GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

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April 28, 2014

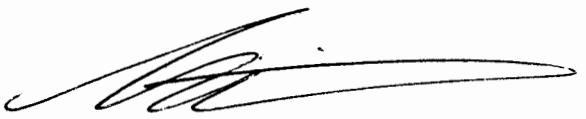
Dear Council Member:

UNIDO as the Implementing Agency for the project entitled: ***Malaysia: GHG Emissions Reductions in Targeted Industrial Sub-Sectors through EE and Application of Solar Thermal Systems***, has submitted the attached proposed project document for CEO endorsement prior to final approval of the project document in accordance with UNIDO procedures.

The Secretariat has reviewed the project document. It is consistent with the proposal approved by Council in June 2012 and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by UNIDO satisfactorily details how Council's comments and those of the STAP have been addressed. I am, therefore, endorsing the project document.

We have today posted the proposed project document on the GEF website at www.TheGEF.org. If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,



Naoko Ishii
Chief Executive Officer and Chairperson

Attachment: GEFSEC Project Review Document
Copy to: Country Operational Focal Point, GEF Agencies, STAP, Trustee

REQUEST FOR CEO ENDORSEMENT

PROJECT TYPE: Full-sized Project
TYPE OF TRUST FUND:GEF Trust Fund

For more information about GEF, visit TheGEF.org

PART I: PROJECT INFORMATION

Project Title: GHG Emissions Reductions in Targeted Industrial Sub-Sectors through EE and Application of Solar Thermal Systems in Malaysia			
Country(ies):	Malaysia	GEF Project ID:[1]	4878
GEF Agency(ies):	UNIDO (select) (select)	GEF Agency Project ID:	120264
Other Executing Partner(s):	KeTTHA, MoSTI, MIGHT, UKM, FMM, SIRIM	Submission Date: Resubmission Date:	12/20/2013 3/21/2014
GEF Focal Area (s):	Climate Change	Project Duration(Months)	60 months
Name of Parent Program (if applicable): ➢ For SFM/REDD+ ☐ ➢ For SGP ☐ ➢ For PPP ☐		Project Agency Fee ($):	400,000

A. FOCAL AREA STRATEGY FRAMEWORK[2]

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Grant Amount ($)	Cofinancing ($)
CCM-2 (select)	Outcome 2.3: GHG emissions avoided; Indicator 2.3: Tonnes of CO_2 equivalent.	Output 2.3: Energy Savings Achieved.	GEF TF	1,775,000	7,970,000
CCM-3 (select)	Outcome 3.1: Favorable policy and regulatory environment created for renewable energy investments; Indicator 3.1: Extent to which RE policies and regulations are adopted and enforced (score of 1 to 5).	Output 3.1: Renewable energy policy and regulation in place.	GEF TF	125,000	530,000
CCM-3 (select)	Outcome 3.2: Investment in renewable energy technologies increased; Indicator 3.2: Volume of investment mobilized.	Output 3.2: Renewable energy capacity installed.	GEF TF	2,100,000	11,500,000
		Total project costs		4,000,000	20,000,000

[1] Project ID number will be assigned by GEFSEC.
[2] Refer to the Focal Area Results Framework and LDCF/SCCF Framework when completing Table A.

B. PROJECT FRAMEWORK

Project Objective: To reduce GHG emissions by promoting and demonstrating sector-specific EE improvements and solar thermal technology utilization in industry.						
Project Component	**Grant Type**	**Expected Outcomes**	**Expected Outputs**	**Trust Fund**	**Grant Amount ($)**	**Confirmed Cofinancing ($)**
1. Development of a regulatory framework and financial incentive schemes to facilitate solar thermal energy utilization and thermal energy efficiency.	TA	Policy papers and financial incentive schemes established and endorsed by stakeholders.	1.1 National counterparts supported to develop three policy papers on solar thermal energy; 1.2 Two financial incentive schemes focusing on solar thermal applications developed.	GEF TF	120,000	525,000
2. Awareness raising and capacity building programme relating to process heating and cooling optimization and solar thermal energy utilization.	TA	Awareness and capacity of equipment vendors, service providers, industry management, plant engineers, and financial institutions in 5 targeted industrial sub-sectors strengthened and utilized.	2.1 Training programme on energy savings based on process heating and cooling conducted for service providers, consultants and industry in selected sub-sectors; 50 equipment vendors, 100 users and 50 experts trained 2.2 Training programme on solar thermal technology conducted for equipment/ component suppliers, service providers, consultants and industry in selected sub-sectors; 30 equipment vendors, 80 users, 40 experts trained 2.3 Awareness raising events organized for industry management and financial institutions on investment in energy savings and solar thermal application.	GEF TF	886,000	2,175,000
3. Demonstration and scaling up of sector-specific energy efficiency and solar thermal energy utilization in targeted industrial subsectors.	INV	Thermal energy efficiency and solar thermal technology demonstrated and deployed in 5 targeted industrial sub-sectors.	3.1 Energy saving measures and investment projects implemented in about 40 factories; 3.2 Of these 40 factories, around 10 implement solar thermal demonstration projects, with a total	GEF TF	2,740,000	16,200,000

			installed solar collecting area of 10,000 m2, and a life time energy generation of 360,000 GJ; 3.3 Case studies prepared and presented under output 2.3 to raise more investment in EE and solar thermal integration using the trained capacity and various financial incentive schemes created.			
4. Monitoring and Evaluation.	TA	Adequate monitoring and evaluation mechanisms are in place, facilitating smooth and successful project implementation and sound impact.	4.1 Regular monitoring exercises conducted according to GEF and UNIDO requirements prepared. 4.2 Mid-term and final project evaluation conducted.	GEF TF	64,000	100,000
				Subtotal	3,810,000	19,000,000
				Project management Cost (PMC)[3]	190,000	1,000,000
				Total project costs	4,000,000	20,000,000

C. SOURCES OF CONFIRMED COFINANCING FOR THE PROJECT BY SOURCE AND BY NAME ($)

Please include letters confirming cofinancing for the project with this form

Sources of Co-financing	Name of Co-financier (source)	Type of Cofinancing	Cofinancing Amount ($)
GEF Agency	UNIDO	Grant	60,000
GEF Agency	UNIDO	In-kind	140,000
National Government	SERI-UKM	In-kind	800,000
National Government	MoSTI, MIGHT	In-kind	250,000
National Government	SIRIM	In-kind	900,000
Private Sector	Industry	In-kind	7,150,000
Private Sector	Industry	Cash[4]	2,000,000
Private Sector	Industry	Loan	8,450,000
Private Sector	FMM	In-kind	250,000
Total Co-financing			20,000,000

[3] PMC should be charged proportionately to focal areas based on focal area project grant amount in Table D below.

[4] Co-financing investment from the private sector will be channeled through the Green Technology Financing Scheme (GTFS), a soft loan scheme worth RM 3.5 billion (eq. to US$1,050 million) for industries, administered by the Malaysia Green Technology Corporation, an institute under KeTTHA; and the TECHNO Fund of MOSTI.

D. TRUST FUND RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY[1]

GEF Agency	Type of Trust Fund	Focal Area	Country Name/ Global	(in $)		
				Grant Amount (a)	Agency Fee (b)[2]	Total c=a+b
(select)	(select)	(select)				
(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
Total Grant Resources						

[1] In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table. PMC amount from Table B should be included proportionately to the focal area amount in this table.

1 Indicate fees related to this project.

2

3

4

5 Consultants working for technical assistance components:

Component	Grant Amount ($)	Cofinancing ($)	Project Total ($)
International Consultants	661,500	256,000	917,500
National/Local Consultants	222,750	635,000	857,750

F. DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT? No

(If non-grant instruments are used, provide in Annex D an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/NPIF Trust Fund).

PART II: PROJECT JUSTIFICATION

A. describe any changes in alignment with the project design of the original pif[5]

The project design is in line with the original PIF, with only minor textual changes introduced, guided by comments received from the GEF Sec. Review, STAP, and a GEF Council member, as well as new data and information collected in the project design (PPG) phase with inputs provided through consultation with the relevant stakeholders. Output 1.2 has been removed as the CEO ER now has a separate component on Monitoring and Evaluation, Component 4. Accordingly, the resources assigned to Component 1 have been reallocated. Resources allocated across Focal Area Objectives have also been adjusted based on further consultations during the PPG phase.

A.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAS, NAPs, NBSAPs, National Communications, TNAs, NCSA, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.

The UNFCCC Second National Communication (2011) calls for the "implementation of energy efficiency (EE) and renewable energy (RE) in the industrial, commercial and residential sectors." It further quotes the National Renewable Energy Policy and Action Plan that calls for a total of 2,080 MW of grid-connected capacity based on renewable energy, of which 255 MW should come from solar photo-voltaic (PV). The Communication also mentions that energy efficiency savings in the industrial sectors could be 1% annually in the period 2015-2020[6].

Malaysia does not have a United Nations Development Assistance Framework (UNDAF), but programmatic support by UN organizations is harmonized with the 5-year plan of the Government, outlined in the Tenth Malaysia Plan.

A.2 GEF focal area and/or fund(s) strategies, eligibility criteria and priorities.

The proposed project aims to support the reduction of fossil CO_2 emissions in Malaysia's industry in general, and in particular, in selected industrial sub-sectors, by improving energy efficiency in industrial heating processes and process optimization, and the utilization of solar thermal energy whenever applicable and feasible. The project is, therefore, fully consistent with Objective 2 of the GEF Climate Change Focal Area Strategy, namely "Promote market transformation for energy efficiency in industry and the building sector" as well as Objective 3, namely "To promote investment in renewable energy technologies." As a result of the proposed project intervention, Malaysia will have improved regulations and financial incentive mechanisms (grant and non-grant instruments) and strengthened technical and institutional capabilities for the development, financing and implementation of solar thermal energy applications and energy efficiency improvements in industry on a sustainable basis.

A.3 The GEF Agency's comparative advantage:

The GEF Council document GEF/C.31/rev.1 gives UNIDO comparative advantage for this Strategic Program under the Intervention Type Capacity Building/Technical Assistance and the project has a strong focus on promoting RE/EE in industry. Combining the provision of policy and normative development support services and capacity building for all market players, UNIDO aims to remove the key barriers to the continuous improvement of energy efficiency in industries and the increased adoption of renewable energy for productive uses. The UNIDO Energy Programme is structured around four core thematic areas: (1) Industrial Energy Efficiency; (2) Renewable Energy for Productive Uses; (3) Low-carbon technologies; and (4) Benchmarking, Monitoring and Verification.

UNIDO is well placed to implement this project due to its expertise in dealing with industry in Malaysia and builds on the experience obtained in the projects **"**Industrial Energy Efficiency for the Malaysian

[5] For questions A.1 –A.7 in Part II, if there are no changes since PIF and if not specifically requested in the review sheet at PIF stage, then no need to respond, please enter "NA" after the respective question.

[6] Estimates based on energy audits performed during the UNDP/GEF Malaysian Industrial Energy Efficiency Improvement Programme (MIEEIP)

Manufacturing Sector (IEEMMS),**"** GEF Id. 3908 and "GEF UNIDO Cleantech Programme for SMEs in Malaysia," GEF Id. 5146. Coordination among the various branches of UNIDO such as the Montreal Protocol Branch, the Environmental Management Branch, and the Business, Investment and Technology Services Branch will also provide ample opportunities for cooperation among related initiatives in the region.[7]

A.4 The baseline scenario and baseline projects and the problem that it seeks to address:

1. Baseline scenario:

1.1. Plans and policies in energy and industrial sectors

The **National Energy Efficiency Act** is expected to be adopted in 2013 or early 2014, and will further foster the efforts by industry and other sectors to reduce energy consumption, not only of electricity but also thermal energy use. The Act would institute a legal and regulatory framework for EE and conservation, the establishment of a centralized agency for EE[8] and the development of a funding mechanism including the establishment of a revolving EE fund.

Malaysia's **National Climate Change Policy** was formulated in 2009; under the **Tenth Malaysia Plan 2011-2015 (10MP)**, Malaysia will adopt a dual strategy in addressing climate change impacts: firstly, adaptation strategies to protect economic growth and development factors from the impact of climate change; and secondly, mitigation strategies to reduce emissions of greenhouse gases (GHGs). The Policy aims to mainstream climate change into national policies, plans and programmes and to strengthen the institutional and implementation capacity to better harness climate change adaptation and mitigation opportunities. The Plan highlights that to "consolidate the energy policy incorporating management practices that enhances renewable energy and energy efficiency" is one of its strategic thrusts (ST5-P2).[9]

On the energy demand side, the 10MP calls for increased energy efficiency to ensure the sustainability of the environment. The 10MP envisages intensifying EE initiatives through the implementation of various measures such as guidelines, standards[10] for appliances, implementation of green technologies, incorporation of EE provisions in the building by-laws[11], promotion of energy efficient and high value added industries and the introduction of the **National Energy Efficiency Master Plan** (**NEEMP**, 2011-2020), as well as the promotion of EE in industry, such as "increasing the use of energy efficient machineries and equipment such as high efficiency motors, pumps and variable speed drive controls." The Plan's target is to reduce electricity consumption by 10% in the year 2020 (7.3 million tonnes of oil equivalent, TOE),[12] compared to a 'business-as-usual' scenario.

In July 2009, the **National Green Technology Policy** was introduced, marking a turning point in the country's history of initiatives on sustainable growth and development. The policy is built on four pillars: energy (seeking to attain energy independence and promote efficient use); environment (to conserve and minimize the impact on the environment); economy (to enhance economic development through the use of technology); and society (to improve the quality of life for all). The Ministry of Energy, Green Technology and Water (KeTTHA) has been assigned to oversee the Green Technology Policy that will, inter-alia, support the government in achieving its target of a 40% greenhouse gas (GHG) reduction per GDP per capita by the year of 2020, as compared to 2005 levels. Companies that practice green activities and management can be provided with

7 A detailed breakdown of UNIDO's in-kind contribution can be found in Annex E.

8 Energy Efficiency and Conservation Agency (EECAM); possibly with SEDA.

9 As one of the key actions regarding industry (KA21) is noted to "Promote and increase EE in industrial sectors" through: (a) review and establishment of legal mechanisms for EE application in industries; (b) provision and promotion of technical and financial assistance or incentives to the industry using EE technology and processes; (c) conduct of technology needs assessment; (d) conduct of energy audit in industrial and building sectors; and Adoption of EE practices by new industries.

10 MEPS: Minimum Energy Performance Standards. One of the EE programmes that has taken off the ground is the Sustainability Achieved via Energy Efficiency (SAVE) Programme. Customers that buy five-star energy efficient electrical appliances such as refrigerators, televisions, air conditioners and fans can get a rebate to make up for the difference in price compared with conventional models. Another important initiative is the establishment of the country's first EE testing laboratory at Malaysia's leading certification, inspection and testing body, Sirim QAS International. The latter will ensure that electrical appliances sold in the country are thoroughly tested and meet globally recognized EE standards and regulations.

11 The Code of Practice for EE and use of RE in Non-Residential Buildings (MS 1525) was introduced in 2001, updated in 2008 and aims at providing guidance to designers of commercial buildings.

12 APEC Energy Overview (2011).

incentives, such as income tax exemptions, investment tax allowances and duty exemptions. This includes energy conservation (companies that provide energy efficiency services as well as companies that reduce their own consumption of energy) and energy generation using renewable energy resources (for sale to third parties or for own consumption).

17 The new **Economic Transformation Program (ETP)** provides a strong focus on 12 growth areas, labeled as National Key Economic Areas (NKEAs), of which one area (EPP 9) is "oil, gas and energy." Within this area, sustainable green technology, renewable energy and the manufacturing of energy efficient products are given proper attention.

18 Malaysia encourages the development of renewable energy in the economy through various policies and strategies. The **Five-Fuel Policy** has made renewable energy one of the components in the fuel mix for power generation after oil, coal, gas and hydro[13] and the 10MP specified a target of 985 MW by 2015 for grid-connected generation from RE sources, which would contribute 5.5% to Malaysia's total electricity generation mix. This is to come from biomass (330 MW), biogas (100 MW), mini hydro (290 MW), solar PV (65 MW) and solid waste (200 MW) and lead to cumulative CO_2 emission avoidance of 11.1 $MtCO_2$. The **National Renewable Energy Policy and Action Plan (2010)** further mentions the targets of 2,080 MW by 2010 and 4,000 MW of renewable energy generated power by the year 2030 (17% of power mix with CO_2 emission avoidance of 145.1 $MtCO_2$). In 2009, grid-connected power from RE was 56.8 MW, less than 1% of the total installed power capacity, which had risen to 74 MW by September 2012[14]. By March 2013, only PV had reached the 10 MP aim of 65 MW with other renewables far below the target.

