

Sida Support to the Energy Sector in Egypt

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**Department for Infrastructure
and Economic Cooperation**

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Sida Evaluation 99/20

**Department for
Infrastructure and Economic
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Glossary

AHTCP	Aswan Hydropower Training Center Project
Amplissima	(Same as CMMMS below)
ATCP	Aswan Training Center Project (same as AHTC)
BITS	(See INEC)
CIDA	Canadian International Development Agency
CMMMS	Computerized Maintenance and Materials Management System
CMMS	(Same as CMMMS above)
Danida	Danish International Development Assistance
EC	European Community
ECEP	Energy Conservation and Environment Program
EdF	Electricité de France
EEA	Egyptian Electricity Authority
EIB	European Investment Bank
EESBA	Egyptian Energy Service Business Association
EREDO	Egyptian Renewable Energy Development Organization
ESE	Egyptian Stock Exchange
FEI	Federation of Egyptian Industries
FSS	Field Support System
GEF	Global Environment Facility
GTZ	<i>Gesellschaft für Technische Zusammenarbeit</i> /The German Agency for Technical Cooperation
HCCED	Holding Company for Construction and Electricity Distribution
HDPS	High Dam Power Station
HPS	Hydro Power Station
HPPEA	Hydro Power Plants Executive Authority
IFC	International Finance Corporation
INEC	Infrastructure and Economic Co-operation (department under Sida)
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau / Germany's Financial Cooperation Bank
KKS	A German system of standardized codes
KTS	<i>Kontraktfinansierat Tekniskt Samarbete</i> /Sida's contract-financed technical cooperation
LE	Egyptian Pounds
Meda	Mesure d'Accompagnement (for channeling EC support)
MEE	Ministry of Electricity and Energy
MPIS	Maintenance Procedure Information System
MPWWR	Ministry of Public Works and Water Resources
MSEK	Million Swedish Kronor
NECC	National Electric Control Center
NEDA	Netherlands International Development Cooperation Agency
NREA	New and Renewable Energy Authority
NTC	Network Training Center
OECP	Organization for Energy Conservation and Planning
PSDP	Private Sector Development Program
SEK	Swedish Kronor
Sida	Swedish International Development Cooperation Agency
TC	Training Center
TOR	Terms of Reference
TPS	Thermal Power Station
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USD	United States Dollar
WO	Work Order

Executive Summary

Overview of Swedish Assistance in Egypt

Swedish cooperation within the energy sector in Egypt has been ongoing since 1978. The allocated amount has been substantial, and therefore Sida has felt the importance to make this comprehensive evaluation of the cooperation. The evaluation is also of importance in the current formulation of a policy strategy for Swedish relations with the Middle East and North Africa, which is presently being developed by the Ministry of Foreign Affairs with assistance from Sida.

This evaluation covers the projects implemented in Egypt from 1978 to 1999, concentrating on three: development of a training center for hydro power in Aswan (the ATC project) (approximately SEK 16 million); installation of “Amplissima” a Computerized Maintenance and Materials Management System (CMMMS) (approximately SEK 10 million); and support for the execution of a feasibility study for the Mount Attaqa (Gebel Attaqa) Pumped Storage Plant (approximately SEK 10 million).

Apart from the projects already implemented, a further review has been performed of ongoing activities in support of use of the Amplissima Computerized Maintenance and Materials Management System CMMMS. Given the interest in continuing this program, this assessment also covers issues relevant to the proposed second phase.

In addition, this review discusses the assessment by Egyptian participants of the professional training programs on various energy-related subjects held in Sweden for participants from throughout the world, and it covers in a more general way the results of the numerous other activities supported by Sida over the last two decades.

Approach and Methods Used

The fact-finding mission started in Stockholm in April 1999, with briefings and interviews with Sida and the two main Swedish implementing counterparts, SWECO and SwedPower. ÅF Energikonsult had also been involved at an early stage of the evaluation period but to such a limited extent that it was decided not to include them during the preparation phase. Background information was also provided through documents compiled from the files of Sida, SWECO and SwedPower.

The actual evaluation took place in Egypt during the last two weeks of April 1999. The work was carried out through interviews (see List of Interviews in Appendix 1), field visits and distribution of a questionnaire covering the International Training Programs. For the latter task, a local consultant, Ms. Hala Amir El Tahir, was hired by Swedec to assist.

The cooperating partners on the Egyptian side were mainly the Egyptian Electricity Authority (EEA), the Hydro Power Plants Executive Authority (HPPEA) and the Organization for Energy Conservation and Planning OECF in Cairo, but additional interviews were conducted with the most active donors in the energy sector and other important stakeholders. The purpose was to investigate the areas in which they were involved and what experiences they have had, to create a base from which eventual recommendations could be derived for future Sida support.

Field visits were performed to the following sites:

- Suez area (Attaqa Power Plant for fact-finding about the CMMMS project, and Mount Attaqa for the pumped storage project);
- Aswan (AHTC project and CMMMS project, by visiting the Training Center, Aswan I, Aswan II and the High Dam);
- Cairo North (Ismailia/Fayed Training Center and Abu Sultan Thermal Plant);
- Cairo South Network Training Center.

Background: Egypt's Electricity Sector

Egypt's electricity sector has developed dramatically in the last two decades, due largely to substantial support by donors, led by the United States, and reinforced by a series of regulatory changes in recent years. In the late 1970s and early 1980s, government policies liberalizing the economy had not yet touched the electric sector, as they focused on opening of Egypt's markets to imported goods and lifting of export restrictions and bureaucratic procedures. The electric sector was technologically outdated, inefficient and overstaffed, and all its activities remained exclusively in the hands of the state.

In the years since 1975, investment programs supported by Egypt and international donors have increased generation capacity more than three-fold (from 3,789 MW in 1976 to over 13,000 MW at present), extended the national electricity distribution system to serve 95% of the country's 60 million people, with improved supply-side efficiency through improvements at generation stations and in the transmission and distribution systems. The expanded generation capacity already makes extensive use of natural gas as a fuel, a resource which was previously not exploited and even wasted; future expansion – much of it financed by the private sector – will increase use of natural gas and will incorporate renewable technologies into Egypt's resource base. Programs have also stimulated efforts to rationalize energy consumption, and supported efforts to integrate Egypt's electric system with those of neighboring countries.

With increased attention on privately financed expansion, and the possibility of privatization of the Egyptian Electricity Authority (EEA), the role of various donor programs is set to change. Accordingly, the findings of this assessment suggest in several places that the focus, objectives and activities of Sida's program in Egypt should consider the impact of these trends.

The government's future plan for restructuring the electric sector includes the partial privatization of the seven vertically integrated distribution companies. Based on discussions with Energy Minister Maher Abaza, it is clear that privatization will not go further than 49%, with the first phase of the initiative covering just 10% of the companies' total assets. Majority ownership of the companies will remain in the hands of EEA. This strategy may not convince private sector players in Egypt's energy market, but it could attract portfolio investment on international or domestic capital markets. Although it remains to be seen whether international investor interest in Egyptian public-sector equities will be very strong, especially in the wake of the 1997-1998 Asian economic crisis. Egypt's capital markets have grown and developed dramatically in recent years, with the ongoing privatization of other state-owned companies expected to increase the number of issues traded. Overseas investors have made substantial inroads into Egypt's capital markets – a recent survey estimated that 44% of total shares on the Egyptian Stock Exchange (ESE) were controlled by international investors. Even so, if the share issues in the seven regional electric companies do not generate significant interest from strategic or international portfolio investors, they still could attract substantial local investor interest.

To keep up with growing demand, the EEA is planning an ambitious program to expand generation capacity to roughly double its current size of 13,300 MW. The expansion plan calls for the bulk of new capacity to come from thermal generation facilities, located in the Delta and Lower Nile Valley, with renewable resources providing some smaller additions on the Gulf of Suez (plans call for 300 MW of wind generation capacity at Za'farana), and a pumped storage facility near Suez (more detail on this project is provided in the "Findings" chapter). Smaller low-head hydro facilities in the Delta region as well as the Nile Valley would provide limited additional hydroelectric capacity, e.g. the New Nag Hammadi Barrage (64 MW) and Assuit Barrage (40 MW).

Findings

Feasibility Study for the Gebel Attaqa Pumped Storage Plant

The Gebel Attaqa Pumped Storage Project (PSP) is currently between the technical feasibility phase and a subsequent study reviewing the risks associated with the project that will be used by the Hydro Power Projects Executive Authority (HPPEA), and EEA itself to determine the suitability of the project as a BOOT contract executed using private financing.

The project owes its genesis in part to two prior projects that examined the feasibility of constructing a pumped storage facility at Ain Sukhna, on the Red Sea coast south of Suez. Two studies on the technical feasibility of pumped storage at the site, one partly financed by the Austrian technical cooperation agency in 1978-1983, and a second supported by USAID in 1991-1992, were executed before SWECO and HPPEA discussed consideration of another site. The interest in another site reflected the lack of promising results at Ain Sukhna.

Given the continued interest in studying the feasibility of a pumped storage facility in Egypt, SWECO proposed a feasibility study for a different site where freshwater would be available, and if possible with a larger head for the generation station. The feature known as Gebel Attaqa, located at the northern end of the Red Sea mountain range, about 15 kilometers west of Suez, seemed to offer a more promising location than Ain Sukhna, with clearer potential secondary benefits. Suez, which obtains its water supplies through the canal that serves Ismailiyya, further north in the Canal Zone, has suffered from restricted access to water at various times, and on a regular basis receives water of inferior quality since it arrives at Suez after having been depleted by competing users between the Delta and Ismailiyya as well as in that city. The storage facility would provide reserve storage for Suez in case of emergency, as well as the possibility of applying some water to tourism-related uses on top of the mountain, and the environmental benefits of peak-load generation without the use of natural gas. Although the site is on the face of it far more promising than Ain Sukhna, it was not selected first because of the more serious problem of mine clearance on the mountain, which was a strategic point on the Egyptian front lines during the period from 1967 to 1973.

HPPEA and EEA approved the SWECO study without modifications in June 1998. Since then, the two agencies have determined that Egypt's objective will be to arrange for financing by private entities through a BOOT or possibly other type of private financing scheme. At present, SWECO and HPPEA are developing proposed terms of reference for a risk assessment study that would be used to evaluate the suitability of a private financing scheme for the project, and the specific provisions that would have to be included for such a contracting scheme to be commercially acceptable. It is HPPEA's intention to submit the TORs for this follow-on study to Sida for support. HPPEA officials confirm that internal resources are available in the 1999 budget and in the five-year plan to support the local currency component of the study and the ongoing requirements for development of the project.

The feasibility study yielded significant results in terms of the technical evaluation. Specifically, the study provided valuable details about the geological characteristics of the site which would in turn impact on the optimal configuration of a pumped storage facility at Attaqa, as well as a cost estimate of the civil and electrical installations, and the design engineering work required. In this respect, the study fulfilled the requirements established in the TORs, and accordingly was approved by the HPPEA and EEA without modification. The economic analysis provided in Section 7 of the Final Report, however, leaves questions regarding the financial evaluation of the project unanswered.

It may be that prior consultation with USAID regarding the results of the Ain Sukhna feasibility study may have yielded the conclusion that the financial feasibility should be estimated in greater detail, perhaps in a preliminary assessment prior to executing the feasibility study based on a review of the USAID-funded study and the criticisms of it made by HPPEA and EEA. Even if not, it seems reasonable to assert that an initial consultation with USAID on the results of the Ain Sukhna study might have shaped the terms of reference for the Gebel Attaqa study towards a more detailed review of the financial viability of the project.

The overall impact of the Sida-sponsored technical feasibility study for the Gebel Attaqa PSP cannot be determined in full at the present time, since the project is still under development. The contribution of the study to EEA's technical knowledge of pumped storage projects, and the characteristics of the Gebel Attaqa site, is substantial. However, until the project is actually constructed or abandoned because of financial constraints, it will not be possible to make a final assessment of the value of the activity supported by Sida.

The Gebel Attaqa project yields a few relevant lessons:

- Better donor coordination might have encouraged Sida to request a more effective assessment of the financial viability of the project, and this would have yielded a stronger final report. Had the assessment been done more completely, less additional work would be required at present to determine the project's financial viability.
- It is true that more contact with USAID may have dissuaded Sida from supporting the study – and the attractiveness of the Gebel Attaqa site, relative to the others further south, might have been overlooked. But the previous studies did not do the project concept justice, and it is likely that Sida would have come to this conclusion from a discussion with USAID and HPPEA about the earlier studies.
- For sites in areas where little detailed geological data are available, a preliminary, limited site exploration report might be considered as a way of detecting the risk that project execution times may be prolonged due to difficult drilling, problems with site clearance, etc.
- Strong local contractors were able to ensure the project's success.

From the foregoing, several recommendations emerge:

- A detailed and thorough financial assessment needs to be executed, including a risk assessment of the project, and an evaluation of the suitability of BOOT and other project financing and contracting mechanisms for this pumped storage project. The financial study should probably be done by an independent organization that does not necessarily have a stake in the continued development of the project.

Amplissima Computerized Maintenance and Materials Management System

The installation of the Amplissima Computerized Maintenance and Materials Management System (CMMMS) by the Egyptian Electricity Authority (EEA) at power stations throughout Egypt has been underway since 1991. At present, Amplissima is installed at nine power plants and the Natio-

nal Electric Control Center (NECC), with the plants representing about 60% of total generation. Another six will incorporate the system in the next phase of the program, for which EEA intends to request additional funding from Sida within the next two months. With the addition of these power plants, some 80% of total generation will come from plants using the Amplissima system.

Implementation of the system in the EEA's fleet of generation stations has proceeded in four phases. Each phase has involved installation of hardware and the Amplissima software, as well as training for plant personnel and the development of an Amplissima Group within EEA. Phase I was the demonstration of the system at the Attaqa Thermal Power Station (TPS) near Suez. Based on the successful demonstration at Attaqa, further funding was dedicated to supporting installation at three more power plants, in Phase II. With the training received during these two phases, EEA staff proceeded to implement Amplissima in several more stations, including several plants where repowering projects financed by the German Kreditanstalt für Wiederaufbau (KfW) were undertaken during 1997, during Phases III and IV. EEA secured support for the Amplissima installation at those plants as part of the over reporting program. This version is supported by Windows 95, with more graphics content, thereby facilitating use by operators who do not have as extensive a command of English. Phase V has not yet started, as the contract is not yet in place, but it is expected to include up to six more power plants.

The latest phase of Amplissima implementation proposed by EEA would include two steps, the first including issuance of a license to EEA for use of the upgraded version of Amplissima, with development of training courses for its application, and supervision of the pilot training courses. The second step will include follow on courses. According to EEA, budget for part of the Phase V implementation is in place, and in fact implementation of the system has begun at Koreimat and Walidiyya power stations.

The implementation of Amplissima supported by Sida and reinforced by USAID, as well as the KfW in other programs, has yielded substantial results. In general terms, the system has permitted operators to overcome major operational difficulties, and to manage their spare parts with greater confidence. Maintenance engineers now have data on spare parts available in the warehouse, the standardization process has begun to eliminate duplicate names and description for identical parts, and there has been some improvement in terms of reducing spare parts inventories to lower, but still adequate levels.

However, there have been some problems during installation and subsequent operation, that may have to do with obstacles to implementation that are not related to Amplissima itself, or to drawbacks with the program. In interviews with personnel at the Attaqa TPS and the High Dam PS, where Amplissima has been installed, as well as the Aswan I and II stations where it has not yet been installed, it is possible to present some more specific findings on both these points. The experience of the plants where Amplissima has been installed has been communicated to other plants, and the message has not been altogether positive. In the specific case of Aswan I, the result is that the head of information systems and controls said in an interview that he did not think Amplissima was necessary for that plant. He noted that the plant has already implemented a German system of standardized codes, known as KKS – although this comment suggests that he does not understand the entire range of Amplissima capabilities, which go beyond that of a standardized coding system for parts.

The trend toward reduced purchases of spare parts, made possible by the improved management of materials using Amplissima, may be reflected in the fact that the materials and services cost category remained level between the 1995-1996 and 1996-1997 fiscal years, the only line item to

remain steady in the last three reporting years given in the EEA financial statements included in its *1996-1997 Annual Report*. However, it is likely that numerous other factors have influenced this variable, making it difficult to assert that the use of Amplissima alone has yielded this result.

On the subject of gender issues, Amplissima has proven to be a very strong tool for enhancing the position of one woman within EEA, suggesting that the combination of training overseas together with learning through close collaboration with the technical assistance team is not inaccessible to Egyptian women professionals. Once a woman has demonstrated her value to the organization, she receives recognition for it, and influence within the organization.

Given what other women have noted about the international training programs, however, it could be argued that the case of the Amplissima coordinator at EEA is unusual. This could be, but it seems unlikely; rather, her success seems more related to vocational and technical training early in her career that made it possible for her to continue to push for opportunity and responsibility.

Several lessons emerge from the experience of supporting the Amplissima program:

- The program has enjoyed the support of two other donor agencies, and coordination of activities has yielded good results.
- The value of Amplissima to EEA could have been enhanced by more effective treatment of the nomenclature standardization issue, as well as more complete Arabization.
- What headquarter determines is not a problem – language ability – may actually be more of one in the field.
- More effective integration of technical assistance with existing training capabilities at the EEA's training centers may have been overlooked; training in Sweden is effective, but it tends to be limited to a small number of individuals who will have a hard time keeping up with training needs in the host country.
- The client's desire to defer conversion of hardware may limit its ability to obtain the full benefits of software
- Solid local vendor support is important to the success of the program.
- Programs that encourage stronger alliances to support the development of Arabized software for specialized applications such as those served by Amplissima could yield even better results – and generate greater business opportunities for Swedish firms hired by Sida.

From these lessons, some recommendations emerge as well:

- For technical assistance programs involving software, Sida should do more to encourage the creation of in-country capabilities to ensure more effective follow-up, more effective technology transfer, and the development of otherwise costly and commercially nonviable local adaptations.
- Sida should seek to ensure better integration of technical assistance with existing training resources.
- Sida should continue to support the Amplissima program, and should place special emphasis on ensuring that the training centers operated by EEA incorporate the program into their regular computer and information systems curricula.

Aswan Hydro Power Training Center

In October 1987, EEA and SwedPower presented the final report of a feasibility study for the development and construction of a hydropower-training center in the Aswan region, referred to as the Aswan Hydropower Training Center (AHTC). The primary-goal was to develop the AHTC into an up-to-date training center to meet the requirements of the hydropower sector in Egypt. It was assumed that a well-functioning Training Center could be a vehicle for further development of the

hydropower companies in the region. The World Bank and local funds from EEA financed construction of the center, its equipment and teaching materials. The Swedish contribution was mainly to provide consultancy services. The first contract for continuous Swedish support was signed in October 1992 and the project ended in June 1996, six months later than expected according to the initial planning. The reason was mainly severe time delays during the construction of the buildings, which were outside the control of the project.

The results of this program may be classified into two main categories, (1) what happened during the project, and (2) what happened after its completion. Each category can be evaluated in terms of efficiency and impact.

Project Efficiency: The initial budget of the Project was SEK 11,361,000 and when the project ended there were still SEK 62,700 of unused funds. The services were carried out during 94 man-months.

The first reason for the time delay was that the original site for the AHTC, for which the Feasibility Study was designed, turned out to be inappropriate for construction work. Another was chosen but also this new site also turned out to have problems that delayed the construction work. Today this can be seen in cracks both outside and inside the buildings.

In 1993/94 the classroom and workshop buildings were finalized and the first basic courses started on 20 November 1993. In 1995 the administration building was completed and in 1996 accommodations for students were finalized. The total capacity of the Training Center is about 200 trainees at any one time.

Regarding the quality of services during the project period, as evaluated several years later, they are considered to have been good. The whole project is well documented by review reports and progress reports. Recommendations given in the reports have been followed up.

Project Impact. Our judgement is that the project objectives have been achieved. The staff of the AHTC has received training on both managerial and pedagogical development. About 28 courses were developed during the project period, covering the most urgent training needs of the power stations. The syllabi were well documented and contained all necessary information. Independent of the Swedish funding, the center was equipped with the latest training technology so that it could probably stand a comparison with any training center in the world of this kind.

Post-project Efficiency: The annual running and investment costs of AHTC are about SEK 4-5 million. In recent years, between 700 and 900 trainees have attended courses per year. Each course is about two weeks, which implies a cost per student-week SEK 2,800.

The total capacity of AHTC is 4,000 participants per year. This number corresponds to the total number of trainees who have received training since the first course started in November 1993 implying that the center is operating at about 20 percent of its capacity.

One of the main problems that the training center faces today is the difficulty of justifying its existence. Some of the overall objectives for its creation were to progressively raise the standards of power-station operations workers, and to gradually improve the efficiency of the production and transmission systems, through training. So far there are no signs which show that the power stations function better today than before. However, there might be some reasons for this situation that are not directly related to the area of responsibility for the AHTC. It is very difficult to change on-the-job performance with a two-week course.

Post-project Impact: The sustainability of the project is very good on the present performance level. About 18 new courses have been developed since the end of the Project, about five courses in 1999 alone. New training areas have also been entered, e.g. transmission and network operations.

Gender issues have been entirely neglected both during the project and since its completion. The energy sector in Egypt is almost totally dominated by men. Among the instructors at the Training center there are two female engineers out of ten, and one English teacher out of two. All the 20 technician-level instructors are men.

Although the trainees' accommodation building has been in operation during three years, it has never accommodated female course participants. The reason is not clear. There are enough women in the system to at least expect some female participation on those courses. Each bedroom is equipped with two beds, toilet and shower so accommodations should not be a problem. On the other hand, Aswan is situated in a conservative part of Egypt when it comes to gender issues. It is quite common that men do not let their wives to stay away overnight. According to female engineers whom we interviewed in Cairo, there should have been an independent building that could accommodate women when necessary, or at least some means of dividing the existing building into two parts. It is impossible to know whether this would have changed the present situation but it is obvious that the present solution does not facilitate female participation to the courses.

The review team identified several recommendations for the AHTC management:

- Try to find ways to measure positive effects of the training provided at AHTC. Perhaps there are positive changes, which might not have been detected because of limited validity and/or reliability in the means of measurement. Develop performance indicators that are directly related to the training programs.
- Systematically follow up all training by unannounced field visits to check on whether actual job performance corresponds to what was taught during the training program. This would also be an opportunity to discover new training needs and get input for revision of existing courses.
- Make study visits to other training centers, such as the GTZ-supported Abu Sultan Station at Fayed in the Canal Zone. Instead of trying to upgrade the skills of the existing personnel, ambitious and intelligent youngsters who were not yet "destroyed" by the system, and who had school averages of at least 85 percent were recruited for three-year courses. The yearly intake of Abu Sultan has varied depending on the power plant's needs. The best graduates have received upgrade training and will become the next generation of managers. Perhaps some of strategies and experiences from the German project could be adopted to improve the AHTC success.

It has to be accepted, however, that the Training Center can contribute to solve training problems only, and even then, only if there is a willingness to change attitudes and behavior. Organizational problems have to be addressed with other solutions, and management problems can only partly be solved by training.

If the South Upper Egypt Electricity Company requests assistance from Sida, it is recommended that INEC start-up a dialogue with the Director General. If those discussions lead towards creation of a new project, it should be focused on business development and organizational development (including human resource development). The output could be an institutional development policy and a strategy plan focusing on management of change.

International Training Programs

The aim of the International Training Programs is to enhance the managerial and technical skills in co-operating countries by providing know-how in areas that are of strategic importance for economic and social development. The International Training Programs promote a greater exchange of skills and experiences between Sweden and partner countries, and encourage a broad spectrum of Swedish participation. The intent is that training program participants should make direct use in their working situation of the knowledge they acquire in the training programs. About 500 Egyptian participants representing many sectors have joined the International Training Programs since 1978. This evaluation covers training for the energy sector only, in courses that have been carried out between 1990 and 1998, involving 62 Egyptian participants at a total cost of approximately 5 MSEK.

This evaluation assesses whether the involved institutions in the Egyptian energy sector have achieved the desired benefits and results as a result of their training. The conclusions and recommendations presented here incorporate observations from the survey of Egyptian participants, but they also include reference to the survey of Jordanian participants, which was carried out during the same mission to the Middle East as the visit to Egypt.

This evaluation shows that some former trainees want more information to be included in the Sida-financed courses, especially more specific subjects which are relevant for their positions. Others think that the courses are already too compressed. To solve that issue, some participants want more time for the courses, while others say that the courses are already too long, because it is difficult for a manager to be away for more than a couple of weeks. The course organizers have probably received these comments already at the ends of the training courses, and they also know that solving one person's problem may create difficulties for others, so participants' suggestions should be taken with caution.

What cannot be evaluated in connection with the course are the long-term effects. This evaluation shows that effects exist and that most of the participants still find the training to be useful several years after completion of the courses. One general comment, however, is that a great number have expressed the need for further contact between the course organizers and themselves. This could partly be organized through regular distribution of a newsletter administered by course organizers, to which the participants should be encouraged to contribute by sending in editorials, articles etc. Another possibility would be to develop a web-site, which provides information about ongoing and future activities, new technologies, etc. A homepage can also receive messages or questions from the former participants and therefore become a powerful tool for the course organizers themselves in marketing their services, developing their international businesses, and developing local networks in the countries where they are active.

Another way of keeping in touch would be for the course organizers to contact the former participants and their supervisors during field visits. Involvement of the trainees' supervisors who have not undergone the same training program might facilitate the process of former trainees functioning as "change agents". From the course organizers' perspective, this could also be an opportunity to investigate further training needs for future assistance.

The course organizers could also investigate whether the international training offered in Sweden can be followed up, by providing more specific training in the participants' home countries. This issue was raised in Jordan, where there are huge industries in need of energy conservation development, yet the courses in Sweden in this area were directed more toward small-scale factories. For this and other reasons, in-country training should be considered. If the training groups are too

small for a course (or series of courses) to be run in one particular country, regional training programs should be considered. Another relevant theme for regional training would be the inter-connection of energy transmission networks between different countries.

Local training could also involve local participation on the teaching side, where such competence is available. Both former participants of international training programs and other local expertise should be utilized to their potential. Involvement in local training could help raise self-confidence and promote individual development, since teaching others is one of the best ways for one to gain a profound understanding of a certain subject.

Further, if such training is organized together with Swedish counterparts, the teaching methods should be similar to those used in the training in Sweden, especially in terms of dialogue and teamwork. Since those methods are not so much used in the Arab teaching cultures, it would be an important task just to convince local teachers to apply these methods in their lesson planning and teaching.

Local training programs would also be more cost-effective than to bring all the students to Sweden. This is not to say that the International Programs should end, but that local training should be added according to specific needs.

It is also possible that local training would attract a higher degree of female participation. The energy sector is a very male-dominated one, and the international training courses are offered at the most senior levels where the concentration of men is highest. However, there are female engineers in managerial positions who can not participate in the Sida-financed courses because of family reasons. Their husbands do not support the idea of their wives being away for a month or two, and many women have small children to consider. If Sida wants to promote female participation, local training could be an effective means of doing so. If a real priority is to be given women in the energy sector, a mentoring program could be established where experienced and successful women from Egypt, Jordan, and abroad actively participate in teaching local courses. For further gender development thinking, it is recommended to contact CIDA in Cairo. They have an ambitious program set out in their Policy on Women in Development and Gender Equity.

Other Program Areas

Beyond the three projects evaluated in detail, there have been numerous other projects supported by Sida during the period under review. These additional projects may be grouped under the categories of high voltage transmission, technical support for the hydropower sector, hydropower development (projects other than Gebel Attaqa), and energy efficiency.

