Sida Evaluation 99/21

Sida Support to the Energy Sector in Jordan

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Glossary

Amplissima	(Same as CMMMS below)
ATPS	Aqaba Thermal Power Station
BITS	(See INEC below)
CEGCO	Central Electric Power Generating Company
CIDA	Canadian International Development Agency
CMMMS	Computerized Maintenance and Materials Management Systems
CMMS	(same as CMMMS and Amplissima above)
Danida	Danish International Development Assistance
EDCO	Electric Distribution Company
EEA	Egyptian Electricity Authority
EPDC	Electric Power Distribution Company
GEF	Global Environment Facility
GTZ	*Gesellschaft für Technische Zusammenarbeit* / The German Agency for Technical Cooperation
HTPS	Hussein Thermal Power Station
IDECO	Privately-owned distribution company
IMF	International Monetary Fund
INEC	Infrastructure and Economic Co-operation Agency (Department under Sida)
JCF	Jordan Cement Factory
JD	Jordanian Dinar
JEA	Jordan Electricity Authority (later NEPCO)
JEPCO	Jordan Electric Power Company
JICA	Japan International Cooperation Agency
KfW	*Kreditanstalt für Wiederaufbau* / Germany's Financial Cooperation Bank
KTS	*Kontraktfinansierat Tekniskt Samarbete* / Contract-Financed Technical Cooperation
NCC	National Control Center
MSEK	Million Swedish Kronor
NEPCO	National Electric Power Cooperation (former JEA)
PEDEEE	Syria's Public Establishment for Distribution and Exploitation of Electrical Energy
PEEGT	Syria's Public Establishment for Electricity Generation and Transmission
RSS	Royal Scientific Society
SEK	Swedish Kronor
Sida	Swedish International Development Cooperation Agency
TC	Training Center
TCTP	Japanese Third Country Training Program
TPS	Thermal Power Station
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USD	United States Dollar

Executive Summary

Overview and Background

Swedish cooperation within the energy sector in Jordan has been ongoing since 1985, and no previous independent evaluation has been performed. This evaluation covers the projects implemented in Jordan from 1985 to 1999, concentrating on the projects related to Computerized Maintenance and Materials Management Systems (CMMMS), with a cost of approximately SEK.

Since then, Sida's Jordan program has allocated SEK 4,048,000 to Sida's contract-financed technical cooperation (KTS, for *Kontraktsfinansierat Tekniskt Samarbete* in Swedish), with KTS activities focused in two general areas: implementation and upgrading of a computerized maintenance and materials management system (CMMMS), known as Amplissima, provided SwedPower (1985-1998); and support for the National Control Center (NCC) in the area of management of interconnected electric systems (1989-1994). The Amplissima program has accounted for about 60% of total spending by Sida and the support to the NCC the balance.

The evaluation also assesses the benefits and results that the program has provided to the Jordanian institutions which have been involved 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 main Swedish implementing counterpart, SwedPower. Background information was also provided through documents compiled from the files of Sida and SwedPower (see List of Documents in Appendix).

The actual evaluation took place in Jordan during the first week of May 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.

The collaborating partner on the Jordanian side were mainly the National Electric Power Cooperation (NEPCO), 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 three sites:

- Hussein Thermal Power Station in Zarqa and its Electric Training Center
- Aqaba Thermal Power Station in Aqaba
- National Control Center, near the Amman South Substation

Background: Jordan's Electricity Sector

Jordan is in the midst of restructuring its electric sector and preparing the generation and distribution sectors of the state-owned National Electric Power Company (NEPCO) for privatization. The national system consists of 1,150 MW of installed capacity operated by NEPCO's generation-sector affiliate, the Central Electric Power Generating Company (CEGCO), and another 118.5

MW of generation capacity operated by the private industrial and municipal companies. Thermal generation facilities make up the vast majority (99%) of total installed capacity in the country, with limited wind (1.4 MW) and hydroelectric (7 MW) capacity making up the balance.

Since 1991, the electric sector has posted rapid growth, averaging over 10% in terms of consumption and over 6% in terms of peak load. This reflects to a large extent Jordan's economic performance, which has been reasonably strong throughout the 1990s, though slower in the period from 1994 to the present than in the immediate aftermath of the Arabian Gulf War (GNP jumped 11% between 1992 and 1991). In addition, Jordan's rapid population growth adds substantial momentum to the growth in electricity demand. Population growth was 4.3% in the 1980s, and though it has been reduced to the 3.7% currently observed, it is still very high compared to other countries in the region (Egypt's stands at about 2% per annum).

Jordan's current economic situation is precarious, however. With limited natural resources, most especially water, but a talented and highly educated population, Jordan has traditionally depended on worker remittances from workers in the oil-rich states of the Persian Gulf for much of its hard currency income. However, since the decline in oil prices beginning in 1986, and especially the Arabian Gulf War in 1990-1991, worker remittances have declined, and Jordan has incurred external debt to finance growth. Already in 1989, Jordan signed a stand-by agreement with the International Monetary Fund (IMF) and rescheduled $573 million in debt with the Paris Club; after the Gulf War, in early 1992, the government signed a new stand-by agreement, rescheduled an additional $771 million in debt, and began implementing economic reforms.

Once the separation of CEGCO and EPDC from NEPCO is complete, the government plans to privatize the two companies, leaving the state with the strategically important transmission and control company. A consulting company will be hired to valuate CEGCO's assets in advance of selling the company. Once CEGCO is privatized, the government will likely implement a competitive market for power, with different generators competing in a market administered by an Independent System Operator (ISO), which would be created from the existing National Control Center (NCC), which was established, with Swedish support, in 1988.

At present, the government's plans for expanding the electric sector include completion of Phase II of the Aqaba Thermal Power Station (ATPS), adding 390 MW (three 130-MW fuel-oil fired units) to the existing 260-MW facility, and issuing a tender for the construction and operation of a 300 to 450 MW gas-fired plant, at Al-Samra near Zarqa, on an IPP basis. The Aqaba extension, which was expected to be in commercial operation by mid-1999, is only in testing at present, but may come on line by late-1999. The Al-Samra facility would need to be ready by 2003. NEPCO estimates that annual demand growth will continue at the 6% pace currently observed, meaning that by 2005 peak demand is likely to reach as much as 1600 MW, requiring that additional capacity over and above ATPS Phase II and Al-Samra be built starting late in 2001 in order to come on line by 2005.

Findings

Amplissima Computerized Maintenance and Materials Management System

Sida's technical cooperation with Jordan in the area of deployment of the CMMMS system known as "Amplissima" began in the late 1980s, when the then Jordan Electricity Authority (JEA) requested Sida's support for installation of the system. Subsequently, in 1997, support was requested for a second time, by the National Electric Power Company (NEPCO), to upgrade the Amplissima system with a new version. This work was completed in early 1998. At present, the Amplissima

system has been installed at the Hussein Thermal Power Station (HTPS), in Zarqa and the Aqaba Thermal Power Station (ATPS), located south of the seaport of Aqaba. The system has not been requested by the other thermal stations in Jordan, nor by the transmission and distribution sectors of NEPCO. The two plants where the system has been installed comprise 54 percent of NEPCO's system, by capacity, representing the backbone of NEPCO's system that provides base-load generation for the national system and some for export to Egypt over the Taba-Aqaba underwater cable.

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.

NEPCO has prepared a new proposal for technical cooperation on Amplissima, this time focusing on upgrades to the system's archiving capabilities, which NEPCO officers argue does not meet the needs of the power plants' staff because the present version cannot handle plant drawings. In addition, the division of NEPCO into three sectoral companies that is now underway has created a situation in which the computer division (which will stay within NEPCO) is requesting assistance to establish the necessary mechanisms and capabilities to provide services to the other two companies in the areas of software development, maintenance, hardware, computer time, tender evaluation, and training.

For the most part the Jordanian counterparts have expressed satisfaction with the results of the technical cooperation supported by Sida, especially following its most recent phase. With the upgrade of the system in 1998, almost all of the problems and weaknesses identified in the years following the initial installation of the system have been addressed. Principal among the weaknesses identified was the lack of a direct link between the "store" module of Amplissima and the maintenance module. A significant period of time passed before work on this link began, due to the interruption in contacts between NEPCO and Sida from 1990 to 1995.

Following the upgrade in the system, at HTPS the Amplissima operators report three problems with the system: (1) the system is not Y2K compliant, in that instructions for scheduled maintenance for periods in the year 2000 are not recognized by the system; (2) there are problems with the printing function that cause the printer to add blank pages to any print run; and (3) the system is unable to handle graphics. These problems are the ones that remain after the upgrade to the system in 1998. A SwedPower representative will travel to Jordan in May or June 1999, to address the Y2K concerns and presumably the printing issue as well. The ability to handle graphics will not be addressed unless the support now being requested by NEPCO is approved by Sida.

Beyond the present limitations of the system itself, it is possible to say that the installation of the system has not delivered all of the benefits that NEPCO, as a relatively well developed electric company, should derive from a new computer management system. Specifically, the program of cooperation has done relatively little to reduce NEPCO's dependence on the supplier of Amplissima and its technical staff for the resolution of any inadequacies of the program (such as the printing error, the Y2K compliance issue, lack of support for graphics). For example, the Y2K problem in the system will require that a SwedPower representative travel to Jordan to address the problem.

It would be preferable if the support provided by Sida were to create a broad range of capabilities in Jordan that would provide the motor for substantial development and secondary technology transfer. In the case of Amplissima, the support provided by Sida would have contributed to deeper capacity formation if it had involved the establishment of a local presence (perhaps a joint venture or subsidiary) with the capacity and authorization to make substantial modifications and adaptations to the software, as well as perhaps develop an Arabized version for the local and broader Middle Eastern market.

The continued interest of NEPCO in the Amplissima software provides a demonstration of the sustainability of the NEPCO program. Management, computer and operations personnel at both of the facilities where Amplissima has been installed indicated their support for the use of the software, and asserted that the system has had a beneficial impact on operations at both facilities. Further, the computer department has expressed interest in deepening its capabilities in the programming area, perhaps through a co-development scheme involving preparation of an Arabized version of Amplissima.

But this issue underscores a complicating aspect of the program with respect to its sustainability. As currently established, with substantial NEPCO outlays associated with the Sida support, and continued dependence on technical support from SwedPower, the program is arguably less sustainable than it would be in the event that Jordanian expertise in the relevant software development fields were developed through the program, thereby enabling NEPCO to become more self-sufficient in the creation, installation, maintenance and dissemination of the Amplissima software. Such a program, if developed, would be substantially more sustainable than one in which the availability of resources at NEPCO will constantly be a constraint to its ability to upgrade to the newest version of Amplissima.

The question should also be asked whether the Swedish contractor offers strong guarantees of being able to provide services to NEPCO or other contractors on a continuing basis. The primary software developer for the projects in Jordan is an independent consultant who was subcontracted by SwedPower. So far SwedPower has been able to manage this arrangement satisfactorily, but the sustainability of this situation may not be guaranteed.

International Training Program

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 assesses whether the involved institutions in the Jordanian energy sector have achieved the desired benefits and results as a result of their training. About 400 Jordanian participants representing many sectors have joined the international training programs since 1978. This evaluation covers training for the energy sector only. According to the terms of reference for this evaluation, 34 participants have undergone training in Sweden; however, this evaluation covers only the 32 participants mentioned on the lists we received. The total cost since 1990 has been approximately SEK 2.5 million.

All participants in the sample are engineers, which means that they have received university education. Six of them have undergraduate level first degree, ten have graduate level degrees, and two have Ph.D's. There is only one woman represented in the sample. In the terms of reference for the

study it was said that no women had received training in Sweden, but there is a discrepancy with other information because, as stated above, the "Architecture, Energy & Environment" had two female participants.

