the long-term costs of the technology and will assist Egypt as well as other countries in adopting environmentally clean and cost effective technologies through the demonstration effects and lessons learned.

2. Project development objective and key indicators

33. The objective of the project is to increase the share of solar-based electricity in the Egyptian energy generation thereby contributing to the Government's objective of diversifying electric power production.

34. The key performance indicators for the development objectives of the project include:

[6] By way of comparison, the GEF-funded ISCC Power Project in Morocco has an incremental cost of $63.2 million, of which GEF is funding $43.2 million, and the Morocco utility, O.N.E. is funding the remaining $20 million.

a. Total electricity generated from solar sources (GWh/year).
b. Solar output as a percentage of total energy produced by the hybrid plant (%).
c. Total electricity generated from the ISCC power plant (GWh/year).

3. Global Development Objective

35. The global development objective of the project is to reduce greenhouse gas emissions from anthropogenic sources by increasing the market share of low greenhouse gas emitting technologies.

36. The project will demonstrate the operational viability of hybrid solar thermal power generation technology and contribute to replication of integrated solar combined cycle (ISCC) power generation technology in Egypt and elsewhere through the learning effect provided by its construction and operation, and through economies of scale as use of the technology spreads. It is one of a number of similar projects in the world supported by GEF, and by other financing sources, as part of a global programmatic effort to accelerate cost reduction and commercial adoption of large-scale low greenhouse emitting generation technologies. Secondarily, the project will make a modest direct contribution to the reduction of greenhouse gas emissions.

37. To evaluate the performance of the project in achieving this global objective, the following indicators have been chosen:

a. Cost of solar thermal (US¢/kWh and US$/kW)
b. Emissions reduced from use of solar fuel (tons of CO_2/year).
c. Number of staff trained in NREA on the various aspects of the solar thermal technology.
d. Dissemination
    i. Number of visitors to and information requests about the plant.
    ii. Number of workshops and conferences in which the experience about the construction and operation of the plant was presented.
    iii. Information about the plant posted on NREA's external web site and in its publications.

Other qualitative indicators will include the documentation of lessons learned:

a. during the pre-construction phase (feasibility study and bidding process, environmental and social safeguards and financing);
b. during the construction of the plant; and
c. from the operation of the plant and initial assessment of the viability of the technology after three years of operation of the ISCC power plant.

4. Project components

38. The project will finance the construction of an Integrated Solar Combined Cycle (ISCC) power plant, to be located in Kureimat, about 95 km south of Cairo, on the eastern side of the river Nile.

39. The plant will have a combined capacity of about 150 MW, including 20 MW of solar capacity. When own consumption of 6.3 MW is deducted, the net overall plant capacity becomes 143.4 MW. The total net energy produced by the plant is expected to be 852 GWh per year, which includes the solar contribution of 33.4 GWh per year. This corresponds to a solar share of 4 % of the total annual energy produced by the plant operating at a full load.

40. The project will be implemented through three components. For Component 1 the costs are known since the procurement process for both the solar and the combined cycle portions have been completed. These costs are inclusive of import taxes on equipment and contingencies. Having said that, NREA will apply for an import tax waiver for select equipment at the time of actual import, which would result in potential savings of US$22.4 million for the project. For Component 2 and 3, estimated costs are presented.

Component 1: The design, construction and initial operation of the proposed Integrated Solar Combined Cycle Plant include two sub-components:

(a) The solar portion of the power plant (US$111 million; *of which GEF will finance US$49.8 million and NREA US$61.2 million*) includes one contract for engineering, procurement, construction, testing, commissioning and two years operation and maintenance (O&M). The solar island consists of a parabolic trough solar field capable of generating about 73 MW (thermal) of solar heat at a temperature of 393°C, the related Instrumentation and Control (I&C) and control room and the heat transfer fluid (HTF) system up to the HTF inlet and outlet flanges of the Solar Heat Exchanger(s).

(b) The capital cost of the combined cycle portion of the plant (US$201 million; *of which JBIC will finance US$151.3 million and NREA US$49.7 million*) includes one contract for the EPC aspect of the power plant. In addition, one 2 year O&M contract will be financed by NREA (US$8.8 million). The combined cycle island will consist of one gas turbine with ISO rating of about 73.3 MWe, one heat recovery steam generator (HRSG), one steam turbine of about 76.5 MWe, and solar heat exchanger(s) capable to absorb about 73 MW (thermal) solar heat plus all associated balance of plant equipment.

Component 2: Comprises capacity building to NREA through consulting services for construction management during the construction, testing and operation of the plant (US$6.36 million, including price contingency financed by JBIC). The capacity building will focus on: (a) detailed engineering designs with special attention to the interface between the solar and CCGT parts; (b) supervising the construction and environmental aspects of the power plant; (c) monitoring the commissioning and guarantee tests; (d) preparing the O&M contract for the CCGT part in terms satisfactory to the Bank. As such, NREA will seek the Bank's comments on

the draft contract before requesting proposals; (e) providing assistance during the 2 year guarantee period as well as assisting NREA in monitoring and evaluation of the performance of the whole plant at least during the two years of the O&M period; and (f) providing training and transfer of know-how in ISCC plant operation, with particular emphasis to dispatching and integration into the power system so that NREA staff can successfully take over the power plant after the respective O&M contracts expire.

Component 3: Comprises the Environmental and Social Impact management component to be financed by NREA (US$0.45 million, including price contingency). This component will include the implementation of the Environmental Management Plan (EMP) which mitigates the potential environmental and social impacts associated with the construction and operation of the power plant.

The breakdown of the project components is provided in the table below:

Items	Equipment/ Work Cost	Others, Taxes & Contingencies	2-year O&M Costs	Total
Component 1				
a) Solar Island	98.74	6.10	6.15	110.99
b) CC Island	184.69	16.28	8.80	209.77
Component 2				
Capacity Building	6.00	0.36	Not applicable	6.36
Component 3				
EMP	0.425	0.025	Not applicable	0.45
Total	**289.86**	**22.76**	**14.95**	**327.57**

Note: Amounts are expressed in US$ million

41. The above costs reflect a reduction in the size of the solar field from 30 MW to 20 MW. The lowest bid for 30 MW was US$130 million. Since the GOE is contributing a significant portion towards the cost of the project, they requested the Bank's No Objection to negotiate a reduction in the cost through a reduction in the solar field size. The Bank's Central Procurement Board (OPRC) granted this request. The 33% reduction in the solar field size translates into a reduction in the solar share of electricity generated by the ISCC from 6% to 4% and the cost of the 20 MW is 20% lower than that of the original 30 MW. At 20 MW, the solar island remains a substantial project component and is deemed to adequately serve the project's pioneering objective.

42. It is important to note that the EPC cost differs from the incremental cost, in that EPC cost is the EPC cost of the plant during project preparation and construction (for design, construction and hardware, etc) while the incremental cost is the difference in cost between the ISCC and a reference plant comprising a combined cycle plant with the same output. Annex 15 presents the detailed incremental cost analysis for the proposed project. For Morocco, the EPC cost of the solar component was $74.6million while the incremental cost was $63.16million (at a 10% discount rate).

43. The Egypt project still is relatively expensive vis a vis Morocco where bidding has also been completed, contracts signed and the prices are known (see summary table below). The Mexico bidding process is being re-launched in light of price increases and in tandem with the Mexican Congress authorizing an increase in the budget approved for the thermal part of the plant which has experienced substantial price increases. The bidding process is expected to be completed by February, 2008. For the solar component, bidders are requested to bid within the envelope of the GEF grant (US$49.8 Million).

Details of Solar Island	**Egypt**	**Morocco**
EPC Cost without taxes and duties (US$ m)	98.7	74.6
Total area m2	130,800	183,120
EPC Cost per m2 (US$/m2)	755.3	407.6
Solar generation (GWhe/year)	33.4	40
Cost per annual production (US$/kWh)	0.648	0.403
EPC Cost per kW (US$/kW)	4,937	3,732
ISCC Levelized electricity costs (¢/kWh)	6.77	5.96
Cost per ton of Co_2 emissions avoided	190	104

44. The main reasons for the cost differential between Egypt and Morocco has to do with significant price increases in the raw material, which continues to increase (for example the Index for Steel Prices (SBB World Index) is currently increasing at a monthly rate of 3.7%; the index was 201 in January 2007 and it was 220 in September 2007)[7]. This factor is affecting practically all power generation technologies, and is not specific to solar technologies[8]. The other main factor is that there is only a limited number of active bidders in the market, and several new projects to bid on. With the Morocco bidding process being slightly ahead of Egypt, the solar contractors were all heavily loaded with projects which led to price increases in Egypt, as Contractors need to expand their manufacturing capabilities.[9] Furthermore, the split package in Egypt may have increased cost due to reduced scope for economies of scale.

5. Lessons learned and reflected in the project design

[7] It should be noted that such increase in raw material and equipment prices are affecting almost all technologies in power generation, and is not confined to ISCC in particular or even renewable energy technologies in general.
[8] For example, the El Tebbin Power Project in Egypt financed by the World Bank has experienced a 40% cost increase in the bid prices compared to the appraisal cost estimates (from US$450 million to US$630 million).
[9] This might help explain, for example, why the lowest bidder in Morocco was the highest bidder in Egypt.

Power Sector Development in Egypt

45. NREA has gained significant experience in designing and implementing wind energy projects with international loan and grant financing. Important lessons drawn from this experience include the importance of transparent and well-managed competitive bidding processes, which have contributed to attracting the interest of major international suppliers.

46. Furthermore, through the development of these projects, NREA has operated under Power Purchase Agreements (PPAs) with EEHC and has gained significant experience in structuring and negotiating such agreements. This experience will be very useful for the proposed project, in which a PPA will be put in place as well as a Gas Purchase Agreement (GPA).

Solar Thermal Power Plant Development Worldwide

47. No large scale solar thermal power plants have been built in developing countries to date, however several small-scale projects are under construction around the world. The most significant solar thermal installations are in California where 354 MW of parabolic troughs, with back-up gas fired steam boilers have been generating electricity and selling it to the utility since the 1980s. Spain has also been gaining valuable experience in designing and constructing solar thermal power project, using the tower technology. The plant comprises 11 MW and is located in Seville. It is being constructed on a turn key basis.

48. To meet the cost reduction objective of this type of project, it is necessary to move beyond the trough/backup boiler design upon which the California plant is based. The purpose is to permit higher thermal efficiencies, improve the dispatchability of the plant and to encourage greater competition in the design and supply of equipment. Such a plant would be more attractive to utilities, thus increasing the market size.

6. Alternatives considered and reasons for rejection

49. ***Project Concept:*** The project was originally conceived to be carried out by the private sector under the arrangements of an Independent Power Producer (IPP), with the solar portion financed from the GEF grant. In mid-2002, the Ministry of Electricity and Energy, through NREA, proposed a change to the project's concept mainly as a result of a general down turn in investor appetite for IPPs and a policy change within the GOE whereby foreign currency exposure related to private sector investment projects was to be borne by private investors. This policy change was the result of increased cost to the Government from the IPPs through the take or pay contracts mostly denominated in US$ in conjunction with the devaluation of the Egyptian pound. In order to confirm the lack of private sector interest, independent consultants carried out a survey of investors who had previously expressed interest in developing the solar-thermal project as an IPP. In this survey, 31 investors were contacted to register their interest to invest in an IPP-style project given the policy change on foreign currency exposure. Only one company filled out the requested questionnaire; another 21 responded by stating that they were either not interested in general or not interested given the policy change. Three firms contacted were no longer in existence, and six responded that they would be interested in principle, but did not fill

out the questionnaire and thus were not considered serious. The financing and implementation concept therefore changed and the project was presented to the GEF for Work Program Inclusion in May 2004 under the current public sector concept.

50. ***Project Configuration (ISCC):*** Early discussion on how to implement OP7 and the recent assessment of the World Bank/GEF Strategy for the Market Development of Concentrating Solar Thermal Power have raised the question of whether solar electricity generating systems with little fossil co-firing would have been a better configuration for the project rather than the ISCC configuration. The assessment recognizes that there may be an issue in terms of perception with an ISCC plant with a solar contribution of only 4%. However, the assessment also points out that a 20MW solar field in either configuration will still generate approximately the same amount of GWh/year of solar electricity and provide the same level of O&M experience, through having to maintain some 130,800 m^2 of solar array. As such, given Egypt's interest in developing alternative energy solutions and recognizing that there is a significant non-technical lead time associated with any new project (permits, authorities, contract administration, etc.) regardless of project capacity, the ISCC choice helps to meet Egypt's energy goals, while deploying a solar field, a field that could have been deemed too hard for the sake of a 15-20 MW plant.

51. ***Technology Choice (Solar Trough):*** Although there are, broadly, three solar thermal technologies: the parabolic trough; the central receiver, and the parabolic dish stirling system, the parabolic trough is the most technically and commercially proven option. The GOE has stressed its preference for a commercially proven technology to the extent possible to minimize risk. As such, it has been decided that the project design be based on the parabolic trough technology.

52. ***Solar Storage:*** The storage option was not considered because the storage technology would add another innovative element (not yet commercially proven on a large scale) and would add extra cost. Nevertheless, it would be possible at a later time to increase the solar field by adding a storage device to the plant.

C. IMPLEMENTATION

1. Partnership arrangements

53. The project will be financed by the following sources: GEF, NREA, JBIC and the National Investment Bank of Egypt (through NREA). The GEF grant will contribute towards the cost of the solar portion of the plant and in parallel JBIC will contribute to the cost of the CCGT portion, including the consulting services contract responsible for the supervision of power plant design, construction and performance integration of the two parts. NREA will contribute to the costs of both the solar and CCGT portions, as well as the O&M contracts and the cost of mitigation of environmental and social impacts.

2. Institutional and implementation arrangements

54. Given that the proposed design has yet to be proven commercially world-wide, the Engineer, Procure and Construct (EPC) arrangements will be followed by 2-year Operation and Maintenance (O&M) contracts to ensure proper operation and maintenance of the ISCC plant

and achievement of maximum output by the solar field. There will be an O&M contract for each portion of the plant, but the O&M contract for the CCGT will be responsible for efficient operation of the entire plant as well as maximizing the output from both parts (see more below).

55. The construction and operation of the ISCC power plant will be implemented in four separate contracts: (i) the construction and O&M of the solar island; (ii) the construction of the combined cycle island; (iii) the O&M of the combined cycle portion; and (iv) a construction management consulting contract for the supervision and integration of the solar and combined cycle islands. The arrangements are being secured using the international competitive bidding procurement method. NREA, as the Executing Agency and as the mandated agency in Egypt to develop renewable resources, will be responsible for project management. NREA will establish a Project Implementation Entity Unit (PIE) headed by an experienced Project Manager who will report to the Deputy Chairman for Projects and Operation. The PIE will be responsible for the day to day management activities of the proposed project and will be staffed by core specialists in technical, financing/accounting, procurement and environmental matters.

56. The PIE will be based at the project site. As required, the PIE will liaise closely with other departments at NREA headquarters for support in legal, financial, and planning matters. Furthermore, EEHC has assured that it will support NREA, as needed, in any technical or managerial aspects, particularly related to the operation of the CCGT as well as compliance with the Environmental Management Plan (EMP). The PIE will benefit from the assistance of the construction management consultant during the implementation of the overall project. Its main tasks are described under section 4 (Project Components) above. This contract will be for the duration of construction plus the two year guarantee period, which will coincide with the two-year O&M contracts (i.e. a total of about 5 years).

57. During the construction and in particular during the O&M period, NREA will assign counterpart personnel to the construction management consultant to ensure close coordination and transfer of knowledge with regard to the operation of the plant so that NREA can take over its operation when the 2 year O&M and construction management contracts expire, as well as monitor and document the project's lessons learned. It will be important that after the issuance of the operational acceptance certificate (30 months from start of construction), NREA revises and readjusts the PIE organizational structure to take into account the start-up of the 2 year O&M period, especially in terms of personnel. The organizational scheme for project implementation is shown in Annex 6. The World Bank will monitor the implementation arrangements as part of its supervision of the project.

58. Contractual clauses regarding heat output from the solar-based power plant component will be incorporated in the O&M contracts between NREA and the contractors in order to maximize the solar output. The contracts for the O&M will be for 2 years. Therefore, the power plant will be operated by the contractors during the first 2 years from commissioning. There will be penalties in case of not meeting the required generation output, the required heat production from the solar field, or exceeding the fuel consumption. During these 2 years, NREA should gain the necessary experience to take over the plant.

59. The project is expected to be implemented between 2008 and 2011, with operations commencing in 2010.

3. Monitoring and evaluation of outcomes/results

60. NREA will monitor the progress against the agreed performance indicators listed in Annex 3. Data and statistics on actual project output and outcomes will be gathered, analyzed and included in periodic progress reports to be submitted to the Bank.

61. NREA will be assisted in this by the construction management consultant. For the EMP, NREA will be assisted by the construction management consultant, and as needed, EEHC's environment department to monitor and ensure compliance with the plan.

62. The Bank supervision effort will cover the estimated 3 years of construction and some period of the 2 year O&M in the interest of capturing lessons learned of the project in line with the project's development objectives and rationale of GEF support. Based on the review of the periodic reports and outcomes of the supervision missions, measures will be taken to ensure that the project is completed without delay and achieves its planned outcomes.

4. Sustainability and Replicability

63. The GOE's commitment to renewable energy resource development is strong as evidenced by its declared objective of diversifying energy sources, including having 3% of its electricity needs represented by renewable energy by 2010 and the establishment of the "petroleum fund" which provides economic incentive to renewable energy producers. Furthermore, although it is anticipated that part of the higher capital cost of the hybrid plant will be offset by the proposed GEF incremental cost grant, NREA will finance incremental cost above US$49.8 million, recognizing the cap on GEF grant support to the project. Finally, the integration of the solar field with a CCGT ensures that the hybrid will provide the required electricity contribution to the system regardless of solar radiation conditions. For these reasons, the hybrid power plant is expected to operate sustainably as an integral part of the Egyptian power system. The incentive structure for the solar and CCGT O&M operators will ensure efficient operation of the plant and optimal design for integration of the solar thermal with the gas-fired plant and maximize solar output from the plant when in operation.

64. Dissemination of information about this project will contribute to possible future replication in other countries and to refining the GEF strategy regarding this technology. Indeed, the general approach adopted by the project is highly replicable within Egypt, regionally and globally. An early study carried out by the Energy Sector Management Assistance Program (ESMAP) suggested that sites with ready access to gas supply, electricity evacuation and water infrastructure would be capable of supporting 5-10GW of solar thermal plant in Egypt. High insolation sites are available across much of the region, though many lack the necessary infrastructure at this time. Worldwide there are suitable sites and, unlike other renewable technologies, integrated solar combined cycle power plants are inherently at utility scale. Having said that, the main barriers to further replication are costs and the associated learning needs, the overcoming of which this project (and the ones in Mexico and Morocco) is expected to contribute to by providing a benchmark for costs and operational information and disseminating it throughout the solar thermal community. However, it is unrealistic to expect

that this project alone (or even combined with the two being prepared) will bring costs down to levels that are competitive with conventional power plants. Further development of this technology outside of the GEF's OP 7 is needed as well as possibly additional international financing institutions support to additional projects.

5. Critical risks and possible controversial aspects

Risk	Risk Rating	Risk Mitigation Measure
From Outputs to Objective		
Insufficient implementation capacity at NREA to contribute to the demonstration and lessons learned about the technology.	M	Build capacity during preparation and implementation and during O&M period; Have the assistance of the construction management consultant. Also, NREA has demonstrated strong implementation capacity through the development of wind projects, with 225 MW of installed capacity and much more planned for. Back up support by EEHC as needed.
From Components to Outputs		
Integration and performance problems due to separate contractors for construction and operation of the solar and the CCGT parts.	H	Hiring of construction management consultant during construction and two years into operation who will help with detailed engineering and design including interface aspects. Having responsibility for the performance of the whole plant allocated to the CCGT O&M contractor with penalties due to NREA for not meeting required generation and possible solar output based on verified data collection.
Technological or design problems	M	Ensure only credible suppliers/contractors are allowed to bid.
Suppliers/Contractors not willing to bid for project with solar element	M	Prequalification resulted in 4 qualified bidders. 3 qualified bidders submitted bids for the contract.
No incentive to maximize solar contribution	M	Incentives are included in contractual arrangements and are based on efficiency of the plant as a whole.
Lack of cost recovery by NREA and impact on plant maintenance	M	PPA with EEHC will ensure coverage of reasonable cost, including maintenance.
Overall Risk Rating	M	

sk), N (Negligible or Low Risk)

6. Loan/credit conditions and covenants

Effectiveness Conditions

- Subsidiary grant agreement between the Recipient and NREA.

Other [classify according to covenant types used in the Legal Agreements.]
Legal Covenants (likely to include):

- Establish the Project Implementation Entity no later than three months after project effectiveness.

D. APPRAISAL SUMMARY

1. Economic analysis

65. The appraisal of the proposed project is based on a feasibility study prepared by Lahmeyer Consultants and a conceptual design study prepared by Fichtner Solar Consultants. These studies provided estimates of the costs of hybrid solar thermal variants and their baseline equivalent CCGTs, including the economic least cost plant size, its dispatch into the power system, possible technology variants and cost estimates. Since the bidding process has been completed, real market data on the cost of both the solar and combined cycle portions are available and are used as the basis to appraise the project.

Cost-Benefit Analysis

66. The cost benefit analysis of the project shows that for a total capacity of 150 MWe, and introducing a 4 % solar contribution, the installed cost of the plant will be about $290 million. The installed cost includes the cost of equipment (based on bids awarded), and the estimated cost for consulting during implementation which has yet to be bid for but represents a small cost component as well as the estimated cost for the EMP[10]. The cost of equipment excludes taxes and import duties (an estimated US$22.4 million).

67. As for operating costs, the present value of fuel, O&M and consumables amounts to $153 million over the 25-year lifetime and the construction phase. The O&M costs in economic terms assume an economic cost of natural gas of US$2.52/mmbtu as compared to the actual price charge to the power sector of US$1/mmbtu. The cost of gas assumption is based on results of a study on the economic cost of natural gas in the domestic market which has been carried out by international consultants financed by ESMAP (Energy Sector Management Assistance Program) and managed by the World Bank.

68. Economic benefits are derived from the economic value of electricity generated, where the average electricity tariff has been assumed to be US$0.07/kWh -- the price for electricity exports to Jordan. The GEF grant of $49.8 million has been included as an economic benefit as it reflects global willingness to pay for this project.[11]

69. Based on these costs and benefits, the project generates a net present value of US$54 million and the EIRR of the project is 13%.

Incremental Cost Analysis

70. To determine the incremental cost of the proposed project, the cost of the proposed plant has been compared to a reference plant using conventional fossil fuel based technology.

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[10] The estimated costs for consulting during implementation and for the EMP are assumed to be incurred during project construction phase. In practice part of such costs may be incurred during operating phase.

[11] In accordance with OP10.04 – Economic Evaluation of Investment Operations, paragraph 8.