With the exception of the analyses of reactive power in the Egyptian transmission grid, all of the activities described here were undertaken during the first fourteen years of Sida's cooperation program with Egypt, that is, through 1991.

The high-voltage transmission studies performed by SwedPower were requested by EEA in order to address specific problems in the transmission system and to support EEA's work to upgrade it. For this reason, there were four separate contracts signed by Sida beginning in 1978 and ending with the reactive power analysis in 1995.

The technical support for the hydropower sector was undertaken in 1979, with inspections of the High Dam Power Station (HDPS) and Aswan I power station performed in the latter half of that year. In addition, another inspection was performed during the period from 1986-1988. These activities were performed by SWECO.

The hydropower development work undertaken prior to the Gebel Attaqa study spans the period from 1978 to 1991, and includes technical support for several new projects as well as rehabilitation and upgrading of existing facilities. Among the new projects are included the Aswan II feasibility study, the Esna feasibility study, the assessment of low-head hydroelectric potential in Lower Egypt, the Qattara Depression (Moghra Oasis) hydrosolar project, and the study performed in advance of the rehabilitation of the Nag Hammadi Barrage and Power Station. These activities were performed by SWECO.

Lastly, the energy efficiency work supported by Sida during 1984-1988 involved the consulting firm ÅF Energikonsult, which performed a series of feasibility studies and demonstrations at industrial facilities in conjunction with the Organization for Energy Conservation and Planning (OECF).

The presence of other technical assistance programs in Egypt that have financed major projects in many of the same areas as have been supported by Sida, makes it difficult to measure in qualitative or quantitative terms the direct impact of the Sida program. At the same time, however, the Sida-supported activities cannot be dismissed as not having had an impact or being irrelevant to Egypt's development objectives.

It would seem that the support provided by Sida in the area of high-voltage transmission, hydropower resource development, and technical support for hydropower operations have had the greatest impact. Their impact, measured in terms of a useful contribution to the development of Egypt's electric sector, has been substantial. While the fact that key officials at EEA have expressed this might be expected, the fact that project identification and development activities initially supported by Sida have later been executed, even by other donors or the EEA itself, suggests that Sida's support was important to completing the projects. Given Sida's limited resources, this is a favorable outcome.

If it is possible to suggest ways for the impact of these activities to be enhanced, these might include greater attention to the linkages between different areas of Sida's KTS activities in Egypt. The main linkage for the transmission and hydropower operations areas would be in the area of training, especially training provided by the EEA and Distribution Company training centers around the country. In the area of hydropower development, the focus of EEA on private financing of new capacity increases the importance of creating a favorable policy and regulatory environment for hydroelectric projects to be contracted, financed, and operated. This is clearly an area where Sida would not be alone in supporting activity, but with adequate coordination of activities, it might be possible for Sida to play a constructive role in the future.

The most important lesson that may be gleaned from the diverse experience of Sida in the areas described in this section is that the support provided has fit well with the needs of Egypt's energy sector, on the one hand, and with the technical capabilities of the providers of technical cooperation, on the other. In the future, Sida's efforts in this sector in Egypt must be based on a prior assessment of needs and identification of niche activities – such as support for hydropower development or diagnostic work for the high-voltage transmission sector – and matching these to Swedish capabilities.

For Swedish technical cooperation to have a long-term impact and relevance to Egypt, and for it to generate business for Swedish manufacturers and service providers in the future, Sida's strategy of mixing technical cooperation with support for training in Sweden should be continued and indeed deepened, perhaps through support for more in-country training.

Given the mix of other donor activities currently underway in Egypt, it would be desirable for Sida to continue to focus on hydropower development activities, perhaps in conjunction with greater attention to the financial engineering for minihydroelectric projects, since EEA does not have, and will not have in the future, the resources to undertake such projects itself. Given this reality, and the ongoing restructuring of the sector, it makes sense for Sida's activities in this area to include greater support for private sector development of minihydroelectric facilities.

Overall Assessment

This summary of the overall assessment is placed after the *findings* section in the Executive Summary to serve as a set of overall conclusions. In the main study, this section is placed before the findings. The activities supported by Sida have been directly relevant to the long-term development of the Egyptian electric system during the period of implementation. There are four major lines of activity in EEA's current expansion plan, and each has been supported (to a greater or lesser extent relative to overall donor support) by Sida's Egypt program.

The ambitiousness of Sida's program may be measured in terms of the overall capacity of the Egyptian electricity sector to absorb international assistance coupled with the level of spending by donors in the electricity sector, the scale and scope of the projects being undertaken, and the capabilities of the Swedish contractors performing the technical assistance. On all counts, Sida's approach has been scaled in accordance with the resources available, on the one hand, and the specific needs and absorptive capacity of the Egyptian electricity sector. This has ensured that KTS spending will produce tangible results.

The impact of Sida's program is difficult to measure in quantitative terms, and only slightly less so in qualitative terms. While there are several reasons for this, perhaps the most important is that the scale of other donor programs is so much larger that activities undertaken by Sida, especially where they complement activities undertaken by the other countries, cannot necessarily be given credit for improvements in operating efficiency or other parameters. The most that can be said is that Sida has played a role in helping EEA realize improvements in several operational areas that can be quantitatively measured.

From a financial standpoint, the EEA's overall performance has not improved dramatically – net income in 1996-1997 was about half of what it had been in 1992-1993 and 1993-1994 – but there have been some improvements in specific areas. For example, growth in the materials and services component of the EEA's income statement, very high in the period from 1992 to 1994, has been slowed considerably. From an efficiency standpoint, EEA has posted substantial improvements, in terms of the volume of generated power per employee, as well as in terms of reduced line losses.

Because of the substantial donor presence in Egypt, projects supported by Sida might have been executed by another donor if Sida had not chosen to do so. While this is true of Sida as well as the other relatively small donor programs, since larger programs can always provide support for specific activities, assuming these activities are consistent with program objectives and criteria.

The sustainability of the results of cooperation may be measured in several ways. First, the degree to which new systems or skills provided by Swedish contractors are incorporated and disseminated within the EEA or other relevant organization will determine the degree of sustainability of the results of the activity. Second, the degree to which the Egyptian agencies involved in a project have spent their own resources and are committed to budget resources to the activity in the future will also be a key factor. And lastly, the extent to which other donor programs are supporting projects and activities that are consistent with those supported by Sida will also be an important determinant

of the sustainability of the results of the activity. Sida's program has enjoyed reasonably good results in terms of sustainability by all three measures.

The adequacy of KTS as a mechanism for supporting technical cooperation may be evaluated in two ways: in terms of the benefits it generates for Swedish firms doing business in Egypt, and in terms of the long-term benefits of the program for Egypt.

The Sida program has undoubtedly generated benefits for the Swedish firms doing business in Egypt. The ability of Swedish firms such as SwedPower and SWECO to gain access to the Egyptian market has been enhanced by Sida support for activities that permit those companies to develop relationships with officials of the EEA and other energy sector institutions. These contacts have led to the invitation of these firms to participate in tenders for major infrastructure projects, including projects other than those being supported by Sida. However, the overall impact of the Sida program on Swedish trade with Egypt has probably been limited. Data are not available for the entire period under review, but figures for the 1990s suggest that Sweden has not registered substantial growth in exports to Egypt – nor has it overtaken other major Egyptian trading partners within the European Union in terms of the value of exports to Egypt.

The long-term benefits of the cooperation may be categorized in terms of two impacts: (1) the creation of local capabilities in the area of cooperation in question, including the formation of professionals within the counterpart organizations, and (2) the formation of specialists and service providers in the Egyptian market. The activities supported by Swedish KTS have for the most part included specific provisions for training and capacity building, which have helped support the development of skilled professionals in the energy sector in Egypt.

To a more limited degree, these projects have led to the establishment of Swedish business ventures in Egypt, either as joint ventures or direct investment, for the provision of services and products in Egypt. Both SWECO and SwedPower have established direct or indirect presence in Egypt, SWECO through a representative office, and SwedPower through a distributor. The creation of a local presence is a more important consideration in some areas than others: for example, in software development, where technology transfer is necessarily limited due to intellectual property considerations, the formation of local firms that can provide ongoing technical support and develop advanced versions of products for continuous upgrading of software is especially important. Without such development, the recipient of Sida-financed technical assistance to install software and train engineers in its use is still dependent on the Swedish provider for follow-on support. This can be costly, and can lead to requests for financial assistance from Sida to continue.

Given the small size of Sida's program in Egypt compared to other donor countries, and the broad range of activities being supported by other donors, it is imperative that Sida consider how to weave its activities with those of the others. This not only helps ensure that resources spent by Sida are invested effectively, but it also ensures that the activities Sida supports yield results that are sustainable, whether through the ongoing commitment of the Egyptian counterpart agency or through support by other donors.

Lessons Learned

Gebel Attaqa Pumped Storage

The project demonstrated that donor coordination is desirable, but it must be undertaken in such a way as to ensure that all the relevant information is obtained, so as to ensure that the most appropriate action is taken. In the case of Gebel Attaqa, had Sida been better aware of the earlier work

done on pumped storage in Egypt, the terms of reference for the project may have ensured that a more complete financial assessment was prepared, facilitating the decision-making process for EEA as well as Sida.

Aswan Hydro Power Training Center

During the Aswan Training Center Project, the role of the consultant was sometimes discussed and it is not difficult to understand if the consultant was frustrated because of the delays. The process-oriented approach was adhered to, however, and we can see today that the feasibility of the project is very good, although it seems to need a bit more time for further development of its efficiency, and to start producing measurable results.

Today the Training Center has got the nearly impossible task to raise the standards of power-station operations and improve the efficiency of the production and transmission systems, through training alone. It has to be accepted that the Training Center only can contribute to solve training problems, and even then, only if there is a willingness to change attitudes and behavior. Organizational problems have to be addressed with other solutions, and management problems can only partly be solved by training.

Another lesson is that gender issues have been entirely neglected both during the project and since its completion. It is not expected that the management of the training center feels the same way, since there is both a toilet and shower in every bedroom of the student's accommodation building.

The problem, though, is that women never have been accommodated there, although the building has been in operation during three and a half years. It is well known that Aswan belongs to one of the most traditional zones in Egypt when it comes to gender issues. It is proposed that measures are taken for facilitating for women living outside the Aswan area, to participate in all courses that might be of relevance for their professional needs.

Amplissima

This program has enjoyed the support of two other donor agencies, and coordination of activities has yielded good results. This program provides an example of how different donor agencies can select specific activities to complement those of others working in the same sector.

The value of Amplissima to EEA could have been enhanced by more effective treatment of the nomenclature standardization issue, as well as more complete Arabization. Programs that encourage stronger alliances to support the development of Arabized software for specialized applications such as those served by Amplissima could yield even better results – and generate greater business opportunities for Swedish firms hired by Sida. These alliances will help create the solid local vendor support that is important to the success of the program.

More effective integration of technical assistance with existing training capabilities at the EEA's training centers may have been overlooked; training in Sweden is effective, but it tends to be limited to a small number of individuals who will have a hard time keeping up with training needs in the host country.

International training programs

The first lesson learned was that it turned out to be very difficult to trace the former course participants. The main reasons were the following: some people had changed job and sometimes moved to other countries, especially from Jordan to the Gulf States. Some had given telephone numbers to the central switchboards of their respective organizations, while they in fact were working somewhere else, sometimes in other towns. The telecoms network had been digitalized in some areas so that new digits had to be found and added to some phone numbers.

This evaluation shows that long-term training effects exist and that most of the participants still find the training to be useful several years after completion of the courses.

A great number of the former participants have expressed the need for further contact between the course organizers and themselves. This could partly be organized through regular distribution of a newsletter administered by course organizers. Another way of keeping in touch would be for the course organizers to contact the former participants and their supervisors during field visits.

It is also possible that local training would attract a higher degree of female participation. Female engineers in managerial positions find it difficult to participate in the Sida-financed courses because of family reasons. Their husbands often do not support the idea of their wives being away for a month or two, and many women have small children to consider.

Recommendations

The recommendations presented here imply the need for more effective coverage of Egypt by Sida by someone stationed full-time in Cairo, whose assignment would be to develop a comprehensive strategy for the country, be familiar with other donor programs, and provide more timely follow-through in the execution of program activities from Sida's side. This individual could also cover other countries in the region.

A comprehensive financial evaluation of the Gebel Attaqa Pumped Storage Plant Project, as presented in the technical feasibility study, should be executed, with a risk assessment of the project, and an evaluation of the suitability of BOOT and other project financing and contracting mechanisms for this pumped storage project. The financial study should probably be done by an organization that does not necessarily have a stake in the continued development of the project.

With respect to the Aswan Hydropower Training Center, it is necessary to stop focusing on the training center alone. It is necessary to start thinking about what the role of AHTC really is, and find the other stakeholders who must be held accountable for their shares of the problems. To carry out this task, the top-management of the South Upper Egypt Electricity Company, may need a neutral interlocutor development of a policy and plan focusing on management of change.

In the short-term, there are also some options that would not require any technical assistance. The following are some examples of immediate tasks for the AHTC management:

- Seek ways to measure positive effects of the training provided at AHTC. Perhaps there are positive changes, which might not have been detected because of limited validity and/or reliability in the means of measurement. It is recommended that performance indicators be developed which are directly related to the training programs. Focus should be not only on the job itself but also on its impact on related areas.
- Systematically follow up all training by unannounced field visits to check on whether actual job performance corresponds to what was taught during the training program. This would also be an opportunity to discover new training needs and get input for revision of existing courses.
- Make study visits and try to learn from other training centers' experiences, e.g. the GTZ-supported Abu Sultan in the Canal Zone and the Canadian-supported Network Training Center in Cairo South.

As for Amplissima, Sida should continue to support the program, and should place special emphasis on ensuring that the training centers operated by EEA incorporate the program into their regular computer and information systems curricula.

Sida should also consider how to encourage contractors for information systems projects to seek more effective local representation in-country, so as to ensure better follow-up and to encourage the emergence of local capabilities and development of adaptations tailored to the needs of in-country clients.

With respect to the International Training Programs, if a real priority is to be given women in the energy sector, a mentoring program could be established where experienced and successful women from Egypt, Jordan, and abroad actively participate in teaching local courses. For further gender development thinking, it is recommended to contact CIDA in Cairo. They have an ambitious program set out in their Policy on Women in Development and Gender Equity.

The course organizers could also investigate whether the international training offered in Sweden can be followed up, by providing more specific training in the participants' home countries. Local training could also involve local participation on the teaching side, where such competence is available.

From the former course participants' point of view, there is need for further contacts with the course organizers after the end of the course. This could partly be organized through regular distribution of a newsletter administered by the course organizers, to which the participants should be encouraged to contribute by sending in editorials, articles etc. Another possibility could be to develop a web-site, which provides information about ongoing and future activities, new technologies, etc. A homepage can also receive messages or questions from former participants and therefore become a powerful tool for the course organizers themselves in marketing their services, developing their international businesses, and developing local networks in the countries where they are active.

1. Introduction and methodology

Contract Financed Technical Assistance

Swedish cooperation within the energy sector in Egypt has been ongoing since 1978. The allocated amount has been substantial, and therefore Sida has felt the importance to prepare this comprehensive evaluation of the cooperation program. The evaluation is also of importance in the current formulation of a policy strategy for Swedish relations with the Middle East and North Africa, which is presently being developed by the Ministry of Foreign Affairs with assistance from Sida.

This evaluation covers the projects implemented in Egypt from 1978 to 1999, concentrating on the following three:

1. Development of a training center for hydro power in Aswan (the ATC project) (approximately SEK 16 million)
2. Computerized Maintenance and Materials Management Systems (CMMMS) (approximately SEK 10 million)
3. Feasibility Study for Mount Attaqa Pumped Storage Plant (approximately SEK 10 million)

Apart from the projects already implemented, a further review has been performed on work with the Amplissima Computerized Maintenance and Materials Management System CMMMS and, based on that, an assessment has been performed on the proposed second phase.

International Training Programs

The evaluation has also assessed the benefits and results that the program has provided to the Egyptian participating institutions. It covers a selection of Egyptian participants in the International Training Programs in the field of energy during the 1990's.

Approaches and Methods Used

The fact-finding mission started in Stockholm in April 1999, with briefings and interviews with Sida and the two main Swedish implementing counterparts, SWECO and SwedPower. ÅF Energikonsult had also been involved at an early stage of the evaluation period but to such a limited extent that it was decided not to include them during the preparation phase. Background information was also provided through documents compiled from the files of Sida, SWECO and SwedPower (see List of Documents in Appendix 2).

The actual evaluation took place in Egypt during the last two weeks of April 1999. The work was carried out through interviews (see List of Interviews in Appendix 1), field visits and distribution of a questionnaire covering the International Training Programs. For the latter task, a local consultant, Ms. Hala Amir El Tahir, was hired by Swedec to assist.

The cooperating partners on the Egyptian side were mainly the Egyptian Electricity Authority (EEA), the Hydro Power Plants Executive Authority (HPPEA) and the Organization for Energy Conservation and Planning OECF in Cairo, but additional interviews were conducted with the most active donors in the energy sector and other important stakeholders. The purpose was to investigate the areas in which they were involved and what experiences they have had, to create a base from which eventual recommendations could be derived for future Sida support.

Field visits were performed to the following sites:

- Suez area (Attaqa Power Plant for fact-finding about the CMMMS project, and Mount Attaqa for the pumped storage project);
- Aswan (AHTC project and CMMMS project, by visiting the Training Center, Aswan I, Aswan II and the High Dam);
- Cairo North (Ismailia/Fayed Training Center and Abu Sultan Thermal Plant);
- Cairo South Network Training Center.

2. Program Context

Development context – overview of the Egyptian energy sector

Egypt's electricity sector has developed dramatically in the last two decades, due largely to substantial support by donors, led by the United States, and reinforced by a series of regulatory changes in recent years. In the late 1970s and early 1980s, government policies liberalizing the economy had not yet touched the electric sector, as they focused on opening of Egypt's markets to imported goods and lifting of export restrictions and bureaucratic procedures. The electric sector was technologically outdated, inefficient and overstaffed, and all its activities remained exclusively in the hands of the state.

In the years since 1975, investment programs supported by Egypt and international donors have increased generation capacity more than three-fold (from 3,789 MW in 1976 to over 13,000 MW at present), extended the national electricity distribution system to serve 95% of the country's 60 million people, with improved supply-side efficiency through improvements at generation stations and in the transmission and distribution systems. The expanded generation capacity already makes extensive use of natural gas as a fuel, a resource which was previously not exploited and even wasted; future expansion – much of it financed by the private sector – will increase use of natural gas and will incorporate renewable technologies into Egypt's resource base. Programs have also stimulated efforts to rationalize energy consumption, and supported efforts to integrate Egypt's electric system with those of neighboring countries.

Since 1991, Egypt's economic situation has also improved dramatically, helped by debt reduction programs implemented in the wake of the 1990-1991 Arabian Gulf War, continued commercial opening and regulatory change. Economic growth has averaged over 5% during 1995-97, with real growth per capita averaging 2.8% since 1990. In 1998, Egypt's economy continued to grow (5.7 percent) despite buffeting from the financial crisis in Asia and the aftermath of the November killings of tourists near Luxor, which caused a sharp drop in tourism revenues. In the energy sector, Egypt's sustained economic expansion has driven corresponding growth in electricity consumption (over 5% during 1993-1997) and demand (over 6% during 1995-1997).

Restructuring of the electric sector

The country's electricity sector is operated by the Egyptian Electricity Sector (EEA), a state-owned company. Under the recent Law 18/1998, which amends Law 12/1976 creating the EEA, the generation and transmission assets of the EEA were annexed to the eight existing distribution companies controlled by the Holding Company for Construction and Electricity Distribution (HCCED). These vertically integrated companies have been restructured into seven regional electricity distribution companies,¹ registered as joint-stock entities and transferred to the EEA from the control of the HCCED.

The government's future plan for restructuring the electric sector includes the partial privatization of the seven vertically integrated distribution companies. Based on discussions with Energy Minister Maher Abaza, it is clear that privatization will not go further than 49%, with the first phase of the initiative covering just 10% of the companies' total assets. Majority ownership of the companies

¹ These are: Cairo Electricity Distribution Co., Alexandria Electricity Distribution Co., Canal Electricity Distribution Co., Beheira Electricity Distribution Co., the merger of the Northern and Southern Delta Electricity Distribution Companies, Northern Upper Egypt Electricity Distribution Co., and the South Upper Egypt Electricity Distribution Co.

will remain in the hands of EEA. This strategy may not convince private sector players in Egypt's energy market, but it could attract portfolio investment on international or domestic capital markets. Although it remains to be seen whether international investor interest in Egyptian public-sector equities will be very strong, especially in the wake of the 1997-1998 Asian economic crisis. Egypt's capital markets have grown and developed dramatically in recent years, with the ongoing privatization of other state-owned companies expected to increase the number of issues traded. Overseas investors have made substantial inroads into Egypt's capital markets – a recent survey estimated that 44% of total shares on the Egyptian Stock Exchange (ESE) were controlled by international investors. Even so, if the share issues in the seven regional electric companies do not generate significant interest from strategic or international portfolio investors, they still could attract substantial local investor interest.

Generation expansion plan

To keep up with growing demand, the EEA is planning an ambitious program to expand generation capacity (see Table 1) to roughly double its current size of 13,300 MW. The expansion plan calls for the bulk of new capacity to come from thermal generation facilities, located in the Delta and Lower Nile Valley, with renewable resources providing some smaller additions on the Gulf of Suez (plans call for 300 MW of wind generation capacity at Za'farana), and a pumped storage facility near Suez (more detail on this project is provided in the "Findings" chapter). Smaller low-head hydro facilities in the Delta region as well as the Nile Valley would provide limited additional hydroelectric capacity, e.g. the New Nag Hammadi Barrage (64 MW) and Assuit Barrage (40 MW).

Although industrial companies have been able to construct generation stations for their own consumption since 1984 (Law 36/1984), only with the passage of Law 100/1996, privately-financed power plants may sell power to the EEA under Build-Own-Operate-Transfer (BOOT) contracts. Already three such projects have been awarded (Electricité de France [EdF], and InterGen have won contracts), with the winners offering very competitive prices (as low as \$0.027/kWh) for power under long-term power-purchase agreements. This step will enable the EEA to reduce the financial outlays and liabilities associated with building and operating the projects itself, although it does not eliminate the financial risk associated with such projects because of the BOOT arrangement.

Regional interconnection

Egypt has also taken the major step of developing electric interconnections with neighboring countries. In October, 1998, Egypt completed the installation of a new 400-kV interconnection with Jordan, through an underwater cable that runs between Taba, on the Egyptian side of the Gulf of Aqaba, and the Jordanian City of Aqaba. The cable can handle up to 600 MW of transfers, but is presently accommodating only about 200 MW on average. To the west, a smaller interconnection with Libya is already in place.

Interconnection will generate important system benefits for Egypt, including voltage support, improved system balance and stability, and, once long-term arrangements for sale and purchase of power are completed, export revenues from sale of power to Jordan and Syria. The present trading arrangements only contemplate power swapping during each of three blocks during the day (T1, T2, T3, corresponding roughly to peak, shoulder and base load power), with a zero export-import balance at the close of every month. These will have to be substituted with power sales arrangements by the time Syria, Turkey and possibly other nations, join the interconnection this year and in 2000.

The interconnection project builds on long-term efforts to upgrade the EEA's high-voltage system, which now links the Aswan High Dam to Cairo over a 550 kV line with an intermediate tie-in at Nag Hammadi, where an aluminum smelter is located. As will be discussed elsewhere in this report, Sida played an important role in supporting this development through contracts for technical cooperation on maintenance and operation of high-voltage transmission systems.

Table 1: Expansion Plan for the Egyptian Electricity Sector

	Plant type	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010*	Total
El-Kureimat	Thermal/ST	1,300.0												1,300.0
Sidi Krir (Phase I & II)	Thermal/ST	325.0	325.0		650.0									1,300.0
Ayoun Mousa	Thermal/ST			325.0	325.0									650.0
El Lahoun	Hydro			0.8										0.8
Hawaret Adlan	Hydro			0.6										0.6
Nag Hammadi Barrage	Hydro			64.0										64.0
Suez Gulf	Thermal/ST					650.0								650.0
Kureimat	Solar Thermal					150.0								150.0
Tafriaa East	Thermal/ST					650.0								650.0
Sharm el-Sheikh	Thermal						650.0							650.0
Toshki	Thermal/ST						650.0							650.0
Safaga	Thermal						650.0							650.0
Dabaa	Thermal/ST							650.0						650.0
Nubaria	Thermal/CC								600.0					600.0
Kafr el-Dawwar	Thermal/GT									300.0				300.0
Cairo North	Thermal/CC									600.0				600.0
Cairo West	Thermal										650.0			650.0
Delta North	Thermal/CC										600.0			600.0
Dabaa / el-Kureimat Extension	Thermal/ST											1,260.0		1,260.0
Attaqa Pumped Storage	Hydro												2,100.0	2,100.0
Assyut	Hydro												40.0	40.0
Damietta	Hydro					12.0								12.0
Zifta	Hydro												3.1	3.1
El-Sikka el-Hadid	Hydro												0.6	0.6
Wadi el-Rayan	Hydro												0.4	0.4
Tawfiqi Canal Intake	Hydro										2.8			2.8
Minoufi Canal Intake	Hydro										2.5			2.5
Gangara	Hydro												0.8	0.8
Abbassi Intake	Hydro												1.8	1.8
Summary	Total	1,625.0	325.0	390.4	975.0	1,462.0	1,950.0	650.0	600.0	905.3	1,250.0	1,260.0	2,146.6	13,539.3
Hydroelectric		2,229.3	Notes: ST, steam turbine; CC, combined cycle; GT, gas turbine.											
Solar thermal		150.0	* Includes facilities for which no date has been planned yet.											
Convention thermal		11,160.0												

Source: EEA.