All the participants in the sample, except for one, have the same employer today as they had at the time of the course, although one employer, JEA, has become a company known as NEPCO. The one participant who has changed employers is now working for the Electric Distribution Company (EDCO). It must be remembered that the participants who became part of the available sample were traced largely due to this lack of movement. In other words, the results should not be interpreted as showing that people generally stay at their jobs. On the contrary, our impression is that many have left, especially to work in the Gulf States.

The conclusions and recommendations presented here incorporate observations from the survey of Jordanian participants, but they also include reference to the survey of Egyptian 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 can not 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. This would also be a useful 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 interconnection of energy transmission networks between different countries.

Overall Assessment

Sida's energy-sector support in Jordan has been highly focused in two areas (operation of interconnected electric systems, and materials and maintenance management), with emphasis on specific tasks to be accomplished over a relatively short period of time. Sida has not supported large projects such as those that it has supported in Egypt (such as the Gebel Attaqa feasibility study, the Aswan Hydropower Training Center).

Relevance of Sida's KTS support

In general, the support provided by Sida has addressed well-defined needs of the Jordanian energy sector, and has been generally beneficial to the JEA and its successor company, NEPCO. As noted, activities have been undertaken in two general areas:

- *Materials and maintenance management*. The support provided to JEA and NEPCO in the installation and upgrading of the Amplissima system has been beneficial in general terms. The system is used effectively by plant staff in the two major generation stations in the country to manage equipment, maintenance activities, and costs;
- *Operation and management of interconnected electric systems*. The support provided for officials from the NCC to visit Sweden and observe management practices for Sweden's electric system and operation of the system in the context of the broader Scandinavian interconnected network was important to JEA's plans to proceed with the electrical interconnection with Egypt.

In addition, the programs supported by Sida have provided training to Jordanian professionals in the energy sector, especially in the area of energy efficiency, which are regarded as having been helpful to participants in their activities in industrial companies, government agencies and research institutions.

The ambitiousness of Sida's program may be measured in terms of the overall capacity of the Jordanian electricity sector to absorb international assistance, coupled with the level of spending by 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 activities in Jordan cannot be considered excessively ambitious.

The effects of Sida's program activities are difficult to assess in quantitative terms, and only slightly less so in qualitative terms. From the quantitative standpoint, while there have been efficiency improvements in NEPCO's operational and financial performance, attributing these impacts to Sida-sponsored activities would be excessive, even though donor activity is more limited in Jordan's energy sector than in other nations. From a qualitative standpoint, meanwhile, the program does appear to have had some impact, insomuch as the development of the energy sector over the last decade has successfully built on input and support provided by Sweden. On these counts, it appears that Sida's program has had a generally positive impact, though it may be that the results of the Amplissima program have fallen short of expectations.

As far as the Amplissima program is concerned, there has been a shift toward more preventive maintenance, as opposed to corrective maintenance, at the Hussein TPS, but apparently not at Aqaba TPS. This impact may be attributable to Amplissima, but was certainly facilitated by it. However, it is difficult to argue that this improvement has directly contributed to the measurable changes in NEPCO's financial statements, where maintenance and operating costs have declined as a share of overall costs.

The sustainability of the results of cooperation is measured in several ways. First, the degree to which new systems or skills provided by Swedish contractors are incorporated and disseminated

within NEPCO or other relevant organization will determine the degree of sustainability of the results of the activity. Second, the degree to which the Jordanian 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 had reasonably good results in terms of sustainability. For example, the implementation of Amplissima has resulted in the effective use of the program at two power plants in the country, with an increasing rate of preventive maintenance at one of the two facilities, application of the software in tracking costs, and consistent efforts to include all plant information in the Amplissima database. There is interest in continuing to use Amplissima at these power plants.

However, there are factors that could erode the sustainability of the program's results. First, it does appear that the remaining facilities do not seem eager to install Amplissima, most likely because of the substantial effort required to enter all data. Since the remaining plants are relatively small compared to the HTPS and ATPS plants where Amplissima has already been installed, this consideration would be especially relevant. In addition, familiarity with the system seems to be highly concentrated in a few individuals, increasing the risk of loss of institutional memory regarding the system if those individuals leave NEPCO. This concentration of expertise is related to the other drawback with the system, namely that the system is not fully disseminated through the organization, since knowledge of English is necessary. Lastly, the ability of NEPCO to economically address problems with the system appears to be limited – troubleshooting requires a visit from SwedPower. This is because the Sida program has helped provide a software system that is used effectively by JEA and NEPCO, but without really creating local capabilities to ensure its continued utilization without further support by Sida.

The commitment of NEPCO to using Amplissima is well-established, both because interest in continuing its use was renewed in the mid-1990s after a hiatus in contacts between Sida and Jordan, as well as because of the substantial resources committed by NEPCO to its installation. However, it remains to be seen whether the management of NEPCO's privatized spin-off companies will continue to use Amplissima. It seems less likely that private firms will want to rely on a system for which they do not have local support – unless they can count on funding from Sida for support by Amplissima's developer, which may not be possible.

The implementation of the Egypt-Jordan interconnection, and the plans to create a competitive electricity market in Jordan, have guaranteed the continued relevance of the technical support that Sida provided in the late 1980s and will continue to provide through the international training courses.

Other donors have been active in the energy sector in ways that do not really have much to do with the activities supported by Sida. This means that there is less likelihood of reinforcing support from other donors for activities supported by Sida.

Recommendations and Lessons Learned

In general, the lesson learned from the Sida experience in Jordan is that a selective approach to supporting projects can yield significant results. With the changes occurring in the electric sector, there may be opportunities to redirect Sida's activities to areas of development that are only now emerging. Regional electric integration and development of hydropower resources in Jordan and Syria may offer two such new areas of collaboration.

With respect to the Amplissima program, the following lessons are most relevant:

- The language of Amplissima does not pose so great a difficulty to users at facilities in Jordan, as the command of English among NEPCO personnel is greater than that of the EEA. However, conversion to Arabic might offer a commercial opportunity that could be exploited jointly, with long-term benefits in terms of sustainability, commercial benefits to the contractor, and broader regional impacts from Sida's development spending;
- With privatization, the sustainability of the Amplissima program may be altered as new management adopts new systems; support for Amplissima must be flexible, in order to meet customer demands

With respect to the international training program, the following lessons seem most relevant:

- It was more difficult than expected to trace the former course participants;
- The 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;
- 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 do not support the idea of their wives being away for a month or two, and many women have small children to consider.

A general recommendation flows from the more specific recommendations made below, namely that improved management of the Jordan and Egypt programs by Sida requires a more continuous presence in country. Even if such a presence were not possible in Jordan itself, it seems that coverage from Cairo would be better than from the greater distance of Stockholm.

This new approach should begin with the development of a strategic plan for Jordan, and an effort to establish how other donors will alter their patterns of support for the energy sector as Jordan restructures its electric industry. One area would be for Sida to explore how it could support the development and construction of the new hydropower facility that Jordan and Syria plan to build on the Yarmouk River.

Based on the lessons learned in Jordan, the following recommendations seem appropriate:

- Educating managers at the top about Amplissima – as well as all other information systems technologies – is both necessary and beneficial. Amplissima does not necessarily have the support of all potential system users within NEPCO. It is possible that the system would have an appreciable impact on efficiency in other parts of the network were it to be installed there;

- The sustainability of the program and its results would probably be greater if the extent of technology transfer were deeper and more comprehensive, as would be the case if a local service provider were associated with the program. This need not jeopardize the commercial interests of the contractor; on the contrary, the arrangement could create new business opportunities for both the contractor and the local partner. One possibility in the near term would be for Sida to support an effort to develop an Arabized version of Amplissima, working conjunction with a local Jordanian, or Egyptian, information systems firm, with the specific task of demonstrating a beta version of the package at Syria's Public Establishment for Electricity Generation and Transmission (PEEGT) and/or the Public Establishment for Distribution and Exploitation of Electrical Energy (PEEDE).

With regard to the international training programs, the recommendation would be to develop the contacts between the course organizers and the former course participants.

- This could partly be organized through regular distribution of a newsletter administered by course organizers. 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. A third possibility for keeping in touch would be for the course organizers to contact the former participants and their supervisors during field visits;
- 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;
- 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.

1. Introduction and Methodology

Contract Financed Technical Assistance

Swedish cooperation within the energy sector in Jordan has been ongoing since 1985, and no previous independent evaluation has been performed. This evaluation covers the projects implemented in Jordan from 1985 to 1999, concentrating on the projects related to Computerized Maintenance and Materials Management Systems (CMMMS)

International training programs

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

Approaches and methods used

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The actual evaluation took place in Jordan during the first week of May 1999. The work was carried out through interviews (see List of Interviews in Appendix), field visits and distribution of a questionnaire covering the International Training Programs.

The collaborating partner on the Jordanian side were mainly the National Electric Power Cooperation (NEPCO), 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 three sites:

· Hussein Thermal Power Station in Zarqa and its Electric Training Center
· Aqaba Thermal Power Station in Aqaba
· National Control Center, near the Amman South Substation

2. Program context

Development context – overview of the Jordanian energy sector

Jordan is in the midst of restructuring its electric sector and preparing the generation and distribution sectors of the state-owned National Electric Power Company (NEPCO) for privatization. The national system consists of 1,150 MW of installed capacity operated by NEPCO's generation-sector affiliate, the Central Electric Power Generating Company (CEGCO), and another 118.5 MW of generation capacity operated by the private industrial and municipal companies. Thermal generation facilities make up the vast majority (99%) of total installed capacity in the country, with limited wind (1.4 MW) and hydroelectric (7 MW) capacity making up the balance. (See Table 1.)

Table 1: Electricity Generation Capacity in Jordan

	Thermal				Renewable		Total
	Steam	Gas Turbines		Diesel	Wind	Hydro	
		Diesel	Natural Gas				
NEPCO							
Hussein Thermal PS	363.0	32.0					395.0
Aqaba Thermal PS	260.0					3	260.0
Aqaba Central PS				22.0			22.0
Marka PS		72.0		30			72.0
Al-Risha P. Station			120.0				120.0
Amman South Gas Turbine		60.0					60.0
Karak PS		18.0		4.5			22.5
King Talal Dam						4	0.0
Wind Energy					0.3		0.0
Hofa Wind park					1.1		1.1
Rehab PS		160.0					160.0
Subtotal	**623.0**	**342.0**	**120.0**	**56.5**	**1.4**	**7.0**	**1,149.9**
Percent share	54.2%	29.7%	10.4%	4.9%	0.1%	0.6%	
Other Organizations							
IDECO				6.0			6.0
Cement Factory (Fuheis)				9.0			9.0
Refinery Co.	14			2.0			16.0
Arab Patash Co.	15			8.0			23.0
Fertilizer Co.	44						44.0
El-Hasa Phosphate Co.				12.0			12.0
Municipalities and Others				8.5			8.5
Subtotal	**73.0**	**0.0**	**0.0**	**45.5**	**0.0**	**0.0**	**118.5**
Percent share	61.6%	0.0%	0.0%	38.4%	0.0%	0.0%	
Total NEPCO and Other	**696.0**	**342.0**	**120.0**	**102.0**	**1.4**	**7.0**	**1,268.4**
Percent share	54.9%	27.0%	9.5%	8.0%	0.1%	0.6%	

Source: NEPCO, 1996.

Since 1991, the electric sector has posted rapid growth, averaging over 10% in terms of consumption and over 6% in terms of peak load. This reflects to a large extent Jordan's economic performance, which has been reasonably strong throughout the 1990s, though slower in the period from 1994 to the present than in the immediate aftermath of the Arabian Gulf War (GNP jumped 11% between 1992 and 1991). In addition, Jordan's rapid population growth adds substantial momentum to the growth in electricity demand. Population growth was 4.3% in the 1980s, and though it has been reduced to the 3.7% currently observed, it is still very high compared to other countries in the region (Egypt's stands at about 2% per annum).