71. The results show that a 150 MWe plant with a 4% solar contribution will increase the installed cost by about US$99 million (from US$191 million (US$158.2 million in present value terms) for a reference CCGT plant to US$290 million (US$240 million in present value terms) for the ISCC plant). There will also be incremental O&M cost, the present value of these costs is about US$19.7 million over the construction and the 25-year project life. The costs are partially offset by the reduced fuel consumption; the present value of which is US$4.3 million. Therefore, the estimated **net incremental cost** (both capital and operating costs) for 20 MWe of solar capacity is US$97.2 million at a 10% discount rate. The proposed GEF financing is capped at US$49.8 million so the remaining incremental cost (US$47.2 million) will be financed by NREA. Annex 15 presents the results in more detail.

Calculation of Incremental Cost	**US$ Million**
Discount rate	10%
Reference Baseline CCGT	
Capital costs	158.2
Fuel costs	113.2
O&M costs	24.1
Consumables	0.7
Total	296.2
PV GWh	5808.6
Levelized electricity costs (cents/kWh)	5.10
ISCC	
Capital costs	240.0
Fuel costs	108.8
O&M costs	43.8
Consumables	0.8
Total	393.4
PV GWh	5808.6
Levelized electricity costs (cents/kWh)	6.77
Increment:	
Capital costs	81.7
Fuel costs	(4.3)
O&M costs	19.7
Consumables	0.0
Total incremental cost	**97.2**
Incremental levelized costs (cents/kWh)	1.67

2. Financial Analysis

Financial Assessment of the New and Renewable Energy Authority (NREA)

Past and Current Performance of NREA

72. NREA revenues stem from research and development activities and in recent years, mainly from the sale of electricity it generates from renewable sources to EEHC. Based on audited accounts for the past four years, the company incurred losses, as it transitioned from a

purely research and development entity to one whose major activity is the production of green energy.

73. NREA has recently been able to negotiate an increase in the tariff per kWh it receives from EEHC for the electricity sold to the grid to 12 Pt/kWh with gradual annual increases planned for future years. This has enabled NREA to fully service its debt obligations in the fiscal year 2005, something it was unable to do in earlier years. As of 2004/05, the authority's long-term debt reached LE 1.28 billion (US$223 million), of which the current portion is estimated to have reached LE 38.4 million (US$6.7 million).

74. In addition, as of 2004/05 NREA has started benefiting from the Petroleum Fund, under which it is eligible to receive 2 Pt per kWh of energy produced from renewable energy sources. In 2004/05 this additional revenue amounted to LE 5.8 million (US$1 million), and it is expected to increase substantially as NREA's installed capacity is augmented.

75. The authority has low levels of accounts payables; however, its receivables from EEHC amount to about LE 33.25 million (US$5.8 million, 287 days). In 2004/05 NREA was able to collect 80% of the revenues it was owed from EEHC.

76. The authority's main operating expense is with salaries and wages, which account for about 80% of total operating expenses. Expenditures on operations and maintenance (O&M) are low amounting to about 8% of operating expenses and only 0.1% of its gross fixed assets. As NREA gears up to become Egypt's major producer of green energy, appropriate maintenance of its facilities will be critical to maximize the electricity output and ensure future sustainability of NREA's assets.

Future Financial Performance of NREA

77. Projections to assess NREA's future financial position and performance have been carried out for the period 2005/06 to 2019/20. A summary of the assumptions used in the forecast is presented is Annex 9 and detailed assumptions are recorded in the project files.

78. Projections for NREA's future performance are based on the following key assumptions:

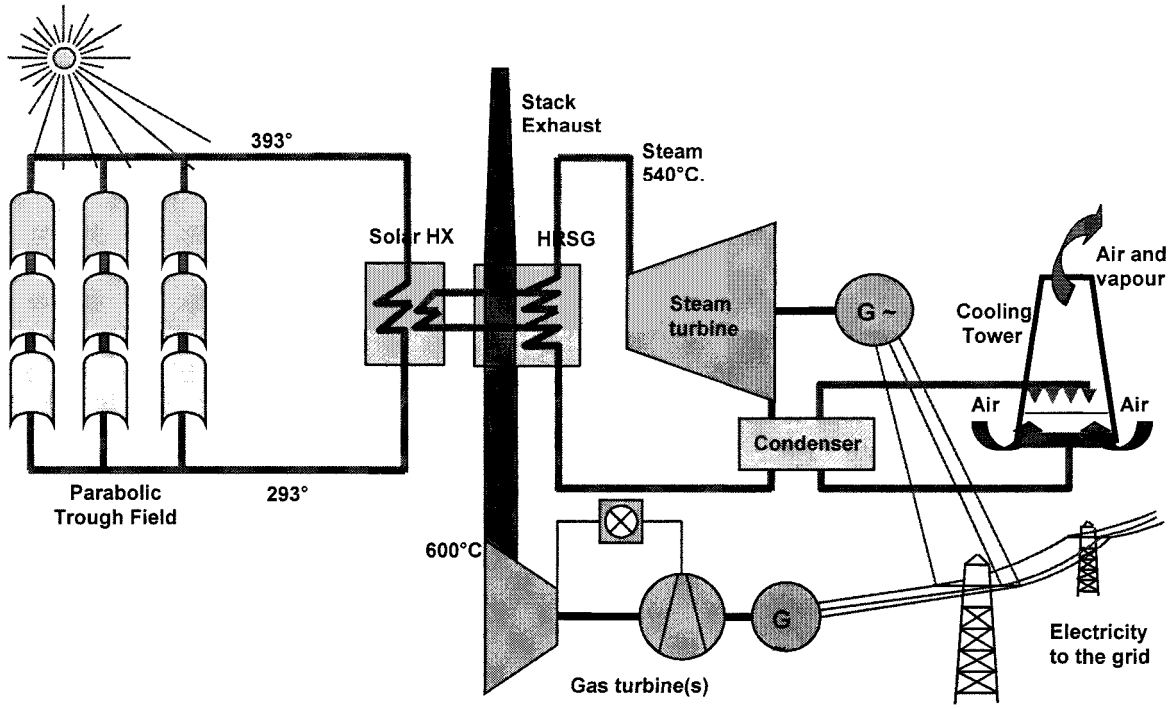
- NREA expects to benefit from the sale of carbon emission reduction credits (based on the amount of CO_2 emissions saved from the electricity it produces from renewable sources) as an additional source of revenue. To this end, it has already signed two bilateral agreements encompassing 140 MW of wind turbines planned to be operational by 2008/09. It is assumed that NREA will be able to sell carbon emission reduction credits for all the renewable projects it plans to implement in the future, excluding the ISCC.
- From 2006/07 onwards, the tariff NREA charges EEHC for the electricity sold increases at the same rate as domestic inflation.
- Gradual increase in the revenue collected from EEHC to 98% by 2009/2010.
- Gradual increase in O&M expenditures to a level that is equivalent to 1% of gross fixed assets by 2013/14, to be in line with additional installed capacity.

79. The analysis shows even though NREA's operating margin and cash flow position are positive, its overall financial performance (taking into account depreciation and finance charges) deteriorates further in the short-term, with net operating losses being incurred up until 2009/2010, mainly due to the need for significant increases in O&M expenditures, as these become a critical element in ensuring the maximization of the electricity output of current and future installed capacity, which are key in ensuring the future sustainability of NREA.

80. It has been agreed with NREA's management to monitor two financial indicators (a) the debt service coverage ratio (DSCR) and (b) the self finance ratio (SFR) as proxies for financial soundness. A minimum DSCR of 1.1 and a minimum SFR of 0.1 are targeted to be achieved upon project close.

3. Technical

81. The plant comprises essentially two portions (a solar portion and a combined cycle portion). The figure below illustrates the design of the integrated plant.



82. The main technical challenge of the proposed scheme is the integration and performance of the two portions making up the power plant. Further, due to the financing sources requirements, the Borrower had to separate the procurement of the two portions, resulting into two contracts (one for the solar and one for the CCGT). The technical integration risk is mitigated through (i) inclusion in the completed procurement process of data exchange between the two bidders who have won the contracts; (ii) hiring of a construction management consulting firm for the supervision and integration of the solar and combined cycle islands, and (iii) hiring

an experienced operator for O&M of the combined cycle island with responsibility to coordinate operation with the O&M operator of the solar island.

83. Several clarification meetings (with both Solar Island and CCGT Island Bidders present) have taken place to discuss the common section in the bid documents on the interface requirements, where each Solar Island bidder will provide their inputs. From the Solar Island Bidder's inputs, one interface document was established which had to be met by the CCGT Bidders.

84. The Solar Island is designed to achieve the lowest cost of generation of solar heat based on the given data file of 8,760 hourly reference values of solar irradiation, solar position and ambient temperature. The contract with the winning bidder includes a performance model for the calculation of heat output as a function of solar irradiation, solar position and ambient temperature.

85. The CCGT Island is designed having as reference the solar island design and cost. In addition, the supplier of the CCGT received interface requirements from the Solar Island supplier.

86. The performance risk is being mitigated through the formulation of incentives in the framework of the two O&M contracts for the solar and CCGT Islands – which will regulate the operation of the plant over its lifetime.

87. The verification of the performance of the solar O&M operation will be by measuring the ambient conditions of solar irradiation and ambient temperature and calculating with the performance model the amount of solar heat which should be generated. This calculated amount will then be compared with the actual generated amount in order to determine if the guarantee has been achieved. For the CCGT Island, a similar procedure can be adopted; in this case the actual solar heat produced by the Solar Island serves as an input in order to determine the requirement for the CC Island operator.

88. The performance and efficient operation of the ISCC will ultimately be assured through incentive mechanisms (penalties and bonuses) as follows:

- The Solar Island is checked for heat production as a function of irradiation. If it is not met there will be corresponding penalties.

- The CCGT Island is checked for electricity production as a function of Solar Heat supplied by the Solar Island. It is the responsibility of the CC Island Operator to use all the Solar Heat supplied. If it is not met there will be corresponding penalties.

89. If the electricity production is not achieved, the shortcoming can clearly be allocated to one of the two operators.

90. In particular, integration and control of the system should be flexible enough to allow the solar contribution to be consistently maximized, while under other circumstances allow power to be efficiently generated on natural gas only (e.g., during night time or if the solar field is not

operational). The bid evaluation criteria and the determination of the levelized electricity cost (LEC) were included in the bidding documents.

4. Fiduciary

Procurement issues:

91. The supplier for the solar island was procured through an international competitive bidding process, in which bidders were given the maximum freedom of choice to meet the plant specifications from the technological and financial points of view. The solar field will be of the proven parabolic trough type, where 2 types of design are available (Euro-trough and LS-3). The combined cycle plant configuration was optimized during the bidding process and became definite when the winning bidder submitted his final design. The bid documents used allowed flexibility for a range of power output in order to have sufficient competition. The bidders were allowed to offer gas turbines of their choice (different or not from the baseline design) which fit best the evaluation criteria. This open approach aimed at ensuring that optimum technology at least cost be employed.

92. A procurement capacity assessment of NREA was carried out during project preparation and identified that NREA has gained good project implementation and procurement experience as a result of its work with several international donors financing some of its projects. The assessment also reviewed that NREA's organizational structure for implementing the project is satisfactory.

93. The completed procurement for the solar island prior to final approvals has permitted project preparation to address several critical procurement issues that are essential to achieving the project objectives. The bidding was carried out according to World Bank Procurement Guidelines to ensure the selection of reputable contractors/suppliers on a competitive basis. In particular:

- Pre-qualification was carried out to ensure that only appropriately qualified contractors/suppliers were invited to bid. Prequalification criteria included: (i) experience and past performance on similar contracts; (ii) capabilities with respect to personnel, equipment design, construction, manufacturing and operation facilities; and (iii) financial position;
- The solar island EPC cum O&M contract was procured using the Bank Standard Bidding Document: for Supply and Installation of Plant and Equipment with two stage bidding procedures;
- Evaluation of the EPC cum O&M bid for the Solar Island and EPC CCGT Island bid was based on: (i) the investment costs (in US$ equivalent); (ii) generation (kWh/a); (iii) solar generation (kWh/a); (iv) O&M costs (US$/a); (v) fuel consumption (Btu/a); and (vi) guaranteed availability and degradation of the unit, and (vi) the final evaluation report was cleared by the World Bank's operations procurement review committee.

94. The CCGT Island bidding process is also completed. The contract is on the basis of EPC only. The O&M contract for the CCGT will be a separately bid. The O&M contractor for the

CCGT will have to guarantee that it meets the annual generation (number of kWh) and fuel consumption (number of million BTU of gas) predicted from the performance matrix (this performance matrix is similar to a performance model) for the actual amount of solar heat delivered to the CC island and also the annual ambient temperature profile.

Financial management issues:

95. The project financial management assessment was conducted to assess the financial management arrangements currently in place at NREA and their adequacy to support the project implementation. The purpose are to identify the associated risks, build up the relevant mitigating measures, and agree with the grant recipient on how to deploy or adjust the current arrangements to support the proposed project and on any special measures that need to be carried out.

96. By virtue of its articles of incorporation, NREA adopts the Egyptian Unified Accounting System (UAS) in maintaining its accounts and for reporting on its financial position and its results of operations. The UAS is complimented by the accounting standards issued by the Central Auditing Organization (CAO) and applicable to public authorities of economic nature like NREA. For donors financed projects, NREA maintains separate parallel records (manual and excel spreadsheets) in order to record and report on these projects' financial position. In order to provide a full picture on the proposed project, the entire project funds (GEF grant, JBIC loan, and NREA's local contribution) will be accounted for in one set of records and financial statements.

97. A reporting risk arises from the nonconformity of NREA's accounting system with the Bank's reporting needs and the inability of the current system in place to report separately on the project funds and transactions. To mitigate this risk, the foreign exchange (FX) department will maintain parallel records for the project transactions in coordination with the PIE at the project site and the cost accounting department, and will be responsible for preparing interim and final project financial statements required by the Bank.

98. NREA's current auditing arrangements are not adequate to report on the project accounts separately and in accordance with Bank requirements. The CAO audit does not report separately on a specific project's accounts. In addition, the Bank requests reviews of the interim financial reports which are not typically provided by the CAO. Therefore it has been agreed that an independent private auditor will be hired to provide a project audit and review reports as required by the Bank.

99. NREA did not manage a designated account under the Wind and Solar projects preparation grants which exclusively used direct payments. GEF grant funds will be fully applicable to one large contract and therefore disbursements under the grant will also take place via direct payments.

100. The high share of local contribution ($126 million out of $327 million total project cost, including 2-year of eligible cost of O&M) can result in delayed funds availability and delayed implementation. NREA will reflect the project investment requirements in its five year budget

plan for FY 07/08 to FY 11/12 to mitigate against this. In addition, NREA has already included part of the project costs in its FY 06/07 approved budget.

101. The above mitigating measures, NREA's previous experience with Bank procedures through the preparation grants (for Solar and Wind Projects), and the relatively simple project design with limited number of contracts result in an overall risk rating of Modest.

5. Social

102. The project will be developed on a site belonging to NREA, close to the existing Kureimat gas-fired combined-cycle power plant owned and operated by EEHC. All construction-related activities will take place on this land. No land acquisition is likely to take place as a result of the project. The area covers desert land with no existing residents or any economic activity taking place. The site is several kilometers from the town of Kureimat, and a separate residential area set aside for the employees of the existing power plant is located about 2 kilometers from the project site. The existing residential complex includes a kindergarten and a sports club. In case any additional buildings will be required, these will be constructed on land belonging to NREA. A labor camp will not be needed as the workers will be recruited locally and will commute by bus on a daily basis. Moreover, the site is located in a relatively remote area a long distance from the nearest permanent settlements, and the construction of the plant is not likely to have negative impacts on local livelihoods. Rather, the planned project has been reported to be received favorably by the local population for several reasons. The most important impact will be local employment, particularly during construction which will bring income to the nearby communities. Small farmers occupying a total of about 1,180 feddans[12] south of the planned power plant also expect to benefit, particularly during construction, as opportunities to sell their produce locally will improve.

103. In view of the above, no resettlement, land acquisition or loss of livelihood is likely to take place as a result of the project and OP 4.12 is not expected to be triggered.

6. Environment

104. An initial scoping study on environmental impacts was undertaken as part of the feasibility study prepared by Lahmeyer. It reported that the environmental impacts of the project were expected to be minimal as: (i) the site is located in the desert without cultural or environmental constraints; (ii) it is close to the existing larger gas-fired power plant at Kureimat for which major infrastructure (gas supply and electricity evacuation) has already been furnished; and (iii) the plant will utilize natural gas and solar heat.

105. Subsequently, a comprehensive EIA following the EIA guidelines in OP 4.01 and under terms of reference cleared by the Bank has been carried out. A draft EIA was disclosed in the InfoShop on July 10, 2006 and in-country disclosure has also taken place. The final EIA was disclosed on December 28, 2006. It includes an assessment of air quality, aquatic environment, noise, flora and fauna, soils and hydrology, traffic and transport, socio-economic, archeological, natural disasters, solid waste management and occupational health and safety. The EIA also

[12] 1 feddan ≈ 1 acre

establishes a detailed environmental management and monitoring program to be followed by NREA and its contractors during plant construction and operation. In addition, the design of the plant incorporates various measures to minimize environmental impacts. These include use of natural gas as the main fuel, low NOx combustors in the gas turbines, a stack height of 35 meters to maximize dispersion of emissions, as well as oil interceptors fitted to the site drainage system and effluent treatment facilities to treat wastewater prior to discharge.

106. There is no resettlement foreseen and no adverse social impacts are expected. The GEF component will ensure that the poor are not adversely affected, as the project will not impact on the current tariff levels in place. The Environmental Mitigation Plan is provided in Annex 10. The cost of the EMP has been estimated at close to US$0.45 million.

7. Safeguard policies

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[ ]
Pest Management (OP 4.09)	[ ]	[ ]
Physical Cultural resources (OPN 11.03, being revised as OP 4.11)	[ ]	[ ]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[ ]
Indigenous Peoples (OP/BP 4.10)	[ ]	[ ]
Forests (OP/BP 4.36)	[ ]	[ ]
Safety of Dams (OP/BP 4.37)	[ ]	[ ]
Projects in Disputed Areas (OP/BP 7.60)*	[ ]	[ ]
Projects on International Waterways (OP/BP 7.50)	[ ]	[ ]

8. Policy Exceptions and Readiness

107. The project will fully comply with Bank policies, and meets the regional criteria for implementation.

108. Furthermore, given the advanced stages of procurement (see below), the project is deemed ready for implementation.

Procurement package	Status	Estimated date for contract signing
CCGT	Bidding complete	October 2007 (done)
Solar plus 2-yr O&M	Bidding complete	October 2007 (done)
Project Manager	RfP issued late September 2006	December 2007
CCGT O&M contract	RfP will be issued in March 2009	September 2009

* *By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas*

Annex 1: Country and Sector or Program Background

Country Issues

A comprehensive economic reform program was adopted in Egypt in 2004, when significant change took place in the cabinet and several new officials were appointed to key ministerial positions. This new government has made economic reform its key objective, notably in areas such as finance, investment, trade and industry. It has also stated its keen interest to enhance the provision of public goods and services, including physical and social infrastructure. The latter includes the power sector.

The investment needs in infrastructure remain substantial. It is estimated that approximately 4-6% of Gross Domestic Product (GDP) needs to be invested annually in infrastructure sectors in the Middle East and North Africa (MENA) region to satisfy new investment requirements as well as maintenance and replacement spending.[13] The decline in investment in the MENA region, including in Egypt, is reported to have compromised the infrastructure base, which is further challenged by the high growth in demand for modern infrastructure services. To ensure adequate provision of electricity, the Egyptian Electricity Holding Company (EEHC) - responsible for generation, transmission and distribution of electricity in Egypt - requires on average about 1,500 MW of new capacity each year. Promotion of renewable energy projects plays a key part in Egypt's generation plan. Indeed, to date 225 MW of wind-turbines have been installed and are operational, performing well at an average capacity factor of 42%.

While investment is required to ensure adequate infrastructure, the Government of Egypt (GOE) is increasingly concerned with the rising fiscal deficit and public debt, which rose from 3.9% in FY00 to 9.6% in FY05. To counter this, the GOE has been implementing several measures to reduce the deficit over the medium term by restraining public expenditures and increasing public revenues. As a result, the deficit as a percentage of GDP for FY06 dropped to 8.6% and the GOE plans to reduce it further by 1% per year for the next five years. The key measures that the GOE has adopted include redesigning of subsidies, controlling growth in public sector employment and cutting unnecessary expenditures. Some reforms already underway include:

- Increasing retail utility prices, including increases in electricity and gas prices.
- Reducing custom tariffs.
- Reducing price controls and subsidies on basic products, including diesel-fuel.
- Increasing interest in the potential for public-private partnerships (PPPs).
- Strengthening and reorganizing the privatization program under the Ministry of Investment established in June 2004.

Against these reforms, the GOE remains committed to providing a public safety net comprising of various subsidies, employment programs and cash transfers and agrees that there is much room for improving the cost-effectiveness of the safety net currently in place and its coverage of the poor. Assistance to do this is included in the Country Assistance Strategy (CAS).

[13] Cited in internal Bank report on "Arab Republic of Egypt: A Short Infrastructure Assessment," December 2004.

Sector Issues and Government Strategy

Access to electricity is high in Egypt (98%). However, the fast growing demand puts significant pressure on the sector's ability to provide reliable and reasonably priced electricity; challenging both its ability to contribute to higher growth and poverty alleviation. To ensure sustainable service delivery, the GOE is implementing reforms in electricity pricing, diversification of supply and improved efficiency through the development of a market for electricity trade.

Electricity pricing: In October 2004, the GOE approved an increase in electricity tariffs, the first increase in 12 years, and a subsequent tariff increase was approved in 2005 in which the average tariff changed to 14.86 Pt/kWh (2.5 US¢/kWh).[14] Further increases to industries were announced in August, 2007. Still, Egyptian electricity prices are low by international standards and when compared to a number of other countries in the region, since prices have declined substantially in real terms over the 12 year period of no price changes and, with the depreciation of the Egyptian pound, in foreign currency terms as well.

In addition to subsidized overall tariffs, there are also substantial cross-subsidies which are not very well targeted. An inclining block tariff is used to subsidize residential customers who use the least electricity. The GOE is fully aware of cross-subsidization in the sector and, although the overall electricity retail tariff has increased, subsidies continue to prevail for politically sensitive customer segments. The GOE is keen to eventually reduce the level of cross-subsidization in the sector and the subsidies in general, but recognizes that this will take time. Bank assistance is being provided under the El Tebbin Power Project (Loan No. 7359-EGT) to design and implement time of use tariffs and load management schemes, which would assist in improving overall cost recovery, as well as sending signals for increased energy efficiency by reducing demand for electricity at peak periods.

Egypt's significant reserves of natural gas play a key role in electricity production. Current proven reserves are estimated at 67.2 trillion cubic feet (Tcf), with an additional 120 Tcf identified as probable and possible reserves.[15] To meet projected domestic demand (industrial, commercial and residential) and export demand (via pipelines and liquefied natural gas terminals) over the next 20 years, about 15 Tcf is estimated to be required. This leaves Egypt with a proven Reserves/Production (R/P) ratio of over 80 years. Domestic gas consumption is dominated by the power sector at 65%, followed by the fertilizer industry, petrochemicals and other industrial sectors. The price of natural gas to industries as well as the power sector has been set at 21 Pt/m^3 (US$1/mmbtu), but an increase over a 3 year period was recently announced for the industrial sector which will see the gas price increase to US$2.65/mmbtu by the third year.

