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IMPLEMENTATION COMPLETION REPORT
(TF-25141 TF-28666)

ON A

GRANT

IN THE AMOUNT OF US$7.4 MILLION

TO THE

REPUBLIC OF TUNISIA

FOR A

SOLAR WATER HEATING PROJECT

December 15, 2004

Finance, Private Sector and Infrastructure
Middle East and North Africa

CURRENCY EQUIVALENTS

(Exchange Rate Effective 11/21/2003)

Currency Unit	=	Tunisian Dinar (TD)
TD1	=	US$ 0.79
US$ 1	=	1.24

FISCAL YEAR

January 1 December 31

ABBREVIATIONS AND ACRONYMS

ANME	:	Agence Nationale pour la Maîtrise de l'Energie (Tunisian National Agency for the Rational Use of Energy)
CES	:	Chauffe-Eau Solaires (Solar Water Heaters)
CO_2	:	Carbon Dioxide (Dioxide de Carbone)
GEF	:	Global Environment Facility (Fonds pour l'Environnement Mondial)
GTZ	:	Gesellschaft für Technische Zusammenarbeit (Office Allemand de la Coopération Technique)
ICB	:	International Competitive Bidding (Appel d'Offres International)
IEA	:	International Energy Agency (Agence Internationale de l'Energie)
IRR	:	Internal Rate of Return (Taux de Rendement Interne)
LPG	:	Liquified Petroleum Gas (Gaz de Pétrole Liquéfié, GPL)
LRMC	:	Long Run Marginal Costs (Coûts Marginaux à Long Terme)
MEDREC	:	Mediterranean Renewable Energy Centre (Centre Méditerranéen pour l'Energie Renouvelable)
NCB	:	National Competitive Bidding (Appel d'Offres National)
NPV	:	Net Present Value (Valeur Présente Nette)
SDR	:	Special Drawing Rights (Droits de Tirage Spéciaux, DTS)
STEG	:	Société Tunisienne d'Electricité et de Gaz (Electricity & Gas National Company)
UNEP	:	United Nations Environment Programme (Programme des Nations Unies pour l'Environnement)
WTP	:	Willingness-To-Pay (Disponibilité à Payer)

Vice President:	Christiaan Poortman
Country Director	Ted Ahlers
Sector Manager	Emmanuel Forestier
Task Team Leader/Task Manager:	Noureddine Bouzaher

TUNISIA
SOLAR WATER HEATING

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Project ID: P005589	*Project Name:* SOLAR WATER HEATING
Team Leader: Noureddine Bouzaher	*TL Unit:* MNSIF
ICR Type: Core ICR	*Report Date: December 14, 2004*

1. Project Data

Name: SOLAR WATER HEATING
L/C/TF Number: TF-25141; TF-28666
Country/Department: TUNISIA
Region: Middle East and North Africa Region

Sector/subsector: Renewable energy (100%)
Theme: Climate change (P); Environmental policies and institutions (P); Pollution management and environmental health (P); Other environment and natural resources management (P)

KEY DATES		*Original*	*Revised/Actual*
PCD:	12/18/1992	*Effective:*	05/19/1995
Appraisal:	05/31/1994	*MTR:*	06/06/1999
Approval:	11/02/1994	*Closing:*	06/30/2004	06/30/2004

Borrower/Implementing Agency: Government of Tunisia/ANER (Agence Nationale d'Energie Renouvelable) (former agency)
Other Partners: N/A

STAFF	Current	At Appraisal
Vice President:	Christiaan J. Poortman	Caio Koch-Weser
Country Director:	Theodore O. Ahlers	Daniel Ritchie
Sector Manager:	Emmanuel Forestier	A. Amir Al-Khafaji
Team Leader at ICR:	Noureddine Bouzaher	Lorenzo Savorelli
ICR Primary Author:	Fanny Missfeldt-Ringius; Rene G. Mendonca	

2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

Outcome:	S
Sustainability:	L
Institutional Development Impact:	SU
Bank Performance:	U
Borrower Performance:	S

	QAG (if available)	ICR
Quality at Entry:		U
Project at Risk at Any Time:		

3. Assessment of Development Objective and Design, and of Quality at Entry

3.1 Original Objective:

The objectives of the project were to assist the Recipient in encouraging the substitution of renewable solar energy for fossil fuels in public and commercial private institutions so as to mitigate global warming by maximizing carbon dioxide displacement and demonstrate the potential of solar water heating (SWH) for reducing global warming. The project's quantitative goal was to install about 50,000 m^2 of solar water heating panels, which would reduce overall energy consumption by 6,000 toe per year, and avoid 18,000 tons of carbon dioxide (CO_2) per year.

3.2 Revised Objective:

Not applicable.

3.3 Original Components:

(1) Technical Assistance Component (US$700,000)

The Technical Assistance component was originally designed to focus on product promotion and advertisement, performance monitoring of the individual systems and the program itself, preparation of ICB procurement packages, and disbursement of the subsidy to the beneficiaries. The originally envisaged breakdown of the technical assistance was US$0.4 million for promotion, US$0.2 for procurement, US$0.03 for training and studies, and US$0.07 for monitoring and evaluation.

(2) Investment in Solar Water Heater equipment by targeted users (US$6.6 million)

By contributing 35 percent of the cost of investment before tax in solar water heaters (including installation), the GEF fund (US$3.3 million), together with Belgian cofinancing (US$3.3 million), provided an incentive to motivate users to invest in solar water heaters rather than in conventional, and less environmentally friendly water heating technologies. The aim was to finance about 150 tailored packages for solar water heating installations of an average cost of US$200,000 each. The project was designed to be implemented over a nine-year period.

Under the original scheme, potential solar water heating users were automatically eligible for obtaining the GEF subsidy by demonstrating they had secured sufficient financing or the purchase and installation of their solar water heating system (excluding the subsidy). They then had to submit a technical proposal for a solar water heating system to Tunisia's Energy Agency "Agence Nationale pour La Maîtrise de l'Energie" (ANME), which would directly pay the subsidy to the system supplier. To identify the supplier, ANME would invite international competitive bids for the provision of the required equipment. The World Bank would review groups of bids every 6 months for no-objection.

The beneficiaries that were originally targeted by the project as users of solar water heaters were hotels, Turkish baths, schools, sports centers, multifamily buildings, or any other public or commercial private institution operating in any sector of the economy, except agriculture or industry. After 1997, subsidies for individual households were also included in the program. Given that the targeted group of beneficiaries was specified as part of the project objectives, widening the group of beneficiaries to the residential sector should have led to a revision of the project's objective.

3.4 Revised Components:

During the implementation two changes were made to the project components.

(1) The first was **a change in the administration of the grant** for the purposes of the project's second component, which affected the procurement of the solar water heating systems. The GEF Trust Fund Agreement dated April 7, 1995 envisaged that the beneficiaries/users of solar water heaters would request a subsidy from ANME and submit an initial technical study of the proposed project. ANME would gather a few submissions until sizable enough for

International Competitive Bidding (ICB) (special provisions were made so that domestic firms could more readily participate in the bidding process). Following bid selection and no-objection by the Bank, the solar water heaters would then be acquired and installed. The subsidy would only be fully disbursed after full installation of the system.

This procedure had a number of drawbacks. First, the users of solar water heaters had no final obligation to purchase the solar water heaters once a supplier was selected. As the application process would last a minimum of 6 to 8 months, there was little guarantee that the beneficiary would still be interested in his system once the supplier was selected. Second, the number of potential beneficiaries that were interested in large systems was rather limited. In fact, the average size of requested solar water heaters during the project's lifetime rarely exceeded 50 m^2 compared with systems of between 350 and 550 m^2 initially foreseen. In addition, both the potential beneficiaries and the local suppliers preferred selecting whom they wanted to do business with freely. Additional problems related to responsibility for the quality of the product in the case of failure: ANME or the supplier. This could have affected the quality of service received by the customers and thus affected the reputation of the scheme.

As the project design was changed, solar water heaters could be procured in accordance with Tunisia's commercial practices at a reasonable price. Prior review by the World Bank was required only for the first 5 contracts regardless of their price, and each contract exceeding US$100,000. During the project lifetime this amount was exceeded only in one case, for which National Competitive Bidding (NCB) was applied. ANME, the implementing agency, had indicated as early as May 30, 1995 in writing that the suggested project structure might be difficult to implement. However, the Bank had replied that procurement rules would not allow for such an amendment to take place. However, this was inaccurate. Following a two-year period of delay in disbursement, the amendment as discussed above was finally signed on April 14, 1997.