19 Under the **Renewable Energy Act** (December 2011), the government has introduced feed-in-tariffs (FiT) for power generated from RE resources to support the 10MP's targets. The FiT is a mechanism that allows electricity produced from indigenous RE resources to be sold to power utilities at a fixed premium price and for a specific duration, funded through a levy of 1% incorporated into the electricity tariffs of consumers. This allows electricity produced from RE to be sold to utilities at a fixed premium price. The Sustainable Energy Development Authority (SEDA), a special agency under the KeTTHA, has been established to administer the FiT fund as well as to support the development of RE in the economy.[15]

20 Considering the wealth of EE and RE related policies currently available in Malaysia and the lessons learned from ongoing energy related projects in the country, the proposed project will, complementary to the on-going GEF/UNIDO IEEMMS project, make the coordination of these policies' implementation one of its central objectives. Such coordination will be the key to the strengthening of a commercial market for thermal EE and solar thermal technology applications in industry.

21 1.2. Energy sector

22 Malaysia is a coastal equatorial economy spread across two main landmasses and endowed with abundant agricultural and energy resources. It has a small but relatively urbanized and middle-income population, with the economy supported by growing services and industrial sectors, including energy production and significant manufacturing. The industry and transport

Exhibit 1 **Energy supply and consumption (2009)**

Primary energy supply (ktoe)		Final energy consumption (ktoe)		Power generation (GWh)	
Indigenous production	84 469	Industry sector	13 419	Total	105 658
Net imports and other	–18 678	Transport sector	16 066	Thermal	98 987
Total PES	65 996	Other sectors	8 758	Hydro	6 671
Coal	9 030	Total FEC	38 244	Nuclear	–
Oil	26 577	Coal	1 378	Geothermal	–
Gas	29 603	Oil	22 757	Other	–
Other	786	Gas	5 826		
		Electricity and other	8 283		

Source: ADB Energy Outlook (2009)

[13] This Policy was introduced under the 8th Malaysia Plan (8MP), 2001-2005.

[14] Plus around 450 MW off-grid (palm oil mills and solar hybrid).

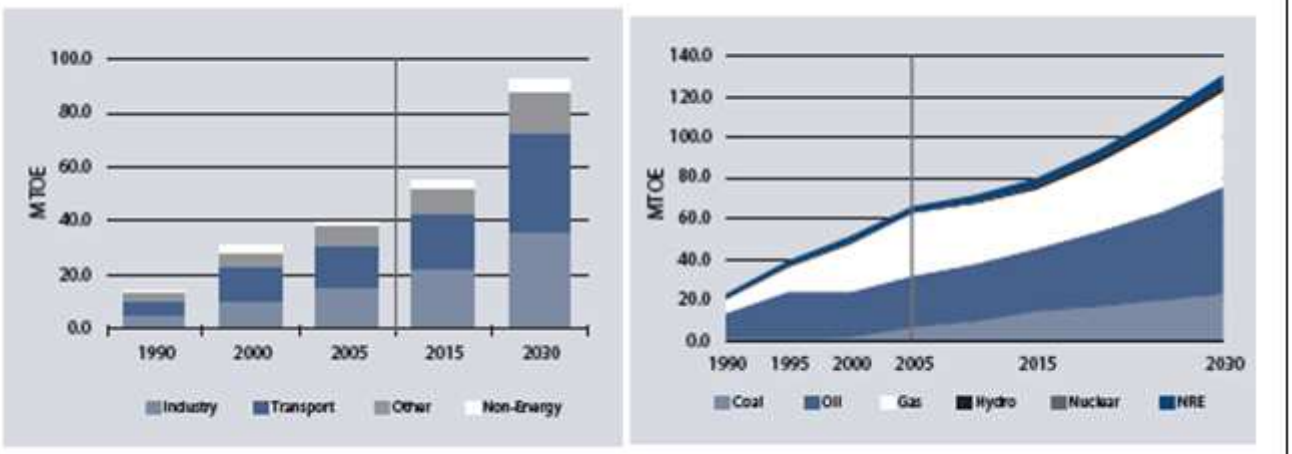
[15] More information on the Renewable Energy Act 2011 and Feed-in-Tariffs can be found on the website of the Sustainable Energy Development Authority (SEDA), at http://seda.gov.my.

sectors dominate Malaysia's energy demand (35% and 42% of final energy demand in 2009, respectively; see Exhibit 1). From 1990 to 2006, the share of final energy demand attributable to industry increased from 37% to 41% as industry's contribution to gross GDP grew.[16]

23 Natural gas and petroleum products constitute the principal fuels, and oil remains dominant in final energy demand (59% in 2009) despite growth in the use of both electricity and natural gas. From 1990 to 2006, the share of natural gas in final energy demand grew rapidly from 29% to 44%, while oil's share fell from 56% to 39% amid concerted efforts to replace oil-fired power with domestically produced gas-fired power. Over the same period, oil's share of final energy demand fell from 69% to 56%, but not in absolute terms as final energy demand more than doubled.[17]

24 Average annual economic growth from 1990 to 2006 was 6.2% and apart from a contraction in 1998 due to the Asian financial crisis, has remained generally stable; economic growth from 2000 to 2006 was a somewhat slower 4.6%. The Asian Development Bank (ADB) Energy Outlook projects GDP to grow at an annual rate of 4.2% in the coming decades, on which the energy demand forecasts of Exhibit 2 are based. The same publication mentions that between 1990 and 2006, Malaysia's population grew from 18.1 million to 26.1 million, an average annual rate of 2.3%. This growth, however, is expected to slow down to 1.3% in the future.

Exhibit 2 **Final energy demand forecasts**



Source: ADB Energy Outlook (2009). MTOE: million tons of oil equivalent; NRE: new and renewable energy

25 Malaysia's rate of industrialization is reflected in the rapid growth of the manufacturing sector and increased energy consumption. Malaysia has been recording a substantial real GDP growth rate, 4.6% in 2008, with manufacturing's share accounting for 29% of GDP in the same year. During the same period, the mining sector, including oil and gas extraction, accounted for 8% of GDP. Final energy demand by the industrial sector is expected to grow at an average rate of 3.4% per year and reach about 35.9 MTOE (million tons of oil equivalent) by 2030 (see Exhibit 2). Under this scenario, industry would remain the largest energy-consuming sector (about 47% in 2030).

26 The maximum demand of the grid system in Peninsular Malaysia grew by 3% from 13,620 MW in 2007 to 15,072 MW in June 2010. The total electricity energy sold by TNB, the main power provider, increased in 2008 by almost 4% to 84,493 gigawatt-hours (GWh) from 81,360 GWh sold in 2007. Malaysia's electricity production, once dominated by oil-fired generation, made a massive switch to natural gas in the 1990s, but in recent years has increased its use of coal in an attempt to diversify fuel used in the sector. Natural gas-fired generation was responsible for producing 64% of Malaysia's electricity in 2006. In power generation, the share of natural gas would decline to 52% in 2030 in favour of coal (37% in 2030) and hydropower.

[16] Transport's share of total final energy demand, in contrast, fell slightly from 38% to 37%. The combined share of TFED for the residential and commercial sectors decreased from 20% to 17%. Source: ADB Energy Outlook (2009).

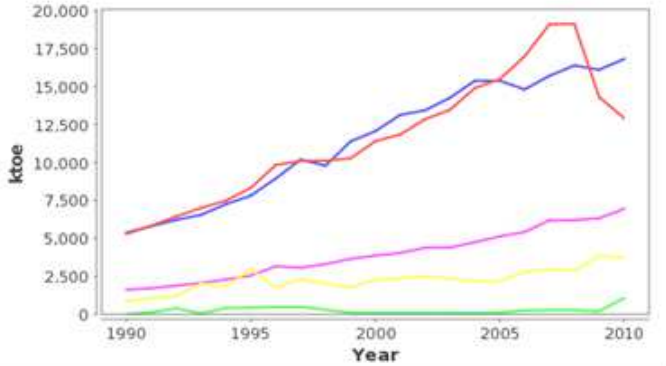
[17] ADB Energy Outlook (2009)

27 This diminishing share of natural gas is a sign that Malaysia's economically recoverable domestic reserves are slowly depleting and such depletion will have significant consequences on the national economy. Under the above-mentioned "business as usual" scenario in the ADB Energy Outlook, Malaysia is projected to become a net energy importer by 2030. Against this background of increasing power consumption and depleting domestic resources, the Government has embarked on awareness campaigns to encourage the use of RE such as solar energy to replace fossil fuels and to promote EE to reduce energy consumption.

28 1.3. Industrial Sector

29 Malaysia's industrial sector accounted for 32% of total GDP in 2010; industrial output is ranked 32nd in the world. The main industries are rubber and palm oil processing and manufacturing, light manufacturing, pharmaceuticals, medical technology, electronics, tin mining and smelting, wood and timber processing (Peninsular Malaysia), wood industries (Sarawak), oil production (Sabah) and agricultural processing, and petroleum production and refining. The major energy-intensive segments of the manufacturing sector are iron and steel, cement, wood, food, glass, pulp and paper, and the ceramics, rubber, chemical, plastics and textiles industries.

Exhibit 3 Final energy demand growth, Malaysia



Source: National Energy Balance, 2010; Energy Commission

30 In the Third Industrial Master Plan (IMP3), twelve industries have been targeted for further development and promotion, due to their strategic importance (in terms of value-added, experts, knowledge and technology content), namely electrical and electronics; medical devices; textiles and apparel; machinery and equipment; metals; and transport equipment as well as resource-based industries (petrochemicals, pharmaceuticals, wood-based, rubber-based, oil palm-based, and food processing).

31 At present, small and medium-sized industries (SMIs)[18] account for more than 96% of the total manufacturing establishments in Malaysia, of which 88% are small-scale industries and 12% are medium-sized.[19] SMIs have experienced substantial gains in productivity despite the fact that they only contribute 30% to output, 19% of total value added and 31% to employment in the manufacturing sector (2005).[20] Added value per employee grew at

Exhibit 4 Energy consumption in industrial companies

	Energy consumption (kTOE)	
	Large	SMI
Food, beverage & tobacco	169.0 - 1,711.5	21.5
Textile and leather	1,244	159.3
Wood and wood products	8.7 - 363.7	-
Paper and paper products	34.9 – 341.9	12.6
Chemicals and chemical products	0.2 – 5,228.6	117.4
Petroleum, coal, rubber and plastics	422.7 – 6,410.1	34.8 – 163.6
Non-metallic materials (cement)	123.8 – 9,474.4	-
Non-metallic materials (glass/clay)	639.8 – 924.0	-
Basic materials	86.1 – 18,518	-
Metal machinery and equipment	2.8 – 598.4	18.2 – 31.1
Electrical products	1.0 – 2,952.2	3.2 – 748.0
Others	77.5 – 731.5	3.0 – 38.5

Source: Azman Ikhsan et.al. (2005); Universiti Teknologi Malaysia, based on data collected in 77 companies and additional 10 energy audits. Energy includes fuels and electricity

[18] In Malaysia, micro industries are defined as having a sales turnover of less than RM 250,000 (or having less than 5 full-time employees), small industries with a turnover between RM 250,000 and RM 10 million (or full-time employees between 5 and 50) and medium industries between RM 10 million and RM 25 million (or full-time employees between 51 and 150).

[19] There are around 39,200 companies in the manufacturing sector. Source: FMM (2010)

[20] Third Industrial Master Plan (2005)

an annual rate of 6.4% for the period of 1991 to 1996, rising from 29.6% in 1995 to 30.5% in 1996. The majority of SMIs are still concentrated in the traditional sectors of food and beverages (20%), fabricated metal products (18%), wood and wood products (17%) and basic metal (4%).

32 In 2010, energy consumption in industry amounted to 12,928 kTOE (kilotonnes of oil equivalent) of which natural gas accounted for 4,310 (33%), petroleum products for 2,798 (22%), coal for 1,826 (14%) and electricity for 3,994 kTOE (31%).[21] Exhibit 4 provides an overview of energy consumption in the various industrial companies per subsector.

33 Energy efficiency solutions in industry:

34 The main sources of energy are diesel, fuel oil, LPG and electricity with energy conservation measures aimed at conserving thermal and electric energy. Energy conservation measures for electricity include, for example: improved lighting efficiency (e.g. high-efficiency ballasts and lamps, lighting controls and occupancy sensors); space conditioning (high-efficiency equipment, improved building design, set air conditioning at appropriate temperatures); improved running of air compressors and motors (replacing old and oversized motors); use of variable speed drives; improved ventilation systems and high-efficiency refrigeration.

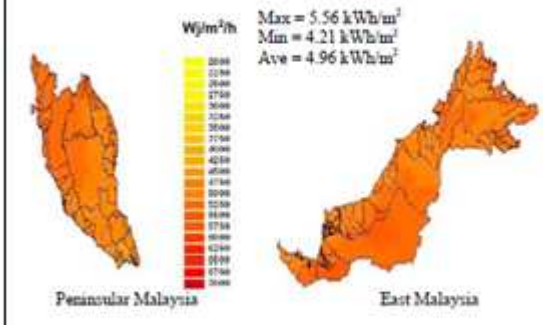
35 The conservation of thermal energy includes for example: improved insulation of heating equipment, ducts, tanks and pipes, installation of waste heat recovery systems, increased efficiency in combustion, water heating or drying processes; efficient air compression and water pumping: good boiler operating practices; application of heat pumps and good maintenance (boiler and furnace maintenance, repairing leaks).

36 To the above measures, proper cleaning, operation and maintenance of systems as well as optimization of system operation can be added. Many industrial heating processes use heat to process materials; these processes use fuel combustion to produce heat, but a portion of this heat is wasted in the form of exhaust gases that need to be discharged from the heating system. These and other losses due to inadequate insulation, improper control of combustion processes etc. can be reduced by proper design, operation and maintenance of the heating system. For lower temperature processes, primary losses are related to the combustion process, heat losses from hot surfaces and hot exhaust gases that contain the heat of water vapour. Recent developments in improved electronic and computer or smart controls, better insulation and their installation technologies, condensing heat exchangers or economizers can be used to improve system efficiency. These heat recovery systems can be integrated with solar thermal heating to improve 24/7 application of solar heat without using large accumulators or the need to have a large solar system.

37 1.4. Solar thermal energy potential

38 Combustion of fossil fuels that results in the production of gases CO_2 and NO_x is a major source of Green House Gas (GHG) emissions throughout the world. However, in many cases it is not given enough consideration in the energy and climate change debate, even though heat supplied by combustion represents the primary source of energy for end users and the production of electricity in all parts of the world. Nearly half of the world's final energy consumption (meaning energy that is supplied to the consumer for all final energy uses such as heating, cooling and lighting) is consumed at the end-user level. In 2009, heat generated by direct combustion of fossil fuels represented 47% of final energy consumption, compared with 17% for electricity, 27% for transport; and 9% for 'non-energy use' (which covers fuels that are used as raw materials in different sectors, such as oil used to make plastics); oil, coal and gas account for more than two-thirds of the fuels used in meeting this significant demand for heat. In Malaysia, the split

Exhibit 5 Solar irradiation, Malaysia



Source: Ayu Wazira et al, A New Approach for Predicting Solar Radiation in Tropical Environment Using Satellite Images – Case Study of Malaysia, 2008

[21] Source: *National Energy Balance 2010,* KeTTHA, ST. Of the petroleum products, the most important fuel in industry in 2010 was diesel (2,057 kTOE)

between electricity and thermal energy demand for industry is in the range of approximately 15% and 85%, respectively. In industries, a large amount of heat generated by fuel use is wasted in the form of high temperature gases and other forms such as hot liquids. With the use of energy saving measures and heat recovery technologies it is possible to reduce usage of fossil fuel, and thus reduce GHG emissions. In some cases it is also possible to use solar heating and cooling methods to substitute fossil fuel generated heat. Due to the fact that most thermal energy in Malaysia is produced by fossil fuels, the implementation of energy efficiency measures and the use of renewable energy such as solar thermal will have a huge impact on fossil CO_2 reduction in Malaysia.

39 Malaysia is characterized with a high potential for solar energy application due to its high level of solar radiation throughout the year, especially in the northern region and in some areas of East Malaysia. The annual average daily solar irradiation for Malaysia ranges from 4.21 to 5.56 kWh/m^2/day (see Exhibit 5).

40 With the establishment of SERI, the Solar Energy Research Institute, in 2005 at University Kebangsaan Malaysia (UKM), more than RM 15 million (equivalent to about US$4.5 million) has been invested for the establishment of facilities, research grants, and small demonstration projects. The focus, however, has mostly been limited to solar PV (photovoltaic) and residential solar water heaters (SWH), rather than on solar thermal applications in industry. The proposed project's focus on solar thermal applications, beyond the standard PV approach, lends it an innovative aspect that will tap into a high-potential market of Malaysia that currently receives minimal attention. Unlike PV application, solar thermal application in industry requires a very high degree in engineering, system integration, system designing, etc. Therefore, despite very high potential, solar thermal energy is still at the initial application stage, not only in Malaysia, but also worldwide.