As natural gas is becoming increasingly important to Egypt's economy, particularly with the growing potential for exports, moving towards cost-based pricing of gas is becoming increasingly important. As a result, the GOE has undertaken a study to determine the cost of gas, which the Bank has assisted through ESMAP (Energy Sector Management Assistance Program). The study has been disseminated among key governmental stakeholders and provided the basis

[14] The 2004 increase was of 8% on average, in 2005 a further 5% average increase was approved, and the government plans further annual increases of 5% for the next 4 years.
[15] Source: Ministry of Petroleum, July 2005.

for the recent increase in gas price to industry and is informing the GOE's longer-term gas pricing policy and strategy.

Diversification of supply: As stated above, the fast growing demand for electricity requires significant investment in generation capacity each year (the increase in demand for electricity in Egypt averaged about 7% during 1997/98–2003/04 and is expected to remain in the 6%–7% range over the next 10 years). Installed capacity of electric power was 20,452 MW in 2005/2006, of which 85% comprised thermal power (10% of which is provided by the private sector through 3 Independent Power Producers, IPPs). The remaining capacity was attributed to hydropower (14%) and wind (1%). Peak load reached 17,300 MW in 2005/2006, and about 90% of the thermal power production was based on natural gas. Initiatives are underway to better understand customer consumption patterns and loads to ultimately implement demand-side management measures to reduce the overall consumption and the growth in demand.[16] World Bank assistance is being provided to this effort.

The GOE's strategy is to continue to implement gas fired power plants, with a long-term view to increase the share of combined cycle gas turbine technology in the generation mix. In addition, the GOE has a target of meeting 3% of its electricity needs from renewable energy sources by 2010; and 20% by 2020 (including hydro which today comprises 13% of the 20% target). Bank technical assistance was recently requested to help in the development and achievement of this plan. The New and Renewable Energy Authority (NREA) has the responsibility to develop renewable resources in Egypt and implement the government's strategy on renewable energy. Until 2001, most of NREA's activities have been in the research and development field, and since then its activities have increasingly turned to the production of renewable energy. NREA has in recent years successfully augmented its revenues with income from the sale of carbon reduction credits under the clean development mechanism. Indeed, agreements have already been signed with the Japanese, the Danish and the German governments.

NREA's strategy is to capitalize on Egypt's abundant wind and solar natural resources to meet the renewable energy target set by the Government. For this purpose it plans to install an additional 850 MW of wind by 2010 and considers the construction of the proposed Integrated Solar Combined Cycle Power Plant (150 MWe) a key development towards improving and diversifying its institutional and technical capacity in the area of renewable energy.

Finally, as an incentive to the development of renewable energy, the GOE has established a mechanism (the 'Petroleum Fund'), where producers of non-fossil fuel electricity receive 2 Pt/kWh. This mechanism is intended to accelerate development of renewable energy by sharing with developers the additional export revenue generated from fuel savings derived.

Electricity Market Development: Following the 2001 unbundling of the electricity sector in Egypt, further reform of the sector includes market development, such as liberalization and greater regional integration. The Ministry of Electricity and Energy is in the process of developing a plan for the introduction of competition in the sector consistent with the

[16] Energy intensity in Egypt in 2004, defined as the energy consumption per unit of GDP was equal to 0.22 toe / 000' 95 US$, which is comparable to other oil producing countries in the region (Algeria: 0.20) and lower than others (Iran: 0.33), but higher than Western European countries such as Germany (0.18) and France (0.19).

implementation of further tariff increases and on-going improvement in the efficiency of the subsidiary companies. This plan will see gradual opening of the sector, starting with the generation segment. To facilitate reform, a regulatory agency has been established and an electricity law is under formulation. A Higher Energy Council was recently established under the chairmanship of the Prime Minister and with members represented by the ministers of electricity, petroleum, finance, planning and economic development. This council reviews energy alternatives, their economics as well as overall energy policy and planning.

Egypt's plans are consistent with - and supported by - its participation in the European Neighborhood Policy (ENP) partnership, which was developed in the context of the European Unions' (EU) 2004 enlargement with the objective of avoiding the emergence of new dividing lines between the enlarged EU and its neighbors. A key feature of the ENP is the bilateral ENP Action Plans mutually agreed between the EU and each partner country. These action plans set out an agenda of political and economic reforms with short and medium-term priorities. In the case of Egypt, the action plan is under discussion and includes market liberalization (in principle by 2010) and continued price reform in both the electricity and gas sectors.

Meeting the reform targets in the action plan will require far-reaching reforms of the Egyptian power sector. Some assistance on how to achieve this is being provided through the EU. The European Investment Bank also has significant grant funds available to Egypt for technical assistance. Nevertheless, significant work remains on the detailed steps required to meet the liberalization objective, as well as Government policy on how to finance sector investments in the longer term, including the respective roles of the public and private sectors. On the latter, the GOE remains open to private sector participation, although the pressure on the financial status of the sector has led to the GOE opting for public sector financing for the time being. Clearly, tariff/subsidy reform would need to accompany any large-scale re-engagement with private participation, as well as and as mentioned earlier; reform of the social safety net, which is a key priority of the GOE. The Bank is providing the Government with assistance to formulate an energy pricing strategy including reforms to social safety nets and social protection in order to support the implementation of tariff/subsidy reforms.

Annex 2: Major Related Projects Financed by the Bank and/or other Agencies

Sector Issues	Project	PDO Rating
Private Sector Power	Port Said and Suez East (IFC)	
Power Generation	El-Tebbin Power Project (World Bank 2006)	S
	Kureimat Power Project (World Bank 1992)	U
	El Kureimat Power Project (AfDB)	S
Power Development	Walidia Thermal Power Station (JBIC)	
	Abou-Zaabal Substation (JBIC)	
	Sidi Krir Transmission and Substation Project (JBIC)	
Clean Energy Development	KfW-sponsored Wind Farm	S
	Danida-sponsored Wind Farm	S
	JBIC-sponsored Wind Farm	
	Spanish-sponsored Wind Farm	
Gas Sector	Gas Investment Project (World Bank 1992)	
	Gas Connections Project (World Bank)	Under Preparation

Annex 3: Results Framework and Monitoring

Results Framework

PDO / Global Environmental Objective	Project Outcome Indicators	Use of Project Outcome Information
1. Increase the share of solar-based power in the Egyptian energy mix	1.1 Total electricity generated from solar sources (GWh/year) 1.2 Solar output as a percentage of total energy produced in the hybrid plant 1.3 Total electricity generated from the ISCC plant	Track solar-based generation and identify changes needed to maximize solar output
2. Contribute to lower CO_2 emissions in energy generation	2.1 Emissions reduced from use of solar fuel (tons of CO_2/year)	Track CO_2 emissions reduction and make adjustments to meet objective
3. Support the development and demonstration of the operational viability of the ISCC configuration, and contribute to its replication.	3.1 Cost of solar thermal power (¢/kWh and $/kW) 3.2 # of NREA staff trained on various aspects of solar technology 3.3 Dissemination of information on the plant and of lessons learned during pre-construction, construction and operation of the plant	Record details of development of solar/ISCC plant to serve as lessons learned for design of future solar/ISCC plants Monitor cost of solar generation and determine if change in operation of solar/ISCC plant is necessary to maximize output
Intermediate Outcomes	**Intermediate Outcome Indicators**	**Use of Intermediate Outcome Monitoring**
Demonstrate the operational viability of solar thermal power generation in Egypt	Solar plant completed and operational with a generation capacity of about 20MW.	Illustrate that solar thermal plants can be constructed and operated efficiently in the context of a developing country.

Arrangements for results monitoring

			Data Collection and Reporting		
Project Outcome Indicators	**Baseline**	**Target Values**	**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
1. Total electricity generated from solar sources (GWh/year)	0	33.4 GWh	Items 1, 2, 3 and 4 will be monitored and reported quarterly during plant operation, to be reported on progress reports.	Monitoring by NREA and the EPC contractor	NREA / EPC contractor
2. Solar output as a percentage of total energy produced in the hybrid plant	0	4 %			
3. Total electricity generated from the ISCC plant (GWh/year)	0	852 GWh			
4. Emissions reduced from use of solar fuel (tons of CO_2/year)	0	20,000 tons of CO_2/year			
5. Cost of solar thermal power (¢/kWh and $/kW)	Unknown	No set target, cost will be identified and monitored during implementation.	Item 5 monitored and reported quarterly during plant construction, to be reported on progress reports.		
6. # of NREA staff trained on various aspects of solar technology	0	To be determined as the project gets implemented.	Items 6 and 7 will be monitored during construction and operation of the plant reported on a quarterly basis throughout the project.		
7. Dissemination of information on the plant and of lessons learned during pre-construction, construction and operation of the plant	0	Dissemination to be determined based in lessons learned during project implementation			
Intermediate Outcome Indicators					
Solar plant completed and operational with a generation capacity of about 20MW	0	Plant is operational	Quarterly progress reports on status of construction of the ISCC plant	Monitoring by NREA and the EPC contractor	NREA / EPC contractor

Annex 4: Detailed Project Description

The project will be developed in Kureimat, about 90 km south of Cairo. The site was selected due to: (i) it comprises an uninhabited flat desert area; (ii) there is high intensity direct solar radiation which reaches 2400 kWh/m^2/year; (iii) it is close to the extended unified power grid as well as natural gas pipelines; and (iv) it is near to water sources (e.g., the Nile River). The design of the project is based on a conceptual design report prepared by Fichnter Consultants

The plant will have a combined capacity of about 150 MW, including 20 MW of solar capacity. When own consumption of 6.3 MW is deducted, the net overall plant capacity becomes 143.4 MW. The total net energy produced by the plant is expected to be 852 GWh per year, which includes the solar contribution of 33.4 GWh per year. This corresponds to a solar share of 4 % of the total annual energy produced by the plant operating at a full load.

The project will be implemented through three components. For Component 1 the costs are known since the procurement process for both the solar and the combined cycle portions have been completed. These costs are inclusive of import taxes on equipment and contingencies. Having said that, NREA will apply for an import tax waiver for select equipment at the time of actual import which would result in a potential saving of US$22.4 million for the project. For Component 2 and 3, estimated costs are presented.

Component 1. The design, construction and operation of the proposed Integrated Solar Combined Cycle Plant include two sub-components:

(a) The solar portion of the power plant (US$111 million; *of which GEF will finance US$49.8 million and NREA US$61.2 million*) includes one contract for engineering, procurement, construction, testing, commissioning and two years operation and maintenance (O&M). The solar island consists of a parabolic trough solar field capable of generating about 73 MW (thermal) of solar heat at a temperature of 393°C, the related Instrumentation and Control (I&C) and control room and the heat transfer fluid (HTF) system up to the HTF inlet and outlet flanges of the Solar Heat Exchanger(s).

(b) The capital cost of the combined cycle portion of the plant (US$201 million; *of which JBIC will finance US$151.3 million and NREA US$49.7 million*) includes one contract for the EPC aspect of the power plant. In addition, one 2 year O&M contract will be financed by NREA (US$8.8 million). The combined cycle island will consist of one gas turbine with ISO rating of about 73.3 MWe, one heat recovery steam generator (HRSG), one steam turbine of about 76.5 MWe, and solar heat exchanger(s) capable to absorb about 73 MW (thermal) solar heat plus all associated balance of plant equipment.

Component 2. Comprises capacity building to NREA through consulting services for construction management during the construction, testing and operation of the plant (US$6.36 million, including price contingency). The capacity building will focus on: (a) detailed engineering designs with special attention to the interface between the solar and CCGT parts; (b) supervising the construction and environmental aspects of the power plant; (c) monitoring the commissioning and guarantee tests; (d) preparing the O&M contract for the CCGT part in terms satisfactory to the Bank. As such, NREA will seek the Bank's comments on the draft contract

before requesting proposals; (e) providing assistance during the 2 year guarantee period as well as assisting NREA in monitoring and evaluation of the performance of the whole plant at least during the two years of the O&M period; and (f) providing training and transfer of know-how in ISCC plant operation, with particular emphasis to dispatching and integration into the power system so that NREA staff can successfully take over the power plant after the respective O&M contracts expire.

Component 3. Comprises the Environmental and Social Impact management component to be financed by NREA (US$0.45 million, including price contingency). This component will include the implementation of the Environmental Management Plan (EMP) which mitigates the potential environmental and social impacts associated with the construction and operation of the power plant.

The breakdown of the project components is provided in the table below:

Items	Equipment/ Work Cost	Others, Taxes & Contingencies	2-year O&M Costs	Total
Component 1				
a) Solar Island	98.74	6.10	6.15	110.99
b) CC Island	184.69	16.28	8.80	209.77
Component 2				
Capacity Building	6.00	0.36	Not applicable	6.36
Component 3				
EMP	0.425	0.025	Not applicable	0.45
Total	**289.86**	**22.76**	**14.95**	**327.57**

Note: Amounts are expressed in US$ million

Annex 5: Project Costs

A

EPC Contract (Million US$)	Local	Foreign	Total cost
1. Intergrated Solar Combined Cycle (ISCC)			
a- Solar			
Total Solar Equipment & Installation	30.29	45.08	75.37
Contractor's Engineering	1.46	21.91	23.37
Taxes and duties on imported equipment	6.10		6.10
Total Cost of Solar Island	**37.84**	**66.99**	**104.84**
b- CC			
Total CC Equipment & Installation	28.61	131.88	160.49
Contractor's Engineering	4.80	19.41	24.21
Taxes and duties on imported equipment	16.28		16.28
Total Cost of CC Island	**49.68**	**151.29**	**200.97**
2- Consulting Service during Implementation	**6.00**	**0.00**	**6.00**
3- Environmental & Social Impact Management	**0.425**	**0.00**	**0.425**
Base Cost (1 + 2 + 3)	**93.95**	**218.28**	**312.23**
Contingencies (Physical)	**0.00**	**0.00**	**0.00**
Contingencies (Price) {3% for Foreign & 6% for Local}	**0.39**	**0.00**	**0.39**
Total Financing Investment Required (excl. IDC)	**94.34**	**218.28**	**312.62**

* ISCC and CC costs are based on bids awarded, including contingencies, taxes and duties on imported equipment and excluding the cost of O&M contracts. Price contingencies are estimated for Component 2 and 3 only.

B

O&M Contract (Million US$)	2 years
Solar O&M Cost	6.15
CC O&M Cost (excl. fuel)	8.80
Total O&M Cost (excl. fuel)	**14.95**

A+B

[Tentative] Financing Allocation (Million US$)

Item	Total	GEF	JBIC	NREA
Solar (EPC)	**104.84**	**49.80**	**X**	**55.04**
Solar (O&M)	**6.15**	**X**	**X**	**6.15**
CC(EPC)	**200.97**	**X**	**151.29**	**49.68**
CC (O&M)	**8.80**	**X**	**X**	**8.80**
Consulting Service during Implementation	**6.36**	**X**	**X**	**6.36**
Environmental & Social Impact Management	**0.45**	**X**	**X**	**0.45**
Total	**327.57**	**49.80**	**151.29**	**126.48**

[k] NREA portion includes $22.38 of taxes and import duties on import equipment.

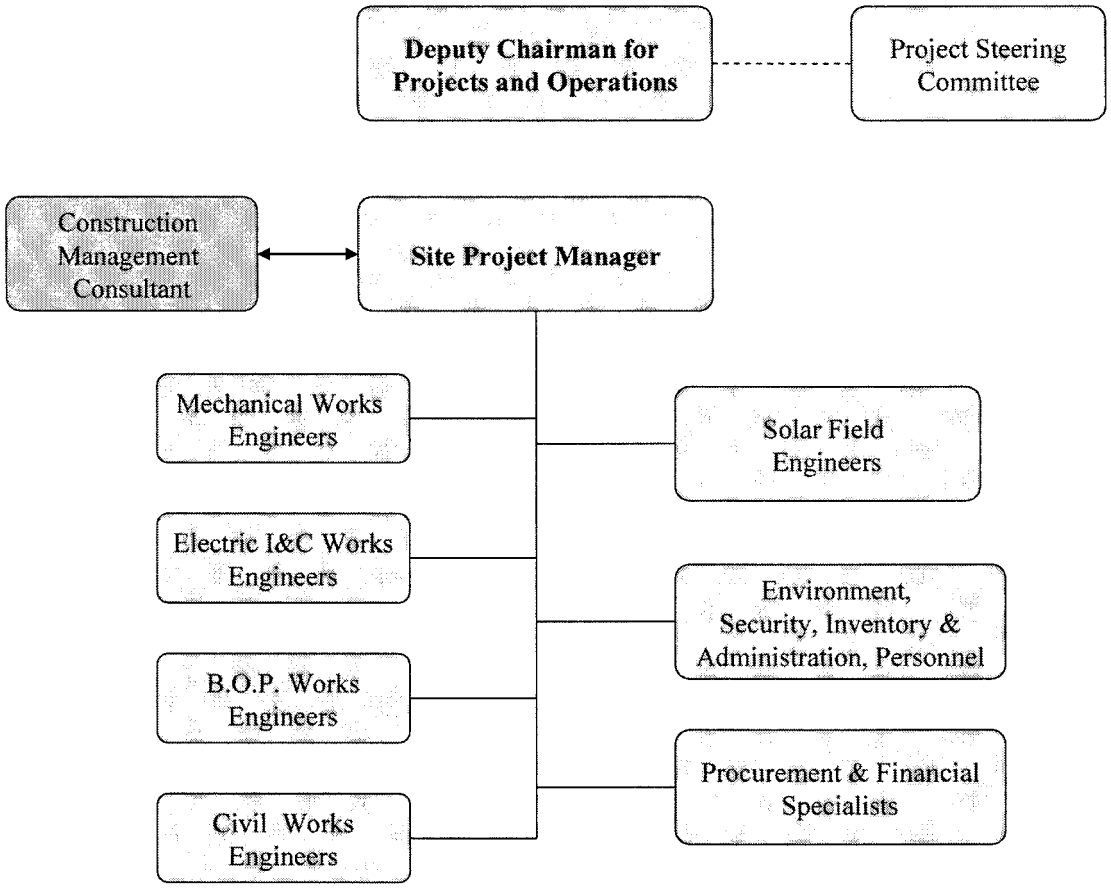
Annex 6: Implementation Arrangements

The project will be implemented by NREA. NREA was established in 1986 (Law No. 102) to act as the focal point to introduce and promote renewable energy technologies, with a particular emphasis on commercial scale electricity generation from renewable sources. NREA has been able to very successfully assume this role and is increasingly focusing on electricity production from wind, and other renewable sources. NREA receives full support from the Ministry of Energy and Electricity to succeed in its role and also receives support from the Egyptian Electricity Holding Company (EEHC) in furthering its capacity to prepare and implement large projects.

NREA, as the Executing Agency and as the mandated agency in Egypt to develop renewable resources, will be responsible for the project management. NREA will establish a Project Implementation Entity (PIE) headed by an experienced Project Manager who will report to the Deputy Chairman for Projects and Operation. The PIE will be responsible for the day to day management activities of the proposed project and will be staffed by a core specialists in technical, financing/accounting, and procurement matters, which will be based at the project site.

In addition, the PIE will liaise closely with other departments at headquarters for support in legal, financial, environment and planning matters. NREA will be assisted in this project by a Consulting Engineering Consultant. Its main mission will be to: (a) review of the detailed engineering designs with special attention to the interface between the solar and CCGT parts; (b) supervise the construction and environmental aspects of the power plant; (c) monitor the commissioning and guarantee tests; (d) prepare the O&M contract for the CCGT portion; (e) provide assistance during the 2 year guarantee period as well as assisting NREA in monitoring/evaluation of the performance of the whole plant at least during the two years of the O&M contractual period; (f) provide training and transfer of know-how in ISCC plant operation, with particular emphasis to dispatching and integration into the power system so that NREA can successfully take over the plant after the respective O&M contracts expire.

Organization Chart of the ISCC Project Implementation Entity



Annex 7: Financial Management and Disbursement Arrangements

Executive Summary and Conclusions:

The project financial management assessment was conducted to assess the financial management arrangements currently in place at NREA and their adequacy to support the project implementation. The purpose is to identify the associated risks, build up the relevant mitigating measures, and agree with the grant recipient on how to deploy or adjust the current arrangements to support the proposed project and any special measures that need to be carried out.

The proposed GEF grant will be made to the GOE and be on-granted to NREA. NREA will also be responsible for financing part of the project cost and repaying the JBIC loan which will finance the foreign cost related to the conventional part of the plant. This loan has already been approved and is guaranteed by the GOE. Cost recovery of the power produced under this project will be ensured through a power purchase agreement (PPA) between NREA and EEHC.

By virtue of its articles of incorporation, NREA adopts the Egyptian Unified Accounting System (UAS) in maintaining its accounts and for reporting on its financial position and its results of operations. The UAS is complimented by the accounting standards issued by the Central Auditing Organization (CAO) and applicable to public authorities of economic nature like NREA. For donor financed projects, NREA maintains separate parallel records (manual and excel spreadsheets) in order to record and report on the projects' financial position. In order to provide a full picture on the proposed project, the entire project funds (GEF grant, JBIC loan, and NREA's local contribution) will be accounted for in one set of records and financial statements.

A reporting risk arises from the nonconformity of NREA's accounting system with the Bank's reporting needs and the inability of the current system in place to report separately on the project funds and transactions. To mitigate this risk, the FX department will maintain parallel records for the project transactions in coordination with the PIE at the project site and the cost accounting department, and will be responsible for preparing interim and final project financial statements required by the Bank.

NREA's current auditing arrangements are not adequate to report on the project accounts separately and in accordance with Bank requirements. The CAO audit does not report separately on a specific project's accounts. In addition, the Bank requests reviews of the interim financial reports which are not typically provided by the CAO. Therefore, it has been agreed that an independent private auditor will be hired to provide project audit and review reports as required by the Bank.

NREA did not manage a designated account under the Wind and Solar projects preparation grants which exclusively used direct payments. The GEF grant funds will be fully applicable to one large contract and therefore disbursements under the grant will also take place via direct payment.

The high share of local contribution ($126 million out of $327 million total project cost, including 2-year of eligible cost of O&M) can result in delayed funds availability and delayed implementation. To mitigate this risk, NREA will reflect the project investment requirements in

its five year budget plan for FY 07/08 to FY 11/12. In addition NREA has already included part of the project costs in its FY 06/07 approved budget.

The above mitigating measures, NREA's previous experience with Bank procedures through the preparation grants (for Solar and Wind Projects), and the relatively simple project design with limited number of contracts collectively contribute to an overall FM risk of Modest.

Country FM Issues:

The Report on Observance of Standards and Codes – Accounting & Auditing (ROSC-AA) (2002) and the draft Country Financial Accountability Assessment (CFAA) report (2003) identified some weaknesses in the reporting and auditing environment in Egypt. The ROSC-AA included an assessment as to the degree of compliance with International Standards on Auditing (ISA). Compliance was found to vary among audit firms and was not always ensured. The 2003 CFAA assessed the fiduciary risk associated with the budgeting arrangements, internal control system, and accounting and financial reporting arrangements to be significant (this assessment covered state owned enterprises and Public Authorities). Such risks are applicable to NREA as a public Authority. Thus, the condition of the country overall reporting and auditing environment affects the project assessed risks and, accordingly, special measures are being taken with regards to FM arrangements as shown below (special reporting and separate audit arrangements).