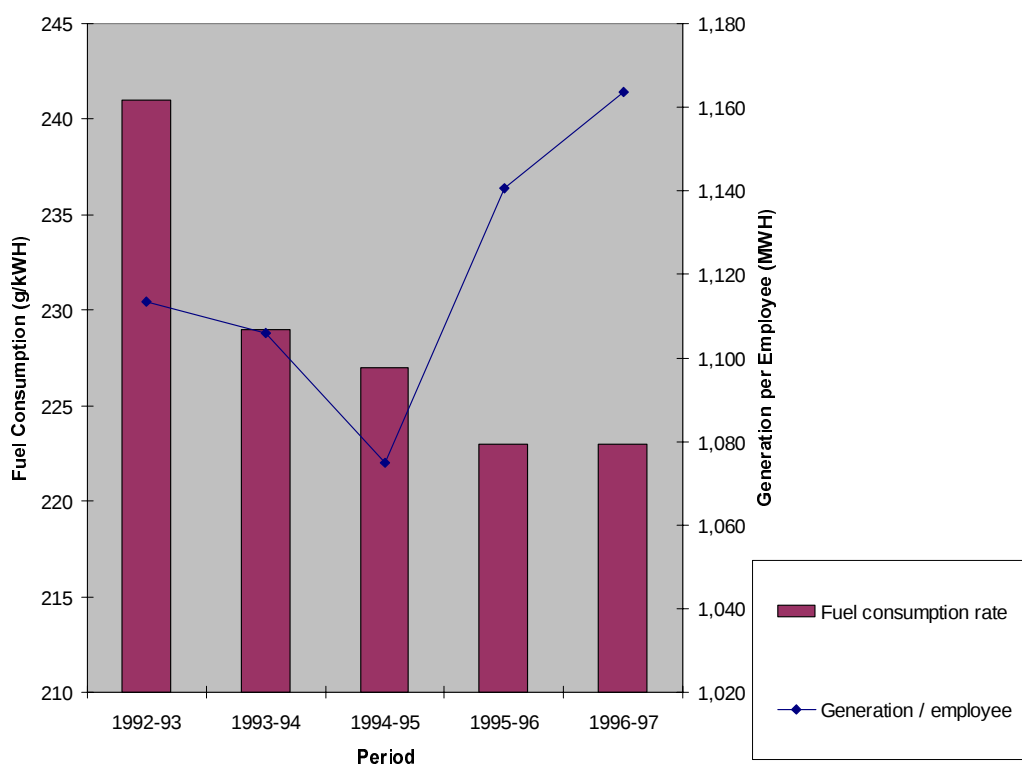
Table 2: EEA financial statements, 1991-1997

Figures in thousands of current LE

Item	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997
Sales of electricity	2,506,390	3,439,975	4,050,897	4,427,611	4,730,046	5,051,567
Other operating revenue	2,128	2,769	5,979	7,878	7,616	8,662
Total operating revenue	2,508,518	3,442,744	4,056,876	4,435,489	4,737,662	5,060,229
Fuel purchases	799,669	1,140,562	1,299,796	1,382,105	1,470,894	1,573,585
Power purchases for sales	1,338	4,855	3,430	1,371	1,610	621
Operating salaries and wages	124,276	158,503	201,017	233,259	277,328	304,066
Materials and services	183,290	228,393	230,659	314,338	337,813	338,092
Other operating expenses (administrative)	109,847	123,311	153,422	187,184	213,178	257,054
Depreciation	428,784	508,168	602,833	692,274	839,956	899,427
Total operating expenses	1,647,204	2,163,792	2,491,157	2,810,531	3,140,779	3,372,845
Operating income	861,314	1,278,952	1,565,719	1,624,958	1,596,883	1,687,384
Net interest expenses	551,914	657,236	660,454	874,924	999,813	1,042,637
Net operating income	309,400	621,716	905,265	750,034	597,070	644,747
Non operating revenues	100,726	111,280	113,402	151,380	216,949	227,224
Non operating expenses	279,418	369,972	713,536	709,570	674,120	721,614
Net income	130,708	363,024	305,131	191,844	139,899	150,357
Fuel purchases / total operating expenses	48.5%	52.7%	52.2%	49.2%	46.8%	46.7%
Materials and services / total operating expenses	11.1%	10.6%	9.3%	11.2%	10.8%	10.0%
Other expenses (administrative) / total operating expenses	6.7%	5.7%	6.2%	6.7%	6.8%	7.6%
Year-on-year change (percent)						
Sales		37.2%	17.8%	9.3%	6.8%	6.8%
Fuel purchases		42.6%	14.0%	6.3%	6.4%	7.0%
Operating salaries and wages		27.5%	26.8%	16.0%	18.9%	9.6%
Materials and services		24.6%	1.0%	36.3%	7.5%	0.1%
Other operating expenses (administrative)		12.3%	24.4%	22.0%	13.9%	20.6%
Net interest expenses		19.1%	0.5%	32.5%	14.3%	4.3%
Net income		177.7%	-15.9%	-37.1%	-27.1%	7.5%

Source: EEA annual reports, 1993-1994, 1995-1996, 1996-1997

Figure 1: EEA performance by productivity and efficiency indicators, 1992-1997



Source: EEA.

Improving efficiency

The EEA has also dedicated substantial attention to improving production efficiency, both at the generation stations as well as in the transmission and distribution sector. Performance has improved in both areas. On the generation side, while the EEA has struggled to keep up output at older facilities (such as the Soviet-era Aswan High Dam station operating, which has suffered recurrent cracking in the turbine runners caused by poor design), overall production per employee has increased steadily in recent years. See Figure 1.

Also, a substantial segment of thermal generation capacity has been converted to use burn natural gas, contributing to increased efficiency in terms of energy value per unit electricity generated. In the powerplant operations area, EEA has implemented the Amplissima materials and maintenance management system, and has improved maintenance practices to include more preventive actions. See Figure 1.

Financial performance

EEA's financial performance has improved with respect to some indicators, but although it is profitable, the agency has not increased its profitability in recent years. Data from the EEA's most recent financial statements are presented in Table 2.

Program description and history

Sida's contract-financed technical cooperation (KTS, for *Kontraktfinansierat Tekniskt Samarbete* in Swedish) and international training programs, have dedicated substantial resources to the Egyptian energy sector since 1978. The KTS spending has totaled over SEK 70 million, with an additional SEK 5 million for the international training program. The energy sector activities represent approximately 55% of the total Swedish KTS spending for Egypt. Egypt's participation in the international training programs has also been substantial.

The KTS activities supported may be categorized in the following general areas (see Table 3):

- Maintenance and materials management, including installation of computer programs to improve power plant operations, and training in their use.
- Hydropower development, including pre-feasibility and feasibility studies for hydropower facilities, both on the Nile as well as in a pumped storage facility, and pre-feasibility assessments for rehabilitation projects.
- High-voltage transmission, including diagnostical studies for the high-voltage transmission system, and feasibility studies for new investment in the transmission area.
- Hydropower technical support, including diagnostical studies at existing hydropower facilities.
- Industrial energy conservation, including energy diagnostics at selected facilities.
- In addition, the international training programs have brought Egyptian professionals to Sweden to participate in the following six courses: energy conservation in industry; energy conservation in sugar plants; management of hydropower development; power system control & operation; electricity distribution management; and management of electric power utilities.

Of these areas, four projects or programs are evaluated in detail in this report:

- Design and program development for the Aswan Hydropower Training Center (AHTC), implemented by SwedPower for the EEA, 1984-1994.

- Installation and training, and subsequent upgrading, of the Amplissima Computerized Maintenance and Materials Management System (CMMMS), implemented by SwedPower for the EEA, 1991 – present. A proposal for additional work in the Amplissima program has been approved by Sida.
- Preparation of a feasibility study for a pumped storage power station at Mount Attaqa (Gebel Attaqa), near Suez, implemented by SWECO for the Hydro Power Plants Executive Authority (HPPEA), 1993-1998. A proposal for further financial analysis of the Gebel Attaqa PSP facility is currently in preparation for presentation to Sida.
- The international training program activities supported by Sida that involve participants from Egypt. Some 500 Egyptian professionals have taken part in the program since 1978, but only the courses held from 1990 to 1999 will be evaluated.

Table 3: Total KTS spending by project, 1978-1999

Figures in thousands of SEK

Project name	Category	Spending
High voltage system studies	1	15,058
Aswan hydropower training center	4	14,091
Amplissima installation and upgrades	6	10,135
Mount Attaqa PSP feasibility study	3	10,080
Industrial energy efficiency	5	4,732
Nag Hammadi rehabilitation study	3	4,180
Engineer training (international training)	4	3,553
Reactive power analysis	1	2,649
Qattara Depression scheme	3	2,628
Aswan I inspection	2	1,825
Esna hydropower plant study	3	1,747
Low-head hydroelectric power assessment	3	1,279
Aswan II feasibility study	3	720
Total		72,677

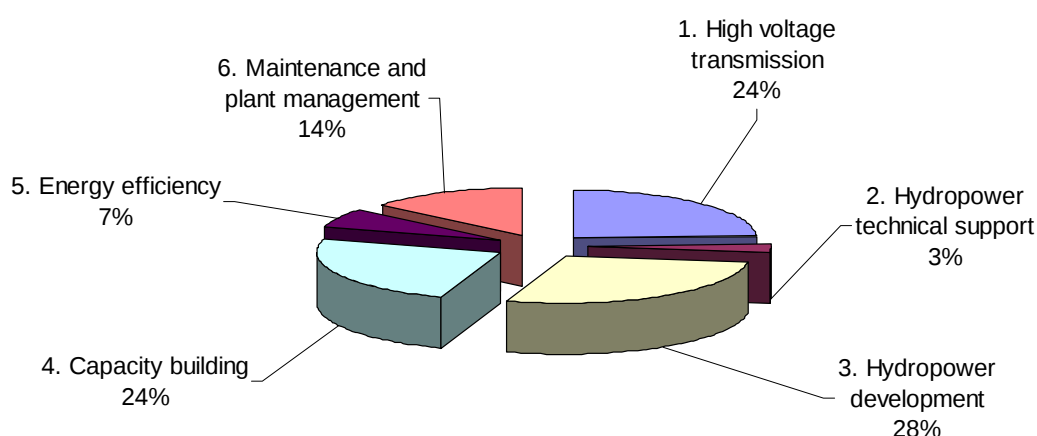
Source: Sida.

Table 4: Share of total KTS spending, by program area

Project category	Share
1. High voltage transmission	24.4%
2. Hydropower technical support	2.5%
3. Hydropower development	28.4%
4. Capacity building	24.3%
5. Energy efficiency	6.5%
6. Maintenance and plant management	13.9%
Total	100.0%

Source: Sida

Figure 2: Egypt KTS spending, by area, 1978-1999



Source: Sida

Table 5: Sida Egypt program spending

Figures in SEK, thousands

Project category / name	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1. High voltage transmission												
High voltage system studies	3,499						5,640			119	5,800	
Reactive power analysis												
2. Hydropower technical support												
Aswan I inspection									1,770	15	40	
3. Hydropower development												
Aswan II feasibility	730											
Low-head hydroelectric power assessment					1,279							
Qattara Depression scheme				2,628								
Nag Hammadi rehabilitation study											1,250	
Ezna hydroelectric plant study		1,747										
Mount Attaqa PSP feasibility study												
4. Capacity building												
Engineer training	2,293						1,260					
Aswan hydropower training center							215		1,515		1,000	
5. Energy efficiency												
Industrial energy efficiency							1,132		3,500		100	
6. Maintenance and plant management												
Amplissima installation and upgrades												
Total	6,522	1,747	0	2,628	1,279	0	8,247	0	6,785	134	8,190	0

Project category / name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Totals	Share
1. High voltage transmission												
High voltage system studies					2,416	233					15,058	
Reactive power analysis											2,649	
											17,707	23.7%
2. Hydropower technical support												
Aswan I inspection											1,825	
											1,825	2.4%
3. Hydropower development												
Aswan II feasibility	2,120										2,850	
Low-head hydroelectric power assessment											1,279	
Qattara Depression scheme											2,628	
Nag Hammadi rehabilitation study	275	2,655									4,180	
Ezna hydroelectric plant study											1,747	
Mount Attaqa PSP feasibility study				8,142			700	1,238			10,080	
											22,764	30.4%
4. Capacity building												
Engineer training											3,553	
Aswan hydropower training center				3,786	3,175	4,400					14,091	
											17,644	23.6%
5. Energy efficiency												
Industrial energy efficiency											4,732	
											4,732	6.3%
6. Maintenance and plant management												
Amplissima installation and upgrades	2,156		3,802							4,177	10,135	
											10,135	13.5%
Total	4,551	2,655	7,588	11,317	6,816	233	700	1,238	0	4,177	74,807	
											annual average (SEK)	3,400
											annual average (USD)	\$ 412

Source: Sida

General program evaluation

For the most part, the Sida KTS program has been implemented through targeted support for specific projects in the energy sector. Projects have typically run in the SEK 1 to 5 million range. Exceptions are the Gebel Attaqa feasibility project, which cost some SEK 10 million over the five-year implementation period (1993-1998) and was the largest single program expenditure (although collectively the high-voltage system design and diagnostic studies cost just over SEK 15 million over 11 years [1978-1988], the Aswan Hydropower Training Center cost more than SEK 14 million over ten years [1984-1994], and the Amplissima installation and upgrading program has been about SEK 10 million over ten years [1990-1999]). See for Table 5 for program summaries.

Hydropower development has been the most important area of spending for Sida during the 1978-1999 period (29% of total spending), followed closely by high-voltage transmission and capacity building (each with over 24%). The only other significant area, in terms of share of spending, is the Amplissima program, accounting for about 13%, including the spending approved for 1999. See Table 4.

Relevance of Sida's KTS support

The activities supported have been directly relevant to the long-term development of the Egyptian electric system during the period of implementation. As noted in the discussion of Egypt's current expansion plan, there are four major lines of activity at EEA, each of which has been supported (to a greater or lesser extent relative to overall donor support) by Sida's Egypt program:

- *Interconnection.* The studies undertaken by SwedPower have addressed serious problems encountered in the high-voltage transmission system, due to age and corrosion from wind-blown dust and sand, moisture and other elements. The studies have also evaluated the requirements of the transmission system to manage reactive power flows and other system dynamics resulting from evolution in the system, generation capabilities, and demand growth. The studies were undertaken in discrete tasks over a period of 17 years. Additional donor financing helped implement the necessary upgrades and expansions.
- *Rehabilitation of existing hydropower facilities.* Two of Egypt's three major hydropower facilities entered their fourth decade of operation during the 1990s, and required significant upkeep and overhauling to ensure continued operation. Studies performed by SWEKO helped identify design and equipment problems at the High Dam facility, and contributed to the preparations of the Aswan I and Nag Hammadi (Mini) overhauls, as well as the construction and completion of the Aswan II power plant. The studies were undertaken in discrete tasks over a period of 13 years. Additional donor financing helped implement the necessary upgrades and expansions.
- *Development of new hydropower resources.* The EEA seeks to add suitable baseload capacity from available hydroelectric resources elsewhere in the Nile valley. Initial evaluations of this hydropower capability were performed by SWEKO in the mid-1980s, but serious development has only begun now. While the additional capacity is not of central importance to the EEA, it is important to the effort to increase the contribution of renewable energy resources to Egypt's overall energy balance. While there are few significant new hydropower projects available on the Nile, Egypt can exploit pumped storage potential, as in the case of the Gebel Attaqa PSP, the pre-feasibility study for which was completed by SWEKO in 1998. Funding for these projects has yet to be identified, but EEA hopes to attract private investors for some of the new capacity.

- *Enhancing operational efficiency.* SwedPower undertook the installation of the Amplissima system at the Attaqa Thermal Power Station (TPS) in the early 1990s, and helped with further work. At present, EEA has installed Amplissima in power plants representing about 75% of generation capacity. EEA reports improvements in spare parts utilization, reduced inventories at some stations, and improvements in maintenance practices. Substantial additional donor financing has supported activities in this area as well.

Ambitiousness of Sida's approach

The ambitiousness of Sida's program may be measured in terms of the overall capacity of the Egyptian electricity sector to absorb international assistance coupled with the level of spending by donors in the electricity sector, the scale and scope of the projects being undertaken, and the capabilities of the Swedish contractors performing the technical assistance. On all counts, Sida's approach has been scaled in accordance with the resources available, on the one hand, and the specific needs and absorptive capacity of the Egyptian electricity sector. This has ensured that KTS spending will produce tangible results.

- *Absorptive capacity of electricity sector and other donor spending.* According to USAID officials, the absorptive capacity of the Egyptian electricity sector is in the range of \$50 to \$70-million per year, with USAID program spending providing a substantial part of that amount each year. During the next two years, USAID has up to \$200 million available for energy-sector projects. Other donors active in the energy sector are contributing perhaps \$20 to \$30 million annually – spending by Danida, for example, will average about \$12 million per year through 2003, with other important donor countries including Germany, Japan, and Canada, as well as the Arab countries, France, Spain and Italy. (More detail on the programs of Germany, Japan, Canada, and the European Community is provided in a separate section under “Findings.”) The level of Sida support is modest by comparison. Annual average spending during the 1978-1999 period was SEK 3.3 million, or about \$400,000 (at current the current dollar exchange rate). As noted, four of the 13 projects exceeded SEK 8 million in spending over the period, accounting for 65% of total spending, while the others ranged from SEK 1 to 5 million in total outlays. This suggests that the Swedish programs in and of themselves are unlikely to lead to too great an extra demand on managerial support, but it is possible that the relatively small size of Sida's program may put it at a disadvantage with respect to other donor programs in terms of securing sustained attention from high-level managers in the EEA.
- *Scale and scope of projects undertaken.* Given the fact that Sida's ability to compete with other donors for the attention of senior management, it is important for the Sida program to engage in well-defined activities. By and large, the programs undertaken appear to have met this criterion. The major projects subject to more detailed review in this report, for example, were well-defined in terms of scope and objectives. The one major activity that appeared to have involved a broader range of concerns within a general area is that of the high-voltage transmission studies. The specific tasks performed under this heading, however, were clearly defined and executed adequately.
- *Swedish capabilities.* The activities undertaken have generally been consistent with the strengths of the Swedish contractors involved in providing the technical assistance. Swedish capabilities in the hydropower sector, for example, are internationally recognized, and were the reason that Sweden was first approached by Egypt for assistance in developing its hydropower potential in the 1940s. Similarly, Swedish capabilities in the management of high-voltage transmission systems and interconnected grids are substantial, based on the development of its own resources and expertise demonstrated in the integration of the Nordic power system. In other areas, however, it is less clear that there is a specific comparative advantage enjoyed by Swedish

suppliers. This is the case with the Amplissima system, as there are several other similar systems on the market, some of which have been judged by utility officials in Egypt and Jordan to be similar and possibly superior to Amplissima. On the whole, however, the Sida program appears to have focused on areas and specific projects where Swedish firms enjoy a comparative advantage.

Traceable effects of the program

The impact of Sida's program is difficult to measure in quantitative terms, and only slightly less so in qualitative terms. There are several reasons for this: first, the scale of other donor programs is so much larger that activities undertaken by Sida, especially where they complement activities undertaken by the other countries, cannot necessarily be given credit for improvements in operating efficiency or other parameters. The most that can be said is that Sida has played a role in helping EEA realize improvements in several operational areas that can be quantitatively measured.

From a financial standpoint, the EEA's overall performance has not improved dramatically – net income in 1996-1997 was about half of what it had been in 1992-1993 and 1993-1994 – but there have been some improvements in specific areas. For example, growth in the materials and services component of the EEA's income statement, very high in the period from 1992 to 1994, has been slowed considerably. From an efficiency standpoint, EEA has posted substantial improvements, in terms of the volume of generated power per employee, as well as in terms of reduced line losses.

Because of the substantial donor presence in Egypt, projects supported by Sida might have been executed by another donor if Sida had not chosen to do so. While this is true of Sida as well as the other relatively small donor programs, since larger programs can always provide support for specific activities, assuming these activities are consistent with program objectives and criteria. Specifically, this is true of the activities that Sida has supported in the hydropower area, the Amplissima program, energy efficiency, and training. Furthermore, given the number of donor countries active in Egypt, it is also likely that the interested Egyptian government agencies will find financing for projects they support, even if the most important donor programs decide not to finance them. The Gebel Attaqa feasibility study provides an example of this dynamic: Austria, and then the U.S., supported studies of a pumped storage project at Gebel Galala, south of Gebel Attaqa, with the U.S. study being terminated after a first phase because the results of the study did not warrant further work. The project enjoyed strong political support within the Ministry of Energy, however, and efforts were made to find support for continued work, and hence the project was proposed to Sida. As it happened, however, the Gebel Attaqa site proved more promising than Gebel Galala, and the results of the feasibility study call for further consideration of the Gebel Attaqa PSP.

In view of this difficulty, it is perhaps more accurate to determine the extent to which Sida-financed programs have been consistent with overall development priorities of the Egyptian government (as enshrined in the current development plan, as well as determined retroactively by reviewing the record of the last twenty years), the extent to which these programs have leveraged support by other donor agencies, and the degree to which activities supported by Sida have resulted in the execution of major infrastructure projects, with or without support from other donors. On all of these counts, the Sida program has produced some notable successes.

Sustainability of the results of cooperation

The sustainability of the results of cooperation may be measured in several ways. First, the degree to which new systems or skills provided by Swedish contractors are incorporated and disseminated within the EEA or other relevant organization will determine the degree of sustainability of the results of the activity. Second, the degree to which the Egyptian agencies involved in a project have

spent their own resources and are committed to budget resources to the activity in the future will also be a key factor. And lastly, the extent to which other donor programs are supporting projects and activities that are consistent with those supported by Sida will also be an important determinant of the sustainability of the results of the activity.

Sida's program has enjoyed reasonably good results in terms of sustainability:

- Sida's support for hydropower resources has been central to the development of new resources, such as Aswan II power station and the Esna Barrage power station, as well as the rehabilitation of several other resources (High Dam, Aswan I).
- Support in the area of high-voltage transmission has contributed to the strengthening of the domestic grid, making it possible to develop the interconnection project. The technical issues that emerged in the technical cooperation have become central to day-to-day operation of the system, thereby ensuring that EEA personnel are well versed in them. There do appear to be requirements for some additional support related to management of the system in the context of a interconnected power market.
- In the case of Amplissima, EEA's commitment to the system is unquestioned, but the degree to which familiarity with the system has been disseminated throughout the EEA may be inadequate – this is one the reasons why the latest proposal for support of Amplissima (approved in 1999) contains a significant training component. In addition, the nature of the product involved suggests that the use of the system can only be sustainable if there are substantial resources located in Egypt to provide long-term technical support and upgrades for the system – something that has been lacking in the case of the Sida program.
- The implementation of the Aswan Hydropower Training Center (AHTC) has shown strong evidence of a commitment to maintaining the programs supported initially by Sida, but there are some concerns about the ability of the center to demonstrate tangible results from the training program. In addition, with privatization the AHTC may come under increasing pressure to be self-sustaining financially, which it is not at the present time.

Adequacy of KTS as a technical cooperation mechanism

The adequacy of KTS as a mechanism for supporting technical cooperation may be evaluated in two ways: in terms of the benefits it generates for Swedish firms doing business in Egypt, and in terms of the long-term benefits of the program for Egypt.

- *Benefits for Swedish firms doing business in Egypt.* The Sida program has undoubtedly generated benefits for the Swedish firms doing business in Egypt. The ability of Swedish firms such as SwedPower and SWECO to gain access to the Egyptian market has been enhanced by Sida support for activities that permit those companies to develop relationships with officials of the EEA and other energy sector institutions. These contacts have led to the invitation of these firms to participate in tenders for major infrastructure projects, including projects other than those being supported by Sida.

However, the overall impact of the Sida program on Swedish trade with Egypt has probably been limited. Data are not available for the entire period under review, but figures for the 1990s suggest that Sweden has not registered substantial growth in exports to Egypt – nor has it overtaken other major Egyptian trading partners within the European Union in terms of the value of exports to Egypt.

- *Long-term benefits of the program for Egypt.* The long-term benefits may be categorized in terms of two impacts: (1) the creation of local capabilities in the area of cooperation in question, including the formation of professionals within the counterpart organizations, and (2) the formation of specialists and service providers in the Egyptian market.

The activities supported by Swedish KTS have for the most part included specific provisions for training and capacity building, which have helped support the development of skilled professionals in the energy sector in Egypt. To a more limited degree, these projects have led to the establishment of Swedish business ventures in Egypt, either as joint ventures or direct investment, for the provision of services and products in Egypt. Both SWECO and SwedPower have established direct or indirect presence in Egypt, SWECO through a representative office, and SwedPower through a distributor.

The creation of a local presence is a more important consideration in some areas than others: for example, in software development, where technology transfer is necessarily limited due to intellectual property considerations, the formation of local firms that can provide ongoing technical support and develop advanced versions of products for continuous upgrading of software is especially important. Without such development, the recipient of Sida-financed technical assistance to install software and train engineers in its use is still dependent on the Swedish provider for follow-on support. This can be costly, and can lead to requests for financial assistance from Sida to continue. In the case of the Amplissima system, in particular, it seems that the distributor relationship provides some local support for customers, but does not create product development capabilities. The formation of such capabilities could be an important new step toward enhancing the sustainability of the results of Sida-financed technical cooperation as well as business benefits for Swedish firms. Sida could place more emphasis on the formation of local capabilities in the private sector as a necessary complement to technical assistance through Sweden-based firms.

Sida's role in relation to others in the sector

Given the small size of Sida's program in Egypt compared to other donor countries, and the broad range of activities being supported by other donors, it is imperative that Sida consider how to weave its activities with those of the others. This not only helps ensure that resources spent by Sida are invested effectively, but it also ensures that the activities Sida supports yield results that are sustainable, whether through the ongoing commitment of the Egyptian counterpart agency or through support by other donors.

This objective is complicated by the fact that information on donor activities in general, and in the energy sector in particular, is difficult to obtain. The data available on donor activities are not consistent, nor are they readily available from multiple sources; the information provided by USAID, for example, does not cover all donor countries, though it does cover the most important ones. Based on the available data, the trend in development assistance in the early 1990s was downward, with total assistance exceeding \$4 billion in 1990, and ranging between \$2 and \$3 billion in the following years, through 1994. (See Table 6.)

In addition, there is little formal donor coordination in general, especially in the energy area; what little there is tends to be ad-hoc. According to USAID, donor coordination activities have tended to be more focused and effective in the wastewater, population and health areas. In the power sector, coordination has not involved so many of the European donor countries as it has the Arab agencies, the African Development Bank, and USAID. Danida, meanwhile, contends that donor coordination has been minimal in the energy area.

Table 6: Donor development assistance to Egypt, 1990-1994

Figures in millions of USD							
Donors	1990	1991	1992	1993	1994	Total	Average
United States	1,104.5	822.9	725.9	1,006.7	749.5	4,409.5	881.9
Arab Countries	2,185.7	510.1	408.6	379.5	94.3	3,578.2	715.6
Japan	98.9	619.6	110.6	276.1	189.0	1,294.2	258.8
France	139.7	163.6	267.4	260.7	409.6	1,241.0	248.2
Italy	86.6	80.5	138.7	145.4	616.7	1,067.9	213.6
Germany	347.1	185.3	714.9	110.9	291.6	1,649.8	330.0
Arab Agencies	(4.4)	35.9	71.7	75.3	66.2	244.7	48.9
European Union	47.9	290.0	72.3	57.4	36.7	504.3	100.9
Canada	32.0	35.8	34.9	30.5	26.9	160.1	32.0
Denmark	19.7	20.7	23.0	26.2	25.1	114.7	22.9
Holland	38.0	37.0	39.3	39.3	39.7	193.4	38.7
Sweden*	0.5	0.3	0.9	1.3	0.8	3.9	0.8
Total	4,096.3	2,801.7	2,608.2	2,409.3	2,546.1	14,461.6	2,892.3

Source: USAID and Neda (Netherlands Development Assistance). Other nations not represented here include: Finland, Britain, and Switzerland.

* Exchange rate of SEK 8.25/USD used throughout.

Source: USAID.

Based on interviews performed by the Sida program review team, the results of which are presented in greater detail in the “Findings” section, it is possible to identify several specific areas of activity on the part of other donors in the energy sector. Sida’s program has supported activities in each of these areas as well.

- *Development of conventional electrical infrastructure.* USAID has played a preponderant role in this area, providing financing for major work at the Shoubra El Kheima power plant (1,200 MW), the Cairo South Power Plant (150 MW), and El Kureimat (1,200 MW). In addition, USAID supported the expansion of the National Energy Control Center’s microwave communication system. Other donors involved in this area include Germany, mostly through the KfW, France and Italy. Sida’s program has been relevant in this area in the transmission sector and in the development of new generation capacity in the Aswan II project.
- *Development of renewable energy infrastructure.* Germany, Denmark, and Japan have been and remain especially active in this area, supporting the development of a wind farm in Za’farana on the Red Sea. Sida’s participation in this sector has been limited to support for the development of new low-head hydropower resources, as well as examining the viability of a pumped storage facility.
- *Rehabilitation and upgrading of existing infrastructure.* USAID has provided financing for major work at the Cairo West Power Plant (350 MW), which was adapted to run both fuel oil and natural gas, and Hurghada (120 MW), where existing gas turbine facility was refurbished, and the modernization of the Aswan High Dam power station. The KfW has also played an important role in financing the rehabilitation of the Nag Hammadi Barrage. Sida has been active in this area in the support of the rehabilitation of Aswan I, a diagnostic evaluation of the High Dam power station, and upgrading the transmission sector.