41 Solar thermal energy is a convenient source of heating and a technology that does not rely on scarce, finite energy resources. Around 45,000 m^2 of collector area was installed in Malaysia in 2009, mainly SWHs for buildings, an increase of almost 40% compared to the previous year. Flat plate collector panels are the dominant solar technology on the market, making up around 95% of total market volume. The biggest manufacturer in the country is Solartech Sales & Service, which has its factory in Petaling Jaya, in the state of Selangor; it is said that the company accounts for almost half of the annual distribution throughout the Malaysian market. The only manufacturer for vacuum tube collectors is Solar Research Design, operating in Kuala Lumpur, with an output of a few thousand m^2 per year. Its brand name *Microsolar* stands for collector panels consisting of water-filled double glass tubes that include a third coaxial tube. The cold water from the tank flows down this extra tube in order to minimize turbulences and heat losses.[22]

42 2. Baseline projects:

43 Over the past few years, a number of baseline projects related to thermal EE and solar thermal energy utilization in industry have been undertaken in Malaysia by the government, industries and research institutions.[23]

44 **2.1. The Green Technology Financing Scheme (GTFS)**

45 In 2010, the government introduced the **Green Technology Financing Scheme (GTFS)**, a soft loan scheme worth RM 1.5 billion (equivalent to about US$450 million) for industries, to enhance the application of green technology in the production of goods, technology and provision of services; the scheme was extended with RM 2 billion in 2012 (equivalent to USD 600 million) for another 3 years ending December 2015.[24] The scheme covers energy (production as well as efficient utilization), built environment, transport, and water and wastewater management sectors, and is implemented by GreenTech Malaysia. Under the scheme, a company can apply for a loan at a participating Malaysian commercial or development finance institution of which the Government guarantees 60% of the loan amount and subsidizes 2% of the interest rate. The proposed project will make use of the GTFS and other existing financial schemes, taking a coordinating approach to catalyze investment, improve awareness and assist industries in accessing these financing opportunities. Specifically, the industries implementing thermal EE combined with solar thermal projects under Component 3 of the

22 *Malaysia Discovers the Advantages of Solar Thermal Technology*, by Baerbel App

23 For example: KeTTHA, MITI, MoSTI, SIRIM, FMM, MIDA, UKM/SERI, UTM,

24 See www.gtfs.my. By the beginning of 2013, 84 companies had received loans reaching RM 1.13 billion (with RM 386 million disbursed). Of the total approved amount of RM 1.13 billion, about RM 835 million was in the energy projects (energy production as well as utilization).

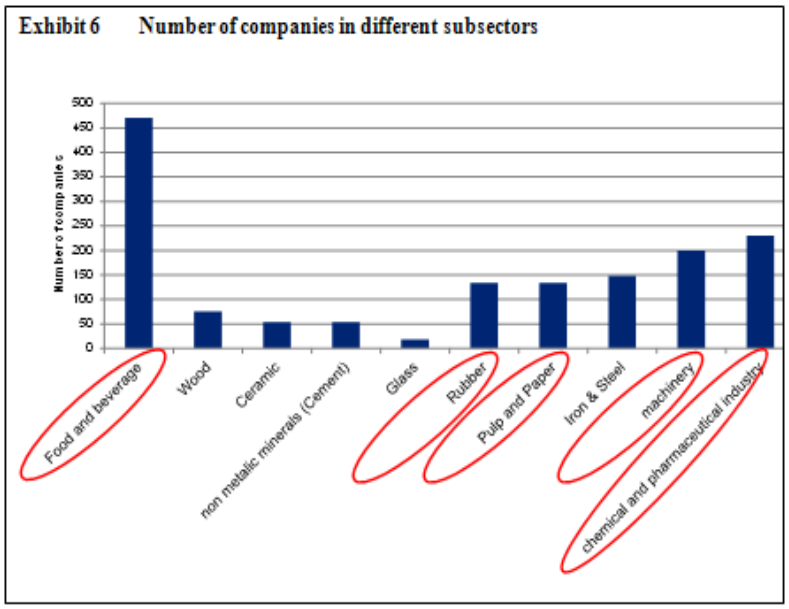
proposed project will be connected with such schemes and assisted throughout the application process via trainings conducted under Component 2.

46 2.2. The Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP)

47 To address barriers to energy efficiency and energy conservation in the country's industrial sector, the Government of Malaysia initiated the **Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP)** to improve the rational use of energy in the industrial sector. Support and funding was provided by the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP), and the Ministry of Energy, Water and Communications (MEWC) was appointed the project's executing agency, while Pusat Tenaga Malaysia (PTM, now rebranded as GreenTech Malaysia) was the designated implementing agency. MIEEIP (2000-2009) has contributed to creating higher awareness of energy efficiency, establishing an energy benchmarking facility for industry, and supporting quick surveys and energy audits in over 60 companies to identify the potential for thermal and electric energy efficiency, focusing on 8 sub-sectors (cement, ceramic, iron & steel, food, glass, wood, pulp & paper and rubber).

48 2.3. The Industrial Energy Efficiency for Malaysian Manufacturing Sector (IEEMMS) Project

49 The new on-going GEF/UNIDO project, **Industrial Energy Efficiency for Malaysian Manufacturing Sector (IEEMMS),** will further improve the policy and regulatory framework, and incentives schemes for energy efficiency in industry. Currently, it is working under the leadership of the Energy Section of the Economic Planning Unit of the Prime-Minister's Office to assist the development of the NEEMP, covering all energy sources. This project will focus on energy systems optimization and energy system management; the new ISO 50001 requires an organization to establish, implement, maintain, and improve an energy management system, enabling systematic achievement of continual improvements in energy performance, energy efficiency, and energy conservation. It imposes requirements on energy supply and consumption in terms of measurement, documentation and reporting, design and procurement practices for energy-using equipment and systems, as well as processes and personnel. It is not only applicable to industry, but also to all organizations that use energy. It is expected that companies and factories of the targeted sub-sectors of this project will want to look for additional measures to further reduce their energy consumption, after they have implemented energy management system and maybe also some other energy system optimization, for instance: compressed air system, pump system, fans system, etc. The IEEMMS project does not cover process heating and cooling optimization and solar thermal utilization, a gap that the proposed project will build upon to broaden the focus of energy efficient applications in industry (please see Annex K). While the focus of the proposed project differs from the IEEMMS project, it will use the newly created human resource pool and improved policy framework under the IEEMMS project in order to avoid replication and reduce transaction costs associated with the new project.



50 2.4. Solar thermal application in Malaysian industry

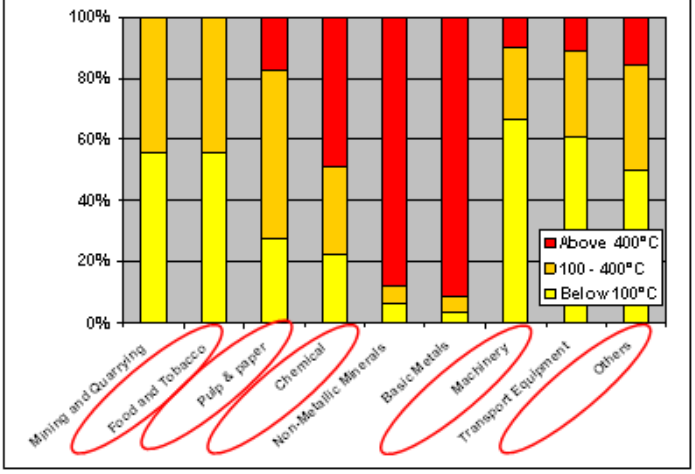
51 During the 9th Malaysia Plan, MoSTI introduced the TECHNOFUND for 'pre-commercialization based projects.' As a result, two solar thermal related projects have funded large-scale solar hot water heating systems in hospitals by the University Kebangsaan Malaysia (UKM) in Cheras and solar drying of

agricultural/marine products by SIRIM Berhad. The total budget of these projects was RM 4 million and the project results will be incorporated into the design of the demonstration projects, under Component 3 of this project.

52 The Universiti Kebangsaan Malaysia Medical Centre (PPUKM) in Cheras is currently set to be the first green hospital in Malaysia with the installation of the country's first large-scale hot water system using solar energy. The solar energy system is made up of 2,304 evacuated tubes with a net absorber area of 186 m^2 to supply hot water to 1,000 beds at PPUKM.

53 The solar thermal system has been designed, manufactured and installed by Zamatel, a local company, with technical support from SERI. In operation since May 2011, the system has helped to reduce LPG consumption by 69,350 m3 and CO_2 emissions by 718 tonnes, annually. The existence of such large systems encourages local solar energy companies, SERI and related government authorities to pioneer and invest resources into the design, manufacturing and installation of solar thermal systems in the potential industrial sub-sectors.

Exhibit 7 Percentage of heat demand on different temperature levels in various industrial subsectors



54 Based on the size (in terms of number of companies) of the different industrial sub-sectors of Malaysia, the potential to use solar thermal energy in Malaysia's industry is quite high, in particular in the food and beverage, chemical and pharmaceutical industries, machinery (metal surface treatment industry) and rubber industries (see Exhibit 7).

55 The sectors with the highest number of companies coincide with those industrial subsectors that utilise low-temperature processes (see Exhibit 8). The solar thermal technology that this proposed GEF project would focus on will be applied in the low-temperature processes (see Annex L) of these subsectors.

56 During the PPG phase, SIRIM has got fund from the TECHNO FUND of MOSTI to conduct quick audits in about 60 SMEs to identify potential for solar thermal utilization. The results will be presented at a national seminar planned for November 2013.

57 **2.5. The GEF/UNIDO Cleantech Programme for SME in Malaysia**

58 This project was launched on 11 October 2013 and will be executed by MIGHT in cooperation with relevant partners for the next 3 years. It will assist to establish a national platform to identifying Cleantech innovators, nurturing and networking them to become successful Cleantech start-ups. It will also cover energy and solar energy utilization.

59 5. Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund/NPIF) or additional (LDCF/SCCF) activities requested for GEF/LDCF/SCCF/NPIF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCF/SCCF) to be delivered by the project:

60 1) Baseline situation and barriers

61 The high level of potential for thermal energy savings and solar thermal energy utilization in Malaysia's industry indicates the benefits associated with an initiative on solar thermal and energy efficiency in industry. The potential in Malaysian industry lies in:

- The availability of good solar irradiation (see page 10);
- The types of subsectors in Malaysia, in terms of numbers of companies, coincide with the subsectors whose

processes have temperature levels into which solar thermal can be integrated into;

- Policies and incentives frameworks for renewable energy and energy efficiency, which have been put squarely on the map under the 10th Malaysia Plan and have been supported by policies, incentives, research and small demonstration projects (see section B.1). The market niche of thermal EE and solar thermal applications in industry is limited in unleashing its potentials as it faces a number of gaps and barriers that are summarised in the table of barriers below.

62 As regards government policy instruments for RE and EE, as well as the number of GEF projects, including MIEEIP and the on-going IEEMMS projects, the emphasis thus far has been mainly on *electric energy*, and much less on *heat applications*. For example, in the area of RE the emphasis has been on RE power generation; in solar energy, programmes have been implemented for solar PV. Apart from domestic solar water heaters, the government does not yet have policies, incentives or standards that specifically aim at larger-scale solar thermal system applications in commercial buildings or in industrial applications. Given the fact that electricity accounts for 33% of industrial energy demand, it makes sense to focus sustainable energy efforts on the 67% of fuel use for thermal applications.

63 As a result of this minimal focus, fewer efforts have gone into energy management of heat in industrial processes and consequently less knowledge and awareness exists in this specific area. There is a similar lack of knowledge of linking such energy conservation efforts with the use of renewable energy, in this case solar for thermal heat applications. GEF support is being requested to help bring application and diffusion of EE and application of solar thermal in industrial (heat) processes in Malaysia to a higher level, by means of a concerted effort by a number of Malaysian organisations and institutions in a mix of targeted training, awareness creation and demonstration activities. The use of solar thermal energy for industrial application demonstrates a very new development in industrial energy supply systems and only some hundred realized examples exist worldwide, but with an increasing development in the last two years. In order to push this development of solar thermal energy in the new application area of industrial processes, the GEF support will be very crucial and incremental to realize the high potential in the reduction of energy consumption and utilization of solar thermal energy.

64 To mitigate the above-mentioned barriers, GEF resources are requested to complement the baseline activities of the Malaysian government and industry.

Barrier	**Project output (incremental activity)**
The enabling policy framework and support programmes for renewable energy have focused on power generation (grid and IPPs) over thermal applications. Furthermore, energy efficiency efforts have often concentrated on electric savings. Consequently there is lack of adequate financing, investment and policy instruments for thermal energy applications.	1.1 Based on an assessment made during the PPG phase, identify needs for development of regulations and programmes and assisting their development; institutional capacity strengthened through on-the-job training. 1.2 Support programmes and mechanisms (e.g. financial incentives, tax breaks, subvention of solar thermal R&D programmes, certification schemes) focusing on thermal energy efficiency and solar thermal applications developed and approved.
There is a lack of awareness and capacity in the application of solar energy in thermal applications, and thermal EE in industry (e.g. pharmaceutical industry, food and beverage processing, metal surface treatment, rubber industry, chemical industry, pulp and paper industry, textiles). Industry and financial institutions are not aware of the high potential for thermal EE and solar thermal energy.	2.1 Skills and competency strengthened for service providers, consultants and industry in the implementation of energy savings based on process heating and cooling, in selected sub-sectors; 2.2 Skills and competency of equipment or component suppliers, service providers, consultants and industry in solar thermal technology improved; 2.3 Enhanced awareness among industry management and financial institutions in order to take decisions on investments in energy saving and solar thermal application (including using case study results of component 3).

Lack of demonstrations on thermal energy saving and commercially viable solar thermal systems in selected subsector industries.	3.1 Energy saving measures and investment implemented in about 40 factories; 3.2 Of these 40 factories, around 10 implemented solar thermal demonstration projects; 3.3 Case studies prepared and presented under output 2.3 to raise more investment in EE and solar thermal integration using the trained capacity and various financing mechanisms created.

65 2) Project rationale, project scope and activities

66 Based on considerations of the solar thermal potential discussion in Section A.4., the following industrial subsectors have been identified during the PPG phase of the proposed project as the most suitable and having the highest potential for solar thermal process heat in Malaysia:

67 Pharmaceutical industry: There are many chemical production processes that need heat at a relatively low temperature level. In this case, primary pre-heating steps might be - keeping in mind other energy sources - supplied by solar energy.

68 Areas within the chemical industry that work exclusively at low temperature levels are biochemical processes utilized by the pharmaceutical industry. Processes in the pharmaceutical industrial applications are distillation, evaporation and drying, with hot water (55-80^{o}C), steam (>120^{o}C) and steam/hot water (>120^{o}C) required as the media, respectively. Different types of collectors such as flat plate collectors, evacuated tube collectors, solar concentrators and solar hot air systems can be used in the pharmaceutical sector depending on the industrial processes.

69 *Textile industry:* In the textile industry, a series of processes run at temperatures below 100°C and as in many other sectors, washing processes are important (wool, fabrics), as well as energy intensive dying processes and special thermal treatments (fixing, ironing). Washing and drying processes are often followed by similarly energy intensive drying processes. The textile manufacturing process can be broadly divided into spinning, weaving and finishing, with the heat supply system very often running on steam. For example, the application of yam conditioning and scouring uses steam with temperatures of 55-60^{o}C and 90-110^{o}C, respectively. Other applications in the textile industry such as sizing, de- sizing, bleaching, mercerizing, dyeing and finishing, all use hot water as media with temperature requirements ranging from 50-95^{o}C.

70 *Pulp and paper industry:* Solar energy can play a major role in the fulfilment of industry's energy requirements. The application of bleaching, debarking and chipping, digesting and washing utilizes hot water as a medium with temperature requirements ranging from 40 to 90^{o}C. The application media for pulping and paper drying are process heating and steam/hot water respectively, with a temperature requirement of over 120^{o}C. Solar heat can be used as supplementary heat, with heat recovery or recycling systems already in place at many plants.

71 *Food and beverage processing:* Food and beverage processing comprises of a whole gamut of segments such as fruits and vegetables, milk and milk products, beer and non-alcoholic beverages, meat, fish and poultry, marine products, grain processing, packaged or convenience foods and packaged drinks. The industrial processes, such as washing and cleaning, and drying and dehydration, use hot water as application media with a required temperature of 40-60^{o}C and 70-80^{o}C, respectively. Meanwhile, processes such as cooking, extraction, mashing, brewing and baking, and pasteurization have temperature requirements ranging from 70 to 100^{o}C, while sterilization, bleaching and hydrogenation need temperatures of 60-120^{o}C. Due to this moderate temperature range in most of the food and beverage industry processes, solar process heat has a very high potential in this sub-sector.