Risk Assessment and Mitigation Measures (MM):

Inherent Risks:

Risk	Risk Before MM	Mitigating Measures (MM)	Risk After MM
Country level:			
- Lack of compliance with IFRS and ISA when preparing and auditing the financial statements of public authorities (NREA). - Budgeting arrangements, internal control system, and accounting and financial reporting arrangements assessed as significant risk by CFAA.	S	- Project financial statements will be audited by a private independent auditor acceptable to the Bank. - Project funds will be ring fenced with funds allocated to specific contracts and using a separate reporting system.	M
Entity level: (NREA)			
The form and content of NREA's audit reports do not fully conform to International Standards on Auditing.	S	- It was agreed with NREA' that the project financial statements will be audited by private independent auditor acceptable to the Bank.	M

Risk	Risk Before MM	Mitigating Measures (MM)	Risk After MM
Project level			
The high share of local contribution can result in delayed funds availability and delayed implementation.	H	- NREA's share in project cost in FY07 was approved in its FY06/07 budget. - NREA will ensure reflecting the project investment requirements in its five year budget plan for FY 07/08 to FY 11/12. - Government commitment to the project.	S
Inherent Risk Before MM	**S**	**Inherent Risk after MM**	**M**

Control Risks:

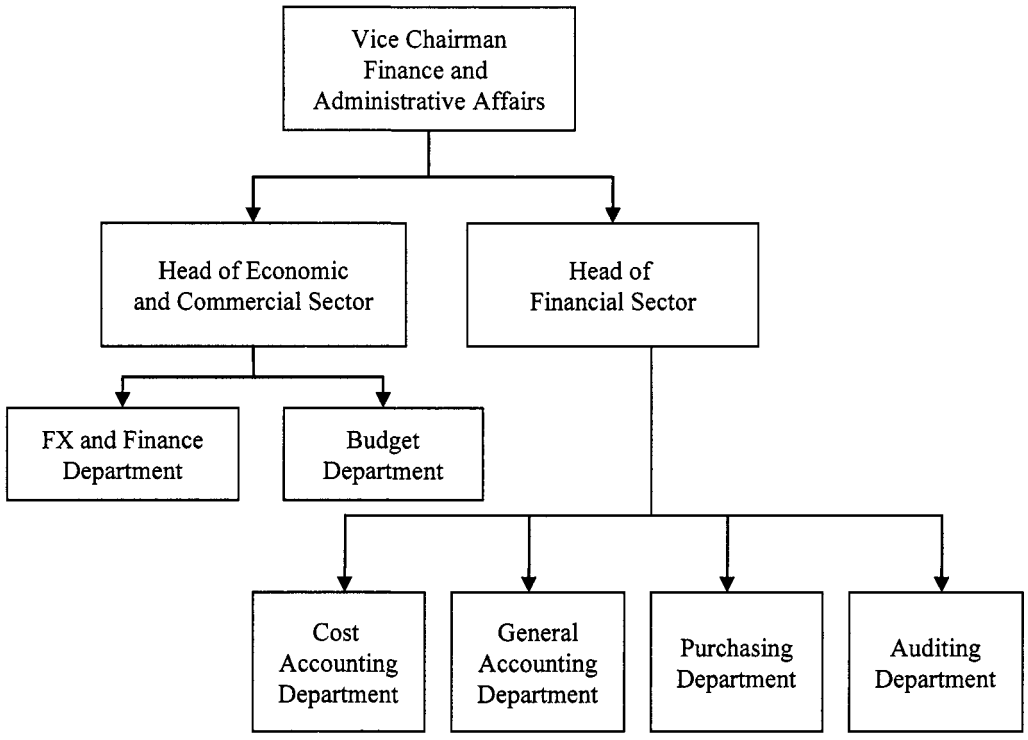
Risk	Risk Before MM	Mitigating Measures (MM)	Risk After MM
Budgeting			
Budgets may not be timely incorporated and updated into the accounting system.	S	- The FX department assigned with the project FM function and the budget department will coordinate together especially that they both report to the same sector head.	M
Internal Control			
Traceability of supporting documents may be inefficient using NREA's current accounting system.	S	- The FX department will maintain complete project records cross referenced to NREA's central filing. - It will also keep copies of supporting documents.	M
Accounting and Reporting			
NREA's current accounting system may not support comprehensive project records and reports for the entire project.	H	The FX department will act as the focal point, coordinate with the Cost Accounting department to track, account for and report on the entire project funds.	S
Auditing			
NREA current auditing arrangements do not provide separate project audit reports in accordance with Bank requirements.	S	It was agreed with NREA that the project audit will be conducted by independent private auditor.	M
Control Risk Before MM	**S**	**Control Risk After MM**	**M**

Implementing Entity:

NREA was established in 1986 as a public authority reporting to the Minister of Electricity and Energy. Its budget is prepared in accordance with the provisions of the law of the State's Public Budget. Its board of directors is entitled to ratify its organizational structure, to ratify its annual budget and final accounts, and to lay down the rules, regulations and internal statutes related to financial, accounting and administrative affairs.

NREA's staff at the FX department has acquired some experience with Bank procedures through the Solar Thermal and the Wind preparation grants. In addition, possible synergies can be materialized from coordination between the FX department, the cost accounting department and the audit department. This is feasible especially as the cost accounting department already records financial information at the project level with classification as to the type of expenditures.

The cost accounting, general accounting, purchasing and auditing departments are headed by the Head of the financial sector. The FX, finance and the budget departments are headed by the Head of the economic and commercial sector. Both of the Head of the financial sector and the Head of the economic and commercial sector report to the Vice President for financial and administrative affairs. The relationships are illustrated in the following chart.



Budgeting:

NREA prepares an annual budget consisting of a current budget that is submitted to the Ministry of Finance and an investment budget that is submitted to the Ministry of Economic Development

(formerly Ministry of Planning). In addition, it prepares a five year investment budget plan. The new 5 year plan will be for the period from FY 07/08 to FY 11/12. The budget submission usually takes place in February of each year. Since the budget is subject to parliamentary approval, exceeding allocations cannot take place without parliamentary approval. Changes among components however can take place with the approval of the Ministry of Economic Development. Changes in allocations of donors' financing require the approval of the donor and the Ministry of International Cooperation. The project budget is currently being prepared in sufficient details to allow monitoring any deviations.

For the project purposes, payments from the local budget are subject to the review of the budget department, the audit department and the Ministry of Finance controller. For payments from foreign loans and grants, the Economic and Commercial sector is relatively more autonomous where budget approval and withdrawal applications are processed within the same sector. However they are later subject to post review by the audit department.

Accounting:

By virtue of its articles of incorporation, NREA adopts the Egyptian Unified Accounting System (UAS) in maintaining its accounts. In this context, it follows the standard chart of accounts per the UAS. Yet it follows the accounting standards issued by the CAO as a complimentary framework for the UAS. On the project level, the cost accounting department records transactions at the individual project level, classify them by type of expenditures and allocate overheads to relevant projects. Although the cost accounting department is not concerned with the project's sources of funding, its recording of project expenditures, mainly direct costs, provides a good source for reconciling project records maintained by the FX department with the cost accounting records. For reporting on its financial position and its results of operations, NREA applies the accounting standards issued by the Central Auditing Organization in Egypt. For donors financed projects, NREA maintains separate records (manual and excel spreadsheets) through its FX department in order to monitor inflows and outflows of donors funds and to report on the projects' financial position.

Finally the limited number of contracts under the project components renders the management of the project funds and the related accounting and reporting functions less complicated.

Internal Control:

The project payments will be processed through multiple layers of control before payments are issued. Throughout this process, segregation of duties will be observed between those who prepare, review, authorize and reconcile payments. Contractors' certificates of payment will be reviewed and approved by the construction management consultant, NREA's site engineers, and finally the audit department. In addition, bank reconciliations are conducted by a section that is different from the section that processes the payments.

Original documents will follow the typical filing system of NREA. In parallel, filing of copies of project supporting documents will be kept at the FX department along with appropriate cross referencing to NREA's central filing system.

The risk of ineligible expenditures arises with the introduction of the use of a designated account. However this risk will be mitigated with the grant funds being fully applied to one contract that is subject to Bank prior review. In addition, direct payments will be made to the contractor from the GEF account.

No special internal audit function exists. The audit function is limited to a compliance check in the form of an ex-ante review for each payment.

Flow of Funds:

Banking Arrangements: The fact the GEF grant funds will be fully applicable to one large contract allows for the use of direct payments as a preferred method of disbursement, as such there is no need for a project designated account.

Availability of Counterpart Funds: With the large amount of local contribution required (about US$126 million), there is a risk in the timely availability of the local contribution. NREA will submit its 5 year budget plan in February 2007 taking into consideration the project investment requirements. In addition, NREA has already included part of the project costs in its FY 06/07 approved budget. Also, the Government has expressed strong commitment at the top to execute and support this project.

Allocation of Grant Proceeds: The GEF grant will be fully applied to one contract which will include the engineering, procurement, construction, testing, commissioning and two years operations and maintenance of the solar portion of the plant up to the set ceiling of US$49.8 million. As mentioned above, NREA is already working on incorporating this project's investment requirements in its 5 year investment plan for the period from FY07/08 to FY 11/12.

Disbursement Arrangements:

The proceeds of the Grant will be disbursed to the contractor through the Bank's direct payment procedure and will be used to finance project activities under the contract. Withdrawal Applications (WAs) for direct payment (and/or Special Commitments) will be accompanied by appropriate records (i.e., contract and invoices) in accordance with the procedures described in the Disbursement Letter and the Bank's 'Disbursement Manual'. NREA will be responsible for submitting WAs for direct payment to the Bank accompanied by the necessary supporting records. As projected by Bank's standard disbursement profiles, disbursements will be completed by Project closure. A four month grace period will be allowed for the payment of invoices submitted by the closing date.

Reporting:

Reporting on the earlier Recipient-executed preparation grants was relatively simple based upon the low size of the grants and the simple nature of the very few consultancy contracts under these grants. The previous grants were accounted for by the FX and finance department at NREA. Since the construction management consultant will provide NREA with periodic progress reports covering the three contracts under the project, such input can be used as a basis for reconciling the financial reports generated at the FX

The reports frequency and submission will be as follows:

Report	Frequency	Due Date	By	Sent to:	Language
Financial report	Monthly	10 days from end of month.	FX dept.	Management	Arabic/English
Interim financial statements	Quarterly	3 weeks from end of quarter	NREA	External auditor	English
Annual financial statements	Annual	3 months from end of fiscal year (FY).	NREA	External auditor	English

(i) Monthly financial report. The reports will be prepared by the FX department on a monthly basis. They will not be sent to the Bank, but used internally by the project management/NREA. They can be reviewed and reconciled with the monthly withdrawal applications and quarterly financial statements sent to the Bank. The Bank will follow up during supervision missions. The format of the reports should be quite simple (a trial balance listing all sources and uses of funds and bank reconciliations).

(ii) Interim financial statements. These will be produced within 3 weeks from each quarter closing date. Their format and content was shared with NREA in an annex to the appraisal mission aide memoire.

(iii) Annual financial statements. The project financial statements should be ready 3 months from the end of fiscal year to enable the submission of the audit report within 6 months after the closing date of the fiscal year. The project financial statements will have to include: (i) a statement of sources and uses of funds indicating funds received from various sources and project expenditures; and (ii) schedules classifying project expenditures by component, sub-component, and category.

To minimize the reporting requirements from NREA, template financial reports were shared with JBIC in order to consider possible synergies between the World Bank and JBIC progress reports. As feasible, the Bank will try to agree with JBIC on common financial reports format.

Attestation Arrangements

To meet the Bank audit requirements, NREA had contracted a private auditor acceptable to the Bank to report on the preparation grants financial statements. Acceptable reports were received by the Bank and no overdue reports are outstanding as of October 2006. For the proposed project, a similar project audit assignment will be required for which the auditor's terms of reference will need to be agreed between NREA and the Bank. This is in addition to an audit of NREA's financial statements as the revenue earning/continuing entity. Discussions with JBIC representative indicated that they do not have an audit requirement for these project financial statements.

The project will be subject to two types of attestation engagements as follows:

Annual Audits: Annual audits for the project will be conducted by an independent private auditor acceptable to the Bank who will be contracted and paid by NREA to audit all project components and provide one report for the project as a whole. The audit report, accompanied by a management letter, will cover the project's financial statements and use of direct payments. The report should be submitted by NREA to the Bank no later than six months following the closing of the fiscal year subject of the audit *(fiscal year July 1 to June 30).* The external audit report should be in accordance with the Bank auditing requirements/TOR and conducted according to International Standards on Auditing (ISA). In addition, NREA should provide the Bank with its annual financial statements and the CAO audit report on them no later than six months following the closing of NREA's fiscal year.

Quarterly Reviews: The same project auditor will also be required to conduct quarterly reviews of the project's interim financial statements within 45 days from the end of each calendar quarter. Withdrawals from the loan that are included in interim statements will be part of the scope of these quarterly reviews.

Report	Due Date	Responsibility	Sent to:	Language	Scope
Interim financial statements (Project)	45 days from end of quarter	External Auditor	Bank	English	Review
Annual financial statements (Project)	6 months from end of the fiscal year	External Auditor	Bank	English	Audit
Annual financial statements (NREA)	6 months from end of the fiscal year	CAO	Bank	English	Audit

Supervision Plan

After the approval of the grant, the Bank FMS will participate in the Bank supervision missions that follow up on implementation progress. At least two supervision missions for the project will be carried out annually in addition to follow up visits as deemed necessary. The review and audit reports of the interim and annual financial statements respectively will be checked on a regular basis by the Bank FMS and the results or any issues will be followed up during the supervision missions. Audit reports and management letters will be checked and any issues identified will be followed up by the Bank FMS. Also, during the Bank's supervision missions, the Project's financial management and disbursement arrangements will be reviewed to ensure compliance with the Bank's requirements and to develop the financial management rating to the Implementation Status Report (ISR).

Annex 8: Procurement Arrangements

A. General

Procurement for the proposed project was advanced during project preparation and has been carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated May 2004; and the provisions stipulated in the Legal Agreement. The Grant will finance a single contract, for which the procurement process is now completed in accordance to World Bank Procurement Guidelines. Procurement of non-bank financed contracts for other components of the power plant (the combined cycle component and consultant services) has been conducted using JBIC's procurement procedures and Standard Bidding Documents (SBD), which are satisfactory to the Bank.

Country Background

A legal framework anchored in the Public Tender Law No. 89/1998 governs public sector procurement in Egypt; the system is described in the updated Country Procurement Assessment Report (CPAR) dated December 2005. The New and Renewable Energy Authority (NREA) is a public entity governed by Law No. 102/1986. Thus, the national laws and regulations are applicable to NREA's procurement system.

Procurement of the Solar Island: The solar island of this project was procured under one contract for engineering, procurement, construction, testing and commissioning and a two-year operation and maintenance contract (O&M) for the Solar field. Such contract consists of the supply and installation (single responsibility contract) of the solar island which is a part of the ISCC Power Plant at Kureimat. The procurement process was carried out during preparation with the help of an international consulting firm financed by a GEF grant to provide technical assistance to NREA to: (i) develop the feasibility study, (ii) develop the prequalification and bidding documents, and (iii) assist with launching the prequalification and bid documents. The borrower carried out a prequalification process under Bank supervision and no objection. Prequalified contractors/suppliers were invited to submit bids for this component. Procurement was conducted using the Bank's SBD for International Competitive Bidding of Supply and Install under two-stage procedures.

B. Assessment of the agency's capacity to implement procurement

An assessment of the New and Renewable Energy Authority's procurement capacity was carried by Armando Ribeiro Araujo (Consultant) and Abdul Gabbar Al-Qattab (Procurement Specialist) in May/October 2006. NREA has gained good project implementation and procurement experience as a result of its work with several international donors financing some of its projects. NREA has been responsible for implementing the project including the Solar Island contract.

The assessment also reviewed the organizational structure for implementing the project. Procurement is carried out by the Purchasing Department of the NREA, which is divided into two purchasing committees: one for smaller contract below one million Egyptian Pounds while

the other - high purchasing committee - supervises, monitors and approves the procurement decisions for all larger contracts.

The Solar Island bidding as indicated above has been completed in accordance to World Bank Procurement Guidelines.

C. Procurement Plan

This project involves the financing of only one contract under International Competitive Bidding. Consequently, a procurement plan was not required.

D. Frequency of Procurement Supervision

In addition to the prior review supervision carried out, the capacity assessment of the Implementing Agency has recommended supervision missions to visit the field to monitor implementation every six months.

Annex 9: Economic and Financial Analysis

Economic Analysis

The appraisal of the proposed project is based on a feasibility study prepared by Lahmeyer Consultants and a conceptual design study prepared by Fichtner Solar Consultants. These studies provided estimates of the costs of hybrid solar thermal variants and their baseline equivalent CCGTs, including the economic least cost plant size, its dispatch into the power system, possible technology variants and cost estimates. Since the bidding process has been completed, real market data on the cost of both the solar and combined cycle portions are available and are used as the basis to appraise the project.

Cost-Benefit Analysis

The cost benefit analysis of the project shows that for a total capacity of 150 MWe, and introducing a 4 % solar contribution, the installed cost of the plant will be about $290 million. The installed cost includes the cost of equipment (based on bids awarded) and the estimated cost for consulting during implementation which has yet to be bid for but represents a small cost component as well as the estimated cost for the EMP[17]. The cost of equipment excludes taxes and import duties (an estimated US$22.4 million).

As for operating costs, the present value of fuel, O&M costs and consumables amounts to $153 million over the 25-year lifetime and the construction phase. The O&M costs in economic terms assume an economic cost of natural gas of US$2.52/mmbtu as compared to the actual price charged to the power sector of US$1/mmbtu. The cost of gas assumption is based on results of a study on the economic cost of natural gas in the domestic market which has been carried out by international consultants financed by ESMAP (Energy Sector Management Assistance Program) and managed by the World Bank.

Economic benefits are derived from the economic value of electricity generated, where the average electricity tariff has been assumed to be US$0.07/kWh -- the price for electricity exports to Jordan. The GEF grant of $49.8 million has been included as an economic benefit as it reflects global willingness to pay for this project.[18]

Based on these costs and benefits, the project generates a net present value of US$54 million and the EIRR of the project is 13%.

[17] The estimated costs for consulting during implementation and for the EMP are assumed to be incurred during project construction phase. In practice part of such costs may be incurred during operating phase.
[18] In accordance with OP10.04 – Economic Evaluation of Investment Operations, paragraph 8.

Table 1 – Summary of Project Economic Costs and Benefits

Cost-Benefit Analysis Summary			US$ Million
		PV at Project Commencement	
Costs:	Capital	240.0	(nominal value $290 million)
	O&M	43.8	
	Fuel	108.8	
	Consumable	0.8	
	Total	393.4	
Benefits:	Electricity	406.6	
	GEF grant	41.2	(nominal value $49.8 million)
	Total	447.8	
	Net Present Value @ 10% discount rate	**54**	
	EIRR	**13%**	

The following table contains detailed breakdown streams of economic benefits, economic costs and the net benefits. During Project construction period, part of the US$290 million installed cost incurred is partially offset by the US$49.8 million GEF grant. The resulting 13% economic rate of return is estimated over the construction and the operation periods.

Table 2 – Detailed Project Economic Costs and Benefits

		Economic Benefits				Economic Costs					Net Benefits
Year		GEF Grant	GWh	Sales	**Total**	Capital Costs	Fuel	O&M	Consumables	**Total**	
Co.	1	9.96	0		9.96	58.0	0	0	0	58.0	-48.0
	2	29.88	0		29.88	173.9	0	0	0	173.9	-144.0
	3	9.96	0		9.96	58.0	0	0	0	58.0	-48.0
Op.	1		852	59.6	59.6		14.8	12.0	0.1	26.9	32.8
	2		852	59.6	59.6		14.9	12.1	0.1	27.1	32.5
	3		852	59.6	59.6		15.1	4.7	0.1	19.9	39.7
	4		852	59.6	59.6		15.2	4.8	0.1	20.1	39.5
	5		852	59.6	59.6		15.4	4.8	0.1	20.3	39.3
	6		852	59.6	59.6		15.5	4.8	0.1	20.5	39.1
	7		852	59.6	59.6		15.7	4.9	0.1	20.7	38.9
	8		852	59.6	59.6		15.9	4.9	0.1	20.9	38.7
	9		852	59.6	59.6		16.0	5.0	0.1	21.1	38.5
	10		852	59.6	59.6		16.2	5.0	0.1	21.3	38.3
	11		852	59.6	59.6		16.3	5.1	0.1	21.5	38.1
	12		852	59.6	59.6		16.5	5.1	0.1	21.7	37.9
	13		852	59.6	59.6		16.7	5.2	0.1	22.0	37.7
	14		852	59.6	59.6		16.8	5.2	0.1	22.2	37.4
	15		852	59.6	59.6		17.0	5.3	0.1	22.4	37.2
	16		852	59.6	59.6		17.2	5.3	0.1	22.6	37.0
	17		852	59.6	59.6		17.3	5.4	0.1	22.9	36.8
	18		852	59.6	59.6		17.5	5.5	0.1	23.1	36.5
	19		852	59.6	59.6		17.7	5.5	0.1	23.3	36.3
	20		852	59.6	59.6		17.9	5.6	0.1	23.5	36.1
	21		852	59.6	59.6		18.0	5.6	0.1	23.8	35.8
	22		852	59.6	59.6		18.2	5.7	0.1	24.0	35.6
	23		852	59.6	59.6		18.4	5.7	0.1	24.3	35.4
	24		852	59.6	59.6		18.6	5.8	0.1	24.5	35.1
	25		852	59.6	59.6		18.8	5.8	0.1	24.7	34.9
										EIRR	**13%**

Financial Analysis

Financial Assessment of the New and Renewable Energy Authority (NREA)

Past and Current Performance of NREA

NREA revenues stem from research and development activities and in recent years, mainly from the sale of electricity it generates from renewable sources to EEHC. Based on audited accounts for the past four years, the company incurred losses, as it transitioned from a purely research and development entity to one whose major activity is the production of green energy.

NREA has recently been able to negotiate an increase in the tariff per kWh it receives from EEHC for the electricity sold to the grid to 12 Pt/kWh with a 5% annual tariff escalation. This has enable NREA to fully service its debt obligations in the fiscal year 2005, something it was unable to do in earlier years. As of 2004/05, the company's long-term debt reached LE 1.28 billion (US$223 million), of which the current portion is estimated to have reached LE 38.4 million (US$6.7 million).

In addition, as of 2004/05 NREA has started benefiting from the Petroleum Fund, under which it is eligible to receive 2 Pt per kWh of energy produced from renewable energy sources. In 2004/05 this additional revenue amounted to LE 5.8 million (US$1 million), and it is expected to increase substantially as NREA's installed capacity is augmented.

The company has low levels of accounts payables; however, its receivables from EEHC amount to about LE 33.25 million (US$5.8 million, 287 days). In 2004/05 NREA was able to collect 80% of the revenues it was owed from EEHC

The company's main operating expense is with salaries and wages, which account for about 80% of total operating expenses. Expenditures on operations and maintenance (O&M) are low amounting to about 8% of operating expenses and only 0.1% of its gross fixed assets. As NREA gears up to become Egypt's major producer of green energy, appropriate maintenance of its facilities will be critical to maximize the electricity output and ensure NREA's future sustainability.