(2) The second change related to the **scope of potential beneficiaries**. The market estimates undertaken at appraisal appeared to favor larger-scale installations mainly in the service sector. However, in practice, it became clear that a more significant market potential was available in the residential sector. To reflect this, the eligibility of individual households for funds was explicitly introduced in Section 1.02 (d) of the Grant Agreement. This amendment was signed on September 10, 1999.

3.5 Quality at Entry:

Quality at entry was unsatisfactory. This relates to both the sectors targeted for investments in solar water heating, the administrative structure under which the project was implemented, and the lack of considerations given to the project's sustainability. Initially it was estimated that the project would target large-scale installations and thus remain within the service and commercial sectors. The estimate for the market undertaken at project appraisal suggested that hotels, Turkish baths, education, health, and sports facilities would amount to 85 percent of the market, while the residential sector would only constitute 15 percent. However, the hot water demand of the residential sector was at 60 percent of the total demand for hot water. This would indicate a larger potential in the residential sector. The market evaluation undertaken at appraisal proved to be inaccurate as 81 percent of the systems sold under the GEF project were installed in the residential sector. The shortcomings of the project's administrative structure, which led to the 1997 amendment of the grant agreement, have been discussed in section 3.4 above. Finally, the project concept did not consider the issue of sustainability of project outcomes following the end of the project. This seems surprising, as the market analysis undertaken as part of the Initial Executive Project Summary (IEPS - the document type preceding the PCD) found that full market penetration with no additional financing support could only be achieved after 20 years.

4. Achievement of Objective and Outputs

4.1 Outcome/achievement of objective:

From the beginning of the project until the end of 2004, about 80,000 m^2 of solar water heater panels have been

installed in Tunisia, of which 51,060 m^2 were installed in the framework of the project. The CO_2 emission reductions that can be attributed to the GEF project amount to about 25,000 tons of CO_2 annually. At appraisal, it was anticipated that the project would avoid 18,000 tons of CO_2 annually through the installation of 50,000 m^2 of collector area. The surface of solar water heaters installed exceeds the project goal by 2.1 percent, and the CO_2 emissions reductions achieved exceed the goal by 39 percent. Thus the project reached its goal of encouraging the substitution of renewable solar energy for fossil fuels, as well as its goal of mitigating climate change.

4.2 Outputs by components:

At appraisal no outputs were specified by component. The evaluation of outputs in this section therefore considers elements that could have been classified as outputs, which would support the overall project objective. Based on this, the project outputs by component were as follows:

(1) Technical Assistance Component

The technical assistance, administered by ANME, facilitated awareness raising, the control and monitoring of solar water heating systems, and the disbursement of the GEF support. The two substantive outputs of the technical assistance were:

Awareness raising: ANME actively engaged in awareness raising through pamphlets, seminars and TV spots. The TV spots by ANME, for example, led to a discernible increase of sales following their screening. Solar water industry representatives found these awareness campaigns to be highly valuable.

Monitoring and Evaluation: The Tunisian authorities considered it key to ensuring the quality of the solar water heating systems under the GEF project, as mediocre performance of local production during the eighties eroded the reputation of this technology. ANME directly verified the good performance of all systems in the service sector, and undertook spot checks of systems in the residential sector. For quality assurance purposes ANME paid a last installment when it was verified that the systems were adequately installed (see section 5.4). This together with the opening of the Tunisian market to international competition re-established the reputation of solar water heating systems in Tunisia.

(2) Investment in Solar Water Heater equipment by targeted users

The main outputs achieved under this component could be summarized as follows:

Disbursement of the subsidy: Disbursement of the project began in 1997 or 2 years after project effectiveness. The project was fully disbursed by March 2002 or two years before project closure. Effectively, the project was disbursed within 5 years of the nine-year lifetime of the project. The disbursement of the subsidy led to the achievement of objectives as illustrated under 4.1.

Subprojects: At appraisal, it was estimated that about 150 subprojects with an average size of US$200,000 would be implemented through the project. After project completion, at total of 17,626 subprojects were implemented. Of these, 171 subprojects were undertaken in the tertiary sector with an average project size of US$30,419, and 17,455 subproject in the residential sector with an average project size of US$1,220.

A competitive market of suppliers established: At the end of the project 8 suppliers exist, of which 2 are manufacturing solar water heaters. One company dominates the market with about 45% market share. The remaining companies divide up the market more or less evenly.

System price: The average sales price per m^2 installed was estimated at IEPS/PCD stage to be 430 TD. In 2001, the average sales price for solar water heaters was 362 TD/m^2. This corresponds to a significant price decrease in real terms. However, the price change from 1997 with an average sales price of 369 TD (when the project began

disbursing) until 2001 was only 5 TD/ m^2. In late 2004, with the end of the 35 percent GEF subsidy, suppliers could only maintain a reasonable level of sales through cuts in their profit margins, which reflect up to the level of the 35 percent subsidy originally paid. But current margins barely cover the simple overhead costs of suppliers. In order to remain in business, suppliers have focused on export markets, developed new promotional schemes, and have diversified their product portfolio. In order to make prices comparable, they have all been converted to 1995 Tunisian Dinar, adjusting for both exchange rate fluctuations and inflation. In the future, as the incremental costs have come down (see Annex 3), sales of carbon credits on the international greenhouse gas market could replace GEF finance.

Fiscal distortions: The Tunisian Government significantly reduced the barriers both for the import of materials to produce solar water heaters and for the import of solar water heaters in 1995 and 1997 respectively. For a discussion see section 5.2.

Employment creation: The solar water heater suppliers estimate that as a result of the project about 400 direct jobs have been created.

4.3 Net Present Value/Economic rate of return:

At appraisal, the calculations of economic costs and benefits were based on one prototype installation, which was thought to be typical of the future types of projects to be installed. This installation was a 350 m^2 system for a hotel where solar power substituted fuel oil. For purposes of comparison, we have chosen an existing installation of 300 m^2, which most closely matches the type of installation envisaged at appraisal. One such installation is operating at the Aziza Hotel in Hammamet. As the original calculations at appraisal used a 25 percent subsidy as a basis rather than the 35 percent subsidy mentioned in the project document and paid in practice., the baseline calculations had to be corrected for this differential before a comparison with the Aziza Hotel could be made.

At 105.53 TD/m^2, the installation at the hotel in the actual project portfolio has significantly lower investment costs than was quoted at appraisal: 279.50 TD/m^2. CO_2 emissions reductions remain the same because both systems are assumed to replace the same conventional system. Both LRMC and IRR are markedly improved when compared with the estimate at appraisal. The LRMC of hot water decreases from 1.53 TD/m^3/m^2 to 1.43 TD/m^3/m^2, and the IRR of the switch from fuel oil to solar water heating increases from 34 percent to 42 percent. The lessons that might be drawn from such a case-by-case comparison, however, are not readily extrapolated. The analysis of price developments in the solar water heater market provides additional insights, which reveal that prices have only been reduced slightly in real terms (see sections 4.2 and 5.1). In order to reach an understanding of the global economic impact of the project, the economic analysis at appraisal estimated the likely market penetration by sector. The estimates of the residential sector potential at appraisal were at 15 percent of the market size. The reality is that 81 percent of the solar water heaters were installed in this sector. The potential for the service sector was estimated at 84 percent of the market size, while the actual contribution of this sector during the project only amounted to 21 percent. The projected global solar water heater market size in terms of m^2 installed remained in the range projected at appraisal.

4.4 Financial rate of return:

Not applicable as no equivalent evaluated at appraisal.

4.5 Institutional development impact:

The institutional development impact has been satisfactory. Partly as a result of the project, the renewable energy department within ANME grew substantially during the project period, and was able to attract additional renewable energy projects during the project lifetime. These included a UNDP/GEF project to develop wind power. ANME has cooperated with numerous bilateral donors on renewable energy including the German Gesellschaft für Technische Zusammenarbeit (GTZ) and the French GEF. ANME has also developed a National Strategy for

Rational Use of Energy and Promotion of Renewable Energies that set quantitative targets for renewable energy and energy efficiency including wind power, solar water heating, photovoltaics, biogas and fuelwood.