- *Improved operation of existing infrastructure.* USAID's activities have given heavy emphasis to improving management of existing resources, as have the activities of the KfW and Sida.
- *Energy efficiency.* USAID has also supported the Energy Conservation and Environment Program, which has promoted more efficient use of electricity as well as fossil fuels by industry and commerce. Germany's KfW has also provided credit facilities for business and industry, but there has been relatively little use of the loan facilities.
- *Training and capacity building.* In this area, USAID, Germany and Canada have been especially active, along with Sida. USAID has focused on executive training, through the Executive Management Training Center in Cairo. The German approach has favored vocational/technical training at the Fayed Training Center in Ismailiyya, while Canada's program has been active in Helwan. Sida's contribution has focused on training for the hydropower sector.

3. Findings

This section will review three projects in detail, and will give more general treatment to a series of other energy sector cooperation projects in Egypt, as well. The three projects that will be reviewed in detail are: the Gebel Attaqa Pumped Storage Project, the installation of the Computerized Materials Management System (CMMS), or “Amplissima,” and the Aswan Training Center Project. The more general review will concern activities supported by Sida in the area of hydropower resource development along the Nile.

A. Gebel Attaqa Pumped Storage Project

Background

The Gebel Attaqa Pumped Storage Project (PSP) is currently between the technical feasibility phase and a subsequent study reviewing the risks associated with the project that will be used by the Hydro Power Projects Executive Authority (HPPEA), and EEA itself to determine the suitability of the project as a BOOT contract executed using private financing.

The project owes its genesis in part to two prior projects that examined the feasibility of constructing a pumped storage facility at Ain Sukhna, on the Red Sea coast south of Suez. Two studies on the technical feasibility of pumped storage at the site, one partly financed by the Austrian technical cooperation agency in 1978-1983, and a second supported by USAID in 1991-1992, were executed before SWECO and HPPEA discussed consideration of another site. The interest in another site reflected the lack of promising results at Ain Sukhna.

The Austrian-supported study was a desk review based on some test tunneling, and assumed that salt water from the Red Sea would be used instead of freshwater from the Nile. The cost of the fieldwork, compounded by the need for mine clearance at that time, has been estimated by HPPEA at LE 500,000 (about US\$602,500 at the current exchange rate). The Austrian support covered foreign currency portion of the project alone, with the balance made up by the HPPEA.

The USAID-supported work, executed through U.S.-contractor Ebasco Overseas Corp., was to consist of three phases (pre-feasibility, technical feasibility, and financial feasibility) but only the first phase was completed. In the final report for Phase I of this program, Ebasco argued that natural gas fired generation stations provided the same benefits more economically and more simply from a technical perspective. In part the conclusion reflected the fact equipment costs would be higher to ensure the exposed plant elements could withstand the corrosive effects of seawater, along with the operational cost of desalinating the seawater. (Equipment costs would also be comparatively high, as well, in the event that seawater were used for generation directly, because of the need to withstand saltwater corrosion.) Yet even so HPPEA officials argued that the Ebasco study did not incorporate the secondary benefits of a pumped storage facility adequately. The USAID study cost an estimated US\$500,000, complemented by limited additional local currency resources. USAID, for its part, viewed the results of the study as a demonstration that pumped storage projects in Egypt would not be a suitable use of resources, and discontinued support for further project development at Ain Sukhna.

Despite the USAID conclusion, HPPEA and EEA, based on general, system development analyses, believed that a pumped storage facility could provide significant benefits to the Egyptian electric system, in addition to the increased peak-load generation capacity. These benefits included the advantages of having water storage capabilities for emergency uses, system stability and voltage support (depending on the location of the plant), and the environmental benefits of avoiding

construction of a gas- or fuel-oil fired plant. These considerations were identified by EEA and HPPEA in an internal study prepared in the early 1980s, based on analyses performed by the Planning Office of the EEA using two computer packages for generating least-cost expansion plans for electric systems (EGEAS and WASP).

Given the continued interest in studying the feasibility of a pumped storage facility in Egypt, SWECO proposed a feasibility study for a different site where freshwater would be available, and if possible with a larger head for the generation station. The feature known as Gebel Attaqa, located at the northern end of the Red Sea mountain range, about 15 kilometers west of Suez, seemed to offer a more promising location than Ain Sukhna, with clearer potential secondary benefits. Suez, which obtains its water supplies through the canal that serves Ismailiyya, further north in the Canal Zone, has suffered from restricted access to water at various times, and on a regular basis receives water of inferior quality since it arrives at Suez after having been depleted by competing users between the Delta and Ismailiyya as well as in that city. The storage facility would provide reserve storage for Suez in case of emergency, as well as the possibility of applying some water to tourism-related uses on top of the mountain, and the environmental benefits of peak-load generation without the use of natural gas. Although the site is on the face of it far more promising than Ain Sukhna, it was not selected first because of the more serious problem of mine clearance on the mountain, which was a strategic point on the Egyptian front lines during the period from 1967 to 1973.

HPPEA and EEA approved the SWECO study without modifications in June, 1998. Since then, the two agencies have determined that Egypt's objective will be to arrange for financing by private entities through a BOOT or possibly other type of private financing scheme. At present, SWECO and HPPEA are developing proposed terms of reference for a risk assessment study that would be used to evaluate the suitability of a private financing scheme for the project, and the specific provisions that would have to be included for such a contracting scheme to be commercially acceptable. It is HPPEA's intention to submit the TORs for this follow-on study to Sida for support. HPPEA officials confirm that internal resources are available in the 1999 budget and in the five-year plan to support the local currency component of the study and the ongoing requirements for development of the project.

Relevance

Given the long-standing interest in pumped storage as an option for the Egyptian electric system, there is no question of the relevance of the Gebel Attaqa study to the overall development objectives of the EEA. Indeed, the clearer utility of evaluating the Gebel Attaqa site calls into question the decision to consider other sites first because of the concerns about safety, but that is not a concern of Sida for the purposes of evaluating the Gebel Attaqa program. In this instance, the Sida-supported work complemented support provided by other agencies, enabling HPPEA to obtain information on an additional site suitable for a pumped storage facility.

However, it should be noted that USAID's program officer for the energy sector indicated that the U.S. program questioned seriously the utility of continuing to pursue pumped storage plants in Egypt, and expressed surprise that there had been no consultation between Sida and USAID regarding the value of reviewing the feasibility of a different site from Ain Sukhna.

In fairness, it should be noted that USAID recognized the defects of the Ebasco study. Among other limitations of the study identified by the Sida review team, it did not involve detailed fieldwork, nor did the cost estimates used in the analysis incorporate site-specific estimates. Rather, historical costs for pumped storage plants in the U.S. were used and adjusted for historical inflation to give a

value appropriate for 1992. This approach would probably have tended to overestimate the cost estimates for the plant – albeit more on the civil works component than the equipment component.

Results

The feasibility study yielded significant results in terms of the technical evaluation. Specifically, the study provided valuable details about the geological characteristics of the site which would in turn impact on the optimal configuration of a pumped storage facility at Attaqa, as well as a cost estimate of the civil and electrical installations, and the design engineering work required. In this respect, the study fulfilled the requirements established in the TORs, and accordingly was approved by the HPPEA and EEA without modification.

The economic analysis provided in Section 7 of the Final Report, however, leaves questions regarding the financial evaluation of the project unanswered. To be fair, while a complete financial evaluation of these issues was not required in the TORs for the study, the presentation of the financial issues given in the study does not adequately present the relevant estimates or justify some of the economic variables used, such as the discount rate or opportunity cost of capital, and cannot be considered adequate even as a preliminary, pro-forma analysis. While it seems that the initial analyses performed by EEA and HPPEA have identified sufficiently compelling reasons for considering projects such as Gebel Attaqa, the feasibility study has not adequately documented the financial benefits of the pumped storage plant. As a result, the feasibility study has not adequately justified continued research into the viability of the project. The risk assessment should provide this evaluation, including detailed financial projections for the project (cash flow statements, income statements and balance sheets), sensitivity analyses of the financials under different financing assumptions, and detailed justification of the financial parameters employed.

It may be that prior consultation with USAID regarding the results of the Ain Sukhna feasibility study may have yielded the conclusion that the financial feasibility should be estimated in greater detail, perhaps in a preliminary assessment prior to executing the feasibility study based on a review of the USAID-funded study and the criticisms of it made by HPPEA and EEA. Even if not, it seems reasonable to assert that an initial consultation with USAID on the results of the Ain Sukhna study might have shaped the terms of reference for the Gebel Attaqa study towards a more detailed review of the financial viability of the project.

Efficiency

The efficiency with which the Sida resources have been employed has been subject to question because of the cost overruns and delays encountered in the execution of the project. Some of the overruns, especially with respect to the drilling activity, may have linked by some observers to the relative inexperience of SWECO in the area of pumped storage. On closer review, however, it appears that the delays and cost overruns reflected largely unforeseen difficulties on the part of the project team, and were complemented by additional outlays of resources by the HPPEA. The delays cannot be attributed to inexperience with the development of pumped storage facilities per se; rather, at most they could be attributed to lack of familiarity with the physical characteristics of the region, something that was impossible to obtain beforehand.

Overall Cost-Efficiency

The overall efficiency of resource use for this project appears to have been adequate. The incremental costs incurred by Sida and HPPEA (perhaps 10% of the initial budget) were associated with unavoidable and necessary additional expenses to complete the project. The final product of the consultancy services was accepted by the HPPEA and EEA without modifications, and is a technically sound and well-organized study. It is possible to criticize the final report for presenting a very limited financial evaluation, but the requirements for this component of the study were not ade-

quately specified in the contract documents, which read simply “Analysis of the overall economy and feasibility of a Pumped Storage Project at Mount Attaqa.”²

Quality of Services

With exception of the financial and economic analysis, which fails to document convincingly the economic case for the project, the results of the feasibility study are technically sound and well presented. Overall, the work product is consistent with the initial terms of reference for the study.

Efficiency of Other Shareholders

Based on conversations with SWECO representatives, the participation of HPPEA and the local contractor responsible for the road construction, providing water supply for drilling, and other related logistical support was effective and even came in below the initial budget. Based on the visit to Suez and Gebel Attaqa, it appears that the project participants supported within the local currency portion of the project performed well and did not incur unnecessary or inefficient expenditures. However, without a more detailed audit of the documentation for spending under the local currency portion of the project, it is impossible to determine for certain whether this was the case. Such an audit is beyond the scope of the present program appraisal.

Overruns

The major reasons for the cost overruns and delays in executing the project have to do with the following:

- *Mine clearance.* The extent of work required to adequately clear the minefields on the mountain was greater than expected. In the end, a significant number of mines were deactivated by military personnel and unexploded shells were recovered from the areas where work was performed. It seems unlikely that there was any way to adequately gauge the scope of this activity until it was undertaken, due to the impossibility of obtaining information about mine placement by both the Egyptian and Israeli military during the armed conflict between 1967 and 1973.
- *Road preparation.* The difficulty of preparing the access tracks to the mountain was substantial. The track to the mountaintop enters from the northwest and reaches the top after several steep inclines. The track is in good condition and was well executed. It should be noted that the local subcontractor who performed this work, Bouhi (from Suez), was able to execute the work for an amount less than originally budgeted by HPPEA.
- *Water supplies for drilling.* This was a substantial problem for the subcontractor assigned to drilling the test wells. Initially it was expected that the water required for drilling could be airlifted to the airstrip near the top of the mountain. This proved to be impossible due to cost. Then a hose was lifted by helicopter to the top of the mountain. This effort also met with failure because the hose broke on a sharp shelf of rock about halfway up the mountain face. The solution that finally succeeded was to establish a cable link between the lower work area and the mountaintop using a cable and then winching the hose up. The local contractor Bouhi executed this work on a performance basis: no payment would be made if the contractor was unsuccessful in attempting to string the hose up to the mountaintop drilling site.

² Agreement Consultancy Services (sic), Appendix A, page 2 of 5.

- *Difficult drilling.* In addition to the logistical obstacles to having enough water on the mountain for drilling, the drilling team encountered several difficulties in executing the test wells, in that the geological structure of the mountain was more complicated and faulted than expected. This was also impossible to know with precision before the project, since no seismic surveys had been performed on the mountain. It should be noted that the Swedish drilling concern originally contracted was replaced by a Finnish company, due to inadequate performance.

Leverage

Also important is the fact that the counterpart organization in this project provided substantial resources for the project. This spending went to several local currency components of the project, including fees paid to the military for mine and shell clearance, aircraft rentals, and road construction. The total Egyptian component actually exceeded that of Sida by a factor of almost 1.5 to 1. (See Table 7.)

Table 7: Cost Sharing for Gebel Attaqa Pumped Storage Project

Project phase	Swedish component (SEK)	Egyptian component (LE)
Main contract	8,142,000	442,400
Addendum 1		250,000
Addendum 2	700,000	958,000
Addendum 3	1,238,000	500,000
Other in-kind contributions*		4,571,000
Exchange rate (currency in USD)	8.25	3.40
Total (USD)	\$1,221,818	\$1,976,882

*Figure based on interviews at HPPEA, including LE 1 million in salaries for HPPEA staff and up to LE 5 million in expenses associated with mine clearance, equipment use, road building and placement of the hose to supply water for drilling at the mountaintop. These expenses are not recorded in the project contracts or addenda.

Based on the foregoing, the level of commitment by the Egyptian counterpart in this project has been significant, and is likely to continue, as the HPPEA plans to submit the risk assessment for consideration by Sida as an ongoing technical cooperation project.

Sustainability

There is strong evidence that this project has solid support from the senior levels of the administration, which all but ensures that it will continue. Accordingly, the support provided by Sida will lead to the execution of a significant project, provided it can overcome the remaining barriers to implementation. The evidence of solid support and strong potential for continuation include:

- Stated interest of EEA and HPPEA in pumped storage since early in the 1980s.
- Continued HPPEA support for the project, and additional outlays to support additional work requirements.
- Stated interest of HPPEA in approaching Sida for support in the new phase of the project, the risk assessment.

However, beyond the strong likelihood that a detailed risk and financial assessment will be performed on the project, the chances that the project will actually be financed remain unclear. No such project has been constructed in the Middle East, and, to the extent of EEA's and the Sida review team's knowledge, no such project has been financed on a BOOT basis anywhere in the world. If a BOOT financing scheme does not appear viable, it would be difficult for EEA to finance the project on its own.

Impact

The impact of the Sida-sponsored technical feasibility study for the Gebel Attaqa PSP cannot be determined in full at the present time, since the project is still under development. The contribution of the study to EEA's technical knowledge of pumped storage projects, and the characteristics of the Gebel Attaqa site, is substantial. However, until the project is actually constructed or abandoned because of financial constraints, it will not be possible to make a final assessment of the value of the activity supported by Sida.

Gender issues

This project does not appear to have had any notable impact on gender issues in the HPPEA. It appears that the engineers from SWECO who participated in the project were all men, and the engineers involved on the Egyptian side were all men. It is not apparent how this project could be made to have contributed to enhancing opportunities for women in the hydropower sector in Egypt unless female engineers were involved in the project through some sort of an "affirmative action" program, and this may have been counterproductive.

Lessons Learned and Recommendations

A. The Gebel Attaqa project yields a few relevant lessons:

- Better donor coordination might have encouraged Sida to request a more effective assessment of the financial viability of the project, and this would have yielded a stronger final report. Had the assessment been done more completely, less additional work would be required at present to determine the project's financial viability.
- It is true that more contact with USAID may have dissuaded Sida from supporting the study – and the attractiveness of the Gebel Attaqa site, relative to the others further south, might have been overlooked. But the previous studies did not do the project concept justice, and it is likely that Sida would have come to this conclusion from a discussion with USAID and HPPEA about the earlier studies.
- For sites in areas where little detailed geological data are available, a preliminary, limited site exploration report might be considered as a way of detecting the risk that project execution times may be prolonged due to difficult drilling, problems with site clearance, etc.
- Strong local contractors were able to ensure the project's success.

From the foregoing, several recommendations emerge:

- A detailed and thorough financial assessment needs to be executed, including a risk assessment of the project, and an evaluation of the suitability of BOOT and other project financing and contracting mechanisms for this pumped storage project. The financial study should probably be done by an independent organization that does not necessarily have a stake in the continued development of the project.

B. "Amplissima" Computerized Maintenance and Materials Management System

Background

The installation of the Amplissima Computerized Maintenance and Materials Management System (CMMMS) by the Egyptian Electricity Authority (EEA) at power stations throughout Egypt has been underway since 1991. At present, Amplissima is installed at nine power plants and the National Electric Control Center (NECC), with the plants representing about 60% of total generation. Another six will incorporate the system in the next phase of the program, for which EEA intends to request additional funding from Sida within the next two months. With the addition of these power plants, some 80% of total generation will come from plants using the Amplissima system.

The Amplissima system consists of different modules that contain data on different aspects of maintenance and spare parts tracking within the individual power plant, and permit the user to generate standardized reports. The modules include the following areas: plant description module, in which specifications for all parts of the facility are registered; the warehouse module, where entries are kept for spare parts and consumables; the purchasing module, which enables the user to generate purchase orders for new parts and materials; the work order module, which enables the user to generate instructions for specific activities as they are required; the preventive maintenance module, for scheduling interval-based activities; and the report module, for generating records from the different modules.

Implementation of the system in the EEA's fleet of generation stations has proceeded in four phases, as described in Table 8. Each phase has involved installation of hardware and the Amplissima software, as well as training for plant personnel and the development of an Amplissima Group within EEA. Phase I was the demonstration of the system at the Attaqa Thermal Power Station (TPS) near Suez. Based on the successful demonstration at Attaqa, further funding was dedicated to supporting installation at three more power plants, in Phase II. With the training received during these two phases, EEA staff proceeded to implement Amplissima in several more stations, including several plants where repowering projects financed by the German Kreditanstalt für Wiederaufbau (KfW) were undertaken during 1997, during Phases III and IV. EEA secured support for the Amplissima installation at those plants as part of the over reporting program. This version is supported by Windows 95, with more graphics content, thereby facilitating use by operators who do not have as extensive a command of English. Phase V has not yet started, as the contract is not yet in place, but it is expected to include up to six more power plants.

The latest phase of Amplissima implementation proposed by EEA would include two steps, the first including issuance of a license to EEA for use of the upgraded version of Amplissima, with development of training courses for its application, and supervision of the pilot training courses. The second step will include follow on courses. The upgraded version will permit users to execute the Work Orders electronically while following the EEA procedures for approvals of such instructions. With new hardware that would also be installed, individual plants would be able to access information about part and materials availability at other plants, thereby permitting more rational use of supplies across the system. In addition, the upgraded system would have the enhanced operability of a Windows-based application over the VMS-based system used originally.

According to EEA, budget for part of the Phase V implementation is in place, and in fact implementation of the system has begun at Koreimat and Walidiyya power stations.

Table 8: Implementation of Amplissima by EEA

Implementation phase and locations(s) and station type	Funding Source	Technical Cooperation Funding (USD)	Egyptian Counterpart Funding (USD)
<i>Phase I (1991-1992)</i>			
Attaqa (thermal)	Sida	\$261,820	\$147,060
<i>Phase II (1993-1994)</i>			
High Dam (hydro)	Sida	\$436,360	\$332,090
Abu Qir (thermal)			
Damietta (thermal)			
<i>Phase III (1996-1997)</i>			
Cairo West (thermal)	EEA	—	N/A
Hurghada (thermal)			
<i>Phase IV (1997)</i>			
Cairo South (thermal)	KfW*	N/A	N/A
Asyout (thermal)			
Damanhour (thermal)			
<i>Phase V (1999-)</i>			
Talkha I, II and Talkha 210 (thermal)	Sida**	\$506,300	N/A
Damanhour (thermal)			
Mahmoudiyya CC (thermal)			
Walidiyya (thermal)			
Abu Sultan (thermal)			
Koreimat (thermal)			

* As part of plant reporting at these facilities. ** Part of Phase V has been approved by Sida. Total contract is for \$634,425. N/A means not available. Sources: Sida and EEA.

Relevance

The importance of more effective inventory management cannot be understated. In an analysis of the operating costs of EEA undertaken by USAID, spare parts and materials purchases were the fastest rising component of overall spending. Indeed, EEA financial data show that the materials and services cost category increased 36% between the 1993-1994 and 1994-1995 fiscal years, the second highest single annual increase after fuel purchases, which shot up 42.6% in the 1991-1993 period. By implementing measures to manage these costs more effectively, EEA can achieve higher levels of efficiency, reduce foreign currency requirements, and reduce the overall burden of the EEA on the national budget. As an example, one EEA engineer reported that in the past, EEA purchasers and contract specialists would tend to add substantial spare parts inventories to initial purchases of equipment and services, generally for five years, thereby adding to the overall capital cost of construction projects and creating a spare-parts overhang that would require adequate cataloguing, storage, protection from theft, etc.

The significance of Amplissima was confirmed by USAID. In interviews, the U.S. Agency was very supportive of the program, and had allocated some funds to a complementary effort to speed up the name standardization process. This issue has been and remains a major hurdle to the complete implementation of the program, since there are numerous parts and equipment suppliers represented at the various thermal and hydroelectric plants in the country, for example, ranging from Russia

(High Dam), the U.S. (some replacement equipment at High Dam, as well as Aswan II and thermal stations), Sweden (Aswan I), Japan (various thermal stations), and Germany (Esna, thermal stations).

With the possibility of limited privatization through a share issue very much present as well, the importance of more effective management can only increase, but at the same time the utility of having an interconnected system permitting one plant to access records on parts availability at another plant could be diminished to the extent that ownership differs from plant to plant. Since it seems unlikely that complete privatization will occur in the near term – the government is only considering sales of minority shares in the seven regional electric companies – the benefits of having an interconnected system would be realized by EEA in the short term.

Results

The implementation of Amplissima supported by Sida and reinforced by USAID as well as the KfW in other programs has yielded substantial results. In general terms, the system has permitted operators to overcome major operational difficulties, and to manage their spare parts with greater confidence. Maintenance engineers now have data on spare parts available in the warehouse, the standardization process has begun to eliminate duplicate names and description for identical parts, and there has been some improvement in terms of reducing spare parts inventories to lower, but still adequate levels.

However, there have been some problems during installation and subsequent operation, that may have to do with obstacles to implementation that are not related to Amplissima itself, or to drawbacks with the program. In interviews with personnel at the Attaqa TPS and the High Dam PS, where Amplissima has been installed, as well as the Aswan I and II stations where it has not yet been installed, it is possible to present some more specific findings on both these points. The experience of the plants where Amplissima has been installed has been communicated to other plants, and the message has not been altogether positive. In the specific case of Aswan I, the result is that the head of information systems and controls said in an interview that he did not think Amplissima was necessary for that plant. He argued that the German KKS system of standardized codes for inventory management made Amplissima unnecessary. However, this comment suggests that he is not aware of the CMMMS capabilities to assist in programming and tracking maintenance activities – indicating that perhaps the system has not been adequately “sold” by the Amplissima team.

Challenges to implementation

There are two major challenges to implementation. First, there is the question of standardization of nomenclature throughout the system. This is proving to be a significant consideration, especially now as EEA wants to unify the individual plants in one system. Clearly, the fact that EEA chose to implement the system in a few plants and then expand to the others has highlighted this difficulty, but it is unclear that there could be any other way to implement Amplissima in an electric system as diverse as Egypt’s. However, it may be that the Sida program did not give enough attention to the standardization issue: according to EEA, USAID helped support the establishment of a single nomenclature for the Authority’s plants. While SwedPower did give sufficient attention to ensuring effective installation of the package at each facility, and in creating a core team within EEA capable of continuing that effort, it does not appear that the work of SwedPower gave adequate attention to the overall strategy for implementing the Amplissima package across the entire generation system.

The process of downloading all the relevant warehouse data into the store module of Amplissima has proven to be more laborious than expected. The Attaqa TPS, for example, has still not completed the process of loading all inventory data into the system. According to the plant manager, this is because the amount of data to be inputted into the system is too much for the two system operators at the warehouse to have handled in the time since the system was first installed.

At the High Dam Power Station, it appears that the plant is also grappling with a similar problem, compounded by the fact that the original equipment in the facility is of Soviet origin and hence identified in Russian – requiring transliteration from a third alphabet.

The sheer magnitude of the inputting challenge points to another, very significant hurdle facing Amplissima. This second challenge is the issue of which language to use in the system. In every plant where interviews were conducted, plant personnel expressed the view that the Amplissima system must be adapted to accommodate entries in Arabic, at least for the purpose of generating work orders with the system. The plant staff charged with carrying out the work orders, and even some of the engineers managing the plants, do not have an effective command of English to ensure that the terminology used in the work orders is properly understood. In order to ensure that the work orders are understood, they have been translated by plant staff into Arabic, creating a laborious and potentially confusing parallel system of work orders.

Clearly, the entire system cannot be translated into Arabic, since the vast majority of the spare parts and materials in the system have to be identified by using their manufacturer's names and designations. This point was recognized by the central management of EEA in Cairo, which decided to implement the system in English. But in the field, at the plant level, there appears to be frustration with the problem that this poses when it is necessary to give instructions to replace a specific part within a work order, as well as in generating work orders that are comprehensible to the technical staff. Hence, there is no alternative to using Arabic in the work orders, since the command of English among the technicians charged with executing them is not going to increase quickly, only over time, as the overall level of training and education in the EEA workforce is raised through the efforts of institutions such as the Aswan Hydropower Training Center.

It may be that the transition to a Windows-based version of Amplissima could help surmount some of these challenges, to the extent that an icon- and menu-based system could facilitate the introduction of Arabic text alongside the English text, when unavoidable, and the possibility of using Arabic script in places where text may be introduced by the user.

Another issue concerning the work orders, which was raised by EEA staff in Cairo, involves the ability of the system to accommodate EEA's procedures for approvals on the work orders from different offices and managers within a plant. As described by EEA staff, the work order (WO), once written by the maintenance manager, must be signed by at least two other supervisors, before being executed. As presently implemented, this requires the generation of a printed version of the WO; the procedure cannot be performed based only on an electronic WO.

Limitations of Amplissima

There are several limitations to the Amplissima system as it was installed at the High Dam PS that were brought to the attention of the review team. According to the head of computer systems at the plant, the computer team has faced substantial challenges in keeping Amplissima up and running because it was never provided with a list of the error messages generated by the system, complicating the normal maintenance of the system. Further, the system does not permit more than one transaction to be printed at a time, nor to generate lists of work orders by period of time or by the operational areas involved in them. Lastly, it appeared that the computer specialist interviewed was not convinced that the system was completely Y2K compliant. To some extent these problems may be related more to follow-up and service by the in-country distributor, the Giza Systems Company, rather than specific flaws in Amplissima itself.

It is possible that the new version of Amplissima that has already been installed in some facilities (but not the High Dam plant) may have reduced these limitations. Before the upgraded system is installed at High Dam, it will be necessary to explain the benefits of the new version to the information systems personnel at the plant.

Efficiency

It is difficult to assess completely the efficiency with which Sida resources were used by the contractor without performing a detailed audit of SwedPower's accounts for the projects involving implementation of Amplissima. However, it is possible to say that EEA headquarters staff and plant management have been generally supportive of the program and appreciative of the role Sida played in implementing it. The products and services delivered to EEA have made it possible to implement the system, although perhaps it has not been used to the full extent of its potential. Based on a review of the relevant contracts, there does not appear to have been any requirement that the Sida contractor design a broader implementation strategy in conjunction with EEA, provide more extensive assistance on the issue of standardization, or adapt the appropriate modules of the Amplissima program for use in Arabic.