Jordan's current economic situation is precarious, however. With limited natural resources, most especially water, but a talented and highly educated population, Jordan has traditionally depended on worker remittances from workers in the oil-rich states of the Persian Gulf for much of its hard currency income. However, since the decline in oil prices beginning in 1986, and especially the

Arabian Gulf War in 1990-1991, worker remittances have declined, and Jordan has incurred external debt to finance growth. Already in 1989, Jordan signed a stand-by agreement with the International Monetary Fund (IMF) and rescheduled $573 million in debt with the Paris Club; after the Gulf War, in early 1992, the government signed a new stand-by agreement, rescheduled an additional $771 million in debt, and began implementing economic reforms.

At present, sluggish growth has renewed concerns about the country's external debt, which, though not as heavy a burden as before, is still among the highest in the world in per-capita terms ($1,800/capita, compared to Egypt's $497/capita).[1] Since assuming power King Abdullah bin Hussein has begun seeking debt forgiveness from major creditor nations and institutions, along with deregulation and privatization, as part of his program to restore economic growth.

Restructuring and privatization of the electric sector

The restructuring and privatization of the electric sector is part of the economic reform program initiated by the late King Hussein in the early 1990s. A new electric sector legal framework, Law 10/1996, converted the Jordan Electricity Authority (JEA) into a state-owned joint stock company, NEPCO, and laid the groundwork for restructuring the company into a generation division (CEGCO) a distribution company (Electric Power Distribution Company, or EPDC), leaving NEPCO to operate the transmission system and control center. The two other privately-owned distribution companies, IDECO and the Jordan Electric Power Company (JEPCO), which account for about 64% of total sales in the country, predate the restructuring of NEPCO.

The new electric sector law also provided for the creation of a regulatory commission, and establishes the legal basis for private financing of power stations, through BOOT contracts or as IPPs. Until now, the bulk of energy sales in the system have depended on generation capacity operated by NEPCO, with the privately owned generation facilities tending to serve the owner's own requirements. Until now, private generators have not sold power to third parties over NEPCO's transmission system.

Once the separation of CEGCO and EPDC from NEPCO is complete, the government plans to privatize the two companies, leaving the state with the strategically important transmission and control company. A consulting company will be hired to valuate CEGCO's assets in advance of selling the company. Once CEGCO is privatized, the government will likely implement a competitive market for power, with different generators competing in a market administered by an Independent System Operator (ISO), which would be created from the existing National Control Center (NCC), which was established, with Swedish support, in 1988.

Expansion plans for the electric sector

At present, the government's plans for expanding the electric sector include completion of Phase II of the Aqaba Thermal Power Station (ATPS), adding 390 MW (three 130-MW fuel-oil fired units) to the existing 260-MW facility, and issuing a tender for the construction and operation of a 300 to 450 MW gas-fired plant, at Al-Samra near Zarqa, on an IPP basis. The Aqaba extension, which was expected to be in commercial operation by mid-1999, is only in testing at present, but may come on line by late-1999. The Al-Samra facility would need to be ready by 2003. NEPCO estimates that annual demand growth will continue at the 6% pace currently observed, meaning that by 2005 peak demand is likely to reach as much as 1600 MW, requiring that additional capacity over and above ATPS Phase II and Al-Samra be built starting late in 2001 in order to come on

[1] Jordan's debt service as a percentage of GNP has increased over the last two decades: in 1997, it was 9.1%, up from 5.2% in 1980. By comparison, the same ratio for Egypt has decreased to 2.5% from 5.8% in 1980. Source: The World Bank.

line by 2005. In May, 1999, Jordan and Syria signed an agreement to built a dam and hydroelectric complex (the Wahda – "Unity" – Dam) on the Upper Yarmouk River, which serves as a boundary between the two countries. Work has not yet begun on the project, and it is not clear what the potential capacity of the facility will be; it is reported that two countries would divide the electricity generated in a 70:30 ratio, with Syria receiving the larger portion.

With the start-up of Jordan's high-voltage interconnection with Egypt through a 400-kV submarine cable from Aqaba to Taba, Egypt, NEPCO has expanded its access to imported power resources. While current flows over the line do not exceed 200 MW, the line can handle transfers of up to 600 MW. In addition, when the interconnection is expanded to include Syria (by late 1999) and Turkey (in 2000), Jordan will have access to competitively priced hydropower resources in Syria and Turkey, as well as from Egypt.

Jordan's program of rural electrification has brought electricity, either from the national grid or from off-grid systems, to almost 99% of the rural population and almost 100% of the estimated 4.5 million inhabitants of the country. Ongoing programs will bring electricity to the remaining 130 villages and settlements. Officials at the Ministry of Planning have said that the most likely approach will be to install diesel generators and low-voltage distribution systems, although there is discussion of using renewable energy technologies to power such systems. The regions of the country where lack of access to electricity is most prevalent include the south and desert southeast of the country (the regions around the cities Ma'an, Aqaba and Shoubak).

In the national grid, the three distribution companies (NEPCO, JEPCO and IDECO) are continuing to expand the coverage of the national distribution system, with special emphasis on the Jordan River Valley region. NEPCO officials familiar with energy efficiency programs note that more attention is required in the rural distribution system, where line losses are highest. According to NEPCO officials involved in energy efficiency programs, the distribution sector accounts for the largest segment of total energy losses in the interconnected system, due largely to the long distances and small loads served by the rural distribution system. The urban areas tend to have lower losses. Overall, NEPCO data show that lines losses have increased in the distribution sector, while efficiency has improved in the other two sectors, generation and high-voltage transmission.

The transmission system has been improved to accommodate the 400-kV interconnection with Egypt, with the addition of high-voltage terminals at the Aqaba and Amman South substations, as well as upgrading the transmission line linking the two. According to NEPCO officials, all the work necessary to energize the interconnection between Syria and Jordan in 1999 has been completed. Officials at the NCC note that additional equipment and training will be required for the NCC to assume the role of ISO for a competitive electric system in Jordan.

NEPCO productivity and efficiency

In recent years, NEPCO has made progress in terms of overall employee productivity, as well as in terms of efficiency as measured by the use of fuel per unit output. However, there appear to have been some difficulties in sustaining progress in both these areas. See Figure 1.

NEPCO financial performance

NEPCO's financial performance has generally improved over the last four years, with steadily increasing net profitability, even though operating expenses have risen more quickly in recent years. This seems to be due, at least in part, to increased prices for electricity sold, as well as to other, purely financial factors, such as exchange rate gains. See Table 2.

Project description and history

Swedish cooperation with Jordan began in 1983, with preliminary agreements to conduct studies for the design of maintenance and operation systems for power plants, which resulted in the first Sida program for the installation of the Amplissima system in the Aqaba and Hussein Thermal Power Stations of the Jordan Electric Authority (JEA), the precursor to NEPCO.

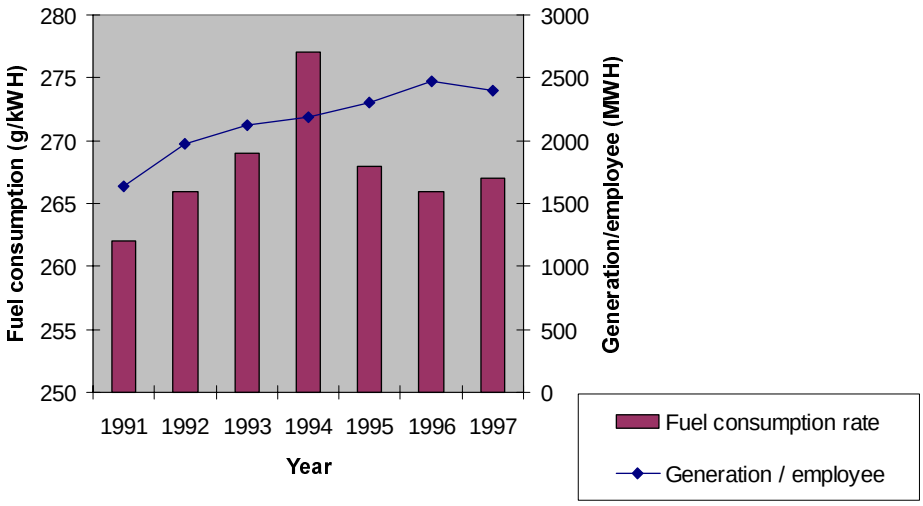
Since then, Sida's Jordan program has allocated SEK 4,048,000 to Sida's contract-financed technical cooperation (KTS, for Kontraktsfinansierat Tekniskt Samarbete in Swedish), with KTS activities focused in two general areas: implementation and upgrading of a computerized maintenance and materials management system (CMMMS), known as Amplissima, provided SwedPower (1985-1998); and support for the National Control Center (NCC) in the area of management of interconnected electric systems (1989-1994). The Amplissima program has accounted for about 60% of total spending by Sida, and the support to the NCC the balance.

In addition, professionals from Jordan have participated in the international training program supported by Sida in Sweden, attending the courses "Energy Conservation and Industry," "Power System Control and Operation," "Architecture, Energy and Environment," and "Standardization: Management and Techniques," with the first two courses in particular drawing the most participants.

The Amplissima project and the international training program are evaluated in detail in this report.

At present, a proposal is being prepared by the Computer Division of NEPCO, to propose a new program in support of the Division as it prepares for the operational separation of NEPCO into the generation, transmission/control, and distribution sectors of NEPCO.

Figure 1: NEPCO performance according to productivity and efficiency indicators1991-1997



Source: NEPCO.

Table 2: NEPCO financial performance, 1994-1997

Figures in JD thousands	1994	1995	1996	1997
Revenues				
Electricity sales	119,242.8	132,012.4	160,203.5	180,854.6
Pole production	1,404.9	1,477.6	1,424.8	1,776.8
Other operating revenues	841.3	1,051.0	900.2	1,131.5
Total operating revenues	121,489.0	134,541.0	162,528.5	183,762.9
Operating expenses				
Operating costs - power stations	70,366.4	77,763.5	94,064.5	109,046.2
Depreciation of fixed assets	16,143.7	18,148.4	23,422.6	33,918.5
Production costs - pole plant	1,042.1	1,193.4	1,269.1	1,613.5
Maintenance expenses	5,038.4	6,013.9	7,698.3	6,969.1
Consumer service and collection	261.2	309.1	339.2	396.3
Consumers' services	138.7	155.2	166.3	201.9
General and administrative	4,350.2	4,714.7	6,027.1	9,954.4
Total operating expenses	97,340.7	108,298.2	132,987.1	162,099.9
Profit from operations	24,148.3	26,242.8	29,541.4	21,663.0
Interest paid and bank charges	(11,961.6)	(11,220.9)	(13,661.7)	(10,621.4)
Currency exchange gain (loss)	(5,050.0)	(6,710.3)	3,556.5	10,872.7
Currency exchange risk	-	-	(1,749.3)	(1,292.1)
Interest income	253.4	350.4	508.6	421.3
Other income and expenses	1,156.2	3,985.8	3,888.0	4,044.1
Net profit from operations	8,546.3	12,647.8	22,083.5	25,087.6
Operating costs - power plants / total operating expenses	72.3%	71.8%	70.7%	67.3%
Maintenance expenses / total operating expenses	5.2%	5.6%	5.8%	4.3%
General & administrative / total operating expenses	4.5%	4.4%	4.5%	6.1%
Year-to-year change in sales revenue		10.7%	21.4%	12.9%
Year-to-year in operating expenses		11.3%	22.8%	21.9%
Year-to-year in operating profit		8.7%	12.6%	-26.7%

Source: NEPCO, annual reports for 1995, 1996 and 1997.

