INDEPENDENT EVALUATION UNIT
OFFICE OF EVALUATION AND INTERNAL OVERSIGHT

INDEPENDENT TERMINAL EVALUATION

Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry

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Contents

Acronyms and abbreviations

Acronym	Meaning
AIDMO	Arabian Industrial Development and Mining Organization
AMEC	Arab Ministerial Council of Electricity
ASPC	Abydos Solar Power Company
B2B	Business to Business
CAPMAS	Central Agency for Public Mobilization and Statistics
CBE	Central Bank of Egypt
CEO	Chief Executive Officer
CIB	Commercial International Bank
COP	Conference of the Parties (followed by the year)
COVID-19	Coronavirus Disease 2019
DAC	Development Assistance Committee
EBI	Egyptian Banking Institute, part of CBE
EE	Energy Efficiency
EEAA	Egyptian Environmental Affairs Agency
EGAC	Egyptian Accreditation Council
EGP	Egyptian Pounds
ENCPC	Egyptian National Cleaner Production Center
EOS	Egyptian Organization for Standardization
FEI	Federation of Egyptian Industries
GEF	Global Environmental Facility
GERD	Grand Ethiopian Renaissance Dam
GJ	Giga Joules (1,000,000,000 Joules)
GOIEC	General Organization for Import and Export Control
IED	Independent Evaluation Division
IMC	Industrial Modernization Center
ISO	International Standards Organisation
LogFrame	Logical Framework
M&E	Monitoring and Evaluation
MBO	Management by Objectives
MENA	Middle East and North Africa
MIC	Ministry of International Cooperation
MTI	Ministry of Trade and Industry formerly Ministry of Industry, Trade and SMEs)
MoE	Ministry of Environment
MTR	Mid-Term Review
MW	Mega Watt (1,000,000 Watts)
NBE	National Bank of Egypt
NCCC	Egyptian Climate Change Strategy
NDC	Nationally Determined Contribution
NEC	National Evaluation Consultant
NGO	Non-Governmental Organisation
NREA	New and Renewable Energy Authority
OECD	Organization for Economic Cooperation and Development
PIR	Project Implementation Report
PM	Project Manager / Project Management.

Acronym	Meaning
PMU	Project Management Unit
PV	Photo Voltaic
PVTD	Productivity and Vocational Training Department
RBM	Results-Based Management
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RE	Renewable Energy
SC	Steering Committee
SDF	Social Development Fund
SDS	Sustainable Development Strategy
SHAMCI	Solar Heating Arab Mark and Certification Initiative
SHIP	Solar Heating in Industrial Processes
SO	System Optimization
SWH	Solar Water Heating
t CO_2 eq	Tonnes of Carbon Dioxide equivalent
TE	Terminal Evaluation
TL	Team Leader
TOR	Terms of Reference
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation
USD	United States Dollars

Glossary of terms relevant to the Terminal Evaluation

Term	Definition
Assumptions	Hypotheses about factors or risks which could affect the progress or success of a development intervention. Necessary conditions for the achievement of results at different levels. These are conditions that must exist if the project is to succeed but which are outside the direct control of the project management. This is called the external logic of the project because these conditions lie outside the project's accountability and can be related to laws, political commitments, political situation, financing, etc.
Baseline	The situation prior to a development intervention against which progress can be assessed or comparisons made.
Coherence	The compatibility of the intervention with other interventions in the country, sector or institution, coherence can be measured at both internal and external level.
Conclusions	Conclusions point out the factors of success and failure of the evaluated intervention, with special attention paid to the intended and unintended results and impacts, and more generally to any other strength or weakness. A conclusion draws on data collection and analyses undertaken, through a transparent chain of arguments.
Effectiveness	The extent to which the development intervention's objectives were achieved, or are expected to be achieved, taking into account their relative importance.
Efficiency	A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results.
External evaluation/review	The evaluation/review of a development intervention conducted by entities and/or individuals outside the donor and implementing organizations.
Formative evaluation/review	Evaluation/review intended to improve performance, most often conducted during the implementation phase of projects or programs.
Gender mainstreaming	The process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality
Impacts	Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended.
Indicator	Quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor. Means by which a change will be measured. Example: Total wastewater in t/yr.
Institutional development impact	The extent to which an intervention improves or weakens the ability of a country or region to make more efficient, equitable, and sustainable use of its human, financial, and natural resources, for example through: (a) better definition, stability, transparency, enforceability and predictability of institutional arrangements and/or (b) better alignment of the mission and capacity of an organization with its mandate, which derives from these institutional arrangements. Such impacts can include intended and unintended effects of an action.
Lessons learned	Generalisations based on evaluation experiences with projects, programs, or policies that abstract from the specific circumstances to broader situations. Frequently, lessons highlight strengths or weaknesses in preparation, design, and implementation that affect performance, outcome, and impact.
Logframe	Management tool used to improve the design of interventions, most often at the project level. It involves identifying strategic elements (inputs, outputs, outcomes, impact) and their causal relationships, indicators, and the assumptions or risks that may influence success and failure. It thus facilitates planning, execution, monitoring and evaluation of a development intervention.
Milestones	Interim targets; points in the lifetime of a project by which certain progress should have been made.

Term	Definition
	They provide an early warning system and are the basis for monitoring the trajectory of change during the lifetime of the project.
Monitoring	A continuing function that uses systematic collection of data on specified indicators to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds.
Outcome	The likely or achieved short-term and medium-term effects of an intervention's outputs.
Outputs	The products, capital goods and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes.
Recommendations	Proposals aimed at enhancing the effectiveness, quality, or efficiency of a development intervention; at redesigning the objectives; and/or at the reallocation of resources. Recommendations should be linked to conclusions.
Relevance	The extent to which the objectives of a development intervention are consistent with beneficiaries' requirements, country needs, global priorities and partners' and donors' policies. Note: Retrospectively, the question of relevance often becomes a question as to whether the objectives of an intervention or its design are still appropriate given changed circumstances.
Results	The output, outcome or impact (intended or unintended, positive and/or negative) of a development intervention.
Results-Based Management (RBM)	A management strategy focusing on performance and achievement of outputs, outcomes and impacts.
Review	An assessment of the performance of an intervention, periodically or on an ad hoc basis. Note: Frequently "evaluation" is used for a more comprehensive and/or more in-depth assessment than "review". Reviews tend to emphasize operational aspects. Sometimes the terms "review" and "evaluation" are used as synonyms.
Sustainability	The continuation of benefits from a development intervention after major development assistance has been completed. The probability of continued long term benefits. The resilience to risk of the net benefit flows over time.
Target	Definite ends to be achieved. Specifies a particular value that an indicator should reach by a specific date in the future. Example: Reduce by 50% the amount of wastewater in t/yr, between 2015 and 2020.
Theory of change	Theory of change or programme theory is similar to a logic model, but includes key assumptions behind the causal relationships and sometimes the major factors (internal and external to the intervention) likely to influence the outcomes.

For more related terms and definitions see also:
OECD-DAC Glossary of Key Terms in Evaluation and Results Based Management (2010); http://www.oecd.org/development/peer-reviews/2754804.pdf.
UNDG Results-based management handbook; https://undg.org/wp-content/uploads/2015/01/UNDG-RBM-Handbook-2012.pdf.
UNIDO e-learning course: Results-based Management and the Logical Framework Approach; http://intranet.unido.org/training/rbm/#home

Executive summary

This independent terminal evaluation of the UNIDO project 'Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry' (commonly known as the SHIP project) was completed at the end of March 2023 after 8 ½ years of implementation.

The evaluation assessed 11 criteria with scores as given below and gives an overall rating of 5, which is Satisfactory.

Criterion	Score
Design	4 – Moderately Satisfactory
Progress towards Impact	5 – Satisfactory
Relevance	6 – Highly Satisfactory
Effectiveness	5 – Satisfactory
Efficiency	5 – Satisfactory
Sustainability	4 – Moderately Satisfactory
Coherence	5 – Satisfactory
Gender Mainstreaming	6 – Highly Satisfactory
Monitoring & Evaluation	5 – Satisfactory
Results-based Management	5 – Satisfactory
Partners performance	5 – Satisfactory
Overall	**5 – Satisfactory**

Overall, the project is regarded as a success and is leaving a good legacy through the conduct of many training (benefiting over 1,300 people), setting up a Revolving Fund worth USD 4million, holding many media and visibility events, and achieving a high degree of awareness, including amongst others; the SHIP website, Installation and Maintenance video on YouTube outreach in Industrial Zones, participation in EXPOs, and use of radio and social media.

The design was appropriate and generally good, well thought-through and despite the long period of intervention, the activities are as relevant as during the inception period. But there were too many activities planned, some of them overlapped and some targets were in the end unrealistic, such as the development of 100 pilot projects. In the end, only 6% of the planned co-financing materialised, and the target of USD 19 million investment into solar energy in the industrial sector has therefore been missed. This has meant that the overall target of reducing over 2 million tonnes of CO_2 as a result of the project is unlikely.

There are many notable impacts including:

- establishment of a Testing Laboratory at NREA.
- a route to have standards and quality certifications through the SHAMCI scheme.
- a comprehensive capacity-building programme delivered.
- 81 feasibility studies / energy audits carried out in industrial premises.
- full resourcing of the planned NBE Revolving Fund loan scheme.
- diversifying beneficiaries beyond the industrial sector (e.g. tourism sector).
- creating a more positive experience about SWH in Egypt.

But there remain challenges for the continuation of project benefits including the current bad economic situation in Egypt, competition with the subsidised price of natural gas, customs tariff management, the unclear and expensive route for manufacturers to achieve SHAMCI certification, and the lack of government resources to continue training and skills development.

The project is found to be highly relevant to the SWH sector and to the strategies of key Ministries and the project has understood that energy efficiency is as important as renewable energy when considering large industrial and commercial consumers. The main targets have been met or exceeded by working on the demand and supply sides of the market and concentrating tirelessly on the four components (policy, financial, technical, and skills & awareness). However, the higher visibility of the project has been missed because of the lack of pilot projects that can be exemplars.

The project resources appear to have been used efficiently, and the original budget has not been exceeded despite the project being extended twice. Due to the complexities and ambitious number of activities the project should have been delivered in two phases. Also, the sustainability of impacts could be compromised as UNIDO withdraws from the sector and the main government stakeholders do not continue to champion and scale-up the initiatives so far.

The mainstreaming of gender has been a particularly strong feature of the project, even if the percentage of women trained was only 21%. The general level of monitoring and reporting has been to a high level, although more financial information should have been made available in the regular PIRs. There was also not enough management of results at the early stages of the project, nor the continual tracking and management of risks during all stages. But since 2019/2020 UNIDO has actively developed the local Egyptian team and their work is highly regarded by stakeholders, noted as cooperative and proactive with good coordination and follow-up with beneficiaries. The local team's skilled and active work on all of the many activities on the ground and the good management in place has been one of the most crucial aspects in delivering this successful project.

Findings and Key Lessons

The following are the main findings and lessons learnt from implementing the SHIP project as drawn out from the evaluation:

- The project design targeting "solar for industrial process heat" was a constraint on the implementation of some activities, so no pilot projects were achieved whereas if the tourism sector was included from the beginning, projects on hotels may have been more easily piloted. Had the project financed one or two systems directly, a push would have been given to the financing and uptake of other schemes.
- UNIDO giving emphasis on designing a Roadmap early on in 2017 demonstrated the SHIP project vision to the government partners. The project drew strength from the involvement of NREA and other government partners and many of the achievements were met because of their central roles. The technical capacities of these government institutions need to continue to be developed to the level of the UNIDO experts, in order to ensure sustainability.
- With a few exceptions, the discussions with industrial partners and beneficiaries were not deep enough and may have stayed at the level of raising awareness and the content of the feasibility studies done. It is now important that those beneficiaries implement new SWH projects which can be regarded as outcomes from the SHIP project.
- Setting up the Revolving Fund was challenging, the complexity was underestimated, and there was low demand for loans. The involvement of the manufacturing sector may not have been the right choice for loans and hotels should now be the priority with good payback periods possible with their high demand for hot water.
- During the implementation of the project there were very volatile situations with COVID-19 and other unforeseen turbulences from difficult economic conditions. The UNIDO team reacted fast to counter these challenges, was flexible to respond to the different market needs and the project pivoted and expanded its focus to include tourism.

- The breadth of the project was large (and the duration long) and many of the activities required a lot of cooperation between entities without taking into consideration uncertainties or human resource fluctuations. Implementation in two separate phases with an evaluation break point in-between might have helped in smoother implementation. However, having the implementation team embedded in Egypt was a new model for UNIDO and it undoubtedly assisted in efficient and faster implementation and should have been enacted earlier.

Recommendations

The following are the key recommendations drawn from this evaluation:

1. The Ministry of Trade and Industry (MTI) has an important role to ensure sustainability of the initiatives started by the project and a follow-up is required by MTI on the implementation of the Roadmap. In addition, government should provide a supportive regulatory environment, including mandating government buildings and large industrial facilities to use renewables and having credible targets in place. There are issues around custom tariff management which impedes the import of renewable energy equipment needs high level political level involvement from the Ministry of Trade and Industry then the Industrial Modernisation Center (IMC) should monitor and review every couple of years how such customs are reducing competitiveness in the market.

2. UNIDO should undertake post-project monitoring on how the first National Bank of Egypt (NBE) loan made was handled and how any schemes that result from the Revolving Fund are maintained, monitored and evaluated.

3. For the trainings already developed and implemented by the Productivity and Vocational Training Department (PVTD), IMC and New and Renewable Energy Authority (NREA), these need to be continuously offered and the pool of trainers/service providers registered under the UNIDO project be continually expanded to match increasing demand. Many of those that have benefited from training of trainers now face financial constraints to continue delivering a range of trainings, so subsidized courses are suggested, particularly to attract more students. The approach within the SHIP project of learning by doing with capacity building, should be applied to the residential sector, not least because of the huge potential solar water heating market.

4. The success of the awareness raising tools should be replicated through MTI using social media, internet-based promotion and even trade events or roadshows for promoting SWH technology.

5. UNIDO should recommend how to scale-up activities and this should be embedded into the exit strategy. Further collaboration with MTI, through the Egyptian National Cleaner Production Center (ENCPC), is still required with a SHIP champion in place to sustain the many project achievements.

In addition, based on this evaluation there are recommendations on how the solar water heating sector could be further bolstered after the SHIP project ends:

- The cost of solar water heater manufacturing has to be reduced to ultimately boost an increase in the market. The inclusion of the tourism sector is crucial to the development of the market so expansion into that sector should be sharpened.
- While the price of natural gas is still low and price of manufacturing SWH is still high, industry needs to come up with innovative ways of being competitive including clustering manufacturers to make certain components in bulk, participating and learning with other MENA countries in product manufacturing and demonstrating the use of solar for process heat in their own facilities. The model that the private sector has used to market solar PV

could be learned from, for example, a developer taking some of the investment risk with commensurate benefit and participating with the beneficiary in realising a SWH project.

- Feedback from the manufacturers is that within the standardisation activities, there needs to be a simpler and cheaper process to achieving the SHAMCI accreditation and a clearer definition of roles between the entities involved in the process.

1. Introduction

The UNIDO project 'Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry', supported by the Global Environmental Facility (GEF), started in October 2014 with an original planned duration of 5 years. It became known as the SHIP (Solar Heating for Industrial Process) project and was completed at the end of March 2023 with an actual duration of 8 ½ years.

The objective of the project was '*To develop the market environment for the diffusion and local manufacturing of solar energy for industrial process heat*'. The project focused on improving the energy efficiency of industrial process heat systems and the introduction of solar thermal (water heating) technologies mainly in industrial companies with a high fraction of low and medium temperature heat demand in three industrial sectors, namely the food, chemical and textiles sectors. Further the project sought to support the local manufacturing of quality components of the solar systems.

This Terminal Evaluation (TE) analyses to what extent has the project in question achieved the expected results within the solar energy sector for industrial process heat in Egypt namely; the promotion of policy instruments; mobilization of financing; improvement in manufacturing the technology and enhancing the technical capacity of people involved in the sector.

The Terminal Evaluation addresses the project's design, its relevance, effectiveness, efficiency, coherence and sustainability, and ultimately its 'progress to impact'. The evaluation aims to develop a series of findings, lessons and recommendations for enhancing the design of new and on-going UNIDO projects (which are similar in nature) and their implementation in the field.

1.1. Evaluation Methodology

The evaluation team was composed of 2 members and they undertook over 20 interviews in country between 12 and 16 March 2023 with a wide range of stakeholders including from the UNIDO Egypt Office, Government partners, participating Banks, Consultants, Service Providers and Beneficiaries. The Project Manager at UNIDO HQ was interviewed remotely on 3 April 2023 together with the Independent Evaluation Division and the team analysed all of the documents provided and has maintained communication with UNIDO during the reporting period to clarify some points.

The Terminal Evaluation is conducted in accordance with the UNIDO Evaluation Policy (2021) and UNIDO Guidelines for Technological Co-operation and Project Cycle (2006), particularly referencing the UNIDO Evaluation Manual (2018). The internationally agreed evaluation criteria are used, which are based on the Organization for Economic Cooperation and Development / Development Assistance Committee (OECD/DAC) Network on Development Evaluation revised Evaluation Criteria and Results Based Management, wherein the whole assessment of the project draws from the analysis made in 'project performance' and 'project impact' criteria. An extra criterion is added under Project Performance using the suggestion from the OECD/DAC 'Better Criteria for Better Evaluation' (2019), which is coherence – to better capture project linkages, systems thinking, partnership dynamics, and complexity.

Table 1 - Evaluation criteria used

EVALUATION CRITERIA	DEFINITION
Project Impact	Long-term effects (direct or indirect, intended or unintended) produced by a development intervention that are positive and/ or negative, primary and/ or secondary and redirect the trajectories of transformation process.
Project Design	**Formulation of the intervention or plan to achieve a specific purpose**

EVALUATION CRITERIA	DEFINITION
Overall Design	Assessment of design in general.
LogFrame	Assessment of the Logical Framework.
Project Performance	**Functioning of the intervention**
Relevance	The extent to which the activity is suited to the priorities and policies of the target beneficiaries and the donor.
Effectiveness	The extent to which the interventions objectives were achieved or expected to be achieved.
Efficiency	A measure of how economically the resource and inputs (funds, time, expertise, services) are converted to results.
Sustainability	The continuation of benefits from an intervention after major development assistance has been completed. The probability of continued long-term benefits and resilience to the net rise of benefit flow over time.
Coherence	Measures the compatibility of the intervention with other interventions in the country, sector or institution. Coherence can be measured at both internal and external level, at least one of the two dimensions should be tackled.
Cross cutting issues	**Important criteria that cut across the intervention**
Gender mainstreaming	Although gender aspects were not considered in the design, the extent to which the intervention has contributed to better gender equality, if any.
Monitoring & Evaluation	Refers to all the indicators, tools and processors used to measure if an intervention has been implemented according to the plan (monitoring) and is having/ has the desired results (evaluation).
Results-based management	Assessment of issues relating to results-based works planning, results-based M &E and reporting based on results.
Partners Performance	
- UNIDO - National Counterparts - Donors	Assessment of contribution of partners to project design, implementation, monitoring, reporting, supervision, backstopping and evaluation. The performance of each partner is assessed individually based on their roles and responsibilities.

In addition, GEF guidelines were applied, such as 'Conducting Terminal Evaluations for Full-sized Projects' and 'GEF's Monitoring & Evaluation Policy' as well as the GEF documentation such as the Project Request for CEO Endorsement dated August 2014. UNIDO's standard rating system has been used to quantify the performance of the project against the criteria listed above and using the methodology described in the UNIDO Evaluation Manual[1].

Table 2 - UNIDO Project Evaluation Rating

Score	Rating	Definition	Category
6	Highly satisfactory	Level of achievement presents no shortcomings (90% - 100% achievement rate of planned expectations and targets).	SATISFACTORY
5	Satisfactory	Level of achievement presents minor shortcomings (70% - 89% achievement rate of planned expectations and targets).	
4	Moderately satisfactory	Level of achievement presents moderate shortcomings (50% - 69% achievement rate of planned expectations and targets).	

[1] Evaluation Manual UNIDO, 2018 – updated in July 2023

3	Moderately unsatisfactory	Level of achievement presents some significant shortcomings (30% - 49% achievement rate of planned expectations and targets).	UNSATISFACTORY
2	Unsatisfactory	Level of achievement presents major shortcomings (10% - 29% achievement rate of planned expectations and targets).	
1	Highly unsatisfactory	Level of achievement presents severe shortcomings (0% - 9% achievement rate of planned expectations and targets).	

The methods deployed during the Terminal Evaluation assignment included:

- Desk review of all UNIDO documents and background information relating to the project as well as notes and minutes from project meetings.
- Carry out semi-structured interviews with project stakeholders at UNIDO (Vienna HQ and Egypt Country Office) and in Egypt (counterparts, GEF focal points, co-financers, implementing partners, supporting agents and beneficiaries).
- Field visits to stakeholder premises and project site/s to observe and take note of all relevant results achieved within the project.
- Tabulate the initial findings from information reviews, meetings and interviews and observations made – for quick reporting.
- Write up the findings in full following the evaluation criteria presented in Table 1.
- Summarise the findings, conclusions and recommendations for the Executive Summary and presentation to UNIDO at HQ.

The output of the evaluation is to check that the project design has given rise to measurable development impact against the objectives and targets laid down in the LogFrame and that the project's relevance, effectiveness, efficiency, sustainability and coherence have been understood and honestly reported on. Recommendations are made based on the findings of all of the above aspects. Analysis is also made on cross-cutting issues (gender, monitoring and evaluation and results-based management) and on the performance of partners in the project.

The evaluation will assist UNIDO in reporting to governing bodies, partner governments and donors for accountability; supporting management by providing clear recommendations to project managers and team leaders; and enhancing in design of new and on-going projects by taking the lessons particular to this project.

1.2. Evaluation Approach

The approach the consultants has taken in the evaluation was systematic, independent and in-depth by consulting as many stakeholders as possible while liaising closely with the UNIDO Egypt office and the UNIDO Project Manager and Independent Evaluation Division (IED) in Vienna. The interviewing of stakeholders in Egypt is regarded as central to the approach in order to enrich the consultants' understanding and evaluation of the project. The reconstructed theory of change approach was used, whereby the intervention was checked against the project results, tracking causal and transformational pathways to change in a clear narrative form. Other approaches used were according to the Terms of Reference with respect to data collection, guide questions, evaluation criteria and the rating systems to be used. The work division between the consultants (Team Leader and National Evaluation Consultant) broadly followed Table 3.

Table 3 - Division of work by the consultants

International Evaluation Consultant / Team Leader (TL)	• Prepare and submit the Inception Report • Lead on design of interviews • Undertake interviews together with the NEC

	• Draft project initial findings while in-country • Lead on writing the draft report • Make presentation to UNIDO HQ • Liaise with UNIDO PM and IED and UNIDO Egypt Office and GEF Focal Point
National Evaluation Consultant (NEC)	• Contribute to the Inception Report • Set up meetings for interviews with UNIDO assistance • Plan and carry out the in-country visits • Undertake interviews with the TL • Draft initial findings with the TL while in-country • Support the TL in providing the draft report • Co-ordinate with UNIDO Egypt Office

The team for the Terminal Evaluation was composed of two members; Simon Taylor, the International Evaluation Consultant and Team Leader and Salma Sabri, the National Evaluation Consultant. Significant support was given to the evaluators by the UNIDO project management team in Egypt who arranged interviews in-country and kept the main partners (GEF Operational Focal Point, Ministry of Trade and Industry and the Egypt National Cleaner Production Center) briefed on the evaluation and also provided all of the relevant documents. An evaluation manager from UNIDO's Independent Evaluation Division provided technical backstopping to the evaluation team to ensure the quality of the evaluation and the Project Manager and her support staff in UNIDO HQ also provided support to the evaluation team.

2. Background

2.1. Findings of the Mid-Term Review

The mid-term review, undertaken in August 2018, was generally positive about the project. However, it noted that the project was behind schedule on several critical components and had not achieved any significant impact to that time. Only three or four projects had been installed to that point. The report also noted that the project was at risk of not setting up the Revolving Fund before the end of the project and that this could impact the number of investments made under Outcome 2.2.

Component 1 on Policy had made good progress with a SHIP roadmap published and two standards under development on solar water heating system certification and installation operations personnel. A test standard for heat exchangers for heat recovery from waste water was suggested in order to improve the quality of designs for these systems.

Component 2 on Finance had a planned subcomponent to establish a revolving fund at the National Bank of Egypt. Negotiations for setting up the fund had stalled at the time of the MTR with both UNIDO and NBE maintaining that they were interested in the arrangement but without an agreement on how to proceed. The Egyptian Pound was devalued the year before the MTR making the purchase of components from abroad significantly more costly. The combination of uncertainty over who should administer the fund, a complex application process and wider economic uncertainty proved to be barriers to SMEs taking advantage of the fund. Devolving the revolving fund to NBE/MTI ownership, streamlining the application process and offering low interest loans were suggested to alleviate these issues.