Leverage

As noted in Table 8, the support provided for Amplissima installation has been complemented by substantial material resources from EEA. Further, EEA personnel have expended considerable time in deploying the system and providing the necessary training to plant staff, who in turn have expended considerable time inputting the necessary data into the system. This demonstrates a significant commitment to using the system in its current versions and to upgrading to the new versions as well.

Sustainability

The EEA has demonstrated a clear commitment to the implementation of Amplissima throughout the Egyptian electric system. In its Business Plan,³ which was prepared with assistance from a USAID-financed contractor, EEA identifies seven key objectives, of which one, "provide high-quality products and services," incorporates Amplissima as a central part of its work program. The specific targets identified as part of the implementation of Amplissima, for 1999, include the following: (1) "enhance the efficiency of utilization of Amplissima where applied;" and (2) "prepare a plan to apply Amplissima to the IT networks."

However, it is important to note that while the commitment at EEA's headquarters may be strong, the extent to which this commitment is felt in the field, where implementation difficulties have caused significant delays and required adoption of complicated procedures, may be far less. It seems likely that with the introduction of the more user-friendly Windows-based version, these difficulties may be reduced. But it seems likely that the only way to truly address potential resistance to its application is to provide for a conversion of the work order module to Arabic.

The support for Amplissima among other donors, on the other hand, seems to ensure that the system will get strong support from senior management in Cairo. USAID, as noted, is highly supportive of Amplissima, and has specifically incorporated deepening its use in a proposal made to EEA in early 1999 for activities under the USAID energy sector cooperation program. In a letter to Dr. Mustafa Sweidan, USAID program director Raouf Youssef notes that demonstrated more efficient inventory management in one of the seven regional electric companies is a long-term, high-priority activity, that could be undertaken with USAID support between March, 1999 and

³ Dated March, 1998.

September, 2001. In the letter, Youssef writes that “this activity requires close coordination with Sida for the implementation of Windows-based Amplissima in the selected EC (electric company).”⁴

Impact

The trend toward reduced purchases of spare parts, made possible by the improved management of materials using Amplissima, may be reflected in the fact that the materials and services cost category remained level between the 1995-1996 and 1996-1997 fiscal years, the only line item to remain steady in the last three reporting years given in the EEA financial statements included in its *1996-1997 Annual Report*. However, it is likely that numerous other factors have influenced this variable, making it difficult to assert that the use of Amplissima alone has yielded this result.

Gender issues

Amplissima has proven to be a very strong tool for enhancing the position of one woman within EEA, suggesting that the combination of training overseas together with learning through close collaboration with the technical assistance team is not inaccessible to Egyptian women professionals. Once a woman has demonstrated her value to the organization, she receives recognition for it, and influence within the organization.

Given what other women have noted about the international training programs, however, it could be argued that the case of the Amplissima coordinator at EEA, Mrs. Mervat Abboud, is unusual. This could be, but it seems unlikely; rather, Mrs. Abboud’s success seems more related to vocational and technical training early in her career that made it possible for her to continue to push for opportunity and responsibility.

Lessons Learned and Recommendations

Several lessons emerge from the experience of supporting the Amplissima program:

- The program has enjoyed the support of two other donor agencies, and coordination of activities has yielded good results.
- The value of Amplissima to EEA could have been enhanced by more effective treatment of the nomenclature standardization issue, as well as more complete Arabization.
- What headquarters determines is not a problem – language ability – may actually be more of one in the field.
- More effective integration of technical assistance with existing training capabilities at the EEA’s training centers may have been overlooked; training in Sweden is effective, but it tends to be limited to a small number of individuals who will have a hard time keeping up with training needs in the host country. SwedPower reports that the next project will include a training component.
- The client’s desire to defer conversion of hardware may limit its ability to obtain the full benefits of software.
- Solid local vendor support is important to the success of the program – SwedPower agrees, and reports that it is seeking a local representation agreement with an Egyptian firm.
- Programs that encourage stronger alliances to support the development of Arabized software for specialized applications such as those served by Amplissima could yield even better results – and generate greater business opportunities for Swedish firms hired by Sida.

⁴ Letter to Dr. Mustafa Sweidan, director of the EEA, from Raouf Youssef, program manager, energy and telecommunications, USAID, February 16, 1999.

From these lessons, some recommendations emerge as well:

- For technical assistance programs involving software, Sida should do more to encourage the creation of in-country capabilities to ensure more effective follow-up, more effective technology transfer, and the development of otherwise costly and commercially nonviable local adaptations.
- Sida should seek to ensure better integration of technical assistance with existing training resources.
- Sida should continue to support the Amplissima program, and should place special emphasis on ensuring that the training centers operated by EEA incorporate the program into their regular computer and information systems curricula.

C. Aswan Hydropower Training Center

Background

In 1985, EEA elaborated the scope of work for a feasibility study for the development and construction of a hydropower training-center in the Aswan region, referred to as the Aswan Hydropower Training Center (AHTC). In October 1987, EEA and SwedPower presented the final report of the study. The primary-goal was to develop the AHTC into an up-to-date training center to meet the requirements of the hydropower sector in Egypt. The overall objectives were the following:

- Make the best use of existing staff (engineers, technicians and workers) by upgrading their skills, as required by the zone, in the fields of power-station operation and maintenance;
- Train new engineers and technicians;
- Train technicians through a three-year secondary school program in collaboration with the Ministry of Education;
- Raise the standards of power-station operations workers;
- Improve the efficiency of the production and transmission systems through training.

The World Bank and local funds from EEA financed construction of the center, its equipment and teaching materials. The Swedish contribution was mainly to provide consultancy services. During 1989 – 1991, the Swedish State Board's Training center, *Jokkmokkskolan*, carried out two courses for participants from EEA; one course in Training center Management and one Instructor Training Course. The first contract for continuous Swedish support was signed in October 1992, covering only the first phase out of five. The phases were the following:

- Phase 1: Curriculum Development and Training Preparation
- Phase 2: Development of Modules and Courses
- Phase 3: Support in Implementation (stage 1)
- Phase 4: Support in Implementation (stage 2), Interim Evaluation and Revision
- Phase 5: Continued Implementation (stage 3), Final Evaluation

SwedPower was limited to an advisory role, providing support in the development and implementation of training programs, technical expertise in hydropower technology, and installation of the training equipment. During phase 5 EEA raised the need for further training development and SwedPower felt the need for a consolidation phase to the AHTC, for additional development of teaching methods, administration and staff development. The goals had not been achieved within the planned time period because of severe time delays during the construction work of the build-

dings. Therefore, phase 5 was followed by a sixth phase (or a prolongation of the fifth if one prefers) by six months, ending in June 1996.⁵

Relevance

In general, institutional development is a never-ending process for companies that want to remain in business. Human resource development is *one* of the tools to such a development so it was relevant to give high priority to constructing and developing a training center that would address the needs of trained labor to the hydro power stations in Egypt.

However, the project objectives did not focus directly on the institutional problems of the power stations. Instead, they were defined in terms of management development and pedagogical development of the Training center itself. It was assumed that a well-functioning Training center could be the vehicle for further development of the hydropower companies in the region. Accepting this limited approach, the Project was well planned and the activities were well linked to the project objectives.

Results

The results may be classified into two main categories, (1) what happened during the project, and (2) what happened after its completion. Each category can be evaluated in terms of efficiency and impact.

	Efficiency	Impact
Project period (until June 1996)	Project Efficiency	Project Impact
Post-project period (after June 1996)	Post-project Efficiency	Post-project Impact

The following discussion will focus on each one of these four boxes.

Project Efficiency

Cost Efficiency

The initial budget of the Project was SEK 11,361,000 and when the project ended there were still SEK 62,700 of unused funds. Some 86% of the costs consisted of fees for the SwedPower staff, and the remaining 14% were materials and reimbursable costs. The services were carried out during 94 man-months, which means that the total cost per man-month, in average, was about SEK 120,450, of which salaries represented SEK 103,650. This is considered to be quite normal for a pure technical assistance project.

A total of 14 consultants were engaged during three and a half years, and expended 94 man-months of effort. Much was achieved, but this is a considerable amount of time – almost eight man-years. Things could probably have gone faster if SwedPower had been given the resources and responsibility to act as managers of the Project, but instead a process-oriented approach was chosen that probably paid off in terms of better sustainability.

Severe delays in the building construction, which were outside the control of the project, also hampered the rate of implementation. In addition, it sometimes happened that SwedPower was

⁵ For a more comprehensive background to the Aswan Hydropower Training Center and its development, see the following documents developed by EEA and SwedPower: Feasibility Study – October 1987, Review Report No 1 - February 1993, No 2A - December 1993, No 2B - March 1994, No 3 – December 1994, the Progress Reports No 1 – 13 and Final Report – June 1996.

required to support activities outside the contract, e.g. project management for development of systems and routines, construction issues, electrical installations, furniture issues, storing facilities, English teaching etc. Their involvement in these additional activities was necessary since they had a direct impact on the tasks of the consultant. It should be positively noted, in addition, that these time delays and additional activities have not affected the initial project budget.

Delays

The Final Report of the Feasibility Study is dated October 1987. It states that the center would be ready to receive students in the autumn of 1990 if a decision was taken during 1987 to build the center. In fact, it should have taken until November 1993 until the first basic courses started, utilizing the facilities “as built”.

The first reason for the time delay was that the original site for the AHTC, for which the Feasibility Study was designed, turned out to be inappropriate for construction work. Another site about 5 km from of the original place was chosen and an Egyptian company got the assignment to design the center, based more or less on the same proposal as for the SwedPower study. Unfortunately, this new site also turned out to have problems that delayed the construction work. Today this can be seen in cracks both outside and inside the buildings. The first treatment of the walls was done about one to two years after completion, but new cracks still appear in both new places and treated ones. It is said that these are shallow and do not represent a risk to safety.

Some differences between the EEA/SwedPower proposal and the final design were that seven classrooms were built instead of the originally proposed four, and the planned laboratories for the secondary education programs were taken out since it had been decided that such training was no longer part of AHTC's duties. Further, the trainee accommodation was enlarged from 16 double rooms to 32. A wood workshop was also included in the new proposal. Altogether, the total capacity of the Training center increased from 140 trainees at any one time to about 200.

In the first EEA/SwedPower Review Report, of February 1993, the estimation was that the AHTC management would be able to take over the buildings from February 1, 1993. In addition, the office premises would be accessible by that time. The center was planned to be fully serviceable by July 1, 1993 and the first regular courses were planned to start in October the same year.

In 1993/94 the classroom and workshop buildings were finalized. In 1995 the administration building was completed, in 1996 accommodations for students were finalized, and in 1999 the switchyard for network training was completed (the switchyard was not part of the original planning).

In Review Report No. 2A, of 15 December 1993, the official opening of the TC was tentatively postponed to February 1994 but the first basic courses had already started on 20 November 1993.

Table 9, below, shows the different phases, activities and time schedule. As mentioned above, phases 1-5 were planned at the start of the Project. Phase 6 was added according to a proposal in Review Report No. 3.

Table 9: Implementation of the AHTC project

Phase and Activity	ORIGINAL SCHEDULE		REVISED SCHEDULE		
	Review Report No. 1, February 1993	Review Report No. 2A, December 1993	Review Report No. 2B, March 1994	Review Report No. 3, December 1994	Final Report, June 1996
Phase 1 – Curriculum Development and Training Preparations	September 1992 – March 1994	November 1992 – May 1994			
Phase 2 – Development of Modules and Courses	April 1993 – April 1994	April 1993 – June 1994			
Phase 3 – Support in Implementation (stage 1)	July 1993 – April 1994	August 1993 – May 1994			
Phase 4 – Support in Implementation (stage 2), Interim Evaluation and Revision	January 1994 – October 1994	April 1994 – February 1995			
Phase 5 – Continued Implementation (stage 3) and Final Evaluation	October 1994 – September 1995	January – November 1995	January – December 1995		
Phase 6 – Consolidation Phase and Training Extension of the AHTCP	N/A	N/A	N/A	Extension of the project	January 1995 to June 1996

Quality of Services

Regarding the quality of services during the project period, as evaluated several years later, they are considered to have been good. The whole project is well documented by review reports and progress reports. Recommendations given in the reports have been followed up.

The project approach seems to be a bit inward-looking. Instead of trying to do the impossible, to solve the institutional problems of the power plants, the focus was on development of the training center itself, which of course was an easier task to define and carry out. It should be mentioned, however, that SwedPower made attempts to connect AHTC's activities to the field requirements. One example was to include representatives of the power stations in training committees. Further, a survey was organized in Aswan 2 Hydropower Station to gather information about how the work was organized, number of staff in the various areas, what tasks they were performing and an estimate of the levels of competence of each employee so that training needs could be assessed.

Project Impact

Have the project objectives been achieved? Although SwedPower might feel that more could have been done if everything had gone according to the plans, our judgement is that the project objectives have been achieved. The staff of the AHTC has received training on both managerial and pedagogical development. About 28 courses were developed during the project period, covering the most urgent training needs of the power stations. The syllabi were well documented and contained all necessary information. They were developed according to certain standards agreed upon between the Consultant and the management of the Training center. Independent of the Swedish funding, the center was equipped with the latest training technology so that it could probably stand a comparison with any training center in the world of this kind.

Post-project Efficiency

Cost-efficiency

According to the Director General of the South Upper Egypt Electricity Company, the company within which the training center operates, the annual running and investment costs are about SEK 4-5 million. In recent years, between 700 and 900 trainees have attended courses per year. Each course is about two weeks, which implies a cost per student-week SEK 2,800 (SEK 4.5 million divided by 800 trainees divided by 2 weeks). From a Swedish perspective, this is quite cost-effective. The Jokkmokkskolan, for instance, estimates its student costs at about 2,500 SEK *per day*, but there are of course major differences between the two training centers. First, the overall costs in Sweden are much higher than in Egypt. Further, Jokkmokkskolan operates as a profit-center, which means that it has to generate its own income without any economical support. Their annual turnover is as high as SEK 15 to 16 million although their market is much smaller than the Egyptian one.

At AHTC, each course has been designed to train 12 participants. The center was equipped to train about 200 trainees at any one time. If it is assumed that the center is open during 40 weeks per year it gives the total capacity of 4,000 participants per year (based on 200 trainees multiplied by 40 weeks, divided by two weeks per session). In fact, this number corresponds to the total number of trainees who have received training since the first course started in November 1993 (during five and a half years), implying that the center is operating at about 20 percent of capacity. This unfortunate situation is due mainly to the following reasons:

- The secondary education program has not started. This program was supposed to accommodate 30 students per year, which would have meant 90 at any time after the initial years. The reason for this is simple. The Lower Upper Egypt Electricity Company consists of about 11,000 employees, which is far too many. According to the top management, about 3,000 to 4,000 would be sufficient, but existing policy on the governmental level makes it impossible to dismiss people. In other words, one might argue that there is no reason for starting recruitment campaigns for getting new staff. In addition, the Ministry of Education has not been willing to pay for the education programs and the Electricity Company can not afford it, since it depends economically on the energy consumers only. It no longer receives financial contributions from EEA.
- There is still no training which upgrades employees to make a career within the system, e.g. for a third-level technician to become a second-level technician and later a first-level technician, or for a second-level engineer to become a first-level engineer.
- There are still many courses to be developed to cover the present training needs.
- Supervisors do not release their subordinates to attend the training programs.
- If the number of trainees is less than six, the courses become postponed.

Another example of the low efficiency level is that EEA in 1998 bought power system and protection equipment to the center for about SEK 500,000. So far, only two courses have been conducted on this equipment. If it could have been foreseen during the feasibility study that the AHTC would operate at such a low performance level three years after the completion of the project, the conclusion would probably have been that the project was not feasible, at least not on the chosen ambition level. What has to be remembered, however, is that the reason for this inefficiency is not lack of training needs in the power stations. On the contrary, the needs are huge but involve many problems that cannot be solved by the AHTC alone.

Quality of Services

It is impossible to evaluate the quality of services of AHTC during a few days' stay in Aswan. The basic pre-requisites seem to be there for high quality performance: The managers seem to be capable and interested in their work. Several instructors have received training in Sweden. There are syllabi for all the courses offered, and they meet high standards. All equipment installed during the project period is still functioning and new investments have been made.

There was not enough time to sit in a class and observe the teachers' performance. It was said, however, that new instructors receive instructor training on how to use equipment and teaching materials. The problem might be to cover the pedagogical aspects of the AHTC's operations: today, there is no systematic pedagogical instructor training in existence.

One of the main problems that the training center faces today is the difficulty of justifying its existence. Some of the overall objectives for its creation were to progressively raise the standards of power-station operations workers, and to gradually improve the efficiency of the production and transmission systems, through training. So far there are no signs which show that the power stations function better today than before. The number of faults, errors, machine stops, accidents, etc. seems to be the same. In other words, the investments made, about 85 MSEK, are to be considered as *costs* which so far have not started to pay off. Part of the explanation *might* be, although this matter was not raised by the training center management, that about 70 percent of the instructors on the engineer level are employed to by AHTC directly after graduation from the university, which means that they lack field experience. (For the technician level this is not the case. It was said that about 80 percent of the instructors come from the field.)

However, there might also be other reasons for this situation that are not directly related to quality of services. All training offered at the AHTC is in-service training, which means that all trainees have an employment at the time for training. Most of these have worked over several years and they and their supervisors are accustomed to performing their work in a certain way. It is very difficult to change on-the-job performance with a two-week course. In other words, even if the training offered at the center is of very high quality, this might not be shown in the performance statistics because of managerial problems, established routines (or lack of routines), lack of (preventive) maintenance, counterproductive attitudes, lack of motivation, poor division of work, or other factors that are not directly related to lack of knowledge or skills. It has to be remembered that training can only solve training problems, and even then, only if there is a willingness to change attitudes and behavior. Organizational problems have to be addressed with other solutions, and management problems can only partly be solved by training.

Post-project Impact

The sustainability of the project is very good on the present performance level. About 18 new courses have been developed since the end of the Project, about five courses in 1999 alone, and more are in the pipeline. New training areas have also been entered, e.g. transmission and network operations, and there will be courses in air-conditioning technology before the end of 1999.

The only immediate threat would be if the training center management and other key personnel resigned from their positions. A more medium-term threat would be if the AHTC continues to fail in proving that the training gives results on the job performance level, which would lead to fewer investments and continuous problems in attracting trainees to attend the courses.

Those in field complain that they have training needs that have not yet been met by AHTC. Some areas that have been mentioned are protection systems for generators, lines and feeders, and distance protection. Another area that is lacking courses, according to those in the field, are computer

courses for control technology. Today, the center does not have computers and software to run such courses. Installation and operation of the Amplissima system would also be a relevant training area.

One of the weaker parts of the training center is the library. It has about 3,245 books registered but only 1,300 different titles. A computer was installed in 1993 with a File Maker Pro program that takes care of the registration of the books, but the program is not fully utilized. It is impossible, for instance, to check which books are out on loan. Before, this kind of registration was done manually, but later the computer took over for a while, until it was felt that it did not have enough capacity (it was too slow). We did find on a manual list that 95 books were out between January and April, 1999, which on average means about one book per day was checked out.

The budget for buying new books and subscriptions of magazines is SEK 17,000 to 18,000 per year. This is not sufficient if the intention is to keep up with new technology and develop courses according to the field requirements.

Another matter that deals with economy in general is that the Principal of the center has very limited freedom of action when it comes to purchases. He has only SEK 5,000 for consumables, of which a maximum of SEK 500 can be spent per purchase. After justification of receipts, the cash-box can be refilled up to the ceiling amount of SEK 5,000.

Gender Issues

Gender issues have been entirely neglected both during the project and since its completion. The energy sector in Egypt is almost totally dominated by men. All technicians seem to be men, though there are some female engineers. Among the instructors at the Training center there are two female engineers out of ten, and one English teacher out of two. All the 20 technician-level instructors are men.

Looking at the list of consultants involved during implementation of the project, all of them seem to have been men, which shows that the situation is more or less the same in Sweden. This might explain, perhaps, why the student accommodation building was not constructed to facilitate female participation in the courses. In the proposal, developed by EEA/SwedPower during the feasibility study, 16 double rooms were planned, each of them containing a toilet and shower. In other words, there would be no problems as long as one looks at the problem from a Swedish perspective. From Egyptian point of view, however, as expressed by female engineers whom we interviewed in Cairo, there should have been an independent building that could accommodate women when necessary, or at least some means of dividing the existing building into two parts (not necessarily 50/50).

The opportunity to make changes in the design was there when the site for the Training center was moved because of the initial construction problems. At that time an Egyptian company got the task to enlarge the students' accommodation from 16 to 32 double rooms. SwedPower was no longer involved, but the new design was more or less the same as the EEA/ SwedPower proposal. The main difference was just that a second floor was put on top of the initially proposed building.

The result has been that although the accommodation building has been in operation during three years, it has never accommodated female course participants. To defend the Consultant, it could be argued that there is no way to know if the situation would have been different with another architectural design. This is true, but the present solution does not *facilitate* female participation to the courses.

Lessons Learned and Recommendations

Gender issues

It should be noted that many men in Egypt do not allow their wives to travel and stay away overnight. If Sida, or any other organization, would like to attract more girls or women into the male-dominated energy sector, it is of ultimate importance to catch their attention and interest before they marry. All of the female engineers with whom we spoke say that it is easier to convince the parents, who want the best for their children (even girls), than to argue with husbands. This implies that vocational education, rather than on the job training, will have the greatest impact on women's lives in Egypt.

Efficiency and Impact

Human resource development and training activities tend to have low status all over the world. It has been heard from companies that during good times there is no time for training activities, and during bad times there is no funding for them. Training is often considered to be a cost instead of an investment. When equipment breaks, halting operations, this is often considered to be a technical problem, not a lack of preventive maintenance or training. At the same time, paradoxically, training is sometimes seen as the only solution for a complex set of problems that require a combination of strategies for organizational development. Instead of attacking the real problems, the symptoms are put in the limelight because they are easier to see.

This description of a general situation is very much applicable to the specific situation of AHTC. On one hand, the center has the impossible task, as stated in the objectives, to progressively raise the standards of power-station operations and gradually improve the efficiency of the production and transmission systems, through training alone. On the other hand, many managers seem not to believe in training at all, so they do not release their personnel when there are relevant courses offered at the center.

What can be done, then? First, it will be necessary to stop focusing on the Training center alone. It will be necessary to raise one's eyes, start thinking about what the role of AHTC really is, and find the other stakeholders who must be held accountable for their shares of the problems.

The Director General of the South Upper Egypt Electricity Company has an almost impossible task. He is in charge of about 11,000 employees, but would need to come down quickly to about 3,000 to 4,000 to increase efficiency and reduce the costs. He is not allowed to dismiss anyone because of political reasons. Today, the company is decreasing at a speed of only about one percent per year and he has to hire as few people as possible, even though there is an urgent need for qualified personnel at key functions. The only income to the company comes from its customers, but the director general has no direct influence on the price per kWh sold. His task is to develop the company into a prosperous one, without being given the resources necessary to make it happen.

From these observations, the following recommendation emerges:

- If the South Upper Egypt Electricity Company requests assistance from Sida, it is recommended that INEC start-up a dialogue with the Director General. If these discussions will lead towards the creation of a new project, it should be focused on business development and organizational development (including human resource development). The output could be an institutional development policy and a strategy plan focusing on management of change.

In a short-term perspective, there are also some options that would not require any technical assistance. The following are some examples of immediate tasks for the AHTC management:

- Try to find ways to measure positive effects of the training provided at AHTC. Perhaps there are positive changes, which might not have been detected because of limited validity and/or reliability in the means of measurement. It is recommended that performance indicators be developed which are directly related to the training programs. Focus should be not only on the job itself but also on its impact on related areas, e.g. recognition that simple cleaning could lead to discovery of faults and errors at an earlier stage so that severe damage does not occur. In the long term this might reduce costs and increase revenue.
- Systematically follow up all training by unannounced field visits to check on whether actual job performance corresponds to what was taught during the training program. This would also be an opportunity to discover new training needs and get input for revision of existing courses.
- Make study visits to other training centers, such as the GTZ-supported Abu Sultan Station at Fayed in the Canal Zone, and the Canadian-supported Network Training center in Cairo South. The GTZ project is of special interest because it has chosen a strategy different from the Swedish financed project, and they are very satisfied with their results. The secret has been that when the project started they considered the existing staff of the power station to be “hopeless cases”. Instead of trying to upgrade the skills of the existing personnel, ambitious and intelligent youngsters who were not yet “destroyed” by the system, and who had school averages of at least 85 percent were recruited for a three-year course. It was based on the same ideas as for the planned secondary education at AHTC that never took off. The yearly intake of Abu Sultan has varied depending on the power plant’s needs. The best graduates have received upgrade training and will become the next generation of managers. Perhaps some of strategies and experiences from the German project could be adopted to improve the AHTC success.

D. International training program for Egyptian energy professionals

Background

According to the Terms of Reference for this evaluation, the aim of the International Training Programs is to enhance the managerial and technical skills in co-operating countries by providing know-how in areas that are of strategic importance for economic and social development. The International Training Programs promote a greater exchange of skills and experiences between Sweden and partner countries, and encourage a broad spectrum of Swedish participation. The intent is that training program participants should make direct use in their working situation of the knowledge they acquire in the training programs. This evaluation will assess whether the involved institutions in the Egyptian energy sector have achieved the desired benefits and results as a result of their training. The main questions to be answered are the following:

- Are there any effects on the individual level among the participants who attended training?
- Has there been any impact on the organizations, where the former trainees work(ed) as a result of the training? Have they been able to act as change agents within their respective organizations?
- How do the participants/organizations themselves evaluate the training programs?
- Have the participants been involved in any other kinds of competence-building activities?
- Has there been any interaction between participation in the training programs and involvement in other Sida-financed activities within the energy sector? What would the effects be of such interaction?
- To what extent have participants left the sector?

Program review

Introduction

About 500 Egyptian participants representing many sectors have joined the International Training Programs since 1978. This evaluation covers training for the energy sector only, in courses that have been carried out between 1990 and 1998, involving 62 Egyptian participants at a total cost of approximately 5 MSEK.

Table 10: Courses offered, number of participants per course and distribution in percent

Course	Number of participants	Distribution
Energy conservation in industry & sugar mills	29	47 %
Management of hydropower	14	23 %
Power system control and operation	10	16 %
Electricity distribution management	7	11 %
Management of electric power	2	3 %
Total	62	100 %

Table 11: Employers at the time for the course and number, and distribution of participants

Course	Number of participants	Distribution
EEA and its zones	14	23 %
Hydro power plant	10	16 %
Energy planning organization	7	11 %
Sugar Company (public)	7	11 %
Delta Sugar Company (private)	4	6 %
Electric power systems engineering	4	6 %
New & renewable energy organization	4	6 %
Rural electrical organization	3	5 %
Alexandria Electric Distribution Company	2	3 %
Cairo Electric Distribution Company	2	3 %
Abu-Kir, chemical industry	1	2 %
Organization not mentioned	4	6 %
Total	62	100 % (rounding off)

Women represent about 29 percent of the participants, which is considered to be relatively high, taking into consideration that the energy sector is a very male-dominated sector. It is possible that Sida or the course organizers during the final selection have chosen female candidates to a larger extent to improve the sex distribution.

Survey Methodology

A local consultant, Ms Hala Amir El Tahir, who normally works at the Ministry of Manpower and Emigration, performed the main part of the data collection. Because of the limited amount of time available, it was decided to create a random sample of 31 participants, representing 50 % of the

target population Unfortunately, only 20 of them could be reached, because 11 were unavailable for the following reasons: two former course participants were working abroad; one had moved to another sector; one was on vacation; one was ill; one had passed away; and five could not be reached because of lack of contact information.