Future Financial Performance of NREA

Projections to assess NREA's future financial position and performance have been carried out for the period 2005/06 to 2019/20. A summary of the assumptions used in the forecast is presented below and detailed assumptions are recorded in the project files.

Projections for NREA's future performance are based on the following key assumptions:

- NREA expects to benefit from the sale of carbon emission reduction credits (based on the amount of CO_2 emissions saved from the electricity it produces from renewable sources) as an additional source of revenue. To this end, it has already signed two bilateral agreements encompassing 140 MW of wind turbines planned to be operational by

2008/09. It is assumed that NREA will be able to sell carbon emission reduction credits for all the renewable projects it plans to implement in the future, excluding the ISCC.

- From 2006/07 onwards, the tariff NREA charges EEHC for the electricity sold will benefit from gradual increases to off-set domestic inflation.
- Gradual increase in the revenue collected from EEHC to 98% by 2009/2010.
- Gradual increase in O&M expenditures to a level that is equivalent to 1% of gross fixed assets by 2013/14, to be in line with the additional installed capacity.

The analysis shows even though NREA's operating margin and cash flow position are positive, its overall financial performance (taking into account depreciation and finance charges) deteriorates further in the short-term, with net operating losses being incurred up until 2008/2009, mainly due to the need for significant increases in O&M expenditures, as these become a critical element in ensuring the maximization of the electricity output of current and future installed capacity, which are key in ensuring the future sustainability of NREA.

During appraisal the team agreed with NREA's management to monitor two financial indicators (a) the debt service coverage ratio (DSCR) and (b) the self finance ratio (SFR) as proxies for financial soundness. A minimum DSCR of 1.1 and a minimum SFR of 0.1 are targeted to be achieved by project close in 2011..

Assumptions for projections of financial performance of EEHC

The analysis is based on actual audited results for the years 2001/02-2004/05 and company estimates for 2005/06. The projections cover the years 2005/06-2019/20. The project implementation period is 2006/07-2013/14.

Key Assumptions for financial statements

Installed capacity	is assumed to increase according to the investment plan received from NREA, with total installed capacity reaching 900 MW by 2009/2010 and remains constant at 1,000 MW from 2010/11 onwards.
Electricity production	is assumed to be a function of installed capacity, with an average capacity factor of 42% for the wind farms. (Source: NREA)
Electricity losses	includes own consumption and is estimated to be 1% of gross production volume. (Source: NREA)
Electricity prices	is assumed to increase annually by the local inflation from 2006/07 onwards for electricity generated from all projects.
Production sold as carbon emission reduction credits	MWh NREA plans to sell according to the provisions of the clean development mechanism as carbon emission reduction credits. (Source: NREA)
Amount of CO_2 saved	is assumed to be 0.567 tons by MWh produced. (Source: Riso)
Price of carbon emission reduction credits	is based on the contractual prices per ton of CO_2 saved, which is the price NREA has negotiated in its current agreements under the CDM framework.

Petroleum Fund	is a fund created by the GOE in which the Petroleum Ministry is to share with NREA the marginal income that is generated by exporting the fuel saved in generating electricity from renewable sources. (Source: NREA).
Inflation	domestic inflation is assumed to be 5% per year as of 2006/07, while the foreign inflation is assumed to be 2.5% per year as of 2006/07.

Income Statement

Revenues	are mainly derived from electricity sales to EEHC, other significant source of revenues comprise of income from carbon emission reduction credit agreements, and the petroleum fund which are expected to increase substantially in the future. Other sources of revenues include research and development activities as well as small scale renewable projects.
Salaries	are assumed to increase with at the rate of 10% per year. (Source: NREA)
Operating & Maintenance Costs	Comprise O&M costs for ISCC and wind projects. These are assumed to increase gradually towards 1% of gross fixed assets by 2014/15 and 1.5% by the end of the projection (Source: NREA and industry practice).
ISCC Fuel Cost	the cost for natural gas needed to supply the ISCC Plant is assumed to be the current domestic market price charged by EGAS of 22 Piasters/m^3, and increase by the local inflation from 2010/11 onwards.
Administrative and Other Operating Expenses	include rental of buildings, utility services for administration, vehicles, etc., and are assumed to increase annually at the rate of local inflation.
Depreciation	the current charge is based on the straight line methodology and assumed to continue as such. To this charge, the project assets are added which are assumed to depreciate over 33.3 years on average, i.e., 3% per year.
Interest	comprises interest payments on borrowings.
Profit tax	NREA tax rate is 10% of its profits.

Sources and Applications of Funds

Internal sources	comprise net operating income before financial charges with the depreciation charge added back.
External sources	comprise of grants and borrowings.
Capital investments	comprise the total of capital investments undertaken by the company including the Project. (Source: NREA)
Debt service	comprises interest charges and repayments on borrowings.
Working capital	is the annual change in currents assets (less cash) and current liabilities.

Balance Sheet

Gross fixed assets	represent the previous year's gross fixed assets plus the work in progress as it is completed.
Work in progress	represents the ongoing investments as they are implemented starting in 2005/06.
Net Account receivables	represents previous year's receivables and the portion of current years billings not collected.
Inventory	represents fuel and materials. It is assumed that inventory will be kept at a level representing 3 months of supply of fuel and materials (Source: NREA)
Account Payables	represents previous years payables for suppliers (e.g., fuel and material) and other operating expenses.
Retained earnings/losses	represent accumulated earnings/losses incurred by the company.
Long-term debt	current long-term debt represents current and future loans taken by NREA to finance its capital investment program. In the short- to medium-term NREA plans to borrow for 100% of its foreign and local future capital needs. (Source: NREA).

NREA Summary Financial Statements

Million Egyptian Pound (LE)

Balance Sheet	2005/06 *Estimate*	2006/07 *Forecast*	2007/08 *Forecast*	2008/09 *Forecast*	2009/10 *Forecast*	2010/11 *Forecast*	2011/12 *Forecast*	2012/13 *Forecast*	2013/14 *Forecast*	2014/15 *Forecast*
Assets										
Cash	139.2	152.5	81.9	14.7	10.4	18.2	63.4	98.6	190.3	348.7
Current assets, net	196.8	226.0	164.7	108.3	128.4	150.1	196.1	252.1	357.1	529.4
Fixed assets, net	1,991.4	3,593.9	5,148.5	7,678.6	7,648.3	7,370.4	7,092.6	6,814.7	6,536.8	6,259.0
Total assets	2,215.0	3,846.7	5,340.0	7,813.7	7,803.5	7,547.4	7,315.5	7,093.7	6,920.8	6,815.2
Liabilities & Equities										
Current liabilities, net	135.6	148.2	186.7	311.9	374.2	429.2	431.6	422.1	393.3	363.8
Long-term liabilities, net	1,879.6	3,553.0	5,023.9	7,401.0	7,324.7	6,970.0	6,613.2	6,266.3	5,948.6	5,660.7
Total liabilities	2,015.2	3,701.2	5,210.6	7,712.9	7,698.9	7,399.2	7,044.9	6,688.4	6,341.8	6,024.5
Retained earnings	(59.2)	(149.2)	(272.6)	(408.4)	(440.3)	(396.8)	(274.3)	(139.7)	34.0	245.7
Total Equity	199.8	145.6	129.4	100.8	104.6	148.1	270.6	405.2	578.9	790.7

Million Egyptian Pound (LE)

Income Statement	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Revenue										
Electricity	56.8	99.4	159.4	263.8	473.0	571.0	599.6	629.6	661.1	694.1
Others	6.0	25.9	45.8	85.5	139.5	140.7	140.7	140.7	140.7	140.7
Expenses										
Operating expenses	21.9	21.9	27.8	38.3	49.6	130.1	164.1	127.3	164.5	171.0
Financing expenses	28.7	28.7	99.9	152.0	246.5	243.7	221.4	199.0	178.4	160.0
Depreciation	71.5	71.5	87.6	138.3	189.1	270.6	277.9	277.9	277.9	277.9
Net Income	**(59.2)**	**(90.0)**	**(123.3)**	**(135.8)**	**(32.0)**	**43.5**	**122.5**	**134.6**	**173.7**	**211.7**

NREA Summary Financial Statements

Million Egyptian Pound (LE)

Cash Flow	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Sources										
Internal cashflow	40.9	97.5	167.0	299.7	482.4	547.6	613.0	605.8	630.8	656.7
Grant & borrowings	664.1	1,785.5	1,692.9	2,724.1	260.4	-	-	-	-	-
Total	705.0	1,883.0	1,859.9	3,023.9	742.8	547.6	613.0	605.8	630.8	656.7
Uses										
Debt services	92.6	176.4	266.8	486.3	544.7	576.0	555.8	525.3	477.7	431.4
Investments	537.8	1,690.0	1,692.9	2,719.1	240.4	-	-	-	-	-
Change in working capital	(53.7)	3.3	(29.2)	(114.3)	(38.0)	(41.1)	(1.6)	30.3	42.1	43.3
Total	576.6	1,869.7	1,930.6	3,091.1	747.0	539.8	567.8	570.6	539.1	498.2
Net cash flow	128.4	13.4	(70.7)	(67.2)	(4.3)	7.8	45.2	35.2	91.7	158.4
Beginning cash balance	10.8	139.2	152.5	81.9	14.7	10.4	18.2	63.4	98.6	190.3
Ending cash balance	139.2	152.5	81.9	14.7	10.4	18.2	63.4	98.6	190.3	348.7

Financial Ratios	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Gross operating margin	65%	78%	81%	86%	79%	77%	83%	79%	79%	79%
Net operating margin	-94%	-72%	-60%	-39%	-5%	6%	17%	18%	22%	25%
DSCR	0.4	0.6	0.6	0.6	0.9	1.0	1.1	1.2	1.3	1.5
Self Finance	0.0	0.1	0.1	0.2	0.5	6.8	Large #	Large #	Large #	Large #
Current ratio	1.5	1.5	0.9	0.3	0.3	0.3	0.4	0.5	0.9	1.4
OPEX/Gross fixed assets	0.5%	0.5%	0.5%	0.5%	0.5%	1.0%	1.1%	0.6%	1.0%	1.0%
Receivables day	316	316	202	136	89	57	54	58	62	65
Payables day	20	20	20	20	20	20	20	20	20	20
Debt to equity	9.7	24.9	39.7	75.6	71.8	48.6	25.4	16.1	10.7	7.4
RoE	-30%	-62%	-95%	-134%	-29%	30%	45%	33%	30%	27%

Annex 10: Safeguard Policy Issues

Environmental Impact Assessment

Introduction: The proposed project falls under the World Bank environmental category B classification due to the fact that the impacts are expected to be site-specific. The site of the proposed plant is a fenced area of desert land – allocated to the Ministry of Energy and Electricity by the GOE for the proposed project – about 95 km south of Cairo. Of the World Bank's ten safeguard policies, only Operation Policy 4.01 on Environmental Assessment is triggered. As such, a full Environmental Impact Assessment (EIA) of the environmental, safety and health impacts was carried out. The latest EIA was disclosed in the Infoshop on December 28, 2006 and locally on June 20, 2006. The EIA was approved by the Egyptian Environmental Affairs Agency (EEAA).

The plant will consist of an integrated solar combined cycle power plant comprising a solar field and a combined cycle power block. With the solar field comprising parabolic trough collectors and heat transfer fluid (HTF) passing through heat exchangers to generate steam and the combined cycle comprising one gas turbines, a heat recovery steam generator and a steam turbine generator. The plant will occupy an area of approximately 2,772,000 m^2 (of which 130,800 the solar portion). The overall generating capacity of the power plant will be 150 MWe. The configuration of the power plant is based on a conceptual design feasibility report carried out by Fichtner Solar (consulting firm).

Alternatives considered: (i) site; and (ii) cooling system.

(i) Four sites were considered (Red Sea Coast, Sinai Peninsula, West Desert and Kureimat). The Kureimat site has been selected based on the minimal additional infrastructure required due to the nearby 750 MW combined-cycle power plant, realization of desirable benefits for the development of the site and the availability of a local workforce.

(ii) Two different cooling systems have been considered for this project: "Once Through" cooling and "Circulating Cooling" (also referred to as "cooling tower"), with or without storage. In the Once Through cooling system, cold water is taken from a source such as sea or river at one point, passed through the condenser to remove latent heat and discharged back to the source at a higher temperature. In the Circulating Cooling system, the cold water is circulated through the condenser to remove latent heat. The hot water from the condenser outlet is further circulated in a cooling tower where the heat carried by the circulating water is further dissipated to the atmosphere by evaporative cooling.

- **For the proposed project, water will be abstracted from the Nile River. As such,** the ISCC will share the water intake structure with the Combined Cycle (CC) plant which is currently under bidding. There are two water intakes for this CC plant, one is under construction and the other is in the design and tendering phase. There will be an agreement between NREA and Upper Egypt Electricity Production Company, owner of CC plant, that NREA will have its own feed water pipe from the second intake structure currently under design and tender. NREA will finance the water pipe and the additional pumps required for transferring the water from the planned intake structure to the ISCC plant. NREA's water

pipeline will be passing via Upper Egypt Electricity Production Company land and there will be no need for any land acquisitions.

The circulating cooling system, i.e. the cooling tower , has been selected for the proposed project due to the following reasons: (i) it requires less water (11,335 m^3 per hour compared to 22,890 m^3 per hour, including make-up water, mirror washing, etc) (ii) it increases power plant efficiency by 1% due to ambient temperatures; and (iii) it is less costly (about 40% less) The use of cooling towers may result in the formation of visible vapor plumes or ground fogging. However, this has been assessed to be manageable given that the prevailing wind is in the NS and NE directions and the plant is about 1.2 kilometers from the road. The option without storage was also selected due to the higher cost associated with storage.

The EIA has been carried out by Energy and Environment Consultants, and sub-contractors, and has been prepared using a combination of quantitative and qualitative assessment techniques ranging from computer modeling for air, water, and noise and traffic impacts to ecological and aquatic surveys and visual evaluations. The design of the plant incorporates various measures to minimize environmental impacts. These include use of natural gas as the main fuel, low NO_x combustors in the gas turbines, a stack height of 35 meters to maximize dispersion of emissions, as well as oil interceptors fitted to the site drainage system and effluent treatment facilities to treat wastewater prior to discharge.

Table 10.1 below provides an overview of anticipated impacts as they comply with Egyptian and World Bank guidelines while the section below summarizes the potential impacts of the construction and operation of the solar-thermal power plant as well as the proposed mitigation measures.

Table 10.1: Summary Environmental Impacts and Guidelines

Impact Area	Predicted Max. Concentration from Kureimat Power Plant	Egyptian Standard	World Bank Guideline
Stack emissions (70% load) when firing Natural Gas			
NOx	<25 mg Nm^{-3}	300 mg Nm^{-3} (1)	320 mg Nm^{-3}
SO_2	<1 mg Nm^{-3}	2,500 mg Nm^{-3}	2,000 mg Nm^{-3}
TSP – General (all sizes)	<5 mg Nm^{-3}	500 mg Nm^{-3} (2)	50 mg Nm^{-3}
Stack emissions (70% load) when firing Light Fuel Oil (<2% of total annual operating time)			
NOx – oil firing	35.88 mg Nm^{-3}	300 mg Nm^{-3}	460 mg Nm^{-3}
SO_2 – oil firing	41.78 mg Nm^{-3}	2,500 mg Nm^{-3}	2,000 mg Nm^{-3}
TSP – General (all sizes)	0.37 mg Nm^{-3}	500 mg Nm^{-3} (2)	50 mg Nm^{-3}
Ground Level Concentration (when firing Natural Gas)			
NOx – 1 hour	33.7 μgm^{-3}	400 μgm^{-3}	-
NOx – 24 hours	14.1 μgm^{-3}	150 μgm^{-3}	150 μgm^{-3}
NOx – 1 year	2.7 μgm^{-3}	-	100 μgm^{-3}
SO_2 – 1 hour	Trace	350 μgm^{-3}	-
SO_2 – 24 hours	Trace	150 μgm^{-3}	150 μgm^{-3}
SO_2 – 1 year	Trace	60 μgm^{-3}	80 μgm^{-3}
PM_{10} – 24 hours	Trace	70 μgm^{-3}	150 μgm^{-3}
PM_{10} – 1 year	Trace	-	50 μgm^{-3}
Liquid Effluent			
pH	6-9	6-9	6-9
BOD	<30 mg/l	<30 mg/l	-
Chromium	-	0.05 mg/l	0.5 mg/l
Copper	<0.5 mg/l	1 mg/l	0.5 mg/l
Iron	<1 mg/l	1 mg/l	1.0 mg/l
Zinc	<1 mg/l	1 mg/l	1.0 mg/l
Oil and Grease	<5 mg/l	5 mg/l	10 mg/l
Total Suspended Solids (TSS)	<30 mg/l	30 mg/l	50 mg/l
Residual Chlorine (total)	<0.2 mg/l	-	0.2 mg/l (3)
Noise (4)			
Daytime (max.)	Max. <55 dB(A)	60-70 dB(A)	40 dB(A)
Night time (max.)	Max. <50 dB(A)	50-60 dB(A0	70 dB(A)

(1) There are no Egyptian standards for NO_2

(2) The Egyptian Standard for TSP (all sizes) refers to emissions far from inhabited urban areas.

(3) "Chlorine shocking" may be preferable in certain circumstances, which involves using high chlorine levels for a few seconds rather than a continuous low level release. The maximum value is 2 mgl^{-1} for up to 2 hours, which must not be more frequent than once in 24 hours (and the 24 hour average should be 0.2mg/l).

(4) There are no sensitive receptors for noise within 0.5 km of the power plant. The area has been categorized as an "Industrial area" with respect to Egyptian ambient noise standards and "Industrial commercial" with respect to World Bank guidelines.

Impact assessment and mitigation measures during construction

Air quality due to dust emissions. Construction activities will result in high levels of dust; however there are no significant residential receptors or sensitive environments in the immediate boundaries of the power plant. Nevertheless, there could be effects on air quality, visibility and traffic safety. To minimize impacts, mitigation measures related to good site practice will be employed, including:

- Roads will be kept damp through use of water sprays;
- Stockpiles of friable materials will be sited and maintained appropriately (including the use of sheets) so as to minimize dust blow (e.g., balancing cut and fill operations);
- Drop heights for material transfer activities such as unloading of friable materials will be minimized;
- The construction phase will begin with the construction of access roads;
- Roads created during construction will be compacted and graveled if necessary;
- Roads used on site will be maintained in good order;
- Access into the site will be regulated;
- Vehicle speed limits of less than 35 km/hr on non-metallic roads will be enforced on site; and
- Lorries and vehicles will be sheeted during transportation of friable construction materials and spoil.

In addition, to ensure that pollutant levels resulting from transport operations are kept to a minimum during construction activities, all vehicles being used on site will meet pollutant emission standards.

Aquatic environment. NREA will not conduct any construction activities on the Nile and the project site is about 2.5 km away from the Nile. Therefore no impacts on the aquatic environment during construction are expected. However the following measures will take place during construction:

- No effluents will be discharged into the water body unless effluent quality has been checked and meets the Egyptian environmental Law 4 requirements, requirements of Law 48/1982 as well as World Bank requirements.
- A site drainage plan will be developed to ensure that if any erosion occurs during storm events, minimal amounts of sediment will result by reducing the flow velocity and sediment load before discharge;
- Temporary stockpiles of soil should be protected from erosion by using a reduced slope angle where practical [such as a slope of 30° instead of 45°]. This can be addressed by the site drainage plan as described above, and
- Good site management practices will be enforced to ensure that the construction site is kept clean and tidy at all times.

In addition, to ensure that access to the Nile river bank is not restricted for public use (as decreed by Egyptian Law) and navigation activities are not jeopardized, the following measures will be implemented:

- The bank across which the intake pipes are constructed will be returned to its original state following construction; and
- Warning signs will mark the intake structures.

All construction teams employed and contracts commissioned will incorporate these mitigation measures as part of the operational procedures in EPC and O&M contracts to be entered.

Noise emissions. There is likely to be significant noise during construction. The noise levels have been modeled and are presented in detail in the EIA report. The noise level during the day time is expected to reach a maximum of <60 dB(A) during the day at the fence of the power plant and <55 dB(A) at night, both within World Bank and Egyptian guidelines. There will also be additional noise due to the construction related traffic, expected at 0.3 dB(A) above ambient levels during the peak construction period, i.e., the first few years. The specific noise mitigation measures listed below are based on standard good site management practices for construction of power plants and include:

- Enforcement of vehicle speed limits, strict controls of vehicle routing and prohibition of heavy vehicle movements during the night;
- Diesel engine vehicles and compression equipment will be equipped with effective silencers;
- Activities with highest noise emissions (e.g. piling) will be undertaken only during the day shift (7 am – 6 pm) and between Sunday and Thursday and not during official holidays; and
- Personnel will use hearing protection when using and/or working in the vicinity of noisy equipment.

Flora and Fauna. Negative impacts on flora and fauna are not expected to be significant due to the characteristics of the site, which is desert land with poor vegetation. Good site management practices and implementation of the following mitigation measures will ensure that any disturbance is reduced to a minimum:

- Personnel and vehicles will be restricted to within the boundaries of the construction site, lay down areas and access roads, and will not be permitted to enter surrounding land.

Soils and Hydrology. The potential for direct impacts on soil and groundwater during construction is largely dependent on the management of the construction site and construction activities. A range of mitigation measures will be implemented to protect soils and, as a result, the groundwater resources, from the direct impacts of the construction. These measures include:

- Engineered site drainage systems will be provided to collect, balance, treat as required and control the discharge of the site run-off;
- Vehicles and personnel will be restricted from accessing areas not designed for construction to prevent accidental or unnecessary disturbances or compaction of the soil; and
- Spoil from construction activities will be monitored and controlled; waste materials which are unsuitable for reuse on-site, for example for landscaping, will be disposed of at an appropriately licensed sanitary landfill site.

In addition, the potential for any transfer of existing contamination will be minimized through the following mitigation measures:

- Protection of the soil from accidental pollution by bordering around proposed storage areas for fuel and chemicals with the capability to store at least 110% of the expected volume;

- Provision of oil and interceptors, such as oil/water separators for the removal of pollutants loading from the site drainage and for the retention and containment of any accidental discharges during construction and operation;
- Removal of waste materials unsuitable for re-use on site during construction to appropriate licensed landfill sites;
- Management of excavations during construction so as to avoid the generation of drainage pathways to underlying aquifers; and
- Provision of impermeable bases in operational areas to prevent absorption of any spillage of process materials.

Traffic and Transport. Construction activities during peak times will generate additional traffic on local roads and in particular, significant volumes of heavy plant traffic and occasional abnormal loads. To minimize any inconvenience and delays, hazards and potential damage to other road users, local population and the local road network, the following mitigation measures will be implemented:

- Abnormal load movements will be confirmed with the General Authority for Roads, Bridges and Land Transport (GARBLT) which is the Competent Administrative Authority (CAA) for highways and regional roads and Giza Governorate for internal local roads. and will adhere to prescribed routes. Their movement will be scheduled to avoid peak hours and notices will be published in advance to minimize disruption as required by GARBLT and Giza Governorate.
- Consideration will be given to staggering construction shifts to split arrival and departure times;
- Scheduling of traffic will be undertaken to avoid the peak hours on the local road network wherever practicable; and
- Construction workers will be transported to the site by buses of contractors.