In addition, Tunisia is starting to share its expertise, particularly in solar water heating, with other countries in the region. A landmark achievement in this context is the establishment of the Mediterranean Renewable Energy Centre (MEDREC) in Tunis on September 27, 2004 (1). MEDREC is a center for renewable energy in the entire Mediterranean basin, which includes as partners institutions such as the International Energy Agency (IEA), the United Nations Environment Programme (UNEP), and the World Bank. The first project to be financed under the patronage of MEDREC is the reinforcement of the market for solar water heaters in Tunisia (see also section 6). In addition, ANME was designated as focal point in the thematic program on renewable energies under the United Nations Convention to Combat Desertification. Finally, ANME is actively assisting the African Development Bank in developing their renewable energy portfolio in Africa.

5. Major Factors Affecting Implementation and Outcome

5.1 Factors outside the control of government or implementing agency:

The **devaluation of the Tunisian Dinar** vis-à-vis the US Dollar between project inception in 1994 from 1 US$ = 0.98 TD and project closure in 2004 to 1 US$ = 1.27 TD is in the order of 22 percent. The devaluation is more pronounced when compared with the Euro zone, which is the main trading partner for Tunisia. Moreover, some of the **prices for most important raw materials** for the production of solar water heaters in Tunisia **have risen sharply** in international markets as a result of the high demand from China. One solar water heating supplier claimed that in 2004 alone the increase in the costs of these materials amounted to 8 percent of production costs. These external factors are very significant for a product such as solar water heaters for which the ratio of material to labor are in the order of 9 to 1.

5.2 Factors generally subject to government control:

In order to facilitate the import of solar water heating parts and systems, the Tunisian Government put in place a number of provisions. In accordance with Decree No. 95-744 of April 24, 1995, local manufacturers of solar water heating systems have **fiscal advantages** for the purchase of raw materials and semi-finished materials. For those materials where no equivalent can be found in the local market, custom duties are reduced by 10 percent, and the tax on value added (TVA) does not have to be paid. Since 1997, the import of complete solar water heating systems also benefits from a 10 percent reduction in custom duties.

In addition to fiscal incentives, the Government implemented a number of policies in support of the GEF project. Among these policies is the instauration of an **obligation for new public buildings** to install solar water heaters. Procurement for these buildings is undertaken through ANME. This aimed at providing a minimum market platform. When the GEF grant was entirely committed in early 2003, the Government provided **additional finance** amounting to TD 824,746.31 to cover subsidies for requests that have been received in excess of available GEF project funds.

On the other hand, the Government has been **subsidizing natural gas and LPG** and, although no estimates are available, it is likely that this subsidy has had a dampening effect on the market penetration of solar water heating.

Another aspect that was not foreseen when the GEF project started was the **rapid expansion of the gas pipeline infrastructure**. While currently only 15 percent of the residential consumers have access to gas, the Xth governmental plan has been stepped up from 30,000 new connections per year by an additional plan to up to 60,000 new connections for the year 2007. As the likely future customers for solar water heating systems and those for new gas connections have substantial overlap (both are in the middle and higher income range), demand analysis for future markets becomes pivotal. The customer base for solar water heaters in the coming years is thus likely to be found in the more isolated areas and in Tunisia's interior.

5.3 Factors generally subject to implementing agency control:

The implementing agency ANME staffed its project implementation unit appropriately. The administration of the Technical Assistance, including the disbursement of the subsidy, was done in an efficient and timely manner.

5.4 Costs and financing:

Despite the changes made to the project, the costs of the project and its financing were unaffected, as the project continued to pay for 35 percent of the cost of installed solar water heaters. Payment of the subsidy was directly made through ANME to the suppliers. All payments were made once it was ensured that the system had been adequately installed and was in good working order. The funds were drawn from a Special Account at the Central Bank, as is common practice for World Bank projects in Tunisia.

6. Sustainability

6.1 Rationale for sustainability rating:

The sustainability of the project is likely. The quantitative project goals stated in the project's objective were well exceeded. As a result of good quality control and mechanisms for system maintenance the deployed solar water heaters will continue to operate in a satisfactory manner. Thus both the annual savings of energy consumption and the avoidance of CO_2 emissions are secured for the lifetime of the installed solar water heating systems. Moreover, the incremental costs of solar water heating systems in the project have been reduced to levels that correspond to the price for CO_2 on the international carbon market (see Annex 3). Thus by selling the avoided CO_2 emissions reductions generated from the use of solar water heaters, the product becomes fully cost competitive.

6.2 Transition arrangement to regular operations:

Under its 2001 Strategy for Rational Use of Energy and Promotion of Renewable Energies Tunisia has adopted a target of installing 300,000 m^2 of solar water heaters by 2010. With the aim of supporting the achievement of this target, ANME is launching a follow-up program for solar water heating in Tunisia in January 2005. It is supported by the Government of Tunisia, the United Nations Environment Programme (UNEP) and the Government of Italy. The follow-up program builds on the lessons learned under the GEF project and includes the following elements:

- Broadening of the potential consumer base by allowing for credit sales, which will be administered through the electricity company STEG;
- A dedicated concessionary credit line available for solar water heaters, for which the terms, including the interest rate, are still being negotiated.

In addition, the Government will offer a per-system flat-rate subsidy of about 100 TD per m^2 (all systems smaller than 4 m^2) as an incentive for the development of a market for solar water heaters. In 2004, the upfront costs remain the biggest hurdle for investment, as the payback period for systems is relatively short with 3 to 6 years. The new system will allow to bring the monthly expenses for solar water heaters in line with its competitors which are gas, fuel oil and LPG. The project horizon is 2010. The funds provided by UNEP and the Italian Government are to provide support through a concessionary credit line for the next 30,000 systems to be installed.

7. Bank and Borrower Performance

Bank

7.1 Lending:

The overall Bank performance was unsatisfactory. The preparation of the grant took 24 months. However, if the first round of review of the proposal by the GEF is taken into account, the preparation of the grant lasted at least 36

months (no date is available for the initial launch of project preparation). Despite the preparation period, the project design exhibited three significant flaws as discussed in section 3.5:

- The residential sector was initially excluded as a beneficiary of the program, although ANME had favored the sector's inclusion based on its overall demand for hot water;
- The **administrative structure** was not adapted to the nature of the project. But the Bank suggested that as a result of procurement rules at the time of project inception, no other arrangement could be made. But this was inaccurate and later reversed;
- No consideration was given to the **sustainability** of project results.

This is the first solar water heating project of the GEF/World Bank that is coming up for ICR review. Both the beneficiary and the World Bank entered a new area of operation for which business models were not readily available. This needs to be considered when evaluating Borrower and Bank performance. In addition, the files kept by the Bank especially until the year 2000 contain substantial gaps. Thus it is difficult to reach a fully conclusive and consistent picture on the interventions undertaken by the Bank.

7.2 Supervision:

The overall Bank performance was unsatisfactory. Even though the Borrower had suggested that changes were necessary in order for disbursement to start, it took two years for the first amendment to be adopted on procurement issues. Although the first amendment required expertise in procurement issues, no procurement expert went on mission to discuss the issues the Borrower had raised. It took another two years for the second amendment to be adopted, which widened the range of eligible project beneficiaries to the residential sector. Only after these two changes took effect did the disbursement of the subsidy increase significantly. As a result of the amendments the project was able to disburse and to fully achieve its quantitative goals by project closure.

The Bank raised the issue of sustainability only towards the end of the project. However, as no provision had been built in the project to cater for sustainability, it was not straightforward to offer solutions. The Bank entered in contact with UNEP, that had additional funds available to work on renewable energy in the Mediterranean region, and discussed the future of the solar water heating project. The subsequent good cooperation between ANME and UNEP enabled the putting in place of a follow-up project.

7.3 Overall Bank performance:

The overall Bank performance is unsatisfactory. The initial stages of project preparation and inception have been unsatisfactory. While during Bank supervision and project completion the project was put back on track, the delays in doing so render the Bank effort during supervision unsatisfactory.

Borrower

7.4 Preparation:

The overall performance of the Borrower is satisfactory. The Borrower was a key driver in bringing this project about and prepared the first detailed project note during project identification. The project concept suggested by the Borrower was based on Tunisia's experience with solar water heating, which dates back to 1982. Major lessons were incorporated in the project design. These features focused on quality-assurance and public awareness raising.