Another eleven former participants were then chosen by the consultant on ad-hoc basis to come up with the chosen number, though the final number actually turned out to be 34. This kind of survey design is not an ideal one, but it was chosen to get input from as large a group as possible.

A questionnaire had earlier been developed by Swedec, which included questions designed to collect information based on the research matters above. In some cases questionnaires were sent out to former participants, sometimes they were filled in during meetings, but in most of the cases they were filled out by the local consultant during telephone interviews.

To investigate some questions more deeply, 15 participants were invited to our hotel one evening. Ten of them showed up; six women and four men. In addition, another 40-minute interview was carried out at another occasion.

Findings

Description of the Sample

All participants in the sample are engineers, which means that they have received university education. One of them has undergraduate level, first degree, and the rest have graduate level or post-graduate level education. Women represent 32 percent of the sample, which is a bit more than their representation in the overall population (which was 29 percent). One reason for their overrepresentation is probably that it was easier to get women to co-operate with the evaluation team in terms of filling and returning the forms. Another reason might be that women have not changed jobs/duties as often as men, see further below, which means that it was easier to find the female trainees. 32 of the participants were employed by the public sector and two employed by the private.

Table 12: Presentation of the sample in relation to target population (see table 1 for comparison)

Course	Total Population		Sample	
Energy conservation in industry & sugar plants	29	47%	13	38%
Management of hydropower	14	23%	9	26%
Power system control and operation	10	16%	6	18%
Electricity distribution management	7	11%	4	12%
Management of electric power	2	3%	2	6%
Total	62	100%	34	100%

Work Situation

Thirty persons (out of 34) had the same employer today as they did at the time of the course. This data should not be used, however, to reach any conclusion about (lack of) movement from one professional field to another. It must be remembered that of the original sample, five former participants could not be traced at all because of lack of information, two persons of the intended sample were working abroad and one had moved to another sector.

Table 13: Change of duties between the time for the course and today

	Men	Women	Total
Change of duties	17	6	23
No change of duties	5	5	10
No answer	1	0	1
Total	23	11	34

Table 14: Career development between the time for the course and today

Position at the time for the Course		Actual Position Today		Changes
Male	Total	Male	Total	
		Consultants	1	+1
Managers	9	Managers	14	+5
Supervisors	7	Supervisors	8	+1
Engineers	7	Engineers	0	-7
Technicians	0	Technicians	0	
Skilled workers	0	Skilled workers	0	
Administrative staff	0	Administrative staff	0	
Female		Female		
		Consultants	1	+1
Managers	2	Managers	3	+1
Supervisors	6	Supervisors	6	0
Engineers	3	Engineers	1	-2
Technicians	0	Technicians	0	
Skilled workers	0	Skilled workers	0	
Administrative staff	0	Administrative staff	0	
Total	34		34	

Table 13 shows that about 77% of the men have changed duties between time of the course and today. For women, only 55% have changed (although it should be noted that percentage presentations are not very reliable for small numbers). Anyway, there is a clear tendency for women to continue, to a larger extent, with their previous duties.

Table 14 gives a rough idea of changes of career. It does not give a complete picture, since the highest level is “manager” and eleven of the former course participants had that title when they attended the course. Some of them have continued their careers, e.g. gone from being a Director to a Director General, but these changes can not be seen in the table.

Two main conclusions can be derived from Table 5. First, men have higher positions than women, in general terms, and second, more men have continued their careers between the time of the course and today. Women tend to stay where they are, to a higher degree.

Utility of the Course

Table 15 shows that almost all course participants found the course to be “rather” or “very useful” for carrying out their duties at work. The small decrease in usefulness for today’s situation, compared to how useful it was before, is due to new duties on-the-job.

Table 15: Utility of the Course

Utility at the time of the Course		Utility for carrying out the present work		
	Total		Total	Change
Not useful at all, a hindrance	0	Not useful at all, a hindrance	0	
Not useful, but not a hindrance	0	Not useful, but not a hindrance	0	
Perhaps a little useful	1	Perhaps a little useful	2	+1
Rather useful	12	Rather useful	13	+1
Very useful	21	Very useful	19	-2
Was necessary in order to get or keep the job	0	Was necessary in order to get or keep the job	0	
Total	34		34	

Among the comments made, the following can be noted, course by course. The numbers within brackets show the number of participants who expressed the same or similar opinions.

Table 16: Participants’ Comments on Energy Conservation in Industry & Sugar Plants Course

Positive Comments	Other Comments
The course was generally useful and good (13)	The course was a <i>little</i> useful, because the electrical part of the course was not sufficient (1)
The course was useful in implementing studies and new ideas about energy conservation and renewable energy (2)	The course should have included more clean energy and renewable energy and its applications for energy conservation (2)
The content was excellent (4)	The course needs more concentration on environmental aspects (1)
New software for energy conservation and new means for plant analysis (1)	Increase the area of computer time and its applications in industry (1)
The quality and the teachers were good (8)	The course should be more specialized towards the participants’ specialization (1)
	The course was too compact. It needs to be prolonged (2)
	There has been no contact with the course organizers after completion of the course (2)

Table 17: Participants' Comments on Management of hydropower Course

Positive Comments	Other Comments
The course is generally useful (9)	The course coordinators were not able to communicate well in a multicultural environment (1)
The course helped in executing the work, and in tendering (1)	The course needs to be rescheduled to have enough time for all subjects, e.g. tendering (1)
The course was very useful for upgrading skills in the area of feasibility studies (1)	
Quality of the course, content and teaching was good (9)	

Table 18: Participants' Comments on Power system Control and Operation Course

Positive Comments	Other Comments
The course was very useful (6)	Parts of the course were built on rather old information (1)
The internships at different control centers were very useful (1)	More time is needed to apply the latest technology (1)
Especially the part on specifications for tendering was interesting (1)	Need for more internships or more practical training (1)
The quality was good (the content, teaching and study visits) (4)	I was the only lady during the course. I wish there had been more ladies (1)
Getting in touch with the Swedish society and culture (1)	Keep in touch with the participants by sending papers, magazines and making visits (2)

Table 19: Participants' Comments on Electricity distribution management Course

Positive Comments	Other Comments
The content was good (3)	Factory visits were not at the same level (1)
Good course for networks updating (1)	Content of the course concerning planning and design was not enough (1)
Useful course for energy conservation and its environmental impact (1)	The time of the course was too limited (1)
The course widened my mind and added economical matters (1)	Teaching was not as good as the course content, as many teachers did not use familiar expressions (1) (Year 1998)
Teaching was good (2)	The course was in management but I did not have a managerial position (1)
	No communication after the course was finished, need of upgrading technical content (magazines)(2)

Table 20: Participants' Comments on Management of electric power Course

Positive Comments	Other Comments
The course gave beneficial knowledge of management, procurement and contracting. It stimulated my personal development and leadership skills. It stressed the importance of maintenance, organization and planning. It upgraded my knowledge in the field of generation, transmission and distribution of electric companies (1)	The course should have included component design, standards, design development (1)
The course was well organized (1)	
The content was adequate and most of the teachers were very qualified (1)	
The course contributed in technology transfer in engineering, procurement and construction (1)	
Combining lectures and workshops during the program is useful for project development (1)	

Did the Sida courses help in applying new changes in the organizations of the former trainees?

Out of the 34 people involved in the study, 19 expressed that the training helped them in applying changes in their respective organizations. Five people did not respond on this question due to fax machine problems when the questionnaire was sent to them. Ten people said that the course has not helped them in applying any changes.

In analyzing the comments, both written and oral, we feel that some participants seemed to answer according to what they thought we wanted to hear. Some of them seem to have thought that participating in this survey might increase the possibility for further Sida-financed training. Therefore, the results should not be overestimated. The only two who commented about why they had not been able to apply any changes said the following: "I work in a governmental sector that is no easy to change by myself. We are committed to the governmental policy," and "Any changes depend on the decision of the chairman."

An outside example to understand this issue would be if one or two Sida officers were sent to a World Bank course in Standardized Methodology for the International Aid Business. Probably the course would be interesting but also very controversial. To act according to the World Bank as an efficient change agent at Sida after attending the course would not be an easy task.

This is not said to deny that there were positive results of the Sida-financed International Training Programs. Many of the comments below demonstrate that concrete improvements were made in organizational development.

Of those who responded "yes, the course helped me in applying new changes in my organization", their explanations were:

- After the course I was involved in training programs in the company and I used the knowledge I've got from the training.

- We have provided staff training; we use course materials as sources in the department; we use brainstorming and work groups; changes related to my own work.
- Knowledge transfer to co-workers which resulted in considerable improvement in my department; improvement in my own performance. For example, we can make better technical assessments today.
- My career changed from distribution manager to work in research, quality and energy conservation. I am still using the material in establishing a new department.
- It helps the work in general.
- Improving the statistics.
- Implementing the methods of studying the energy demand and its management.
- We applied what I learned to make better use of the facilities in sugar plants.
- After the course I suggested new ideas (in 1990) which are now being applied, such as establishment of an Energy Conservation Center.
- We plan training for technicians in energy conservation and its implementation.
- Besides the technical information I've gained, the course changed my behavior concerning how to respect people and how to deal with people in a civilized way.
- It helped me in applying new technology in my job as a Studies and Research Engineer.
- Helpful in analysis and collection of energy related data.
- It helped me set up a new sector Distribution Control Centers, and the Company got many projects from this sector.
- It has been helpful in preparing our new projects and in preparation of tender documents.
- Promoted my managerial capacity and ability to make decisions more effectively and economically.
- Helped train me and my staff on new technology; building a new power station with the new strategy of privatization (BOOT)

Have the former course participants participated in any other Sida-financed activities?

- 32 former trainees, state that they have not participated in any other Sida-financed activities. One of them applied to the Electrical Utilities Management Course but was not selected.
- One course participant says that he attended a project management course in 1996.
- One person did not answer the question.

General Conclusions and Recommendations for Future Activities

The conclusions and recommendations presented here incorporate observations from the survey of Egyptian participants, but they also include reference to the survey of Jordanian participants.

This evaluation shows that some former trainees want more information to be included in the Sida-financed courses, especially more specific subjects which are relevant for their positions. Others think that the courses are already too compressed. To solve that issue, some participants want more time for the courses, while others say that the courses are already too long, because it is difficult for a manager to be away for more than a couple of weeks. The course organizers have probably received these comments already at the ends of the training courses, and they also know that solving one person's problem may create difficulties for others, so participants' suggestions should be taken with caution.

What cannot be evaluated in connection with the course are the long-term effects. This evaluation shows that effects exist and that most of the participants still find the training to be useful several years after completion of the courses. One general comment, however, is that a great number have expressed the need for further contact between the course organizers and themselves. This could partly be organized through regular distribution of a newsletter administered by course organizers, to which the participants should be encouraged to contribute by sending in editorials, articles etc. Another possibility would be to develop a web-site, which provides information about ongoing and future activities, new technologies, etc. A homepage can also receive messages or questions from the former participants and therefore become a powerful tool for the course organizers themselves in marketing their services, developing their international businesses, and developing local networks in the countries where they are active.

Another way of keeping in touch would be for the course organizers to contact the former participants and their supervisors during field visits. Involvement of the trainees' supervisors who have not undergone the same training program might facilitate the process of former trainees functioning as "change agents". From the course organizers' perspective, this could also be an opportunity to investigate further training needs for future assistance.

The course organizers could also investigate whether the international training offered in Sweden can be followed up, by providing more specific training in the participants' home countries. This issue was raised in Jordan, where there are huge industries in need of energy conservation development, yet the courses in Sweden in this area were directed more toward small-scale factories. For this and other reasons, in-country training should be considered. If the training groups are too small for a course (or series of courses) to be run in one particular country, regional training programs should be considered. Another relevant theme for regional training would be the inter-connection of energy transmission networks between different countries.

Local training could also involve local participation on the teaching side, where such competence is available. Both former participants of international training programs and other local expertise should be utilized to their potential. Involvement in local training could help raise self-confidence and promote individual development, since teaching others is one of the best ways for one to gain a profound understanding of a certain subject.

Further, if such training is organized together with Swedish counterparts, the teaching methods should be similar to those used in the training in Sweden, especially in terms of dialogue and teamwork. Since those methods are not so much used in the Arab teaching cultures, it would be an important task just to convince local teachers to apply these methods in their lesson planning and teaching.

Local training programs would also be more cost-effective than to bring all the students to Sweden. This is not to say that the International Programs should end, but that local training should be added according to specific needs.

It is also possible that local training would attract a higher degree of female participation. The energy sector is a very male-dominated one, and the international training courses are offered at the most senior levels where the concentration of men is highest. However, there are female engineers in managerial positions who can not participate in the Sida-financed courses because of family reasons. Their husbands do not support the idea of their wives being away for a month or two, and many women have small children to consider. If Sida wants to promote female participation, local training could be an effective means of doing so. If a real priority is to be given women in the energy sector, a mentoring program could be established where experienced and successful

women from Egypt, Jordan, and abroad actively participate in teaching local courses. For further gender development thinking, it is recommended to contact CIDA in Cairo. They have an ambitious program set out in their Policy on Women in Development and Gender Equity.

E. Review of other projects

Beyond the three projects evaluated in detail, there have been numerous other projects supported by Sida during the period under review. These additional projects may be grouped under the categories of high voltage transmission, technical support for the hydropower sector, hydropower development (projects other than Gebel Attaqa), and energy efficiency. These activities are reviewed in this section in the same format used in the detailed assessments presented above.

Background

With the exception of the analyses of reactive power in the Egyptian transmission grid, all of the activities described here were undertaken during the first fourteen years of Sida's cooperation program with Egypt, that is, through 1991.

The high-voltage transmission studies performed by SwedPower were requested by EEA in order to address specific problems in the transmission system and to support EEA's work to upgrade it. For this reason, there were four separate contracts signed by Sida beginning in 1978 and ending with the reactive power analysis in 1995.

The technical support for the hydropower sector was undertaken in 1979, with inspections of the High Dam Power Station (HDPS) and Aswan I power station performed in the latter half of that year. In addition, another inspection was performed during the period from 1986-1988. These activities were performed by SWECO.

The hydropower development work undertaken prior to the Gebel Attaqa study spans the period from 1978 to 1991, and includes technical support for several new projects as well as rehabilitation and upgrading of existing facilities. Among the new projects are included the Aswan II feasibility study, the Esna feasibility study, the assessment of low-head hydroelectric potential in Lower Egypt, the Qattara Depression (Moghra Oasis) hydrosolar project, and the study performed in advance of the rehabilitation of the Nag Hammadi Barrage and Power Station. These activities were performed by SWECO.

Lastly, the energy efficiency work supported by Sida during 1984-1988 involved the consulting firm ÅF Energikonsult, which performed a series of feasibility studies and demonstrations at industrial facilities in conjunction with the Organization for Energy Conservation and Planning (OECF).

Relevance

As noted elsewhere in this report, Sida's KTS support to Egypt has coincided well with the long-term needs of the Egyptian electricity sector. In the period under review, the activity addressed the needs to repair and upgrading of the electric system, which by the mid-1970s was badly deteriorated and technologically outdated. Over time, the focus of the program has turned more to development of new resources, improved management of materials and labor resources, as well as training.

The activities supported by Sida mentioned in this section have established the basis for the interconnection initiative as well. Up to the mid-1970s, Egypt's high-voltage network did not include very high voltage ties. The 500 kV ties between Aswan and Cairo, which form the backbone of the system now in place, were not completed until 1986, after a decade of work, supported in part by other donors, including USAID. The expansion was complicated by the fact that the older Soviet-manufactured equipment suffered from several significant problems, including poor reliability, poor

availability of spare parts, and substantial vulnerability to sandstorms. The technical support needed by EEA included guidance for improving the excitation system, the performance of which was inadequate due to the old, Soviet-era circuitry, as well as dynamic studies of the electric system. Clearly, the improvement of the domestic grid was an essential first step before linking the Egyptian grid to that of other countries could even be contemplated. It should be noted that work on the interconnection project began in 1986, once the 500 kV system was in place.

Efforts to upgrade existing generation capacity, which was largely hydro-based given the dependence on hydroelectric generation after the construction of Aswan I and the Aswan High Dam, were also a clear priority for Egypt during the 1970s and 1980s. Given the defects discovered in the High Dam Station, furthermore, the urgency of the activities undertaken in part by Sida was even greater. The initial work performed by SWECO was complemented by support from other donors, most notably the U.S., which launched a \$140-million effort with the Egyptian government in 1982. USAID financed the foreign exchange costs for the design, manufacture, testing and commissioning of replacement hydraulic turbines, circuit breakers, relaying and control instrumentation and rehabilitation of hydraulic gates and mechanical equipment associated with the 12 hydro turbine-generators. U.S. technical assistance and technical supervision was also provided during the rehabilitation, installation, testing and start-up.

Also in the 1980s, EEA sought to evaluate the potential for additional hydroelectric generation capacity. The Sida-sponsored study executed by SWECO during the period from 1982 to 1986 helped identify generation potential at several sites in the Delta and along the Nile, including Damietta, Dayrout, Zifta, Nasiri, Rosetta, Esna, Nag Hammadi and Assuit. Several of these sites, most notably Damietta, Zifta, Nag Hammadi and Assuit are included in the current network expansion plan of the EEA. Given the limited additional capacity that these minihydroelectric projects would provide, the EEA was also keen to explore other possibilities. For this reason, the Moghra Oasis project, which would involve creating an artificial salt-water river from the Mediterranean to the Qattara Depression in northwestern Egypt and using the flow to generate power, was also considered, and SWECO performed an initial study.

There is a clear rationale for improving energy efficiency in a system such as that as Egypt's, where constraints on generation and transmission make it more effective in the short-term, and more economical, to control demand rather than adding new generation capacity or transmission lines. In the mid-1980s, peak load in the EEA system was expanding rapidly – over 12% – making it very difficult, and costly, to keep up by constructing new generation capacity. Efforts to control demand growth through energy efficiency programs offered (and continue to do so) a more effective solution to provide adequate service.

Since that time, USAID has also supported activities in the area of energy efficiency. Since 1988, the Energy Conservation and Environment Program (ECEP) has provided technical assistance and equipment to over 150 industrial and commercial facilities, and demonstrations of energy efficient technologies and process changes have been performed at over 30 facilities. An outreach program has been established to provide information to interested organizations and individuals, and specialized training has been given to over 5,000 professionals in Egypt, and 100 participants have attended training courses overseas. Most recently, ECEP has supported the formation of a business organization, the Egyptian Energy Service Business Association (EESBA). EESBA, in turn, will form part of a public-private Energy Efficiency Council, which will also include representatives of the EEA and the Federation of Egyptian Industries (FEI).

Results

By and large the results of these project activities have been favorable, although some project activities have not progressed as quickly as had been hoped, making it harder to assess the overall impact of the activities. In terms of the work products themselves, these appear to have been prepared in compliance with their respective terms of reference, and provided useful input to the EEA and other relevant agencies. Only in a couple of cases can it be said that the study performed was of little added value.

In the case of the support in the area of the national high-voltage transmission system, EEA officials have expressed satisfaction with the results of the work performed by SwedPower. Based on the limited documentation of the program available, it appears that the work was performed to a high standard, and consistent with the terms of reference established for the projects. The recommendations made by SwedPower appear to have been adopted, and in the case of one study regarding reactive power compensation, may have saved EEA from investing in a more expensive technical solution than was necessary. It was not possible to establish the extent to which the SwedPower reports were widely disseminated to other donor agencies in the case where other donors (USAID, KfW) supported projects to upgrade segments of the transmission sector.

While there does appear to be a linkage established between the support provided in this area and the training courses available to Egyptian engineers through the international training program, and the technical assistance provided by SwedPower did include training, according to SwedPower specialists, it does not appear that the project made a specific link to the training programs developed by EEA in its training centers. The EEA does have a network training center at the Cairo South TPS, which is receiving support from Canada's CIDA, while USAID has supported activities to build up high-voltage laboratory analytical capabilities to support the transmission sector.

In the end, however, the results of this activity must be considered in the context of the overall expansion plan for the transmission sector, and the substantial advances made by Egypt in this area with the support of numerous donors, not just Sweden. The fact that the EEA has made substantial improvements to its network that have enabled it to complete high-voltage interconnections with Jordan and Libya – and indeed, to contemplate a far more ambitious project of widening the interconnection to Turkey, Syria, Iraq and facilitating a grid for the entire Mediterranean Basin – suggests that Egypt has advanced significantly since the early phases of the work performed by SwedPower.

With respect to hydropower development, the most important activity was the survey of minihydro-electric potential. To date, there has been additional little development work performed, although the original study was completed in 1986. There appear to be two main reasons for the delay:

- HPPEA must coordinate its activities in this area with the Ministry of Public Works and Water Resources (MPWWR, formerly the Ministry of Irrigation), since all hydroelectric projects are tied to infrastructure projects controlled by the MPWWR. The objectives of the MPWWR and HPPEA do not always coincide. In the late 1980s and early 1990s, the activities of the MPWWR were directed more at some major rehabilitation projects, specifically the Esna Barrage renovation (completed in 1992) and a similar project at the Nag Hammadi Barrage that is now underway. In addition, the perception of MPWWR regarding hydroelectric potential may differ from that of HPPEA. For example, MPWWR considers the Minoufi Head Regulator project, which it has just awarded, an unpromising hydroelectric project, but HPPEA includes it on its development list. Given the clear potential for turf battles between the two agencies, it is likely that specific projects will take longer to develop than might otherwise be the case.

- Resources for the development process and the construction of the projects have been limited, and these projects, given their relatively small size, have not been able to compete with the far larger capacity expansions that have been undertaken in the thermal power sector.

The other significant study performed in this area, the pre-feasibility assessment for the Moghra Oasis project, has not prospered. Given the characteristics of the project as initially conceived, this does not seem surprising. The project is similar in scale to the other grandiose undertakings proposed in Egypt – the El-Salam Canal in Sinai and the Tushka Project, which will carry water from Lake Nasser to the oases of the New Valley in the Western Desert – but apparently without the collateral benefits of creating new agricultural potential in the country, since a saltwater lake would be created in the Qattara Depression. Indeed, the environmental impacts of creating an inland salt sea could be both negative (groundwater contamination at the Siwa Oasis settlement, higher salt content in dust in the region) as well as positive (higher moisture levels in the region). If the objective was to identify other economically viable energy resources in Egypt (given the high oil prices of the time), attention should probably have gone to consideration other renewable energy resources (wind and solar), before considering a project where clearly the civil construction and equipment costs involved would be substantial – the project would involve construction of the artificial river and use of equipment able to tolerate saltwater. This study is perhaps the only project of all the activities supported by Sida where a critical appraisal of the proposed study might have prevented the waste of resources that might have been better spent elsewhere.

In the case of the work performed to provide technical support to the hydropower sector, the two studies performed by SWECO, at the Aswan I HPS and the High Dam HPS, provided useful input regarding the technical condition of these two facilities.⁶ While it is true that Sida cannot take credit for all of the long-term results of cooperation in this area, since other donors have also been active, the information provided was doubtless of significant utility to the EEA and the other donors that supported the rehabilitation of the two power plants.

In FY 1982, the government of Egypt and USAID initiated a \$140 million project to improve the reliability and efficiency of the High Dam HPS at Aswan. USAID financed the foreign exchange costs for the design, manufacture, testing and commissioning of replacement hydraulic turbines, circuit breakers, relaying and control instrumentation and rehabilitation of hydraulic gates and mechanical equipment associated with the 12 hydro turbine-generators. U.S. technical assistance and technical supervision was also provided during the rehabilitation, installation, testing and start-up. The Sida evaluation team was unable to confirm with USAID officials whether the results of the High Dam turbine study were considered by the U.S.-financed engineering team. Ultimately, it would be at the discretion of the EEA to provide the results of the study to the USAID contractors or not.

It is useful to note that the design flaws identified by SWECO do not appear to have been remedied by the overhaul supported by USAID. During the visit of the Sida review team to High Dam HPS, the engineers on duty at the facility reported that renewed cracking problems have been detected and that a team from EEA was due to visit the plant to review the situation.

Lastly, in the area of energy efficiency, it was difficult to assess the actual benefits of the program without making visits to the industrial firms where the energy audits were performed. From the

⁶ See SWECO, "Report on turbine study for SEA (for *el-Sadd el-Ali*, or High Dam) plant, performed during September to December, 1979," March 26, 1980; and SWECO, "Report on turbine study for Aswan I power station performed during the period 25-27 September, 1979," March 26, 1980.

perspective of the Organization for Energy Conservation and Planning (OECF), the counterpart agency for the studies and technical assistance provided by ÅF Energikonsult with Sida financing, however, the project successfully brought the issue of energy efficiency to the attention of industrial managers. However, it is important to ask why this activity did not continue, as there has been substantial activity on the part of other donors since the mid-1980s in this area (USAID, JICA, Spain, and the European Union, to name just a few).

Without the benefit of a meeting with ÅF Energikonsult, which was not possible, it may be that the OECF itself did not prove to be institutionally the most effective counterpart for supporting energy efficiency activities in Egypt. OECF is a quasi-governmental agency, and has been most effective in providing up-to-date data on energy usage in Egypt, but is not necessarily an organization with which the private sector will prefer to work. USAID has concluded that this is the case, and, through its ECEP program, has adopted an approach directed more at creating the technical and institutional resources within the private sector to make it possible for industries to develop projects on their own or with the support of specialized firms in Egypt. In a sense, Sida has concluded the same thing, as its continued involvement in energy efficiency in Egypt is through the international training program; the course on energy efficiency in the sugar industry has been the most popular course offered, attracting almost half of the Egyptian participants in the program since 1990.

The other aspect of the energy efficiency problem, which ECEP has begun to address, is that of financing. This issue requires working with the financial intermediaries in Egypt, and the sources of the necessary financial resources from international financial institutions. It is important to note that the International Finance Corporation (IFC), working with grant funds from the Global Environment Facility (GEF), has begun attacking the problem of financing for energy efficiency in Egypt.

Efficiency

Given the limitations of this review, it was not possible to assess the cost-efficiency of the technical assistance services provided by SwedPower, SWECO, and ÅF Energikonsult under the KTS agreements reviewed in this section.

Leverage

Little or no information was available on the Egyptian counterpart outlays associated with the projects reviewed in this section, and hence it is not possible to assess the extent to which Sida's involvement stimulated in-country resources to be spent on these projects.

Sustainability

The criteria for sustainability applied elsewhere in this report include the degree of Egypt's commitment to the results of the technical cooperation support provided, the degree to which Egyptian specialists have assimilated the results and technical expertise involved, the presence of financial resources to support the continuation of the projects that were supported, and consistency with the program objectives of other donors active in Egypt. On most of these counts, the results of the programs reviewed in this section exhibit a high degree of sustainability.

In the case of support for the high-voltage transmission sector, it is clear that the progress made by Egypt in expanding and upgrading its system, together with the substantial commitment involved in developing an interconnection with Jordan and other countries in the region, create a situation where continued investment and development of the system is essential. The results of Sida's cooperation here are necessarily sustainable, from the perspective of EEA's commitment to allocated resources to the transmission sector.

Perhaps a more important point, however, regards the extent to which this support has enriched the network training programs that EEA runs at the Cairo South TPS (with support from Canada's

CIDA). Here, it seems that sustainability might have been improved by linking the training provided by SwedPower for the engineers with the training provided at the Cairo South Training Center.