Component 3 is on improving the manufacture, supply and distribution of solar energy components and systems for businesses. The potential to lower costs was evident at the MTR but to date the market volume was not conducive to investment in local manufacturing. It was found

the project could potentially exceed the greenhouse gas emissions target if the capacity to do so were successfully built in the country.

Component 4 is building the capacity of designers, developers, installers and operators. Design is critically important for SHIP systems, but was behind schedule at the MTR. The MTR recommended accelerating this capacity building in order to provide a pipeline of viable investments before the end of the project.

The MTR noted that Monitoring and Evaluation could be improved to monitor and manage the failing outputs by diversifying financiers and focussing on increasing the number of investment grade projects available to the project. The MTR also suggested extending the project by a year in order to mitigate the effects of the significant economic challenges faced by Egypt in the previous years.

2.2. Country Background

Egypt is the most populated country in the Middle East and North Africa (MENA) region with a population growth rate of 1.66% in 2021[2] and over 104 million inhabitants, over half under the age of 30. Since the majority of Egypt's geography consists of expansive desert, 43.1% of citizens live in urban areas along the Nile or Mediterranean Sea, such as Cairo, Alexandria, or Aswan. Cairo is not only the largest city in the Arab World, with a population 12.3 million, but is also one of the densest. Egypt's government officials have been making efforts to decentralize living and working arrangements since 1970 as a way to improve quality of life. Rather than focusing on improving infrastructure within the city Cairo, many of the proposed solutions involve moving residents into recently constructed metropolitan areas in the desert, creating an urbanization problem. This strategy comes with a high cost such as interference with agricultural practices and increasingly limited water access along with huge new investments in infrastructure and services in the newly developed areas, like the new capital city.

Egypt has seen impressive economic gains and improvements to the average per capita income[3]. It also enjoys universal school enrolment with gender parity in both basic and higher education and most of the population has access to water yet, more than ten years after the beginning of the Arab upheavals, Egypt is still in the transformation process. High population growth coupled with high unemployment, high poverty levels, high inflation rates and underemployment are among the most pressing political and socio-economic problems.

In 2019 Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS) announced that 32.5% of the population was living below the national poverty line, up from 27.8% in 2015 (see Figure 1). This signifies that the economy is not supporting all Egyptians[4].

[2] https://datacommons.org/place/country/EGY?mprop=count&popt=Person&hl=en#
[3] World Bank (2020) School enrolment, primary and secondary (gross), Gender Parity Index (GPI), Egypt. https://data.worldbank.org/indicator/SE.ENR.PRSC.FM.ZS?locations=EG
[4] Ahram Online (2019) http://english.ahram.org.eg/NewsContent/3/12/341838/Business/Economy/-percent-of-Egyptians-live-below-poverty-line-CAPM.aspx

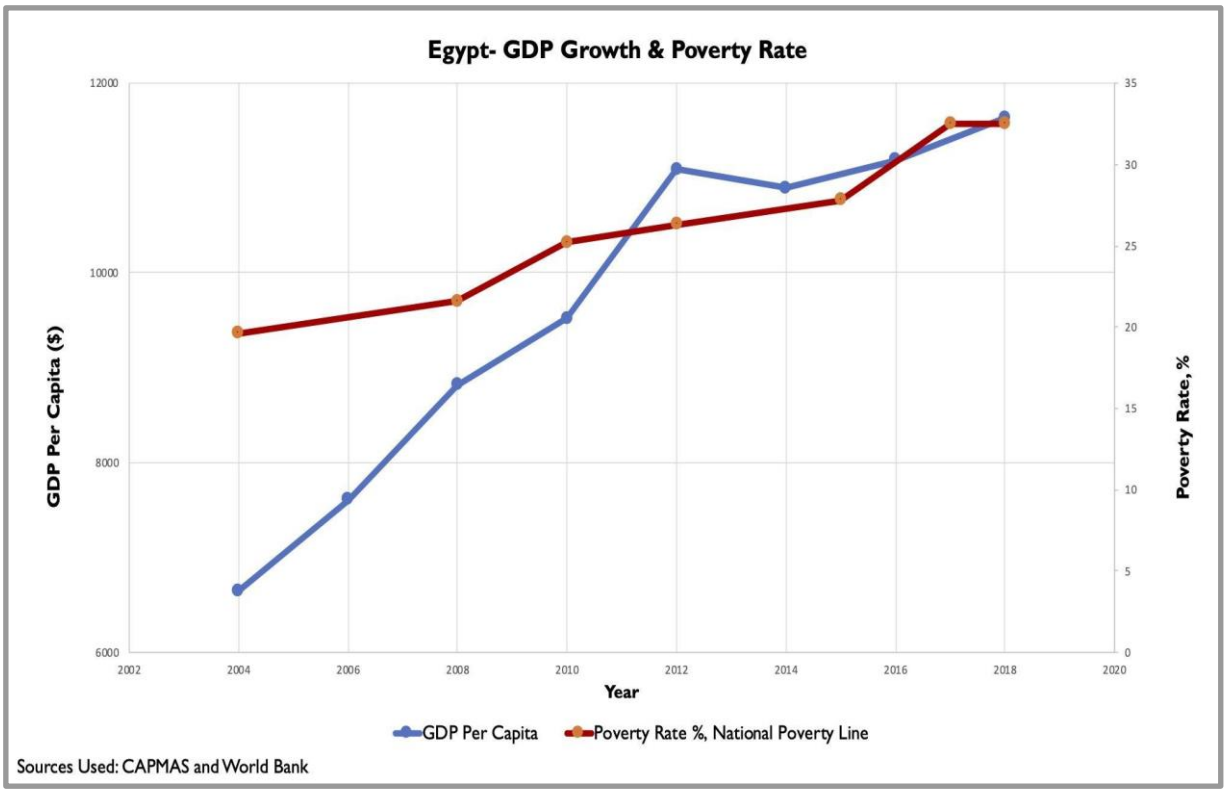


Figure 1 – Growth and poverty rate for Egypt 2002 to 2020[5]

In 2021 Egypt's unemployment rate was 9.33%, a 0.16% increase from 2020[6]. Women are vastly under-represented in the labour market and the economic gender gap remains high. Egypt ranks 140th out of 153 countries in women's economic participation and opportunity[7]. Egypt's score on the J2SR Economic Gender Gap metric is well below the global average. Only 18% of working-age women are participating in the economy, compared to 65% of men[8].

Youth, especially female youth, also experience a high unemployment rate of 60.5%, limiting Egypt's ability to grow economically[9]. Egyptian education at the secondary and tertiary levels does not equip youth with the relevant skills to parlay their studies into employment, and so youth at all levels are underprepared for the labour market and lack the skills, training and opportunities necessary to contribute to and benefit from the local economy.

To better address these economic challenges, Egypt should integrate the private sector in the development process. The legal and regulatory framework in Egypt remains not sufficiently supporting private businesses and is the main reason behind Egypt's low ranking in the World Bank's Doing Business Report[10]. Additionally, at least 50% of firms in Egypt are informal, producing goods and services valued at EGP 3 trillion and employing four million workers[11] and unregulated microenterprises and start-ups are not included in the tax base and have not grown enough to increase employment opportunities. The private sector space is also crowded by unfair

[5] Egypt/USAID (2020) Country Development Cooperation Strategy 2021-2026
[6] https://www.macrotrends.net/countries/EGY/egypt/unemployment-rate
[7] World Economic Forum (2020) Global Gender Gap Report
[8] CAPMAS (2020) Quarterly Labor Force Surveys 2018-2020
[9] CAPMAS (2020) Q2 2020 Labour force report. http://www.capmas.gov.eg/Pages/GeneralNews.aspx?page_id=1
[10] USAID (2020) Egypt Country Development Cooperation Strategy (2021 – 2026)
[11] https://english.ahram.org.eg/NewsContent/50/1202/423530/AlAhram-Weekly/Economy/Egypts-massive-informal-economy-Transitioning-to-f.aspx.

competition from military and state-owned enterprises. Military agencies implement massive infrastructure projects, produce consumer goods ranging from food to household appliances, and import basic commodities for civilian markets[12].

In February 2023, a report from the Central Agency for Public Mobilisation and Statistics cited that Egypt's December 2022 inflation rates marked the highest in five years after climbing dramatically since March 2022. The annual urban consumer inflation rate grew to 21.3% in December, exceeding economist predictions[13]. The report argues that the current economic crisis is mainly caused by the Russian invasion of Ukraine, as Egypt relies on Russia and Ukraine for 80% of its wheat imports. The restriction of the global grain market caused wheat import prices to double. Because of the Ukraine conflict, the corresponding energy crisis has affected the Egyptian economy. Egypt imports approximately 100 million barrels of crude oil annually and the spike in prices has increased production and manufacturing costs. The food and beverage sector has been the most heavily impacted, with prices skyrocketing to 37.9% from December 2021 to December 2022. According to the recent Policy Brief Program, inflation is widespread, also affecting the costs of medical services, furniture and housing.

Steady devaluation of the Egyptian pound has compounded the increase in inflation rates. In March 2022, the Central Bank of Egypt (CBE) devalued the pound by 14% after foreign investors pulled USD 20 billion out of Egypt because of the war in Ukraine. Afterwards, the country devalued the currency several times along with gradual increases in fuel prices. Since then the pound has almost lost more than half of its value in relation to the US dollar. The prolonged economic spiral along with other factors led to a shortage of foreign currency, with net international reserves plunging 19% during the summer of 2022. The dollar shortage, exacerbated by the depreciation of the pound, has created a huge black market, contributing to rising prices.

2.2.1. Environmental Problems

Egypt has an expanding population and limited resources. Statistics show that the country's population has tripled from 1950 to 2000 representing an increased pressure on natural resources and the environment. In addition, the persistence of unsustainable consumption and production patterns constitute a major challenge that hinders Egypt's developmental process. Starting from the Egyptian Revolution of 2011 environmental issues have increased and problems now include water scarcity, air pollution, damage to historic monuments, animal welfare issues and deficiencies in waste management. The country has made some efforts to address these issues, but progress has been slow and inconsistent.

Egypt is one of the most water-scarce countries in the world, with most of its water resources coming from the Nile River. A growing population, outdated agricultural practices, climate change, and the construction of Ethiopia's Grand Ethiopian Renaissance Dam (GERD) is jeopardising continued security of Egypt's water supplies. This has implications in terms of health due to waterborne diseases, sanitation, and hygiene, as well as impacts on economic opportunities and livelihoods in terms of farming and other industries[5]. The government has implemented serious initiatives to address these issues, such as promoting water conservation and investing in desalination plants. However, these efforts have been limited by political and economic factors and the country continues to face significant water scarcity.

Air pollution has been a major problem in Egypt, especially in Cairo and other densely populated areas. The air pollution in downtown Cairo is more than 10 to 100 times of acceptable world

[12] Owners of the Republic: An Anatomy of Egypt's Military Economy, Carnegie Middle East Center, (2019). https://carnegie-mec.org/2019/11/18/owners-of-republic-anatomy-of-egypt-s-military-economy-pub-80325

[13] Policy Brief Program (2023)

standards[14]. Sources of the dust and small particles are transportation, industry and open-air waste-burning. The country's heavy reliance on fossil fuels and outdated transportation infrastructure has contributed to high levels of particulate matter in the air, which cause respiratory problems and other health issues. Furthermore, air and water pollution in Cairo have a destructive effect on the many important monuments in the city, yielding to early erosion. In recent years the government has taken measures to tackle this issue, such as implementing stricter emissions standards for cars and expanding public transportation options. However, progress has been slow and many of these initiatives have faced resistance from the public and private sectors.

The current environmental crisis is a product of multifaceted factors including high population growth rates, the inadequacy of the governance system, the increase in economic activities, traditional and cultural habits and practices, behavioural attitudes, lack of awareness and information, the absence of systems that foster creativity and innovation, high urbanization rate coupled with negligence in integrating environmental considerations in governmental practices.

2.2.2. Policy Background

As a response to the various challenges that Egypt faces, legal and institutional changes have been taken in the past few years by the government to promote and implement sustainable development through the introduction of sustainable consumption and production (SCP), energy efficiency (EE) and renewable energy (RE) practices, while providing an enabling environment. On a policy level, the government embarked on an economic reform program supported by the International Monetary Fund (IMF) which includes the full liberalization of the energy market (both fuel and electricity) through raising the pre-tax cost-recovery ratio on the majority of fuel products.

In 2014 the government began to reduce energy subsidies and raise fuel prices, expecting to complete it by FY 2024/2025. As the Ministry of Electricity and Renewable Energy is the key leader of the energy policy reform programme, it designed the Sustainability Electricity Plan (2018/2019 - 2021/2022) focusing on maximizing energy production from local resources and diversifying supply, reducing the intensity of energy consumption, and transition to a low carbon pathway in the electricity sector. The plan focuses on two main pillars, advancement of the solar energy sector, and the electrical energy efficiency plan. With respect to the first pillar, solar energy should become a key player in the production and exporting of energy to other countries. This can be achieved through enhancing institutional and individual capacities of the local market players, developing the local and regional market and enhancement of the executive supporting legislations and strategic policies. The strategy is mainly about how ready Egypt is to enhance the sector but does not bind the sector to any clear targets.

On the executive level, a number of Egyptian Ministries started adopting the sustainability vision of the government and emphasized it in their plans and policies. In 2014, the Ministry of Planning and Economic Development launched a discussion process to incorporate sustainability into a number of themes covering the period 2015-2030, which resulted in "the Sustainable Development Strategy (SDS): Egypt Vision 2030" in 2016. The SDS is based on inclusive sustainable development and balanced regional development principles for improving the quality of lives and welfare and its Vision 2030 serves as an umbrella for a number of other strategies. This contributes to supporting the second pillar of the strategy "Strategic Framework of the Energy Sector" by introducing improvements to the Egyptian energy sector. With the hosting of COP 27 in November 2022 in Sharm El-Sheikh, along with the current economic crisis, the country's reform agenda remains focused on the conditions set by the IMF loan and on economic growth, while incorporating RE and EE as topics cross-cutting in different strategies and implementation plans.

[14] https://en.wikipedia.org/wiki/Egypt#Economy

According to the sustainable development vision, all Ministries started to align their strategies. The Ministry of Trade and Industry (MTI) prepared a five-year strategy (2016-2020) based on a clear vision; "Industrial development to be the engine of sustainable and inclusive economic development in Egypt, which meet domestic demand and enhance exports growth, and for Egypt to become a key player in the global economy." The strategy is very comprehensive, including five main interconnected pillars and also discussing resource efficiency. The Ministry is still preparing its new strategy based on same concept.

Another increasingly important player in the Egyptian arena is the Ministry of Environment (MoE). The Ministry with the support of international partners, especially the United Nations Environment Programme (UNEP) and GEF has worked hard in the past couple of years to advocate SCP policies as tools to achieve sustainable development. This is articulated clearly in the Egyptian Climate Change Strategy (NCCC) until 2050. The NCCC can be regarded as a roadmap for achieving the challenges of climate change including RE and EE measures, within the framework of updated Egypt Vision 2030. An important goal is targeting to increase the percentage of contribution of new and renewable energy to the total electricity production to enhance SCP.

The Ministry of Petroleum and Mineral Resources is also contributing to achieving the country's renewable energy target of 42% (measured by capacity) by 2035 through its second pillar "Securing oil and natural gas supplies through expanding upstream activities, diversification of resources and working towards modifying the energy mix[15].

2.2.3. Renewable Energy Background

Egypt is the third most populated country in Africa and is the largest consumer of oil and gas on the continent. The country was estimated to have about four billion barrels of oil reserves in 2015 and produces about 700,000 barrels per day[16]. It has the fourth largest natural gas reserves in Africa after Nigeria, Algeria Mozambique and, with a production of over 50 billion cubic metres per year[17], is a net exporter of gas.

Egypt's energy sector is dominated by fossil fuels, with natural gas accounting for 58.7% of the country's primary energy (electricity and heat), followed by oil at 33.7% (vehicles and electricity) and coal at 1.3% (for a few industries). The remaining 6.3% is electricity generation from hydroelectric, solar and wind power[18]. The total energy consumption was 1,054 TWh in 2021 and has been rising by nearly 7% per year since the early 2000s (Table 4).

Table 4 - Egypt energy consumption (TWh) in 2021 by source

Source	Consumption (TWh)	Percentage
Solar	7	0.7%
Wind	20	1.9%
Hydro	38	3.6%
Gas	619	58.7%
Coal	14	1.3%
Oil	355	33.7%
Total:	**1,054**	

[15] https://www.petroleum.gov.eg/en/about-ministry/Pages/strategic-purpose.aspx
[16] Sustainable Energy for All: https://www.se4all-africa.org/seforall-in-africa/country-data/egypt/
[17] World Bank: https://datacatalog.worldbank.org/search/dataset/0042286/MENA---Energy-Indicators
[18] Our World in Data: https://ourworldindata.org/energy/country/egypt

This heavy reliance on fossil fuels has led to several challenges for the country, including high energy costs, increasing greenhouse gas emissions, and vulnerability to oil price fluctuations. Subsidies for fossil fuels represent a significant portion of the budget deficit for the country and a subsidy reform is underway to reduce this cost for the state. These subsidies together with the devaluation of the Egyptian pound have had a major dual effect on the economic situation of all societal segments, especially the industrial sector. The increase in the imported raw material and the energy prices was seen as one of the biggest challenges, which companies would have to deal with if they still wanted to survive in the market.

In 2016 Egypt released the Integrated Sustainable Energy Strategy with targets for renewable energy production of 20% by 2020 and 42% by 2035[19]. Beyond this high-level target, there are currently no specific targets for heating, cooling or transport[20]. In 2022, 83.5% of production by installed capacity was from fossil fuels and 16.5% from low carbon sources (see Table 5) which means the target for 2020 was missed.

Table 5 - Breakdown of electricity generation by installed capacity[21]

Source	Area	Capacity	Percentage
Natural gas	Cairo	6,300 MW	71%
	Alexandria	3,000 MW	
	Kafr El Shiekh	5,550 MW	
	Dakahlia	1,040 MW	
	Others	9,143 MW	
	Subtotal	**25,033 MW**	
Oil	Cairo, Alexandria and Suez	4,290 MW	12%
Hydro	Aswan and Qena	2,756 MW	7.9%
Solar		1,900 MW	5.4%
Wind		1,125 MW	3.2%
	Total	**39,904 MW**	

Figure 2 below shows that when it comes to electricity actually delivered, only 11.38% of consumption is from low carbon sources. The discrepancy is explained by the fact that gas and oil generators have a much higher capacity factor than the renewable sources, so each MW of installed fossil fuel generation generates more energy than the renewables.

[19] IRENA: IRENA_Outlook_Egypt_2018_En 2018
[20] https://rise.esmap.org/country/egypt-arab-rep
[21] Wikipedia https://en.wikipedia.org/wiki/List_of_power_stations_in_Egypt

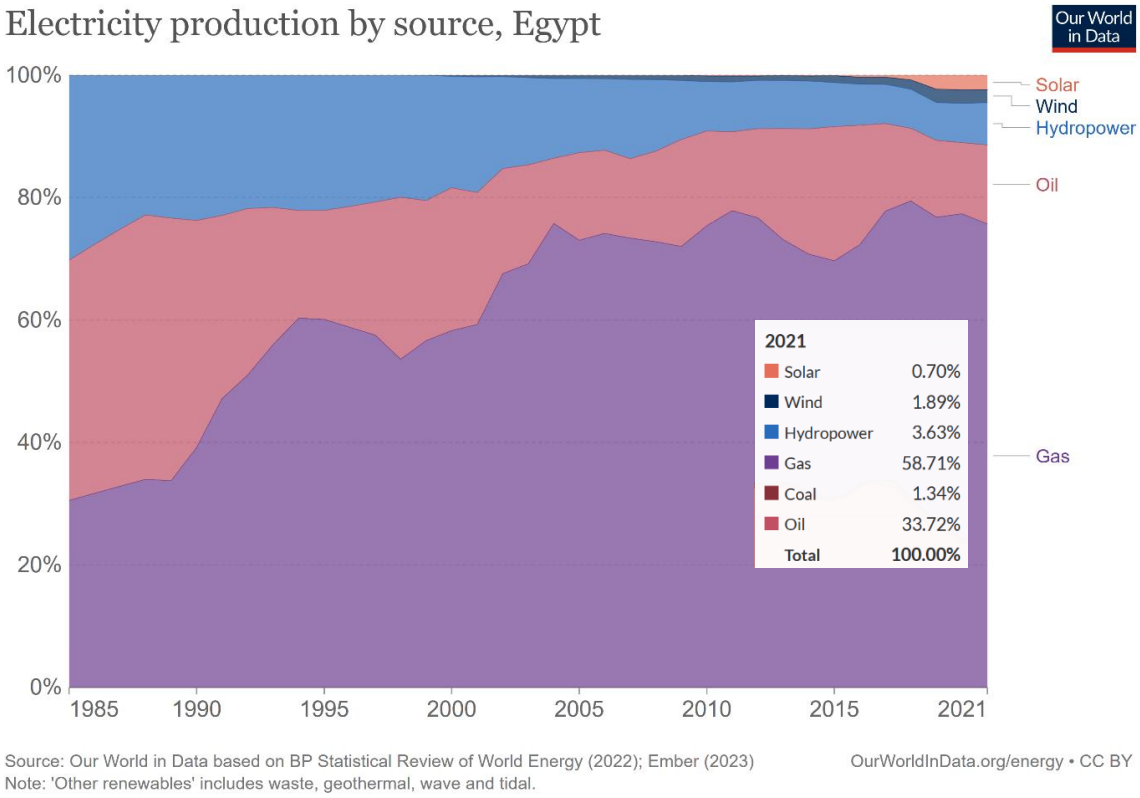


Figure 2 – Electricity generation by source, Egypt[18]

However, looking to the future, Egypt has several major low carbon plants in planning including:

- 4,800 MW of nuclear power at the El Dabaa site is scheduled to begin production in 2030, although the project has experienced significant delays[22].
- The Abydos Solar Power Company (ASPC) is developing a 500 MW photovoltaic plant in Kom Ombo. China Energy is due to start construction at the site about 600 km south of Cairo this year[23].
- Separately, China Energy is to build a hydrogen plant due to produce 140,000 tonnes of green hydrogen each year. The facility will be powered by a mix of wind and solar power[24].

Overall, renewable capacity is expected to increase by 4,000 MW by 2026[25], mainly from onshore wind and solar, which is close to 10% of the current generation capacity and is a doubling of the supply from solar and wind.

2.2.4. Solar Water Heating Sectoral Background

The solar resource in Egypt is both plentiful and close to population centres and the amount of solar irradiation is one of the best in the world (see Figure 3), especially west of the Red Sea. It would

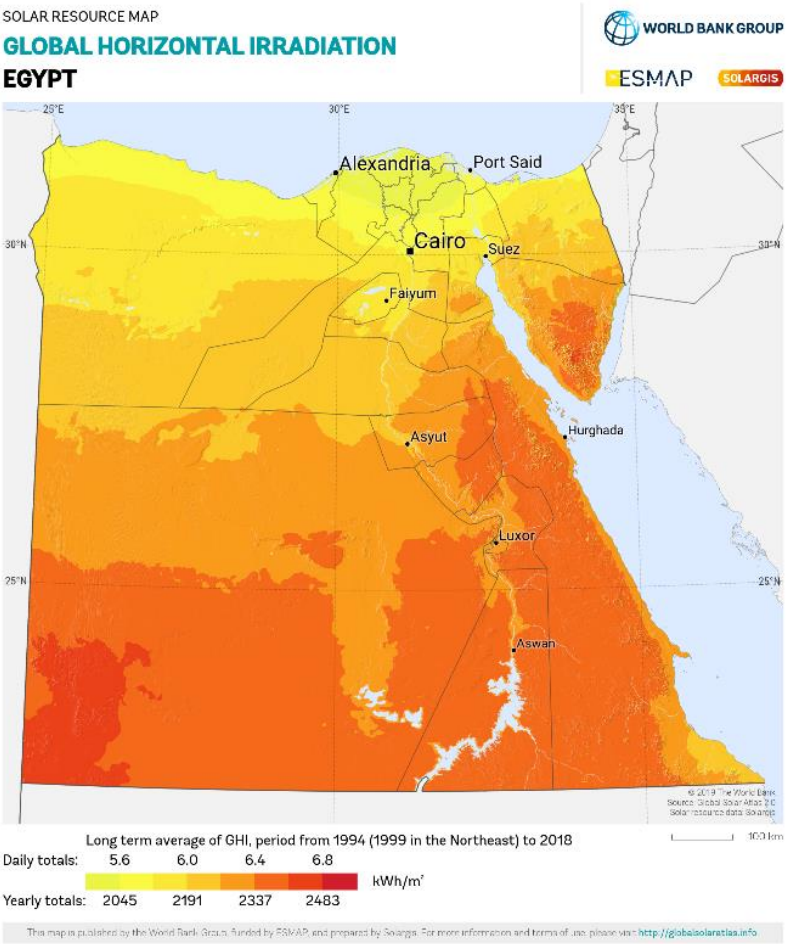
[22] World Nuclear Association https://world-nuclear.org/information-library/country-profiles/countries-a-f/egypt.aspx
[23] Saudi Gulf Projects https://www.saudigulfprojects.com/2022/12/china-energy-awarded-500mw-solar-pv-project-in-egypt/
[24] Energy Live News https://www.energylivenews.com/2023/03/16/china-energy-building-5bn-hydrogen-plant-in-egypt/
[25] Renewables 2021, Analysis and forecasts to 2026, IEA 2021 https://www.iea.org/reports/renewables-2021

therefore seem logical and sensible for solar technologies to be utilised for both electricity and heating requirements. Although the solar PV sector is increasingly active, for example, a very large solar PV park of 1.7GW was installed in Benban in the Western Desert in 2019 demonstrating that large scale solar is feasible in Egypt, the country has not seen similar take up of solar water heating (SWH) technologies.