Socio-economic effects. The assessment of impacts suggests an overall positive impact on the local population given that the use of local labor will be prioritized during construction. No mitigation measures are proposed.

Archaeology. Careful examination of existing literature and data did not reveal any sites of archaeological or cultural heritage of importance on or around the site. In the unlikely event that remains being found, construction activities will be stopped and the Supreme Council of Antiquities will be consulted on the most appropriate measures, which could include the following:

- Where possible, remains will be protected in-situ from construction activities, by relocating non-essential activities;
- Where identified remains cannot be protected, an excavation of the indicated area will be undertaken prior to the commencement of construction activities to record and remove vulnerable remains and features;

- Any finds of archeological, historic or cultural significance will be given to the appropriate CAA; and
- Preparation of a Chance Finds Procedure which lays out the steps to be taken if archeological, historical or cultural remains or finds are discovered during construction activities. The procedures will clearly set out how the construction team will be briefed so that they are aware of what to look out for and the actions which must be taken should a potential find be uncovered.

Flooding. Since the site lies on the western edge of the eastern desert, there is a potential for the power plant site to be affected by occasional flash flooding. In order to reduce any potential impacts of flooding during construction, the following mitigation measures will be implemented:

- During the early stages of construction, a site drainage system will be built, equipped to protect the site against potential flooding;
- Site drainage will be constructed in such a way as to dissipate flood waters away from the main plant areas and to discharge clean waters to a natural drainage basin or a ground well and any potentially contaminated waters to the surrounding land and any potentially contaminated waters to the discharge facility via the oil interceptor;
- Desert lands to the east of the site will be re-enforced to ensure that erosion does not take place; and
- Culverts will be constructed on the access road to allow adequate transit of flood waters.

Solid Waste. To ensure that impacts from the generation of solid waste and its disposal are successfully avoided, the following mitigation measures will be implemented:

- All wastes taken off site will be carried out by a licensed waste contractor and NREA will audit the disposal procedure;
- All solid wastes will be segregated into different waste types, collected and stored on site in designated storage facilities and areas prior to release to off-site disposal facilities;
- All relevant consignments of waste for disposal, will be recorded, indicating their type, destination and other relevant information, prior to being taken off site; and
- Standards for storage area, management systems and disposal facilities will be agreed with the relevant parties.

An engineer with responsibility for environmental aspects will be responsible for solid waste management at the site and will ensure that all wastes are managed to minimize any environmental risks.

Occupational Health and Safety. NREA will ensure that construction activities are undertaken in a manner which does not present hazards to workers' health and safety. In particular, NREA will establish and integrate policies and procedures on occupational health and safety into the construction and operation of the power plant. Emergency and accident response procedures will also be included in an EHS manual for the power plant which will be prepared during construction.

The following measures will be implemented during the construction and operational phases:

- Compliance with international standards for good practice;
- Adherence to local and international guidance and codes of practice on EHS management;
- Management, supervision, monitoring and record-keeping as set out in the plant's operational manual;
- Implementation of EHS procedures as a condition for all contracts;
- Clear definition of the EHS roles and responsibilities of the companies contracted to work on site and to all their individual staff (including the nomination of EHS supervisors and coordinator);
- Pre-construction and operation assessment of the EHS risks and hazards associated with construction and operation, including consideration of local cultural attitudes, education level of workforce and local work practices;
- Provision of appropriate training on EHS issues for all employees of site, including initial induction and regular refresher training, taking into account local cultural issues;
- Provision of health and safety information;
- Regular inspection, review and recording of EHS performance; and
- Maintenance of a high standard of housekeeping at all times.

Impact assessment and mitigation measures during operation

Mitigation measures introduced into the design and construction phase of the power plant will be carried forward into the operational phase through the O&M contracts and by NREA. Several proposed mitigation measures are integrated into the design of the power plant in order to minimize any impacts on the environment. These include measures such as low NOx combustors, noise silencers and water discharge controls. The following section identifies additional measures to further mitigate impacts during operation of the plant.

Air Quality.

Emissions guidelines. Several specific measures have been taken to reduce stack emissions from the power plant and to comply with Egyptian and World Bank standards. The power plant will fire natural gas as its main and only fuel which is the least polluting fuel available (with negligible sulfur dioxide emissions and low particulate matter emissions). In order to reduce NO_x emissions when firing natural gas or light fuel oil, low NO_x combustors are used on the gas turbines (and water injection to fuel oil in emergency). In addition, a stack measuring 35 meters has been designed to minimize dispersion of emissions into the surrounding atmosphere. Stack

emissions to the air from the proposed plant are expected to be within the Egyptian, as well as the World Bank guidelines[19].

Air quality guidelines. In order to establish the potential atmospheric emissions from the power plant and its impact on ambient air quality, dispersion modeling has been undertaken and the results of the modeling indicates that the predicted off-site maximum annual and 24 hour mean ground levels of NO_2 and PM concentrations do not exceed the Egyptian nor the World Bank ambient air quality guidelines when natural gas is burned. As described above, natural gas is planned to be used at all times.

Aquatic Environment. Cooling water and process water for the plant will be drawn from the Nile River via an intake structure that is shared with the Combined Cycle currently under tendering and bidding. Potable water will be supplied to the plant via the same source. Cooling water will be recycled in the cooling tower, therefore no discharge of cooling water to the Nile will take place. The process water will be disposed of after treatment via a pipeline back to the Nile. The treated effluent will be continuously monitored to ensure that it meets the legal requirements for discharge on the Nile (Law 48/1982). In case of non-compliance, the effluent will be recycled for further treatment prior to final disposal.

The following mitigation measures will be implemented:

- An industrial treatment facility will receive wastewater from combustion turbine area floor drain, ST tube oil centrifuge, tank farm area, ST area floor washing and transformer area drain and process them into an oil/water separator where wastewaters are channeled to the common effluent tank for treatment before discharge to the Nile;
- GTG wash water will be collected in an individual sump and discharged with a portable pump to a tanker for off-site disposal via a licensed contractor;
- Waters contaminated by chemical wastes will be channeled from neutralization pit and combustion turbine compressor wash effluent to the common effluent tank for treatment before off-site disposal;
- Sanitary wastes will be collected via plant sewage and sewerage lines in a local sanitary treatment plant where the untreated waters will be re-used in the plant plantation irrigation program while the dirt will be collected for off-site disposal by sanitary road tankers of a licensed contractor;
- Solar field will be provided with an emergency strategy for immediate response to any accidental spillages, operational leakages or droplets of thermal oil to allow collection and control as required;
- Bunds or sumps will be installed on-site to isolate areas of potential oil or other spillages, such as transformer bays, from the site drainage system;
- Oil and chemical storage tanks will have secondary containment structures that will hold 110% of the contents of the largest storage tank;

[19] World Bank Pollution Prevention and Abatement Handbook – Part III: Thermal Power – Guidelines for New Plants, July 1998.

- Areas for unloading oil and hazardous chemical materials will be isolated by curbs and provided with a sump; equipped with a manually operated valve;
- Transformers will be provided with pits to retain 110% of the coolant capacity of the transformers which will include fire fighting water. Alternatively, each main oil-filled transformer foundation will drain through a corner sump directly to an underground oil collection chamber sized to retain 110% of the coolant capacity of the transformer plus deluge water (for the worst single catastrophic failure). Adjacent to this collection chamber will be constructed an oil separator which will normally function to separate any oil contaminated to the storm water collected from within the transformer foundations and the clean water drained to the discharge structure. The transformers will not contain PCBs; and
- Storm water runoff from equipment slabs that may be subject to oil contamination exposure will be collected and channeled through an oil/water separator prior to discharge.

In addition, the following good site management practices will be adhered to:

- Wastewater will be collected and treated before being discharged. The main water treatment steps include:
    - neutralization of any wastewater that has a pH outside the range of 6 to 9;
    - oil separation of any wastewater that may be contaminated with oil or grease; and
    - filtration of any wastewater that may contain high concentrations of suspended solids.
- No solid wastes will be discharged into the Nile;
- Drainage systems will be designed on site to prevent any contaminated surface runoff from being discharged into the Nile without prior oil separation and neutralization of any other contamination; and
- All effluent discharges will comply with local Egyptian and World Bank standards.

Noise Emissions. A number of noise mitigation measures have been built into the conceptual design of the plant in order to ensure that noise levels are minimized and that all items of the plant are operating to local and international standards.

Specific design mitigation measures include:

- Gas and steam turbine generators, air compressors, pumps, and the emergency diesel engines are enclosed in sound enclosures;
- Air compressors are equipped with air silencers; and
- Noisy outdoor equipment have been designed to a noise limit of 85 dB(A) at one meter.

In addition, all personnel working in noisy areas will be required to wear hearing protection.

- **Flora and Fauna.** No significant impacts are expected.

Visual Impact. Landscaping will include tropical shrubs (trees, grass, and palm groves) around the site. All plants will be indigenous species.

Soils and Hydrology. During plant operation, the main potential for impacts to occur to soils and hydrology (including run-off into the surrounding lands) will arise as a result of spillages and storage of chemicals and fuels on site. Good site management practices will minimize potential impacts.

Solid Waste. The mitigation and management measures during construction also apply to the operation phase.

Health and Safety. In addition to the operational health and safety measures during construction described above, the following mitigation measures will be implemented during construction:

- Development and implementation of an Operational Health and Safety Plan with appropriate training during construction;
- Provision of training for use of protection equipment and chemical handling;
- Clear marking of work site hazards and training in recognition of hazard symbols;
- Development of site emergency response plans;
- All personnel working or standing close to noisy equipment will be required to wear noise protectors; and
- Drinking water will be supplied to the plant via plant water supply system which will be complying with drinking water standards published by the World Health Organization.

Environmental Management Plan for the Kureimat Solar Thermal Project

Construction Impact Mitigation, Monitoring and Management Measures

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Air Quality									
Dust emissions caused by construction activities, construction vehicles movements, and transport of friable construction materials.	Implementation of good site practices including: • Appropriate siting and maintenance of stockpiles of friable materials so as to minimize dust blow; • Minimizing drop heights for material transfer activities such as unloading of friable • Construction phase to begin with construction of access roads; • Roads will be kept damp via a water bowser; • Roads will be compacted and graveled if necessary; • Site roads will be maintained in good order; • Regulation of site access; • Sheeting of lorries transporting friable construction materials and spoil; • Enforcement of vehicle speed limits <35km/h	Before and during construction	Initiate baseline air quality survey in cooperation and coordination with existing key performance indicators. Measurements and analysis of these pollutants to be made by a trained staff assigned by NREA/ISCC-KPP and submitted to EEAA, WB or any other concerned authority. Annual reporting of summary results (or more if requested) and submitted to the EEAA, WB or any other concerned authority. Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of NREA.	Implementation of good site practices shall be the responsibility of contractors and subcontractors under the supervision of NREA with support from EEHC.	NREA with support from EEHC.	Dust levels (TSP, PM_{10})	Semi annual reporting of summary results (or more if requested) submitted to WB, EEAA.	NREA responsible for management of the air quality monitoring measurements and submission of reports. Basic training of persons employed to operate and maintain the monitoring. NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices.	Air quality measurement equipment through NREA or third party (US$ 20K). Management time and reporting for the air quality monitoring (US$ 30K)

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Aquatic Environment									
Contamination of the aquatic environment as a result of construction activities on land e.g. spillages, disposal of liquid wastes; surface run-off, exposure of contaminated soils (see also under "Soils and Hydrology").	Management activities will include the following: • No discharge of effluents into the ambient environment unless effluents has been checked and meets all the local requirements; • Development of a site drainage plan which reduces flow velocity and sediments load; • Protection of temporary stockpiles of soil from erosion by using a reduced slope angle where practical, and sheeting • Maintenance of well kept construction site.	During construction	Nile river survey undertaken July 2003 and May 2004 along many profiles fronting the site. Report to be maintained for later monitoring and evaluation during operation. Water quality issues (temperature, pH, COD, BOD, TOC, DO, TSS, oil & grease, residual chlorine, heavy metals. Monitoring is required to ensure the implementation of management practices during construction.	Implementation of good site management shall be the responsibility of all contractors under the supervision of NREA with help from EEHC. Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of NREA with the help of EEHC.	NREA with support from EEHC NREA with support from EEHC	Fluid effluents within the site. Soil erosion. Surface water runoff. Sewage effluents. Earth, mud and debris depositions on roads.	Monthly for water quality issues. Quarterly reporting of summary results submitted to EEAA and WB.	NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices. . These mitigation measures must be a condition of any construction contracts commissioned. NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices.	Management time and costs included in the cost of the Project Management Unit. Management time and costs included in the cost of the Project Management Unit.

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Noise Increased noise in the project area as a result of the use of noisy machinery and increased vehicle movements.	Implementation of good site practices including: • Enforcement of vehicle speed limits; • Strict controls of vehicle routing; • Diesel engine contraction plant equipment to be fitted with silences; • Limited noisy construction activities at night; • Use of protective hearing equipment for workers.	During construction	Monitoring and supervision by NREA is required to ensure the implementation of good site management practices by all contractors during construction.	Implementation of good site management shall be the responsibility of all contractors under the supervision of NREA with help from EEHC.	NREA with support from EEHC	Noise complaints register to voice concerns. Check validity using noise measuring devices.	NREA will produce a monthly log of any complaints and action taken and submit to the EEAA and WB. Quarterly reporting of summary results submitted to EEAA and WB.	NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices.	Management time and costs included in the cost of the Project Management Unit. Noise measuring through independent third party (US$ 20K)
Flora and Fauna Site Clearance-Vegetation removal and habitat disturbance.	• Good site management practices will be observed to ensure that disturbance of habitats off-site is minimized. • Specific mitigation measures include restricting personnel and vehicles to within construction site boundaries, lay down areas and access roads.	During construction	Monitoring and supervision by NREA is required to ensure the implementation of good site management practices by all contractors during construction.	Implementation of good site management shall be the responsibility of all contractors under the supervision of NREA with help from EEHC.	NREA with support from EEHC	Good conservation of floral wealth. NREA to check the status of floral species weekly.	Monthly Number of trees conserved or replanted.	NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices.	Management time and costs included in the cost of the Project Management Unit.

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Soils and Hydrology Site clearance excavation and disposal of material, exposure of potentially contaminated soils, spillage or leakage of substances on land, movements of equipment and vehicles on site.	The potential for impacts are largely dependent on management of the construction site and activities. The following mitigation measures will be implemented: • Development of effective site drainage systems; • Restriction of access only to construction site areas; • Monitoring and control of spoil; • Disposal of waste materials unsuitable for reuse on-site, (e.g. for landscaping) at appropriately licensed sites; • Provision of oil interceptors; • Management of excavations during construction to avoid the generation of drainage pathways to underlying aquifers; • Provision of impermeable bases in operational areas to prevent absorption of spillage.	During construction.	Monitoring is required to ensure the implementation of good management practices during construction.	Implementation of good site management shall be the responsibility of all contractors under the supervision of NREA with help from EEHC.	NREA with support from EEHC	Site drainage Access only to construction site areas. Spoils Waste materials. Oily waters. Drainage pathways. Potential spillage in operational areas. Soil sample test. Ground water sample test.	Quarterly reporting of summary results submitted to EEAA and WB.	NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices.	Management time and costs included in the cost of the Project Management Unit. Site drainage system included in construction.

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Traffic and Transport Disruption, noise and increased air pollution due to increased traffic, heavy loads and abnormal loads.	Standard good practice measures will be implemented as follows: • Adherence to abnormal load movements to prescribed routes, outside peak hours and advance publication of movements if required; • Construction shifts will be staggered; • Scheduling of traffic to avoid peak hours on local roads.	During construction.	Monitoring is required to ensure the implementation of good site management practices by all contractors during construction.	Implementation of good site management shall be the responsibility of all contractors under the supervision of NREA with help from EEHC.	NREA with support from EEHC	Increased congestion. Travel time (compared to reasonable daily commute).	Monthly, based on a representative sample	NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices.	Management time and costs included in the cost of the Project Management Unit.
Socio-Economic Environment Positive impacts identified.	All activities related to the construction of the new plant will take place within the area belonging to NREA. A local labor force will be employed for the project thus no need for workers colony. Contractors will be responsible for relevant temporary water and toilet facilities.	During construction.	Record local employment provided by the project	PIE at the site.	NREA with help from EEHC.	Workers satisfaction as measured by staff interviews and complaints submitted.	NREA will produce a monthly log of any complaints and action taken and submit to the EEAA and WB.	Responsibility of NREA.	Management time and costs included in the cost of the Project Management Unit.

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Archeological Potential chance finds of archeological remains during construction.	The project site does not lie on, or in the immediate vicinity of any known archeological areas of interest. If remains are found, NREA is committed to: • Cease activities and consult Antiquities authority; • Protection in situ if possible; • Excavation of areas where protection not feasible; • Preparation of a Chance Finds Procedure and Method Statement.	During construction.	Supervision of construction activities.	Construction contractors. NREA will allocate responsibilities in accordance with the Chance Find Procedures.	NREA with help from EEHC.	Chance Finds	Daily, to be reported quarterly.	NREA to ensure that all workers on site are aware of the importance of archeological remains and must report any potential finds immediately. Immediate liaison with Competent Administrative Authority should a potential find be uncovered.	Management time and costs included in the cost of the Project Management Unit. Should chance finds occur, protection and excavation could add significantly to the cost.
Natural Disasters Flash Flooding,	Good engineering design will incorporate the following mitigation measures: • Drainage system designed to direct flood water from main plant areas into a natural drainage basin/wadi or a ground well and direct potentially contaminated waters through the oil interceptor.	During construction.	No monitoring measures are envisaged.	NREA.	NREA with help from EEHC.			NREA to ensure that all workers on site receive training in emergency preparedness and response procedures.	Management time and costs included in the cost of the Project Management Unit. Site drainage system included in construction

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Solid Waste Management	Good Practice measures such as the following: • All waste taken off-site will be undertaken through the EPC . NREA will audit disposal procedure; • Segregation of wastes and safe storage; • Recording of consignments for disposal; • Prior agreement of standards for storage, management and disposal with relevant authorities.	During construction.	Monitoring is required to ensure the implementation of good management practices during construction.	Implementation of good site management shall be the responsibility of all contractors under the supervision of NREA with help from EEHC.	NREA with help from EEHC	Disposal procedure submitted by contractors and approved by NREA.	Quarterly reporting of summary results submitted to EEAA and WB.	NREA to ensure all contractors and sub-contractors working on-site are aware of EMP and all employees are given a basic introduction training on good construction site and management practices.	Management time and costs included in the cost of the Project Management Unit.

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Occupational Health & Safety	Good local and international construction practice in Environment, Health and Safety (EHS) will be applied at all times and account will be taken of local customs, practices and attitudes. Measures include: • Implementation of EHS procedures as a condition of contract all contractors and sub-contractors; • Clear definition of the EHS roles and responsibilities of all construction companies and staff; • Management, supervision, monitoring and record-keeping as set out in the plant's operational manual; • Pre-construction and operation assessment of the EHS risks and hazards; • Completion and implementation of Fire Safety Plan prior to commissioning any part of the plant; • Provision of appropriate training on EHS issues for all workers; • Provision of health and safety information; • Regular inspection, review and recording of EHS performance; and • Maintenance of a high standard of housekeeping at all times.	During construction.	Monitoring is required to ensure the implementation of EHS Policies, plans and practices during construction.	Implementation of good site management shall be the responsibility of all contractors under the supervision of NREA with help from EEHC.	NREA with help from EEHC.	Management procedures in place. Workers health and safety as measured by number of incidents.	Daily. Quarterly reporting of summary results submitted to EEAA and WB.	NREA to ensure all contractors and sub-contractors with workers on site have reference to the requirements of the EMP and are aware of the EHS policies and practices. All employees will be given basic induction training on EHS policies and practices. NREA is responsible for ensuring that a Fire Safety Plan, which conforms to NFPA 850, is prepared and implemented prior to commissioning of any part of the plant.	Management time and costs included in the cost of the Project Management Unit plus preparation of the EHS plan (US$ 50K)

Operational Impact Mitigation, Monitoring and Management Measures

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Air Quality Emissions from stack are not expected to exceed standards. Ambient air quality affected by emissions from the power plant.	Mitigation measures have already been included in the design of the plant and, given NREA/ISCC's. Commitment to use Natural Gas for available operating time, no further mitigation measures are proposed. NREA/ISCC will however demonstrate the validity of the conclusions drawn in the EIA report. NREA/ISCC will demonstrate the validity of the conclusions drawn in the EIA report. If ground level concentrations are found to be above local and World Bank standards options for further mitigation will be discussed.	During first three years of operation.	Monitoring of stack emissions for NOx, SO_2, particulate matter and carbon monoxide (CO) via test ports installed in the main stacks. Monitoring of NOx, SO_2, CO, PM_{10} and TSP. Monitoring stations in the existing KPP will monitor short-term concentrations in the area predicted to have the highest impacts on humans. ISCC will install analyzer station near or within the site that will include a continuous monitoring of meteorological conditions (temperature, wind speed, direction, etc).	The analyzer stations will be owned and operated by NREA.	NREA with help from EEHC	Stack emissions (PM_{10}, NOx, SOx and CO). Ambient air pollutants concentrations (at least NOx, SO_2, CO, PM_{10} and TSP).	Frequent data acquisition. Quarterly reporting to the World Bank/EEAA. Reports are to be available to any of the concerning authorities (World Bank, EEAA).	Records must be kept and summary data (including any deviations from Egyptian and World Bank standards) will be submitted to the Government and World Bank on annual basis (or more frequently if required). Annual reporting by NREA/ISCC to Government and World Bank (or more frequently if required) highlighting key features and comparing results with air quality standards and prediction in EIA report.	Automatic stack monitors (included in project cost). Management time for compilation of reports and performance monitoring included in cost of PIE.