General program evaluation

Sida's energy-sector support in Jordan has been highly focused in two areas (operation of inter-connected electric systems, and materials and maintenance management), with emphasis on specific tasks to be accomplished over a relatively short period of time. Sida has not supported large projects such as those that it has supported in Egypt (such as the Gebel Attaqa feasibility study, the Aswan Hydropower Training Center).

Relevance of Sida's KTS support

In general, the support provided by Sida has addressed well-defined needs of the Jordanian energy sector, and has been generally beneficial to the JEA and its successor company, NEPCO. As noted, activities have been undertaken in two general areas:

- *Materials and maintenance management.* The support provided to JEA and NEPCO in the installation and upgrading of the Amplissima system has been beneficial in general terms. The system is used effectively by plant staff in the two major generation stations in the country to manage equipment, maintenance activities, and costs.

- *Operation and management of interconnected electric systems.* The support provided for officials from the NCC to visit Sweden and observe management practices for Sweden's electric system and operation of the system in the context of the broader Scandinavian interconnected network was important to JEA's plans to proceed with the electrical interconnection with Egypt.

In addition, the programs supported by Sida have provided training to Jordanian professionals in the energy sector, especially in the area of energy efficiency, which are regarded as having been helpful to participants in their activities in industrial companies, government agencies and research institutions.

Ambitiousness of Sida's approach

The ambitiousness of Sida's program may be measured in terms of the overall capacity of the Jordanian electricity sector to absorb international assistance, coupled with the level of spending by 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 activities in Jordan cannot be considered excessively ambitious.

- *Absorptive capacity of Jordanian electricity sector.* The Jordanian electric sector appears to be receiving relatively little technical assistance compared to what other sectors are receiving. This reflects the fact that NEPCO exhibits a relatively high level of technical competence compared to utilities in other countries in the region, together with the fact that the needs of other sectors are far more pressing. Hence, the level of support being provided by Sweden does not seem like to exceed the management capacity of NEPCO or its spin-off firms. In addition, given the relatively limited donor activity in the sector, there does not appear to be as much competition for management attention, as is potentially the case in Egypt's energy sector.

- *Scale and scope of projects being undertaken.* Sida's support for activities in the operations and management area of the national electric system, and the main thermal plants in the country, does not appear to have coincided with other donor activities. This suggests that the focus and impact of Sida's support is more likely to be distinguishable than is the case in other sectors where several donors are active. The scope of activities supported by Sida has not been excessively ambitious.

- *Capabilities of Swedish contractors.* The capabilities of SwedPower in the two areas of activity are entirely consistent with the requirements of the Sida program, and the services provided have been of high quality and well executed.

Traceable effects of the program

The effects of Sida's program activities are difficult to assess in quantitative terms, and only slightly less so in qualitative terms. From the quantitative standpoint, while there have been efficiency improvements in NEPCO's operational and financial performance, attributing these impacts to Sida-sponsored activities would be excessive, even though donor activity is more limited in Jordan's energy sector than in other nations. From a qualitative standpoint, meanwhile, the program does appear to have had some impact, insomuch as the development of the energy sector over the last decade has successfully built on input and support provided by Sweden. On these counts, it appears that Sida's program has had a generally positive impact, though it may be that the results of the Amplissima program have fallen short of expectations.

As far as the Amplissima program is concerned, there has been a shift toward more preventive maintenance, as opposed to corrective maintenance, at the Hussein TPS, but apparently not at Aqaba TPS. This impact may be attributable to Amplissima, but was certainly facilitated by it. However, it is difficult to argue that this improvement has directly contributed to the measurable

changes in NEPCO's financial statements, where maintenance and operating costs have declined as a share of overall costs (see Table 2). Available financial data cover the period of transition from JEA to NEPCO (1994-1997), a change that introduces other variables that could affect financial performance. Data from the late 1980s, which would be used to look for evidence of an impact after the initial installation of Amplissima, are unavailable; it seems unlikely that the most recent installation would yield improvements of nearly the same magnitude as the initial installation, and in any case, the 1998 and early 1999 financial data are likewise not available.

With respect to the support given NCC for improved operation and management of electric systems, the program's impact may be measured from a qualitative perspective, but would be hard to assess in quantitative terms. The program has yielded long-term results in terms of building up expertise and capabilities to handle the complex operational and management challenges posed by interconnection, and the international training program has effectively provided on-going capacity building support that has proved extremely important to the NCC.

Sustainability of the results of cooperation

The sustainability of the results of cooperation is measured in several ways. First, the degree to which new systems or skills provided by Swedish contractors are incorporated and disseminated within NEPCO or other relevant organization will determine the degree of sustainability of the results of the activity. Second, the degree to which the Jordanian 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 had reasonably good results in terms of sustainability:

- The implementation of Amplissima has resulted in the effective use of the program at two power plants in the country, with an increasing rate of preventive maintenance at one of the two facilities, application of the software in tracking costs, and consistent efforts to include all plant information in the Amplissima database. There is interest in continuing to use Amplissima at these power plants. The existing installations of the system are on hardware that is rapidly becoming obsolete, and will likely become harder to service and maintain and familiarity with and availability of spare parts for such equipment diminishes.[2] This will require a substantial new investment, which may be a deterrent - although if the investment is made, it will be possible to transfer data from the VAX-based version of Amplissima to a PC-based version, using Windows.

  However, there are factors that could erode the sustainability of the program's results. First, it does appear that the remaining facilities do not seem eager to install Amplissima, most likely because of the substantial effort required to enter all data. In addition, familiarity with the system seems to be highly concentrated in a few individuals, increasing the risk of loss of institutional memory regarding the system if those individuals leave NEPCO. This concentration of expertise is related to the other drawback with the system, namely that the system is not fully disseminated through the organization, since knowledge of English is necessary. Lastly, the ability of NEPCO to economically address problems with the system appears to be limited – troubleshooting requires a visit from SwedPower. Sustainability would be enhanced if there

[1] NEPCO does have a maintenance agreement with a local company for this equipment.

were locally available maintenance capability, which would also provide software development capabilities that could support the development of an Arabized (and also Roman-compatible) system, for use in Jordan and throughout the region.

- The commitment of NEPCO to using Amplissima is well-established, both because interest in continuing its use was renewed in the mid-1990s after a hiatus in contacts between Sida and Jordan, as well as because of the substantial resources committed by NEPCO to its installation. However, it remains to be seen whether the management of NEPCO's privatized spin-off companies will continue to use Amplissima. It seems less likely that private firms will want to rely on a system for which they do not have local support – unless they can count on funding from Sida for support by Amplissima's developer, which may not be possible.
- The implementation of the Egypt-Jordan interconnection, and the plans to create a competitive electricity market in Jordan, have guaranteed the continued relevance of the technical support that Sida provided in the late 1980s and will continue to provide through the international training courses.
- Other donors have been active in the energy sector in ways that do not really have much to do with the activities supported by Sida. These means that there is less likelihood of reinforcing support from other donors for activities supported by Sida.

Adequacy of KTS as a technical cooperation mechanism

The KTS mechanism has proven more useful in the context of the support given the NCC as opposed to that provided to JEA and NEPCO for the installation and upgrading of the Amplissima system.

In the case of the support given NCC, this has proven relevant to the long-term development of the electric system in Jordan, and essential to the success of the interconnection project. The support provided by Swedish contractors under KTS contracts was delivered effectively and was highly appreciated by the Jordanian officials who took part.

In the case of the Amplissima system, however, it would appear that the Sida program has helped provide a software system that is used effectively by JEA and NEPCO, but without really creating local capabilities to ensure its continued utilization without further support by Sida. On the one hand, institutional capacity to ensure adequate training in use of the system may be too limited – concentrated in one person – and not incorporated into the training programs for new entries into the sector. On the other, the presence of in-country or in-region technical capability to develop new versions of the software, provide effective technical support, and adapt the software to local and regional requirements has not developed through the KTS support provided by Sida.

Sida's role in relation to others in the sector

As noted in the separate section on donor activities, Sida's support for activities in the operation of the country's electricity sector does not appear to be matched by other donors. Other donor programs have tended to focus on other energy-related issues, to the extent that they have supported energy-related work at all.

This is an advantageous position to be in, from one perspective, but it also gives rise to assertions that continued support for the energy-sector activities that have been undertaken is not necessary, and other areas should be given priority in future programs.

3. Findings

This section presents the findings of the Sida review team on two programs: the Amplissima CMMMS program and the international training program. Additional information on donor activities is presented in a separate section.

A. "Amplissima" Computerized Maintenance and Materials Management System

Background

Sida's technical cooperation with Jordan in the area of deployment of the CMMS system known as "Amplissima" began in the late 1980s, when the then Jordan Electricity Authority (JEA) requested Sida's support for installation of the system. Subsequently, in 1997, support was requested for a second time, by the National Electric Power Company (NEPCO), to upgrade the Amplissima system with a new version. This work was completed in early 1998. At present, the Amplissima system has been installed at the Hussein Thermal Power Station (HTPS), in Zarqa and the Aqaba Thermal Power Station (ATPS), located south of the seaport of Aqaba. The system has not been requested by the other thermal stations in Jordan, nor by the transmission and distribution sectors of NEPCO. The two plants where the system has been installed *comprise 54 percent* of NEPCO's system, by capacity, representing the backbone of NEPCO's system that provides base-load generation for the national system and some for export to Egypt over the Taba-Aqaba underwater cable. (See Table 1)

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.

NEPCO has prepared a new proposal for technical cooperation on Amplissima, this time focusing on upgrades to the system's archiving capabilities, which NEPCO officers argue does not meet the needs of the power plants' staff because the present version cannot handle plant drawings. In addition, the division of NEPCO into three sectoral companies that is now underway has created a situation in which the computer division (which will stay within NEPCO) is requesting assistance to establish the necessary mechanisms and capabilities to provide services to the other two companies in the areas of software development, maintenance, hardware, computer time, tender evaluation, and training.

Relevance

The relevance of the Amplissima program to NEPCO's development is substantial. As Jordan's electric system has expanded, the need for more effective management and tracking of maintenance activities and spare parts inventories has increased. With the transformation of the JEA into NEPCO, and the attendant effort to improve the financial position of the company, the establishment of mechanisms to track and control costs has been a major concern. Amplissima provides a mechanism for tracking these costs and managing them more effectively.

It should be noted, however, that there is nothing particular about Amplissima, as opposed to other products that perform a similar function, that drove the decision to install it at the facilities of the JEA (or later, NEPCO). Indeed, certain NEPCO officials say that the decision to install Amplissima was driven primarily by the fact that it could be obtained with external support from Sida. Other similar systems were available at the time, including one utilized by Vattenfall, but these were more expensive. Even so, the needs of NEPCO can be adequately addressed by Amplissima.

Results

For the most part the Jordanian counterparts have expressed satisfaction with the results of the technical cooperation supported by Sida, especially following its most recent phase. With the upgrade of the system in 1998, almost all of the problems and weaknesses identified in the years following the initial installation of the system have been addressed. Principal among the weaknesses identified was the lack of a direct link between the "store" module of Amplissima and the maintenance module. A significant period of time passed before work on this link began, due to the interruption in contacts between NEPCO and Sida from 1990 to 1995.

Following the upgrade in the system, at HTPS the Amplissima operators report three problems with the system: (1) the system is not Y2K compliant, in that instructions for scheduled maintenance for periods in the year 2000 are not recognized by the system; (2) there are problems with the printing function that cause the printer to add blank pages to any print run; and (3) the system is unable to handle graphics. These problems are the ones that remain after the upgrade to the system in 1998. A SwedPower representative will travel to Jordan in May or June, 1999, to address the Y2K concerns and presumably the printing issue as well. The ability to handle graphics will not be addressed unless the support now being requested by NEPCO is approved by Sida.