A UNIDO concept note looking into the potential for the SWH market in the MENA region[26] identified several factors that have contributed to the poor development of the SWH market:

- An historic bad reputation of SWH operations (from the 1980s – 1990s), with an uncontrolled market and lack of quality control (equipment and services for installation and maintenance).
- Technology acquisition cost too high, due to limited local manufacturing of various components of the SWH and reliance of imported components.
- Traditionally low energy tariffs, mainly for residential users, with limited profitability for the user due to the high investment cost of SWH systems.

Although the installed SWH capacity is estimated to be the largest in the region (about 750,000 m^2), Egypt has the lowest installed area per capita, and is a long way behind countries such as Tunisia and Jordan, which have 6 – 7 times the amount considering the size of their populations.



[26] UNIDO Egypt Concept Note - Regional SWH Market Development - Egypt, Jordan, Morocco, Palestine & Tunisia (Feb 2023)

Figure 3 - Global Horizontal irradiation (World Bank Group)[27]

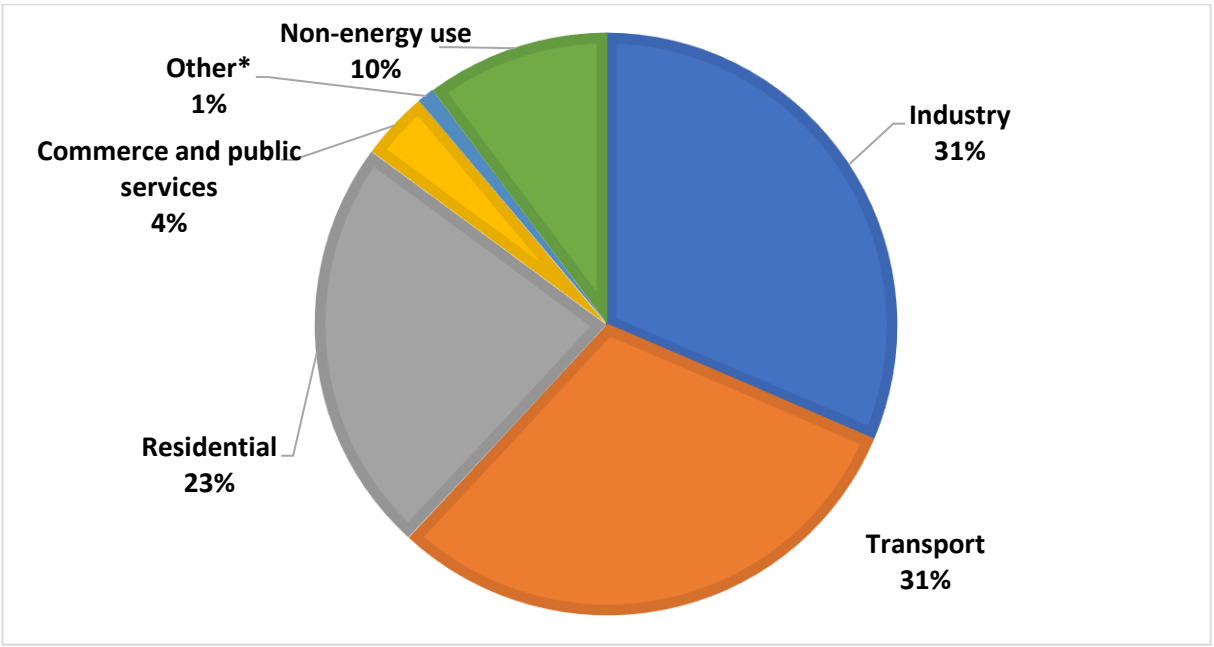
When the project was conceived in 2013, UNIDO and MTI identified solar heating for industrial processes as an intervention that could provide significant decarbonisation for the energy sector[28]. The SHIP project aimed to incubate the sector to achieve this decarbonisation potential and was designed to be in line with the country's goals at that time:

- to optimize the use of available energy sources and minimize environment pollution,
- to expand the utilization of new and renewable energy resources, and
- to restructure the electricity sector to optimize investments and improve electrical services.

The industrial sector was noted at the start of the project as one of the highest energy consumers in the country, representing over 40% of the final energy consumption, with the textile industry consuming 8% of industrial energy consumption, the food industries consuming 14% and the chemicals industry around 20%, constituting a total of 42% of the entire industrial consumption.

This data was drawn from a study in 2001[29] and is very old, dating from 1995. Therefore the evaluation sought updated information about energy consumption in those sectors. Although there is no recent analysis, it is estimated that the food sector consumes 8% of energy, textile industries remain around 8% and the chemicals sector may have increased in activity and energy use. If the hotel/tourism sector is added, these four sectors probably make up about half of industrial/commercial use of energy so their activity is significant.

The electricity consumption of industry is still a key proportion of the overall electricity use in the country (Figure 4) and in terms of overall energy (including oil and gas), industry still consumes about 31% of total energy (IEA 2020[30]).



[27] World Bank Group: https://globalsolaratlas.info/download/egypt
[28] Mid-term review of the UNIDO project, Solar Heating in Industrial Processes in Egypt, UNIDO ERP ID: 120073, GEF ID: 4790
[29] UN, ESCWA (2001), Efficient Use of Energy in the Industrial Sector
[30] IEA 2020, Clean Energy Transitions in North Africa https://www.iea.org/reports/clean-energy-transitions-in-north-africa

Figure 4 – Share of electricity use in Egypt[30]

2.3. Project Background

The UNIDO project 'Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry', supported by the Global Environmental Facility (GEF), and started in October 2014 with an original planned duration of 5 years. It became known as the SHIP (Solar Heating for Industrial Process) project and was completed at the end of March 2023 with an actual duration of 8 ½ years.

The project has four (4) main components:

1. Component 1: Develop policy instruments to promote the use of solar energy for industrial process heat in 3 sectors.
2. Component 2: Mobilize financing for the deployment of solar energy for industrial heat.
3. Component 3: Improve the manufacture, supply and distribution of solar energy components and systems.
4. Component 4: Build the capacity of technical staff designing, developing and servicing solar systems.

The objective of the project was '*To develop the market environment for the diffusion and local manufacturing of solar energy for industrial process heat*'. The project focused on improving the energy efficiency of industrial process heat systems and the introduction of solar thermal (water heating) technologies mainly in industrial companies with a high fraction of low and medium temperature heat demand in three industrial sectors, namely the food, chemical and textiles sectors. Further the project sought to support the local manufacturing of quality components of the solar systems through a combination of technical assistance and investment activities. Details of the project are given in Table 6 below:

Table 6 - Project factsheet

Project title	**Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry**
UNIDO ID	120073
GEF Project ID	4790
Country(ies)	Egypt
Project donor(s)	GEF
Project approval date/GEF CEO endorsement date	February 2013
Planned project start date (as indicated in project document/or GEF CEO endorsement document)	October 2014
Planned project completion date (as indicated in project document/or GEF CEO endorsement document)	October 2020
Actual project completion date (as indicated in UNIDO ERP system)	March 2023
Project duration (year): Planned: Actual:	 5ys 8ys
GEF Focal Areas and Operational Programme	CCM-2, CCM-3: Climate Change
Implementing agency	UNIDO
Government coordinating agency	Ministry of Industry, Trade & SMEs (MITS), National Renewable Energy Authority (NREA)
Donor funding	USD 6,500,000

UNIDO input (in kind, USD)	USD 140,000
Co-financing at CEO Endorsement, as applicable	USD 37,300,000
Total project cost (USD), excluding support costs	USD 42,500,000
Planned terminal evaluation date	January 2023-March 2023

2.3.1. Project Objectives and Outcomes and LogFrame

The project Logical Framework with the main objective and originally planned outcomes (targets) and planned means of verification outcomes per Component is summarised in Table 7. The individual outputs designed within this LogFrame are detailed in the full table shown in Annex 1.

Table 7 – LogFrame for use within the evaluation

	BASELINE	**TARGET**	**VERIFICATION**
OBJECTIVE: To develop the market environment for the diffusion and local manufacturing of solar energy for industrial process heat.	The energy productivity of Egyptian industry is way below international average - Energy consumption per output is 10 to 50% higher than international average.	2,166,085 t CO_2 eq reduced as a result of the spillover of project activities (indirect bottom-up).	Validated energy savings& energy generated from project reports.
COMPONENT 1 – Develop policy instruments to promote the use of solar energy for industrial process heat in 3 sectors			
OUTCOME 1: Policy instruments promoting the use of solar energy for industrial process heat.	No roadmap for solar thermal energy in industry endorsed by the stakeholders. No quality standards for solar energy systems enforced. No certification programme for personnel installing solar energy systems enforced.	Roadmap for solar thermal energy in 3 industrial sectors adopted by stakeholders. Minimum quality standards for solar energy systems enforced. Certification scheme for personnel in place.	Government institutions, Official gazette.
COMPONENT 2 – Mobilize financing for the deployment of solar energy for industrial heat			
OUTCOME 2: Financing for the deployment of solar energy for industrial heat mobilized.	Limited investments made in solar thermal technologies in the industrial sector. Limited emission reductions as a result of fuel switching to solar energy for industrial heat (project replication effect).	$ 19 million invested in solar energy in the industrial sector. 8,907,180 GJ direct savings over 10 years. Direct emission reductions of 722,028 t CO2 eq. over 10 years.	Reports of financial institutions, reports and statistics of development financial institutions and Government agencies.
COMPONENT 3 – Improve the manufacture, supply and distribution of solar energy components and systems			
OUTCOME 3: The local manufacture, supply and distribution of solar energy components and systems is strengthened.	10% of the products manufactured fulfil quality requirements.	50% of products manufactured locally fulfil quality requirements.	Statistics and reports of the Government.

	BASELINE	TARGET	VERIFICATION
COMPONENT 4 – Build the capacity of technical staff designing, developing and servicing solar systems			
OUTCOME 4: Technical capacity of the system designers, developers, facility managers and service providers for solar energy utilization for industrial process heat enhanced.	No institutionalized training courses available.	4 Training courses developed are run at the vocational training schools.	Curricula of the Vocational training schools.

2.3.2. Project Budget

The project budget was originally set at USD 43.8 million, comprising a USD 6.5 million GEF grant and USD 37.3 million in co-financing from various sources. The majority of the budget was assigned to financing projects and improving the in-country supply chain for solar heating in industry, including training of staff from relevant sectors including finance, design, manufacturing and installation. The remainder of the budget was for enabling activities such as developing a policy framework and managing the project.

Table 8 - Financing plan summary - Outcome breakdown[31]

Project outcomes/components	Donor (GEF) ($)	Co-Financing ($)	Total ($)
PC1- Develop policy instruments to promote the use of solar energy for industrial process heat	300,000	1,500,000	1,800,000
PC2- Mobilize financing for the deployment of solar energy for industrial heat	2,400,000	20,600,000	23,000,000
PC3- Improve the manufacture, supply and distribution of solar energy components and systems	2,800,000	13,000,000	15,800,000
PC4- Build the capacity of technical staff designing, developing and servicing solar systems	600,000	1,000,000	1,600,000
M&E	100,000	200,000	300,000
Project management cost	300,000	1,000,000	1,300,000
Total ($)	**6,500,000**	**37,300,000**	**43,800,000**

As reported in the Project Implementation Report (PIR) for 2021 and 2022, the following table shows the spending by component up to end of June 2022 (therefore missing the final 9 months of the project).

Table 9 – Calculated expenditure by Component from PIR 2021 and 2022 (USD)

Component	to 2021	2021 - 2022	to June 2022	Percentage
Component 1 – Policy component	203,585	16,156	219,741	73.2%
Component 2 – Awareness raising and Technical Assistance	2,400,007	1,934	2,401,941	100.1%
Component 3 – Laboratory Accreditation and Upgrade	2,345,334	44,313	2,389,647	85.3%
Component 4 – Capacity Building	587,936	353,430	941,366	156.9%
Component 5 – M&E	43,261	5,321	48,582	48.6%

[31] Terminal Evaluation TOR

Component	to 2021	2021 - 2022	to June 2022	Percentage
Project Management	192,612	35,269	227,881	76.0%
Totals	**5,772,735**	**456,423**	**6,229,158**	**95.8%**

Within the Terms of Reference (TOR), an up-to-date table (shown later in Table 12) indicates that an additional USD 131,348 was spent between end of June and 15 October 2022, making the percentage spent of 97.9%. It is notable that the Component that has been deemed as successful (capacity building) overspent the planned budget while Component 1 had a small under-spend and USD 410,000 savings were made on Component 3. The Monitoring and Evaluation (M&E) budget is still active due to this on-going TE and the full Project Management cost is yet to be finalised. So overall, the GEF finances look on track to the plan and tightly managed.

2.3.3. Co-financing

The co-financing portion of the budget was made up of USD 2.74 million of in-kind contributions and USD 34.56 million in cash. USD 33.5 million of the cash contribution was intended to be in the form of loans (soft and hard) from the National Bank of Egypt (NBE) Bank, Commercial International Bank (CIB) (private sector) and the Social Development Fund (national government).

Table 10 - Co-Financing source breakdown[31]

Name of Co-financier *(source)*	In-kind	Cash	Total Amount ($)
Ministry of Industry, Trade & SMEs (MITS)	600,000		600,000
National Renewable Energy Authority (NREA)	2,000,000		2,000,000
National Bank of Egypt (NBE) *Bank (Loan)*		2,000,000	2,000,000
Commercial International Bank (CIB) *Private sector (Loan)*		20,000,000	20,000,000
Social Development Fund *National Government (Loan)*		11,500,000	11,500,000
UNIDO *GEF Agency*	140,000	60,000	200,000
Various industries *Private sector*		1,000,000	1,000,000
Total Co-financing ($)	**2,740,000**	**34,560,000**	**37,300,000**

The evaluation asked all interviewees about the type of in-kind contributions that their institution made and most responses were that staff time was given to the project activities. In the case of NREA, as well as their staff time given to the activities over the project duration, they did contribute significantly to the establishment and certification of the SWH Testing Laboratory However, the accrual of these various in-kind sums (based on timesheets and records of material purchases) is not recorded in the project documentation and it is therefore not possible to ascertain the extent to which these planned in-kind contributions were made by those government agencies.

In terms of the co-financing, the NBE and National Financial Management Consultant confirmed during the in-country evaluation that when the first GEF grant tranche of USD 1 million had been transferred end of March 2021 to prepare the Revolving Fund, the bank had already put aside its matched USD 1 million. A pre-condition to the release of the final USD 1 million from GEF was NBE approving the first loan, which was achieved at the end of March 2023, with NBE signing a loan agreement with the company FRESH, for an amount of EGP 60 million (equivalent to USD 1.94 million).

This loan would enable FRESH, a major Egyptian home appliances manufacturer with 14 factories, to manufacture solar water heater components over 4-phases, beginning with complete local production of the water tank and then increasing the investment to include manufacture of the solar panel and all the requirements of the product from plastic components:

- Phase 1 (2023): 150 Litre Tank Production
- Phase 2 (2023): Localization of Accessories

- Phase 3 (2025): Solar Collector Production
- Phase 4 (2026): Bigger Tank Capacities (200-250-300 Litre)

For the other planned co-financing loans, there is no record of this cash co-financing having been provided from CIB or from the Social Development Fund (SDF).

2.3.4. Project Implementation

The project started in October 2014 with a planned duration of 5 years. It was completed at the end of March 2023 with an actual duration of 8 ½ years. Although the project had good success in training staff, the target number of pilot projects was reduced over time, from 100 to 30 in March 2019 and then down to 14 in February 2020 and none were installed by the end of the project, although 3 are in the pipeline as shown in Table 11.

The final project report (PIR-9, Annex 7) states that five companies preferred to self-finance their projects or get their financing elsewhere. This suggests that there is some appetite for SWH in Egyptian industry, but the demand is lower than anticipated and that the Revolving Fund may need to be redesigned to make it more attractive.

Table 11 – SWH projects in the pipeline

Entity	Willingness to install SWH	Value	Status
FRESH	Upgrade the production line of SWH enameled tanks (150 litre), localization of accessories, solar collector production, then bigger tank capacities.	EGP 60 million	Technical and feasibility report developed, Credit Worthiness and Risk management process completed. Loan made a enfd of March 2023.
Egyptian Solar System Company	Upgrade production line of SWH stainless tanks with automated welding machine to increase the capacity of production.	USD 233,660	Technical and feasibility report developed, NBE Credit Worthiness process
Lagoon View Resorts	Willingness to install SWH units to supply hot water for guest rooms.	USD 197,798	Technical and feasibility report developed, NBE Credit Worthiness process

Figure 5 shows the principal events affecting the project and the major milestones.

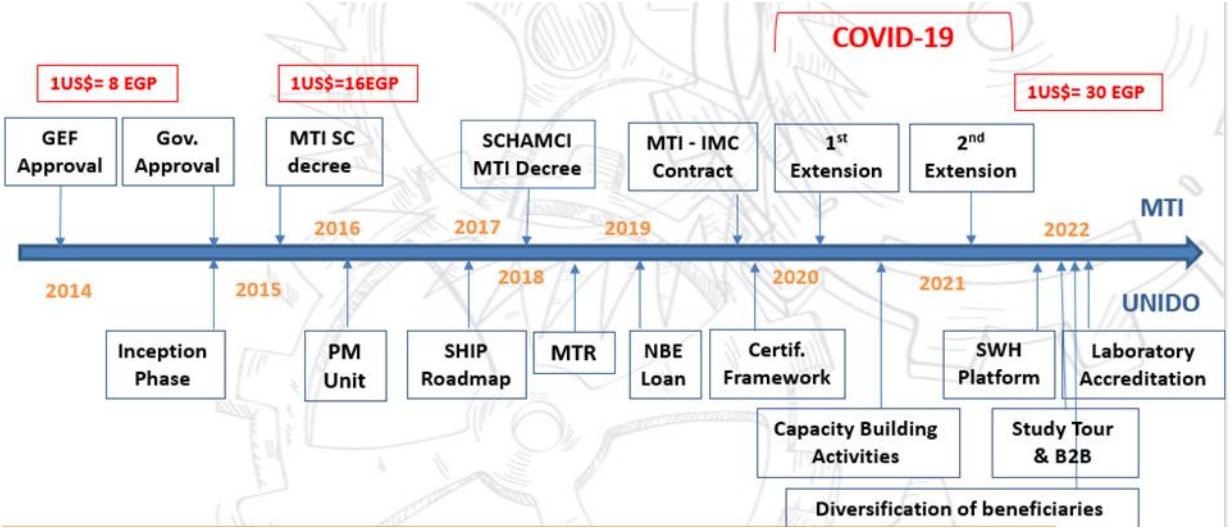


Figure 5 - Timeline for the SHIP project (UNIDO Presentation)

There was frustration in the early part of the project (2015 – 2018) that it took a long time to start because of slow security approvals from government, lack of staff availability and changes in personnel. This situation improved in late 2019 to early 2020 when the project management (previously with the ENCPC) was decentralised to an Egypt office by UNIDO HQ. Since then the project has caught up with all activities. This did affect the implementation duration of the project as two extensions (October 2020 and October 2021) were required with a long process for contract amendments for IMC and ENCPC.

The training and public engagement elements started slowly but were largely complete by June 2019. The policy instruments concerning standards and certification were completed at around the same time. It would have been better for the project if these could have been achieved earlier, as this could have reduced or eliminated the delay. More regular oversight by UNIDO or an external evaluator might have identified this as an issue sooner.

The introduction of the Solar Heating Arab Mark and Certification Initiative (SHAMCI) was a major milestone in 2018. The initiative provides a framework for accreditation of designs and systems to give assurance on the quality and performance of a system. This initiative was developed by Regional Center for Renewable Energy and Energy Efficiency (RCREEE)[32] and incorporates stakeholder and resource requirements from 11 Arab states in the MENA region and gives confidence both to clients and financiers regarding the quality of solar water heating products.

There were various factors that contributed to low number of demonstration projects and delay to the project. Chief amongst the external factors were a significant devaluation of the Egyptian pound in November 2016, slow administration of the Revolving Fund and Covid-19. It doesn't appear that this was raised as a risk until the MTR in August 2018. A further devaluation of the Egyptian pound occurred in October 2022, when some companies were actively engaged in taking a loan. These devaluation events made it difficult for Egyptian businesses to take advantage of the scheme by making imports immediately more expensive and increasing commercial uncertainties.

The Revolving Fund took a long time to set up with discussions between UNIDO and NBE taking several years to reach a workable agreement. The contract between UNIDO and NBE was signed in November 2019, which was when the project was originally going to end. At this point, Covid-19 appeared and slowed or halted activities across the globe for 12-18 months. It also had a knock-on effect on the project duration although the project team were able to pivot to online meetings for a some of the training courses. The first application was received in January 2021 from the Kandil factory, and the first USD 1 million was transferred to the fund by the end of March 2021. Although the Kandil project did not move ahead, a second loan application from FRESH was achieved before the project closed end of March 2023, therefore the full USD 2 million Revolving Fund is now in place to fund future projects.

The NREA Testing Laboratory was accredited in June 2022 and is a really useful resource and enabler for SWH in general. The laboratory was developed to certify designs to the SHAMCI standard and is the only lab able to do so in the MENA region. This laboratory is one of the significant legacies of the project.

It was recognised that a limitation of the original project design was to focus solely on industrial projects. In April 2022, this remit was extended to cover other SWH technologies and beneficiaries (e.g. hotels) which will enable the industry to make full use of the Revolving Fund.

[32] https://rcreee.org/solar-heating-arab-mark-and-certification-initiative-shamci/

2.3.5. Project Governance

There were nine (9) steering committee meetings, nine (9) annual progress reports and four (4) Project Implementation Reports (PIR) over the course of project (see Annex 7). The governance for these meetings was good with an appropriate level of detail discussed, good attendance and useful minutes produced. However, the frequency of the meetings and reports appears to be low for a project of this scale. Project meetings at least every 6 months can be useful to keep a project on track and it is often desirable to have more than one steering committee meeting per year. One project report covered a duration of 26 months (August 2018 to September 2020 inclusive) which is far too long a period between reports.

Table 12 shows that almost half of the budget was spent in the first year, 2015, and the vast majority of that was spent on "contractual services". The commitment of USD 2 million for the revolving Fund with NBE was accounted for at this stage, with an additional USD 100,000 for technical assistance to generate the pipeline of potential projects. Other significant project costs were:

- Approx. USD 0.5 million for contracts with ENCPC and later on, IMC
- Roadmap development – International (and national) Consultants
- Training for Egyptian Bankers – International Trainers
- Awareness and communication contract – National company

Table 12 - UNIDO budget allocation and expenditure by budget line (to 15 Oct 2022) [31]

Items by budget line	2015	2016	2017	2018	2019	2020	2021	2022	Total expenditure	
									(USD)	%
Contractual Services	2,317,678	355,777	574,999	296,648	544,538	428,000	61,132	127,043	4,705,815	***74***
Equipment	0	0	11,944	9,571	10,304	16,072	166,955	5,305	220,151	***3,5***
International meetings	0	0	0	0	2,035	0	0	1,657	3,692	***<0,1***
Local travel	4,417	1,854	10,718	5,462	12,350	3,493	131	42,148	80,573	***1,3***
Nat. Consult./Staff	61,514	50,854	64,651	94,034	79,945	191,926	211,189	166,026	920,139	***14,5***
Other Direct Costs	4,359	1,134	181	4,152	8,073	15,038	13,110	9,243	55,290	***0,8***
Staff & Intern Consultants	0	11,703	43,197	22,677	44,561	70,474	35,269	30,704	258,585	***4,1***
Train/Fellowship/ Study	0	0	100,254	0	0	4,886	11,121	0	116,261	***1,8***
	2,387,968	421,322	805,944	432,544	701,806	729,889	498,907	382,126	**6,360,506**	

By the end of the project, almost all of the UNIDO contribution had been spent, however no evidence was provided that the main planned co-finance (from CIB and SDF) was provided to the project.