7.5 Government implementation performance:

The performance of the borrower is satisfactory. The Government supported the implementation of the project with much flexibility as described in section 5.2. However, subsidies extended to natural gas have been counterproductive, as they reduced the competitiveness of solar water heaters. The same applies for subsidies given to LPG. In 2004, the Government reduced its subsidies for the connection of households to the natural gas network

to one third of its original cost with the aim of enhancing the competitiveness of solar water heating.

7.6 Implementing Agency:

The performance of the implementing agency is satisfactory. At all stages of the project ANME has been a key driver. The original project idea was developed by ANME and presented to the Bank. Once the project was launched, the project unit in the renewable energy agency was set up promptly and a public awareness campaign was launched. Following the reform of the administrative structure of the project, subsidies were in general disbursed expeditiously. The large number of requests for subsidies at the height of the project's disbursement led to some minor delays in the disbursement. The unit's team was staffed with engineers. Although the team at ANME was very effective, it may have been useful for the unit to be able to draw more on business administration type of experience.

7.7 Overall Borrower performance:

Based on the above, the overall Borrower performance is satisfactory.

8. Lessons Learned

The major lessons learned from this project are as follows:

(1) Evaluation of market size needs to consider substitute markets

In the context of the Tunisia solar water heating project the market was initially overestimated with an average subproject size projected at ten times larger than those installed during project implementation. In addition, the analysis focused on existing market shares at the time of project identification, which predicted only a minor role for the residential sector. This led to a misspecification of the project design. A more appropriate basis for such analysis is the study of substitute markets, as these reveal verifiable Willingness-To-Pay (WTP) estimates.

(2) Project procurement plans need to cater to market conditions

At project closure all active suppliers in Tunisia's solar water heating market are small- and medium-sized companies. To enhance the possibility of small companies to participate under projects promoting small and medium-sized renewable energy systems, procurement rules in the project design need to cater for their participation. As the Tunisia solar water heating project shows, small companies commonly do not compete under ICB. If ICB packages offered are too small for an international supplier, it leads to a major delay in project disbursement. This was the case in the Tunisia solar water heating project. Thus it is recommended to administer such contracts in accordance with common commercial practice in the country, as through the 1997 amendment adopted under the Tunisia solar water heating project. Alternatively, Article 3.12 of the "Guidelines Procurement under IBRD Loans and IDA Credits" (2004) may allow for the swift disbursement of funds in a market with small actors.

(3) Improving product quality and reliability are important factors in stimulating and sustaining demand

The history of the domestically manufactured product preceding the GEF project illustrates that bad quality can harm demand for solar water heaters. As part of the GEF project, each system in the service sector, and a random sample of residential installations were controlled by the project unit at ANME for their performance before a final tranche of the subsidy was disbursed. The result was that the performance of systems installed as part of the project were close to 100 percent, and that in late 2004 all systems that were installed are in good working condition. At the end of the project, the reputation of solar water heaters as a high quality product is fully reestablished.

(4) Projects that develop markets based on concessionary finance need to consider sustainability upfront

Projects based on concessionary finance that support products over a limited time period should actively consider how the sustainability of a market can be assured following project closure. Sustainability can be achieved by (i)

including barrier removal activities; (ii) considering learning cost curves; (iii) establishing a stakeholder community, including through a network of local industry; and by (iv) providing a framework for market development (extending customer base both domestically and abroad).

9. Partner Comments

(a) Borrower/implementing agency:

The Borrower generally agreed with the observations made in this evaluation, and the comments made focused on clarifying some of the quantitative goals reached under the project, including the role the Government of Tunisia played at the time of GEF subsidy depletion.

(b) Cofinanciers:

The Government of Belgium made available about US$3.3 million to support the investment component of the project. The management of these funds was transferred to the World Bank, and the World Bank was entrusted with their supervision.

(c) Other partners (NGOs/private sector):

The private sector was pleased with the GEF project, which had enabled 8 companies to enter the solar water heating business. Some regret was expressed to the effect that the project did not envisage a follow-up project to develop the solar water heater market further.

10. Additional Information

N/A

Annex 1. Key Performance Indicators/Log Frame Matrix

Outcome / Impact Indicators:

Indicator/Matrix	Projected in last PSR[1]	Actual/Latest Estimate
Tons of avoided CO2 emissions: 18,000 tons/year at project closure.	18,000 tons of CO2 avoided emissions per year, and a total of 50,000 m2 of collector area installed.	25,500 tons of CO2 avoided emissions per year, and a total of 51,060 m2 of collector area installed as a direct effect of the project, and 80,000 m2 of collectors installed in Tunisia since the project began.

Output Indicators:

Indicator/Matrix	Projected in last PSR[1]	Actual/Latest Estimate
About 150 subprojects of an average size of US$200,000 (see note 2).	See note 2.	171 projects in the tertiary sector with project size of on average US$30,419 and 17455 projects in the residential sector of on average US$1,220 were implemented.
Reduction in the price of solar water heaters (see note 2).	See note 2.	In real terms there has been only a slight decrease in the average price from 369 TD/m2 in 1997 to 362 TD/m2 in 2003.
A competitive market of suppliers established (see note 2).	See note 2.	8 suppliers exist, of which 2 are manufacturing solar water heaters. While one company has about 45 percent of the market, the remaining companies divide up the market more or less evenly.
Fiscal barriers removed (see note 2).	See note 2.	Among the areas where barriers were removed by the Government are: · Border taxes · VAT
Employment creation (see note 2)	See note 2.	The solar water heater suppliers estimate that as a result of the project about 400 direct jobs have been created.

[1] End of project

/2: **No output indicators were determined at the time of project appraisal, because a system of output indicator matrices did not exist.** For the purpose of this ICR indicators that could have made sense in the context of this project were selected to highlight the achievements under the project appropriately.

Annex 2. Project Costs and Financing

Project Cost by Component (in US$ million equivalent)

Component	Appraisal Estimate US$ million	Actual/Latest Estimate US$ million	Percentage of Appraisal
Technical Assistance Component	0.70	0.64	91
Investment in Solar Heating Equipment	20.20	20.66	109
Total Baseline Cost	20.90	21.30	
Total Project Costs	20.90	21.30	
Total Financing Required	20.90	21.30	

Project Costs by Procurement Arrangements (Appraisal Estimate) (US$ million equivalent)

Expenditure Category	Procurement Method[1] ICB	NCB	Other[2]	N.B.F.	Total Cost
1. Works	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2. Goods	10.10 (3.30)	0.00 (0.00)	0.00 (0.00)	10.10 (3.30)	20.20 (6.60)
3. Services	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
4. Miscellaneous	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
5. Miscellaneous	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
6. Miscellaneous	0.00 (0.00)	0.00 (0.00)	0.70 (0.70)	0.00 (0.00)	0.70 (0.70)
Total	10.10 (3.30)	0.00 (0.00)	0.70 (0.70)	10.10 (3.30)	20.90 (7.30)

Project Costs by Procurement Arrangements (Actual/Latest Estimate) (US$ million equivalent)

Expenditure Category	Procurement Method[1] ICB	NCB	Other[2]	N.B.F.	Total Cost
1. Works	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2. Goods	0.00 (0.00)	0.00 (0.00)	0.09 (0.09)	0.13 (0.07)	0.22 (0.16)
3. Services	0.00 (0.00)	0.00 (0.00)	0.52 (0.52)	0.02 (0.02)	0.54 (0.54)
4. Miscellaneous	0.00 (0.00)	0.00 (0.00)	9.68 (3.39)	12.01 (3.21)	21.69 (6.60)
5. Miscellaneous	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
6. Miscellaneous	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Total	0.00 (0.00)	0.00 (0.00)	10.29 (4.00)	12.16 (3.30)	22.45 (7.30)

[1/] Figures in parenthesis are the amounts to be financed by the Bank Loan. All costs include contingencies.

[2/] Includes civil works and goods to be procured through national shopping, consulting services, services of contracted staff of the project management office, training, technical assistance services, and incremental operating costs related to (i) managing the project, and (ii) re-lending project funds to local government units.