Beyond the present limitations of the system itself, it is possible to say that the installation of the system has not delivered all of the benefits that NEPCO, as a relatively well-developed electric company, should derive from a new computer management system. Specifically, the program of cooperation has done relatively little to reduce NEPCO's dependence on the supplier of Amplissima and its technical staff for the resolution of any inadequacies of the program (such as the printing error, the Y2K compliance issue, lack of support for graphics). For example, the Y2K problem in the system will require that a SwedPower representative travel to Jordan to address the problem. It would be preferable if the support provided by Sida were to create a broad range of capabilities in Jordan that would provide the motor for substantial development and secondary technology transfer. In the case of Amplissima, the support provided by Sida would have contributed to deeper capacity formation if it had involved the establishment of a local presence (perhaps a joint venture or subsidiary) with the capacity and authorization to make substantial modifications and adaptations to the software, as well as perhaps develop an Arabized version for the local and broader Middle Eastern market.

It should be noted, however, that to some extent the limitations of the system may be self-imposed. Although there is a Windows-based version of Amplissima, it was not installed in the most recent project, because NEPCO preferred to continue working with a VAX-based system, largely to avoid "wasting" the investment made in the VAX hardware. Clearly, adherence to the older computing hardware will limit NEPCO from taking advantage of the newer versions of Amplissima that will continue to come out. Sooner or later, the shift to a PC and server-based system will have to be made. The shift will not imply any massive disruption in the use of Amplissima, as the older version's data can be downloaded into the new version; the only major disruption would potentially be the change in hardware.

While it is true that this suggestion might be challenged on the grounds that transfer of the source code to NEPCO could lead to a loss of commercial benefits for the software's developers, it should be noted that the evolution of the product already means that the installed version is outdated – the version of Amplissima that was installed only last year was superceded by the Windows-supported version of the software at about the same time. Broader licensing arrangements – with higher costs associated with them – would perhaps have been preferable to the narrower agreements currently in place. It is important to note that Egypt's EEA is also seeking a blanket license for use of Amplissima throughout its system.

Alternatively, a closer tie between the developer of Amplissima and NEPCO could lead to the co-development of a version specially tailored markets in the Arab world, specifically a version with more Arabic-language capability to permit broader use at facilities where the users' command of English may not be as great as in the headquarters offices. This approach would permit the developer to provide better follow-up service and possibly generate royalties from sales to other customers plus follow-on service to its existing clients.

There is also evidence that some NEPCO personnel were not convinced that Amplissima was the best system that could be obtained on the market to address the company's needs. The evidence for this assertion is in the fact that no other plants in NEPCO's system have requested the installation of the system, and even that only one other national utility of the several that came to visit the JEA when it first installed the system actually installed it – Egypt's EEA. The reluctance of other facilities besides HTPS and ATPS to install Amplissima may be attributable to the substantial effort required to enter all data. Since these plants are relatively small compared to HTPS and ATPS (see Table 1), this consideration would be especially relevant.

In Jordan, the complaints that have been registered about Amplissima may not be specific to the system, but certainly are influenced by the experience of the HTPS and ATPS staff with implementation. The primary objection to the system (and perhaps any system), an official from HTPS reports, is the fact that the data loading process has often proved very onerous. In the case of Phase II of ATPS (where an additional 390 MW of capacity are in final stages of testing and commissioning), the acquisition of readily usable data in a suitable electronic format has not been possible, so technicians must review the technical manuals to obtain the relevant specifications to create component entries in Amplissima. The difficulty stems from the fact that NEPCO's contract with ABB, which is building the three units, did not include provision of the data in a usable form. When specifications for the first two units at ATPS (Phase I) were being sought for downloading into Amplissima, JEA had to request the relevant data from the manufacturer and input them by hand as well.

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, given the general satisfaction with the system, it is possible to conclude that the installation of the product was completed in a timely fashion by the Sida contractor. Rather than comment on any evidence of inefficiency or excessively long implementation times on the part of the Sida consultant, NEPCO and the Ministry of Planning both noted that the response time from Sida itself seemed excessively long. For example, NEPCO officials noted that the Amplissima upgrade that was performed in 1997-1998 was first contemplated and requested by NEPCO in 1995. Similarly, a Ministry of Planning official provided the team with a copy of a letter to Sida that was sent in late 1998 and to which no reply has yet been received.

Leverage

One measure of the value of the Sida contribution in terms of its impact on resource allocation in the cooperating country, and therefore of the sustainability of the spending by Sida, the leverage of the Sida resources, in terms of the cooperating organization contribution to the project.

As described in Table 3, the degree to which Sida resources have been leveraged by local resources is substantial. In the case of the First Phase of Amplissima deployment (including both Amplissima as well as the computer upgrade program), the local contribution made by NEPCO (support for in-country stay of Swedish experts, other direct costs), was equivalent to about 77% of the Sida outlay, while in the Second Phase, the local contribution made by NEPCO represented 165% of Sida's support. Together, the NEPCO contribution is 112% that of Sida. This is a comparatively high level of local contribution compared to the estimates for other projects in Egypt.

Table 3: Cost Sharing for Installation of Amplissima at HTPS and ATPS, Jordan

Project phase	**Swedish component (SEK)**	**Jordanian component (JD)**
First Phase (1988-1989)		
HTPS and ATPS: maintenance TC	616,000	25,700
JEA-Amman: computer TC	1,335,000	90,000
Second Phase (1997-1998)		
HTPS and ATPS	1,845,000	258,200
Exchange rates (versus USD)	5.85 (1988) / 8.25 (1998)	0.45 (1988) / 0.70 (1998)
Total (USD)	$557,140	$625,970

Source: NEPCO. First phase figures are estimates, as actual documentation is not readily accessible. Exchange rates are approximate.

Sustainability

The continued interest of NEPCO in the Amplissima software provides a demonstration of the sustainability of the NEPCO program. Management, computer and operations personnel at both of the facilities where Amplissima has been installed indicated their support for the use of the software, and asserted that the system has had a beneficial impact on operations at both facilities. Further, the computer department has expressed interest in deepening its capabilities in the programming area, perhaps through a co-development scheme involving preparation of an Arabized version of Amplissima.

But this issue underscores a complicating aspect of the program with respect to its sustainability. As currently established, with substantial NEPCO outlays associated with the Sida support, and continued dependence on technical support from SwedPower, the program is arguably less sustainable than it would be in the event that Jordanian expertise in the relevant software development fields were developed through the program, thereby enabling NEPCO to become more self-sufficient in the creation, installation, maintenance and dissemination of the Amplissima software. Such a program, if developed, would be substantially more sustainable than one in which the availability of resources at NEPCO will constantly be a constraint to its ability to upgrade to the newest version of Amplissima.

The question should also be asked whether the Swedish contractor offers strong guarantees of being able to provide services to NEPCO or other contractors on a continuing basis. The primary software developer for the projects in Jordan is an independent consultant who was subcontracted by SwedPower. So far SwedPower has been able to manage this arrangement satisfactorily, but the sustainability of this situation may not be guaranteed.

Impact

It is difficult to measure the impact that Amplissima has had in quantitative terms. While there has been a marked improvement at both HTPS and ATPS with respect to certain basis operating parameters, it is not possible to isolate the impact of Amplissima from the impact of other factors, such as that of increases in the overall demand for power that have been translated into higher levels of availability at those facilities. It is possible, however, to say that management of the HTPS and ATPS has determined that operation has improved, although neither plant appears to have maintained data on spare parts inventories over time that might show an impact by Amplissima.

According to staff at the HTPS, the Amplissima system has played a role in the increase in preventive maintenance relative to the amount of corrective maintenance performed at the power plant. Currently, some 70 percent of maintenance is preventive, with only 30 percent corrective. The situation at ATPS is the inverse, with 70 percent corrective and 30 preventive. According to staff at ATPS, this is because the facility has higher plant factors than HTPS, although both are considered base-load facilities. It is not possible to show the long-term trends in the patterns of maintenance at either facility, since long-term data have not been kept. Nor is it possible to assess the extent to which stocks of spare parts have decreased over time, as these records are not readily accessible at the plant level.

At the same time, however, available data from NEPCO suggest that the utility has had a difficult time improving its performance. The most recent data from the company's annual report show that the plant factors for each facility have varied considerably over the 1992-1997 period, even as total consumption has increased steadily throughout the same period. For example, ATPS has registered plant factors between 53 percent and 88 percent within two years of each other, and HTPS has posted more regular results between 50 and 70 percent. The variations at ATPS are especially relevant since it constitutes the primary base-load facility in the Jordanian system, followed by HTPS.

Overall, NEPCO has not demonstrated the same steady improvement in terms of efficiency as has the EEA in Egypt. This could be because NEPCO begins from a higher level of productivity and efficiency than does EEA, although EEA's measures of thermal efficiency are higher than those of NEPCO (it should be pointed out that there could be methodological differences to explain the discrepancy). In the areas of productivity per employee and transmission losses, NEPCO has posted superior performance.

Lessons learned and recommendations

From the foregoing, some key lessons emerge:

- The data entry requirements for adopting Amplissima are considerable, and may constitute a major obstacle to implementation in smaller facilities. NEPCO views this activity as training for its newer staff, but training is necessarily a secondary activity to more urgent matters when they arise, thereby making it like that implementing Amplissima will take longer than normally anticipated.

- The language of Amplissima does not pose so great a difficulty to users at facilities in Jordan, as the command of English among NEPCO personnel is greater than that of the EEA. However, conversion to Arabic might offer a commercial opportunity that could be exploited jointly, with long-term benefits in terms of sustainability, commercial benefits to the contractor, and broader regional impacts from Sida's development spending.
- With privatization, the sustainability of the Amplissima program may be altered

Based on these lessons, the following recommendations seem appropriate:

- Educating managers at the top about Amplissima – as well as all other information systems technologies – is both necessary and beneficial. Amplissima does not necessarily have the support of all potential system users within NEPCO. It is possible that the system would have an appreciable impact on efficiency in other parts of the network were it to be installed there.
- The sustainability of the program and its results would probably be greater if the extent of technology transfer were deeper and more comprehensive, as would be the case if a local service provider were associated with the program. This need not jeopardize the commercial interests of the contractor; on the contrary, the arrangement could create new business opportunities for both the contractor and the local partner.

B. International Training Program

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 Jordanian 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 400 Jordanian participants representing many sectors have joined the international training programs since 1978. This evaluation covers training for the energy sector only. According to the

terms of reference for this evaluation, 34 participants have undergone training in Sweden; however, this evaluation covers only the 32 participants mentioned on the lists we received. The total cost since 1990 has been approximately SEK 2.5 million.

Only two women are represented in the numbers below, and both were the sole participants in the course "Architecture, Energy & Environment."

Table 4: Courses offered, number of participants per course and distribution in percent

Course	**Number of participants**	**Distribution**
Energy conservation in industry	21	66%
Power system control and operation	8	25%
Architecture, Energy & Environment	2	6%
Standardization: Management & Techniques	1	3%
Total	**32**	**100%**

Table 5: Employers at the time of the course, and number and distribution of participants

Employer	**Number of participants**	**Distribution**
Arab Potash Company	7	22%
NEPCO (former JEA)	7	22%
Jordan Cement Factories	4	13%
Jordan Petroleum Refinery Co.	3	9%
Royal Scientific Society	3	9%
Industrial Commercial and Agricultural Co.	2	6%
Middle Ghor Industry Co.	1	3%
Ministry of Energy and Mineral Resources	1	3%
Ministry of Public Works and Housing	1	3%
UNRWA	1	3%
Unknown organization	2	6%
Total	**32**	**100%**

Survey Methodology

In Jordan, there was no local consultant to assist in compiling the data. NEPCO offered a great deal of help through the Head of Training, but since NEPCO only represents some of the participants and many of them were abroad, it turned out to be difficult to get in touch with them. Another difficulty was the time limit. We were in Egypt for two weeks but in Jordan for only one. The Swedish Embassy provided assistance by sending questionnaires by fax to the various companies of the former participants, asking the companies to send a copy of the questionnaire to each person mentioned on the list. Participants were to send their replies to Swedec's headquarters in Sweden in case they were not able to hand in their answers on time. Unfortunately, this method resulted in only 12 completed questionnaires out of the population of 32, so the attrition rate from the original lists was high. A final attempt was made to increase the number of answers by including all of the participants who we discovered, even if they had attended the courses before 1990. This provi-

ded six more questionnaire responses, and included courses other than those mentioned above. Since we consider this information to be relevant for evaluation of the international training programs, they have been included in most of the results below. Four of these people had participated in a Sida-financed "Electric Power Engineering & Management Course" carried out during 1986, 1990, 1993 and 1994, but for some reason did not appear on the lists received from Sida.