72 *Metal surface treatment:* Metal surface treatment processes can be found in a large variety of different producing companies; e.g. it is the core business in galvanization, in the automotive industry and in the steel industry. The metal surface treatment sector thrives on processes that generally require low-range temperatures. Metal surface treatment applications include degreasing, rinsing, plating, post plating treatment,

cleaning and washing, and utilize hot water as media with required temperatures of 70-80°C, 50-60°C, and 40-50°C, respectively. The different chemical solutions are filled in baths that are mainly heated up by internal heat exchangers. This simplifies the integration of solar thermal heat and the baths can then be used as heat storage thus reducing the overall system costs of a solar thermal application.

73 *Rubber industry:* The main process steps of rubber glove manufacturing consist of cleaning and drying, coagulant dipping and drying, latex dipping, vulcanization, leaching, chlorination and slurry dipping. In most of the processes the gloves are passed through baths that need a temperature of 60-90°C. In general, the integration possibilities for solar thermal heat are similar to those in the metal surface treatment industry.

74 *Petrochemical and chemical industry:* Both of these sectors use a large percentage of their total heat demand for steam generation or liquid heating. Waste heat is used to increase the overall energy efficiency of the industry and this process can be optimized and where economically justifiable, solar heat can be used as a supplementary energy source for feed water or other liquid pre-heating where the source temperature is currently raised by using waste heat or additional fuel.

75 *Steam generation*: Almost all major industries use steam that is generated by using different types and sizes of boilers to meet process needs or as a product component. Use of waste heat reduction through the implementation of several possible steps and recovery of waste heat can increase overall thermal efficiency. In selected cases it is possible to supplement or supply heat for feed water preheating, combustion air preheating etc. The extensive use of steam indicates the high potential for benefits of the possible application of solar heat.

76 The project will focus on solar thermal applications that use conventional, non-concentrating, collectors in the low-temperature range (up to 100-150°C).

77 Focusing on the abovementioned sub-sectors, the proposed GEF project will build on existing experiences with the GEF funded MIEEIP and IEEMMS projects (see Section A.4) and develop knowledge and new approaches to the optimization of the production process heating and cooling. These will be based on best available practices, boiler optimization, optimization of cooling devices and heat recovery, heat exchanging devices, heat integration and pinch analysis for the design of heat exchanger networks, detailed calculation of heat exchangers, storage management, solar process heat, process integration, identification of suitable solutions, and system integration, etc.

78 Specific awareness raising campaigns are needed to target decision makers i.e. the industries most suitable for solar thermal process heat in the selected subsectors as given in Section A.4. Several market demonstration projects are required to gain more experience and to increase confidence in this emerging technology. Furthermore, expertise is needed to promote thermal energy savings and applications of solar thermal technology in combination with overall system optimization. Training courses for professionals are required to raise awareness and to overcome the current lack of specific expertise among professionals (planners, installers). The GEF-supported project will advise the government on the provision of policy guidelines and instruments to companies for the installation of solar thermal systems to drive their industrial processes.

79 The project will utilize the experience of SIRIM, SERI-UKM and CETREE-USM[25] in Malaysia, as well as build on the accumulated knowledge and experience of the AEE Institute for Sustainable Technologies (AEE-INTEC), Austria. Experience from other industrialized countries, such as the USA, Germany, and Japan, and emerging economies, such as China, India, and Brazil, in the field of process optimization, optimization of process heating and cooling, and solar thermal integration will also be utilized. The project will also introduce existing software, such as Pinch software, Sankey software, and solar simulation tools through the project.

80 This project seeks to address the before-mentioned barriers in an integrated and holistic approach by combining demonstration projects with a high replication potential and thorough training and awareness-raising activities and interventions to establish a market environment conducive to investments in clean

[25] SIRIM: government-owned company for industrial, technology innovations and standards development. SERI-UKM: Solar Energy Research Institute of the Universiti Kebangsaan Malaysia; CETREE-USM: Centre for Education and Training in Renewable Energy and Energy Efficiency of the Universiti Sains Malaysia

thermal energy practices and technologies in industry. This will be achieved through the project's three substantive components:

81 Component 1: Development of a regulatory framework and financial incentive schemes to facilitate solar thermal energy utilization and thermal energy efficiency.

Outcome	Output
Policy papers and financial incentive schemes established and endorsed by stakeholders.	1.1 National counterparts supported to develop three policy papers on solar thermal energy.
	1.2 Two financial incentive schemes focusing on solar thermal applications developed.

82 Based on assessments and consultations with all stakeholders, in particular the Malaysia Investment Development Authority (MIDA) and the Sustainable Energy Development Agency (SEDA), and the recent survey conducted by SIRIM under the project financed by the TECHNO FUND, this component will support the Government's efforts to create an enabling environment for local manufacturing entities to implement thermal EE and the efficient application of solar thermal systems, for example, to expand the existing NEEMP to also cover other energy sources in addition to electricity. GEF's support will be used to hire international and local consultants to share experience and practice from other countries, such as the EU, USA, China and India, etc. and further consultation with all stakeholders, in particular attention will be given to consult with relevant industries and institutions. The project will assist the development of the identified promotional regulations, support programmes, incentives, financing mechanisms, standards for relevant solar thermal equipment, etc.

83 A detailed proposal with a cost-benefit analysis will be prepared for the improvement of current policy instruments which could include financial incentives, tax breaks, subvention of solar thermal R&D programmes, and a certification scheme for solar thermal technology. Grant and non-grant instruments, for example those related to the Green Technology Financing Scheme administered by Green Tech Malaysia on behalf of KeTTHA and with a total budget equivalent to US$1 billion, the Renewable Energy Fund under SEDA, the TECHNO FUND under MoSTI, and other financing schemes become available during the project implementation, will be further developed and applied to ensure adequate availability of financial sources for energy saving implementation and solar thermal application in industry. As the institutions managing these funds are also members of the Project Steering Committee, there will be close coordination with the decision makers of these bodies on a regular basis; for example, it has been agreed that a similar financial scheme to the existing FIT scheme to be managed by SEDA will be developed under the project to provide financial incentive for solar thermal energy projects. The current FIT scheme, also managed by SEDA, covers only solar PV projects. As the amount to be allocated to these new schemes has not yet been determined, it has not been included as co-financing under Component 1. The project will work closely with participating industries to assist them in accessing these funds, advice will also be provided on a suitable institutional structure, while on-the-job training will be carried out for relevant Government officials, for example for those of EPU, SEDA, ST, Malaysia Green Technology Corporation, MIGHT, etc.

84 The foreseen project will also support policy and decision makers in the development of attractive subsidy and financial schemes in order to guarantee the market deployment of solar thermal installations in Malaysia's industry. The key success factors for this are the removal of the barrier of high upfront costs by developing long-term predictable financial incentive schemes[26] based on best practices (performance-based incentives), the establishment of mechanisms for monitoring and evaluation and setting up energy reduction targets.

85 The project will also assist in the implementation of the developed policies and subsidy/financial schemes through capacity building for the related institutions under Component 2 and through implementation of pilot

[26] In general, four different kinds of financial incentive schemes can be highlighted: i) Investment subsidy/direct funding (a percentage of the investment is financed by the public sector); ii) Obligations (regulation of solar thermal installation by law); iii) Credit funding (e.g. an annuity grant); and iv) Tax incentives.

projects under Component 3. In particular, the implementation of the created subsidy and financial schemes is necessary to gradually replace the TA support provided by the project to the first pilot projects. In order to achieve this, the TA support from the project to the 40 factories (Output 3.1) and 10 pilot projects (Output 3.2) will be gradually phased out towards the end of the project life in order to ensure the sustainability of the project. More explanation of this process is detailed under the Component 3 section of this document. The policy and incentives developed by this project will focus on thermal EE and solar thermal energy, whereas the focus of the policy and incentives of the GEF4 project on IEE are limited to the implementation of energy management systems based on ISO50001. Thus, the policy activities of these two projects will be complementary rather than creating an overlap.

86 Component 2: Awareness raising and capacity building programme relating to process heating and cooling optimization and solar thermal energy utilization.

Outcome	Output
Awareness and capacity of equipment vendors, service providers, industry management, plant engineers, and financial institutions in 5 targeted industrial sub-sectors strengthened and utilized.	2.1 Training programme on energy savings based on process heating and cooling conducted for service providers, consultants and industry in selected sub-sectors; 50 equipment vendors, 100 users, and 50 experts trained.
	2.2 Training programme on solar thermal technology conducted for equipment/ component suppliers, service providers, consultants and industry in selected sub-sectors; 30 equipment vendors, 80 users, and 40 experts trained.
	2.3 Awareness raising events organized for industry management and financial institutions on investment in energy savings and solar thermal application.

87 This component will develop training materials and programmes, and deliver trainings on the optimization of process heating and cooling, and solar thermal technologies in the targeted industrial sub-sectors.

88 Training on thermal EE will be at the user and expert levels and will focus on process heat for cleaning, drying, evaporation, sterilization, pre-heating boiler water, boiler optimization, etc. for technical staff, plant and energy managers and consultants (see Annex N).[27] Targeted groups include: i) engineers from solar thermal companies; ii) energy managers of enterprises in the targeted industries and factories that have implemented energy management systems with support of the on-going IEEMMS project; iii) engineering companies and equipment manufacturers or vendors; and iv) universities and other research centres. The sustainability of these trainings will be ensured through close cooperation between SERI, SIRIM and the Federation of Malaysian Manufacturers (FMM). SIRIM, together with FMM Institute, will coordinate and organize the trainings and outreach to potential participating factories. The FMM Institute, SIRIM and SERI will build their own capacity by working closely with UNIDO under Component 2 of the proposed project, thus allowing them to continue with such trainings beyond the scope of the project's lifespan. Close cooperation between these institutions and also with other relevant universities, for example, UTM, Faculty of Engineering and Green Technology Universiti Tunku Abdul Rahman, etc. will encourage national ownership and the institutionalization of the project's approach. SERI will consider incorporating the training programme developed by the project into their curriculum. KeTTHA has the intention to establish an EE institute that once established will use the developed training materials and project equipment.

89 Solar thermal technology suppliers will be trained on determining solutions, system design, system integration, manufacturing, installation, operation and maintenance, etc. so that they can provide high-quality and affordable products and deliver appropriate and affordable after-sales service to their clients. It will first focus on the technologies for a low temperature range, up to 100°C-150°C. It is expected that:

[27] These training courses will be carried out in cooperation with the "AEE - Institute for Sustainable Technologies". The Institute was set up in AEE – Institute for Sustainable Technologies was founded in 1988 as an independent research association and is one of the leading institutes for applied research in the fields of solar thermal energy, low-energy and zero energy buildings as well as in energy efficiency in industry.

- 50 experts will be trained in the optimization of process heating and cooling in the selected sub-sectors;
- 40 experts will be trained in solar thermal applications in the selected industry sub-sectors; the training will not only focus on identification and design of the suitable solar thermal equipment, but also on the integration of the solar thermal equipment with the existing production process.
- 100 plant managers and energy managers will receive basic training on EE based on process optimization, process heating and cooling and solar thermal integration;
- Training will also be provided to develop bankable project proposals to apply for various funding and incentives schemes, as well as to financial institutions in the evaluation of funding applications. These will include, for example, SEDA, MIDA, MGTC, and SME Corp. which will implement the financial incentive schemes to be developed by the project.

90 Other activities will focus on raising awareness of the potential costs, benefits and opportunities of various support programmes created, different grant and non-grant instruments for energy savings in selected sub-sectors and for the application of solar thermal energy, allowing company owners and managers to take informed decisions on investment opportunities and develop viable proposals. The case studies to be developed will be based on comprehensive technical and economic analyses and tangible results in energy savings and GHG reductions of the demonstration projects under component 3 and will be used for awareness raising activities. Sources of finance and financing mechanisms will also be identified. For this purpose, bank officials will receive training from the project and will consider loan applications for the demonstration projects and, where applicable, link with existing non-grant instruments.

91 The training will build on the training provided on energy management (EnMS/ISO 50001) and systems optimization (pumps, steam, compressed air, fans/motors) under the GEF/UNIDO IEEMMS project[28] (2011-2016) by expanding into the new area of process heating (steam, direct firing) and process optimization, and by linking process heating (steam) with solar thermal applications[29]. Companies that have participated in the IEEMMS-supported training will be the first candidates to receive additional training on process heat and systems optimization, as well as the solar thermal energy applications provided under the proposed project (refer to the list given in Annex F).

92 Component 3: Demonstration and scaling up of sector-specific EE and solar thermal energy utilization in targeted industrial subsectors

Outcome	Output
Thermal energy efficiency and solar thermal technology demonstrated and deployed in 5 targeted industrial sub-sectors.	3.1 Energy saving measures and investment projects implemented in about 40 factories;
	3.2 Of these 40 factories, around 10 implement solar thermal demonstration projects, with a total installed solar collecting area of 10,000 m2, and a life time energy generation of 360,000 GJ.
	3.3 Case studies prepared and presented under output 2.3 to raise more investment in EE and solar thermal integration using the trained capacity and various financial incentive schemes created.

93 This component will provide direct support to around 40 plants of the selected sub-sectors to improve their EE through process optimization and optimization of process heating and cooling. At least 10 of these 40 plants will be selected for the installation of solar thermal energy systems to substitute fossil fuel energy. These 10

[28] *Malaysia: Industrial Energy Efficiency for Malaysian Manufacturing Sector* (GEF 3908)

[29] Further the material and knowledge on trainings out of the European IEE project EINSTEIN of energy efficiency and renewable energy for industry and the EUREM training course (European Energy Manager) will affect the development of this training program

solar thermal demonstration projects will serve to tap into the financing schemes coordinated under Component 1, and test the built capacity developed under Component 2, thus ensuring that the interventions are effective and sustainable.

94 Based on the factory visits in the PPG phase, the rubber glove, food, pharmaceutical, laundry, textile and electroplating industries showed the highest potential for solar and waste heat process heat integration.[30] The following integration points for solar and waste heat integration to supply process heat could be identified in several companies:

- Preheating of boiler feed water;
- Leaching process for rubber gloves;
- Heating in oleo-chemical processes;
- Heating up water baths for electroplating industry;
- Heating, washing and rinsing processes for carbonated and non-carbonated drinks;
- Heating up of cleaning water and detergents (CIP-Cleaning in Place fluid) in the food industry;
- Pre-heating of boiler makeup water for the production of direct steam in a steam boiler in laundries.

95 The target is to support 40 plants; these are not equally divided between the various sub-sectors; criteria for the selection of companies are:

- Size of the company (small, medium and large company); this will follow the definition of MIDA (see footnote 12);
- Local or multinational company;
- Commitment to participate in the project and willingness to share experiences;
- Potential savings in thermal energy and GHG emissions reduction;
- Easiness and potential for replication/duplication of the demo project;
- Available space for the solar thermal collector.

96 A series of workshops will also be organised to promote the project's activities and this in turn will help to identify suitable factories for visits and the carrying out of detailed audits. The database of the IEEMMS project will be used to ensure that factories meet the criteria of the proposed project and an additional database will be developed in cooperation with FMM and several manufacturing associations such as the Malaysian Rubber Glove Manufactures Association. The use of the existing database from the IEEMMS project will be used to identify factories that already have a base of energy efficient operations into which solar thermal applications can be incorporated. However, efforts will also be made to include industries that did not participate in the IEEMMS project but are interested in participating in the proposed project's demonstration projects; the National Seminar on Solar Thermal for Industrial Applications, taking place in Kuala Lumpur in November 7 2013 will be used to identify just such enterprises.

97 There are currently no local companies manufacturing the solar evacuated tube needed for medium temperature industrial applications in Malaysia; the product is imported from China and Europe. To start the demonstration projects, it is suggested that the system is designed, installed and commissioned by one or more local companies with the assistance of international and trained local consultants. The products and system components such as the solar thermal collector, controller, and pumping system can be imported from abroad. However, it is hoped that potential manufacturers will set up local production as local demand increases. The selection of enterprises to commission the demonstration projects will follow the rules and regulations of the project financiers, donors etc. As a demonstration project, the system should be certified according to the international and local industry standard to ensure that the system is safe and provides positive impacts for end

[30] For process heat optimization there are an additional five more sector identify cement, iron and metal, ceramic, chemical and petrochemicals and pulp and papers. These sectors consume high amount of process heat, mainly supplied by natural gas, coal and medium fuel oil/diesel.

users. In the procurement of such equipment, the GEF grant will help to identify potential suppliers/equipment, coordinate the procurement by participating enterprises, and assist in the eventual design of the tender and products for the demonstration projects.