Following the amendment in relation to the administration of funds for solar water heaters, line 4 entitled "Miscellaneous" highlights the disbursements made in relation to the GEF subsidy for solar water heaters. The expenditure category is Subgrants (Component 2).

Project Financing by Component (in US$ million equivalent)

Component	Appraisal Estimate			Actual/Latest Estimate			Percentage of Appraisal		
	Bank	Govt.	CoF.	Bank	Govt.	CoF.	Bank	Govt.	CoF.
Technical Assistance	0.70	0.00	0.00	0.64	0.00	0.00	91.4	0.0	0.0
Investment in Solar Water Heating Equipment	6.60	0.00	13.60	6.66	1.00	14.16	100.9	0.0	104.1

Annex 3. Economic Costs and Benefits

At appraisal, the calculations of economic costs and benefits were based on one prototype installation, which was thought to be typical for the future types of projects installed. This installation was a 350 m^2 system for a hotel where solar power substituted fuel oil. To compare this example we have chosen the type of installation in the subproject portfolio, which most closely matches this case. This is the 300 m^2 Hotel Aziza in Hammamet. Two more hotels have had installations of 300 m^2, of which one cost exactly the same amount as the sample hotel, and the other cost about 5 percent less than the selected sample hotel.

Two changes had to be made to adjust the calculation at appraisal:

- Although a subsidy level of 35 percent had been agreed at appraisal, the economic and financial calculations in the appraisal document are based on a subsidy of 25 percent. Thus, figures for the GEF subsidy were adjusted to 35 percent;
- An error was made when calculating the NPV for hot water use of +10 percent compared with the value at appraisal. This error was corrected, and also affects the value of the long-run marginal costs of water.

When considering the cost comparison in Table A3-1, it needs to be taken into account that the subprojects developed under the project were on average substantially smaller than the selected sample project with the average size in the service sector at 62 m^2 per installation, and in the residential sector at 3 m^2 per installation. Due to these differences – along with the difference in size of the portfolio sample – the per system analysis is based on an approximation for TD/m^2, with a sensitivity range for different sizes of installations.

Table A3 – 1 presents the results of the analysis. It shows that the hotel in the actual project portfolio has significantly lower investment costs. As a result, the incremental cost of avoided emissions is also significantly lower, because the level of the GEF subsidy payment is lower. Incremental costs are evaluated as the relative share of the GEF subsidy and the amount of emissions avoided. While CO_2 emissions reductions remain the same as both systems are assumed to replace the same conventional system, both LRMC and IRR are markedly improved when compared with the estimate at appraisal. The lessons that might be drawn from such a case by case comparison, however, are not readily extrapolated. The analysis of price developments in the solar water heater market provides additional insights, which reveal that prices have only been reduced slightly in real terms mainly as a result of the worsening of Tunisia's terms of trade (see sections 4.2 and 5.1).

Table A3 – 1

	At appraisal	**Hotel Aziza, Hammamet**
Investment costs (TD/m^2)	279.50	105.53
NPV costs (TD/m^2)	271.82	253.68
NPV hot water (m^3/m^2)	177.57	177.57
CO2 emissions (tons/m^2)	3.18	3.18
LRMC of hot water (TD/m^3 per m^2)	1.53	1.43
Avoided CO2 emissions (tons/m^2 year)	0.46	0.46
IRR (%)	34	42
Payback period (years)	3	3
Incremental costs of avoided emissions	10.61	4.01

The economic analysis at appraisal then makes an estimate of the likely market penetration by sector. Table A3-2 shows the actual market penetration of sectors through this project. Table A3-3 compares the relative market shares that were expected at appraisal with the actual market shares under the project. The estimates of the residential sector seriously underestimated its potential, while the potential for the service sector was seriously

overestimated. This not withstanding have the overarching quantitative targets of the projects been slightly surpassed.

Table A3 – 2				
Sectors	**Number of subprojects**	**Surface (in m2)**	**Investment (in TD)**	**Subsidy (in TD)**
Residential Sector	17,455	45,972.5	20,148,699.69	7,003,621
Service Sector	171	10,537	4,919,267.65	1,721,743.68
Hotels	40	6,401	2,809,435.52	983,302.43
Turkish Baths	58	719	418,184.40	146,346.54
Public buildings	54	2,729	1,358,779.85	475,572.95
Other	18	652	317,007.32	110,952.56
Total	17,796	51,417	25,067,967.34	8,725,364.68

Table A3 – 3		
	At appraisal (in %)	Ex post project portfolio (in %)
Residential Sector	15	81
Service Sector	84	18
Hotels	60	11
Turkish Baths	1	1
Other	23	6
Note: Shares based on m^2 installed. At the level of shares indicated in the appraisal document there appears to be a rounding error with 1% remaining unexplained.		

Annex 4. Bank Inputs

(a) Missions:

Stage of Project Cycle	No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.)		Performance Rating	
Month/Year	Count	Specialty	Implementation Progress	Development Objective
Identification/Preparation				
05/17/1992	*3*	TASK TEAM LEADER (1); ENERGY SPECIALISTS (2)		
Appraisal/Negotiation				
05/31/1994	*4*	TASK TEAM LEADER (1); ENERGY PLANNER (1); otherwise not known.		
Supervision				
06/22/1996	*2*	FINANCIAL ECONOMIST (1); RENEWABLE ENERGY SPEC (1)	S	
07/19/1997	*1*	ENERGY PLANNER (1)	S	
09/24/1997	*1*	POWER ENGINEER (1)	S	
05/05/1998	*1*	ENERGY PLANNER (1)	S	
11/03/1999	*2*	ENERGY PLANNER (1); EGY CONSERV. EXP. (1)	S	
06/10/2000	*3*	MISSION LEADER (1); ENERGY PLANNER (1); FINANCIAL SPECIALIST (1)	S	
11/04/2000	*2*	POWER ENGINEER/TTL (1); SR. ENERGY PLANNER (1)	S	
02/15/2002	*1*	SENIOR POWER ENGINEER (1)	S	
10/17/2002	*1*	SR. POWER EGR/TTL (1)	S	
05/09/2003	*2*	TASK TEAM LEADER (1); ENV. ECONOMIST (1)	S	
05/22/2004	*1*	SR. POWER EGR (1)	S	
ICR				
10/16/2004	*1*	ENERGY ECONOMIST (1)	S	

(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US$ ('000)
Identification/Preparation	n.a.	n.a.
Appraisal/Negotiation	n.a.	191
Supervision	/1	335
ICR	5	25

Total	n.a.	551

/1 SAP data for staff weeks are only available starting FY00 to date. For supervision the total number of staff weeks is 40.9.

Annex 5. Ratings for Achievement of Objectives/Outputs of Components

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

	Rating				
☐ *Macro policies*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Sector Policies*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
☐ *Physical*	● *H*	○ *SU*	○ *M*	○ *N*	○ *NA*
☐ *Financial*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
☐ *Institutional Development*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
☐ *Environmental*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
Social					
☐ *Poverty Reduction*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Gender*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Other (Please specify)*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Private sector development*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
☐ *Public sector management*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Other (Please specify)*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*