To get deeper understanding about the long-term effects of the courses, two meetings were held with a total of nine former course participants, one meeting at NEPCO with four trainees, and another at our hotel with five participants. Below follows a table showing the actual distribution of courses and participants who were used in the further analysis.

Findings

All participants in the sample are engineers, which means that they have received university education. Six of them have undergraduate level, first degree, ten have graduate level, and two have Ph.D's. There is only one woman represented in the sample. In the terms of reference for the study it was said that no women had received training in Sweden, but there is a discrepancy with other information because, as stated above, the "Architecture, Energy & Environment" had two female participants.

Table 6: Presentation of the final sample in relation to target population

Course	**Original Population**		**Available Sample**	
Energy conservation in industry	21	66%	6	33%
Power system control and operation	8	25%	4	22%
Architecture, energy & environment	2	6%	1	6%
Standardization: Management & techniques	1	3%	0	0
Electric power engineering & management	0	0	4	22%
Electricity distribution management	0	0	1	6%
Quality control in industry	0	0	1	6%
Unknown course	0	0	1	6%
Total	**32**	**100%**	**18**	**100%**

Work Situation

All the participants in the sample, except for one, have the same employer today as they had at the time of the course, although one employer, JEA, has become a company known as NEPCO. The one participant who has changed employers is now working for the Electric Distribution Company (EDCO). It must be remembered that the participants who became part of the available sample were traced largely due to this lack of movement. In other words, the results should not be interpreted as showing that people generally stay at their jobs. On the contrary, our impression is that many have left, especially to work in the Gulf States.

Table 7: Change of duties between the time for the course and today

	17 Men + 1 Woman
Change of duties	6
No change of duties	12
Total	**18**

Table 7 shows that most of the people in the sample have not changed duties since the time of the course. Compared to Egypt this is very different, but no conclusions should be drawn from such a small sample, especially considering the constraints to the data collection process.

Table 8 below gives a rough idea of changes of career for participants in this sample. It does not give a complete picture, since the highest level is "manager" and nine of the former course participants had that title when they attended the course. Three of them reported that they have continued their careers, but those changes can not be seen in this table.

Table 8: Career development between the time of the course and today

Position at the time of the Course		**Actual Position Today**		**Change**
Managers	9	Managers	11	**+2**
Supervisors	2	Supervisors	3	**+1**
Engineers	7	Engineers	4	**-3**
Technicians	0	Technicians	0	
Skilled workers	0	Skilled workers	0	
Administrative staff	0	Administrative staff	0	
Total	**18**		**18**	

Utility of the Course

Table 9 shows that 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, in contrast with its usefulness before, is due to new duties in the job.

Table 9: 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	0	Perhaps a little useful	2	**+2**
Rather useful	6	Rather useful	7	**+1**
Very useful	12	Very useful	9	**-3**
Was necessary in order to get or keep the job	0	Was necessary in order to get or keep the job	0	
Total	**18**		**18**	

Among the comments made, the following can be noted course by course from 1990 to 1998. Participants attending courses earlier than 1990 have not been included in the comments below, since the syllabi may have changed considerably since then. The numbers within brackets show the number of participants who expressed the same or a similar opinion.

Table 10: Participants' Comments on "Energy Conservation in Industry"

Positive Comments	Other Comments
Useful in general terms (2)	There were some unqualified teachers who were new to the subject (1) (…in 1998)
Useful, because of energy auditing; studies, production cost; environmental aspects (2)	The course was heavily focused on the thermal part, not so much about electricity (1)
Useful in carrying out energy conservation audits, feasibility studies and other studies (1)	Advanced knowledge about energy should be added to the subjects (1)
High quality of teaching, especially experts from the Swedish industries (2)	Experiences of large industries should be included in the course (2)
The methods and tools used were very good (1)	More attention should have been given to auditing (1)
The course content was good (3)	It would be better if the course could start in August (1)

Table 11: Participants' Comments on "Power System Control & Operation"

Positive Comments	Other Comments
The course gave a general overview of requirements of national control centers, etc, and the new technology in building them (1)	
The course was very good and, also the teachers and field visits (1)	
The material used during the course was good and gives the general overview of building and organizing control centers (1)	

Table 12: Participants' Comments on "Architecture, Energy & Environment Course"

Positive Comments	Other Comments
The course was very useful and I am taking into consideration what I learned from the course, during my design work (1)	The computer Program was not user-friendly, and needs more time. It should have been introduced at an earlier stage of the course (1)
The quality of the course and the teaching was high. The lectures were very knowledgeable and their work was based on both research and practical experience. The library and the periodical research magazines were very helpful (1)	

Table 13: Participants' Comments on "Advanced Electric Power Engineering & Management"

Positive Comments	Other Comments
The course was useful in the power system planning, and a little useful in demand side management (1)	The course content was not advanced enough. It could be given to the level below management level (1)
I gained good knowledge in project management, safety, environment, application of PC, economic vision in decision making, and team work (2)	The course was good in general but not for managers. The course could have been shorter (1)
The course was well organized, very good quality in all aspects (1)	Different levels of participants did not serve the efficiency of the course (1)
	The course should have been divided into two parts, generation and transmission, to give more information to each participant in his field of specialty (1)
	The financial part was very short (1)
	The course should have included a visit to a car factory and a furniture factory (1)

Table 14: Participants' Comments on "Electricity Distribution Management"

Positive Comments	Other Comments
The course was useful for developing ways of thinking in design, planning, operation and maintenance of distribution systems (1)	The quality of some teachers were not high enough (1)

Table 15: Participants' Comments on "Quality Control in Industry"

Positive Comments	Other Comments
The course was useful for improving my overall professional performance in planning, documentation, evaluation and problem analysis (1)	
The quality and content of the course were perfect (1)	

Did the Sida course help in applying new changes in the organization of the participants?
In this sub-chapter, all of the questionnaires are taken into consideration, including the answers from participants who attended courses before 1990.

Ten people say explicitly that they have not (yet) applied changes in their organizations as a result of the courses. One states that "because of the restrictive methods and rules used within the organi-

zation, there is not sensitiveness [sic] for newly gained ideas". Another says that he completed the course five months ago, which is not enough time for achieving long-term effects.

Two participants did not answer the question. The remaining six say that the course helped them to apply changes in their organizations in the following ways:

- The course helped me a great deal in performing feasibility studies, energy conservation audits and evaluations for upgrading projects; the operation mode of the power plant has been modified according to the results of my study (saving $700,000 per year).
- The course encouraged me to carry out a new study on production lines in order to save energy.
- The course opened up new ways to handle "telecontrol systems" issues, especially the functionality and performance issues.
- The course helped in implementing the existing control center and the enhancements afterwards, and also in organizing the work of the department.
- The course gave the general requirement for building control centers, and their operations, communication, etc. I participated in tendering for upgrading of our NCC.
- The course helped me to a great extent.

Have the former trainees participated in any other Sida-financed or competence-building activities?
Only two participants said that they have had contact with other Sida-financed activities. One of them received training by SwedPower on installation of CMMMS since that area was at that time his responsibility, and he also participated in developing and implementing the system in his company. The other one has participated as a manager and counterpart in the Control Center project.

Outside Sida-financed activities, the following can be noted when it comes to participation in competence-building activities:

- I participated in an energy conservation conference in Lebanon and in Moata University, Jordan. Further, I have submitted an article to the World Cement Magazine, Jan/99, "Upgrading Projects in JCF and its effect on Energy and Environmental Aspects". (JCF stands for Jordan Cement Factory.)
- I have participated in Jordan University Workshop for Energy Conservation and Recovery.
- I have participated in conferences, lectures and given technical presentations and written papers, etc.
- I have participated in a training course in France 1998, about operational studies for the interconnection between Jordan, Syria, Egypt and Turkey.
- In 1984, I participated in a Power Systems Engineering Course at the Westinghouse Advanced School.
- I have participated in local seminars and training courses.

General conclusions and recommendations for future activities

The conclusions and recommendations presented here incorporate observations from the survey of Jordanian participants, but they also include reference to the survey of Egyptian 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 can not 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. This would also be a useful 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 interconnection 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 Arabic 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.

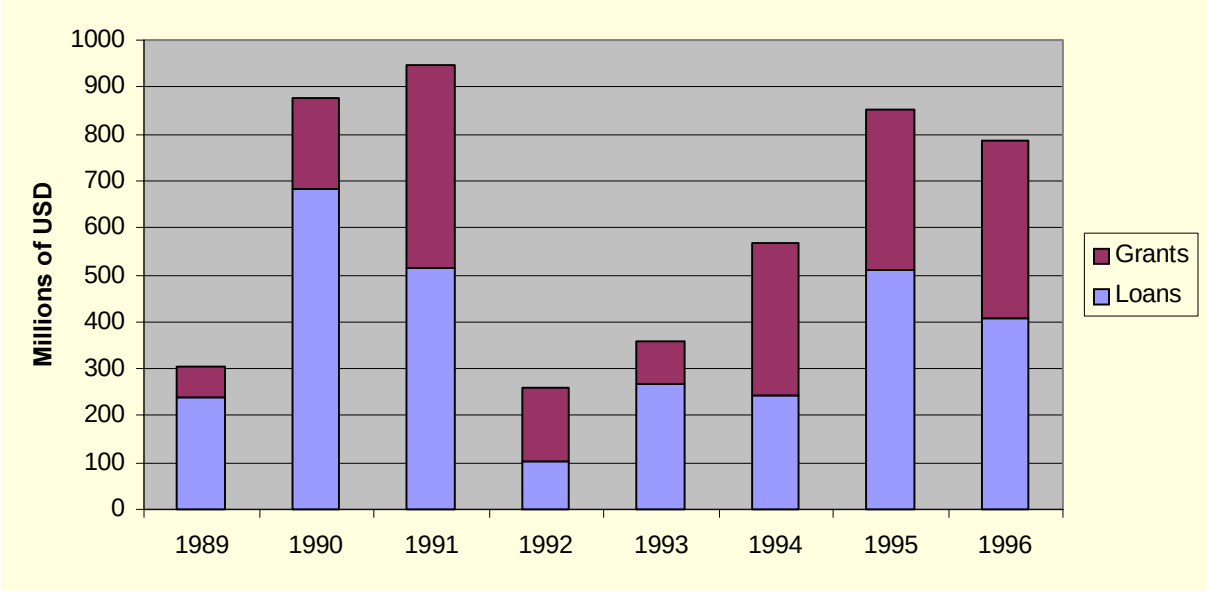
If Sida wants to promote female participation, local training could be an effective means of doing so. If a real priority is to be given women in the energy sector, a mentoring Program could be established where experienced and successful women from Egypt, Jordan, and abroad actively participate in teaching 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."