98 The solar thermal system is intended to supply thermal heat for industrial applications, supplementing a conventional heat supply system, and fuel savings will be assessed by developing the specific energy index (energy use per unit of product) of the product/process before and after the installation of solar thermal evacuated tube system. The difference of the index is considered as the fossil energy savings and can be converted into GHG emissions reduction. The results of the demonstration activities will be assessed, monitored and disseminated as case studies.

99 The GEF grant will be used to provide assistance in carrying out assessments, identification of energy saving opportunities combined with solar thermal utilization, the design and preparation of procurement documents, conducting procurement of equipment, and can also cover a small percentage of the equipment costs, on average 20%, depending on the total equipment amount, complexity of the project, replication, and GHG emissions reduction, etc. All other costs associated with the demonstration projects will be borne by the participating companies, but potential sources of financing could include; SME Bank, SME Corp, Green Technology Financing Scheme (GTFS) Renewable Energy Fund, MIDA, TECHNO FUND, etc. The demonstrations will directly reduce energy consumption and reduce greenhouse gas emissions, while also consolidating the expertise provided under Component 2 and the policy framework developed under Component 1, and supporting the awareness raising programme under Component 2. For example, the experts trained in Component 2 will provide (with support from UNIDO's international experts) services to the 10-40 plants that will implement process and heat optimization and solar thermal systems and thus provide technical assistance and gain valuable hands-on experience themselves.

100 Technical assistance is provided to support investors and developers (on an as-needed basis) in project preparation and design, i.e. assessment and cost-benefit analysis, pre-feasibility analysis, full feasibility analysis, formulation of bankable proposals and, designing, manufacturing, installation and commissioning of solar thermal systems linked with systems optimization. The GEF Technical Assistance support is crucial to attract the 'early birds' that want to invest in solar thermal energy production and its application as part of energy efficiency improvements in selected industrial subsectors.

101 Case studies will be prepared based on comprehensive technical and economic analyses of the pilot projects, and will also present experience gained and tangible GHG emission reductions achieved. These case studies will be used in the awareness raising activities under Component 2. It is expected that more factories within the targeted sub-sectors and other suitable sub-sectors in industry and commercial building sectors will use the trained expertise and various funding schemes and incentives created to implement energy efficiency improvements projects and installations of solar thermal systems during the last two years of the project and beyond project completion.

102 The co-funding contributions from project partners for this component are by far the largest of all the components, and commitments from GreenTech, MoSTI, MIDA, FMM, and SEDA have been secured and confirmed in their respective co-financing letters.

103 Component 4: Monitoring and Evaluation

104 The monitoring and evaluation component will ensure that adequate monitoring and evaluation mechanisms are in place, facilitating smooth and successful project implementation and sound impact. Specifically, this component's outputs include; (i) Regular monitoring exercises conducted according to GEF and UNIDO requirements prepared; and (ii) Mid-term and final project evaluation conducted. The monitoring and evaluation approach taken by the project is explained in more detail in Annex H.

105 3) Innovation, Sustainability and Replicability

106 The proposed project's focus on energy efficiency gains through solar thermal applications is innovative in that this is a relatively new approach in Malaysia and the market is still at a nascent stage. Usage of solar thermal energy for industrial applications is still limited, with only around 100 examples at the global level, thus allowing Malaysia to use the capacity developed through this project to tap into a niche market that will

continue to expand in the coming years. Such innovative niche markets are key for emerging economies that are searching for a cost advantage in the global economy outside of cheap labour and manufacturing costs. GEF funding is very much required to allow Malaysia to take this initial step. This innovative approach is especially applicable to Malaysia as it has a high solar thermal energy potential and a baseline that is developed enough to adapt to new and innovative technologies.

107 Sustainability of project interventions will be ensured through capacity building of institutions and end users, as well as demonstration of solar thermal applications. Capacity building activities will be built around training programmes on energy savings from process heating and cooling and on solar thermal technology for suppliers, consultants, and industry management and personnel. These programmes will take a train-the-trainer approach to ensure that capacity is built in a sustainable manner, allowing the market for solar thermal applications in Malaysia to growth beyond the project implementation period. Furthermore, the development of policies and financial schemes to promote and encourage investment in solar thermal applications will work towards creating a policy framework that will support energy efficiency in the long term, having a lasting impact on the policy environment.

108 The awareness raising activities under Component 2 will seek to raise interest in and understanding of the benefits associated with solar thermal industrial applications. By creating awareness, the project will seek to increase adoption of solar thermal applications in regions other than those directly focused on by the project's interventions. The capacity building and policy activities of this project will encourage this, and the case studies developed under Output 3.3 will disseminate the energy efficiency gains and energy savings across multiple regions of Malaysia. Furthermore, as Malaysia is considered a regional leader in multiple industries, this project has the potential to share lessons learned, and thus encourage adoption, at the regional level.

109 A.6 Risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and measures that address these risks:

110 The main risks, their ratings and the mitigation strategies for the project are listed below, while details on risks/assumptions per outcome are given in the results framework of Annex A):

Risk	Rating	Mitigation
Management priorities in the participating public sector and private sector organizations change over time before and during project implementation	Low	Signing of a Terms of Reference (ToR) and Cooperation Agreement with the project partners before commencement of the project as well as Co-financing letters.
Effective coordination between various project partners.	Low	A proper coordination will be sought through the Project Steering Committee and ad-hoc working groups per subsector or theme that can be set up as needed, bringing in other partners and beneficiaries. The Project Management Unit (PMU) will play a key role in the coordination of these various interests, channelling them into the day to day execution of the project.
Companies have doubts regarding techno-economic viability. Thus, demonstration projects are delayed, limiting the opportunity to disseminate success stories and develop case studies.	Medium	To overcome this risk, the factories selected as demonstration sites will be carefully evaluated; this will include management support, financial strength, technical backup, and replication abilities. The demonstration project proponents are anticipated to provide initial case study results and thus serve as examples for other factories to replicate. While the GEF grant will support the demonstration projects in a number of ways (including up to 20% of equipment costs), all other costs will be borne by the participating companies, thus ensuring that continued participation is in the interest of their management.

Risk	Rating	Mitigation
Limited number of participants interested in training and no immediate demand for services for trained experts as the growth of the market for solar thermal technology is slower than expected.	Low	The integrated approach of the project is expected to mitigate this risk by not only promoting the technology but also creating a new market and demand for the application in heat processes in the industrial and commercial sectors. The capacity building approach adopted by the project combined with awareness campaigns and policy coordination will ensure the sustainability of the project and thus development of the solar thermal technology market in Malaysia to mitigate this risk. The capacity of SERI and the FMM Institute will be strengthened by the project so that they will continue providing support to the local experts,
Incentives and the financial support system are insufficient.	Low	The capacity of financial and governmental institutions will be strengthened on energy saving opportunities and solar thermal systems and their potentials. Grant and non-grant instruments will be developed and applied to ensure the availability of financing resources. Experiences from other countries will be shared, and results from the demonstration projects will be widely presented.
Government financing and policy instruments for thermal energy application in industry are not effective enough to incentivize industrial stakeholders' investment in solar thermal technologies.	Low	Close coordination between policy makers and industry, through FMM, various Chambers of Commerce and Industries, etc. will aim to mitigate this risk by designing or revising financing/policy instruments that are in line with the needs of industry. Focus will be given to provide adequate support to the industries for the implementation of solar thermal energy application: better technical support, awareness raising on the consequences of climate change, zero-GHG emissions from solar energy, sufficient information on the availability of various financing schemes, etc.
Climate change risks: increased cloud cover from climate warming reducing solar radiation levels	Low	Careful design of the solar thermal systems will be ensured during project implementation.

111 A.7 Coordination with other relevant GEF financed initiatives

112 Research and development (R&D) promotes and supports the production of high quality, up-to-date and relevant outputs, products and services related to solar thermal energy. It also plays a crucial and important role in the on-going efforts to further improve production processes, to raise the quality standards of solar thermal technology and to cut costs through the introduction of new and innovative methods. The sources of funding for R&D in Malaysia are mainly from MoSTI through IRPA (Intensification of Research in Priority Areas) Funds and the Industrial Research and Development Grant Scheme (IGS).

113 The project will also use the results of the on-going GEF UNIDO project on Industrial EE for the Malaysian Manufacturing Sector (IEEMMS) as discussed in the baseline project section (Section B.1). For example, the proposed project may select those companies or plants that have received support from the IEEMMS project in implementing energy management system and energy system optimization, to provide support and assistance to further reduce their energy consumption by the optimization of process heating and cooling, solar thermal energy integration. The proposed project will also seek to coordinate with other ongoing GEF-funded projects

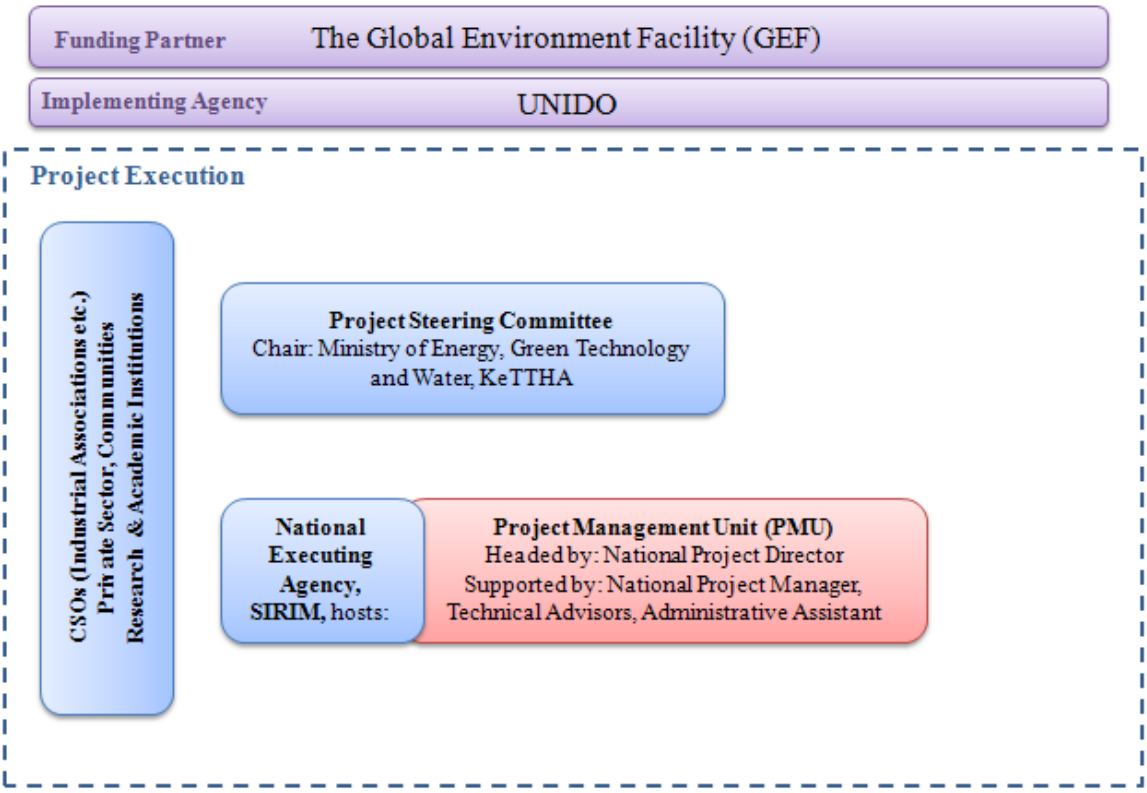
such as the GEF UNIDO Cleantech Programme in Malaysia that recently started implementation, and has launched an innovative approach of private sector involvement that offers learning opportunities for the proposed project. The innovative concepts technologies developed and disseminated as a result of the Cleantech project could also provide opportunities for cooperation should they include innovative technologies, such as the solar thermal applications focused on by this project.

114 On capacity building and demonstration projects, SIRIM Berhad will coordinate with the SERI, UKM and other relevant institutions for the content of training activities and implementation relating to solar thermal and EE improvements.

115 B. ADDITIONAL INFORMATION NOT ADDRESSED AT PIF STAGE:

116 B.1 Describe how the stakeholders will be engaged in project implementation.

117 An Organigram of the management of the project implementation can be seen below:



118 A Project Steering Committee (PSC) will be established to provide strategic guidance, and coordination between various ministries and other stakeholders. Many key partners of this new project are also those of the on-going IEEMMS project which will ensure the effective coordination of the two projects via the various project management levels, the PSC, project management and technical working groups. The PSC will meet at least once every six months with ad-hoc meetings organized when necessary. While there are a number of PSC members, experience gathered from similar projects has shown that effective coordination and active participation by the key project stakeholders can be maintained as long as all members are relevant to the project.

119 The local project executing agency will be *SIRIM Bhd.* that will host the Project Management Unit (PMU).

120 SIRIM will appoint one of its senior managers to be the National Project Director (NPD) who will act as the Government representative to work closely with the PMU to ensure that the daily management of project execution is fully in line with Government priorities, rules and regulations, and that all local inputs and participation in the project implementation are on time and adequate. The NPD shall have adequate authority and knowledge within the Government to get the necessary support from all local project partners to perform

his/her duties under this Project, in particular to ensure that the Project is supporting Malaysian efforts.

121 The Project Management Unit (PMU) is responsible for the daily management of project activities/execution, and will also act as the Project Steering Committee Secretariat. It will provide guidance/advice in the execution of each project component, in accordance with the project document. The PMU will comprise of:

- National Project Manager (NPM; fulltime, paid from the GEF budget);
- Administrative Assistant (fulltime, paid from the GEF budget);
- Technical Advisors (part-time, paid from GEF budget and co-financing).

122 The major stakeholders involved in the execution of the project are:

	Stakeholder	**Mandate and/or function in Malaysia**
Implementing Agency	UNIDO	UNIDO is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability. In recent years, UNIDO has assumed an enhanced role in the global development agenda by focusing its activities on poverty reduction, inclusive globalization and environmental sustainability. The Organization draws on four mutually reinforcing categories of services: technical cooperation, analytical and policy advisory services, standard setting and compliance, and a convening function for knowledge transfer and networking. UNIDO is the implementing agency of the proposed project and a member of the PSC.
National Executing Agency	SIRIM Berhad	The Department of Standards Malaysia (DSM) has appointed the Standards and Industrial Research Institute of Malaysia (SIRIM Berhad) as the sole 'national standards development agency.' SIRIM Berhad is a wholly owned company of the Government (incorporated in 1996) under the Ministry of Finance Incorporated. While Standards Malaysia is responsible at the policy level, SIRIM is responsible at the technical level for the development of standards, as well as R&D development, engineering and design services, technology commercialization, training and consulting services and (through SIRIM QAS Int. Sdn. Bhd.) providing certification, inspection and testing services. SIRIM Berhad will be the national executing agency of the project, responsible for hosting the Project Management Unit (PMU) and will appoint the National Project Director (NPD). The survey conducted by SIRIM will serve as input for the creation of an enabling olicy environment under Component 1, and SIRIM will also assist in the organization and coordination of trainings under Component 2. In addition, SIRIM will also be involved in the implementation of energy saving measures and solar thermal demo projects. SIRIM Berhad will be a member of the PSC.