Annex 6. Ratings of Bank and Borrower Performance

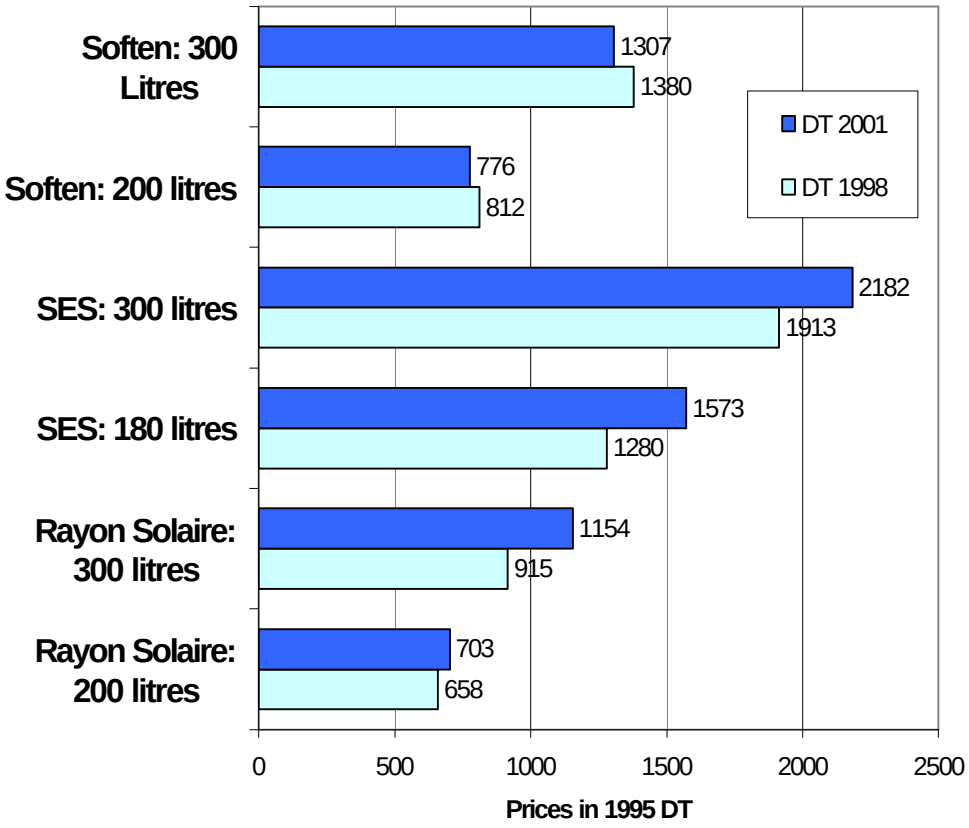
(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

6.1 Bank performance	*Rating*			
☐ *Lending*	○ *HS*	○ *S*	● *U*	○ *HU*
☐ *Supervision*	○ *HS*	○ *S*	● *U*	○ *HU*
☐ *Overall*	○ *HS*	○ *S*	● *U*	○ *HU*

6.2 Borrower performance	*Rating*			
☐ *Preparation*	○ *HS*	● *S*	○ *U*	○ *HU*
☐ *Government implementation performance*	○ *HS*	● *S*	○ *U*	○ *HU*
☐ *Implementation agency performance*	○ *HS*	● *S*	○ *U*	○ *HU*
☐ *Overall*	○ *HS*	● *S*	○ *U*	○ *HU*

Annex 7. List of Supporting Documents

(1) ANME/ United Nations Environment Programme/ Italian Ministry of the Environment (2004). Communiqué de Presse. Inauguration à Tunis du Centre Méditerranéen des Energies Renouvelables. Premier projet pour équiper 30.000 foyers tunisiens de chauffe-eau solaires.



Additional Annex 8. Borrower's Report

1. Données du projet :

Nom : Chauffage solaire de l'eau sanitaire
Pays/ Département : Tunisie
Région : Moyen Orient et Afrique du Nord
Secteur/Sous-secteur : Tertiaire et résidentiel

DATES CLES

		Originale	Révisée/Réelle
DCP :	25/10/1994	*Effectif* : 25/10/1994	25/10/1994
Evaluation :		*Examen à mis-parcours* : 31/12/1998	03/06/1999
Approbation :		*Clôture* : 30/06/2004	30/06/2004

Emprunteur/Agence d'exécution : GOUVERNEMENT DE TUNISIE/AGENCE NATIONALE POUR LA MAITRISE DE L'ENERGIE

2. Classement de la performance principale :
(S=Satisfaisant, TS=Très Satisfaisant, I=Insatisfaisant, TP=Très Probable, P=Probable, IP=Improbable, TIP=Très Improbable, TI=Très Insatisfaisant, E=Elevé, SU=Substantiel, M=Modeste, N=Négligeable)

Résultat : S
Viabilité : P
Impact développement institutionnel : S
Performance Banque : S
Performance Emprunteur : S

1. Evaluation des objectifs de développement, de la conception et de la qualité initiale :

1.1 : Objectif original :

Les principaux objectifs du projet sont d'encourager la substitution des combustibles fossiles dans tous les secteurs économiques à l'exception de l'agriculture et de l'industrie par l'énergie solaire, permettant ainsi l'atténuation du réchauffement de la planète en maximisant le remplacement du CO2, et de démontrer le potentiel de réplication de cette approche choisie - chauffage solaire de l'eau - pour réduire le réchauffement de la planète.

Ce projet visait l'installation d'environ 50 000 m² de capteurs solaires permettant ainsi de réaliser des économies d'énergie de l'ordre de 6 000 tep/an et d'éviter annuellement l'émission dans l'atmosphère de 18 000 tonnes de CO2.

1.2 : Objectif révisé :

Sans objet.

1.3 : Composantes originales :

Le projet comportait deux composantes :

a) la composante d'assistance technique (700 000 US$), qui finance :

- l'organisation et l'exécution de la promotion et de la publicité du produit, afin d'accroître la sensibilité du marché ;
- le lancement d'appels d'offres internationaux (International competitive biddings) pour plusieurs installations à la fois, selon les règles de la passation des marchés de la Banque Mondiale ; cela comprend une formation au profit des entreprises privées tunisiennes, des consultants et de l'ANME, afin de prédéterminer d'une façon professionnelle la taille, les coûts et les avantages futurs d'une installation d'un système de Chauffe-eau Solaires (CES) sur un site spécifique. De plus, l'assistance technique sera fournie à l'ANME afin de se conformer totalement aux procédures de la Banque requises pour la passation des marchés ;
- La garantie de performance des installations solaires des points de vue technique, économique et environnemental.

b) L'investissement partiel sous forme de subvention des installations solaires (6,6 millions US$) :

Le fonds FEM et le Royaume de Belgique ont alloué à cette composante un montant de 6,6 millions US$ (3,3 millions US$ accordé par le FEM et 3,3 millions US$ accordé par le Royaume de Belgique) pour subventionner les installations solaires pour le chauffage de l'eau sanitaire à hauteur de 35% de l'investissement hors taxes. Ceci rendra ces installations économiquement attractifs pour les bénéficiaires potentiels du secteur tertiaire et de l'habitat collectif.

1.4 : Composantes révisées :

Le projet a été amendé à trois reprises au cours de son cycle de vie.

Le premier amendement, signé le 14 avril 1997, a concerné l'aspect procédural du projet. En effet, le document du projet a prévu que toute réalisation d'installation solaire doit faire l'objet d'un appel d'offres international afin de garantir la technologie ayant le meilleur rapport qualité/prix. Cette procédure n'était pas appropriée pour un développement réel du marché de chauffage solaire de l'eau dans le secteur tertiaire et l'habitat collectif et ce pour les raisons suivantes :

- Le marché constaté en ce moment, est constitué de projets privés relativement de petites tailles (environ 50 m²) et la procédure d'appels d'offres (étude de faisabilité, préparation de cahier des charges, lancement d'appel d'offres, dépouillement des offres et signatures des contrats) est tellement longue qu'elle peut affecter la décision finale du bénéficiaire ;
- Etant donné que les bénéficiaires participent au financement des projets à hauteur de 65% de l'investissement HT, ils ont manifesté leur souhait d'avoir plus d'accès et de contrôle sur le choix de leurs fournisseurs ;
- Les sociétés privées, actives dans le domaine, ont manifesté leurs intérêts de développer le marché par leur soins et ce, en identifiant les bénéficiaires afin de réduire le temps de réalisation des projets tout en répondant à toutes les conditions du cahier des charges.

Le deuxième amendement, signé le 10 septembre 1999, a consisté en l'élargissement de la liste des bénéficiaires éligibles aux avantages accordés par le projet. Cette modification a concerné l'intégration du secteur résidentiel dans la liste des bénéficiaires du projet et ce compte tenu de la grande quantité d'énergie que consomme ce secteur pour le chauffage de l'eau sanitaire.

Le troisième amendement, signé le 17 janvier 2004, a porté sur le changement de la monnaie du fonds FEM du Droits de Tirage Spéciaux (DTS) en US$.

1.5 : Qualité initiale :

L'ANME classe la qualité initiale du projet dans la catégorie insatisfaisante.

A l'origine, l'objectif du projet visait l'encouragement de l'utilisation de l'énergie solaire pour le chauffage de l'eau sanitaire en ciblant uniquement le secteur tertiaire et l'habitat collectif. De plus, la procédure fixée par le

document du projet prévoyait que toute réalisation d'installation solaire doit faire l'objet 'un appel d'offres international.