4. Donor activities in Jordan

Background

Jordan has been a long-time recipient of foreign assistance. There appears to have been a substantial variation in the level of such assistance due to political factors, most importantly the country's support for Iraq in the 1990-1991 Gulf War. Data from the United Nations' Development Program (UNDP), show that Jordan received almost $5 billion in grants and loans over the period from 1989 to 1996, with grants making up 40% of that figure. However, both the total amount disbursed, and the relative share of loan and grant support have varied considerably during that period, reaching a high of $948 million in 1991 and a low of $259 million the following year. It should be noted that Jordan did receive substantial amounts of support in 1991 to compensate for the sudden influx of returnees from the Persian Gulf region, and experienced the sharp downturn in assistance as several donor states withdrew support in protest over Jordan's support for Iraq in the Gulf War (1990-1991). (See Figure 2.)

Figure 2: Trends in donor support to Jordan, 1989-1996



Source: UNDP.

With respect to cooperation in the energy sector, there appears to be far less donor activity in the energy sector at present than has been the case in Egypt – reflecting the sector's comparatively higher level of development – as well as the fact that the sector is on a path to privatization, which will render some of the newly formed companies of the electric sector ineligible for assistance from certain programs and certain donors. Furthermore, several donors have chosen to focus on those issues, such as water resources, to which they have accorded greater importance than energy.

United States – U.S. Agency for International Development

The USAID office in Amman indicated that it is not supporting activities in the energy sector at the present time, and consequently no interview was held. However, a review USAID's main areas of activity in Jordan sheds some light on the needs that are perceived to be the most urgent in Jordan. USAID's program includes three general categories: water resources, economic opportunity, and

family planning. USAID spending in Jordan has increased dramatically in recent years, reaching $140 million in FY1998, up from $126 million in FY1997 and $7.2 million in FY1996. According to USAID, Jordan now ranks among the largest recipients of U.S. assistance on an aggregate basis, and among the most important recipients in per-capita terms. During the period from 1999 to 2002, Jordan will continue to receive these higher levels of assistance, with new, additional resources possible as well as part of the U.S. commitment to supporting Jordan's King Abdullah bin Hussein in the wake of the death of King Hussein.

The water resources program has focused on three issues: promotion of more effective water management, through better data collection and more adequate policies; enhanced technical efficiency of water use, through the introduction and use of modern water use technologies; and improved wastewater treatment facilities, through improvements to plants such as Al-Samra, which now handles 80% of Jordan's wastewater, and the construction of a new plant at Wadi Mousa, near Petra. Through improved resource use promoted by these program areas, more water will be available for residential, agricultural and industrial users.

The economic opportunity program has focused on the need to stimulate job creation to help provide employment for Jordanians who have returned from jobs in the Persian Gulf nations in the aftermath of the Arabian Gulf War, as well as young workers who are entering the labor pool. Activities have focused on the creation of micro-enterprises, through micro-lending and support for entrepreneurs, especially women, and on supporting economic policy reform through a multi-year balance of payments program.

The family planning program is intended to help Jordan bring its burgeoning population growth under control: although the birth rate has declined in recent years, population growth is still well over 3%, implying that the country's population will double in about 20 years. The program addresses the need for reliable information on family planning issues, expansion of access to services and products, and support for policy changes to make the provision of such services more efficient.

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

The budget for the GTZ grant support to Jordan has been DM 12-15 million (about $6.7 to $8.3 million) per year over the last two decades. Today, GTZ is implementing 22 projects in the country. The co-operation with the energy sector is one of the smallest areas and includes only one project: "rational use of energy," with a focus on small and medium enterprises. The following list identifies the sectors currently receiving support and their share of the total budget.

- Water sector, 40%, reflecting the perception shared by other donors that the scarcity of water is Jordan's greatest challenge;
- Modernization of administration, 40 percent;
- Agriculture, 12 to 15%;
- Energy sector, about 4%;
- Regional development of southern Jordan, environmental support, and institutional support for conservation of archaeological monuments, 1 to 4%.

Over the last three to four years, the energy sector has received about DM 500,000 (some $277,000) per year. The present agreement covers 1999-2001 (three years). Before then, the support was about DM 1 million (about $560,000) per year, and sometimes even more. The reason for the decrease is that the energy sector is now considered to be a modern one and that several other sectors are more behind.

A recently concluded project, "Research and Development Program on the Use of Renewable Energy Resources in Jordan," was carried out between 1989 and 1997. It consisted of the following five subprojects: improvement of solar water heating systems; further development of wind-powered mechanical water pumps; establishment of a laboratory for control and power electronics; field tests of a photovoltaic screw pumping system; and South – South cooperation in the use of solar and wind energy

In general, it was judged that the Project succeeded in achieving its goals by commercializing the use of renewable energy in Jordan, although some problems were also mentioned. One was that the relatively low electricity prices forced the producers of solar heating systems to use cheap materials, which meant that systems tended to brake down easily, especially since there is no tradition of preventive maintenance in Jordan. Another problem was that the water pumps used for the wind-powered water pumps, came from Germany and did not work well in the harsh conditions of the Jordanian desert. They broke down because of lime deposits and also because of lack of maintenance.

The counterpart organization for the rational use of energy project and the renewable energy project is the Higher Council for Science and Technology, through the Royal Scientific Society as the implementing organization. (The RSV has also been represented by three participants on the "Energy Conservation in Industry" training course in Stockholm supported by Sida.) The GTZ project covers technical assistance, materials and equipment, training organized in Jordan, Germany and India, and participation on fairs of relevance for the project.

In January 1999, the final report was presented of an incentives study for promotion of efficient energy use in Jordanian industry: "Rational Use of Energy Constraints". The main objective of the project is to encourage local industries to adopt the recommended energy efficiency measures and to convey the energy conservation behavior to their employees. The review have shown that the potential energy saving in the industrial establishments ranged from 5% to 38% of the total energy bill. This translated to into JD 5.6 million in savings (67 MSEK), representing almost 5% of the industrial sector energy consumption for 1997.

Another project that might come up in the future is "Energy Efficient Refurbishment of Street Lighting in Amman." The final report of the feasibility study was presented in February, 1999. GTZ has shown interest in supporting this area, because street lighting was the fastest growing electrical load in Jordan during 1996/97 (with an annual growth rate of 11%), and second, that street lighting load coincides with the maximum demand load that typically occurs shortly after sunset each day. Given current electricity tariff policy, the subsidy for this segment of consumption places a burden on Jordan's finances.

Japan – Japan International Cooperation Agency (JICA)

JICA support to the energy sector is mainly carried out through two different semi-related activities. The first is direct support to NEPCO's Electric Training Center in Zerqa, near Hussein TPS, and the second is a "Third Country Training Program" (TCTP).

The agreement to establish the training center goes back to 1986, when the aim was to meet the training needs for efficient provision of electricity. The center was equipped with modern training materials for practical training covering all areas of the electricity industry such as thermal generation stations, high voltage transmission lines, substations, distribution networks and consumer services. The center was designed to accommodate 200 trainees per year, both from Jordan and from neighboring countries. The center provides two-year initial training courses as well as short-term upgrading courses in the various subjects.

The two-year programs are offered to students who have finished their compulsory education and have a secondary certificate (scientific and industrial). The program period is divided into four semesters, during which there are basic courses and then specialized training in one of three areas: generation, transmission or distribution. The first semester is carried out at the training center and the rest of the training is practical, done in the field. A monthly allowance is paid during the training period. The trainees also have health insurance, social security and daily transport between the Zerqa City and the center or work site.

The second type of Japanese support, TCTP, is aimed at promoting human resource development, targeting future leaders for sustainable development. The program can roughly be divided into courses held in Japan and courses held in other countries. Courses held in Japan include technical training programs for young people. Course length varies from one month to one year.

TCTP courses held in Jordan are carried out through two different projects: (1) for the Arab countries in general (Algeria, Bahrain, Djibouti, Egypt, Lebanon, Mauritania, Morocco, Oman, Saudi Arabia, Tunisia and Yemen); and (2) for Palestinians only.

The project for the Arab countries is now in its second phase. The first phase lasted between June, 1992, and August, 1996, and consisted of five 14-15 week courses at the Electrical Training Center. The second phase started in May 1997 and has so far implemented three courses consisting of 14 weeks each, 14-18 trainees per course, covering the following areas:

- 1997: Construction and maintenance of aerial bundle cables and underground cables
- 1998: Construction and maintenance of distribution systems overhead line and cable jointing
- 1999: Construction and maintenance of transmission overhead line 132 kV and transmission of substation.

The lectures have been performed by both Jordanian and Japanese experts.

The second kind of projects: TCTPs for Palestinians only, have consisted of two sub-programs over the years: (1) an Electric Power Training Course, and (2) a Medical Equipment Maintenance Training Course. For the energy sector related course, the first phase ended in November 1998 and a survey team will visit Palestine to discuss the second phase. The same kinds of courses have been offered to the Palestinians as for the other Arab countries.

United Nations' Development Program

The UNDP office in Jordan is supporting several activities relevant in the energy sector in Jordan. Overall, UNDP programs in the country have a pipeline of approximately $19 million, with additional complementary funding from other donors and the Government of Jordan yielding total spending of about $24.5 million.

Environment, energy and natural resource management projects account for about 80% of total UNDP commitments, and just under 70% of total spending, in this pipeline. Other program areas include governance and public administration (accounting for 10% of UNDP outlays and 14% of total spending) and poverty and gender (accounting for 1% of UNDP and 3% of the total budget). Under the heading of environment, energy and natural resource management, wildlife conservation programs (including an $8.45-million project in the Dana wildlands in the eastern desert) account for 61% of total spending, climate change and energy programs account for 24% of total spending, while support for environmental policy and education initiatives account for an additional 13%, and water the remaining 2%.

Current activities in the energy area include:

- Financing for a methane capture project at the Ruseifa landfill in Amman, which will produce electricity for use by the Greater Amman Municipal Government. The project is expected to cost about $6 million, with funding of $2.5 million coming from UNDP, and another $2 million from Danida, and a complementary $1.5 million from the government of Jordan.
- Support for the RSS to develop a project to identify barriers to financing energy efficiency in Jordan, and implement strategies to overcome these barriers. The UNDP has arranged for a small grant from the Global Environment Facility (GEF) to the RSS to prepare the proposal to the GEF for a larger grant, up to $750,000.

The UNDP has also launched a debt-swap program to support environment and natural resource projects in Jordan, which could include energy- and climate-change projects among others. The debt-for-environment swap concept would allow Jordan to reallocate local currency resources that would otherwise be used to purchase foreign currency to settle external debt obligations. The resources freed up in this way would be deposited in a trust fund established for this purpose, and spent on programs approved by the creditor country as a condition for the swap. The UNDP has recently held seminars on the mechanism, and has identified a range of projects that could be selected by donors for support through the debt-swap mechanism.

5. Lessons and recommendations

In general, the lesson learned from the Sida experience in Jordan is that a selective approach to supporting projects can yield significant results. With the changes occurring in the electric sector, there may be opportunities to redirect Sida's activities to areas of development that are only now emerging. Regional electric integration and development of hydropower resources in Jordan and Syria may offer two such new areas of collaboration.

Amplissima

With respect to the Amplissima program, the following lessons are most relevant:

- The language of Amplissima does not pose so great a difficulty to users at facilities in Jordan, as the command of English among NEPCO personnel is greater than that of the EEA. However, conversion to Arabic might offer a commercial opportunity that could be exploited jointly, with long-term benefits in terms of sustainability, commercial benefits to the contractor, and broader regional impacts from Sida's development spending.
- With privatization, the sustainability of the Amplissima program may be altered as new management adopts new systems; support for Amplissima must be flexible, in order to meet customer demands

International Training Programs

With respect to the international training program, the following lessons seem most relevant:

- It was more difficult than expected to trace the former course participants.
- The 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.
- 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 do not support the idea of their wives being away for a month or two, and many women have small children to consider.

General recommendation

The overall recommendation that flows from the more specific recommendations made below, is that improved management of the Jordan and Egypt programs by Sida requires a more continuous presence in country. Even if such a presence were not possible in Jordan itself, it seems that coverage from Cairo would be better than from the greater distance of Stockholm.