2.3.6. Main Stakeholders

A map of stakeholders across the 4 components of the project is shown in Table 14 below with all stakeholders in the original project document also listed for reference. The evaluation in-country schedule (see Annex 3) was developed by the UNIDO Egypt office who identified the key stakeholders to be interviewed by the Team Leader and National Consultant.

Respondents confirmed a wide range of involvement in the SHIP project, with UNIDO staff who wrote the design and were present at the beginning in 2014, government partners participating from 2015/2016, UNIDO Consultants engaged from 2017, and various beneficiaries joining since 2019 with the latest participant from the tourism sector joining only one year ago. A table of the respondents to the interviews as part of the Terminal Evaluation is given below showing the breakdown per type of partner and their number of years of involvement. A full list of the people met is given in Annex 4.

Table 13 - Profile of interviews undertaken in the TE

Institution	UNIDO	Public Partners	Consultant/ Service Providers	Beneficiaries	Banks	Total
Years involved	9 (from 2014)	7 (from 2016)	6 (from 2017)	4 (from 2019)	6 (from 2017)	
No. interviews	4	7	4	5	1	**21**
Details	UNIDO Staff in Egypt and HQ	MTI PVTD EOS NREA EEAA IMC ENCPC	Chemonics INTEGRAL Individual Consultants	Egyptian Solar Energy Company Oriental Weavers Maarib Factory Akassia Hotel FRESH	National Bank of Egypt (NBE)	
No. people met	4	17	6	7	3	**37**

Of the interviewees questioned, UNIDO, its Consultants and some of the public partners (ENCPC and IMC) were involved in all Components of the project, whereas the beneficiaries were more involved in Components 3 and 4 for improvement of SWH manufacture and training of technical staff. Beneficiaries pursuing financing under the Revolving Fund managed by NBE participated in Component 2, and other government institutions were mainly working within the policy area of Component 1.

Table 14 – Stakeholder map

Solar Energy for Industrial Process Heat	**Component 1**	**Component 2**	**Component 3**	**Component 4**
	Develop policy Instruments	Mobilize financing for deployment	Improve manufacture, supply & distribution	Build capacity of technical staff designing, developing and servicing solar systems
Lead Stakeholder	Chemonics	National Bank of Egypt (NBE) & Industrial Sector	NREA	Beneficiaries: Trainees/ Consultants
Stakeholder 1	Ministry of Trade and Industry	IMC	PVTD	Beneficiaries: SWH Local Manufacturers
Stakeholder 2	IMC	ENCPC	Beneficiaries: SWH Local Manufacturers	Chemonics
Stakeholder 3	ENCPC	Tourism Sector	Chemonics	IMC
Stakeholder 4	Integral Rise	FEIs		NREA
Stakeholder 5	EOS	Academia (Awareness Raising)		PVTD
Stakeholder 6	EGAC	25 Banks (Capacity Building)		
Stakeholder 7	RCREEE			

1. UNIDO - United Nations Industrial Development Organisation
2. ENCPC – Egyptian National Cleaner Production Center (PMU)
3. MITS – Ministry of Trade, Industry and SMEs
4. NREA – New and Renewable Energy Authority
5. Federation of Egyptian Industries
6. EEAA – Egyptian Environmental Affairs Agency (GEF Focal Point)
7. EOS – Egyptian Organization for Standardization
8. EGAC – Egyptian Accreditation Council
9. PVTD – Productivity and Vocational Training Department
10. NBE - National Bank of Egypt
11. IMC - Industrial Modernization Center (MITs arm)
12. Beneficiaries: Tourism Sector
13. Beneficiaries: Industrial Sector
14. Beneficiaries: SWH Local Manufacturing
15. Beneficiaries: Trainees/Consultants
16. MIC - Ministry of International Cooperation
17. Service Providers - Chemonics
18. Private Organizations - RCREEE/SEDA (NGO)
19. *CIB – bank (planned in Project Doc but did not participate)*
20. *Social Development Fund (planned in Project Doc but did not participate)*

2.3.7. Project Risks

During the interviews the following were identified as risk factors that emerged during the implementation of the project. Most of these caused delays and crucially, were not foreseen at the inception phase, but could have been predicted:

- Complexity of designing the Revolving Fund meant it took 4 years to develop and sign with NBE.
- The accreditation process for the NREA Testing Laboratory took longer than planned and the calibration of some equipment had to be repeated by European providers due to the COVID-19 situation.
- Within EOS, there were lots of risks faced during implementation which were not foreseen. Multi-stakeholder involvement with unclear clear responsibilities and duplication of roles were the main challenges.
- Risk of attracting enough beneficiaries to install SWH or bringing new or existing manufacturers forward, because these companies have had to change their operations against the high uncertainty of the Egyptian currency rate and general increased costs of energy interventions.
- Devaluation of the currency, the COVID pandemic, general economic issues such as inflation, high interest rates and the war in Ukraine were risks that have affected the project negatively, although foreseeing these and mitigating measures would have been difficult.

The use of a formal risk management structure and process (that can be also discussed with the main stakeholders) would have identified these and obliged the project to develop mitigations earlier. For example, opening the fund to non-industrial beneficiaries only happened in the final months of the project.

A list of risks was identified at the beginning of the project within the GEF Endorsement document. Although risks were discussed at most of the progress meetings, there doesn't appear to have been a live risk register that enables noting the status of all risks, including new risks that were identified during the course of the project.

The risk table below appears in some of the reports and minutes but only from June 2019 onwards (for example, see SHIP UNIDO PIR-5 and 4790_GEF_PIR_FY 2019 to 2022 in Annex 7), but no new risks are logged in the table. For example some significant commercial risks are noted in the March 2022 progress report (SHIP UNIDO PIR-8 in Annex 7). These are:

- Low demand due to long payback period.
- Preference for energy efficiency measures due to lower cost and payback period.
- Larger factories prefer to self-finance (this may be due to the bureaucracy of the application process).
- Variation in cost for identical systems from different suppliers leading to low confidence in the supply chain.

These risks should really have been identified earlier in the project and should also have been tracked. A recommendation for UNIDO is to require projects to implement a risk management process which includes logging and tracking risks and which has clearly defined thresholds so that risks of varying likelihood and severity can be raised to the appropriate level. The person tracking the risks should be appropriately trained and have a clear understanding of who to inform when risks reach a certain threshold then the person being informed should have the authority to deal with the risk. There are many standard methodologies for UNIDO to choose from but a relatively

simple one showing likelihood severity and risk pre- and post-mitigation should be sufficient for projects of this kind.

Table 15 shows the original list with their status at the end of the project, as drawn from UNIDO's PIR. Analysis of this table shows that UNIDO's own analysis of residual risk at the end of the project may be over-optimistic and that the risk reductions identified may not be justified. For example, although it is clear that there is improved political commitment to supporting SWH technology, this may not translate to required actions due to governmental resource (finance and staff) constraints. Also, the financial risks remain significant as long as the continuing devaluation and economic uncertainty hangs over the country and the sustainability of financial mechanisms may remain as high risk because only one of the planned co-financing mechanisms (USD 4 million from NBE) was achieved.

Table 15 – Project risk table

Risk	Potential Impact	Probability	Mitigation	Residual Risk at end of Project	Evaluator's comments on the residual risks.
Political Risk: Lack of government commitment to support the project.	**High**	Very low	A comprehensive awareness plan is included aimed at business owners and senior managers to explain the benefits of implementing an EnMS and convince enterprises to avail of the training and technical assistance available.	Changed to **Low Risk** due to continuous collaboration with the relevant counterparts MTI, IMC/ENCPC, NREA, GOIEC and EOS through SC meetings, study tour and awareness events which strengthened the national commitment to the project.	The risk of government support waning due to lack of resources (financial and staffing) means that this remains at **Medium Risk**. MTI's decree 914 still needs to be enforced, and it would be useful if there were a scheme to accredit designs and installed systems. The impact of this risk is mitigated somewhat now that the Revolving Fund and the SHAMCI systems are in place.
Technical Risk: There is limited technical risk since RE technologies (solar, wind, etc) are widely used in many developing countries. The risk can however come from the selection of an unsuitable site.	**Medium**	Low	Efforts will be done to pick suitable sites notably by extensively analyzing solar insolation records.	Changed to **Low Risk** due to national consultants trained on SWH design to ensure high performance in submission of the feasibility studies in addition to the careful selection of industrial factories for implementation of the solar water heater system. Adequate monitoring is taking place throughout the design phases to help the industrial sector in design & implementation process.	This is correctly changed to **Low Risk**, as long as the monitoring of designs and installations continues after the end of the project.
Financial risk: financial/credit constraints, high capital costs and an inhospitable investment environment prevent Egyptian private sector from investing in the projects. The existing financial mechanisms are inadequate and could affect investment	**High**	Low / medium	In Egypt, like in many countries worldwide, efficient financial mechanisms have been set up. Based on the national and global experience it is possible to develop suitable financial tools for Egypt.	Changed to **Medium Risk** because a financial assessment of the Egyptian market is regularly conducted to take the required measures to mitigate the financial risks. COVID-19, devaluation of EGP and global situation caused financial instability that led to a loss of appetite in the Egyptian industrial sector to implement pilot projects and focusing on economic activities rather than energy related activities. The project has proposed diversifying the fund beneficiaries to include more sectors along with an in-depth study of	Economic uncertainty due to devaluation of the EGP remains a problem and, for this reason, it may be difficult for firms to take advantage of the Revolving Fund. Diversifying in terms of sector and technology have mitigated this to a **Medium Risk**, as suggested.

Risk	Potential Impact	Probability	Mitigation	Residual Risk at end of Project	Evaluator's comments on the residual risks.
projects on a larger scale.				the market situation and sectors categorization where the Tourism sector was selected as one of the highest potential sectors with good market size.	
Effects of project on the environment and biodiversity: the project has opposite effects than those expected.	**Low**	Low	The project will promote market-based development of renewable energy use for air conditioning and hot water production. Such technologies (solar thermal, heat pumps, etc) are well exploited and do not have negative environmental impacts. Further the involvement of the ENCPC will ensure that the production of these components is done in line with the principles of resource efficiency.	Maintained a **Low Risk** because UNIDO launched awareness campaign promoting the project targets and showing the environmental benefits of using SWH and RE in general in the industrial sector. UNIDO generated case studies and published them. Feasibility studies developed that proves the efficiency of integrating solar water heaters on the industrial processes and savings of CO2 emissions.	This is correctly labelled as **Low Risk**.
Sustainability risk: failure to achieve project outcomes and objectives after successful delivery of outputs.	**High**	Low / medium	By making market players fully aware of the economic potential of RE technologies and by equipping them with the capacity and tools to realize and reap the benefits of such potential, the project will generate a self-reinforcing market. In addition, the policy framework and financial mechanisms that will be put in place will create a positive context that is expected to ensure the attainment of the project outcomes and their sustainability.	Changed to **Medium Risk** because the project has involved various players covering the market cycle starting from SWH manufacturers/service providers, laboratory facility, the industrial sector and NBE. All the roles & responsibilities were defined during planning stages of the project and entities were invited to participate in their respective fields of expertise to eliminate the risk of sustainability failure beyond the project life-time. NREA is fully engaged in the laboratory upgrade and calibration plan, EOS leading with PMU the mandate of	This is correctly labelled as a **Medium Risk**, but only because of the diversification of technology and sector noted. If the tourism sector had been allowed in earlier so that the systems could be tried and some projects installed, then this would be a **Low Risk**.

Risk	Potential Impact	Probability	Mitigation	Residual Risk at end of Project	Evaluator's comments on the residual risks.
				SCHAMCI standard and the personnel certification framework. IMC with external consultancy developed a national roadmap for local manufacturing supply chain to provide best practices for manufacturing, designing and installing of SWH. Project consultants and services are now listed within IMC list of certified consultants and provided services. NBE along with many others are involved in capacity building and awareness raising seminars to enhance their knowledge on investments in the RE market. Revolving fund with NBE is established under the umbrella of the Ministry beyond project life-time. The creation of an information exchange platform enables smoother communication with all parties. All together shall generate a self-reinforcing market after successful delivery. The above mentioned covers the financial support, supply side and demand side in addition to SWH quality control measures in order to enable to a strong SWH market to ensure sustainable SWH market beyond project life-time.	
Sustainability of Financial Mechanisms risk: failure to establish and sustain financial mechanisms to	**High**	Low / medium	By developing strong relationships with stakeholders including beneficiaries, investors, donors, banks and financial institutions and mobilizing a variety of funding types	Changed to **Low Risk** because a Revolving Fund is set up with 2M$ from GEF and another 2M$ as a contribution from NBE. The business frame created in the form of soft loans to finance the SWH technology investments in the Egyptian	The sustainability of financial mechanisms remain as **High Risk** because only one of the planned co-financing mechanisms (USD 2 million from NBE) was achieved. This is less than 6% of the total co-financing for project funding and represents a significant gap in future capability for the fund.

Risk	Potential Impact	Probability	Mitigation	Residual Risk at end of Project	Evaluator's comments on the residual risks.
support access to project financing.			including private sector, government financing and other the project will build a financial platform that can be used for matchmaking between potential projects and investors.	industry. This includes the possibility of integrating the Central Bank's initiative to support small and medium enterprises. Awareness campaign, press releases, revolving fund brochure, flyer and awareness events in addition to workshops, project website and many other means of communication has emphasized to the industrial sector the presence of such tools and financial mechanisms that supports access to project financing. More than 350 bank trainees (> 15% Females representation) capacitated over 6 years covering 15 national/International banks to ensure their knowledge of EE/RE financial models and be of support to the industrial sector beneficiaries. SWH Platform developed used for matchmaking between potential projects and investors.	
Climate Change Risk: Climate change impacts could impact on solar technologies due to variations in cloud cover- though the science remains uncertain.	**Low**	Low	Sun radiation in Egypt remains very high and is considered among the best in the world.	No change	This is correctly labelled as **Low Risk**.

3. Findings of the Terminal Evaluation

As suggested by the UNIDO IED and as is the practice by many development agencies, the six-point rating system is applied to this assessment as introduced in Table 2.

3.1. Project Design

The design of the project should formulate a plan for the intervention to achieve the specific purpose as discovered in the preparatory phase and the evaluation looks at overall design and interrogates the Logical Framework (LogFrame).

When the project was designed, Egypt ranked among the 11 countries in the world showing fastest growing GHG emissions and the installed capacity was not able to meet the increasing electricity demand. To face those issues, the Egyptian government set up policies and targets to increase the share of renewables in the energy mix and to promote the involvement of the private sector. At that time the Ministry of Electricity had a number of goals under its power strategy and those goals still remain and have been added to[33]; the Ministry has also now incorporated Renewable Energy into its title. Ten years after the project was designed and started, there is more emphasis on renewables, for example the Integrated Sustainable Energy Strategy to 2035 sets renewable energy targets of 20% of the electricity mix by 2022 and 42% by 2035. Promotion of energy efficiency and utilization of renewable energy not only contributes to the reduction of greenhouse gases but also are consistent with the long-term development goals of the Egyptian economy.

The design of this project is generally good, well thought through and despite the long period of intervention, the activities are as relevant as during the inception period. The identified activities plausibly led to results when measured against output as well as at the outcome and impact level. The wide range of government partners from different levels (e.g. MTI and EEAA at national level and NREA and IMC at execution level) helped to achieve the various activities. But reflecting at the end of implementation, some of the targets seem not realistic especially for the development of 100 installations (pilots) of technologically advanced solar energy systems made in industrial applications. This indicates that the market study at the beginning was not thorough enough and a closer eye on some of the risks that did materialise may have re-aligned this target.

The design responded to the individual capacities and needs of the partners based on consultations in the Steering Committee (SC) meetings. Modification in approach, time or activities were planned and agreed upon in a participatory way. Because the design was specific about benefiting only industries, this became a burden for the feasibility studies undertaken since each factory has different heating needs. The project should have been more inclusive to allow different types of beneficiaries such as hotels, which ended up being added later anyway.

In addition, the technology was defined very specifically in the project design, with the main objective being "To develop the market environment for the diffusion and local manufacturing of solar energy systems for industrial process heat" and then having solar energy for industrial process heat running through the Outcomes for each Component (1. Policy instruments; 2. Financing; 3. Local manufacture, supply and distribution; 4. Technical capacity building). The technology could have been more open-ended to give some flexibility during implementation; however to have both the supply and demand sides represented was a strong point in the design.

The design of the Revolving Fund was good because of the extremely competitive interest rate offered and other attractive benefits as outlined in Figure 6.

[33] see http://www.moee.gov.eg/english_new/strategy.aspx

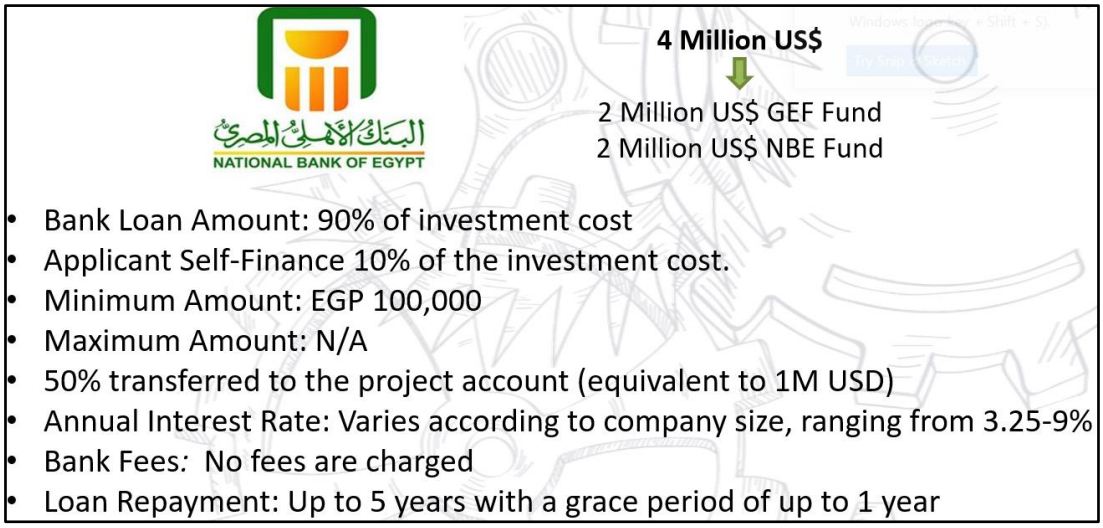


Figure 6 – Summary of the Revolving Fund set up by NBE

However, a problem cited by several potential applicants to NBE was the time-consuming application process with four steps to go through before funding could be agreed and an opaque approval process that took over 6 months in some cases. The delay in implementing the Revolving Fund and bureaucratic application process contributed to not achieving the number of pilot projects anticipated by the project and this issue should have been identified and mitigated earlier.

As the summarised LogFrame shows in Table 7, the components and their requisite outcomes are clear although too general in nature (e.g. Outcome 1 just states 'Policy instruments promoting SWH' without identifying the how the identified policy instruments should look at the end of the project). The activities and planned outputs do provide the detail, although as shown below there are too many activities. The project had to deliver against an overwhelming number of 61 activities many of which could have been combined, for example there are 6 individual and unnecessarily detailed activities for awareness building / information exchange across Components 2 and 3. There is also overlap between activities in many components, particularly on the capacity building activities:

- Component 1 (2 Outputs) – 6 activities
- Component 2 (4 Outputs) – 16 activities
- Component 3 (5 Outputs) – 21 activities
- Component 4 (4 Outputs) – 18 activities

Finally, the design did not embed a vison on how to upscale project activities as part of the exit strategy to explain and continue all of the achievements, impacts and various benefits to the wide range of stakeholders involved.

Despite this, local team have delivered well against this LogFrame as shown in the final progress table in Annex 6, although it has not been able to verify whether the overall objective of reducing carbon dioxide emissions by over 2 million tonnes has been met (the analysis suggests it has not).

Some of the analysis done in the MTR with regards to design are echoed here but with some limitations due to changing circumstances since 2018:

- The project design is comprehensive and addresses the needs for market transformation, but its preparation occurred before changes of floating the currency and raising energy prices, so currency devaluations that occurred in November 2016, March and October 2022

and January 2023 (rising from EGP 8 to 30 exchange rate to 1 USD) affected project plans because of the beneficiaries having to operate in the real market.

- Gender considerations are included in the project design, particularly for the trainings with an overall target of 276 females (20% of participants) and were continually monitored to check that targets were attained.
- Despite the external disruption in the economy and financial sector, the project design and implementation arrangements remained valid, although the implementation arrangements for financial instruments were not as robust as they could be.
- The GEF grant was devolved to national ownership through the NBE, but the delay in getting the Revolving Fund operational and its complex application process meant that the main target of encouraging the industrial private sector to take forward pilot SWH projects was missed.
- Overall, the design was appropriate but during the implementation there was a need for improvement in terms of assessment of the on-going risks, many of which have significant affected important targets, notably; USD 19 million invested in solar energy in the industrial sector; direct emission reductions of 722,028 t CO_2 eq. over 10 years through 100 installations of solar energy made in industrial applications.

Considering all of these assessments, the design (including overall project design and of the LogFrame) is regarded as a score of 4, which is Moderately Satisfactory.

3.2. Progress to Impact

The definition of the 'Progress to Impact' evaluation criterion is to assess any long-term effects (direct or indirect, intended or unintended) of the intervention whether positive or negative that have redirected the transformation process, which in this project is "To develop the market environment for the diffusion and local manufacturing of solar energy for industrial process heat". The impact of the project is a wide-ranging assessment point and runs through the design and performance, and also covers barrier analysis.

When the project started, there were no showcases for solar water heating and only bad experiences from the 1980s when the market sold poor quality imported or local products. The SHIP project offered tailor made solutions so that the design of a SWH system is based on the customers' needs. In that respect the project has offered a new and positive experience that is well timed, acting as a pillar for growing the market after the recent COP 27. The strengthening of the value chains that can be realised by manufacturers has been demonstrated and there is much more appetite from industry than when the project started.

Many of the activities encouraged local manufacturing by working on certification, establishing a Testing Laboratory and improving the capacities of NREA. The project has laid some foundations for a growing market by also focusing on standardization and quality through the use of the NREA facilities. Indeed when the project started NREA didn't see a role for SWH compared to the much more active solar PV market. Now NREA plays a leading role in the sector with the only certified Laboratory in the MENA area.

The SHIP project brought increased publicity about SWH and conducted many meetings, seminars and conferences and through its own website continues to show success stories from private companies. For the companies that benefitted from the walk-throughs and energy audits, the project has had a positive impact on their business development and for those seeking to manufacture SWH products, they have generally responded well to the focus on standards and certification, although there have been challenges in this area. The market can be strengthened by focussing on local manufacturing and this was a key part of the Roadmap and Implementation Plan.

The Roadmap aimed to disseminate solar energy for industrial heat in three (3) identified sectors by performing assessments of the potential for energy efficiency measures first, prior to switching to a renewable energy source (as per the original GEF document). As Table 16 shows, this resulted in 81 detailed assessments after 260 walk-throughs (from a database of 410 companies) and the activity is regarded as a success because almost 80% of projects identified are being implemented as energy efficiency measures (their payback period often being less than 1 year). However, the ability of these beneficiaries to move ahead with SWH projects has been affected by Egypt's current economic situation and the much longer payback periods. Therefore, the support given to new potential beneficiaries (such as in the tourism sector) and manufacturers of SWH technology needs to be continued in the short-term through UNIDO follow-up to help the feasibilities done to materialise into real projects.