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Aquatic Environment Discharge of process, cooling blowdown and sanitary waters.	The design of the intake structures has already incorporated measures to reduce impacts Wastewaters including drainage from treatments plant, HRSG area equipment drainage, cooling towers blow down and sample cooler will be treated first in a common effluent tank before off-site disposal through discharge by gravity , to a natural drainage basin/wadi or a ground well. Effluent treatment plant will receive wastes from combustion turbine area floor drain, ST lube oil centrifuge, tank farm area, ST area floor washing and transformer area drain and process them into an oil/water separator where wastewaters are channeled to the common effluent tank for treatment before discharge to a natural drainage basin/wadi or a ground well. GTG wash water will be collected in an individual sump and discharged with a portable pump to a tanker for off-site disposal via special contractor part of EPC contractor scope. Wasters contaminated by chemical wastes will be channeled from neutralization pit and combustion turbine compressor wash effluent to the common effluent tank for treatment before off-site disposal. Sanitary wastes will be collected via plant sewage and sewerage lines in a local sanitary treatment plant where the treated water will be re-used in the plant plantation irrigation program while the dirt will be collected for off-site disposal by sanitary road tankers of a licensed contractor. Solar field will be provided with emergency strategy for immediate response to any accidental spillage. Operational leakages or droplets of thermal oil to allow collection and control as required.	Lifetime of the plant.	Prepare regular water quality monitoring program including: Quality of all water prior to discharge (monitoring of all discharged water for temperatures and pH, monitoring of process water for COD, TSS, oil & grease and residual chlorine and monitoring of heavy metals and other pollutants). Monthly monitoring of fish catches on intake screens including species, numbers and size (over a 1 year period).	NREA with help from EEHC.	NREA with help from EEHC.	Basic parameters as per Law 48/1982 and Law 93/1962.	Frequent monitoring of water quality. Frequent monitoring of heavy metals and other pollutants. 3-monthly monitoring of plume. Annual monitoring of benthic environment (over 1 year period). Monthly monitoring of fish catches on intake screens (over 1 year period). Reports are to be available to any of the concerning authorities (World Bank, EEAA).	Records will be kept and compared on regular basis against Egyptian and World Bank standards and impacts predicted in the EIA. Summary reports (with any exceptions identified) will be submitted to the Government and the World Bank annually (or more frequently if required). NREA/ISCC to ensure that all employees are given basic induction training on the requirements of the EIA, good site management practices and H&S procedures. The PIE will ensure implementation of procedures	Management time is included in the cost of the PIE. Design features included in the project costs. Water Quality measurement equipment (included in operation costs)

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
	Water spillage from mirror washing and cleaning will be monitored and controlled. Bunds or sumps will be installed on-site to isolate areas of potential oil or other spillages, such as transformer bays, from the site drainage system. Oil and chemical storage tanks will have secondary containment structures that will hold 110% of the contents of the largest storage tank. Areas for unloading oil and hazardous chemical materials will be isolated by kerbs and provided with a sump; equipped with a manually operated valve. Transformers will be provided with pits to retain 110% of the coolant capacity of the transformers which will include fire fighting water. Storm-water runoff from equipment slabs that may be subject to oil contamination exposure will be collected and channeled through an oil/water separator prior to discharge into the discharge pathway. In addition, good site management practices including the following will be implemented: • Neutralization, oil separation, flocculation and filtration of any contaminated water before discharge; • No disposal of solid wastes into the discharge structure; • Regular maintenance of site drainage system to ensure efficient operation; and • All discharges will comply with local Egyptian and World Bank guidelines. NREA/ISCC will demonstrate the validity of the conclusions drawn in the EIA report. If pollutant concentrations in the discharge or impacts to surrounding environment are found to be above local and World Bank standards or unacceptable, options for further mitigation will be discussed.								

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Noise	Specific design mitigation measures to minimize noise impacts include: • Gas turbines; • Steam turbine generators are equipped with appropriate sound protecting enclosures; • Air compressors are equipped with silencers; • Noisy outdoor equipment are designed to a noise limit of 85dB (A) at 1m. In addition, plant workers will be provided with protective wear in plant areas with high noise levels. The plant will operate in accordance with internationally accepted health and safety measures.	During first year of operation.	Given that no sensitive receptors are located in the immediate vicinity of the plant, no monitoring is envisaged.	NREA with help from EEHC.	NREA with help from EEHC.	Power plant compliance with EIA.	Annual reporting of summary results submitted to EEAA and WB.	Should any complaints be received regarding noise, these will be logged and NREA will investigate problem. NREA/ISCC to ensure that all employees are given basic induction training on the requirements of the EIA, good site management practices and H&S procedures. NREA will ensure implementation of procedure	Management time is included in the cost of the PIE. Design features included in the project costs. US$ 5 K over 5 years for third party measurements
Flora and Fauna Disturbance to habitats are a result of noise, vehicle and personnel movements.	The following mitigation measures will be implemented: • Restrict personnel and vehicle movements to access roads and within boundaries of site only; and • Control of noise during operation.	Lifetime of the plant.	No monitoring is envisaged.	NREA with help from EEHC.	NREA with help from EEHC	Good plantation.	Annually.	NREA/ISCC to ensure that all employees are given basic induction training on the requirements of the EIA, good site management practices and H&S procedures. NREA will ensure implementation of procedures.	Management time is included in the cost of the PIE.

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Visual Impact Visual image of power plant from surrounding areas.	The visual effect of the power plant will be improved through: • Creation of landscaped boundary along the fence of the power plant.	Lifetime of the plant	No monitoring is envisaged.	NREA with help from EEHC.	NREA with help from EEHC	Improved visual image.		Management of landscaped areas to maximize visual image and habitat creation. NREA/ISCC to contract a suitable firm to manage landscaped areas.	Management time is included in the cost of the PIE. Landscaping US$ 150K in addition to US$ 10K annually for maintenance
Soil and Hydrology Spillage of oils, chemicals or fuels on site.	Good site management measures as described under **Aquatic Environment** will minimize any potential risks. As part of this, regular checks of bunds and drainage systems will be undertaken to ensure containment and efficient operation.	Lifetime of the plant	NREA will monitor application of the EIA and good site management practices and take corrective action if required.	NREA with help from EEHC.	NREA with help from EEHC	Quality of bunds and drainage systems. Efficient operation.	Quarterly reporting of summary results submitted to EEAA and WB.	NREA/ISCC will implement a Spills Response Plan and all employees will receive corresponding training.	Management time is included in the cost of the PIE.
Solid Waste	Good practice measures undertaken during the construction phase will be continued into the operation phase, disposal via special contractor part of O&M contractor scope..	Lifetime of the plant	Monitoring is required to ensure the implementation of management practices during operations.	NREA with help from EEHC	NREA with help from EEHC	Management contracts in place.	Quarterly reporting of summary results submitted to EEAA and WB.	NREA/ISCC to ensure all employees are given basic induction training on good training on good operation and site management practices.	Management time is included in the cost of the PIE. Management contract US$ 20K annually

Issue/Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and frequency of reporting/ monitoring	Management and Training	Cost (US$)
				Implementation	Supervision				
Occupational Health and Safety, Risks and Hazards	Standard international practice on EHS issues shall be employed on site. In addition, the following measures will be undertaken: • Provision of training in use of protection equipment and chemical handling. • Use of protective equipment. • Clear marking of work site hazards and training in recognition of hazard symbols. • Installation of vapor detection equipment and control systems. • Development of site emergency response plans.	Lifetime of the plant	Regular on site training. Regular staff checks, system checks and field tests of emergency procedures by on-site management.	NREA with help from EEHC	NREA with help from EEHC	Management procedures in place Workers health and safety measured by incidents, injuries and illnesses.	Monthly reporting of summary results submitted to EEAA and WB.	NREA/ISCC to ensure that all employees are given basic induction training on H&S policies and procedures, Emergency Preparedness and Response Plan and a Spills Response Plan. NREA/ISCC is responsible for ensuring that the site emergency response plan in complete and implemented prior to commissioning any part of the power plant.	Management time is included in the cost of the PIE.

Summary of Implementation Cost of the EMP

Phase of Implementation	Cost in US$
Construction	US$ 120K
Operation	US$ 150K + US$ 35K annually (for the first 5 years)
Total	**Approx US$ 445 K**

Annex 11: Project Preparation and Supervision

	Planned	Actual
PCN review	October 1, 1997	October 1, 1997
Initial PID to PIC	September 27, 1999	September 27, 1999
Initial ISDS to PIC	January 14, 2004	January 14, 2004
Appraisal	October 30, 2006	October 30, 2006
Negotiations	December 12, 2006	December 13, 2006
Board approval	December 11, 2007	
Planned date of effectiveness	February 15, 2008	
Planned date of mid-term review	October 15, 2009	
Planned closing date	October, 31, 2011	

Key institutions responsible for preparation of the project:

New and Renewable Energy Authority (NREA)

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Anna Bjerde	TTL and Lead Energy Specialist	MNSSD
Lizmara Kirchner	Financial Analyst	MNSSD
Armando Ribeiro Araujo	Procurement Adviser	MNSSD
Rene Mendonca	Senior Power Engineer	MNSSD
Rome Chavapricha	Infrastructure Specialist	MNSSD
Fanny Missfelt-Ringius	Senior Environmental Economist	AFTEG
Abdulgabbar Al-Qattab	Procurement Specialist	MNAPR
Mohamed Yehia Abd El Karim	Financial Management Specialist	MNAFM
Ihab Shalan	Environmental Specialist	MNSSD
Knut Opsal	Senior Social Development Specialist	MNSSD
Hayat Al-Harazi	Program Assistant	MNSSD

Bank funds expended to date on project preparation:

1. GEF Bank resources: US$379,641.73
2. Trust funds (PDF Band C): US$1,050,000.00
3. Total: US$1,429,641.73

Estimated Approval and Supervision costs: US$518,570

1. Remaining costs to approval: US$25,000
2. Estimated annual supervision cost: US$85,000

Annex 12: Documents in the Project File

1. Conceptual Design for the ISCC – January 2004
2. Environmental Impact Assessment for 150 MW Kureimat Integrated Solar Combined Cycle Power Plant Project, June 2006
3. Theses for creating a common basis for the conclusions from the WB/GEF Workshop on Solar Thermal Technology, Washington (Working Paper) March 2005
4. Procurement Capacity Assessment, May 2006
5. Bidding documents for the Solar Thermal Island – March 2006-May 2007.

Annex 13: Statement of Loans and Credits

			Original Amount in US$ Millions					Difference between expected and actual disbursements	
Project ID	FY	Project Name	IBRD	IDA	GRANT	Cancel.	Undisb.	Orig.	Frm Rev'd
P040858	1999	EG - SOHAG Rural Dev	0.00	25.00	0.00	0.00	5.81	3.95	3.42
P049166	1998	EG East Delta Ag. Serv.	0.00	15.00	0.00	0.62	8.03	7.31	4.46
P005173	1995	EG Irrigation Improvement	26.70	53.30	0.00	0.00	2.57	8.80	-1.05
P041410	1999	EG Pumping Station Rehab III	120.00	0.00	0.00	20.00	22.76	42.76	0.00
P050484	1999	EG Secondary Education Enhancement Proj	0.00	50.00	0.00	0.00	25.47	22.87	2.22
P088877	2006	EG- FINANCIAL SECTOR REFORM DPL	500.00	0.00	0.00	0.00	500.00	333.33	0.00
P082914	2004	EG-AIRPORTS DEVELOPMENT PROJECT	335.00	0.00	0.00	0.00	235.74	84.54	0.00
P091945	2006	EG-EL TEBBIN POWER	259.60	0.00	0.00	0.00	259.60	3.33	0.00
P082952	2005	EG-Early Childhood Education Enhancement	20.00	0.00	0.00	0.00	19.90	4.38	0.00
P045175	1998	EG-HEALTH SECTOR	0.00	90.00	0.00	0.00	12.82	4.81	1.58
P056236	2002	EG-HIGHER EDUCATION ENHANCEMENT PROG	50.00	0.00	0.00	0.00	23.59	22.79	7.28
P093470	2007	EG-MORTGAGE FINANCE	37.10	0.00	0.00	0.00	37.24	0.00	0.00
P049702	2004	EG-SKILLS DEVELOPMENT	5.50	0.00	0.00	0.00	4.56	3.63	0.00
P045499	2000	Egypt NATIONAL DRAINAGE II	50.00	0.00	0.00	0.00	11.90	9.56	0.00
P073977	2005	Integrated Irrig Improv. & Mgmt.	120.00	0.00	0.00	0.00	119.40	8.57	0.00
P090073	2006	Second Pollution Abatement Project	20.00	0.00	0.00	0.00	20.00	2.67	0.00
		Total	1,543.90	233.30	0.00	20.62	1,309.38	563.32	17.92

STATEMENT OF IFC's
Held and Disbursed Portfolio
In Millions of US Dollars

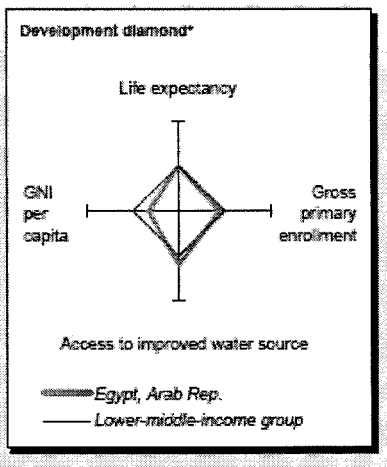
		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic	Loan	Equity	Quasi	Partic
1996	ANSDK	1.33	0	0	0	0.56	0	0	0
2004	Alexandria Fiber	8	0	0	0	7	0	0	0
2001	Amreya	4.69	0	0	0	4.69	0	0	0
2006	CIB LLC	0	0.72	0	0	0	0.48	0	0
1999	CIL	0	0.74	0	0	0	0.74	0	0
2004	CIL	0	0.15	0	0	0	0.15	0	0
1992	Carbon Black-EGT	0	1.48	0	0	0	1.48	0	0
1997	Carbon Black-EGT	0	1.48	0	0	0	1.48	0	0
1998	Carbon Black-EGT	4	0	0	0	4	0	0	0
2000	Carbon Black-EGT	5	0	0	0	0	0	0	0
2002	Ceramica Al-Amir	3.33	0	0	0	3.33	0	0	0
2006	Cmrcl Intl Bank	0	23.28	0	0	0	23.03	0	0
2006	EFG Hermes	20	0	0	0	0	0	0	0

		Committed IFC				Disbursed IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic	Loan	Equity	Quasi	Partic
2004	EHF	0	1.7	0	0	0	1.7	0	0
2005	Egypt Factors	0	3	0	0	0	0	0	0
2006	Gippsland	0	4.61	0	0	0	2.03	0	0
2001	IT Worx	0	2	0	0	0	2	0	0
2004	Lecico Egypt	8.94	0	0	0	8.94	0	0	0
1986	Meleiha Oil	0	8.62	0	0	0	0	0	0
1988	Meleiha Oil	0	9.2	0	0	0	0	0	0
1992	Meleiha Oil	0	13	0	0	0	0.94	0	0
2005	Merlon Egypt	1	0	0	0	0	0	0	0
2002	Metro	10.5	0	0	0	10.5	0	0	0
1992	Misr Compressor	9.7	0	0	0	9.7	0	0	0
	Orix Leasing EGT	4	0	0	0	0	0	0	0
1996	Orix Leasing EGT	0	0.53	0	0	0	0.53	0	0
2001	Orix Leasing EGT	1.09	0	0	0	1.09	0	0	0
2001	Port Said	41.07	0	0	132.53	41.07	0	0	132.53
2002	SEKEM	4.18	0	0	0	4.18	0	0	0
2006	SONUT	10	0	4	0	0	0	0	0
2004	SPDC	18.4	0	0	0	18.4	0	0	0
2001	SUEZ GULF	40.4	0	0	129.07	40.4	0	0	129.07
1997	UNI	2.05	0	0	0	2.05	0	0	0
2001	UNI	2.06	0	0	0	2.06	0	0	0
2005	Wadi Group	15	0	0	0	7.5	0	0	0
Total Portfolio:		214.74	70.51	4	261.6	165.47	34.56	0	261.6

		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic
2004	ACB Acrylic	0.00	2.40	0.00	0.00
2004	Merlon Egypt	0.00	0.00	0.00	15.00
2000	ACB Expansn III	4.00	0.00	0.00	0.00
2006	Rally Energy	10.00	0.00	0.00	0.00
Total Pending Commitment:		14.00	2.40	0.00	15.00

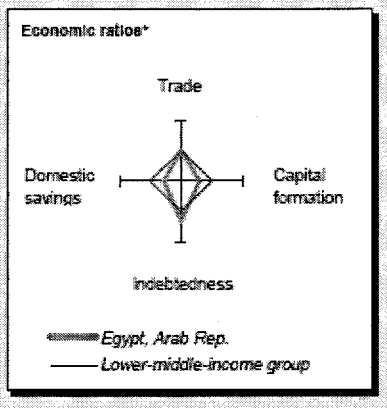
Annex 14: Country at a Glance

POVERTY and SOCIAL	Egypt	M. East & North Africa	Lower-middle-income
2005			
Population, mid-year *(millions)*	74.0	305	2,475
GNI per capita *(Atlas method, US$)*	1,250	2,241	1,918
GNI *(Atlas method, US$ billions)*	92.5	685	4,747
Average annual growth, 1999-05			
Population *(%)*	1.9	1.9	1.0
Labor force *(%)*	2.6	3.5	1.4
Most recent estimate (latest year available, 1999-05)			
Poverty *(% of population below national poverty line)*	17	..	..
Urban population *(% of total population)*	43	57	50
Life expectancy at birth *(years)*	70	69	70
Infant mortality *(per 1,000 live births)*	28	44	33
Child malnutrition *(% of children under 5)*	9	13	12
Access to an improved water source *(% of population)*	98	89	82
Literacy *(% of population age 15+)*	71	72	89
Gross primary enrollment *(% of school-age population)*	101	103	114
Male	103	106	115
Female	98	100	113

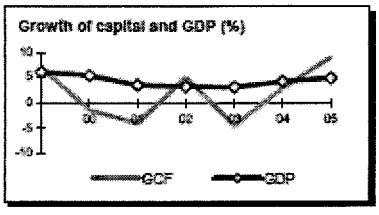


KEY ECONOMIC RATIOS and LONG-TERM TRENDS	1985	1995	2004	2005
GDP *(US$ billions)*	34.7	80.2	78.8	89.3
Gross capital formation/GDP	26.7	17.2	16.6	17.3
Exports of goods and services/GDP	19.9	22.5	28.6	31.7
Gross domestic savings/GDP	14.5	12.2	16.2	17.2
Gross national savings/GDP	..	19.4	21.0	22.0
Current account balance/GDP	-9.3	0.6	4.3	4.8
Interest payments/GDP	2.6	2.1	0.8	..
Total debt/GDP	104.2	55.7	38.4	..
Total debt service/exports	25.8	13.4	8.8	..
Present value of debt/GDP	..	..	34.0	..
Present value of debt/exports	..	..	101.3	..

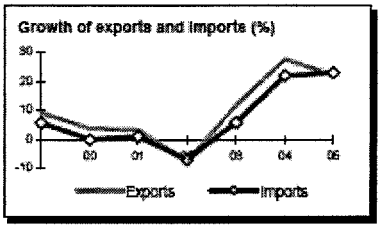
	1985-95	1995-05	2004	2005	2005-09
(average annual growth)					
GDP	3.9	4.7	4.2	4.9	5.8
GDP per capita	1.7	2.7	2.2	2.9	4.8
Exports of goods and services	7.6	5.1	27.6	22.2	11.8



STRUCTURE of the ECONOMY	1985	1995	2004	2005
(% of GDP)				
Agriculture	20.0	16.8	15.1	13.9
Industry	28.6	32.3	36.9	38.7
Manufacturing	13.5	17.4	16.3	18.2
Services	51.5	50.9	48.0	47.4
Household final consumption expenditure	68.2	77.3	71.4	70.2
General gov't final consumption expenditure	17.2	10.5	12.4	12.7
Imports of goods and services	32.0	27.5	28.9	31.9



	1985-95	1995-05	2004	2005
(average annual growth)				
Agriculture	2.7	3.5	1.9	3.4
Industry	4.8	4.3	2.5	3.5
Manufacturing	5.0	5.7	2.9	3.3
Services	3.4	4.7	6.1	6.4
Household final consumption expenditure	4.4	4.4	3.2	4.5
General gov't final consumption expenditure	-1.0	2.8	2.7	3.0
Gross capital formation	-4.7	4.1	2.9	8.9
Imports of goods and services	-0.2	3.7	22.0	22.9



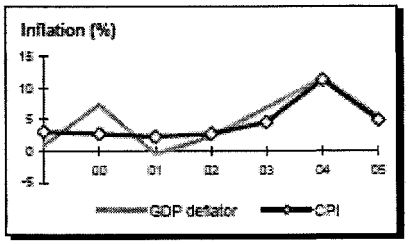
Note: 2005 data are preliminary estimates.

This table was produced from the Development Economics LDB database.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will be incomplete.

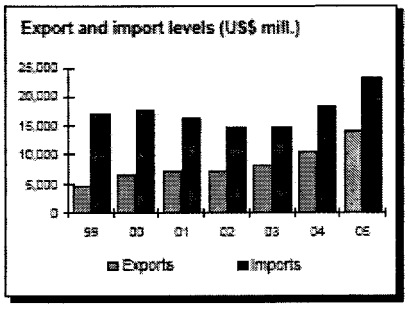
PRICES and GOVERNMENT FINANCE

	1985	1995	2004	2005
Domestic prices				
(% change)				
Consumer prices	12.1	15.7	11.3	4.9
Implicit GDP deflator	9.0	11.4	11.5	5.4
Government finance				
(% of GDP, includes current grants)				
Current revenue	22.2	25.9	25.9	24.1
Current budget balance	-13.7	2.6	2.0	-1.3
Overall surplus/deficit	-21.6	-1.2	-2.4	-6.0



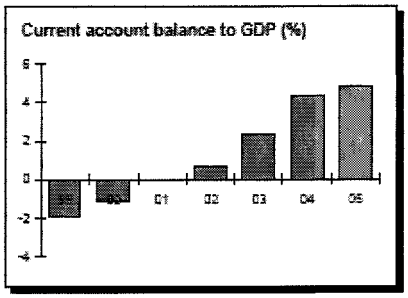
TRADE

	1985	1995	2004	2005
(US$ millions)				
Total exports (fob)	..	4,957	10,453	14,000
Cotton	..	2,178	3,910	5,000
Other agriculture	..	306	202	106
Manufactures	..	1,655	3,972	5,529
Total imports (cif)	..	12,811	18,266	23,100
Food	..	2,760	1,877	2,371
Fuel and energy	..	721	2,639	3,363
Capital goods	..	3,108	3,506	4,792
Export price index *(2000=100)*	..	99	128	138
Import price index *(2000=100)*	..	115	122	128
Terms of trade *(2000=100)*	..	86	105	108



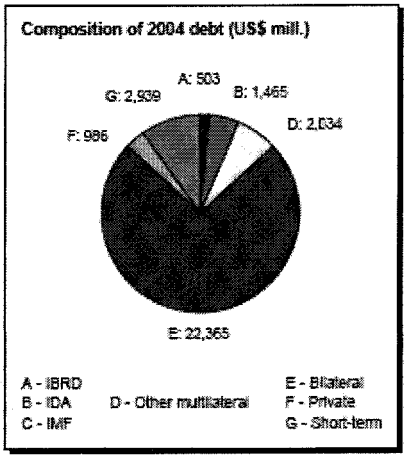
BALANCE of PAYMENTS

	1985	1995	2004	2005
(US$ millions)				
Exports of goods and services	6,866	12,887	22,948	28,900
Imports of goods and services	12,606	16,840	23,258	29,100
Resource balance	-5,741	-3,952	-309	-200
Net income	-991	141	-207	-100
Net current transfers	..	4,198	3,934	4,600
Current account balance	-3,209	388	3,418	4,300
Financing items (net)	3,022	366	-3,576	-329
Changes in net reserves	187	-754	158	-3,971
Memo:				
Reserves including gold *(US$ millions)*	..	..	..	16,367
Conversion rate *(DEC, local/US$)*	1.0	3.4	6.2	6.0



EXTERNAL DEBT and RESOURCE FLOWS

	1985	1995	2004	2005
(US$ millions)				
Total debt outstanding and disbursed	36,137	33,499	30,292	..
IBRD	1,048	1,320	503	492
IDA	802	1,035	1,465	1,420
Total debt service	2,815	2,381	2,317	..
IBRD	147	312	99	98
IDA	8	21	50	52
Composition of net resource flows				
Official grants	734	1,006	1,389	..
Official creditors	1,634	60	-868	..
Private creditors	573	-311	-228	..
Foreign direct investment (net inflows)	1,178	598	1,253	..
Portfolio equity (net inflows)	0	0	26	..
World Bank program				
Commitments	59	80	670	..
Disbursements	269	125	100	165
Principal repayments	70	212	116	118
Net flows	198	-87	-16	48
Interest payments	84	121	33	32
Net transfers	114	-208	-49	15



Note: This table was produced from the Development Economics LDB database. 6/12/06

Annex 15: Incremental Cost Analysis

Baseline

An analysis of Egypt's system expansion plan, fuel supply and availability, and potential candidate plants suggests that the least-cost baseline course of action will be the commissioning of further gas-fired combined cycle capacity. The baseline plant is therefore assumed to be a combined cycle gas turbine (CCGT) fueled with natural gas capable of producing the same net energy output of 852 GWh per year as the proposed GEF alternative.