Project Steering Committee (PSC) Chair	Ministry of Energy, Green Technology and Water (KeTTHA; *Kementerian Tenaga, Teknologi Hijau dan Air Malaysia*)	The role of KeTTHA is to facilitate and regulate the electricity sectors in the country, to ensure affordable energy is available to consumers throughout the country (by reviewing tariffs imposed by the utilities and monitoring standards of the utilities), to monitor energy programmes and to promote energy efficiency and renewable energy. The Ministry, in coordination with the Economic Planning Unit (of the Prime Minister's Office), provides the general direction, and strategies in the energy sector. KeTTHA is also responsible for the promotion, innovation in and application of green technologies and for the water sector. KeTTHA will be the Co-chair of the PSC.
	Ministry of Science, Technology and Innovation (MoSTI)	MoSTI seeks to increase productivity and competitiveness in agriculture, manufacturing and service sectors, generate new sources of wealth in technology and knowledge-intensive sectors (such as biotechnology, ICT, sea and space technology as well as industrial technology) and to raise the country's capacity for knowledge, creativity and innovation. MoSTI will be a member of the PSC.
Project Steering Committee Members	Ministry of International Trade and Industry (MITI)	MITI has the function of planning, formulating and implementing policies on industrial development, international trade and investment; encouraging foreign and domestic investment; promoting Malaysia's exports of manufacturing products and services by strengthening bilateral, multilateral and regional trade relations and cooperation as well as enhancing national productivity and competitiveness in the manufacturing sector. MITI will be a member of the PSC.
	Ministry of Natural Resources and Environment (MNRE)	MNRE is the GEF Focal point in Malaysia and its major areas of focus include: (i) Natural resource management; (ii) Conservation and management of environment and shelters; and (iii) Management of land survey and mapping administration. MNRE will be a member of the PSC.
	Energy Commission (ST; *Suruhanjaya Tenaga*)	ST has been the regulatory agency for the electricity and piped gas supply industries in Malaysia since 2001. The Commission's main tasks are to provide technical and performance regulation for the electricity and piped gas supply industries, safety regulations for electricity and piped gas, to advise the Minister on all matters relating to electricity and piped gas supply and to ensure consumer protection. Another function of the Commission is to promote the use of renewable energy and the conservation of non-renewable energy. Several initiatives have been started, mostly related to efficient electricity production and use. The Energy Commission will be a member of the PSC and will participate in the capacity building activities under Component 1.
	Sustainable Energy Development Authority (SEDA)	SEDA has recently been established and assigned to administering the FiT (feed-in tariff mechanism) and promoting renewable energy technology in Malaysia. SEDA will be a member of the PSC and will participate in the capacity building activities under Component 1.
	Federation of Malaysian	FMM was established in 1968 and is Malaysia's largest private sector

	Manufacturers (FMM)	economic organisation in Malaysia, representing over 2,000 manufacturing and industrial service companies of varying sizes. FMM is officially recognised and acknowledged as the voice of industry in Malaysia, and its institute offers training courses to upgrade the skills and knowledge of manufacturing sector employees. FMM will coordinate the organization of training courses, and participate in the selection of plants for EE improvements and the installation of STSs and awareness raising activities for its members. FMM will be a member of the PSC and will also assist in the development of the database under Component 3.
	Malaysia Green Technology Corporation (MGTC)	MGTC, or more commonly known as GreenTech Malaysia, was established on 12 May 1998 as the Malaysian Energy Centre or *Pusat Tenaga Malaysia* (PTM). As a national energy research centre, PTM focuses on the development of the energy sector, especially technological research and demonstration of RE and EE. In August 2009, the Government launched the National Green Technology Policy with the aim to provide direction toward the management of sustainable environment. To pursue it further, PTM was restructured as GreenTech Malaysia on 7 April 2010, to act as the implementing arm of KeTTHA. MGTC is the focal point to drive and facilitate the implementation of the development and promotion of green technology in Malaysia. MGTC will be a member of the PSC and will participate in the capacity building activities under Component 1. In addition, the Green Technology Funding Scheme, under the auspice of GreenTech Malaysia, will contribute to the project in the form of potential investment in the projects conducted under Component 1 and 3.
	Economic Planning Unit (EPU, Energy Section)	The EPU is the principal government agency in Malaysia that was set up in 1961 to "focus on development planning, on high problems in plan execution, and on all forms of foreign aid" for the nation. It has been made responsible for the formulation, implementation, progress evaluation and revision of development plans. EPU will be a member of the PSC and will participate in the capacity building activities under Component 1.
	Malaysian Investment Development Authority (MIDA)	Under MITI, the MIDA is the government's principal agency for the promotion of the manufacturing and services sectors in Malaysia. MIDA assists companies that intend to invest in these sectors, as well as facilitates the implementation of their projects. MIDA also evaluates applications for projects in the manufacturing and related services sectors, such as manufacturing licenses, tax incentives, expatriate posts, duty exemptions on raw materials, components, machinery and equipment MIDA will be a member of the PSC.
onal Stake holder	Department of Standards Malaysia (DSM)	DSM is an agency under the ambit of MoSTI and is the national standards and accreditation body for Malaysia with its roles and functions governed by the Standards of Malaysia Act 1996 (Act 549). DSM is also the national representative for Malaysia in international and regional standardization activities.

	SERI (Solar Energy Research Institute), University Kebangsaan Malaysia (UKM)	SERI carries out research and knowledge dissemination in solar energy and renewable energy technology, management and policy in the context of economic and environmental sustainability. SERI will assist in the organization and coordination of trainings under Component 2.
	Malaysian Industry – Government Group for High Technology (MIGHT)	Under the purview of the Prime Minister's Office, MIGHT is a membership-driven organization which members from industry, government and academia to promote high technology development and industrial advancement. MIGHT will participate in the capacity building activities under Component 1.
	SME Corps. Malaysia	In 1996, SMIDEC was established to spur the development of small and medium enterprises (SMEs) by providing infrastructure facilities, financial assistance, advisory services, market access and other support programmes. In 2007, SMIDEC was transformed into SME Corp. as the single dedicated agency (under MITI) with the responsibility to formulate overall policies and strategies for SMEs and to coordinate programmes across all related Ministries and Agencies.
	SME Bank	An agency under MITI, SME Bank complements financial products and services offered by commercial banks through integrated financial products and business development advisory services for SMEs.
	Gender Dimensions:	Relevant women entrepreneurs, associations and gender focal points will be invited to participate in project implementation as described in the relevant paragraphs above; for example, whether the project will have adequately addressed gender issues and gender mainstreaming. Efforts will also be made to include ministerial gender focal points in project steering committee meetings where possible.
	Civil Society Organizations (CSOs):	Relevant CSOs will be invited to participate during project implementation

123 **B.2 Describe the socioeconomic benefits to be delivered by the Project at the national and local levels, including consideration of gender dimensions, and how these will support the achievement of global environment benefits (GEF Trust Fund/NPIF) or adaptation benefits (LDCF/SCCF):**

124 The project reflects commitment to improve energy efficiency and renewable energy as a pivotal way to meet the climate change challenge. The project will not only help limit energy demand, but by also improving the reliability of energy supply, will enhance economic competitiveness, generate employment, and reduce local, regional, and global air pollution. Under the project, activity for the deployment of energy efficiency and solar measures in thermal energy use will also save money for end-users i.e. industrial companies in Malaysia by providing cost-effective solutions. In addition to the economic benefits, energy efficiency measures have great potential to reduce CO2 emissions.

125 Based on UNIDO's experience in the implementation of similar technical assistance projects in Malaysia and South-East Asia, socioeconomic benefits in the form of improved South-South cooperation can be expected. As this is a relatively new market concept in Malaysia, lessons learned can be taken from other emerging economies and cooperation at later points in the project can be expected. This cooperation will be vital if a local market for the production of the products and system components required for industrial applicants of solar thermal energy is to develop in Malaysia. The growth of such a market will also lead to additional socioeconomic benefits such as job creation, income growth and a general improvement in the standard of living.

126 Gender dimensions are considered a key stakeholder for the development of industry, energy and environmental resources and climate change mitigation. Therefore, a gender analysis will be carried out as part of the capacity assessment of Output 1.1 at the outset of the project. Gender mainstreaming action will be integrated into all stages of the project cycle, in particular in the training and skills strengthening activities of outputs 2.1 and 2.2. References to gender will be consistent throughout the project approach, the activities, indicators, and budget. Female experts will also be encouraged to participate in the training and other project activities.

127 B.3 Explain how cost-effectiveness is reflected in the project design:

128 In additional to the above benefits, it is expected that the project will result in considerable global environmental benefits in terms of GHG emission reductions through a substantial reduction in fuel and electricity consumption, fuel switching by replacing fossil fuels with solar thermal energy and putting in place energy efficiency practices and measures. The following table compares the cost effectiveness of reducing GHG emissions in the proposed project, based on the estimates presented in Annex G.

	Cumulative GHG reduction ($ktCO_2$)	**GEF Cost-effectiveness (USD/tCO_2)**
Direct emission reductions (2014-2018)	2,759 $ktCO_2$	1.4
Indirect emission reductions (bottom-up)	5,518 $ktCO_2$	
Indirect emission reduction (top-down)	17,197 $ktCO_2$	

129 Using solar thermal energy in the selected sub-sectors of Malaysia to replace energy from conventional sources is more cost-effective than using other renewable energy resources, (for example, the next possible option would be biomass) for a number of reasons:

- The size of application at different factories is relatively small for a cost-effective biomass application;
- There is almost no waste from the selected sub-sectors that could be used as biomass, therefore, the collection and transportation costs of the required amount of biomass for each of the application would be very high and challenging;
- The majority of biomass used in Malaysia is from the palm oil sector. The use of this biomass is mainly for composting, pulp & paper, wood industry, and animal feedstock;
- In contrast, Malaysia has a very high solar thermal energy yield rate per collector area unit;
- Using solar thermal energy has a lesser environmental impact in comparison to biomass;
- Based on the experience of the ongoing GEF-funded project in Thailand (GEF ID 4184) which uses rice husk and bamboo waste to generate power, the direct emission savings cost of biomass implementations is USD 11.9 per ton of direct CO2 emissions. In contrast, the proposed solar thermal project in Malaysia has a cost of USD 1.4 per ton of direct CO2 emissions.

130 The cost-effectiveness of the project design has been embedded into the integrated approach of the project to address the existing barriers: improvement of the policy framework and financial incentives schemes, institutional and human capacity building with a strong focus on on-site practical training, demonstration and awareness raising. A very detailed and well-designed collaboration and coordination system among all stakeholders and with the other concerned projects and programmes, as well as a comprehensive M&E plan will contribute to project cost-effectiveness. Mindful combination of local and international expertise in the project development and implementation phases will also contribute to cost-effectiveness. Last but least, the proven expertise of UNIDO in this form of project in other countries can bring about cost reductions without

compromising quality.

131 KeTTHA, as the PSC Chairman and the GEF FP, will facilitate strong coordination with past, on-going and future GEF projects under the Climate Change focal area, in particular with the GEF3 IEE project by the UNDP and GEF4 IEE project by UNIDO, to save costs, create synergies and avoid overlaps. The proposed project will be implemented under the overall global GEF UNIDO programme, which will allow close cooperation and experience sharing with other countries that will help to save the costs and create greater impact.

132 C. DESCRIBE THE BUDGETED M &E PLAN:

133 Project monitoring and evaluation (M&E) will be conducted in accordance with established UNIDO and GEF procedures. According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies like Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, reports and other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities. The overall objective of the monitoring and evaluation process is to ensure successful and quality implementation of the project by: i) tracking and reviewing project activities execution and actual accomplishments; ii) providing visibility into project progress so that the implementation team can take early corrective action if performance deviates significantly from original plans; iii) adjust and update the project strategy and implementation plan to reflect possible changes on the ground, results achieved and corrective actions taken; iv) keep the GEF Secretariat updated on all project activities.

134 The Logical Framework Matrix in Annex A provides performance and impact indicators for project implementation along with their corresponding means of verification. These will form the basis upon which the project's M&E Plan will be built. In particular, the impact and performance indicators in Annex A will track, report and review project activities and accomplishments in relation to: establishment and adoption of policy papers and financial incentive schemes, capacity building and utilization, awareness raising and demonstration projects. In addition, a standardized approach will be used for monitoring energy reduction in the 40 plants, following the ISO 50001, Energy Management Standards and the process heat assessment guidelines to be developed and trained on during the project implementation. GHG emissions reductions will be calculated based on the energy saving amounts; the detailed process for doing so is elaborated on in Annex H. Progress made in achieving the project targets will be reported in the form of Project Implementation Reports (PIR) to be submitted to the GEF on an annual basis

135 UNIDO will be responsible for overall management and tracking of project milestones as well as reporting to the GEF. The M&E procedure will consist of a) project inception, b) semi-annual reviews, c) tracking project progress and d) independent mid-term and final evaluation. The estimated total budget for M&E is US$164,000 (US$64,000 from the GEF and US$100,000 from co-financing).

136 Following is the table summarizing key M&E activities with the GEF budget:

M&E Activity Categories	Feeds Into	Time Frame	GEF Budget (USD)	UNIDO (USD)	Co-Financing (in-kind USD)	Responsible Parties
Measurement GEF Tracking Tool specific indicators	Project management	Continuous	30,000	42,000	17,000	PMU
Monitoring of project impact indicators (as per LogFrame)	Project management;	Continuous				

Periodic Progress Reports	Project management; PSC Meeting	Semi-annually				
Mid-term review/ evaluation	Project management; PSC	At project mid-term	17,000	8,000	8,000	UNIDO PM, PMU and independent evaluator
Independent terminal evaluation	Terminal Evaluation Review (TER) conducted and Terms of Reference for evaluation drafted by UNIDO EVA.	Project completion	17,000	10,000	15,000	Independent evaluator, PMU, UNIDO PM, and UNIDO Evaluation Group
TOTAL			**64,000**	**60,000**	**40,000**	

137 More details on M&E are provided in Annex H and progress indicators are given in Annex A.

138 D. LEGAL CONTEXT:

139 The Government of Malaysia agrees to apply to the present project, mutatis mutandis, the provisions of the Revised Standard Technical Assistance Agreement concluded between the United Nations and the Specialized Agencies and the Government of 1 March 1962.

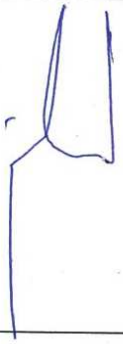
PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT(S) ON BEHALF OF THE GOVERNMENT(S):): (Please attach the Operational Focal Point endorsement letter(s) with this form. For SGP, use this OFP endorsement letter).

NAME	POSITION	MINISTRY	DATE *(MM/dd/yyyy)*
Dr. Lian Kok Fei	GEF Operational Focal Point Undersecretary of Environmental Management & Climate Change Division	**MINISTRY OF NATURAL RESOURCES AND ENVIROMENT (MONRE), MALAYSIA**	04/13/2013

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for CEO endorsement/approval of project.

Agency Coordinator, Agency Name	Signature	Date *(Month, day, year)*	Project Contact Person	Telephone	Email Address
Mr. Philippe Scholtès, Officer in Charge, Programme Development and Technical Cooperation Division (PTC) UNIDO GEF Focal Point		20/3/14	Khac- Tiep Nguyen, Energy and Climate Change Branch, UNIDO 	+43 1 260 26 3086	k.nguyen@unido.org

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

Project Result	Indicator	Baseline	Targets	Source of verification	Risks and Assumptions
Project Objective					
To reduce GHG emissions by promoting and demonstrating sector-specific thermal EE improvements and solar thermal technology utilization in industry.			**Direct energy savings and substitution:** Solar thermal: 360,000 GJ; Thermal energy efficiency: 40,603,583 GJ **Lifetime GHG emission reduction:** Solar thermal: 24 $ktCO_{2;}$ Thermal energy efficiency: 2,735 $ktCO_{2.}$ **Post-project replication** (investment in RE/EE opportunities in industry) will lead to indirect emission reduction of between 5,518 and 17,197 $ktCO_2$	Project progress report Demonstration projects validation reports End-of-project impact report Project website	

Component 1: Development of a regulatory framework and financial incentive schemes to facilitate solar thermal energy utilization and thermal energy efficiency					
Outcome 1					
Policy papers and financial incentive schemes established and endorsed by stakeholders.	Number of policy papers on solar thermal energy endorsed by stakeholders; Number of financial incentive schemes (e.g. tax breaks, certification schemes) established and endorsed by stakeholders.	No specific policy papers or financial incentive schemes for the promotion of industrial solar thermal energy utilization have been endorsed by the Malaysian institutions.	3 policy papers on solar thermal energy endorsed by stakeholders (score 4 from the GEF's 0 to 5 score range); 2 financial incentive schemes endorsed and established by stakeholders (score 4 from the GEF's 0 to 5 score range).	Official documents Websites of organizations Publicity given in media	National authorities are willing to adopt specific regulations; Interest by stakeholders to apply EE (especially in the SMEs) exists and can be maintained.
Output 1.1					
National counterparts supported to develop three policy papers on solar thermal energy.	Number of policy papers developed; % of counterparts taking part in the development of policy papers report having benefitted from built capacity; Number of workshops and seminars organized.	There are currently no policy papers on solar thermal energy under development.	At least 3 policy papers on solar thermal energy developed; At least 70% of counterparts taking part in the development of policy papers report having benefitted from built capacity; At least 5 workshops and seminars organized.	Technical reportsProject progress reports Workshop proceedings	
Output 1.2					
Two financial incentive schemes focusing on solar thermal applications developed.	Number of financial incentive schemes (e.g. tax breaks, certification schemes) developed; Number of seminars/ events to present and discuss proposals organized.	No financial incentive schemes for the specific purpose of promoting the utilization of solar thermal energy in industry are available.	At least 2 financial incentive schemes developed. At least 5 workshops and seminars/events to present and discuss proposals organized	Technical reports Workshop proceedings Publicity in media Project progress reports	National authorities are willing to adopt specific regulations.