Table 16 – List of audits and SWH feasibilities carried out in industrial and tourism sectors

#	Name	Sector	#	Name	Sector	#	Name	Sector	#	Name	Sector
1	Labranda Hotel	Tourism	22	EGIT	Industrial	42	Al-Arabia	Industrial	62	Phatrade Sadat	Industrial
2	JAZ Aquamarine	Tourism	23	Arab Development	Industrial	43	El-Safa	Industrial	63	Kandil	Industrial
3	Lagoon View Resorts	Tourism	24	Swifax	Industrial	44	El-Negma Pasta	Industrial	64	P&J	Industrial
4	Mobica Abo rawash	Industrial	25	El Gonih Tannery	Industrial	45	Cold stone	Industrial	65	Wassila tex	Industrial
5	Savola	Industrial	26	Juhayna Egy foods	Industrial	46	Juhayna El-Dawlya	Industrial	66	Moughrabi	Industrial
6	Maarib	Industrial	27	Timex Tannery	Industrial	47	EMESSA	Industrial	67	Raya Foods	Industrial
7	Lotus fresh tex 1	Industrial	28	Juhyana El-Marwa	Industrial	48	Cairo Aromatic	Industrial	68	Oleo Misr	Industrial
8	Lotus fresh tex 2	Industrial	29	MARSO	Industrial	49	Sana Foods	Industrial	69	Fruit republic	Industrial
9	Lotus new jeans	Industrial	30	Hbfoods	Industrial	50	Mideternean	Industrial	70	Tema foods	Industrial
10	Lotus old Jeans	Industrial	31	Dr. Baker	Industrial	51	El-Sarg	Industrial	71	Eagle Chemicals V2	Industrial
11	Lotus Makkah	Industrial	32	Alasdeqaa	Industrial	52	Sana extension	Industrial	72	El-Mohandes	Industrial
12	Piel Color Crust	Industrial	33	El-Baraka (KB Denim)	Industrial	53	Tiba	Industrial	73	Masterline	Industrial
13	Piel Color Gelatine	Industrial	34	Juhayna El-Masreya	Industrial	54	Smart Garments	Industrial	74	Sentido Akassia	Tourism
14	Phatrade Obour	Industrial	35	Orient group	Industrial	55	Protiena	Industrial	75	Al-Mira	Industrial
15	Pyramids Poultary	Industrial	36	Esperanza (die house)	Industrial	56	El-Chourbagui	Industrial	76	Sakr	Industrial
16	Embee International	Industrial	37	T&C Garments	Industrial	57	Espreanto Jeans	Industrial	77	Warda tex	Industrial
17	Lazuli Hotel Marsa Alam	Tourism	38	Concorde Moreen Beach Resort	Tourism	58	Upper Egypt for food Industries	Industrial	78	Egyptian German Card board	Industrial
18	Interstate for paper industries	Industrial	39	Bliss Nada Beach Resort Marsa Alam	Tourism	59	Rohdes Al Borouj for food industries	Industrial	79	Eagle Chemicals V1	Industrial
19	Star tex (Textile)	Industrial	40	Star glue	Industrial	60	Lotus suez canal	Industrial	80	NASYDCO	Industrial
20	Borg al-Arab for Dyeing	Industrial	41	Piel Color beam house	Industrial	61	Elrowad Tannery – Leather	Industrial	81	Universal For carton	Industrial
21	Plaza	Industrial									

The capacity building offered by the project is recognised by beneficiaries, the bank and public partners as a positive impact. Capacity building was delivered through formal sessions and the energy audits, benefitting not only trainers (e.g. at IMC) but also recipients of the comprehensive feasibility studies done within the audits. As the project progressed, the level of engagement increased, for example in seminars at the beginning, 20% of invitees attended which increased to 90% towards the end of the project.

Significant awareness has been generated to all participants, whether the industrial sector or representatives of government agencies, about the use of solar heat within industry and there is the start of a culture change through the training of trainers model (with government representatives of PVTD, IMC, ENCPC and NREA benefiting). Some consultants trained by UNIDO are registered now with IMC and can provide solar technical assistance along with energy audits. There is demand from services coming from high energy consuming sectors such as food, textiles, leather and chemicals.

The study tours in Tunisia and Europe were noted as very beneficial (and at no cost) to the beneficiaries' energy teams, not least because they were exposed to methodologies for energy efficiency as well. Those interviewed will implement some of the measures proposed and they also

have seen the benefit in investing in solar PV. For example, one Egyptian company created a business relationship with a company visited in Tunisia that might end in a future joint venture.

The project has offered a considerable number of feasibility studies (thermal energy audit/optimization first then proposals for SWH installations second), an approach that was appreciated in Egypt, as it was not just promoting a product. This new mentality and vision for renewable energy within the industrial sector was seen as innovative in the SWH market but unfortunately did not result in demonstration or pilot projects. Energy efficiency recommendations were better received due to lower costs to implement and faster payback periods and most of the audited companies are now actively working on their recommendations, so it is too early to see major impacts.

In nearly all interviews the economic issues faced by the private sector in the supply (and demand) side were cited as the major barrier, causing reticence from many potential project beneficiaries. As well as the devaluation of the pound (its value halving against the dollar in one year), there are inflationary pressures (31.9% in February 2023), continuing backlogs of getting imported goods out of ports and global supply chain shortages for some essential components. There is a shortage of foreign currency, which limits the dollar value of imports allowed unless a company has made enough exports in dollars.

As well as the devaluation of the currency, many respondents also cited the COVID-19 pandemic, general economic crisis, the war in Ukraine and high interest rates as barriers to seeing actual implementation of the studies conducted because of the postponement of decisions to invest.

Competition with the price of natural gas has been a barrier for SWH going forward; gas is subsidised, cheap, the cleanest fossil fuel and reliable with no supply chain issues. Solar PV is much more attractive for the manufacturing sector than SWH and there has been limited opportunities and demand for the actual SWH application although the market is large.

Lack of clarity on custom tariff management has been a hindrance to those needing components for local manufacture. Government bodies concerned are unfortunately looking only at maximizing revenue from the customs process rather than thinking how Egyptian manufacturers could become competitive to export and earn dollars and contribute to the macro economy.

It was made clear that the route for accreditation under the SHAMCI certification scheme is not easy for companies that want to achieve a quality mark and the costs (EGP 70,000) are prohibitive and they may not bother apply. There are multiple stakeholders involved including NREA, EOS and GOIEC (General Organization for Import and Export Control) and even with the Decree 914 that should enforce the process, very few requests for certification are materialising, only those received through the project activities. A new accreditation is also suggested as important for export of products which is an Energy Rating Label or 'Green Mark' (as in Europe) for the environmental credentials of the product and the company that manufactured it.

Lack of skilled human resources is another challenge within the wider renewable energy industry particularly in the public sector which will become more acute with the ending of the SHIP project. The UNIDO inputs were essential to develop skills and knowledge and despite over 1,300 people benefiting from the training, issues of low numbers of trainers, inability to hire more trainers and the requirement to subsidise courses for the main target group (students), means that continued training efforts may stall.

A further future challenge in reaching all of the potential for solar heating for industry is that 50 - 60% of industrial activity is informal in Egypt which is 4 times bigger that the formal factory-based industrial processes and making changes to energy systems for these potential beneficiaries will be difficult, if not impossible.

In terms of the extent to which the project has put in place conditions to overcome barriers to the popularisation of SWH, the following table summarises those hindrances identified at project preparation (see GEF CEO Endorsement_121114, pages 22 – 24, Annex 7) and evaluates whether the higher level impacts have helped overcome these barriers.

Table 17 – Evaluation of barriers identified and actions required at preparation stage

1. Policy arena • Absence of policy instruments to support the introduction of RE. • Competing corporate priorities such as competitiveness, other environmental and/or regulatory concerns.	Assess the market potential and prepare roadmaps for the introduction of solar energy in selected sectors and introduce standards for quality components and products and a certification scheme for technicians working in this area. Assisting the government to put in place a roadmap and related action plan for utilizing solar energy for industrial process heat. Assisting state organizations to put in place policy measures to promote the use of solar energy for process heat in industry and promote the local manufacturing of quality products.	Roadmap was developed in 2017 and was carried through into the feasibility studies and audits done. Government institutions were engaged in the Roadmap and Implementation Plan process. Although promotion of solar heating within industry was done, few beneficiaries may move to local manufacture.
4. Awareness arena • Lack of awareness of the potential and the opportunities. • Weak technology knowledge. • Lack of information about GHG emissions reduction opportunities in the sector compared to other investment alternatives.	Widespread awareness programs targeting management and decision-makers on the benefits of RE, as well as the impact in terms of costs-benefits, efficiency improvement, competitiveness and environmental impacts. Technology transfer and capacity building for designing solar thermal systems. Close cooperation with ongoing initiatives, consultants and universities and implementing 100 demonstration projects. In addition to training of experts on the system optimization and the system design.	A further 413 people trained on topics such as platform operation (Google analytics), energy savings from solar heat, EE measurements for audit, basic and advanced SWH design. 10 awareness events conducted between 2016 and 2022 with 708 participants benefiting.

As the table shows, the evaluation of actions made against the barriers identified at the inception of the project is particularly strong and show that the journey has started within the solar heating sector, towards the overall goal of reducing the energy intensity of Egyptian industry in a way that may be sustainable and could lead to ongoing energy and carbon dioxide savings.

Assessment of the interview responses and scoring the information above indicates that the project impact measured against the long-term effect of 'developing the market environment of solar energy for industrial process heat' would achieve a score of 5, which is Satisfactory.

3.3. Relevance

The relevance of an intervention is the extent to which the activity is suited to the priorities and policies of both the target beneficiaries and the donor(s). Firstly, it is clear that the SHIP project has high relevance to the donor because the GEF is a catalyst to promoting renewable energy on many fronts, from removing barriers and building capacity to direct financing of investments in renewable energy technologies, while taking action on climate change by adopting and implementing programs to limit emissions of greenhouse gases.

Secondly, the national level plans and strategies relevant to the SHIP project are listed below:

- Ministry of Electricity and Renewable Energy Plan (2018)
- Ministry of Trade and Industry Development Strategy (2016 – 2020)
    - e.g. Page 21 on Public Policy - "the industrial sector must respond to the development of renewable energy, and should generate energy from natural sources, whether from the wind, sun, and/or recycling of industrial and agricultural waste".
- Ministry of Environment Climate Change Strategy 2050
    - e.g. within Goal 1 – "Increasing the use of renewable energy to generate electricity within industrial facilities and the applications of solar thermal energy in industrial processes".
- Ministry of Environment Egypt's First Updated NDC (2022)
    - e.g. Page 18 – "increase the share of solar heating in the industrial processes of relevant sectors and promote roof-top PV systems".
- Ministry of Petroleum Strategy[34]
    - e.g. "Securing oil and natural gas supplies through expanding upstream activities, diversification of resources and working towards modifying the energy mix".

Although these are policies and strategies that comply well with the concept of the project, the actual contribution that solar water heating can make is relatively small compared to other forms of clean energy (solar PV, wind and nuclear power). The NDC document has a target of only 5,300 solar water heaters within urban buildings by 2030, which is only 1% of the potential market, estimated as 450,600 in 2022.

Many respondents to interviews confirmed that because the project is championing sustainable development through the use of renewable energy, it is in line with current government priorities and with MTI's development strategy. Reference was often made to COP 27 which was held in Sharm El-Sheikh in November 2022 and the subsequent promise of government through many ministries to accelerate the achievement of the target of 42% renewable energy in the country's energy mix before 2035.

After holding COP 27, all Egyptian strategies had to be updated to include gender-responsive approaches in tackling climate change. Egypt is mandated under the National Determined Contributions (NDC) to develop more renewable electricity, cleaner transportation and make improvements in the petroleum sector (i.e. less flaring of gas) and should update the report every 5 years. Actions required from government are based on the Egyptian Sustainable Development Strategy with the Ministry of Electricity (responsible for demand side), Ministry of Petroleum (supply side) and Ministry of Environment (focusing on energy efficiency). Other national strategies coming out of the COP 27 and other international conventions such as the UN's Sustainable Development Goals (SDGs) mean that there is a new focus on diversification of energy resources, including the study of renewable energy within school and college curriculums.

Reduction of carbon emissions is one of the priorities of the Egyptian government. If energy can be saved through solar water heating, it is bound to be supported, especially if it improves energy use in industry. Although there is not a proper 'free market' for energy in Egypt and the government still controls electricity and gas prices, there are signs that the Ministries of Electricity and Petroleum are moving at a faster pace to remove subsidies as well as diversifying the energy mix.

[34] https://www.petroleum.gov.eg/en/about-ministry/Pages/strategic-purpose.aspx

Removal of fossil fuel subsidies is a constructive measure due to the hindrance they place on development of alternative forms of energy.

For respondents from the private sector, the project has compatibility with many of their own environmental policies and priorities, for example the textile industry beneficiaries are (or aim to be) certified to ISO 50001 in Energy Management Systems and NBE ensures sustainability is one of its key strategic pillars. It was found that the private sector generally has more ambitious targets for energy and sustainability, often because energy savings can improve their financial performance.

It is therefore clear that the project's relevance attains a score of 6, which is Highly Satisfactory, although there is one minor concern whether UNIDO has remained focussed on the relevance of the project to the direct needs of the targeted industrial sector, which is more about energy efficiency rather than solar heat.

3.4. Effectiveness

Effectiveness measures the extent to which the intervention's objectives were achieved and is therefore fairly wide-ranging because it also can look at the achievement of outputs and their outcomes in the LogFrame. Within the interviews held, questions were asked about benefits that have arisen, how those benefits would continue in the short and medium term and the key drivers in achieving the project goal.

The SHIP project' approach has been holistic in trying to reach the planned goals by understanding the product, undertaking the market studies, developing the Roadmap, providing access to finance, training labour for the local market, building awareness across the sector, while keeping an eye on product standards and regulatory aspects. Apart from the lack of actual demonstration projects to point at, the targets made in the LogFrame have been met or been over-achieved as shown in UNIDO's summary below and as detailed in Annex 6. Effectiveness is particularly high for Components 1 and 4.

Key Result Area	Target completed	Target exceeded
Component 1 – Develop Policy Instruments	• Certification scheme for personnel and companies. • SHAMCI Standard for SWH components.	• National Roadmap & Implementation Plan for strengthening local components manufacturing.
Component 2 – Mobilize financing	• Revolving Fund established with NBE of value 4M U$.	• Diversifying the fund to include local manufacturing and tourism sector.
Component 3 – Improve manufacture, supply and distribution	• NREA laboratory up-graded, calibrated and accredited. • SWH components and systems minimum requirements installation/maintenance developed. • Feasibility studies for over 80 industrial facilities and hotels.	
Component 4 – Build capacity	• Capacitating governmental staff through knowledge transfer from Tunisia and Europe. • SWH Platform launched. • Two Training Centers established (NREA and PVTD).	• Capacity Building: 1,318 (21% Female representation). • Outreach Campaign: 708 participants (governmental bodies included).

A key driver has been the way the project worked on demand and supply sides, the market and certifications and the way it connected with suppliers, manufacturers and service providers. The

saving of energy costs for the industrial sector is the main driver for this project although the cost savings are generally in the medium to longer term. Payback is highly dependent on the amount of investment made and scale of the project, whether it is applied to established versus new factories, and it also depends on companies' priorities and whether they are working for local market or exporting.

In the end, involvement of banks in the project has been effective and the capacity building of NBE was perceived as especially important. Still, the structure of the loan should include energy efficiency as well as renewable energy solutions to make it attractive and unlock investment opportunities. Because companies in the industrial sector are always looking for reduction of costs, the availability of a cheap loan could convince them to invest in SWH and save costs.

The project generated side activities such as the involvement of the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) in the production of the Roadmap and striving to have the SHAMCI certification scheme as the standard and quality mark for local SWH products (see box below). The project therefore responded to and helped address the bad experiences in the 1980s SWH market when there was low quality and poor after sales.

Solar Heating Arab Mark and Certification Initiative (SHAMCI)

The SHAMCI is the first Arab certification scheme for solar thermal products and services in the Arab region promoting the adoption of standard quality measures, accreditation systems and quality labels. It provides a regional industrial and regulatory compliance framework for policy makers, industrial sector and end-consumers. Inspired by the Solar Keymark, SHAMCI is built around specific characteristics and needs of 11 Arab states in the MENA region. SHAMCI was initiated by RCREEE the with the support of the Arabian Industrial Development and Mining Organization (AIDMO) based on the Arab Ministerial Council of Electricity (AMEC) of the League of Arab States request. RCREEE helps analyze regional needs, invites international and regional field experts, and communicates with different stakeholders including policy makers, industrial sector, and end-consumers to ensure SHAMCI adoption on a national level. RCREEE also conducts various workshops and capacity development activities, develops project documentations, and publishes communication and awareness tools.

(https://rcreee.org/solar-heating-arab-mark-and-certification-initiative-shamci/)

Because a key part of the project has been on training and capacity building and being as visible as possible, it has created a heightened awareness about SWH technologies as a whole, although the lack of visible pilot projects is a disappointment. The fact that SWH can be utilized in the industrial sector was quite new information and the project helped to overcome the previous bad experiences and reputation that the technology has previously suffered from. However, a concern is that the boosting of the huge potential market has not been achieved as a result. If the market is generated, the manufacturers would follow naturally into that space.

There are specific outputs not met as per the LogFrame (for example '100 installations of solar energy made in industrial applications') but this does not mean the project has not been effective overall. The evaluation rates the Effectiveness performance criterion at a score of 5, which is Satisfactory. This reflects that effectiveness was boosted by flexibility within the project when the tourism sector was brought in and that the capacity building over-achieved, although if of UNIDO's Consultant's had been embedded within the IMC, effectiveness would be higher.

3.5. Efficiency

The efficiency is a measure of how economically the resources and inputs are converted to results and within the expected timeframe. The inputs are usually cash, funding, loans, services given (in-kind), expertise (paid or unpaid) and people's time. Each interviewee was asked what inputs they

gave, and all responded that they had given time rather than any cash or funding, and some gave in-kind inputs such as provision of local transport at their cost.

The reporting of disbursements was not made available to the TE except as ascertained from the latest annual Project Reports (nos. 6 to 9), cumulative spend to the end of August 2020 (83.4%), end of August 2021 (91.5%) and end of September 2022 (97.6%) against the original budget total of USD 6.5 million. The Project Implementation Reports for 2020 does not detail the breakdown by Component (to compare to the original GEF document in Table 8) but the PIR in 2021 and 2022 does have these in summary, but and refers to annexes that details the financial flows, which again are not available to the TE.

The main source of information for flow of financial resources is from the Project Document combined with UNIDO's Project Management ERP database up to 15 October 2022 which in summary shows the approximate figures (from Table 18):

- Loan facility to NBE – USD 2 million (31.4%)
- Contractual Services – USD 2.7 million (42.5%)
- Equipment – USD 220,000 (3.5%)
- Meetings and local travel – USD 84,000 (1.4%)
- National Staff/Consultants - USD 920,000 (14.5%)
- Staff and Internal Consultants (UNIDO PM) – USD 259,000 (4.1%)
- Others including Training and Study – USD 172,000 (2.7%)

Table 18 – Main expenditures (to 15 Oct 2022)

Items by budget line	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total expenditure**	
									(USD)	***%***
Contractual Services	2,317,678	355,777	574,999	296,648	544,538	428,000	61,132	127,043	4,705,815	***74***
Equipment	0	0	11,944	9,571	10,304	16,072	166,955	5,305	220,151	***3,5***
International meetings	0	0	0	0	2,035	0	0	1,657	3,692	***<0,1***
Local travel	4,417	1,854	10,718	5,462	12,350	3,493	131	42,148	80,573	***1,3***
Nat. Consult./Staff	61,514	50,854	64,651	94,034	79,945	191,926	211,189	166,026	920,139	***14,5***
Other Direct Costs	4,359	1,134	181	4,152	8,073	15,038	13,110	9,243	55,290	***0,8***
Staff & Intern Consultants	0	11,703	43,197	22,677	44,561	70,474	35,269	30,704	258,585	***4,1***
Train/Fellowship/ Study	0	0	100,254	0	0	4,886	11,121	0	116,261	***1,8***
	2,387,968	421,322	805,944	432,544	701,806	729,889	498,907	382,126	**6,360,506**	

The first thing to note is that the bulk of project expenditure (USD 4.7 million) for Contractual Services is not detailed enough considering it makes up three-quarters of the budget. The USD 2 million GEF grant was accounted for as early as 2015 as Contractual Services but this passed much later through the National Bank of Egypt for the Revolving Fund (loans to participating businesses). If this loan amount is taken out, this would mean that other Contractual Services have an annual flow as shown in Figure 7.

Figure 7 – Contractual Services expenditure year-by-year

The Contractual Services activities with major expenditure have been identified as:

- 2016 – Roadmap, produced by PSE, Industrial Solar and RCREEE
- 2017 – Bankers Awareness Trainings
- 2017 – Study Tour 1 to Tunisia
- 2017 – ENCPC Contract
- 2019 – IMC Contract
- 2020 – European Study Tour
- 2022 – Study Tour 2 to Tunisia

These interventions tend to coincide with the peak years for expenditure as shown in the bar chart above and provide an explanation as to how Contractual Services were delivered. In terms of value for money, the evaluation considers that the amount for Contractual Services is commensurate to the cost of the national counterparts (ENCPC and IMC), the international consultants and the cost of Study Tours for 35 people to Tunisia and 12 people to Europe, which will be significant in those respective years.

It is accepted by UNIDO (and SC) interviewees that there was slow implementation from 2015 to 2018 and that the project had to catch up in 2019 and 2020, rushing many activities at the end, including the completion of the second GEF USD 1 million tranche just days before the project closed. At the start of the interventions, turn-over of staff in HR, both at the Steering Committee and within UNIDO caused delays in decision making. The staffing cost (including national consultants and interns) has the following expenditure by year, which reflects the manner in which the local office staff numbers were increased in the later years.

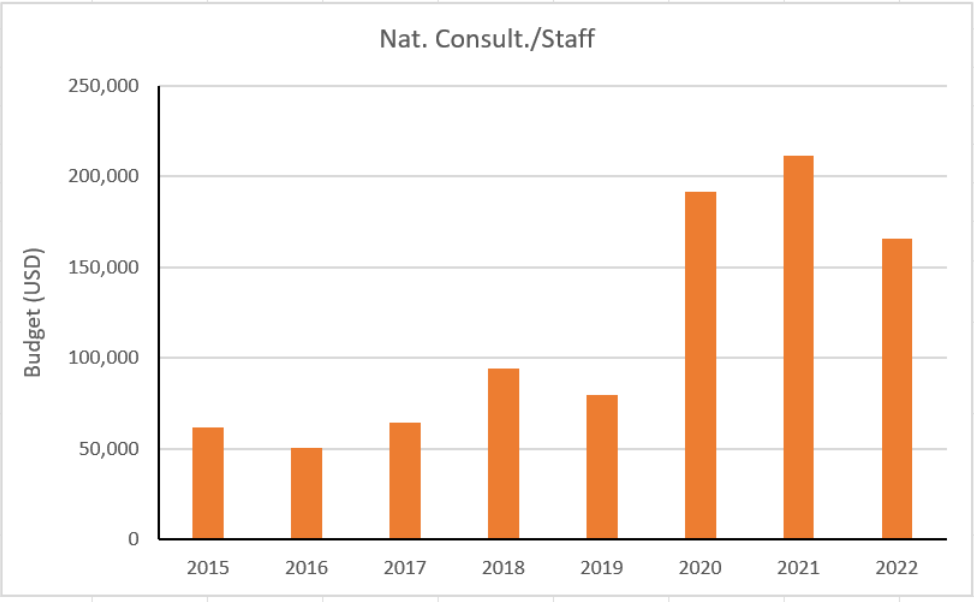


Figure 8 – National Staff and Consultants expenditure year by year

These figures translate to an average of about 2 to 3 staff employed in the opening years (2015 – 2016), about 4 people in 2017 – 2019 and between 8 and 9 in the last 3 years. The core staff at the time of the TE are in the table below.

Table 19 – UNIDO core staff details

Designation	No.	Female	Male
National Program Officer	1	1	
Technical Experts	3	1	2
Junior Technical Experts	1	1	
Communication Consultant	1	1	
M&E Expert	1	1	
Admin Assistant	1	1	
	8	**6**	**2**

This analysis corresponds with the evaluated staffing levels and number of Consultants employed through the years and is assessed as an efficient use of those resources (USD 920,000), particularly given the progress made in all outputs by component.

The amounts for equipment at USD 220,000 would seem reasonable because of the support given to NREA in setting up and certifying the Testing Laboratory and the material needs for the various technical trainings. The relatively small sums for local meetings and others costs, including the support to trainings and studies indicate an efficient use of financial resources.

The MTR reported that the SHIP project was cost effective given that there was a chance of leveraging in the investment from NBE worth millions of dollars. It was also noted that project implementation was efficient because of engaging partners and agencies at little incremental cost. However, the MTR's concern was that the project management could be more efficient, although delays could be ascribed to external factors in Egypt. Given that the subsequent challenges of COVID-19 and continuing economic upheavals and the way the UNIDO local team have completed all of the planned activities, the efficiency of project management has clearly improved since the MTR.

The project was able to obtain co-financing of USD 2 million from the NBE although companies that have applied for it reported that the Revolving Fund application process takes too long (6 or 7

months) compared to an expected time of 3 months. The main government entities (MTI, ENCPC, NREA, IMC, EOS) have consistently participated with inputs as their counterpart. This has meant that spending about USD 550,000 per year (USD 4.4 million over 8 years) is good value for money given the wide-ranging impacts that the SHIP project has made. An added aspect is that the project was expended twice by a total of more than 2 years, yet it has been able to operate using the same original budget.

With regards to efficiency, an important evaluation point is that the project as designed and eventually delivered in 8.5 years was quite complex for one phase and that it could have had two separate phases with a full review and M&E in between. The implication of this to the evaluation of efficiency is that the score is 5, which is Satisfactory.