GEF Alternative

The plant will be of about 150 MWe capacity combining a conventional fossil fuel portion of about 130 MWe and an input from solar sources of about 20 MWe. When own consumption of 6.3 MWe is deducted, the net overall plant capacity becomes 143 MWe. The total net energy produced by the plant is expected to be 852 GWh per year, which includes the solar contribution of 33.4 GWh per year. This corresponds to a solar share of 4 percent of the total annual energy produced by the plant operating at a full load. The technology for the solar field is parabolic trough.

In the Egyptian context, Kureimat is a least cost site with excellent levels of solar insolation of 2,431 kWh/m2/year at a latitude of 30°, direct access to natural gas, water supplies and direct access to the national electricity grid. The project is based on a feasibility study and a conceptual design report financed by the GEF, which assess the technical and economic feasibility of solar thermal technology in Egypt and specify the design of the ISCC power plant at Kureimat. The ISCC power station will have the characteristics shown in Table 1 below.

Table 1: Characteristics of the Integrated Solar Combined Cycle Power Plant

Parameter	Value
Gross Plant Capacity (MWe)	150
Of which Solar Field (MWe)	20
Net Electricity Output (GWh/yr)	852
Solar Share (proportion of net energy output)	4 %
Total Installed Cost* (US$ million)	$290
Levelized Electricity costs (cents/kWh)	6.77

* Installed cost comprises the equipment cost ($283.4 million) and consulting cost during implementation and EMP cost ($6.4 million). Import taxes on equipment ($22.4 million) are excluded.

The technical, economic and financial data are based on bids awarded. Power plant capacity and the relative proportion of the fossil and solar components are indicative and based on the results of the feasibility and draft conceptual design report study. Plant configuration will be optimized during the bidding process and will only become definite when the winning bidder is selected

and the contractual framework (the security package) negotiated. This open approach will help ensure that optimum technology at least cost is employed.

Scope of the Analysis

System Boundary

The analysis is based on the direct comparison of the proposed solar thermal plant with the least-cost conventional solution of the same annual output. It is recognized that the introduction of solar-thermal capacity to the national grid might require further adjustments in the system expansion plan, not least because the proposed plant is relatively small compared to the conventional power stations that might be built in the baseline. These system-wide effects are ignored in the current analysis. While they could be captured in a broader study of the entire system expansion plan, a simple plant-by-plant comparison was preferred, for the following reasons:

- The Egyptian power system is growing relatively fast. Relative to this expansion and the overall size of the system, the proposed addition is relatively minor and can be absorbed without major repercussions;
- There is a trade off between spatial and temporal system boundary: A plant-by-plant comparison ignores systemic effects, but allows the analysis of the entire plant lifetime. A system expansion analysis, on the other hand, has a wide spatial system boundary, but usually covers no more than 10-15 years of plant life. In the current context – where systemic effects are assumed to be small, and the time horizon of the expansion plan is relatively short – covering the entire plant life was considered more important.

An earlier sensitivity run of the system expansion plan performed by EEHC with and without a solar thermal / fossil fuel hybrid plant resulted in incremental costs in the same range as calculated in the plant-by-plant comparison.

Additional Domestic Benefits

The GEF alternative will result in some improvements in domestic air quality, but these additional domestic benefits are marginal. Egypt has a separate program targeted at local air pollution, especially in the urban areas where it is worst.

This project will position Egypt as a world leader in the commercialization of solar thermal technology and as a potential source of goods and services for future solar thermal power projects both domestically and abroad, particularly in the high insolation region in which it finds itself.

Input Costs

Capital Costs

In aggregate, the 150 MW ISCC installed cost of US$290 million is approximately US$1,933/kW. Looking separately, the solar thermal power generation without combined cycle costs about US$4,937/kW (US$98.74 million for solar island divided by 20 MW (excluding import taxes), substantially higher than the baseline CCGT, which costs about US$1,469/kW

(excluding taxes). The size of the solar field is 130,800 m^2 and is estimated to cost US$ 754/m^2 ($98.74 million divided by 130,800 $m^{2)}$.

In the GEF PDF Block C application, costs were estimated for the solar field of $1,897/kW, average plant costs for a hybrid at $894/kW and a likely cost of solar electricity of 9.5 US¢/kWh. For a volumetric central receiver, costs were estimated at $902/kW with the solar field at $2,137/kW and solar electricity at 10.2 US¢/kWh..

Recurrent Costs

The main recurrent cost elements concern operations and maintenance (O&M) and fuel purchases. Good O&M data for solar thermal power are available from the 354 MWe of plant that has been operating in California since the 1980s. Over the years, operators have succeeded in substantially reducing O&M costs by increasing the efficiency and lifetime of components, improving the effectiveness of the solar field, power block interface and other measures. As a result, the typical O&M costs for a solar field have come down to about 1.3 US¢/kWh, compared with about 0.3 US¢/kWh for a typical CCGT. The higher O&M costs of the solar field are partially offset by savings in fuel costs. The economic cost of natural gas in Egypt is estimated to be US$ 2.52 per million BTU, which translates into levelized electricity costs of 6.77 US¢/kWh for the integrated plant at a 10% discount rate.

Key Assumptions

Key assumptions are summarized in Table 2 below:

Table 2 – Key Assumptions

Parameter	Value
Technical:	
Plant lifetime	**25 years**
Total Plant Capacity	**150 MWe**
Fossil Capacity	**130 MWe**
Solar Capacity	**20 MWe**
ISCC GWh generated	**852 / year**
Incremental solar efficiency	**85%**
GT capacity factor	**32.65%**
GT efficiency	**34.92%**
ST efficiency	**67.57%**
Economic:	
ISCC capital cost	**$290 million ($1,933/kW)**
Reference CCGT	**$191 million ($1,469/kW)**
Economic cost of gas	**$2.52/MM Btu**

Incremental Costs

Using the data presented above, the results indicate that for a total capacity of 150 MWe, introducing a 4% solar contribution will increase the installed cost of the plant from about US$191 million for a conventional CCGT to about US$290 million for the integrated solar combined cycle plant. There will also be incremental O&M cost, the present value of these costs is about US$19.7 million over the construction and the 25-year project life. The costs are partially offset by the reduced fuel consumption; the present value of which is US$4.3 million. Therefore, the estimated net incremental cost (both capital and operating costs) for 20 MWe of solar capacity varies between US$88.3 million to US$108.6 million, using discount rates between 6%-14%. The GEF financing is capped at US$49.8 million for the project and any remaining incremental cost will be financed by NREA. US$97.2 million incremental cost has been used in the cost estimates and financing plan of this project. Table 3 below presents the results in more detail.

Table 3 – Incremental Cost

Calculation of Incremental Cost			**US$ Million**
Discount rate	6%	10%	14%
Reference Baseline CCGT			
Capital costs	170.2	158.2	147.6
Fuel costs	181.0	113.2	76.0
O&M costs	38.5	24.1	16.2
Consumables	1.2	0.7	0.5
Total	391.0	296.2	240.2
PV GWh	9141.8	5808.6	3951.2
Levelized electricity costs (cents/kWh)	4.28	5.10	6.08
ISCC			
Capital costs	258.1	240.0	223.8
Fuel costs	174.1	108.8	73.0
O&M costs	66.1	43.8	31.2
Consumables	1.2	0.8	0.5
Total	499.5	393.4	328.5
PV GWh	9141.8	5808.6	3951.2
Levelized electricity costs (cents/kWh)	5.46	6.77	8.31
Increment:			
Capital costs	87.9	81.7	76.2
Fuel costs	(6.9)	(4.3)	(2.9)
O&M costs	27.6	19.7	15.0
Consumables	0.0	0.0	0.0
Total incremental cost	**108.6**	**97.2**	**88.3**
Incremental levelized costs (cents/kWh)	1.19	1.67	2.24

Table 4: Incremental Cost Matrix

	Baseline	Alternative	Increment
Domestic Benefits			
a) physical	852 GWh per year of electricity	852GWh per year of electricity (818 GWh are generated through the combustion of gas, and 33.4 GWh are produced through the solar field).	None
b) programmatic	Limited NREA/EEHC institutional capacity to develop complex private renewables-based generation projects	Demonstrated practical viability of utility-based solar thermal technology Participation in planning, preliminary design of technical and financial requirements, preparation of bidding documents for hybrid plant	Reduction of perceived risks in renewables-based power; gain in operational experience Up to 20 NREA/EEHC Staff at various levels trained in solar/hybrid technology
	Limited regulatory capacity for renewables	Regulatory staff training in solar thermal	Solar thermal regulatory capacity
Global Benefits			
a) environmental	16.14 million tons of CO2 emitted over 25 years.	15.78 tons of CO2 emitted over 25 years.	0.5 million tons of CO2 abated over 25 years of project.
b) programmatic	No hybrid solar thermal power plants in utility operation; high risk perceived by investors	20 MWe solar thermal capacity. Demonstration effect/combining impact with similar plants in other countries	20 MWe of solar thermal capacity More countries and investors globally willing to consider STP hybrid options
	Solar thermal industry dormant with little future prospects; costs high	Revived interest/market opportunities for solar thermal industry	Creation of new opportunities for STP industry as a result of cost reductions
Incremental Costs (see table 3)			US$97.2 million

Annex 16: STAP Roster Review

Independent Technical Review

Reviewer: Mr. Pascal DeLaquil
President
Clean Energy Commercialization, LLC
Annapolis, MD - USA

1. Introduction

This project will assist the GOE, through its relevant agencies the Egyptian Electricity Holding Company (EEHC) and New and Renewable Energy Authority (NREA), to procure and benefit from a hybrid solar thermal power plant through an Engineer Procure and Construct (EPC) contract with a 2-year operation and maintenance (O&M) contract. A similar project was proposed in early 2002 using an independent power producer approach. However, the GOE changed its policy on foreign currency exposure related to private sector investment projects, and this caused private interest in infrastructure projects (in general) to evaporate. Therefore, based on a request from the Government, the project's concept was changed to a publicly financed approach.

Selection of the EPC/O&M contractor will be through an international bidding process, and details of the selected plant design are expected to vary slightly, but based on the conceptual design study by Fichtner Solar, the project is expected to comprise an Integrated Solar Combined Cycle (ISCC) plant configuration with a total capacity of about 150MW and a solar thermal component of about 20MW. On an annual basis, the solar field will contribute about 4% of the total energy produced by the plant. The EPC/O&M contractors will be able to optimize their design through choice of proven solar trough technologies, turbine generator equipment, and degree of local content, as long as the proposed design meets the performance specifications from the GOE.

2. GEF Context

The proposed project addresses GEF Operational Program 7 (OP7): reducing the long-term cost of low greenhouse gas-emitting technologies. OP7 aims to accelerate market penetration of several large-scale backstop technologies that are constrained by high capital costs and high commercial risks. The strategy is to identify projects that address national priorities and then finance the incremental costs of investments, capacity building and other activities that reduce market barriers and perceived risks by investors.

Based on the technical success of the 354 MW of solar thermal power plants still operating in California after more than 15 years, this technology can be considered an important large-scale non-carbon emitting backstop technology. Many of these plants currently operate at solar outputs that exceed their initial design specifications. However, current costs for this technology are high, and significant cost reductions for this technology can only begin to occur with the implementation of new projects. The proposed project is one of four similar projects demonstration (the others being in India, Mexico and Morocco) which have been sponsored by GEF as part its program to accelerate cost reduction and commercial adoption of large-scale non-carbon emitting generation technologies.

3. Key Issues

3.1 Project Approach

The switch from a private sector to a public sector financing approach has specific advantages and disadvantages. The key disadvantage is that it may not be sustainability over the long-term because of changing government policy and the public sector's limited access to capital. However, in the near-term, the proposed EPC/O&M contract approach for this project preserves many of the important features of the private sector approach. Namely, the choice of technology and its associated risks will be borne by the contractor during construction and the initial five year operating period, and that entity will be in the best position to manage those risks. Second, the contract will contain appropriate incentives for maximizing the utilization of the solar field over the long term. Third, the contractor and key suppliers will be positioned to capture of technology and organizational learning effects that are essential to achieving long-term cost reductions.

The fact that the main activities of NREA are evolving from research and development to production and sales of electricity from renewable sources is a potentially powerful, but risky development. It provides a strong governmental drive to realize the social and environmental benefits of renewables (as long as the policy remains strong), but it also means that significantly more capacity building will be required in support of this project.

Specifically, it is stated that this project will benefit from a study that is about to be commissioned under a GEF preparatory grant to review institutional options for NREA in support of wind projects. The aim is for the study to identify an action plan that can be included in the implementation of the solar-thermal project. What is the timing of this study in relation to the project? Will the results be available in time to impact this project?

Regarding consulting services for project management during the EPC/O&M contract period, the Project Brief reads as if the contractor will be responsible for project management rather than being tasked to support the Project Implementation Entity (PIE) within NREA in their role as the project manager and implementing agency. For effective capacity building, the PIE should lead the project management team, and while the contractor may perform all the project management activities, PIE members will need to be involved both for training purposes and to be able to recommend documents for approval to NREA and EEHC management.

This would seem appropriate given that the Project Document states (on Page 10) that NREA has gained significant experience in designing and implementing wind energy projects with international loan and grant financing. However, ISCC plants are significantly more complex than wind farms, and having the project management and support contractor on board before the start of implementation is critical.

Another important project feature is the decision to include an incentive/penalty structure in the O&M contract that will act to maximize the solar output, and to ensure the continuation of the incentive structure in the PPA contract between NREA and EEHC. This will help achieve the GEF program goal by promoting an effectively operated demonstration and ensuring sufficient learning experience within the solar thermal industry.

A single contract encompassing the ISCC plant is the proper basis for procurement. Use of the World Bank Procurement Guidelines and the Bank's standard two-stage bidding procedures should ensure that a reputable contractor is selected in an open and transparent manner.

This reviewer agrees that a public financing of the first solar thermal project can be done at lower cost and with a greater degree of certainty, since the private sector would demand a premium for assuming both the technical and financial risks of the project. In the proposed public sector approach, the contractor continues to assume the technical risks, but NREA and the GOE are assuming the financial project risks.

The institutional and implementation arrangement for the project is clear from the level of the NREA and below. However, above the NREA, it only states that the project will be overseen by MEE. This reviewer believes that a Project Steering Committee (PSC) is needed to ensure that the broader project objectives are met, especially those dealing with capacity building, replication, information dissemination and public awareness. The PSC should have members from other interested government ministries in addition to MEE, the GEF and the IFIs providing loans to the project. In addition, an interested NGO should be invited onto the PSC.

3.2 Scientific and Technical Soundness

Solar thermal power plants that raise steam to generate power have been successfully operating for over 15 years. The basic concept of the ISCC (integrating a solar thermal steam generating field with a natural gas combined cycle power plant) is sound and has been extensively studied. While such a project has yet to be implemented, a project following this concept should be completely feasible, as the technical basis for such an integrated system is quite straightforward.

Details of the technical and economic effectiveness of the power plant will depend on the design and equipment choices of the selected bidder. Therefore, this review is based on the conceptual design identified in the Project Brief, and it seeks to identify the most important technical issues that will to be addressed during the implementation of the project.

The size of the solar thermal field at about 20 MW is sufficiently large to provide relevant operating experience and contribute to the re-establishment of manufacturing capacity for critical solar field components that will help lead to lower costs in the future.

The project document states that "two types of solar parabolic trough designs are available: Euro-trough and LS-3." In fact, other potential designs do exist. Does the project intend to limit bidders to these two types of trough designs because they are more technically proven? Some experts believe that the LS-2 collector is a more reliable design than the LS-3 collector. Will that design be allowed?

The project document correctly states the need for proven technology, and the intention to pre-qualify all bidders. It is therefore recommended that a list of acceptable solar trough designs be developed and reviewed with potential bidders during the pre-qualification process. In the prequalification discussions, the project should be open to other solar trough designs, provided that the potential bidder is able to demonstrate an acceptable level of development.

Page 9 states that "To enable both existing types to compete for the project, the physical size of the solar field will be scaled to fit the requirements of both designs corresponding to a size of 1,000 x 1,125 meters." This is unclear. I believe that what is meant is that the physical area for the solar field will be fixed at 1,000 x 1,125 meters, and the bidders will be allowed to optimize the output of their solar field within this space limitation. If this is the correct interpretation, then the text should be clarified.

This reviewer supports the decision to exclude thermal storage from the project design, as this technology has not been adequately developed for solar trough systems and because storage adds little value to a hybrid plant.

The Project Brief states that NREA is working together with Fichtner Solar to develop the performance specifications of the proposed plant. In addition to minimum qualifications for the solar trough technology, these performance specifications must ensure effective integration of the steam systems for the solar field and the gas-fired combined cycle plant. The contractor selection process should also review plant designs to ensure that the plant will operate effectively in all modes. In particular, integration and control of the system should be flexible enough to allow the solar contribution to be consistently maximized, while under other circumstances allow power to be efficiently generated on natural gas only (e.g. during nighttime or if the solar field is not operational).

3.3 Adequacy of the Financing Mechanism

Page 13 states that a preliminary analysis of the impact of the project on NREA's financial position has been conducted and will be finalized during appraisal. What was the result of this preliminary analysis? Given the cost and performance of the conceptual design, and assuming the current financial prices for gas and electricity, does the project have a positive cash flow? The incremental costs analysis in the Project Brief is based on the economic prices for gas and electricity, and it does not provide any insight into whether this project approach is at all sustainable. A preliminary financial analysis would indicate whether and by how much the GOE may need to subsidize the NREA for operation of this plant.

Page 15 states: "Ensuring that the necessary controls are in place to monitor performance and ensuring prompt payment of the grant to the operators will be important considerations for the project's implementation plan." This implies that the GEF grant will be partitioned into an investment portion and an operating portion. This project feature is specified nowhere in the Project Brief that this reviewer could find. It should be properly introduced and clarified.

If a portion of the GEF grant is used to support the O&M contract during the first 5-year period, how will NREA be able to assume responsibility for O&M in the second 5-year period?

3.4 Identification of Global Environmental Benefits

The project's principal global environment objective is to contribute to improving the economic attractiveness of solar thermal technology globally. The project will create global learning effects that will lead to a reduction in costs for the technology over the long term. Globally, solar thermal power plants have the potential to provide a significant proportion of new electricity generating capacity in the next century on a non-carbon emitting basis if this project, and the others within the program, are successful in reducing the technology's costs and risks to a competitive level. Major markets exist for this technology in other high sunlight regions of the world.

3.5 Fit with GEF Goals

The project has a good fit with the GEF Operational Program #7. The plant itself will have lower CO2 emissions than a fossil-based plant of the same annual output. More importantly, it will help revitalize the solar thermal industry, and it will facilitate the technological and organizational learning that are critical to achieving long-term cost reductions.

3.6 Regional Context

The project is a good fit to Egypt's growing electricity demand, its growing commitment to renewable energy power project development, its excellent solar resource and its current availability of natural gas.

3.7 Replicability

This project, and its companions in Mexico, India and Morocco, is not likely to result in immediate cost-competitiveness for solar thermal power plants. The study Cost Reduction Study for Solar Thermal Power Plants, Enermodal Engineering, May 1999 commissioned in collaboration with the GEF Secretariat to determine the viability of long term cost reductions for solar thermal technology concluded that a phased approach should be adopted. These four projects represent the first of three phases, and they will provide an initial opportunity for cost reduction. In the assessment of this reviewer, the targets for cost reduction of solar electricity in the range of 10-11 US¢/kWh and a capital cost of solar fields of about $2,000/kW by 2010 are quite achievable. Meeting these targets would create very important opportunities for replication of this project, not only in Egypt, but also throughout the Mediterranean Region, South Asia, and other parts of the world with similar climates. The need for future GEF buydown will most strongly depend on the cost of conventional power and the valuation (if any) of environmental externalities.

3.8 Sustainability

The public sector financing approach being proposed for this project will establish the contractual arrangements necessary for the first 10 years of plant operation. Beyond that period, a new PPA will be required, but given that the investment costs will have been written down, the marginal operating costs for the plant should be attractive. For potential follow-on projects, the project is not designed to address the government policies that distort the market prices for gas and electricity.

From the GEF perspective, the main sustainability issue will be to ensure that the plant is operated in a manner that maximizes the output from its solar field throughout the lifetime of the plant so as to maximize the technology learning and cost reduction benefits.

4. Secondary Issues

4.1 Linkages to Other Focal Areas

No comment.

4.2 Linkages to Other Programs

As already mentioned, this project has linkages to other similar projects in Mexico, India and Morocco, and it forms part of the GEF program on Greenhouse Gas Reduction.

4.3 Degree of Involvement of Stakeholders

According to the Project Brief, there is a high degree of involvement of the key government stakeholders, especially EEHC and NREA. Early engagement with potential developers is stated to be underway to ensure a willingness to submit bids. Given that the new financing approach will remove significant financial risks from the bidders, it can be expected that interest among potential developers will be high.

4.4 Capacity Building Aspects

The proposed project contains specific elements of capacity building that will involve EEHC and NREA staff. These are necessary and appropriate. In addition, successful implementation of the project will provide needed capacity building within the international solar thermal power plant manufacturing sector.

4.5 Innovativeness

No comment.

5. Conclusion

This reviewer's overall assessment is that the project is technically feasible, that the proposed approach to project development is sound, and that the project has significant long-term potential to meet GEF goals.

MAP SECTION

ARAB REPUBLIC OF EGYPT

- SELECTED CITIES AND TOWNS
- GOVERNORATE CAPITALS
- NATIONAL CAPITAL
- RIVERS
- MAIN ROADS
- RAILROADS
- GOVERNORATE BOUNDARIES
- INTERNATIONAL BOUNDARIES

GOVERNORATES IN NILE DELTA:

1 KAFR EL SHEIKH
2 DAMIETTA
3 PORT SAID
4 ALEXANDRIA
5 BEHEIRA
6 GHARBIYA
7 DAGAHLIYA
8 MENOUFIYA
9 SHARGIYAH
10 QALIUBIYA
11 ISMAILIA
12 CAIRO

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