Component 2: Awareness raising and capacity building programme relating to process heating and cooling optimization and solar thermal energy utilization					
Outcome 2					
Awareness and capacity of equipment vendors, service providers, industry management, plant engineers, and financial institutions in 5 targeted industrial sub-sectors strengthened and utilized.	% of participants reporting that they feel capable of successfully applying the knowledge/ skills acquired in their workplace;	Currently only one institution and one company offer services, albeit limited, on solar thermal utilization, and there are very few consultants for boiler and furnace efficiency improvements.	90% of participants report that they feel capable of successfully applying the knowledge/ skills acquired in their workplace; (score 5 from the GEF's 0 to 5 score range);	Evaluation reports Website of organizations and companies Project progress reports	Availability and willingness of experts to receive training; Willingness of companies and vendors to receive expert training.
Output 2.1					
Training programme on energy savings based on process heating and cooling conducted for service providers, consultants and industry in selected sub-sectors.	Number of trainees at various levels, users, experts, etc. trained in process heating optimization and waste heat recovery.	No comprehensive trainings on process heating and cooling are available in the selected sub-sectors.	50 equipment vendors, 100 users and 50 experts trained.	Training reports Project progress reports Company information	Availability and willingness of experts to receive training. Willingness of companies and vendors to receive expert training.
Output 2.2					
Training programme on solar thermal technology conducted for equipment/ component suppliers, service providers, consultants and industry in selected sub-sectors.	Number of trainees trained at various levels on solar thermal systems and integration in industrial processes.	No comprehensive trainings on solar thermal technology are available in the selected sub-sectors.	30 equipment vendors, 80 users and 40 experts trained	Training reports Company info and plant visits	Interest by stakeholders to apply solar thermal integrated with EE improvements exists and can be maintained.

Output 2.3					
Awareness raising events organized for industry management and financial institutions on investment in energy savings and solar thermal application.	Number of awareness raising events organised; Number of publications issued; project website developed.	No comprehensive awareness programme on solar thermal energy utilization or on thermal EE in industry exists.	At least 20 awareness raising events for the target group (industry managers, financial institutions) organized, including experience with the demonstration projects; 20 publications, posters etc. issued; project website operational.	Technical reports Company info and plant visits	Willingness of government agencies and commercial banks to support RE (solar thermal) and EE in industry.
Component 3 - Demonstration and scaling up of sector-specific EE and solar thermal energy utilization in targeted industrial subsectors					
Outcome 3					
Thermal energy efficiency and solar thermal technology demonstrated and deployed in 5 targeted industrial sub-sectors.	% of plants reporting that they will continue to use and maintain the technology transferred by the project in their plants.	The selected sub-sectors do not currently have ongoing demonstration projects for thermal EE and solar thermal technology.	90% of plants report that they will continue to use and maintain the technology transferred by the project in their plants.	Evaluation reports Website of organizations and companies Project progress and technical reports Monitoring and case study reports	Interest by stakeholders to apply EE (especially in the SMEs) exists and can be maintained.

Output 3.1					
Energy saving measures and investment projects implemented in about 40 factories.	Number of facilities in which EE in thermal processes have been implemented.	No such demonstration projects are currently available in the selected sub-sectors.	40 companies with EE improvements in process heating and cooling;	Project progress and technical reports Monitoring and case study reports; Company information	Interest by companies to apply EE and systems optimization exists and can be maintained.
Output 3.2					
Of the above 40 factories, around 10 implemented solar thermal demonstration projects.	Number of facilities in which solar thermal energy utilized.	No such demonstration projects are currently available in the selected sub-sectors.	10 facilities with integrated solar thermal systems.	Project progress and technical reports Monitoring and case study reports; Company info and plant visits	Companies are willing to implement EE measures in thermal systems and integrate with solar thermal.
Output 3.3					
Case studies prepared and presented under output 2.3 to raise more investment in EE and solar thermal integration using the trained capacity and various financial incentive schemes created.	Number of case studies prepared and presented at awareness raising events; Number of future investment opportunities identified.	Due to the lack of demonstration projects and investment in solar thermal technologies in industry, case studies are nonexistent.	10 case studies prepared and presented at seminars/ workshops (total of 20 event days, held at workshops at various places throughout Malaysia);	Progress reports Presentations and training materials	

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

1. Final GEF Sec Review of PIF on April 2012

Question Number	Secretariat comment	Response by UNIDO at CEO ER
31. Items to consider at CEO endorsement	Please consider the following items to be addressed for the submission of the CEO Endorsement Request: i. The scope (grant and non-grant) and the level of GEF funding for investment activities should be clearly justified based on the incremental cost principle. ii. Specific reference should be provided regarding the outcomes, outputs, and direct/indirect benefits of the existing EE project and how their overlap with those of the proposed project will be avoided. iii. Specific commitments of resources from the existing Malaysian funding instruments that will be supplemented by the GEF resources should be documented.	Response to the three items mentioned: i. There is no non-grant GEF funding for investment activities of this project. The scope for the GEF grant has been described in many parts of the CEO ER, for instance in Component 3 of section 2: Project rationale, project scope and activities under A5. Due attention will be given during project implementation to carefully consider the scope and level of each demonstration project based on the incremental cost principle, and support by the Government and commitments by each of the host plants. Energy efficiency (and renewable energy) for industry has been on the agenda in Malaysia and has been supported by a number of GEF projects, including MIEEIP and the on-going IEEMMS. Much of the national (and donor-supported) efforts have focused on savings in electric use of energy. Fewer efforts have gone into energy management of heat in industrial processes and consequently less knowledge and awareness exists in this specific area. There is a similar lack of knowledge of linking such energy conservation efforts with the use of renewable energy, in this case solar for thermal heat applications. GEF support is being asked to help bring application and diffusion of EE and application of solar thermal in industrial (heat) processes in Malaysia to a higher level, by means of a concerted effort by a number of Malaysian organisations and institutions in a mix of targeted training, awareness creation and demonstration activities. The use of solar thermal energy for industrial application demonstrates a very new development in industrial energy supply systems and only some hundred realized examples exist worldwide, but with an increasing development in the last two years. In order to push this development of solar thermal energy in the new application area of industrial processes, GEF support will be very crucial and incremental. ii. In several parts of the CEO ER, in particular under Section 1.3: Industrial Sector of A.4. The baseline project and the problem that it seeks to address, and A.5. Incremental/Additional cost reasoning, specific references have been provided regarding the outcomes, outputs and direct and indirect benefits of the existing GEF 3 and GEF 4 EE projects, and how overlap with the proposed project will be avoided, as well as synergies and continuation created. In summary: The efforts regarding EE application (in combination with RE) in industry by UNIDO can be regarded as capacity strengthening (training), awareness raising, policy incentives and demonstrations in: i) ISO 50001 (EnMS) and energy management systems; ii) system optimization (pumps, motor/fan, compressed air, steam) focusing on electricity; and iii) process heat system optimization: waste heat management, heat exchanger and storage management, etc. The UNDP/GEF MIEEIP project laid the general foundation for EE promotion and awareness in industry, the UNIDO/GEF IEEMMS goes

		deeper by focusing on the above-mentioned i) and ii) points, while this proposal complements IEEMMS by focusing on point iii), plus linking it with options for solar thermal application. From the viewpoint of technology focus, there is no overlap with IEEMMS, although similarities in project setup (e.g. the way trainings are prepared and conducted) may suggest so. In awareness raising and policy incentives, some overlap may occur, but it will be ensured that there is a continuous dialogue and coordination between the two project teams. In any case, the same entities are involved in both projects (e.g. KeTTHA, SIRIM Bhd, FMM, SME Corp) which will facilitate day-to-day coordination iii. 'Green' investments (including targeted EE and RE) from the GTFS (Green Technology Financing Scheme) can apply, see pp. 7. Under the scheme, a company can apply for a loan at a participating Malaysian commercial or development finance institution of which the Government guarantees part of the loan and provides an interest subsidy. In addition, SME Bank complements financial products and services offered by commercial banks through integrated financial products and business development advisory services for SMEs.

2. STAP Review of PIF on 8 May 2012: STAP's advisory response to the GEF Secretariat and GEF Agency(ies): **Consent**

Guidance from STAP	UNIDO Response by UNIDO at CEO ER
- **Baseline:** This will include continued R&D funding and continuation of other funding sources for EE in industry, but mainly for electrical appliances. Potential energy savings from EE and solar thermal systems have been calculated for each sub-sector. It is not clear if this is the technical or economic potential so the "realistic potential" may be lower.	Technical and economic potential have been considered by each temperature levels of the processes in the selected subsectors and solar fraction. In the CEO ER, detailed EE estimates are provided in Annex G and are based on the 'economic potential' of each subsector and by distinguishing between high-temperature and low-temperature applications. The solar thermal potential fuel substitution is more detailed as well, making estimates per industrial subsector.
- Demonstrations: How will the factories be selected? Will the 40 plants be equally divided between the 5 sub-sectors or will the share be made according to the estimated shares of energy savings shown in Table 1? - Will they all be energy inefficient without having implemented any energy saving techniques to date or will there be a mix? The baseline for each will need to be carefully evaluated. If already energy efficient, any improvements will be more difficult to achieve.	The selection of the most promising subsectors is described at the end of Section A.5. The target is to support 40 plants; these are not equally divided between the various sub-sectors. The criteria for the selection of companies are: a. Size of company (small, medium and large company); this will follow the definition of MIDA; b. Local or multinational company; c. Commitment to participate in the project and willingness to share experiences; d. Level of energy intensity or efficiency, potential for waste heat recovery and application of solar heating to replace fuel energy use that would result in energy savings as well as GHG reduction. e. Potential for replication/duplication of the demonstration project; f. Available space for the solar thermal collector where applicable ; g. Potential for applicability and use of local or international benchmark for energy use and best practices for the

	industry. Furthermore, a series of workshops will be organised to promote project activities and this will help in turn to identify the suitable factory for visits and carrying out of the detail audit. The project will use the data base of the IEEMMS project to ensure that factories meet the criteria of the project. An additional data base will be developed in cooperation with FMM and several manufacturing associations such as the Malaysian Rubber Glove Manufacturers Association. Some companies will have participated in IEEMMS so some efficiency improvements in these companies will have been implemented as part of a) ISO 50001 implementation and b) optimization in electric systems and machinery (pumps, motors, etc.). However, IEEMMS does not cover process heat and waste heat management. Thus, it is not that have done EE improvements in one area will make further EE difficult to achieve; it will be the opposite, having been exposed to EE in electric energy use, EE improvements in process heat will be easier to achieve.
- **10 solar thermal plants are planned:** Will solar thermal companies be invited to tender and, if so, will this only be local manufacturers or would foreign vendors also be allowed to tender? Will systems need to be certified to an industry standard? If cheaper Chinese models are available, might they provide a greater incentive for replication than more costly locally made systems? What scale of installation is envisaged for each factory? What form of thermal back-up, if any, will be used on cloudy days? How will the fossil fuel savings be assessed since annual energy demands often vary with the volume of production? STAP recommends using energy per unit of product produced as a metric in the project.	Currently there is no local company capable of manufacturing the solar evacuated tube for medium temperature industrial applications in Malaysia; the product is imported from China and Europe. To start the demonstration projects it is planned that the systems are designed, installed and commissioned by local companies, with support of project experts, all aims at local capacity building, and creating and maintaining a functioning local market, which will facilitate more solar thermal energy utilization. The products and system components such as solar thermal collector, controller, pumping system are imported from China and Europe, if they would not be available in the country at that time. All the collectors and necessary other parts will be certified to the industry standards which will be decided with the end consumer companies beforehand. As a demonstration project, the system should be certified according to the international and local industry standard to ensure that the system is safe, performing well and will have a positive impact on end users. The scale of the installation diverse from factory to factory but will be all large scale application from approx. 300 m² to several thousand square meters. The thermal back-up system will be most of the time the already existing system (wood boiler, natural gas boiler, oil boiler). In the framework of the EE the efficiency of the boiler will be investigated and maybe improved. In some cases maybe a new heat supply system will be installed. The boiler efficiency and so the possible fossil fuel savings will be calculated by measurements of the flue gas (temperature and composition) and the optimum combustion calculation. Benchmark comparison (energy per unit) will be used for a

	first indication of the energy performance of the factories Pls. Refer also to relevant information provided under Component 3 of the A5.Incremental/Additional cost reasoning.
- Climate change abatement and risk: It seems the GHG emission reductions should be 1,060,000 t CO2-eq/yr (not 1.060 kt as stated). This equates to around $4/t CO2 of GEF funding (including grants) which is relatively costly. A small risk of increased cloud cover from climate change warming reducing the solar radiation levels is possible.	The PIF estimates were indicative only; direct (lifetime) emission reduction is 2,759 $ktCO_2$. This equates to US$1.4/$tCO_2$ of GEF funding. This is not out of the ordinary as one of the two technical focus technologies, solar thermal in industry application, is a relatively new phenomenon (not only in Malaysia, but also worldwide). In comparison with energy efficiency, solar thermal applications are not as far on the path of the market development and introduction cycle. The technology has the interest of Malaysian authorities and stakeholders, however, as having large potential in the long term. Hence, the GEF support can be justified. Climate Change risk has been added to A6 of Part II of the CEO ER.
- EE Monitoring: It is not clear how the EE improvements will actually be measured in the various factories to be monitored. Will this be done for each technology or through the main gas/electricity meters for all technologies? Are baseline data likely to be available from past accounts?	Some data on energy consumption in audited factories are available from MIEEP (at PTM, now called GreenTech) for comparison; energy consumption will be monitored as part of project outputs. In addition, energy assessment/energy audit will be carried out regularly in all the factories once they implement EnMS or energy system optimization. In the beginning of the energy audit of each factory there will be the collection and measurement of the relevant energy data for important processes. For the monitoring phase these relevant data will be measured again and so there will be a comprehensive comparison between before and after possible. If available the data will be extracted from the general operating data logging In the calculation of Annex G, an irradiation level is assumed that corresponds with Malaysia's climatic conditions (4.96 $kWh/m^2/day$).

3. Comments from the Germany GEF Council Member: 28 June 2012

Comments	Responses
1. Will a standardized approach to monitoring project results, both GHG reductions and socio-economic benefits be applied for the 40 plants? Please provide details.	Yes, a standardized approach will be used for monitoring energy reduction in the 40 plants, following the ISO 50001, Energy Management Standards and the process heat assessment guidelines to be developed and trained on during the project implementation. GHG emissions reduction will be calculated based on the energy saving amounts. It will involve monitoring of energy reductions in terms of GJ per year or GJ per unit of production, actual monitoring or measurement of NOx at the production levels during the base line and modified system, and the type of energy used. The type of energy used has a major impact on CO2 emission per unit of energy used. For example, use of commonly used natural gas discharges 56 kg CO2 reduction per GJ energy used or reduced while use of commonly used bituminous coal may give approximately 100 kg per GJ of energy

	used or saved. Since there is no simple relationship between NOx emissions and type of energy used or saved , NOx emissions from fuel fired systems depend on the type of combustion equipment and their operation in addition to the type of energy source (fuel) used. Hence, actual measurements of NOx emissions in terms of kg of NOx per GJ of energy use are used to estimate reduction in GHG emission related to NOx emission. Hence, monitoring of the three parameters (energy use or reduction, type of energy or fuel source and NOx emissions during the plant energy audit) above would provide the necessary GHG reduction data.
2. Also, please provide more details about the socio-economic benefits of implementation. Do estimates exist regarding impact on job creation?	Socio-economic benefits (i.e. Payback consideration) will be calculated based on the amounts of energy saved, GHG emissions reductions, investment, etc. Based on UNIDO's experience in the implementation of similar technical assistance projects in Malaysia and South-East Asia, socioeconomic benefits in the form of improved South-South cooperation can be expected. As this is a relatively new market concept in Malaysia, lessons learned can be taken from other emerging economies and cooperation at later points in the project can be expected. This cooperation will be vital if a local market for the production of the products and system components required for industrial applicants of solar thermal energy is to develop in Malaysia. The growth of such a market will also lead to additional socioeconomic benefits such as job creation, income growth and a general improvement in the standard of living. The demonstrations will encourage other plants to consider use of such an approach. The trainings provided to the industrial representatives will inform them about the approach, its ease of use and results. Apart from skills enhancement and 'on-the-job' experience, socio economic benefits include reduction in energy use, reduction in waste energy and heat, an improved working environment in the factories due to reduction or elimination of waste heat that may be creating hot and uncomfortable working conditions. Direct job creation will result for engineers and technicians that will employ the newly acquired skills. Since the methodology will be applied at all 40 plants, its socio-economic benefits will be demonstrated over a wide range of industries and encourage other plants to apply the methodology resulting in broader socio economic benefits for the country. It is difficult to estimate job creation, but measurement of jobs creation should be considered part of the project's impact
3. How does the project contribute to other national development goals?	The national goal is to reduce energy use and GHG emission reduction as stated in section A.4 of the CEO ER. Reduction and recovery of waste heat, application of solar heating and cooling systems to replace fuel generated energy or electricity used in the factories will result in energy reduction for the factories. The exact amount of reduction depends on the type of industry and processes used by the factories, however, a reduction of 5% to 15% can be expected when the energy reduction, recovery and substitution measures are applied.