Ces deux facteurs ont entravé le décollage du projet et ce en dépit des efforts considérables déployés par l'ANME en matière de sensibilisation et d'identification des bénéficiaires potentiels. En effet, outre la procédure qui n'a pas été appropriée pour un développement réel du marché, le secteur résidentiel, qui représente environ 60% de la demande en eau chaude sanitaire, n'a pas été considéré parmi les bénéficiaires du projet.

De plus, le marché relatif aux bénéficiaires ciblés (secteur tertiaire et habitat collectif) a été surestimé lors de l'élaboration du document du projet. En effet, il a été négligé certains facteurs du marché qui ont affecté négativement le déroulement du projet à savoir :

- le développement rapide du réseau gaz naturel et le raccordement de la majorité des hôtels par ce réseau ont affecté directement la rentabilité des installations solaires et par conséquent le nombre de projets à réaliser ;
- le manque d'engagement des établissements publics pour réaliser des installations solaires. En effet, ces établissements suivent une procédure administrative relativement longue pour la préparation de leurs budgets : une planification préalable des budgets est donc nécessaire pour la réalisation de ces projets.
- Les bains maures, dont la consommation d'eau chaude est considérable, ne sont pas adaptés pour abriter des grandes installations solaires. En effet, outre l'absence quasi totale d'un local technique capable de contenir les différentes composantes de l'installation solaire (ballon de stockage, échangeurs, pompes,…) la taille des terrasses des bains maures ne sont pas suffisantes pour implanter les capteurs solaires nécessaires pour le bon fonctionnement de l'installation solaire.

2. Réalisations des objectifs et résultats :

2.1 : Résultat/ réalisation des objectifs :

L'ANME attribue une côte satisfaisante à la réalisation des objectifs du projet. Cette côte est basée sur la dynamique que le projet a créé pour l'utilisation de l'énergie solaire pour le chauffage de l'eau au point qu'il a dépassé ses objectifs aussi bien en terme de quantité (plus de 56 000 m² de capteurs solaires au lieu de 50 000 m² prévus) qu'en terme de délais (en moins de temps que prévu ; c'est-à-dire seulement sur la période 1997-mars 2002). Concernant les objectifs environnementaux, l'ANME attribue une côte satisfaisante. En effet, la surface totale des capteurs solaires installés dans le cadre de ce projet (56 867 m²) permettrait de réaliser des économies d'énergie primaire de 12 420 tep/an et d'éviter, annuellement, l'émission dans l'atmosphère de 25 800 tonnes de CO2.

2.2 : Résultats par composante :

La sous composante relative à la sensibilisation et la promotion est jugée satisfaisante. En effet, depuis le démarrage du projet, l'ANME a déployé des efforts considérables pour sensibiliser les bénéficiaires potentiels et les décideurs sur les opportunités économiques et environnementales que représente le chauffage solaire de l'eau sanitaire. A cet effet, plusieurs campagnes de promotion ont été lancées pendant la période du projet basées sur :

- *la télévision* : par la diffusion à plusieurs reprises de films documentaires et de spots publicitaires incitant les différents consommateurs d'eau chaude à l'utilisation de l'énergie solaire ;
- *les séminaires* : par la présentation des avantages du projet dans les manifestations nationales et internationales ;
- *les dépliants* : par l'élaboration de 5000 dépliants et 1000 brochures afin de présenter le projet dans les différentes manifestations.

Tous ces efforts de sensibilisation ont contribué d'une façon significative à la diffusion des chauffe-eau solaires tout le long du projet.

La sous composante relative à la formation des techniciens de l'ANME et des consultants privés est jugée

satisfaisante. En effet, l'ANME a renforcé ses capacités internes à travers le recrutement et la formation d'ingénieurs et techniciens pour assurer la gestion et la mise en œuvre du programme et notamment la vérification technique et financière des études de faisabilité et leur approbation, la réception et le contrôle technique des installations solaires. De plus, l'ANME a organisé plusieurs sessions de formation aussi bien pour les bénéficiaires potentiels (Ministère de l'intérieur, Ministère de la Défense,…) que pour les différents opérateurs privés tels que les fournisseurs, les bureaux d'études et les bureaux de contrôle.
Toutefois, cette composante mérite d'être consolidée à deux niveaux. Le premier concerne les bureaux d'études et les bureaux de contrôle où il a été constaté un manque de leur implication dans la réalisation des installations solaires et ce malgré les nombreuses sessions de formation organisées en leur profit. Ceci pourrait être justifié par l'étroitesse du marché d'études dans ce secteur qui n'a pas aidé à faire émerger les bureaux d'études spécialisées. De ce fait, les fournisseurs se sont chargés d'apporter à leurs clients une prestation clé en main.

Le deuxième niveau concerne le réseau d'installateurs qui nécessite un contrôle continu et une mise à niveau pour offrir les garanties nécessaires sur la qualité de l'installation et le service après vente.

La sous composante assistance technique est jugée très satisfaisante. En effet, dès le début du projet, l'ANME n'a cessé d'apporter son assistance technique aux bénéficiaires pendant les différentes phases de la réalisation des projets. En effet, pour les établissements publics, l'ANME assiste les bénéficiaires à déterminer leurs besoins énergétiques en matière d'eau chaude, leur prépare le cahier des charges techniques, participe activement au dépouillement des offres et assure la réception provisoire des installations solaires. Pour les établissements privés, l'ANME examine les études technico-économiques qui lui parviennent et porte les corrections nécessaires afin d'optimiser le fonctionnement et la rentabilité économique des différentes installations.

La sous composante relative au suivi et à l'évaluation de l'impact environnemental du projet est jugée insatisfaisante. En effet, au début du projet, il était prévu l'équipement de chaque installation solaire par un système de télé contrôle qui permettra à l'ANME de faire l'analyse des données et de diffuser les résultats aussi bien aux bénéficiaires qu'aux fournisseurs. Or, étant donné que la taille moyenne des installations solaires collectives est relativement petite (environ 50 m²), l'emploi de ces systèmes de suivi devient injustifié en raison de leurs coûts élevés (environ 3 000 DT).

A cet effet, il a été décidé d'opter pour des simples compteurs d'énergie qui mesurent la quantité d'énergie produite et la quantité d'eau chaude consommée. Cette solution, qui nécessite le prélèvement mensuel des données nécessaires, ne peut être assurée que par le bénéficiaire lui-même et ce pour les raisons suivantes :

- les installations solaires réalisées dans le cadre de ce projet, sont nombreuses et dispersées sur tout le

territoire tunisien ;

- le rythme accéléré des réalisations de nouvelles installations empêche l'ANME d'assurer cette tâche.

Paradoxalement, cette procédure n'a pas permis d'atteindre les résultats escomptés. En effet, malgré l'insistance de l'ANME auprès des bénéficiaires sur l'importance de cette action, le nombre de fiches de suivi envoyé par ces derniers à l'ANME reste dérisoire et ne permet pas le suivi efficace des installations. Ceci pourrait être dû au fait que le nouveau concept, basé sur le contrat de Garantie des Résultats Solaires « GRS », qui a été introduit pour la réalisation de chaque installation solaire n'a pas eu les effets désirés sur le comportement des consommateurs finaux en matière de suivi périodique de l'installation et l'envoi des fiches à l'ANME.

La composante relative à la subvention des installations solaires est jugée très satisfaisante. En effet, la dynamique créée par le projet a conduit à l'épuisement des fonds dédiés à la subvention des installations avant terme (mars 2002) et a permis de dépasser l'objectif quantitatif du projet qui consiste à installer 50 000 m² de capteurs solaires.

2.3 : Valeur actuelle/ taux de rentabilité économique :
2.4 : Taux de rentabilité financière :
2.5 : Impact de développement institutionnel :

L'impact du projet sur le développement institutionnel est jugé très satisfaisant. En effet, avant le démarrage du projet et depuis la mise en faillite de la Société des Energies Nouvelles « SEN » qui était la seule société opératrice à cette période, il n'existait que deux petits ensembliers de chauffe-eau solaires qui se partageaient sur un petit marché de niche. Avec la dynamique apportée par le projet, à partir de 1997, il a été crée un véritable tissu d'opérateurs privés formé de huit acteurs dont trois fabricants locaux et cinq importateurs. Ces opérateurs ont réussi à mettre en place un réseau de distributeurs formé d'environ 130 installateurs qui assurent la commercialisation et le service après vents des chauffe-eau solaires. Actuellement, on estime que 500 emplois directs et indirects ont été crées grâce au projet.