This new approach should begin with the development of a strategic plan for Jordan, and an effort to establish how other donors will alter their patterns of support for the energy sector as Jordan restructures its electric industry. One area would be for Sida to explore how it could support the development and construction of the new hydropower facility that Jordan and Syria plan to build on the Yarmouk River.

Amplissima

Based on the lessons learned in Jordan, the following recommendations seem appropriate:

- Educating managers at the top about Amplissima - as well as all other information systems technologies - is both necessary and beneficial. Amplissima does not necessarily have the support of all potential system users within NEPCO. It is possible that the system would have an appreciable impact on efficiency in other parts of the network were it to be installed there.
- The sustainability of the program and its results would probably be greater if the extent of technology transfer were deeper and more comprehensive, as would be the case if a local service provider were associated with the program. This need not jeopardize the commercial interests of the contractor; on the contrary, the arrangement could create new business opportunities for both the contractor and the local partner. One possibility in the near term would be for Sida to support an effort to develop an Arabized version of Amplissima, working conjunction with a local Jordanian, or Egyptian, information systems firm, with the specific task of demonstrating a beta version of the package at Syria's Public Establishment for Electricity Generation and Transmission (PEEGT) and/or the Public Establishment for Distribution and Exploitation of Electrical Energy (PEEDE).

International Training Programs

With regard to the international training programs, the recommendation would be to develop the contacts between the course organizers and the former course participants.

- This could partly be organized through regular distribution of a newsletter administered by course organizers. 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. A third possibility for keeping in touch would be for the course organizers to contact the former participants and their supervisors during field visits.
- 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.
- 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.

Appendix 1: List of Interviews in Jordan

Ministry of Energy and Mineral Resources
Ahmad Bashir, Secretary General (May 3)

Ministry of Planning
Mustafa Zahran, Director – Productive Projects Department (May 3)
Saleh Al-Kharabsheh, Productive Projects Department Productive Projects Department (May 3)
Mustafa Al-Saleh, Director Bilateral Cooperation (May 5)
Mohammed Mikyar, Head of Bilateral Cooperation (May 5)

National Electric Power Company (NEPCO)
(includes CEGCO, NEPCO/Transmission, JEPCO and other local distribution companies)

NEPCO (Headquarters / Transmission Sector)
Waddah M. Nabulsi, Managing Director - NEPCO (May 3)
Fakhr Anshasi, Manager - Computer Department (May 2, May 3)
Khalid Mustafa Othman, Director of Operations - CGCO (May 6)
Walid Khalid Doleh, Head of Construction Section (May 6)
Niazi Musa Idris, Manager, Technical Planning Department (May 6)
Ali Yusef al-Zu'bi, DSM Section Head (May 8)
Basem W. Al-Azhari, Assistance Managing Director - Finance (May 8)
Kamel S. Al-Atout, Finance Section Head (May 8)

National Control Center
Khalid M.T. Amro, Manager (May 2, May 8)
Majed Al-Jabri (May 2)
Mohammed Al- Hammouri (May 2)
Amir Zaghal (May 2)
Bashair Shweikeh (May 2)
Talal Hussein (May 2)
Amin Al Zaghal (May 6)

Hussein Thermal Power Station
Asri S. Qutishat, Computer Department Manager (May 2, May 3, May 4, May 5)

Aqaba Thermal Power Station
Khalid Shukry, General Manager (May 5)
Abdel Fattah al-Nusur, Operations Head (May 5)
Walid al-Muhur, Computer Section (May 5)
Abdel-Hakim Suleiman, Computer Section (May 5)

Electric Training Center – Hussein Thermal Power Station
Riyad Al-Rousan, Head of Power Plant and Sub-Station Department (May 4)
Mohammed Awadat, Head of Transmission and Distribution Department (May 4)

Central Electricity Generation Company (CEGCO)
Hussain R. Elayian, Technical Planning Manager

Renewable Energy Research Center, Royal Scientific Society (RSS)
Malek A. Kabariti, Director (May 4)
Ammar Al-Taher, Manager - Thermal Energy Division (May 4)
Walid Shahin, Engineer (May 4)

Government of Sweden
Hakan Damm, Counsellor (May 4)
Sersa Kurdi, Administrative Officer (May 4)

Government of Japan
Yosio Yabe, Resident Representative - JICA (May 6)
Dima Hammondeh, Training Program Officer (May 6)

U.N. Development Program (UNDP)
Dr. Maher Abu-Taleb, Consultant for Project Formulation (May 6)

Government of Germany (GTZ)
Burgharad Kehr, Director (May 5)

Appendix 2: List of documents

Swedpower

1.1 General

NEPCO (formely JEA): Electric Training Center

1.2 CMMMS-Systems

BITS, 1986-05-06: Jordanien: Datoriseringsprogram för JEA

BITS, 1986-05-20: Jordanien: Besöksrapport

BITS, 1997-06-17: Beslut. Uppgradering av underhållssystem till kraftindustrin - Jordanien

JEA, 1984: Jordan Electricity Authority Annual Report

JEA, 1984-10: Feasibility Study for Implementation of a Computerized Maintenance System for Hussein Thermal Power Station

JEA, 1986-04: Technical Assistance for JEA from Sweden

JEA/SwedPower, 1983-10: Study Report on Operation and Maintenance of Thermal Power Stations

JEA/SwedPower, 1985-01-25: Conceptual Design of a Maintenance System

JEA/SwedPower, 1985: Feasibility Study on Physical Protection and Review of Specification for National Control Center

JEA/SwedPower, 1985-11: Computerized Maintenance at HTPS. Final Report

JEA/SwedPower, 1987-07: Secondment of Computer Expert

Jordan Times, Article 1985-01-22: Jordan, Sweden sign trade exchange, credit protocol

Kommerskollegium, 1985-09-30: Jordanskt förslag rörande överenskommelse om ekonomiskt-, handels-, industriellt och tekniskt samarbete

NEPCO/SwedPower, 1997-10-02: Agreement between National Electric Power Co of the Hashemite Kingdom of Jordan (NEPCO) and Swedpower AB.

NEPCO/SwedPower, 1998-10: The Amplissima System. Final Project Report

SwedPower, 1987-09: Secondment of Maintenance Expert and Implementation of Maintenance Management System at Hussein and Aqaba Thermal Power Stations

2.1 Other projects by Swedpower

2.1.1 Training

BITS, 1989-06-19: Beslut. Jordanien: Utbildningsinsats avseende det nationella kontrollcentret.

SwedPower, 1991-11: Project Report. Consultancy Services for Counterpart Personnel to the Management of Jordan National Control Centre

2.1.2 Transmission Network System

JEA/SwedPower, 1985-06: Feasibility Study on Physical Protection and Review of Specification for National Control Center

JEA/ SwedPower, 1987-09-15: Feasibility Study for the Interconnection between Jordan and Egypt. Financial Proposal

JEA/SwedPower, 1989-08-14: Agreement. Consultancy Services for Counterpart Personnel to the Management of Jordan National Control Centre

Appendix 3: Terms of Reference for the Evaluation of Energy Sector Cooperation with Jordan

1 Background

The evaluation covers cooperation with Jordan 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 exhange of skills and experiences between Sweden and partner countries and encourage a broad spectrum of Swedish participation in the cooperation.

The Technical Cooperation with Jordan started in 1982. Most of the projects financed have been within the telecommunications and transport sectors. Other important sectors have been energy and industry.

The total grant as per 31 December 1998, reached SEK 41,5 million for some 25 projects. Within the energy sector, 6 projects have been financed since 1986 to a total cost of 4 MSEK. The main emphasis has been on Computerized Maintenance and Materials Management Systems (CMMMS). The system Amplissima has been applied within these projects. The most recent project on this subject was implemented between 1997 and 1998. This has been the largest project within the energy sector in Jordan, with a Swedish contribution of 1,8 MSEK.

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 the 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 400 Jordanian participants have joined the International Courses since 1978, to the amount of 25 MSEK. As regards energy sector related courses, 34 participants have been trained during the period 1990-1997 to a cost of approximately 2,5 MSEK. There have been only male participants in the energy related courses.

Concessionary Credits
Sweden has also provided support to the Jordanian energy sector through concessionary credits. The total amount is 48 MSEK, whereof the grant element amounts to 14,4 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 Jordan has been on-going since 1985, and no previous independent evaluation has been performed.

The purpose of the evaluation is the following:

- To identify and analyse the results produced through the support to the energy sector in Jordan 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 Jordan 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 Jordan between the years 1985-1999. The evaluation should mainly concentrate on the projects related to Computerized Maintenance and Materials Management Systems (CMMMS).

International Training Programmes:
The evaluation should assess the benefits and results that the programme has given to the involved Jordanian institutions. It cover a selection of participants from Jordan 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 Jordan within the energy sector through BITS and Sida. A more detailed study and in-depth analyses should be made on the recent CMMMS-project, previously mentioned.

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 Jordanian 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 organization 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.

4.1.2 In-depth analyses

This concerns the projects related to CMMMS. 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 fulfilled.
- Assess if the project specific objectives have been fulfilled.
- Assess if the overall objectives, as specified in the project documents, have been fulfilled.

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 estimate 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 Jordanian partners. Are the effects sustainable without further assistance?
- Analyse to what extent the Jordanian 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 Jordan 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

- Assess the need for future assistance within the Jordanian energy sector.
- What are the operational and strategical lessons learned from the projects?

4.2 International Training Programme

The Consultant shall evaluate the effects and results of the Jordanian participation in the International Training Programmes within the energy sector, in order to lift up issues, give recommendations for future activites 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 impact has been created at the organisation that he/she represents 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 Jordan, report writing and presentation of the report. The cooperating partners on the Jordanian side will be National Electric Power Cooperation (NEPCO). A contact person will be appointed by NEPCO, who will coordinate the work on the Jordanian side. Sida will provide background information as well as documentation from its archives. The Swedish consultant, Swedpower, is expected to cooperate fully with the implementation team and to provide further documentation.

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

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

The total duration of the evaluation is estimated to approximately two weeks, to be coordinated with the evaluation regarding the energy sector in Egypt. The fact-finding mission to Jordan is expected to require approximately one week. Places to visit are primarilly the following:

- Amman (headquarters of NEPCO)
- Power station in Zarqa

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.

6 Reporting

The evaluation report shall be written in English. 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 Jordanian partner 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 (final) draft report.

The draft report shall be presented to Sida at a seminar of approximately two hours, and should preferrably be coordinated with the presentation of the report regarding the Egyptian energy sector.

Recent Sida Evaluations

99/8 The Collaboration between Sida and SAI, The Department of Social Antrhropology (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
Department for Democracy and Social Development

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, Estifanos Tekle
Department for Democracy and Social Development

99/11 Apoyo de Asdi al Sector Salud de Nicaragua. Prosilais 1992-1998. Marta Medina, Ulf Färnsveden, Roberto Belmar
Department for Democracy and Social Development

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 Svenningsson
Department for Evaluation and Internal Audit

99/15 Sida Supported Advantage Projects in the Baltic States. Claes Lindahl, Petra Stark
Department for Central and Eastern Europe

99/16 Diakonia Program for Democracy and Human Rights, the El Salvador Case. A qualified monitoring. Vegard Bye, Martha Doggett, Peter Hellmers
Department for Latin America

99/17 Dollars, Dialogue and Development. An evaluation of Swedish programme aid. Howard White, Geske Dijkstra, Jan Kees van Donge, Anders Danielsson, Maria Nilsson
Department for Evaluation and Internal Audit

99/18 Atmospheric Environment Issues in Developing Countries. Gun Lövblad, Per Inge Iverfeldt, 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
Department for Central and Eastern Europe

99/20 Sida Support to the Energy Sector in Egypt. Rolf Eriksson, Edward Hoyt
Department for Infrastructure and Economic Cooperation

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