In the case of technical support for the hydropower sector, it should also be apparent that Egypt's commitment to developing and upgrading its capabilities in the hydropower area was manifested in the effort that went into creating and building up the Aswan Hydropower Training Center (AHTC), described in greater detail in a separate chapter. The support provided to EEA predated the creation of the AHTC, so it is not appropriate to suggest that more focus on training in the sort of diagnostic work provided by SWECO could have been provided.

As for the development of hydropower resources in Egypt, the sustainability of hydropower development is necessarily limited in any country, and in the case of Egypt, it is likely that there is little room for major new developments in the hydropower sector. Given the total concentration of Egypt's hydraulic resources in the Nile and the relatively gentle topography of the Nile Valley, Egypt does not have many other hydropower projects to develop beyond the Assuit project and the minihydroelectric plants considered by SWECO in its survey. Once these are built, during the next decade or two, there will be no other conventional hydroelectric projects to consider. This leaves, of course, the possibility of pumped storage facilities, such as Gebel Attaqa, and perhaps others, but numerous other considerations will enter into the calculation as to whether these are feasible. These issues would include the availability of capital (private or otherwise) for such ventures, which is the issue at Gebel Attaqa, the availability of water, and the changing economics of energy generation technologies, especially those (such as wind and solar energy) that will compete with hydropower in the future as Egypt's fossil energy resources are depleted.

Lastly, although Sida's program support for energy efficiency technical cooperation has not continued, its support for energy efficiency in general has continued. The issue area will continue to be a major focus of attention in the future, but it is unclear whether the current mix of training and support for the formation of organizations to promote energy efficiency that is being provided by a range of international donors will be successful in truly transforming the Egyptian market for energy efficiency technologies and services. Among other considerations that will require more attention in the future is the issue of resources, how to reduce the perceived risk associated with financing energy efficiency projects executed on a performance contracting basis, and how to give clients greater confidence in the services that specialized companies provide.

Impact

It is difficult to gauge the impact of Sida's programs in the areas reviewed in this section. Most important, the presence of other technical assistance programs in Egypt that have financed major projects in many of the same areas as have been supported by Sida, makes it difficult to measure in qualitative or quantitative terms the direct impact of the Sida program. At the same time, however, the Sida-supported activities cannot be dismissed as not having had an impact or being irrelevant to Egypt's development objectives.

Based on the discussion provided above, it would seem that the support provided by Sida in the area of high-voltage transmission, hydropower resource development, and technical support for hydropower operations have had the greatest impact. Their impact, measured in terms of a useful contribution to the development of Egypt's electric sector, has been substantial. While the fact that key officials at EEA have expressed this might be expected, the fact that project identification and development activities initially supported by Sida have later been executed, albeit by other donors or the EEA itself, suggests that Sida's support helped projects come to fruition. Given Sida's limited resources, this is a favorable outcome.

If it is possible to suggest ways for the impact of these activities to be enhanced, these might include greater attention to the linkages between different areas of Sida's KTS activities in Egypt. The main linkage for the transmission and hydropower operations areas would be in the area of training, especially training provided by the EEA and Distribution Company training centers around the country. In the area of hydropower development, the focus of EEA on private financing of new capacity increases the importance of creating a favorable policy and regulatory environment for hydroelectric projects to be contracted, financed, and operated. This is clearly an area where Sida would not be alone in supporting activity, but with adequate coordination of activities, it might be possible for Sida to play a constructive role in the future.

Gender issues

It was not possible to assess the impact of these programs on opportunities for women in the various fields involved. It does seem unlikely that there was much impact, however slight.

Lessons learned and recommendations

The most important lesson that may be gleaned from the diverse experience of Sida in the areas described in this section is that the support provided has fit well with the needs of Egypt's energy sector, on the one hand, and with the technical capabilities of the providers of technical cooperation, on the other. In the future, Sida's efforts in this sector in Egypt must be based on a prior assessment of needs and identification of niche activities – such as support for hydropower development or diagnostic work for the high-voltage transmission sector – and matching these to Swedish capabilities.

For Swedish technical cooperation to have a long-term impact and relevance to Egypt, and for it to generate business for Swedish manufacturers and service providers in the future, Sida's strategy of mixing technical cooperation with support for training in Sweden should be continued and indeed deepened, perhaps through support for more in-country training.

Given the mix of other donor activities currently underway in Egypt, it would be desirable for Sida to continue to focus on hydropower development activities, perhaps in conjunction with greater attention to the financial engineering for mini-hydroelectric projects, since EEA does not have, and will not have in the future, the resources to undertake such projects itself. Given this reality, and the ongoing restructuring of the sector, it makes sense for Sida's activities in this area to include greater support for private sector development of mini-hydroelectric facilities.

4. Lessons learned and recommendations

This section reviews the salient lessons learned in the review of Sida's Egypt program, and offers some recommendations.

Lessons learned

Gebel Attaqa Pumped Storage

Donor coordination

Donor coordination is desirable, but it must be undertaken in such a way as to ensure that all the relevant information is obtained, so as to ensure that the most appropriate action is taken. In the case of Gebel Attaqa, had Sida been better aware of the earlier work done on pumped storage in Egypt, the terms of reference for the project may have ensured that a more complete financial assessment was prepared, facilitating the decision-making process for EEA as well as Sida.

Aswan Hydro Power Training Center

Time delays and project approach

During the Aswan Training Center Project, the role of the consultant was sometimes discussed and it is not difficult to understand if the consultant was frustrated because of the delays. The process-oriented approach was adhered to, however, and we can see today that the feasibility of the project is very good, although it seems to need a bit more time for further development of its efficiency, and to start producing measurable results.

Efficiency and Impact

Today the Training Center has got the nearly impossible task to raise the standards of power-station operations and improve the efficiency of the production and transmission systems, through training alone. It has to be accepted that the Training Center only can contribute to solve training problems, and even then, only if there is a willingness to change attitudes and behavior. Organizational problems have to be addressed with other solutions, and management problems can only partly be solved by training.

Gender Issues

Another lesson is that gender issues have been entirely neglected both during the project and since its completion. It is not expected that the management of the training center feels the same way, since there is both a toilet and shower in every bedroom of the student's accommodation building.

The problem, though, is that women never have been accommodated there, although the building has been in operation during three and a half years. It is well known that Aswan belongs to one of the most traditional zones in Egypt when it comes to gender issues. It is proposed that measures are taken for facilitating for women living outside the Aswan area, to participate in all courses that might be of relevance for their professional needs.

Amplissima

Donor coordination

The program has enjoyed the support of two other donor agencies, and coordination of activities has yielded good results. This program provides an example of how different donor agencies can select specific activities to complement those of others working in the same sector.

Utility of KTS

The value of Amplissima to EEA could have been enhanced by more effective treatment of the nomenclature standardization issue, as well as more complete Arabization. Programs that encourage stronger alliances to support the development of Arabized software for specialized applications such as those served by Amplissima could yield even better results – and generate greater business opportunities for Swedish firms hired by Sida. These alliances will help create the solid local vendor support that is important to the success of the program.

Linkage to training

More effective integration of technical assistance with existing training capabilities at the EEA's training centers may have been overlooked; training in Sweden is effective, but it tends to be limited to a small number of individuals who will have a hard time keeping up with training needs in the host country.

International training programs

Problems in tracing the former course participants

The first lesson learned was that it turned out to be very difficult to trace the former course participants. The main reasons were the following: some people had changed job and sometimes moved to other countries, especially from Jordan to the Gulf States. Some had given telephone numbers to the central switchboards of their respective organizations, while they in fact were working somewhere else, sometimes in other towns. The telecoms network had been digitalized in some areas so that new digits had to be found and added to some phone numbers.

Training Effects

This evaluation shows that long-term training effects exist and that most of the participants still find the training to be useful several years after completion of the courses.

Need for further contact

A great number of the former participants have expressed the need for further contact between the course organizers and themselves. This could partly be organized through regular distribution of a newsletter administered by course organizers. Another way of keeping in touch would be for the course organizers to contact the former participants and their supervisors during field visits.

Gender Equity

It is also possible that local training would attract a higher degree of female participation. Female engineers in managerial positions find it difficult to participate in the Sida-financed courses because of family reasons. Their husbands often do not support the idea of their wives being away for a month or two, and many women have small children to consider.

Recommendations

General

The recommendations presented under the heading of each project reviewed imply the need for more effective coverage of Egypt by Sida by someone stationed full-time in Cairo, whose assignment would be to develop a comprehensive strategy for the country, be familiar with other donor programs, and provide more timely follow-through in the execution of program activities from Sida's side. This individual could also cover other countries in the region.

Gebel Attaqa Pumped Storage Plant

A comprehensive financial evaluation of the project as presented in the technical feasibility study should be executed, with a risk assessment of the project, and an evaluation of the suitability of

BOOT and other project financing and contracting mechanisms for this pumped storage project. The financial study should probably be done by an organization that does not necessarily have a stake in the continued development of the project.

Aswan Hydropower Training Center

It is necessary to stop focusing on the training center alone. It is necessary to start thinking about what the role of AHTC really is, and find the other stakeholders who must be held accountable for their shares of the problems. To carry out this task, the top-management of the South Upper Egypt Electricity Company, may need a neutral interlocutor development of a policy and plan focusing on management of change.

In the short-term, there are also some options that would not require any technical assistance. The following are some examples of immediate tasks for the AHTC management:

- Seek ways to measure positive effects of the training provided at AHTC. Perhaps there are positive changes, which might not have been detected because of limited validity and/or reliability in the means of measurement. It is recommended that performance indicators be developed which are directly related to the training programs. Focus should be not only on the job itself but also on its impact on related areas.
- Systematically follow up all training by unannounced field visits to check on whether actual job performance corresponds to what was taught during the training program. This would also be an opportunity to discover new training needs and get input for revision of existing courses.
- Make study visits and try to learn from other training centers' experiences, e.g. the GTZ-supported Abu Sultan in the Canal Zone and the Canadian-supported Network Training Center in Cairo South.

Amplissima

Sida should continue to support the Amplissima program, and should place special emphasis on ensuring that the training centers operated by EEA incorporate the program into their regular computer and information systems curricula.

Sida should also consider how to encourage contractors for information systems projects to seek more effective local representation in-country, so as to ensure better follow-up and to encourage the emergence of local capabilities and development of adaptations tailored to the needs of in-country clients.

International training programs

Gender issues

If a real priority is to be given women in the energy sector, a mentoring program could be established where experienced and successful women from Egypt, Jordan, and abroad actively participate in teaching local courses. For further gender development thinking, it is recommended to contact CIDA in Cairo. They have an ambitious program set out in their Policy on Women in Development and Gender Equity.

Local training programs

The course organizers could also investigate whether the international training offered in Sweden can be followed up, by providing more specific training in the participants' home countries. Local training could also involve local participation on the teaching side, where such competence is available.

Keep in touch with former course participants

From the former course participants' point of view, there is need for further contacts with the course organizers after the end of the course. This could partly be organized through regular distribution of a newsletter administered by the course organizers, to which the participants should be encouraged to contribute by sending in editorials, articles etc. Another possibility could be to develop a web-site, which provides information about ongoing and future activities, new technologies, etc. A homepage can also receive messages or questions from former participants and therefore become a powerful tool for the course organizers themselves in marketing their services, developing their international businesses, and developing local networks in the countries where they are active.

Appendix 1: List of interviews in Egypt

Ministry of Electricity and Energy (MEE)

Maher Abaza, Minister of Energy (April 22)

Hydroelectric Power Projects Executive Authority (HPPEA)

Sherif Abulnasr, Chairman, HPPEA (April 19, April 29)

Ahmed el-Marakby, Vice Chairman, HPPEA (April 18)

Mohamed el-Gazzar, Managing Director for Studies and Research (April 18)

Ramadan A.M. Basha, Senior Hydraulic Engineer (April 18)

Ahmed Abulfadl, Advisor (April 20)

Naguib Rizk, Advisor (April 21)

Ibrahim Ahlami, Senior Geologist (April 18-19)

Egyptian Electricity Authority (EEA)

Cairo Headquarters

Dr. Mustafa Sweidan, Chairman (April 22)

Dr. Ibrahim Yassin, Managing Director for Studies, Research and Development (April 22)

Mrs. Mervat Abboud, Leader of Amplissima Team – EEA Headquarters (April 20)

Dr. Mohammed Awad, Vice Chairman for Research and Planning (April 28)

Dr. Amal El-Khashab, Advisor – Office of Research and Planning (April 28)

Dr. Hassan Yunis, Vice Chairman for Operations (April 29)

Dr. Zeinab Abdel-Azim, Vice Chairman for Human Resources (April 22)

Dr. Bassiony M. El-Baradie, Human Resource Consultant (April 22)

Gamal L. Tawfik, Director General Training Department (April 22)

Eman Tawfik Kamel, Training Department (April 22)

South Upper Egypt Electricity Company

Hamdy El-Shafei, Chairman

Safwat Bassanti, Director of Aswan I and Aswan II

Aswan Hydropower Training Center

Ahmed el-Fattah Badawi, Director General (April 24)

Ezzat Halim Abadir, Deputy Director (April 24)

Aswan High Dam

Ibrahim Ebeid Awad, Director of Computer Engineering Division (April 25)

Ala'a ad-Din Ali Mohammed Saqr, Engineer in Charge of Shift (April 25)

Aswan I Power Station

Kamil Raghib Hakim, Head of Instrumentation and Controls Division (April 25)

Aswan II Power Station

Badri Madbouli Hamada, Director General – Electrical (April 25)

Attaqa Thermal Power Station

Deya'a el-Din Yusuf, Manager, Attaqa Thermal Power Station, Suez (April 18)

Organization for Energy Conservation and Planning (OECP)

Dr. Hani A. Alnakeeb, General Director and Acting Chairman (April 26)

Ministry of Public Works and Water Resources

Nabil Fawzy Nashed, Head of Reservoirs and Grand Barrages Sector (April 29)

Anan Abdullah, Director for the El-Salam Canal Project (April 29)

Government of Sweden

Christer Sylvén, Ambassador (April 21)

Jan Thessleff, Counselor, Embassy of Sweden (April 21)

Ragia Rezk, Social & Cultural Relations Assistant (April 21)

U.S. Agency for International Development (USAID)

Raouf Youssef, Chief, Power and Telecommunications Division (April 21, April 26)

UKDFID/SEAM

Philip Jago, SEAM Project Manager (April 21)

Government of Austria

Christian H. Schierer, Commercial Attaché (April 27)

Government of Denmark

Elo Christer Olsen, Counsellor – Development (April 28)

Government of Germany

Dr. Stefan Glock, Director – German Financial Cooperation (KfW) (April 28)

Dr. Friedrich Sauermann, Director – El Fayed Training Center, Ismailiyya (April 28)

Government of Japan

Kengo Yamamura, First Secretary (April 29)

Government of Holland

Dr. Tarek A. Murad, Senior Program Officer, Development Cooperation Section (April 29)

Government of Canada

Ms. Manal Guindy, Canadian Embassy, Development Coordinator (April 29)

European Community

Suresh Bir, Director – Industrial Modernization Project (April 28)

Stefan Zens, Counsellor (April 28)

Noha El Sayed, Manager – European Information Correspondence Center (April 27)

SWECO International

Magda Houta (April 28)

Asea Brown Boveri SAE

Åke Finn, Vice President (April 28)

ARA/Ontario Hydro, Toronto, (CIDA Specialized Institutional Support Project)

J.W. (Wayne) McComb, Project Manager, Project Manager (April 29)

Daryl Capson, Protection Specialist (April 29)

Neil Jessup, Substation Specialist (April 29)

Appendix 2: List of documents

1.1 General

1984-03-12: Agenda for meeting with H.E. Mrs Birgitta Dahl, Minister of Energy in Sweden

CIDA, 1995: CIDA's Policy on Women in Development and Gender Equity

CIDA, 1998-05: Egypt – Program Overview & List of Projects

Federal Republic of Germany, 1996: Development Cooperation. Arab Republic of Egypt - Federal Republic of Germany

Ministry of Electricity & Energy, and Swedish Government, 1997-06: Technical Cooperation between Ministry of Electricity & Energy and Swedish Government

Ministry of Foreign Affairs, DANIDA, 1996-04: Egypt – Strategy for Danish – Egypt Development Cooperation

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BITS, 1990-08-09: Direktörsbeslut att bevilja högst 2 120 000 för utbildning av instruktörer vid utbildningscentret i Assuan.

British Council: 1983-10-03: Egyptian Electricity Authority. Manpower and Training Plan 1984-1987

EEA, 1985-11: Development of Hydropower Training Centre in Upper Egypt Zone. Terms of Reference for Feasibility Study

EEA, 1997/98: Training Directory

EEA/SwedPower, 1984-10: Development of Hydropower Training Centre in Upper Egypt Zone. Pre-feasibility Study

EEA/SwedPower, 1987-10: Aswan Hydro Power Training Centre. (Final Report - Feasibility Study)

EEA/SwedPower, 1989-03: Addendum No. 1 to the Agreement "Feasibility Study for a Hydro Power Training Centre in Upper Egypt Zone at Aswan".

EEA/SwedPower, 1989-09: Aswan Hydro Power Training Centre. Staff Training in Sweden.

14 August - 22 September 1989. Final Report

EEA/SwedPower, 1990-08: Addendum No. 2 to the Agreement "Feasibility Study for a Hydro Power Training Centre in Upper Egypt Zone at Aswan"

EEA/SwedPower, 1990-11-17: Training Seminar for Senior Management

EEA/ SwedPower, 1991-03: Addendum No. 2 to the Agreement "Feasibility Study for a Hydro Power Training Centre in Upper Egypt Zone at Aswan

EEA/SwedPower, 1991-09: Aswan Hydro Power Training Centre.

Instructor Training in Sweden 13 May - 5 July 1991

EEA/SwedPower, 1992-10-19: Addendum No. 3 to the Agreement "Feasibility Study for a Hydro Power Training Centre in Upper Egypt Zone at Aswan.

EEA/SwedPower, 1993-01: Aswan Training Centre Project. Progress Report No.1.
19 October 1992 - 31 January 1993

EEA/SwedPower, 1993-02: Aswan Training Centre Project. Review Report, Phase 1,
October 30, 1992 to January 31, 1993.

EEA/SwedPower, 1993-12-15: Aswan Training Centre Project. Review Report No. 2A

EEA/SwedPower, 1994-03-15: Aswan Training Centre Project. Review Report No. 2B

EEA/SwedPower, 1994-12: Aswan Training Centre Project. Review Report No. 3

EEA/SwedPower, 1996-06: Aswan Training Centre Project (ATCP). Final Report

EEA/SwedPower, 1974 - 1999: ATC Syllabi, In-service courses

ESB International, 1990-04: Manpower and Training Management Study. Ireland

SwedPower, Letter, 1984-02-06: Förstudie vattenkraftutbildning Assuan - Egypten.

SwedPower, 1990-01-23: Reserapport - Aswan Power Training Centre

SwedPower 1990-11-26: Reserapport - Aswan Hydro Power Training Centre

Vattenfall AB/Jokkmokkskolan & SwedPower 1992: Project agreement mellan

Vattenfall AB/Jokkmokkskolan och SwedPower angående Konsultinsatser för Aswan Hydro Power Training Centre, EEA, Egypten

Vattenfall AB/Jokkmokkskolan & SwedPower AB, 1996-05-13: Aswan Hydro Power Training Centre - Kompletteringsavtal Nr. 3

1.3 CMMMS-Systems – Swedpower

BITS, 1990-10-17: Direktörsbeslut, Egypten: Datoriserat underhållssystem

BITS, 1992-11-06: Technical Cooperation with Sweden through BITS. Ref: Computerized Material and Maintenance System for Power Plants

BITS, 1992-11-18: Generaldirektörsbeslut. Datoriserat underhållssystem - utbildning och teknisk assistans vid installation

BITS, Letter, 1992-12-21: Egypten: Tilläggsinsats Attaka kraftstation, datoriserat underhållssystem

BITS, Letter, 1992-12-21: Computerized Maintenance System at Attaka Power Station-supplement assistance

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EEA, Letter 1992-05-11: Request for Swedish financing

EEA/SwedPower, 1990-12: Supply and Installation of Amplissima. A Computerized Maintenance Management System. Proposal

EEA/SwedPower, 1991-03: Contract for Supply and Installation of Amplissima, a Computerized Maintenance Management System

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Ministry of Electricity & Energy, Letter, 1992-05-12: Request for Swedish financing

Ministry of International Cooperation. Letter, 1990-02-22: Request for financing Computerized Maintenance Management System

SwedPower, 1990-07-11: Amplissima Maintenance Management System. Attaka Power Station

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Qattara Authority/SWECO 1979-01: Aswan II Feasibility Study. Final Report Volume 1

Quattara Project Authority/SWECO, 1980-11-18: Agreement for Design and Supervision of Construction, Manufacture and Erection of Works for Aswan II Power Plant

SWECO, 1980-03-26: Report on Turbine Study for Aswan I Power Station

SWECO, 1980-03-26: Report on Trubine Study for Sad el Ali (SEA) Plant

1.6.2 Qattara

Qattara Hydro and Renewable Energy Projects Authority/SWECO, 1983-12: Moghra Hydrosolar Power Project. Final Report. Volume 1

Qattara Hydro and Renewable Energy Projects Authority/SWECO, 1983-12: Moghra Hydrosolar Power Project. Final Report Volume 2. Drawings. Plates and Appendices to Chapter 3

1.6.3 Mini Power Plant, Min. of Irrigation

Ministry of Irrigation Reservoirs and Grand Barrages Sector/SWECO 1981-12-23: Agreement on Engineering Study for Mini Power Installation in Egypt

Ministry of Irrigation Reservoirs and Grand Barrages Sector/SWECO, 1986-01: Water Power of the Nile. Mini Power Installations in Egypt. Engineering Study. Final Report. Volume 1. Main Report

1.6.4 Nag Hammadi Mini Power Plant

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HPPEA/SWECO, 1992-10: Nag Hammadi Mini Power Plant Hydroelectric Power Station.

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1.6.5 ESNA

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Appendix 3: Donor Country Activities in Egypt

This section reviews information available regarding the programs of other donors active in Egypt for projects in the energy sector. Given limited time in Egypt and scheduling problems, it is not an exhaustive survey of all programs being implemented in Egypt at the present time, but does provide some information regarding the potential for SIDA coordination with other donors in Egypt.

Background

Egypt is one of the largest recipients of foreign assistance and technical cooperation in the world. Foreign assistance has totaled some \$1.8 billion per year in recent years, although projections suggest that this figure will diminish in the years ahead. At present, the largest foreign donor is the United States, followed by the Arab world (principally countries in the Persian Gulf region) and European Community (EC). In the future, it is expected that the EC will become the largest donor of foreign assistance in Egypt. In comparison, Swedish technical assistance is very small, accounting for about one percent of the total with some \$400,000 per year on average over the period from 1978 to 1999.

The overall amounts of foreign assistance increased initially in the late 1970s after the signing of the Camp David accords with Israel, led by U.S. assistance. Amounts increased again in the aftermath of the Persian Gulf conflict in 1991, as major donor countries moved to forgive some 50 percent of debt incurred with donor countries.

Assistance and technical cooperation has ranged across the entire spectrum of economic and social sectors, as well as military assistance. While the energy sector, and specifically the electricity sector, has been a major area of activity for many donors, Sweden's program activities have had a significant impact. The following section highlights cooperation activities undertaken by key donor countries, and attempts to illustrate how SIDA's activities have been complementary to them, where appropriate.

United States – U.S. Agency for International Development

The USAID energy sector program has allocated some \$1.6 billion in spending on infrastructure, training and policy development in Egypt since 1975. The infrastructure component of the program is now being phased out, with another two years to go on a \$200-million program in four key areas (program closure is scheduled for September, 2001). The program areas include human resources and workforce training, financial viability of the company, improved regulatory environment, and enhanced efficiency.

The major program areas may be summarized as follows:

- *Power Sector Support*, begun FY 1989 (\$461 million). This USAID program provided substantial capital infrastructure support as an incentive to the EEA to adopt sector policy changes to encourage rational investment and consumption decisions. The main policy objective supported by the program was an initiative to reduce subsidies for electricity. The average consumer price of electricity increased from 19 percent to 80 percent of its economic price between 1989 and 1994, but has been no increase in pricing since 1994. USAID assistance included grants for major construction, rehabilitation and/or modernization at the Aswan High Dam Hydro Power Station (HPS), Shoubra El Kheima Thermal Power Station (TPS), Cairo South TPS, Cairo West TPS, Hurghada TPS, El Kureimat TPS, expansion of the National Energy Control Center's microwave communication system, and regional control centers for the Alexandria and Cairo zones.

- *Alexandria Electrical Network Modernization*, begun FY 1989 (\$50 million). The program provides for the rehabilitation of selected areas of Alexandria's electrical distribution network and the construction of a modern Regional Control Center in Alexandria. The Regional Control Center has been constructed and an extensive communication network established linking the Center to more than 50 power stations and substations in the Alexandria area and along the north coast to collect and present operating performance data on the network and substations. This project is providing enhanced electric service to the nearly 1.1 million customers in the Alexandria governorate and an estimated 100,000 customers living along the north coast of Egypt between Alexandria and Marsa Matrouh.
- *Power Sector Support II*, begun FY 1994, (\$200 Million planned). USAID assistance is being provided to the EEA to improve its planning and efficiency, strengthen its financial viability, increase its autonomy, and promote regulatory reform in the sector. This policy-based reform program will accelerate and enhance EEA's transformation into an autonomous utility capable of operating on a commercially sound, self-sustaining basis. Reform targets were approved by USAID, the EEA, the Ministry of Electricity and Energy, and the Ministry of Economy and International Cooperation on May 19, 1995.

To date, USAID officials argue that the initiatives in these areas have helped Egypt's electricity sector make changes that have helped bring it to its current stage of development. This has been done by keying continued disbursements of assistance in the sector to concrete policy, administrative, and operational criteria. According to USAID, these criteria have largely been met, although there are some areas where Egypt has not achieved the goals established with USAID. The changes that have been made, however, have begun to yield promising results, both in terms of attracting investment to Egypt's private power sector as well as in terms of improved performance. However, work on a small number of issues will continue. In recent communications with the EEA, USAID has identified ongoing activities in these key areas that are required to complete the work of the program.

For the next two years USAID has identified activities that include several under the heading of "high priority programs for immediate action," "high-priority activities for long-term implementation," and "medium-priority actions." Each category is reviewed in turn:

- *High-priority programs for immediate action.* These include: further work on the analysis of options for the creation of a power pool in Egypt (8 months, \$300,000); strengthening system planning at the EEA (6 man-months, \$300,000); support for implementation of a modified financial planning system (2 man-months, \$200,000); performance of an information systems assessment and development of an IS implementation program (\$2.5 million over a three-month initial period and a 15-month implementation phase); a legal regulatory review (1.5 months, \$100,000); a business planning exercise to develop a high-level and department strategy documents (18.5 man-months, \$600,000); development of a cash-management program (5 man-months, \$200,000); and development of a debt management program (8 man-months, \$500,000).
- *High-priority programs for long-term implementation.* These activities would have to have been started by March 1999 in order to be able to complete them before September, 1999. The activities include two areas relevant to the program supported by SIDA involving deployment of the Amplissima computer program: support for diagnostic evaluations and new investment to optimize preventive maintenance by EEA (42 man-months, \$400,000 and \$2 million in equipment, hardware and software); and a pilot project to demonstrate optimization of inventory controls at one of the seven electric companies (58 man-months, \$3.5 million, including \$225,000 in local

services and \$1 million in equipment, software and purchases. A USAID program document notes that “this activity also requires the close coordination with SIDA for the implementation of the Windows-based version of Amplissima at the selected electric company.”