5. Facteurs principaux affectant l'exécution et les résultats :

5.1 : Facteurs étrangers au contrôle de l'Etat ou de l'Agence d'exécution :

Les facteurs en dehors du contrôle du gouvernement tunisien et de l'ANME, qui ont affecté le projet sont les suivants:

- Le passage du secteur hôtelier par une période financièrement difficile, n'a pas permis à ces derniers d'investir dans des installations solaires pour le chauffage de l'eau ; ceci ne figurait pas parmi leurs priorités d'investissement ;
- La taille moyenne, relativement petite, des installations solaires collectives, qui a conduit au recours à des simples compteurs d'énergie pour faire le suivi économique et environnemental du projet, a entravé l'exécution de cette tâche.

5.2 : Facteurs généralement assujettis au contrôle de l'Etat :

Plusieurs facteurs ont contribué au bon déroulement du projet. En effet, il y a eu un changement de la stratégie de l'Etat en matière de développement de la filière des chauffe-eau solaires depuis le milieu des années 90. Cette stratégie consiste à désengager l'Etat de la filière en tant qu'opérateur et donner une plus grande place aux opérateurs privés tout en créant un environnement concurrentiel entre eux. Ceci s'est traduit par le démantèlement du monopole public de la SEN en 1995 et l'apparition d'un premier noyau d'opérateurs privés. De plus, l'Etat tunisien a mis en place des avantages spécifiques pour le chauffe-eau solaire, en plus de ceux accordés pour les énergies renouvelables en général : il s'agit de la suspension de la TVA et l'instauration de droits de douane minimum sur l'importation des chauffe-eau solaires, mettant ainsi l'industrie locale en concurrence directe avec les fabricants étrangers.

5.3 : Facteurs généralement assujettis au contrôle de l'agence d'exécution :

Depuis le début du projet en 1995 et jusqu'à octobre 2000, les moyens humains de l'ANME mis à la disposition du projet, étaient limités et ne pouvaient pas assurer l'exécution des tâches qui leur ont été confiées avec l'efficacité voulue, ce qui a engendré dans plusieurs cas des retards de paiement de la subvention. En effet, les trois ingénieurs qui forment l'unité du projet ont eu la charge d'assurer l'assistance technique des différents acteurs, les actions de sensibilisation et de promotion, l'examen technico-économique et l'approbation des dossiers relatifs aux installations solaires collectives, la vérification administrative des dossiers résidentiels, la réception provisoire des installations réalisées et le déblocage des subventions.

Afin de pouvoir suivre le rythme rapide des réalisations, l'ANME a renforcé, en octobre 2000, l'équipe du projet par trois techniciens qui se sont chargés du traitement des dossiers résidentiels depuis l'examen du dossier jusqu'à la réception des systèmes et le déblocage de la subvention.

5.4 : Coûts et financement :

Le présent projet a disposé d'un fonds global de 7,3 MUS$ réparti comme suit :

- 0,7 MUS$ pour financer les actions relatives à la composante « assistance technique » du projet ;
- 6,6 MUS$ pour la subvention proprement dite des installations solaires à hauteur de 35% du coût hors taxes de ces installations.

Les subventions engagées par le projet ont atteint 8 694 700 DT dont 8 601 700 DT ont été déboursées au profit des sociétés actives dans le domaine du chauffage solaire et 93 000 DT sont en cours de déblocage par la Banque Mondiale. Il est à signaler qu'une partie des subventions déboursées (824 700 DT) ont été décaissées à partir du budget de l'Etat tunisien à cause de l'épuisement des fonds GEF et Belge.

Le taux de décaissement des dons s'élèvent à 99% des 2,6 millions d'euros accordés par la Belgique et à 98,5% des 4 millions US$ accordés par le GEF. Il est à signaler que l'ANME a demandé auprès de la Banque Mondiale le décaissement de 93 263,929 DT relatif à la subvention des actions engagées avant le 30 juin 2004 et qui devront être décaissées avant le 30 octobre 2004.

Le chiffre d'affaire réalisé par les différents opérateurs, dans le cadre du projet, s'élève à plus que 22 Millions de Dinars Tunisien (MDT). Le coût moyen d'un m² de capteur solaire, sur la période du projet, est d'environ 437 DT/m² et le coût d'une tonne de CO2 évitée est estimé à 15,25 DT.

2. Viabilité :

L'ANME classe la viabilité des réalisations dans le cadre du projet dans la catégorie insatisfaisante. En effet, malgré que le projet a permis une relance significative du marché avec un produit de qualité et une implication de huit opérateurs, le marché du chauffe-eau solaire n'est pas encore capable de se développer d'une manière autonome.
L'épuisement des fonds prévus pour la subvention a été survenu dans une période critique où le marché a commencé à atteindre son régime de croisière, sans pour autant atteindre une autonomie complète. En effet, la diffusion des chauffe-eau solaires a largement baissé, passant d'environ 18 000 m² en 2001 à environ 8 000 m² de capteurs solaires en 2003.

Dans le but d'assurer la pérennité du secteur après l'achèvement du projet, l'Etat tunisien a mis en place un ensemble de mesures incitatrices. Ainsi il a procédé au renforcement des avantages fiscaux pour la fabrication locale et l'importation des chauffe-eau solaires en élargissant la liste des matières premières et des produits semi finis pour bénéficier de l'exonération de la TVA et des droits de douane minimum. De plus, il a été mis en place la procédure relative à l'octroi de la subvention de 20% définie dans le cadre du code d'incitation aux investissements et accordé aux installations solaires réalisées dans le secteur tertiaire. D'autre part, l'Etat a exprimé son engagement pour le développement du secteur par l'obligation de l'utilisation des chauffe-eau solaires dans les nouveaux bâtiments publics.

Concernant le secteur résidentiel et étant donné le coût élevé des chauffe-eau solaires par rapport aux autres systèmes classiques de chauffage, l'ANME œuvre actuellement à la mise en place d'un nouveau mécanisme de financement afin d'assurer la pérennité de ce secteur.

3. Performance de la Banque et de l'Emprunteur :

Banque :

3.1 : Opération de prêt :

L'ANME juge la performance de la Banque au cours de la préparation du projet insatisfaisante. La Banque n'a pas pensé suffisamment à la durabilité de l'approche préconisée par le projet. La plus grande critique qu'on pourrait faire à l'égard du projet est qu'il n'a pas préparé sa succession. Le projet aurait dû intégrer dès sa conception les mécanismes nécessaires pour assurer la continuité du développement du marché après la fin de l'opération.

De plus, La Banque n'a pas réussi à évaluer d'une manière satisfaisante le potentiel du marché des chauffe-eau

solaires en Tunisie. En effet, elle n'a pas pris en compte les spécificités de chaque sous secteur (hôtels, bains maures, hôpitaux,…) et leurs impacts sur le degré de pénétration de la technologie des chauffe-eau solaires dans ces établissements. De plus, la Banque n'a pas prévu l'impact de l'évolution du réseau gaz naturel sur la diffusion de cette technologie dans le secteur tertiaire et de l'habitat collectif.

D'autre part, la procédure fixée par la Banque Mondiale pour la réalisation des installations solaires n'était pas appropriée et n'a pas permis un développement réel du marché en question.

Supervision :

La performance de la Banque au cours de l'exécution du projet est jugée très satisfaisante. Les efforts de la Banque ont porté aussi bien sur la résolution des problèmes rencontrés lors de l'exécution du projet que sur la supervision du projet.

3.2 : Performance globale de la Banque :

La performance globale de la Banque est jugée satisfaisante.

4. Leçons tirées :

Le projet a permis de tirer les conclusions suivantes :

- La mise en place et le test d'un mécanisme financier et institutionnel pour le développement du secteur de chauffage solaire de l'eau ;
- La création d'un embryon d'un tissu industriel formé d'un réseau de quelques fabricants de chauffe-eau solaires (CES), de représentants de compagnies étrangères et de petites entreprises d'installation ;
- L'initiation d'un marché de CES ;
- La disponibilité des éléments de décisions pour assurer la pérennité du secteur ;
- La reprise des résultats et conclusions du projet pour la relance du marché avec plus de garantie au niveau durabilité.