3.6. Sustainability

There are two aspects to the sustainability criterion, its environmental credentials (which are clear in this case being the promotion of renewable energy) and the continuation of the benefits after the assistance with the probability of continued long-term resilience to the rise of benefit flow over time. For the latter, interviewees were asked whether the benefits seen would continue to be ensured in the short, medium or long-term.

Co-operation with NREA and the breadth of the capacity development programme are regarded as successes and through the continuing involvement of government partners, the impacts of the project should be able to be pushed into the longer term. However, there is a concern that despite the number of public institutions involved in the project, there has not been enough government support for the SWH sector to sustain the project outputs. It was commented that MTI (through IMC and ENCPC) have to continue to push the initiatives, together with the business community.

The Revolving Fund under Component 2 is one of the essential components for the sustainability of results. It is positive that the GEF and the Steering Committee has worked proactively with UNIDO to enable continued support (for three months under the on-going Motors project) to those wanting to avail of that facility. This is especially important because the first loan (over USD 1.9 million) has been approved in March 2023, which enabled the full USD 2 million from GEF plus the counterpart USD 2 million from NBE to be available for the future.

Some marketing is still needed to increase the demand on the loan. MTI could take the leading role and disseminate information using its affiliated entities (IMC, responsible for existing establishments and IDA, responsible for new establishments) and share information about the benefit to companies of having the loan, if they are willing to share their success stories.

Sustaining the project towards the goal of properly developing the market for diffusion and local manufacturing to solar water heaters will in large part be driven by availability of finance which is why the involvement of banks was so important. However, the process for accessing finance through the loan facility has not been a simple process, requiring a long wait and lot of supporting paperwork for applicants. Because of the economic turbulence seen in Egypt over the duration of the project (see Figure 9 as an example of the value of the EGP), the investment environment remains difficult for companies to either manufacture products or install systems. If companies on the supply or demand-side can see financial benefit, there will be natural take-up and sustainability. Therefore further financial incentives or subsidies may be needed for installation of solar water heaters.

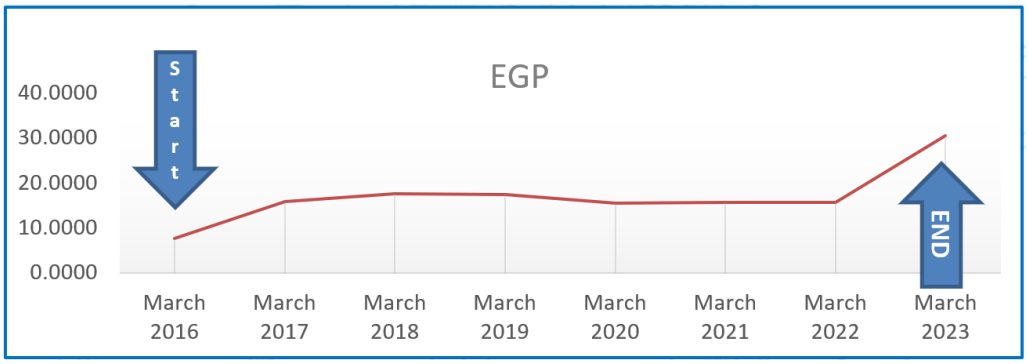


Figure 9 – Variation of value of EGP (2016 – 2023)

An additional successful step towards ensuring sustainability is the NREA Testing Laboratory. It is the only accredited / certified Lab. in the MENA region which will continue providing that service as well as support the stakeholders in the sector through trainings and exposure of the technology to participants from the MENA and wider African countries.

For the private sector participants, it is recognised that the project provided great support in terms of information, know-how, contacts and study tours that will help guarantee sustainability. But there is still a need of an institution that follows up technically and on the execution of a SWH installation (e.g. a list of vendors to contact, technical support to guide through the process). With the late participation from the tourism sector, the demand will increase as they need to conduct their own studies while asking for technical support. The institution that could provide this is the IMC, who have a bank of certified experts including 30 trained consultants / companies that can provide technical assistance on solar heating design along with energy audits. This pool of service providers (public and private) was passed to IMC by UNIDO to encourage sustainability.

The various trainings delivered by the project in Components 2, 3 and 4 (detailed below in Table 20) will support sustainability together with the awareness raising activities (see Table 21). However, one of the main beneficiaries of ToT (PVTD) indicated that after UNIDO support ends, their continued training of students may be hampered because of funding constraints. To ensure full sustainability more trainers are needed to expand training courses because the trained personnel also teach many other subjects. However, new appointments have been halted by government for the past 15 years within the public sector.

Table 20 - Summary of trainings undertaken

Comp.	Output	Dates	Training	No. of trainees	% of women	Study Tour	ToT
2	2.3	2017 – 2022	Technical capacity of staff of local banks on the assessment of projects enhanced	384	15%	Tunisia (12)	3 from banks
3	3.2	2020 - 2022	Capacity of testing laboratory staff on testing protocols and procedures	21	33%	Europe (12)	NREA, EOS, EGAC
3	3.3	Oct 2019 Feb 2020	Basic tools and training for improving the quality of locally manufactured components	106	16%	Tunisia (23)	67 companies
3	3.4	2019 - 2020	Best practices of solar energy components and systems manufacturing	220	16%		
3	3.5	Aug – Dec 2021	Training on platform operation and MNE using Google analytics	21	65%		

Comp.	Output	Dates	Training	No. of trainees	% of women	Study Tour	ToT
4	4.1	2017 – 2019	Energy savings based on process heat optimization for experts, facility managers and service providers	153	25%		
4	4.1	2017 - 2019	Expert Training on Energy Efficiency and solar heat in the industry	49	5%	11 Visits to Training Sites	18 Qualified Consultants (IMC)
4	4.1	2021	Measurement Training for Energy Efficiency Audits	46	25%		
4	4.2	Jul 2020 - Mar 2021	Basic SWH design	96	18%		
4	4.2	Nov 2021	Advanced SWH design	48	18%		33 Qualified Consultants (IMC)
4	4.3	Mar 2021	ToT solar thermal equipment installation and servicing for technicians, installers and service providers	22	9%		13 Qualified trainers and 50 qualified installers
4	4.3	2017 – 2022	Solar thermal equipment installation and servicing for technicians, installers and service providers	99	16%		NREA, PVTD, ENCPC, IMC
4	4.4	2019 - 2021	Business development for solar energy businesses	53	17%		ENCPC, IMC
			TOTAL	**1318**	**21%**		

Table 21 - Awareness activities conducted

Awareness Event	Date	#
SWH Manufacturers	March 2016	14
10th Ramadan Industrial City	July 2016	22
Obour Industrial City	October 2016	19
Sadat City	May 2017	16
British University in Egypt	April 2019	150
National Research Center	June 2019	250
Borg-Al Arab Industrial Zone	December 2019	120
6th of October Investors Association – NBE Loan	March 2022	34
10th of Ramadan Investors Association – NBE Loan	March 2022	31
Suez Canal Authority – NBE Loan	May 2022	52
Total		**708**

Finally, ENCPC recognises that they are the responsible party for now scaling up the SHIP project's initiatives and the outputs can be embedded under the decarbonization initiative. ENCPC is mandated by the Prime Minister to oversee the decarbonization of the industrial sector and issue carbon credits. They have already started on digitalization of the services using virtual reality software to automate the auditing process. Further to this, UNIDO is trying to develop a new project

on introducing SWH in 5 MENA countries (Egypt, Jordan, Morocco, Tunisia and Palestine) to upscale activities and is at the stage of seeking donors to fund it.

It is evaluated that there has been a reasonable degree of sustainability built into the intervention, but it does still depend on how the Revolving Fund will be administered and made available in the future. There may also still be a need for UNIDO to be a champion for coordination and continuity, yet the project is bound to close in the coming months, even with the side-line support from an associated project. Therefore the score for Sustainability would be 4, which is Moderately Satisfactory.

3.7. Coherence

This is a new criterion using suggestions from the OECD/DAC's 'Better Criteria for Better Evaluation' (2019) which measures the compatibility of the intervention with other initiatives in the respective sector/s and tries to capture project linkages, systems thinking, partnership dynamics and complexity. This was assessed through the interviews with two questions, one on whether the project was in line with priorities and policies of the stakeholder's institution and the other on whether there is compatibility with other institutions and to the country as a whole.

The reform of the energy sector by the Ministry of Electricity in 2015 to phase out the control of electricity prices has now put pressure on industry to look for cheaper alternatives, particularly in the food, leather, textile and chemicals industries which have high energy consumption. But solar water heating has not yet reached the popularity of solar PV and perhaps the manufacturing sector was not the best choice to focus on. Therefore, the inclusion of the tourism sector, as a key driver of Egypt's economy was a wise strategy that can increase demand for solar water heating systems. The concern is that it is a very late inclusion into the intervention although it fits with the project aims and objectives.

NREA maintains that Egypt has a good potential to become a regional (or pan-African) exporter of SWH technologies. But from the manufacturers interviewed there is a concern that government interference and heavy bureaucracy in Egypt is drowning the process for responding to the large market. Based on learning from the Tunisian experience, it requires the correct government intervention to facilitate the process. For example, government could enforce that a certain percentage of buildings are built with solar heaters. Also, with the application for the loan from NBE, the procedures are clear from the bank's side but the approval process has been taking too long (more than 6 months).

The project delivered 11 standards for solar heating systems for the industrial (and residential) sectors and how to accredit the various components for locally manufactured parts and those that need to be imported. Although the accreditation system for manufacturers is now in place with the required inputs from NREA and EOS, there needs to be a follow through on the enforcement of Decree 914, which states that both importers and producers are obliged to follow the EOS standards and quality process to evaluate the conformity of products and verify the quality and performance of the products before they are put on the market, after tests are carried out by NREA.

Customs tariffs should create the best conditions for importing renewable energy equipment. Although there are free tariffs for importing whole and complete products, the same does not apply to component parts (such as vacuum tubes or selective coated collectors) which stifles local manufacturers to maintain competitiveness. Partners are aware of this issue but the facilitation of resolving customs issues has been missing from the project.

Overall, the SHIP project has laid some important and timely foundations for greater market penetration of SWH but various aspects within Egyptian economy and government strategies referred to in the section on relevance have to settle down before the technology can properly take off and meet its huge potential in the Egyptian market.

It is clear that the intervention has a high degree of compatibility which is demonstrated particularly in coherence to industry (and tourism) companies involved in manufacturing (supply) or installation (demand). For partners such as NREA, ENCPC and IMC, there has been good coherence but within the Ministry of Electricity strategy and targets, SWH does not seem to fit (focus is more on solar PV electricity). Therefore the Coherence criterion should score 5, which is Satisfactory.

3.8. Gender Mainstreaming

Gender equality refers to the equal rights, responsibilities and opportunities not only of women but also men, girls and boys; those rights should not depend on whether people are born male or female. Empowerment of women signifies gaining power and control over women's own lives through raising awareness, building confidence, expansion of choices, increased access to and control over resources and changing institutions which reinforce gender discrimination. Gender parity seeks to achieve equal numbers of men and women at all levels of an organisation, particularly at decision-making levels.

UNIDO evaluations should ensure that the evaluation complies with policies on gender equality, the empowerment of women and gender parity with such questions as:

- Were gender issues identified in the design stage and were gender dimensions integrated into the project?
- Was gender equality reflected in the objective/s and to what extent are the output/outcome indicators gender disaggregated?
- Did project monitoring and assessment collect and analyse gender disaggregated data?
- How gender balanced was the composition of the PMU, the Steering Committee, experts and consultants and beneficiaries?

The evaluation ascertains the extent to which the intervention has contributed to better gender equality and parity and whether it has empowered women.

Gender aspects were considered in the project's design with consideration of gender dimensions within socio-economic benefits to be delivered and in two main areas. Firstly, by having minimum targets of equally qualified women attending the trainings, assisting with accessibility, minimum level of literacy, adequate day times and good locations for women participation and secondly, by integrating gender sensitive indicators into the project results framework.

In the MENA region, although women have higher attendance of university to men, in 2019 the female labour force only stands at 24.6% compared to a global average of 47.8%[35] and women generally face more challenges than men in gaining employment opportunities. Engineering and technology sectors such as renewable energy which involves manufacturing and installing equipment do tend to have under-representation of women, which was confirmed by interviewees. Therefore for the project to reach 21% of the representation of women in the trainings, is considered as a reasonable success as the sector is not generally attractive for females. The timings for those trainings, the environment and location were all reported as helping encourage women's participation.

The evaluation met 37 people during the 21 interviews undertaken and 14 (38%) were women with a high degree of involvement in the project. Many of the institutions had a high percentage of women already in the workforce, compared to the industry averages:

[35] https://www.statista.com/statistics/1155104/mena-labor-participation-rate-by-gender-and-region/

- Oriental Weavers – Energy team led by a woman.
- Maarib Factory – 3 women out of 8 (38%) in Energy Team.
- Akassia Hotel – although few women at the remote hotel location, a good representation in the Head Office in Cairo.
- IMC – the Project Lead a woman and reported 30% representation in the institution.
- PVTD – 30% of the tutors are women.
- ENCPC – 2 in 6 (33%) of the key staff are women.
- FRESH – although only 10% women in the factory, 40% in the whole company.

From the UNIDO side, women were highly involved and leading the project's design and its inception including the Project Manager at HQ, who maintained this position throughout the project implementation. The head of the GEF Focal Point in Egypt is a woman who has likewise been involved since the inception of the project. The UNIDO Egypt office has been headed by a woman since 2020 and the majority of the team are women. There was a suggestion that more of the Steering Committee should have been women, but it is recognised that of the five (5) SC Chairs, the first three from 2016 – 2020 were women and the final SC meeting was attended by 50% women.

Gender was reported on in almost all of the nine (9) annual Progress Reports including the percentages of women in the trainings conducted, which was quite high for the bank's trainings (capacity building) but reduced for the technical trainings (measurement, design, installation). Gender mainstreaming was also reported clearly in the Project Implementation Reports (2020, 2021 and 2022). The second gender dimension, that of carrying out a baseline at the start of the project (to integrate gender indicators) was indeed done in 2016. A specialist was recruited who produced a report with Action Plan with clear tasks, timeline and budget to foster gender mainstreaming and female participation, efficiently through the various activities.

It is assessed that the Gender Mainstreaming scores 6, which is Highly Satisfactory.

3.9. Monitoring and Evaluation

The monitoring and evaluation of the intervention refers to the indicators made in the LogFrame (its design) and the tools used by the project team (UNIDO and main partners) to measure whether the project has been implemented according to the plan (monitoring) and whether it is having the desired results (evaluation). This process should be happening externally to any formal (independent) evaluations such as the MTR or this TE. It includes the LogFrame, baseline reports, periodic reports, minutes of meetings and documentation of activities.

The defining document in this respect is of course the LogFrame but also in the interviews it was asked whether their institutions monitored the project in any way and the tools used and if there were any formal assessments (or evaluations) done by them. Within the LogFrame, there are 4 outcomes and 15 outputs with targets that should be monitored by the core project team (UNIDO/PMU, Project Coordinator, SC and GEF OFP) through the duration of the project.

The document for this purpose is the UNIDO Project Implementation Report (PIR) which is done for the GEF for a fiscal year (1 July – 30 June). Unfortunately, the PIR is only available for FY 2019 to 2022 and the reporting on budget is quite limited as presented earlier in Table 9. However, there are nine (9) Annual Progress reports from 2016 to 2022 which have similar information required of the PIR and these log the detailed progress per component with supporting annexes and data.

The project also has a discrete extra Component 5 for M&E, the output of which was presented to the evaluation team while in-country (Table 22) and proves that the local office is aware of and is performing the necessary M&E tasks for this project although not with the frequency required. The quality of those submissions seen by the evaluation is to a high level which will enable good post-evaluation analysis by the Head Office.

Table 22 – Monitoring and Evaluation tools used by the UNIDO local office

	Report	Entity	Frequency	Info. Level	Submitted
1.	Monitoring Report	UNIDO EG	Monthly	Activity level	2016-2023
2.	Project Progress Report	MTI	Quarterly	Activity level	(14) 2019-2022
3.	Project Disbursement Plan	MTI	Quarterly	Component level	(14) 2019-2022
4.	Project Implementation Report	UNIDO EG/HQ	Six-months	Outcome level	(9) PIRs
5.	GEF FY Project Imp. Report	GEF	Yearly	Outcome level	(4) 2019-2022
6.	Planet Group Reporting	UNIDO EG/HQ	Yearly	Component level	(3) 2020-2022
7.	JWP/One UN Reporting	UNIDO EG/HQ	Yearly	Component level	(4) 2019-2022
8.	VNR – Achievements Reporting	UNIDO HQ	Yearly	Project level	(1) 2021
9.	UNCT SDG Mapping	UNIDO HQ	Yearly	Project level	(3) 2020-2023
10.	Gender Streaming Forecast	UNIDO HQ	Yearly	Project level	(2) 2021-2022
11.	Gender Streaming Data	UNIDO HQ	Yearly	Project level	(2) 2021-2022
12.	MTR/TE	GEF	2.5 years	All	(1) MTR

However, what was found from the interviews with other stakeholders is that when asked in Qu. 12 whether their institution monitored the project in any way, and if any formal evaluations were done to see whether the project is having the desired results, most respondents drew a blank, inferring that they expected UNIDO to undertake this. This exercise would be especially important for the key governmental stakeholders, at MTI, ENCPC and IMC because ENCPC was formally contracted to be responsible for carrying out walk-throughs, thermal audits, measurements and IMC was responsible for logistics/transportation and contracting of service providers.

Because of the missing financial information in the PIR for the early years and the lack of support given to other institutions to undertake their own M&E, the score for this criterion (monitoring and evaluation) would be 5, which is Satisfactory.

3.10. Results Based Management

The definition of this evaluation criterion is an assessment of issues relating to results-based planning of the work, the M&E and reporting back, which would usually, but not exclusively, fall into UNIDO's responsibility. Results-Based Management (RBM) is sometimes called Management by Objectives (MBO) and the tool used is the LogFrame which guides the planning, implementation and evaluation of an intervention, using the principles of objectives, indicators, baselines, targets and sources of verification as well as risks and assumptions.

The LogFrame was assessed together with the following table, which follows the timeline of the project and sees how the works progressed and how the activities were reported on and checked against results expected. As the project activities proceeded, in addition to these tools used to manage results, the local UNIDO office stated that they prepared monthly monitoring reports although these have not been made available to the evaluation.

Table 23 – Results management against timeline

Stage	Management of Results
Preparation (2013 – 2014)	• GEF documentation (PIF and CEO Endorsement) • GEF and Government Approvals

Stage	Management of Results
Inception (2015 – 2017)	• SC Meetings • Roadmap and Implementation Plan • Annual Reporting • Monthly Monitoring Reporting
Mid-Term (2018 – 2019)	• SC Meetings • SHAMCI Decree • NBE Contract Agreement • Annual Reporting • Monthly Monitoring Reporting • MTR
Extensions (2020 - 2022)	• SC Meetings • IMC Contract Agreement • Capacity Building Reports • Project Disbursement Plan • Annual Reporting • PIR (GEF) • Monthly Monitoring Reporting • UN Internal Reporting (HQ) • Gender Streaming (HQ)
Closing (2023)	• SHIP Terminal Presentation • Exit Plan • TE

The assessment of RBM monitoring has already been considered to some degree in the previous section and judged as good, especially the detailed tracking of each of the activities, led by the UNIDO Egypt Office. The reporting of activities against the works originally planned has generally been satisfactory although in the early years the reporting was limited to annual submissions until better in-country project management was brought in from 2019/2020.

Further concerns are two-fold; i) whether the assessment of risks was done pro-actively enough in the mid-term when COVID-19 and external factors caused delays, particularly for the establishment of the Revolving Fund and ii) whether the delays that built up were managed in a manner to try and avoid the two extensions that were then required. In the end, the project which was designed as a 5-year intervention lasted over 8 years and towards the close of the project, one of the most important activities in Component 2 (i.e. enabling the Revolving Fund) was still being concluded.

Although the management of results is generally solid, because of the infrequent reporting at the early stages and concern that the risk register was not kept live, the assessment of RBM would also be evaluated as 5, which is Satisfactory.

3.11. Partners Performance

This section assesses the contribution of partners to the project design, implementation, monitoring, reporting, supervision, backstopping and evaluation and concentrates on UNIDO, the National Counterparts and the Donor.

UNIDO

The feedback from the evaluation has been overwhelmingly positive for UNIDO's management of the project and its coordination with stakeholders. The UNIDO inputs were highly regarded, noted as cooperative and proactive, with good coordination and follow up with beneficiaries. The following are highlights from the findings:

- The project was designed in a participatory manner with good involvement of the key stakeholders who subsequently became members of the Steering Committee.
- UNIDO is one of the main players in the renewable energy sector and their involvement gives importance to activities in this sector.
- UNIDO followed up well on activities and gave beneficiaries regular reminders to stay on track. For new beneficiaries such as hotels, UNIDO's expertise and 'knocking on the door' is still needed.
- UNIDO coordinated between consultants and the industrial sector, attended meetings and followed up on delivering data. Although UNIDO did not offer trainings in SWH manufacturing, trainings and methodology were conducted for installation and maintenance.
- Having a UNIDO local team taking the lead in the field of activity is a relatively new approach for UNIDO as usually projects are run from the HQ. This model assisted in efficient and faster implementation and should have been done earlier in the project cycle.

Some lessons learnt for UNIDO's performance is that sometimes the activities planned exceeded available human resources which caused delay. It was observed that the same UNIDO team members are often managing different activities across several projects. The project should have engaged the tourism sector from the beginning, as they are a very relevant and easy target group for solar water heating. Now some hotels (and factories) with feasibility studies want to start implementing and need further technical advice and support from the project.

National Counterparts

At the start of the project, the pace was not fast enough and UNIDO did not manage the Steering Committee well. This improved in the later stages although it was noted that the current Chair of the Steering Committee had only been involved in the last 1.5 years while there have been four other Chairs, with an average tenure of less than 2 years.

UNIDO has built a good relationship and access to MTI, not least because the local office is within the Ministry building. Overall, the project was continuously collaborating and engaging the main national counterparts to implement the targeted objectives:

- **Egyptian National Cleaner Production Centre (ENCPC)** - the leading executing partner and host location for the PMU. Of the total of 260 walk-throughs, ENCPC were responsible for 55.
- **Industrial Modernization Centre (IMC)** - worked closely with the PMU throughout Component 2. IMC has added the list of verified trained consultants to their list of SWH design certified consultants. Of the total of 260 walk-throughs took place with IMC responsible for 100.
- **New and Renewable Energy Authority (NREA)** - played the leading role for providing RE data, supporting policy development and setting up testing facilities for the quality assurance of locally produced components and systems.
- **Egyptian Organization for Standardization (EOS)** - supported the elaboration and adoption of quality standards for the local manufacturing of components, products and vendors.
- **Egyptian Accreditation Council (EGAC)** - the sole national body for the assessment and accreditation of conformity in Egypt, performing testing/calibration of laboratories, inspection and certification of products and systems, as well as personnel, with main role to overlook and confirm the accreditation of the NREA laboratories.

- **Productivity and Vocational Training Department (PVTD)** - provides productivity and vocational training service to improve Egyptian industrial development, it qualifies technical staff at various skill levels to improve productivity in industry and develop management systems. PVTD supported the roll out of various training modules to the industrial sector.
- **National Bank of Egypt (NBE)** - the largest Egyptian bank with a 27% share of the market for deposits and 21% of the loans market and the leading Egyptian bank in development/environmental financing. Main role was the manager of the Revolving Fund created within the project.

Donor

The GEF Focal Point is the Egyptian Environmental Affairs Agency (EEAA) which already has an existing close cooperation with UNIDO, not least because of the local office and presence of staff in Egypt and other UNIDO projects with GEF funding. This relationship helped UNIDO to make changes to the focus with the project, i.e. diversifying into hotels as beneficiaries. More recently the GEF Board approved the approach of UNIDO maintaining some focus on the SHIP initiatives while the project had been officially closed, to maintain support to some beneficiaries that have joined in activities towards the end.

The lesson is that the GEF oversaw the design of an intervention that in some areas was not realistic (i.e. the ability to encourage pilot projects) and this is perhaps because the market study was not thorough enough. Because the project was very comprehensive and quite ambitious in scope, the activities could have been applied in more planned stages and over 2 phases, not at once in one phase.

Overall the partners performance and their contributions into the project can be rated as a 5, which is Satisfactory.

4. Conclusions

4.1. Main conclusions

The UNIDO project 'Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry' (commonly known as the SHIP project) has been evaluated following its completion at the end of March 2023, after 8 ½ years of implementation. The evaluation used in-country interviews with the whole range of stakeholders, discussions with UNIDO HQ and analysis of documents provided. The summary of evaluation scores is given below and averaging across the 11 criteria with equal weighting gives an overall rating of 5, which is Satisfactory.