- *Medium-priority activities.* These include some areas where SIDA has been active in the past, especially in the training area: executive development; advisory work for the boards of directors of the seven new companies; regulatory advisory assistance; customer relations; organizational development; and support for restructuring activities and legal compliance at the new companies.

Denmark – Danida

Egypt has been a program country for Danida since 1989. Danida has focused its activities in three areas, including the environment (pollution prevention), the development of renewable energy resources, and water supply and sanitation in Upper Egypt. Egypt is the richest of the twenty nations in Denmark’s program, with Danida’s interest in continuing with Egypt reflecting the desire to support stability in a country crucial to stability and peace in the region.

Danida’s focus on renewable energy, especially wind power, has included technical assistance in the past, but this seems less likely to continue, with greater emphasis going to the provision of soft credits for the construction of wind power facilities along the Red Sea coast. This activity reflects Danida’s assessment that Denmark’s resources in the renewable energy field are substantial, and that other donor activity has not been so substantial, at least in the past. Also in the energy area, Danida has supported the construction of a regional control center in the Canal Zone, one of several built around the country to enhance operation of the distribution network in the country. According to Danida officials, the center will contribute to reductions in energy losses in distribution, and hence save energy and produce environmental benefits. This project also included a training component, and is expected to be completed this year. Several regional centers are being built, with support from other major donors, including USAID.

Danida officials argue that there has been relatively little donor coordination in the energy sector, despite interest in such consultation and efforts in this direction by UNDP.

In the future, Danida will continue to work in the major areas it has established, with the possible addition of the health sector. During the period from 1998 to 2003, energy-related projects make up the bulk of disbursements, with 43 percent, followed by water, with 14 percent, and the environment, with 18 percent. Debt relief will account for 10 percent, and local grants 4 percent, with health, industry and other programs accounting for another 11 percent.

In the period from 1990 to 1994, total disbursements by Danida were over \$114 million dollars, an annual average of about \$23 billion. Budgeted spending for the period 1998 to 2003 is expected to average about \$28 million annually.

Netherlands – Neda

Development assistance to Egypt of the Netherlands has not focused on the energy sector, but it has touched on another relevant area, that of water resource management, irrigation and drainage, with a special focus on the region of Fayyoun Governorate south of Cairo. The drainage and water management program accounted for about 26% of total bilateral assistance during the 1991-1996 period, the largest program area after debt relief. Total assistance averaged just under \$40 million a year during that period.

Water management in the Fayyom is relevant to the energy sector, as the region is one where small-scale hydroelectric potential has been the focus of special attention by the HPPEA, specifically the El-Azab and El-Lahoun plants. Importantly, the governorate requested support from Neda for an assessment of hydroelectric potential, and the request was turned down. It appears that the hydropower resources assessment prepared by SWECO did not address the Fayyom area in much detail, most likely because work had already proceeded on the generation stations in the region.

Neda has also supported some limited solar photovoltaic and wind-energy projects under the heading of support for infrastructure and transportation. The photovoltaic project was funded during the 1981-1985 and 1986-1990 budget cycles, while the wind/diesel generators project received some \$800,000 in support over the 1990-1996 cycle. Given the limited size of the programs, they were not reviewed in the detailed evaluation prepared for Neda in 1998.

Germany – Kreditanstalt für Wiederaufbau (KfW) and Gesellschaft für Technische Zusammenarbeit (GTZ)

GTZ

The German Agency for Technical Cooperation (GTZ) is separated institutionally from the Financial Cooperation, which is administered by the German Bank for Reconstruction (KfW). GTZ was established in 1974 as a limited company under German law; its sole shareholder is the Federal Republic of Germany. As GTZ is a non-profit enterprise, any surplus generated is used for GTZ-financed projects in partner countries.

The GTZ's Cairo office was established in 1981 and the following areas have been given highest priority:

- Sustainable use and conservation of agricultural resources;
- Human resource development;
- Improvement of living conditions in urban areas.

As can be seen the energy sector is not considered to be one of the main problem areas in Egypt, but there is an energy project under human resource development, namely Training of Power Station Personnel in Cairo North (Ismailia/Fayed and Abu Sultan). This project started in June 1989 and the contribution until December 1998 had been about 290 man-months of expatriate technical assistance and about 226 man-months of locally employed experts and administration staff. The project has also included training equipment and material, workshops in Cairo North and Fayed, and vehicles.

The project objective is to introduce and adapt a modern and comprehensive dual oriented vocational training system for power plant maintenance staff at the Fayed Training Center and the Abu Sultan Power Plant. The method of training is based on vocational training used in Germany, where there are close links between theoretical and practical instruction, directed to today's requirements of the power industry. Specialization and proficiency courses are being developed and introduced in the fields of advanced power plant technology, operation, and maintenance. Fayed Training Center co-operates closely with the Technical Secondary School at Fayed, which is under the umbrella of the Ministry of Education.

To meet the need for highly skilled mechanics and electricians for power plant maintenance, young trainees who have finished preparatory school, undertake three years of vocational training, in which practical workshop instruction and on-the-job training at the Abu Sultan Power Plant play important roles.

It is not difficult to see the similarity between this approach and the suggested one in the feasibility study by EEA/SwedPower, made in October 1987. The difference is that the German project succeeded to implement this strategy, while the management of the power stations in the Aswan area felt that there were already too many employees in the companies so there was no need to start a project that would aim at producing more labor.

Another difference between the two projects is related to the results of the training programs. The management of the Abu Sultan Power Plant seems to be satisfied since the reliability of the units has become increased from 75-85 % before, to about 85-90 % as a result of the project. For the South Upper Egypt Company, the situation is a bit more worrying since there are not yet any measurable positive effects to show that the huge investments made into Aswan Training Center have started to pay off.

KfW

The KfW, Germany's financial cooperation bank, has one representative in Cairo. Some activities are handled directly by the KfW representative in Egypt, while others are dealt with by a program officer at the KfW in Frankfurt. In the last decade, the KfW has helped finance a range of electrical sector infrastructure projects, with comparatively small technical cooperation grant funding provided in certain cases.

The focus of the financing activities of the KfW has been on building up conventional electricity capacity, with smaller projects in support of renewable energy (60 MW of wind generation capacity at Za'farana on the Red Sea), and environmental impact reduction. These projects are the latest in German-Egyptian cooperation that dates back to 1962, with over DM 1.5 billion in disbursements in concessional loans plus additional commercial loans. Projects supported include:

- Construction and rehabilitation of power stations and substations (Among other things, Aswan I Hydro Power Station has been overhauled and modernized under a German DM 250 million soft loan.)
- Rural electrification in Fayoum Governorate
- Training of personnel in power station maintenance and operation

As the environmental situation in Egypt is alarming, especially in densely populated areas, the German and Egyptian Governments agreed in mid 1990s to direct the Financial Co-operation in the electricity sector towards projects that have a distinctly positive ecological effect. Accordingly, the projects today focus primarily on efficiency-increasing measures and on the utilization of regenerative energies.

European Community (EC)

As U.S. assistance decreases in size during the next decade, assistance from the EC is expected to increase and account for an increasingly large percentage of total assistance given to Egypt. Since 1980, Egypt has been the largest recipient of EC assistance in the southern and eastern Mediterranean region, with an average of € 143.9 million (about \$155 million) annually during 1986-1995, out of a total of € 588.8 million (\$635 million) per year.

At present, EC support is being channeled through the *Mesure d'Accompagnement* (Meda) provided in conjunction with the entry into force of the Euro-Med Free Trade Agreement between the EC and 12 southern and eastern Mediterranean nations, which enters into force in 2010. The first Meda (Meda 1, 1996-2001, but extendable) includes about € 1.25 billion (approximately \$1.35 billion) in grant support focused on four major areas: social development, education, health, and industrial

modernization. The Industrial Modernization Program (IMP) will cost about € 430 million (\$464 million), of which Egypt will contribute a 37% cost-share in local currency.

Meda 1 significantly increases the level of EC spending on technical cooperation and related programs in Egypt. Until 1996, support was provided through a series of four protocols, encompassing both grant and concessionary lending; several projects supported by the protocols have involved the development of energy sector infrastructure. Whereas the protocols generated some € 50 million per year (perhaps \$54 million) in technical assistance, that level of spending is expected to increase to between € 200 to 250 million (\$216 to \$270 million) per year in the four key program areas. Over and above spending in these program areas, the Private Sector Development Program (PSDP) will generate some € 25 million (\$21.6 million) in support for Egyptian businesses over five years.

It is important to note that these programs will not target the energy sector. According to EC officials in Cairo, the EC has determined that Egypt's energy sector no longer requires technical assistance, rather financing (albeit on concessional terms).⁷ In the future, energy-related cooperation is more likely to occur at the regional level, as opposed to the bilateral level. During the 1986-1995 period, EC commitments of technical assistance to energy sector projects totaled some € 182 million, of which only € 40 million were committed after 1990.

A recent example of EC grant-based technical cooperation with Egypt in the energy sector is the support provided for the development of the extension of the Sidi Krir power plant. Several major projects are being implemented with loans provided by the EC as well. At present, several projects are being executed with concessional financial support provided through the European Investment Bank (EIB).

EC cooperation has also been important in the area of renewable energy. EC funding helped launch the Egyptian Renewable Energy Development Organization (EREDO), a research and testing institution designed to provide support for the development of renewable energy in Egypt. The EC provided about € 6.7 million to the project in 1985. The project was executed in cooperation with Italy's development program, which provided grant financing, and complementary spending by the Government of Egypt, through the New and Renewable Energy Authority (NREA). The EC has since supported other renewable energy initiatives, such as a proposed feasibility study for a solar thermal and gas turbine combined-cycle power generation project.

EC cooperation with Egypt has also occurred through regionally oriented projects, such as the support provided for studies of energy integration in the Middle East. The project was launched as part of the EC's effort to support the peace process, following the signature of the peace agreement between Israel and the Palestinians. This project evaluated the economic benefits of interconnection of electric grids, or projects to trade electricity generated with fossil-fuel resources, such as natural gas, located in the region. However, the breakdown of the peace process following the election of Benjamin Netanyahu in Israel led to political tensions that have stalled the project. According to officials at the EC Delegation in Cairo, the project is in risk of cancellation. In the meantime, Egypt's efforts to pursue electric interconnection with neighboring countries has bypassed the possibility of interconnection with Israel and the PNA.

⁷ There are other indications that Egypt's status as an emerging market has made it less eligible for assistance – food aid has been suspended as well. The emphasis of the Meda spending programs is rather to support private business and industry to modernized and become more competitive in advance of the implementation of the Free Trade Agreement between the EC and Egypt.

This regional approach to energy issues is included in the Barcelona Declaration (1995), which lays the groundwork for regional cooperation on energy issues. Areas specifically addressed include energy planning, resource development, generation of interconnections and networks, promotion of energy efficiency, development of new and renewable energy resources, and energy-environment related concerns. These objectives were advanced further in the Trieste Conference, at which a Euro-Mediterranean Energy Forum was established, and the Malta Conference in 1997, which established the economic and financial parameters of Euro-Mediterranean cooperation in several areas, including energy.

During the 1999-2004 period, several EC energy programs will provide assistance to projects involving various Euro-Mediterranean nations. These include the Intersumed project, which supports pre-feasibility studies for renewable energy projects in Algeria, Egypt, Israel, Morocco, the PNA, Tunisia and Turkey. For its part, the Synergy program will support the PNA in institution building activities, energy efficiency regulation in the Maghrib region, organization of conferences and the execution of energy planning studies in various areas of the region, including Egypt. Another program is the Thermie technology transfer initiative, which supports demonstration and dissemination of energy efficient technologies within the EC and transfer in the world market. In the technology transfer area, this includes support for pre-feasibility studies, technology transfer and industrial exchanges in areas such as renewables, energy efficiency, and environmentally improved uses of fossil fuels.

Japan – Japan International Cooperation Agency (JICA)

Japan is not providing technical cooperation assistance to Egypt in the energy sector. At present, all support under consideration would be provided in the form of concessional loans, with some grant assistance for the survey, feasibility and planning stages. Two major projects are being evaluated: the Toshka solar energy project, and the Za'farana wind energy project, are the subject of evaluation at present; if Japanese participation is authorized, a renewal of concessional lending will have to be approved. All lending activity in Egypt was suspended in March, 1991, and in 1992, Japan accorded Egypt a debt reduction of about ¥ 450 billion (about \$4 billion).

Current grant assistance totals about \$90 million annually, with emphasis in the water, infrastructure, agriculture and health sectors. In one case, that of the Assiut Barrage rehabilitation study, Japan supported work on an assessment of the energy generation potential of the new facility. No other requests for support touching on the energy sector have been requested, however.

Canada – CIDA

Egypt has been eligible for Canadian support since 1976 and has consistently ranked among the main recipients of Canadian assistance. Initially, aid programs with Egypt consisted of lines of credit for commodities and infrastructure projects. Beginning in the mid-1980s there was a shift from program aid to a technical assistance capacity building approach, with an emphasis on the energy and agricultural sectors. As Egypt shifted to a more market-oriented economy, there was an increasing recognition of the importance of supporting private-sector development and economic reform. The CIDA Country Development Policy Framework for Egypt was adopted in 1993, after formal consultations with Egypt. The strategy supports the transition towards a market economy and promotes the sustainable management of natural resources. The last years, Canada has been concentrating the Program further on social reform, gender equity and environmental issues. The support to the EEA is therefore being phased out. The intention is to stop when the present contract expires in March 2000.

The largest portion of CIDA's assistance to Egypt has been delivered through bilateral projects as detailed in Table 21.

Table 21: Canadian technical assistance for Egypt (in C\$ millions)

1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
26.3	16.2	13.8	11.5	15.5	18.4	19.7

The present EEA Support consists of C\$16.3 million from 1990 to 2000. The executing agency is the ARA Consulting Group Inc, in a consortium with Ontario Hydro. The purpose is to assist the EEA in devising and implementing management and institutional changes to its human resource policies and systems. The support is focused on improving the reliability of the power systems and should contribute to a better EEA employee performance. Three Canadian experts reside in Cairo.

The expected results are the following:

- Improved quality of training at the Network Training Center (NTC) in Helwan (Cairo). Increased instructor capability to carry out needs analysis. New maintenance courses.
- Integrated training at NTC. On-the-job training for the Field Support System (FSS) in the Cairo Zone. Utilization of the Maintenance Procedure Information System (MPIS).
- More effective training programs for women. Environmental education integrated into all NTC courses. Improved environmental awareness among NTC trainees.
- Cairo Zone satisfied with maintenance systems.

The project achievements are satisfactory so far. The following activities are carried out:

- NTC develop skills and knowledge. Management and supervisory skills training on field training systems to improve the performance on the transmission lines.
- Establish a MPIS. Develop technical information, integrating the activities of the NTC and the FSS in the Cairo Zone. Network communications by exchanging computerized technical information with the various zones.
- Develop a FFS in the Cairo Zone. Train mentors/coaches. Provide attachment training. Produce training aids. Supply technical equipment.

Appendix 4: Terms of Reference for the Evaluation of Energy Sector Cooperation with Egypt

1 Background

The evaluation covers cooperation with Egypt within the energy sector through the programmes of (i) Contract Financed Technical Cooperation, and (ii) International Training Programmes.

Contract Financed Technical Cooperation

The aim of the Contract Financed Technical Cooperation is to promote human resource development in low and middle income countries and to provide know-how in areas which are of strategic importance for the development of partner countries. It shall promote a greater exchange of skills and experiences between Sweden and partner countries and encourage a broad spectrum of Swedish participation in the cooperation.

The Contract Financed Technical Cooperation with Egypt started in 1977. The majority of the projects financed have been within the energy sector (55%). Other important sectors have been telecommunications, industry and environment.

The total grant as per 31 January, 1999, reached 135 MSEK for approximately 100 projects.

The energy sector accounts for approximately 75 MSEK for around 35 individual decisions by BITS/Sida on projects or phases of projects. The main implementing partner on the Swedish side has been Swedpower, but also Sweco (and ÅF Energikonsult AB to a lesser extent). The Egyptian partners have been Egyptian Electricity Authority (EEA), Organisation for Energy Conservation and Planning (OECP) and Hydro Power Plant Executive Authority (HPPEA). The projects have covered the following main areas:

- High tension I-VI (Swedpower, EEA)
- Training of electrical engineers I-IV (Swedpower, EEA)
- Rehabilitation/inspection of hydro power stations (Sweco, EEA/Min. of Irrigation)
- Energy saving (ÅF Energikonsult AB, OEP)
- Hydro power training center in Aswan (Swedpower, EEA)
- Computerized Maintenance and Material Management System, CMMMS, (Swedpower, EEA)
- Feasibility study for pumped storage power plant (Sweco, HPPEA)

A complete list of projects is found as Appendix X.

International Training Programmes

The aim of the International Training Programmes is to enhance the managerial and technical skills in co-operating countries by providing know-how in areas which are of strategic importance for economic and social development. The international training programmes promote a greater exchange of skills and experiences between Sweden and partner countries and encourage a broad spectrum of Swedish participation. It is intended that training programme participants shall have direct use of the knowledge they acquire in the training programmes in their working situation. The training programmes are normally organized in Sweden.

About 500 Egyptian participants have joined the International Training Programmes since 1978, to the amount of 33 MSEK. As regards energy sector related courses, 62 participants have been trained during the period 1990-1998 at a cost of approximately 5 MSEK.

Concessionary Credits

Sweden has also provided support to the Egyptian energy sector through concessionary credits. The total amount is 250 MSEK, with a grant element of 80 MSEK. It is not however included in the assignment to review this support.

2 Purpose of the Evaluation

The Swedish cooperation within the energy sector in Egypt has been on-going since 1978. One previous evaluation has been performed in 1987 of the projects within the area of high-tension. The allocated amount has been substantial, and therefore it is of great importance to make a comprehensive evaluation of the cooperation. The evaluation is also of importance in view of the work to formulate a policy strategy for the Swedish relations with the Middle East and North Africa, that is presently being carried out by the Ministry of Foreign Affairs, with assistance from Sida.

The purpose of the evaluation is the following:

- To identify and analyse the results produced through the support to the energy sector in Egypt through the Contract-Financed Technical Co-operation (KTS) and International Training Programme on a regional, national and organisational level.
- To provide Sida with additional input and recommendations for future decisions on cooperation within the energy sector with regard to Egypt as well as to similar projects in other countries.

3 Scope of the Evaluation

Contract Financed Technical Assistance:

The evaluation should cover the projects implemented in Egypt between the years 1978-1999. A more detailed study and in-depth analyses shall cover the following three groups of projects: (i) Development of training center for hydro power in Aswan (approx. 16 MSEK), (ii) Computerized Maintenance and Materials Management Systems (CMMMS) (approx. 10 MSEK), and (iii) Feasibility Study for Mount Ataqa Pumped Storage Plant (approx. 9 MSEK).

Apart from the already implemented projects the Consultant should also review the first phase of a currently on-going project on CMMMS, and based on that, make an assessment of the proposed second phase.

International Training Programmes:

The evaluation should assess the benefits and results that the programme has given to the involved Egyptian institutions. It cover a selection of participants from Egypt in the international training programmes within the field of energy during the 1990's.

4 The Assignment (issues to be covered in the evaluation)

4.1 Contract Financed Technical Cooperation

The evaluation should cover a general focus on all Swedish cooperation with Egypt within the energy sector through BITS and Sida. Furthermore, a more detailed study and in-depth analyses should be made on three groups of recently implemented projects, which are specified below.

4.1.1 General focus

The general focus should cover the long-term effects of the cooperation on an aggregated level. The following issues should be taken into consideration:

- The relevance of the cooperation in relation to sector needs and Egyptian strategies for the sector.
- The degree of ambition of the approach in relation to the problems to be solved through the projects.
- The traceable effects of the cooperation on an institutional, regional and national level. This includes the issue of improved efficiency, e.g. in production and transfer of electrical power, in improvement of the environment, in more efficient operations, in a better functioning organisation etc.
- The sustainability of the results of the cooperation.
- Assess whether the instrument “Contract Financed Technical Co-operation” has been a suitable choice of development instrument for the specific project output/s and objective/s.
- Sida’s role in relation to other donor’s activities within the sector. A brief presentation of the activities of other donors and within which areas they are active.

4.1.2 In-depth analyses

This group of projects consists of three separate blocs of projects; (i) Hydro Power Training Center in Aswan, (ii) Computerized Maintenance and Materials Management Systems and (iii) Feasibility Study for Ataq Pumped Storage Power Station. The following aspects shall be covered:

4.1.2.1 Relevance

- Assess if the projects have been relevant to their overall objective/s of development cooperation.
- Assess if the planned outputs have been achieved.
- Assess if the project specific objectives have been fulfilled.
- Assess if the overall objectives, as specified in the project documents, have been fulfilled.

Applicable for the Mount Ataq feasibility study:

- How does the study relate to a Master Plan or other feasibility studies?
- Has the report been properly presented and commented upon finalization? Has it been used, modified and adopted?
- Have other donors been involved? Are there other related studies?

4.1.2.2 Efficiency

- Assess the cost-efficiency of the projects.
- Evaluate the quality of services, including value of money, performed by the Swedish counterparts.
- Evaluate the efficiency of the various stakeholders co-operation, positive and negative experiences when relevant.
- Identify and define reasons for any delays, overruns and hick-ups in the implementation process of the projects and comment on additional costs and unintentional effects involved.

4.1.2.3 Impact

- Assess the short-term as well as the long-term effects of the activities carried out.
- Assess the impact of the transferred knowledge to the concerned Egyptian partners. Are the effects sustainable without further assistance?
- Analyse to what extent the Egyptian partners have been able to continue the process of transferring the knowledge within their own organisation.

- Has the cooperation resulted in or facilitated any commercial relations or any other spin-off effects between Egypt and Sweden within the energy sector?
- To what extent have issues regarding environment been considered in the projects? Have the projects resulted in any direct positive or negative environmental effects?
- How have the issues regarding gender been considered within the projects? Have the projects resulted in any specific effects regarding the gender issues?

4.1.2.4 Lessons learned

- What are the operational and strategical lessons learned from the projects?
- In brief assess the need for future assistance within the Egyptian energy sector.
- Comment on the presently on-going cooperation CMMMS project and possible changes to be made for the planned second phase.

4.2 International Training Programmes

The Consultant shall evaluate the effects and results of the Egyptian participation in the International Training Programmes within the energy sector, in order to highlight issues, give recommendations for future activities and to give answers to questions such as the following:

- To what extent have the participants been able to act as change agents within their respective organisations after returning from the training programmes?
- What are the effects of the individual participant who attended the training and what has been the impact at the organisation that he/she represented while at the training programme?
- How do the participants/organisations themselves evaluate the training programmes?
- To what extent have participants left the sector?
- What other kinds of competence building activities have the participants been involved in?
- To what extent has there been an interaction between participation in the training programmes and other Sida financed activities within the energy sector and what are the effects of this interaction?

5 Methodology, Evaluation Team and Time Schedule

The evaluation should take place during spring 1999. It will include gathering of facts and interviews with Sida and the implementing counterparts in Sweden, a fact-finding mission to Egypt, report writing and presentation of the report. The cooperating partners on the Egyptian side will mainly be EEA and HPPEA, but also OECP. A contact person will be appointed by EEA, who will coordinate the work on the Egyptian side. Sida will provide background information as well as documentation from its archives. The Swedish consultants, (mainly Swedpower and Sweco,) are expected to cooperate fully with the implementation team and to provide further documentation.

The evaluation team is suggested to consist of at least two members. The team should have specific skills within the following areas:

- Energy sector, with specific emphasis on maintenance, projecting and training.
- Development cooperation in general with development economics in particular.
- Pedagogical methods/vocational training.

One local Consultant may be affiliated to the team. In this case, it must be ensured that the Consultant does not have any obligations or interests that are directly or indirectly related to the activities subject to the evaluation.

The total duration of the evaluation is estimated to approximately four weeks. The mission to Egypt is expected to require approximately two weeks. Places to visit are primarily the following:

- Cairo (headquarters of EEA, HPPEA and OECP)
- Suez (Ataqa Power Plant for CMMMS project, Mount Ataqa site for pumped storage project)
- Aswan (Hydro Power Training Center, High Dam for CMMMS-project)
- (- If necessary, visits to other power stations, training centers etc.)

Background material consists mainly of project documentation that can be collected at Sida as well as the implementing partners. Further information should be gathered through interviews with the implementing partners and others concerned, and in the case of the Training Programmes, with the former participants as well as their organisations. Contact persons within EEA and HPPEA will be appointed by these organisations.

5 Reporting

The evaluation report shall be written in. Format and outline of the report shall follow the guidelines in *Sida Evaluation Report – a Standardized Format* (see Annex 1). Five copies of the draft report shall be submitted to Sida and to the main Egyptian partners concerned no later than May 17, 1999. Within 2 weeks after receiving Sida's comments on the draft report, a final version in five copies and on diskette shall be submitted to Sida. Subject to decision by Sida, the report will be published and distributed as a publication within the Sida Evaluations series. The evaluation report shall be written in Word 6.0 for Windows (or in a compatible format) and should be presented in a way that enables publication without further editing.

The evaluation assignment includes the production of a Newsletter summary following the guidelines in *Sida Evaluations Newsletter – Guidelines for Evaluation Managers and Consultants* (Annex 2) and also the completion of *Sida Evaluations Data Work Sheet* (Annex 3). The separate summary and a completed Data Work Sheet shall be submitted to Sida along with the draft report.

The draft report shall be presented to Sida at a seminar of maximum two hours duration, and should preferably be coordinated with the presentation of the report regarding the Jordanian energy sector.

Recent Sida Evaluations

- 99/7 Environmental Projects in Tunisia and Sengal. Ulf von Brömssen, Kajsa Sundberg
Department for Infrastructure and Economic Cooperation
- 99/8 The Collaboration between Sida and SAI, The Department of Social Anthropology (SAI),
Development Studies Unit, Stockholm University. Ninna Nyberg Sörensen, Peter Gibbon
Department for Natural Resources and the Environment
- 99/9 Access to Justice in Rural Nicaragua. An independent evaluation of the impact of Local Court
Houses. Elisabeth Lewin, Christian Åhlund, Regina Quintana
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- 99/10 Working with Nutrition. A comparative study of the Tanzania Food and Nutrition Centre and
the National Nutrition Unit of Zimbabwe. Jerker Carlsson, Suraiya Ismail, Jessica Jitta,
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- 99/11 Apoyo de Asdi al Sector Salud de Nicaragua. Prosilais 1992-1998. Marta Medina, Ulf
Färnsveden, Roberto Belmar
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- 99/12 Nordic Support to SATCC-TU, Southern Africa Transport Communications Commission,
Technical Unit. Björn Tore Carlsson, Leif Danielsson.
Department for Infrastructure and Economic Cooperation
- 99/13 Cooperation Between Sweden and Ukraine in the Field of Local Self-Government.
Lars Rylander, Martin Schmidt
Department for Central and Eastern Europe
- 99/14 Research Cooperation between Sweden and Uruguay 1986-1995. An evaluation and some
general considerations. Osvaldo Goscinski, Mikael Jondal, Claes Sandgren, Per Johan
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- 99/15 Sida Supported Advantage Projects in the Baltic States. Claes Lindahl, Petra Stark
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monitoring. Vegard Bye, Martha Doggett, Peter Hellmers
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- 99/17 Dollars, Dialogue and Development. An evaluation of Swedish programme aid. Howard White,
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Åke Iverfeldt, Stefan Uppenberg, Lars Zetterberg
Department for Infrastructure and Economic Cooperation
- 99/19 Technical Assistance to Central and Eastern Europe. A cooperation between Chambers of
Commerce in Sweden and in Central and Eastern Europe. Claes Lindahl, Monica Brodén,
Peter Westermark
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