Criterion	Score
Design	4 – Moderately Satisfactory
Progress towards Impact	5 – Satisfactory
Relevance	6 – Highly Satisfactory
Effectiveness	5 – Satisfactory
Efficiency	5 – Satisfactory
Sustainability	4 – Moderately Satisfactory
Coherence	5 – Satisfactory
Gender Mainstreaming	6 – Highly Satisfactory
Monitoring & Evaluation	5 – Satisfactory
Results-based Management	5 – Satisfactory
Partners performance	5 – Satisfactory
Overall	**5 – Satisfactory**

Overall, the project is regarded as a success and is leaving a good legacy through the conduct of many trainings (benefiting over 1,300 people), setting up a Revolving Fund worth USD 4 million, holding many media and visibility events and achieving a high degree of outreach and awareness built, with a website in place for the future.

The design was appropriate at the inception of the project in 2013 and generally good, well thought-through and despite the long period of intervention the activities are as relevant as during the inception period. The LogFrame is very clear and has been well managed by the project team. But there were too many activities planned, some of them overlapped and a few targets were in the end unrealistic, such as the development of 100 pilot projects. The focus on the industrial sector was also too prescriptive although the project had the flexibility to add the hotel sector later on.

There are many notable impacts that will have long-term effects and contribute to the objective of developing the market environment for the diffusion and local manufacturing of solar energy for industrial process heat. The establishment of a Testing Laboratory at NREA and the route to have standards and quality certifications for the technology with assistance of the EOS is one notable outcome. The increased publicity and creating a more positive experience about SWH in Egypt has been another, as has the capacity building and feasibility studies / energy audits done. The full resourcing of the NBE Revolving Fund just before the project's close is also an important outcome and the project has now put in place conditions in the four arenas (policy, financial, technical and skills & awareness) to overcome barriers to the popularisation of solar water heating for process heat.

But there remain challenges for the continuation of project benefits including the current bad economic situation in Egypt, competition with the subsidised price of natural gas, customs tariff management, the unclear and expensive route for manufacturers to achieve SHAMCI certification and the lack of government resources to continue training and skills development.

The project is found to be highly relevant to the SWH sector and to the strategies of key Ministries and it is positive to now have focus on diversifying beneficiaries beyond the industrial sector. The project has understood that energy efficiency is as important as renewable energy when considering large industrial and commercial consumers. Coherence with other initiatives in the sector is also good and relevance to manufacturers is strong, although with the Ministry of Electricity and Renewable Energy, the focus is more on the potential for solar PV. Nevertheless the project has laid some important and timely foundations for the greater market penetration of SWH.

The effectiveness has been good, and the main targets have been met or exceeded by working on the demand and supply sides of the market. The involvement of banks at the beginning has borne fruit with the operationalisation of the Revolving Fund, which has assisted one applicant with a loan of USD 1.9 million. However, the higher visibility of the project has been missed because of the lack of pilot projects that can be exemplars, and in the end only 6% of the planned co-financing materialised so the target of USD 19 million investment into solar energy in the industrial sector has been missed. This has meant that the overall target of reducing over 2 million tonnes of CO_2 as a result of the project is unlikely.

The project resources appear to have been used efficiently, not least because the original budget has not been exceeded despite the project being extended twice, but due to the complexities and ambitious number of activities, the project should have been delivered in two phases. Notwithstanding the legacies already mentioned, the sustainability of impacts could be compromised as UNIDO withdraws from the sector and the main government stakeholders do not continue to champion and scale-up the initiatives so far.

There is no question as to the success in the mainstreaming of gender concerns, even if the percentage of women trained was only 21%, because this sector has traditionally been male dominated. The monitoring of gender aspects has been a particularly strong feature of the project, as has been the general level of monitoring and reporting, although more financial information should have been made available in the regular PIRs. There was also not enough management of results at the early stages of the project (2015 – 2019), nor continual tracking and management of risks during all stages, but the focus on developing the local team who were very active on the ground since 2019/2020 has been crucial in delivering this successful project.

4.2. Findings and Key Lessons

UNIDO's approach of working closely with industrial sector companies on a needs-based approach offering tailor made solutions and encouraging learning by doing has raised awareness about the complexities of implementing solar heat for industrial processes and making quality SWH products. But defining the technology in the project design as "solar for industrial process heat" put a constraint on the implementation of some activities whereas to have been more technology open-ended would have allowed some flexibility in reaching some targets. To date there no pilot projects were achieved (and it is not envisaged to have any in the next year) whereas solar systems for hotels may have been more easily piloted.

One finding is that the technical capacities of the government institutions have not been developed to the level of the UNIDO experts, even after the capacity building offered by the project. UNIDO endeavoured to diversify the government partners but due to continued weak capabilities and financial constraints, there needs to be a reconsideration of the design and approach of the capacity building to achieve better outcomes.

Despite that, the project did draw strength from the involvement of NREA and other government partners such as ENCPC, IMC, PVTD and EOS; many of the achievements were met because of their central roles. UNIDO giving emphasis on designing a Roadmap early on in 2017 was very important and demonstrated to the government partners that a project needs to have a vision and provide guidance to reach that vision, not just have capacity building and funding for project activities. UNIDO ensured that the project contained activities that addressed all elements of the market for SWH and this is how a deep impact was attained, rather than just counting output in numbers.

The project had to work in difficult circumstances, including the slow start due to government approvals and the long time to create the Revolving Loan Fund then a very volatile situation in the later stages with COVID-19 and other unforeseen turbulences from difficult economic conditions that were changing quickly. Yet, the project reacted fast, was flexible to respond to different market needs and was able to pivot and expand focus to include tourism.

One of the private sector partners that has installed a large solar PV system on the factory roof mentioned that a good understanding of energy aspect of company and experience in practical implementation is important in realising a SWH project. Those companies that are interested in protecting the environment as well as reducing operating costs would be the best developers of systems in the future. The point made about changing mindset of industry and believing that renewable energy will make a difference is reinforced as well as developers understanding that a side benefit of installing a SWH system helps to stimulate future demand.

However, the engagement from industry is difficult to predict and companies can be suddenly affected by external factors. With a few exceptions, the discussions with industrial partners and beneficiaries were not deep enough and may have stayed at the level of raising awareness and the content of the feasibility studies done. A tripartite agreement between government, industry and UNIDO at the commencement of the project activities may have assisted.

Despite the good final design of the Revolving Fund and good participation of the one bank that remained with the project (NBE), setting up the fund was challenging and the complexity was underestimated, and there was low demand for loans. This may now pick up with the GEF's USD 2 million commitment milestone recently met to be matched by the bank's equal counterpart funding. The bank thought that the involvement of the manufacturing sector may not have been the right choice for loans and that the tourism sector (hotels) should be the priority as one of the main drivers of economy with good payback periods possible. The bank also agreed that the route to achieving the Revolving Fund was too long and complex for the relatively small size of the fund.

The capacity building activities and transfer of knowledge encouraged through the project were regularly commented as being crucial in the implementation of this type of 'innovative' project. But often the timeframe of courses was too compressed in relation to the content to be covered, i.e. too much information in short time. Often, the language used was too advanced for technicians and electricians and as a result they did not absorb all information.

For the awareness activities, there were many techniques used to reach out to stakeholders including websites, social media, outreach in industrial zones, participation in EXPOs and press releases. This has been highly effective not least because local UNIDO staff drove the initiatives with enthusiasm and professionalism and contributed to the targets begin exceeded. Having the implementation team embedded in Egypt was a new model for UNIDO (although it is also done in Lebanon) and it undoubtably assisted in efficient and faster implementation and should have been enacted earlier.

Finally, the lack of SWH demonstration project/s in industrial applications as a result of the project is a learning point. Had the project financed one or two systems directly, a push would have been given to the financing and uptake of other schemes. The breadth of the project was large enough (and the duration long enough) to have been implemented in two stages and not all at once in one phase. Many of the activities required a lot of cooperation between entities in a short time frame without taking into consideration uncertainties or human resources fluctuation and implementation in separate phases would have helped in this regard.

4.3. Recommendations

1. The Ministry of Trade and Industry (MTI) has an important role to ensure sustainability of the initiatives started by the project and a follow-up is required by MTI on the implementation of the Roadmap. In addition, government should provide a supportive regulatory environment, including mandating government buildings and large industrial facilities to use renewables and having credible targets in place. There are issues around custom tariff management which impedes the import of renewable energy equipment needs high level political level involvement from the Ministry of Trade and Industry then the Industrial Modernisation Center (IMC) should monitor and review every couple of years how such customs are reducing competitiveness in the market.

2. UNIDO should undertake post-project monitoring on how the first National Bank of Egypt (NBE) loan made was handled and how any schemes that result from the Revolving Fund are maintained, monitored and evaluated.

3. For the trainings already developed and implemented by the Productivity and Vocational Training Department (PVTD), IMC and New and Renewable Energy Authority (NREA), these need to be continuously offered and the pool of trainers/service providers registered under the UNIDO project be continually expanded to match increasing demand. Many of those that have benefited from training of trainers now face financial constraints to continue delivering a range of trainings, so subsidized courses are suggested, particularly to attract more students. The approach within

the SHIP project of learning by doing with capacity building, should be applied to the residential sector, not least because of the huge potential solar water heating market.

4. The success of the awareness raising tools should be replicated through MTI using social media, internet-based promotion and even trade events or roadshows for promoting SWH technology.

5. UNIDO should recommend how to scale-up activities and this should be embedded into the exit strategy. Further collaboration with MTI, through the Egyptian National Cleaner Production Center (ENCPC), is still required with a SHIP champion in place to sustain the many project achievements.

In addition, based on this evaluation there are recommendations on how the solar water heating sector could be further bolstered after the SHIP project ends:

- The cost of solar water heater manufacturing has to be reduced to ultimately boost an increase in the market. The inclusion of the tourism sector is crucial to the development of the market so expansion into that sector should be sharpened.
- While the price of natural gas is still low and price of manufacturing SWH is still high, industry needs to come up with innovative ways of being competitive including clustering manufacturers to make certain components in bulk, participating and learning with other MENA countries in product manufacturing and demonstrating the use of solar for process heat in their own facilities. The model that the private sector has used to market solar PV could be learned from, for example, a developer taking some of the investment risk with commensurate benefit and participating with the beneficiary in realising a SWH project.
- Feedback from the manufacturers is that within the standardisation activities, there needs to be a simpler and cheaper process to achieving the SHAMCI accreditation and a clearer definition of roles between the entities involved in the process.

Annexes

Annex 1 - Project Logical Framework

Result	Baseline	Target / Indicator	Source of verification	Risk & Assumptions
Project Objective: To develop the market environment for the diffusion and local manufacturing of solar energy for industrial process heat.	The energy productivity of Egyptian industry is way below international average - Energy consumption per output is 10 to 50% higher than international average	2,166,085 t CO_2 eq reduced as a results of the spillover of project activities (indirect bottom-up)	Validated energy savings& energy generated from project reports	Willingness of state and industry to embrace program and invest time and money in improvement
Component 1: Develop policy instruments to promote the use of solar energy for industrial process heat in 3 sectors				
Outcome 1.1: Policy instruments promoting the use of solar energy for industrial process heat.	No roadmap for solar thermal energy in industry endorsed by the stakeholders No quality standards for solar energy systems enforced No certification programme for personnel installing solar energy systems enforced	Roadmap for solar thermal energy in 3 industrial sectors adopted by stakeholders Minimum quality standards for solar energy systems enforced Certification scheme for personnel in place	Government institutions, Official gazette	Willingness of the Egyptian Government to promote solar energy in industry
Output 1.1.1 A roadmap and implementation plan for dissemination of solar energy for industrial heat formulated	No roadmap for solar thermal energy in 3 industrial sectors developed	Roadmaps for solar thermal energy in 3 industrial sectors developed	Project Reports Official documents Websites of organizations	
Output 1.1.2 Instruments to control the quality of solar components, companies and personnel performing installation and maintenance of solar energy systems	No quality standards for solar energy systems developed	2 standards for solar energy systems developed		
	No certification framework for certification of personnel developed	1 Framework for the certification of personnel developed		
Component 2: Mobilize financing for the deployment of solar energy for industrial heat				
Outcome 2.1.: Financing for the deployment of solar energy for industrial heat Mobilized	Limited investments made in solar thermal technologies in the industrial sector Limited emission reductions as a result of fuel switching to solar energy for industrial heat (project replication effect)	$ 19 million invested in solar energy in the industrial sector 8,907,180 GJ direct savings over 10 years. Direct emission reductions of 722,028 t CO2 eq. over 10 years.	Reports of financial institutions, reports and statistics of development financial institutions and Government agencies	Banks interested and willing to invest in RE
Output 2.1.1. Revolving Fund to facilitate financing of solar thermal technologies is set up	No dedicated fund for financing solar energy for industrial applications	Revolving fund is set-up and disburses US$ 4 million over the project duration in loans	Bank report and statements of the fund account	
Output 2.1.2. Solar thermal technologies installed in selected facilities	Limited projects improving the energy efficiency of the industrial heat system implemented	System optimization measures for industrial process heat implemented in 100 enterprises	Workshop report Progress & monitoring reports	

	Limited installations of solar energy in industrial applications	100 installations of solar energy made in industrial applications	Monitoring reports, site visits	
Output 2.1.3. Technical capacity of staff of local banks on the assessment of projects enhanced	Staff of local banks have a limited knowledge of the assessment of business plans for financing solar thermal installations in industry	150 bank staff trained on evaluation of projects (30% females)	Workshop reports	
Output 2.1.4. Awareness campaign on solar thermal technologies for industrial process heat implemented	Limited activities targeting the awareness of industries, experts and stakeholders on solar thermal applications in the industrial sector	20 workshops organized targeting 500 participants (30% females) 2 Leaflets distributed 5 press releases published 100 best practice case studies compiled 10 visits to successful projects organized	Workshop reports, publicity in media, progress reports	
Component 3. Improve the manufacture, supply and distribution of solar energy components and systems				
Outcome 3.1.: The local manufacture, supply and distribution of solar energy components and systems is strengthened	10% of the products manufactured fulfill quality requirements	50% of products manufactured locally fulfill quality requirements	Statistics and reports of the Government	
Output 3.1.1. Laboratory facility for testing quality of the local manufactured and imported products is accredited	No facility for testing the quality of locally manufactured products is accredited	1 Facility for testing is accredited	Official reports	
Output 3.1.2 Basic tools and training required for improving the quality of locally manufactured components provided	None of the local manufacturers possess tools required to produce good quality components	40 companies own tools required to improve the quality of their manufactured products Manual on best practices in the manufacturing developed	Site visits Reports Progress reports	
Output 3.1.3. Training programme on best practices in the manufacture of solar energy components and systems conducted	Staff of local manufacturers do not have the skills to manufacture good quality products	200 technicians from selected companies trained (10% females) Manual on best practices developed	Training reports Manual available	
Output 3.1.4 Capacity of the testing laboratory staff on testing protocols and procedures developed	Staff of the testing laboratory do no have the skills required for the testing	20 experts of the testing laboratory trained (20% females) Manual on testing procedures developed	Training reports Manual available	
Output 3.1.5 A platform to enhance information exchange, cooperation and partnerships between local industries, international centers of excellence and technology suppliers created	No platform is available	1 platform is established and functioning	Progress report, website of the platform, monitoring of statistics and figures	
Component 4: Build the capacity of technical staff designing, developing and servicing solar systems				

Outcome 4.1. Technical capacity of the system designers, developers, facility managers and service providers for solar energy utilization for industrial process heat enhanced.	No institutionalized training courses available	4 Training courses developed are run at the vocational training schools	Curricula of the Vocational training schools	Availability of experts to receive the training Vocational training schools have sufficient capacity to hold the trainings
Output 4.1.1. Training programme on energy savings based on process heat optimization for experts, facility managers and service providers is conducted	Staff of companies not aware of the opportunities for EE improvements	100 experts trained on SO (10% females)	Training reports, progress reports	
Output 4.1.2. Training programme on system design for experts, facility managers and service providers is conducted.	No experts aware of the best practice in the design of solar thermal systems	20 experts and 50 vendors trained on system design (10% females)	Training reports, progress reports	
Ouput 4.1.3. Training programme on solar thermal equipment installation and servicing for technicians, installers and service providers established.	A limited number of technicians is trained on proper installation and servicing procedures	200 technicians trained on proper installation and servicing practices (10% females)	Training reports, progress reports	
Output 4.1.4. Training programme on business development for solar energy businesses developed	Enterprises and entrepreneurs working in the energy sector do not possess sufficient management skills to support the market development	100 entrepreneurs trained on business development (20 % females)	Training reports, progress reports	

Annex 2 – Terms of Reference

https://downloads.unido.org/ot/30/75/30757871/TOR_Independent%20terminal%20evaluation.%20EGYPT.%20Utilizing%20solar%20energy%20for%20industrial%20process%20heat%20in%20Egyptian%20industry%20(UNIDO%20project%20No.%20120073_%20GEF%20ID_%204790)%20(February%202023).pdf

Annex 3 – In-country schedule and itinerary

Date	Time	Person to meet	Entity	Position/affiliation	Virtual/Physical	Location
Sunday 12th of March 2023	10:00 - 10:30	Dr. Gihan Bayoumi	UNIDO	National Programme Officer	Physical	2 Latin America Street, Qasr Al Nile
	10:30 - 12:30	PMU Dr. Gihan Bayoumi Eng. Yahia El Masry Eng. Yasmine El Bayoumy Eng. Moaaz El Gebaily Eng. Sondos Eissa Mrs. Amira Abdel Galil Eng. Hana Farag	UNIDO	Team: Discuss Project objectives/targets/status National Programme Officer Technical Expert Junior Technical Expert Technical Consultant Technical Expert Communication Consultant Monitoring and Evaluation Expert	Physical	2 Latin America Street, Qasr Al Nile
	Lunch Break					
	13:30 - 14:00	Mr. Amr Hazzaa	MTI	Minister's Advisor & Head of Developmental Projects Unit (Steering Committee Chair)	**Virtual**	2 Latin America Street, Qasr Al Nile
	14:00 - 15:00	Shahenaz Fouad	UNIDO	National Project Coordinator Deep Egypt Programe	**Virtual**	2 Latin America Street, Qasr Al Nile
	15:00 - 16:00	Dr. Ahmed Huzayyin	Chemonis	Manager of the Eco-Industrial Dept, Chemonics Egypt Consultants	Physical	2 Latin America Street, Qasr Al Nile
Monday 13th of March 2023	**09:15 - 10:00**	Mr. Samir Sobhy Ayad	Beneficiary	Chairman - Egyptian Solar Energy Company	Physical	Block 302 Street 40 from Street 3, Industrial City Zone One, 6th of October, Giza
	Average 1 hr transporting to PVTD					
	11:00 - 11:30	Eng Amal Hamdi	PVTD	Head of Energy Unit	Physical	30 Tadrib El Motadaribeen St. El Amireya, El Zaytoun, Cairo
	Average 30 mins. Transporting to EOS					
	12:00 - 12:45	Eng. Abir Sadek	EOS	GM .Technical Relations Department	Physical	16 Tadrib El Motadaribeen St. El Amireya, El Zaytoun, Cairo
	Average 30 mins. Transporting to office					
	15:00 - 15:45	Eng. Rabab Manee	Beneficiary	Energy & Environment Sustainability Manager, Oriental Weavers	**Virtual**	Virtual
	15:45 - 16:30	Eng. Wissam Waheed	Beneficiary	Akassia Hotel Owner (Tourism Sector)	**Virtual**	Virtual
	16:30 - 17:15	Eng. Hatem Adawy	Beneficiary	Maarib Factory (Industrial Sector)	**Virtual**	Virtual

Tuesday 14th of March 2023	10:00 - 11:00	Ms. Hoda Omar GEF Dr. Mohamed Farouk Dr. Nader Ali	GEF/ EEAA	- GEF Unit Director - General Manager of Sustainable Energy Department - Director of the Clean Energy Department	Physical	30, Misr Helwan El-Zyrae Road, Cairo, Maadi
	Average 15mins. Transporting to NBE					
	11:30 - 12:30	Mr. Shahir Zaki Dr. Hoda Sabry	NBE	TBC Senior Financial Management Consultant	Physical	NBE Tower, 1187 Nile Corniche, Egypt 29th floor in the South Tower
	Average 30mins. Transporting to IMC & Lunch Break					
	14:00 - 15:00	Eng. Mohamed Kamal Mrs. Reham Abdel Ghaffar	IMC	- Deputy Director International Project Department - Project Manager	Physical	1195 Corniche El Nile, Cairo Egypt
	Average 15mins. Transporting to MTI Office					
Wednesday 15th of March 2023	10:00 -12:00	Dr. Mohamed El Khayat Eng. Ehab Ismaeil Eng. Amgad El Heweihy Eng. Ehab Farouk Eng. Ayman Fathy - EGAC	NREA/EGAC	- Chairman -Vice Chairman - Head of Research, Study and Testing	Physical	Ibrahim Abou El Naga, Nasr City
	Average 1 hours Transporting to Fresh Facility & Lunch Break					
	13:30 - 15:00	Eng. Bahaa Dimitry	Beneficiary	Vice CEO - Fresh	Physical	EWH factory in 10th of Ramadan
	16:30- 17:00	Mr. Ahmed Rezk	UNIDO	Deputy Representative, and OiC Egypt	**Virtual**	2 Latin America Street, Qasr Al Nile
Thursday 16th of March 2023	10:00 - 11:00	Dr. Ahmed Wafiq	Integral	Managing Director	Physical	2 Latin America Street, Qasr Al Nile
	11:00 - 12:00	Eng. Mohamed Sabry	MTI/ENCPC	- Deputy Director and Acting Director of ENCPC	Physical	2 Latin America Street, Qasr Al Nile
	Lunch Break					
	13:00 - 14:30	PMU Dr. Gihan Bayoumi Eng. Yahia El Masry Eng. Yasmine El Bayoumy Eng. Moaaz El Gebaily Eng. Sondos Eissa Mrs. Amira Abdel Galil Eng. Hana Farag	UNIDO	Team: Discuss Project objectives/targets/status National Programme Officer Technical Expert Junior Technical Expert Technical Consultant Technical Expert Communication Consultant Monitoring and Evaluation Expert	Physical	2 Latin America Street, Qasr Al Nile
	15:00 - 16:00	Eng Ali Habib	Consultant	Energy Expert	**Virtual**	2 Latin America Street, Qasr Al Nile

Annex 4 – People met who participated in interviews during the Evaluation

Interviewee Name	Organization	Position	Date	Group
Dr. Gihan Bayoumi	UNIDO	National Programme Officer	12.3.23	UNIDO
Yahia El-Masry	UNIDO	SHIP Technical Expert	12.3.23	Consultant
Moaaz Gebaily	UNIDO	SHIP Technical Expert	12.3.23	Consultant
Mr. Amr Hazzaa	MTI	Minister's Advisor & Head of Developmental Projects Unit (Steering Committee Chair)	12.3.23	Partner
Ms. Shahenaz Fouad	UNIDO	National Project Coordinator- Egypt Programme	12.3.23	UNIDO
Dr. Ahmed Huzainn	Chemonics	Manager of the Eco-Industrial Dept, Chemonics Egypt Consultants	12.3.23	Consultant
Dr Samir Sobhy Ayad	Egyptian Solar Energy Company	Chairman	13.3.23	Beneficiary
Amal Hamdi	PVTD	Head of Energy Unit	13.3.23	Partner
Nermine Adel	PVTD	Director of Mechatronics Dept. TCC	13.3.23	Partner
Merwat Demian	PVTD	Director of the Practical Training Dept at the staff training institute & trainer for Solar Thermal system	13.3.23	Partner
Amal Mohamadein	PVTD	Trainer for Solar Thermal System and closed Loop control	13.3.23	Partner
Ehab Hassan	PVTD	Director of Leather Goods	13.3.23	Partner
Ahmed Moh Abdel Aty	PVTD	Trainer for Solar Thermal System	13.3.23	Partner
Abou Zeid Lotfy	PVTD	Trainer for Solar Thermal System	13.3.23	Partner
Abir Sadek	EOS	General Manager. Technical Relations Department	13.3.23	Partner
Eng. Rabab Manee	Oriental Weavers (Textile Sector)	Energy & Environment Sustainability Manager	13.3.23	Beneficiary
Eng. Hatem Adawy	Maarib Factory (Industrial Sector)	General Manager	13.3.23	Beneficiary
Asma Bahubaish	Maarib Factory (Industrial Sector)	Quality Control Manager	13.3.23	Beneficiary
Eng. Wissam Waheed	Akassia Hotel (Tourism Sector)	Owner	13.3.23	Beneficiary
Hoda Omar	Egyptian Environmental Affairs Agency (EEAA)	GEF Head	14.3.23	Partner
Nader Ali	EEAA	General Manager of Sustainable Energy Department	14.3.23	Partner

Interviewee Name	Organization	Position	Date	Group
Mohammed Farouk	EEAA	Head of Inspection and Compliance	14.3.23	Partner
Hoda Sabry	UNIDO	Senior Financial Management Consultant	14.3.23	Consultant
Shahir Zaki	NBE	General Manager. International Financial Services Sector	14.3.23	Partner
Noura Moh. Abou el Nasr	NBE	Deputy Manager. National and Environmental Project Loans Unit	14.3.23	Partner
Mohamed Kamal	IMC	Deputy Director International Project Department	14.3.23	Partner
Reham Abdel Ghaffar	IMC	International Project Manager	14.3.23	Partner
Ehab Ismaeil Amin	NREA	Vice Chairman for Technical Affairs	15.3.23	Partner
Ehab Farouk Abd el-Aziz	NREA	Head of Research, Study and Testing	15.3.23	Partner
Amgad El Heweihy	NREA	Head of Sector of Studies, Research and Testing	15.3.23	Partner
Eng. Bahaa Dimitry	FRESH	Vice CEO	15.3.23	Beneficiary
Mohamed Abdel Hay	FRESH	Plant Manager	15.3.23	Beneficiary
Ahmed Rezk	UNIDO	Deputy Representative, and OIC Egypt	15.3.23	UNIDO
Dr. Ahmed Wafiq	INTEGRAL	Managing Director	16.3.23	Consultant
Eng. Mohamed Sabry	ENCPC	Deputy Director and Acting Director	16.3.23	Partner
Eng. Ali Habib	UNIDO	Energy Expert	16.3.23	Consultant
Rana Ghoneim	UNIDO HQ	Project Manager	03.4.23	UNIDO

Annex 5 - Guide questions for planned interviews

It is proposed to use semi-structured interviews with key informants with both the Team Leader and National Consultant present. The majority of meetings are planned to be in person, but for those to be conducted virtually, the same process is used. The differences between these techniques are highlighted below:

- Structured interviews - Uses a standard list of questions following a pre-determined order – easily conducted and compared to other interviews BUT does not allow for flexibility in answering and sometimes fails to solicit depth in the answers.
- Semi-Structured interviews – Uses a standard list of questions but the interviewer can determine the order depending on the flow of the conversation – creates a good balance between formal responses and spontaneity BUT makes comparability with other interviews more difficult.

Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry

UNIDO ID: 120073

Interviewee details:

Name_____

Institution / Employer_____

Place of work address_____

Length of employment_____

Questions:

1. Please describe how have you been involved in the project and for how long?

   _____

   _____

   _____

   _____

   _____

2. What specific components in the project you have been involved with?

   [Component 1: Develop policy instruments to promote the use of solar energy for industrial process heat in 3 sectors.
   Component 2: Mobilize financing for the deployment of solar energy for industrial heat.
   Component 3: Improve the manufacture, supply and distribution of solar energy components and systems.
   Component 4: Build the capacity of technical staff designing, developing and servicing solar systems]

   _____

   _____

   _____

   _____

   _____

3. Would you say that the project is **IN LINE WITH THE PRIORITIES** and policies of your institution?

   _____

   _____

   _____

   _____

   _____

4. What are the other institutions involved and did the project have **COMPATIBILITY** with their policies and to the country as a whole?

5. How would you describe the **IMPACT** of the project, for any long-term results produced (Outputs & Outcomes)?

6. Would you say that these results will **BE SUSTAINED** in the short, medium or long-term?

7. What have been the **KEY DRIVERS** to achieve the project goal (i.e. *To develop the market environment for the diffusion and local manufacturing of solar energy for industrial process heat)*. Have there been any **BARRIERS**?

8. Has the project put in place the **CONDITIONS TO HELP** these drivers and to overcome the barriers to achieve the long-term goal?

9. What **INPUTS** did your institution commit to in the project (i.e. funding, time, services etc.)?

10. Have there been any **RISKS** (technical, financial, institutional or environmental) in the project implementation, and will they affect the continuation of project results?

11. How were **GENDER** issues integrated into the project (i.e. involvement of women in decision making etc.)?

12. Did you/your institution **MONITOR** the project in any way? Have you/your institution formally **ASSESSED or EVALUATED** whether the project is having the desired results? How was this done?

13. Do you have any comments about how **UNIDO and other donors** to the project managed the design, implementation, monitoring, reporting, supervision, backstopping and evaluation of the project?

14. Overall, what **LESSONS** do you draw from this project intervention?

Date of interview:

Name and signature of interviewer:

Annex 6 – Performance against LogFrame and exit strategy

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
Component 1. Develop policy instruments to promote the use of solar energy for industrial process heat							
1.1. A roadmap and implementation plan for dissemination of solar energy for industrial heat in the 3 selected sectors formulated	1.1.1.1. Perform a detailed assessment of the potential for EE improvements and introduction of solar energy in the three selected sectors	Completed	**100% of targets achieved** 1st, 2nd & 3rd progress reports delivered Final roadmap developed Initiation workshop conducted Public Workshop Conducted	No			
	1.1.1.2. Develop the roadmaps and implementation plan	Completed		Yes	It is the MTI role to continue to follow-up on the Implementation Plan for the roadmap of the local manufacturer and to do the regular update for the market data and feasibility according to the changes in the market	MTI	ENCPC
	1.1.1.3. Conduct stakeholder consultations to ensure public acceptance of the suggested roadmaps & plans	Completed		No			
1.1.Instruments to control the quality of solar components, companies and personnel performing installation and	1.1.2.1. Develop standards for minimum required quality of solar components	Completed	**100% of targets achieved** National Roadmap for strengthening the quality of locally manufactured products and components related to SWH and Solar thermal technologies completed and published. Standards for minimum required	Yes	Regular follow-up on the International Standards for the solar water heater. system/components to update the national standards if required	MTI	EOS

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
maintenance of solar energy systems	1.1.2.2. Develop a framework for the certification of personnel working in the installation and maintenance of solar energy systems	Completed	quality of solar components developed. Manual of standard operation procedure on installation and maintenance of SWH components and systems developed. Minimum requirements for Installer & Maintainer certification scheme formulated.	Yes	Keep promoting the certification scheme and the training through the training centers in NREA, PVTD and SWH Egypt Platform. Evaluate the training content with the trainees and update the content according to the need of the trainees	NREA	PVTD
	1.1.2.3. Define lists of approved solar collectors and other component manufacturers and lists of approved installers	Completed	Training centres operational scheme developed and supplied with required equipment. PVTD and NREA training centres establishment. Train of the trainers (IMC, PVTD and NREA). SCHAMCI/Solar Keymark became mandatory SWH standard for all manufacturers and suppliers with ministerial decree.	Yes	Keep tracking the certified personnel and companies through the SWH Egypt Platform and the training centers in NREA and PVTD	NREA	NREA
Component 2. Mobilize financing for the deployment of solar energy for industrial heat							
2.1.1. Revolving Fund to facilitate financing of solar thermal technologies is set up	2.1.1.1. Set-up a revolving fund to finance investment projects	Completed	**100% of targets achieved** As part of being agile and responding to current changes on both international and national levels from COVID-19 and national economic situation, the project has drafted a proposal for a modified funding mechanism that requests the inclusion of nonindustrial sectors such as the tourism sector as well as requesting to support the SWH local manufacturers to receive funding from the SHIP revolving fund in order to diversify the funding opportunities, encourage local	No			
	2.1.1.2. Train staff of local banks on identification, development and evaluation of demonstration projects	Completed		Yes	NBE Local staff members are operating the revolving fund which will continue beyond the project duration. Other local staff members from local banks are now capable to understand and deal		

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
			manufacturing and speed up the disbursements rates. The fund will support the tourism sector and local manufacturing of SWH		with the RE projects in case funding will be there.		
	2.1.1.3. Establish links with banks offering RE loans	Completed		No			
2.1.2. Solar thermal technologies installed in selected facilities	2.1.2.1. Select companies where pilot projects will be implemented	Completed	SHIP continues its effort to enroll industrial enterprises under the project umbrella with valuable technical assistance. 410 Companies are identified and recorded in the Leads Database, where the food sector represents 55% of the registrations, textile 27% and Chemicals 16%. 260 Walkthroughs, 81 detailed thermal audits prepared and 9 measurements visits conducted. The project target has changed from 100 to 14 pilot projects.	No	The idea is to keep the NBE revolving fund running beyond the project duration in order to sustain the project's activities. NBE is familiar and trained on how to continue to operate the fund. The idea was also to familiarise IMC to the contracting procedures needed for hiring technical experts who were trained by the project and who can carry out feasibility studies. The project was providing the experts' fees during its life time, but after its termination, it is IMC's role to seek for funding for those experts. Funding		
	2.1.2.2. Prepare technical and financial feasibility studies for 100 pilot projects	In process		No			
	2.1.2.3. Sign loan agreements with 100 enterprises	In process		Yes			
	2.1.2.4. Companies will procure and install solar thermal equipment for 100 pilots	In process		Yes			
	2.1.2.5. Monitor, verify and report the performance of the installed systems	Pending		No			

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
					could be provided by the beneficiries.		
2.1.3. Technical capacity of staff of local banks on the assessment of projects enhanced	2.1.3.1. Organize 5 introductory workshops for 150 bank staff	Completed	**100% of targets achieved** 10 training rounds completed reaching accumulated 353 trainees over the project life-time, Covering 22 National/International banks with 15% females representation. 1st Study Tour to Tunisia in cooperation with IEE project in 2017. 2nd Study Tour to Tunisia in June 2022 included NBE representatives as well as first tour.	Yes	Technical capacity which was built by the project for the local banking staff will enable them to understand the nature of RE projects and how those should be funded.		
	2.1.3.2. Organize 3 expert training workshops for 60 bank staff	Completed					
	2.1.3.3. Provide personal coaching for 20 bank staff	Completed					
2.1.4. Awareness campaign on solar thermal technologies for industrial process heat implemented	2.1.4.1. Organize 20 workshops over the project lifetime	Completed	**90% Targets Achieved:** 11 Workshops completed with over 600 participants. Marketing Material produced; Project Logo, Rollup, Brochure and Notebooks. 6 Press releases in Newspapers both En/Ar languages. SWH platform launching event with 52 participants. Disseminating Installer and Maintainer (I&M) educational film via all virtual platforms. Disseminated 2 case studies on UNIDO accelerator and SHIP's platforms.	No			
	2.1.4.2. Develop and distribute leaflets	Completed		Yes	I suggest the virtual version of SHIP's promotional material including the leaflets to be uploaded on IMC's website under the project's tab and to be uploaded on SHIP's peer to peer website. SHIP website to be handed and managed by IMC as well.	IMC	MTI

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
	2.1.4.3 Prepare and disseminate press releases via various media sources	Completed	UNIDO participated in the World Youth Forum (WYF), specifically in the "Energy Pathways: Towards a Safer Future". MoIC/UNDP energy video published in "All African Week" Marketing campaign launched using outdoor billboards, radio channels airing 37.5 hours, branded trucks, industrial zone parades, promotional videos, revolving fund brochure and flyer, complete coverage of all project activities, website/social media creation, Infographic PSA video and promotional stands in FEI/IMC/MoTI. All publications and material had a gender dimension. Drafted infographic representing lessons learnt throughout project life-time.	Yes			
	2.1.4.4. Document and disseminate good practice case studies of demonstration projects implemented through the project	Completed		Yes	Continuation of the operation of the project's website where all documentation of project results, case studies, manuals, lessons learnt are published, is considered a way to sustain the project's efforts		
	2.1.4.5. Organize technical tours to installed sites	Pending					
Component 3. Improve the manufacture, supply and distribution of solar energy components and systems							
3.1.1. Laboratory facility for testing quality of the locally manufacturers and imported	3.1.1.1. Perform an assessment and mapping of the existing and planned laboratory facilities and capacities in the country. Provide advisory support and agree on the scope of the tests to be accredited	Completed	**100% of targets achieved:** Combined list of manufacturers, suppliers completed. Registration form for interested SWH	No			

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
products accredited	3.1.1.2. Develop the quality management system of the target laboratory following international accreditation standards for the target tests	Completed	suppliers distributed. NREA completed the tests and received the certification on 31st of January 2022 for the participation in the proficiency test of "Testing of Solar Collector and system" and Conducting One cycle of inter-laboratory comparison. Accreditation test of CENER in NREA laboratory was completed and report was developed. Qualified engineers certified according to the newly released standards for the SWH testing methods. Training material developed on the testing procedures revision.	No			
	3.1.1.3. Develop the related testing procedures, sampling techniques, verification and validation protocols needed for the target scope	Completed		No			
	3.1.1.4. Conduct at least one cycle of inter-laboratory comparison and proficiency testing scheme as part of the accreditation process	Completed		Yes	NREA needs to review the standards every year for any updates required in the Lab. Keep track of the validation of the calibrated Sensors. Must do regular internal audits for the sensors and regular checks for all the solar water heater tests	NREA	NREA
	3.1.1.5. Apply and go through accreditation process	Completed		Yes	Keep track of the validation of the calibrated Sensors for the renewal of the certificates every year	NREA	NREA
3.1.2. Capacity of the testing laboratory staff on testing protocols and procedures developed.	3.1.2.1. Develop training material on testing protocols and procedures for quality testing of products and components	Completed	November 2020 for the duration of 11 days an on-line training course titled "Training on testing protocols and procedures of SWH components" on both theoretical and practical parts to 15 trainees affiliated to NREA, EOS & EGAC. An on-line training was provided by CENER in May 2022 over 3-days for	No			
	3.1.2.2. Organize an expert group meeting with experts from various centers of excellence to share and exchange knowledge and lessons learned on quality testing of solar components and products	Completed		No			

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
	3.1.2.3. Train 20 experts from NREA and EOS	Completed	revising the testing procedures. The training was attended by 6 trainees (50% females).	No			
	3.1.2.4. Conduct on the job coaching and monitoring of the staff practices	Completed		No			
3.1.3. Basic tools and training required for improving the quality of locally manufactured components provided	3.1.3.1. Select 40 companies to be assisted in upgrading their practices to ensure quality manufacturing of components	Completed	**100% of targets achieved:** 1st Study Tour conducted to Europe in February 2020 for information exchange to NREA representatives. 2nd study tour in June 2022 to Tunisia with participation of NREA, ENCPC, IMC, NBE and representatives from manufacturers and service providers (22 participants; 18 males and 4 females equivalent to 18%) During the study tour, MoU of cooperation were signed with SEDA, NREA and ENCPC. B2B event was organized in September 2022 combining various market stakeholders for linkages and market stimulation.	No			
	3.1.3.2. Identify and procure tools and sets of equipment required to ensure better quality manufacturing of components	Completed		No			
	3.1.3.3. Develop a manual on best practices in the manufacture of solar energy components and systems	Completed		No			
	3.1.3.4. Train 40 companies on the use of the tools and equipment and the improvements required for their components/products	Completed		Yes	The training material is shared with IMC to keep developing this kind of training	MTI	IMC
	3.1.3.5. Create linkages between the supply and demand side to stimulate the market	Completed		Yes	This can be the role of NREA to promote the registered companies/personals on the SWH Egypt Platform and, update all the finical tools that can be used for financing the SWH system through the platform. this will create a sustainable linkage		
	3.1.3.6. Technical assistance for start-ups and solar energy entrepreneurs	Completed		Yes	The training material is shared with IMC to keep developing this kind of training	MTI	IMC

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
3.1.4. Training programme on best practices of solar energy components and systems conducted d systems conducted	3.1.4.1. Prepare a manual on best practices in the manufacture of solar energy components and systems	Completed	**100% of targets achieved:** Manual developed. The activity focus was re-visited to provide capacity building services to manufacturers rather than upgrade; Two trainings conducted - October 2019 & Febrary 2020 to 24 companies and 43 companies/4 institutes respectively. Training for 220 participants completed (35 females 16%, 185 males 84%)	No			
	3.1.4.2. Identify 40 companies to receive the training	Completed		No			
	3.1.4.3. Organize workshops to train at least 200 technicians from selected companies	Completed		Yes	The training material is shared with IMC to keep developing this kind of training	MTI	IMC
3.1.5. A platform to enhance information exchange, cooperation and partnerships between local industries, international centers of excellence and technology suppliers created	3.1.5.1. Design the framework of the platform: Partners, scope, objectives, means for attracting investments in the sector, etc	Completed	**100% of targets achieved:** A platform to enhance information exchange, cooperation and partnerships between local industries, international centres of excellence and technology suppliers created. NREA signed handing over form of SWH platform. Training on platform operation & MNE using google analytics developed to 9 trainees from NREA IT & technical team. 6 MNE platform operation reports delivered.	No			
	3.1.5.2. Launch and operate the platform	Completed		No			
	3.1.5.3. Monitor the results of the platform and feed-in opportunities for improvement	Completed		Yes	NREA must keep monitoring the platform as we developed a framework for monitoring the data of the platform. and we trained NREA on how to use google analytic to analyze the data to keep	NREA	NREA

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
					updating the platform		
Component 4. Build the capacity of technical staff designing, developing and servicing solar systems							
4.1.1. Training programme on energy savings based on process heat optimization for experts, facility managers and service providers is conducted	4.1.1.1. Adapt the UNIDO SO library for process heat to the selected sectors	Completed	**100% of targets achieved:** SSO equipment purchased. SSO material adapted and customized to Egypt context. 2 trainings on SSO for 129 trainees were held. 18 technical experts registered in IMC service provider list.	No			
	4.1.1.2. Measurement equipment available for SO implementation and verification	Completed		No			
	4.1.1.3. Awareness program for SO expert training	Completed		No			
	4.1.1.4. Training of 20 SO experts delivered over 18 months	Completed		No			
	4.1.1.5. Ongoing support to national trainees for duration of project	Completed		No			
	4.1.1.6. (1/2) day course delivered to 50 vendor companies	Completed		No			
	4.1.1.7. (2) day user training delivered to 100 engineers working in selected industrial sectors	Completed		No			
4.1.2. Training programme on system design for experts, facility managers and service providers is conducted	4.1.2.1. Develop training material on the design for solar thermal systems for industrial purposes	Completed	**100% of targets achieved:** Material Developed. 27 Trainees through 4-days online training and 6 industrial facilities completed SWH system designs plus refreshment webinar to 20 local experts. 8 SWH designs completed and 23 SWH design consultants certified. 2-Rounds of basic SWH design training for factories representatives and suppliers in March 2021 for	No			
	4.1.2.2. Training of 20 experts delivered over 12 months	Completed		No			
	4.1.2.3. Ongoing support to national trainees for duration of project	Completed		No			

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
	4.1.2.4. (1/2) day course delivered to 50 vendor companies	Completed	more than 69 individuals affiliated to 37 solar thermal systems' manufacturers/suppliers and 32 manufacturing industries. Advanced SWH design training round to 21 participants organized.	No			
	4.1.2.5. Integrate the training into ongoing curricula of the vocational training schools and relevant universities	Completed		No			
4.1.3. Training programme on solar thermal equipment installation and servicing for technicians, installers and service providers established.	4.1.3.1. Develop training material on the design for solar thermal systems for industrial purposes (on solar thermal equipment installation and servicing for technicians, installers and service providers established.)	Completed	**100% of targets achieved:** Material Developed and published. Two Training Rounds: Tools/equipment & practices improvement upgrade for 106 participants/67 Companies. Train of the Trainer (ToT) theoretical and practical training completed Measurements equipment's purchased and delivered, two training centres prepared in NREA and PVTD Five rounds of the training of SWH installation and maintenance were developed to several target audiences such as NREA, IMC and SWH market to 99 participants (16% females 16 female particpants). Coaching 5 NREA staff, 8 from IMC that attended ToT. Technical support to NREA to roll out the training for SWH installation and maintenance in cooperation with PVTD and IMC.	Yes	We developed 2 training centers for the installation and maintenance of the SWH system/components. and develop training of the trainers for candidates from NREA, PVTD, and IMC as well as coaching them. By this way we guaranteed the sustainability of developing this training and qualify personals. The trainers from NREA, PVTD, and IMC need to qualify more trainers too and coach them	NREA	PVTD
	4.1.3.2. Training of 200 technicians	Completed		Yes	We developed 2 training centers for the installation and maintenance of the SWH system/components. and developed training of the trainers for candidates from	NREA	PVTD

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
					NREA, PVTD, and IMC as well as coaching them. By this way we guaranteed the sustainability of developing this training and qualify personals. The trainers from NREA, PVTD, and IMC need to qualify more trainers too and coach them		
	4.1.3.3. Integrate the training into ongoing curricula of the vocational training schools	Completed		Yes	PVTD has a short-term curriculum, so they must decide if they can integrate it in the long-term curriculum	MTI	PVTD
4.1.4. Training programme on business development for solar energy businesses developed	4.1.4.1. Develop training material on business development and entrepreneurship for the solar energy businesses	Completed	**100% of targets achieved:** Training material on business development and entrepreneurship for solar energy businesses were developed. 9 one to one consultation sessions completed. One session to IMC. Taining on business development and entrepreneurship for the solar energy businesses to 145 participants affiliated to solar thermal systems' manufacturers,	Yes	We developed a Training of the trainers for candidates from IMC on the as well as coaching them on business development and entrepreneurship for the solar water heater businesses. training material is shared with IMC to keep developing this kind of training	MTI	IMC

Output	Activity	Status	Achievements	Exit Action Needed?	Recommended Exit Action	Responsible Entity	Supervising Counterparty
	4.1.4.2. Training of 100 small enterprises	Completed	suppliers, start-ups & entrepreneurs (17% females, 25 female participants).	Yes	We developed a Training of the trainers for candidates from IMC on the as well as coaching them on business development and entrepreneurship for the solar water heater businesses. training material is shared with IMC to keep developing this kind of training	MTI	IMC
	4.1.4.3. Integrate the training into ongoing curricula of the vocational training schools	Completed		No			

Annex 7 – List of documents reviewed

Title	Date	Type	Author
TOR: Independent terminal evaluation of project Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry	01/01/23	TOR	UNIDO
Evaluation Manual	05/07/19	Manual	UNIDO
Progress Report (01 Mar 2016 –31 August 2016) PIR 1	31/08/16	Progress Implementation Report (6 months)	Not Stated
Progress Report (01 September 2016 – 30 June 2017) PIR 2	30/06/17	Progress Implementation Report (10 months)	Not Stated
Progress Report (01 July 2017 – 30 November 2017) PIR 3	30/11/17	Progress Implementation Report (5 months)	Not Stated
Progress Report (01 December 2017 – 31 July 2018) PIR 4	31/04/18	Progress Implementation Report (8 months)	Not Stated
Annual Progress Report (01 July 2018 –30 June 2019) PIR 5	30/06/19	Progress Implementation Report (annual)	Rana Ghoneim/Mark Draeck
Progress Report (1August 2018 – 30 September 2020) PIR 6 (Filename Annex 2)	30/09/20	Progress Implementation Report **(26 months)**	Not Stated
Annual Progress Report (01 September 2020 – 31 August 2021) PIR 7 (Filename Annex 2)	31/08/21	Progress Implementation Report (annual)	Not Stated
Annual Progress Report (01 September 2021 – 01 March 2022) PIR 8 (Filename Annex 2)	01/03/22	Progress Implementation Report (annual)	Not Stated
Final Progress Report (24 February 2015 – 01 October 2022) PIR 9 (Filename Annex 2)	02/03/22	Progress Implementation Report (Whole Project)	Not Stated
Annual Progress Report (01 July 2019 –30 June 2020) PIR_FY_2020	30/06/20	Progress Implementation Report (annual)	Mark Draeck
Annual Progress Report (01 July 2020 –30 June 2021) PIR_FY_2021	30/06/21	Progress Implementation Report (annual)	Gihan Attia/ Mark Draeck
Annual Progress Report (01 July 2021 –30 June 2022)PIR_FY_2022	30/06/22	Progress Implementation Report (annual)	Rana Ghoneim/Mark Draeck
SHIP Project 1st Steering Committee meeting	13/04/16	Minutes	Not Stated
SHIP Project 2nd Steering Committee meeting	30/01/17	Minutes	Moaaz Gebaily
SHIP Project 3rd Steering Committee meeting	30/12/17	Minutes	Yahia El-Masry Moaz Gebaily
SHIP Project 4th Steering Committee meeting	26/03/19	Minutes	Yahia El-Masry

Title	Date	Type	Author
SHIP Project 5th Steering Committee meeting	06/02/20	Minutes	Hana Farag
SHIP Project 6th Steering Committee meeting	15/10/20	Minutes	Hana Farag
SHIP Project 7th Steering Committee meeting	11/12/21	Minutes	Hana Farag
SHIP Project 8th Steering Committee meeting	20/03/22	Minutes	Hana Farag
SHIP Project 9th Steering Committee meeting	26/10/22	Minutes	Hana Farag
Steering Committee Decree (in Egyptian)	N/A	N/A	N/A
Mid Term Review	31/08/18	Mid Term Review	Thomas Hamlin
4790_UNIDO Letter_Project Extension GEF ID 4790 Egypt 120073	07/12/20	Extension Letter	Ciyong Zou
MoTI_Extension Letter September 2021	12/09/21	Extension Letter	Ahmed Reda