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS[31]

A. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES FINANCING STATUS IN THE TABLE BELOW:

PPG Grant Approved at PIF: **USD 75,000**			
Project Preparation Activities Implemented	***GEF/LDCF/SCCF/NPIF Amount ($)***		
	Budgeted Amount	***Amount Spent To date***	***Amount Committed***
1. Baseline assessment	45,000	45,000	
2. Consultation and commitment confirmation	0	0	
3. Detailed project design	30,000	25,328.74	4,671.26[32]
Total	75,000	**70,328.74**	4,671.26

[31] If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities.

[32] The remaining funds will be used to contribute to the cost of organizing a Seminar on Energy Efficiency and Systems Optimization for Commercial and Industrial Sectors

ANNEX D: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used**)**

Provide a calendar of expected reflows to the GEF/LDCF/SCCF/NPIF Trust Fund or to your Agency (and/or revolving fund that will be set up)

N/A

ANNEX E – BUDGET AND CO-FINANCING DETAILS

Overview of UNIDO Budget; GEF Financing and Co-Financing:

Budget Allocation			
Component 1 – Regulations and Incentives	**GEF**	**Co-Financing**	**TOTAL**
International experts(s)	17,500		17,500
National Consultants	5,250	100,000	105,250
Travel	5,775	30,000	35,775
Subcontracts	25,000		25,000
Training, Seminars	60,000	355,000	415,000
Equipment; premises			
Misc.	6,475	40,000	46,475
TOTAL	**120,000**	**525,000**	**645,000**
Component 2 – Awareness and Capacity	**GEF**	**Co-Financing**	**TOTAL**
International experts(s)	238,000		238,000
National Consultants	75,000	200,000	275,000
Travel	78,900	345,000	423,900
Subcontracts	84,500	100,000	184,500
Training, Seminars	235,000	870,000	1,105,000
Equipment; premises	125,000	600,000	725,000
Misc.	49,600	60,000	109,600
TOTAL	**886,000**	**2,175,000**	**3,061,000**
Component 3 – Investment and Demonstrations	**GEF**	**Co-Financing**	**TOTAL**
International experts(s)	367,500		367,500
National Consultants	135,000	5,000,000	5,135,000
Travel	123,750	500,000	623,750
Subcontracts	834,400	2,640,000	3,474,400
Training, Seminars	62,500	1,000,000	1,062,500
Equipment; premises	1,119,800	7,000,000	8,119,800
Misc.	97,050	60,000	157,050
TOTAL	**2,740,000**	**16,200,000**	**18,940,000**
Component 4 – Monitoring and Evaluation	**GEF**	**Co-Financing**	**TOTAL**
International experts(s)	38,500	30,000	68,500
National Consultants	7,500	30,000	37,500
Travel	9,800	20,000	29,800
Subcontracts			
Training, Seminars	7,500	15,000	22,500
Equipment; premises			
Misc.	700	5,000	5,700
TOTAL	**64,000**	**100,000**	**164,000**

Project Management	GEF	Co-Financing	TOTAL
International experts(s)			
National Consultants	156,250	500,000	656,250
Travel	11,250	150,000	161,250
Subcontracts			
Training, Seminars			
Equipment; premises	20,000	300,000	320,000
Misc.	2,500	50,000	52,500
TOTAL	**190,000**	**1,000,000**	**1,190,000**

UNIDO In-Kind Contribution Breakdown:

Form of Contribution	USD
Contributions from other technical branches: Montreal Protocol Branch (MPB), Business Investment and Technology Branch (BIT), and Environmental Management Branch (EMB).	$50,000
Contributions from field offices, including the UNIDO Regional Office in Bangkok, Thailand.	$20,000
Contributions from project beneficiaries in UNIDO's workshops, trainings and regional meetings, etc.	$10,000
Contributions from UNIDO's training materials and other related documents, publications etc.	$60,000
TOTAL	**$140,000**

ANNEX F – LETTER OF ENDORSEMENT

Please find attached.

ANNEX G – ESTIMATE OF ENERGY SAVINGS AND GHG EMISSIONS REDUCTIONS

Background information

Sectors	Subsectors	No Cost Energy Savings			Low Cost Energy Savings			High Cost Energy Savings			Total Energy Savings		
		Electrical MWh/yr	Thermal GJ/yr	Total GJ/yr	Electrical MWh/yr	Thermal GJ/yr	Total GJ/yr	Electrical MWh/yr	Thermal GJ/yr	Total GJ/yr	Electrical MWh/yr	Thermal GJ/yr	Total GJ/yr
Food	Edible Oils	296	6,193	7,259	348	85,370	86,624	669	226,420	228,828	1,313	317,983	322,711
	Processed Food	1,007	13,478	17,102	537	22,530	24,462	472	7,611	9,331	2,016	43,619	50,876
	Total	1,303	19,671	24,361	885	107,901	111,087	1,141	234,031	238,159	3,329	361,602	373,587
Wood	Particle Board	0	2,345	2,345	40	1,369	1,712	0	71,913	71,913	40	75,828	75,970
	Ply Wood	466	3,040	4,716	89	65,037	65,357	225	140,072	140,883	780	208,148	210,956
	Furniture & Saw Mill	66	698	935	611	62,434	64,634	2,241	0	8,067	2,918	63,132	73,635
	Total	532	6,083	7,996	740	129,040	131,702	2,466	211,985	220,863	3,737	347,107	360,561
Ceramic		248	37,673	38,566	382	73,855	75,229	750	38,861	41,561	1,380	150,389	155,356
Cement		324	209	1,375	630	4,598	6,866	72,427	76,529	337,266	73,381	81,336	345,508
Glass		1,035	27,723	31,449	334	12,530	13,732	2,047	51,544	58,913	3,416	91,797	104,095
Rubber	Tyre	628	6,868	9,127	0	7,524	7,524	200	14,796	15,517	828	29,188	32,168
	Glove	421	25,029	26,544	335	3,531	4,738	1,576	50,257	55,929	2,332	78,817	87,211
	Others	147	20,812	21,339	1,594	3,169	8,909	641	10,538	12,846	2,382	34,519	43,093
	Total	1,195	52,708	57,010	1,930	14,224	21,171	2,417	75,592	84,292	5,541	142,524	162,472
Pulp & Paper	Integrated	149	36,627	37,163	0	39,199	39,199	554	665,396	667,391	703	741,222	743,753
	Corrugator Carton Box	643	12,079	14,395	249	29,006	29,901	243	22,622	23,498	1,135	63,706	67,794
	Total	792	48,706	51,559	249	68,205	69,100	797	688,018	690,889	1,838	804,928	811,547
Iron & Steel	Slag Furnace/Mini Mills	1,528	40,412	45,913	2,910	43,155	53,631	3,722	98,259	111,658	8,160	181,826	211,202
	Rolling Mill	182	17,079	17,733	376	365	1,718	1,084	33,315	37,216	1,641	50,758	56,667
	Foundry	152	0	548	454	0	1,635	0	0	0	607	0	2,184
	Total	1,862	57,490	64,194	3,740	43,520	56,985	4,805	131,574	148,874	10,408	232,584	270,053
Total		7,291	250,263	276,510	8,889	453,871	485,872	86,851	1,508,134	1,820,796	103,031	2,212,268	2,583,178

This section gives some useful background tables based on energy savings estimate in the MIEEIP project:

Sectors	Food	Wood	Ceramic	Cement	Glass	Rubber	Pulp & Paper	Iron & Steel	Total	Correction factor
Energy consumption ('000 GJ/yr)	1,835	1,032	774	21,557	4,000	611	5,080	4,223	39,113	
Energy costs (10^6 RM/yr)	42.2	13.5	24.1	204.2	97.8	16.9	84.2	160.1	643.0	
- No cost	24	8	39	1	31	57	52	64	277	67%
- Low cost	111	132	75	7	14	21	69	57	486	36%
- High cost	238	221	42	337	59	84	691	149	1,821	14%
Total savings ('000 GJ/yr)	374	361	155	345	104	162	812	270	2,583	615
Total cost savings (10^6 RM/yr)	8.5	5.2	6.0	33.8	2.5	4.3	19.8	5.3	85.3	
CO_2 emission reductions (kt/yr)	28.0	30.4	14.5	444.7	8.1	18.9	194.4	22.8	761.7	181.4
# of audited factories	10	7	6	3	3	9	6	4	48	
Factories registered	471	75	54	54	18	134	134	148	1,088	

Source: UNDP (2006) and PTM (2007)

List of potential companies (based on MIEEIP and IEEMS projects

No.	Company	Industry Sector
1	Aalborg Portland (M) Sdn. Bhd.	Cement
2	ALPS Electric (M) Sdn. Bhd.	Electromechanical Component
3	Amphenol	Panel Board Connector
4	Amsteel mills Sdn Bhd	Steel
5	Antara Steel Mills Sdn Bhd	Steel
6	Bestcan Food Tech Industry Sdn Bhd	Food
7	Bodibasixs Manufacturing Sdn. Bhd	Toiletries
8	BP Petronas Acetyls Sdn. Bhd.	Acetic Acid
9	Butterworth Paper Cups Sdn. Bhd.	Paper Cups
10	Camfil Farr Malaysia Sdn Bhd	Filters
11	Calsonic Kansei Malaysia Sdn Bhd	Car Components
12	DHJ (Malaysia) Sdn Bhd	Textile
13	DS Rubber Products Sdn Bhd	Rubber Products
14	Emico Holdings	Home & Sports Equipment
15	Engtex Ductile Iron Pipe Industries Sdn. Bhd.	Kuantan, Pahang
16	Erinco Sdn Bhd	Food
17	Entegris Sdn Bhd	Eletronic Component Support
18	F & N Beverage Manufacturing Sdn. Bhd.	Food
19	Freescale Semiconductor (M) Sdn. Bhd.	Semiconductor
20	Fujisash Malaysia Sdn. Bhd.	Integrated Aluminium Extrustion
21	Fujitsu Component (M) Sdn. Bhd.	PC Products
22	Goodway Rubber Industries Sdn. Bhd.	Rubber Compounds
23	Goucera Tile Industries	Ceramic
24	GS Paper & Packaging Sdn. Bhd.	Paper
25	GUH Circuit Ind. (PG) Sdn. Bhd.	Electrical Goods & Appliances
26	Harvik Rubber Industry	Rubber Boots
27	Hitachi Air Conditioning Product (M) Sdn. Bhd.	Air Conditioning Products
28	Hovid Berhad	Drugs, Health and Dietary Supplements
29	Hume Cemboard Industries Sdn Bhd	Fibre Cement Boards
30	HeveaBoard Berhad	Wood
31	Idemitsu Lube (Malaysia) Sdn Bhd	Chemical
32	Intel Technology Sdn. Bhd.	Computer
33	ITL Asia Pacific Sdn. Bhd.	Medical Devices
34	Johnson Mattey Sdn Bhd	Autocatalysts
35	Kobe Precision Technology Sdn. Bhd.	Aluminum Ground Substrate
36	Keck Seng Berhad	Oil Refinery

37	Lafarge Cement Sdn. Bhd.	Cement
38	Luvata Malaysia Sdn. Bhd.	Metal Solutions
39	Luxchem Polymer Industries Sdn Bhd	Resin
40	Mac Food Sdn Bhd	Food
41	Malay Sino Chemical Industries Sdn Bhd	Chemical
42	Malaysian Mosaics Berhad	Ceramic
43	Malaysian Newsprint Industries Sdn. Bhd.	Newsprint
44	Malaysian Smelting Corp. Sdn. Bhd.	Tin Metal
45	MAPA Glove Sdn. Bhd.	Glove
46	Medical Latex (DUA) Sdn Bhd	Condoms
47	Metrod Sdn Bhd	Copper, Rod & Wire
48	Muda Paper Mills Sdn. Bhd.	Paper Mill
49	Natural Oleochemicals Sdn Bhd	Oleochemicals
50	Negeri Sembilan Cement Industries Sdn Bhd	Cement
51	Negeri Sembilan Cement Industries, Perlis Plant	Cement
52	Nippon Paint	Paint
53	Niro Ceramic (M) Sdn. Bhd.	Granite & Marble
54	Nordenia (Malaysia) Sdn Bhd	Packaging Solution
55	Palm-oleo (Klang) Sdn Bhd	Oleochemicals
56	Pan Century Edible Oils Sdn Bhd	Edible Oils
57	Penfabric Mill 1	Clothing
58	PGEO Edible Oils Sdn Bhd	Edible Oils
59	PML Dairies Sdn. Bhd.	Beverage
60	Prym Consumer (M) Sdn. Bhd.	Needleworks
61	Purecircle Sdn. Bhd.	Stevia Ingredients
62	QL Foods Sdn Bhd	Food
63	River Electronics Sdn Bhd	Eletronic Component
64	Rubberex Corporation (M) Sdn. Bhd.	Gloves
65	SCG Industries (M) Sdn Bhd	Semiconductor
66	Schaefer Kalk (M) Sdn Bhd	Lime based products
67	Segamat Panel Boards Sdn Bhd	Wood base thin panels
68	Silterra	Semiconductor
69	Soon Soon Oilmills Sdn Bhd	Oil & Fat
70	Southern Steel Berhad	Steel
71	Sumitomo Electric Interconnect Product (M) Sdn. Bhd.	Electric Interconnect
72	Shinko Electronics Sdn Bhd	Electronics Components
73	Suzuki Assembler Malaysia Sdn. Bhd.	Motorbike
74	Tasek Corporation Berhad (TCB)	Cement
75	Titan Petchem (M) Sdn Bhd	Olefins and Polyolefins,
76	TMC Metal (M) Sdn Bhd	Recycling Materials
77	Tong Heer Aluminium Indus. Sdn. Bhd.	Aluminum Extrustion Products
78	Toshiba Electronics Malaysia	Laptops & Notebooks
79	Wonderful Compound Sdn. Bhd.	Wire & Cable
80	Wonderful Creamery (M) Sdn Bhd	Food

81	Ye Chiu Metal Smelting (M) Sdn Bhd	Metal Recycling
82	Yoonsteel (M) Sdn. Bhd.	Iron, Steel Casting & Diecasting

Emissions Reductions Calculation:

Direct emission reductions:

This section describes the calculation of energy savings and resulting greenhouse gas emissions. These calculations have taken into account the revised methodology of *Calculating Greenhouse Gas Benefits of the Global Environment Facility Energy Efficiency Projects*.[33] The first table below describes the base data and assumptions upon which the calculations and estimates in this Annex are based:

Base data				mmbtu	1054.6 MJ			
				GWh	3600 GJ			
				gallon	3.785 L			
				USD	3 RM			
Fuel mix in industry (thermal; excl. electricity)								
	kgCO2/GJ	Mix Malaysia	t/GWh	Energy			USD/MJ	RM/mmbtu
Coal	95	10%	342	25.1 MJ/kg	315 RM/ton		0.0042	13.24
Heating oil	77	38%	277.2	36.4 MJ/litre	0.45 USD/litre		0.0124	39.11
Gas	55	52%	198	32.6 MJ/m3	6.12 USD/mmbtu		0.0058	18.36
Average emission factor		67.36 kgCO2/GJ						
Average energy price		8.134 USD/GJ						
Unsubsidized price		12.660 USD/GJ						

The table is based on information provided by ST[34] and mida.gov.my. Based on data for the fuel mix in industry[35], the table provides emission factors and price (USD/GJ) that are used in the subsequent tables. There are two prices, the subsidized price (due to the current subsidization of natural gas for large energy users, at about 40%) and what would be the real market price (averages over 2012).

The savings potential and solar thermal estimates are partly derived from the data provided by MIEEIP (see tables in the beginning of this Annex) and discussions with potential candidate companies[36]. The target for companies working with the project in efficiency in thermal systems is 40. Associated with low-temperature applications, 10 companies are targeted to install solar thermal systems; these companies will be identified during project implementation, but a tentative list of potential candidates is given above.

Estimate of Energy Savings:

	Fuel usage per facility (GJ)	Savings	Savings (GJ)	Average investment (USD)	Number of facilities targeted	Total savings (GJ/yr)
Food & beverages	175,000	15%	26,250	100,000	10	262,500
Textiles	175,000	15%	26,250	100,000	5	131,250
Chemicals	200,000	15%	30,000	100,000	5	150,000
Plastics / rubber	180,000	15%	27,000	100,000	7	189,000
Paper / wood	500,000	15%	75,000	100,000	6	450,000
Other				100,000	7	

Number of facilities	**40**	
Investment	4,000,000	USD
Annual savings	9,620,212	USD
Savings (unsubsidised)	14,973,877	USD
Lifetime	10	years
Lifetime savings	11,827,500	GJ
Lifetime CO_2 avoided	796,700	tCO_2

33 http://www.stapgef.org/revised-methodology-for-calculating-greenhouse-gas-benefits-of-gef-energy-efficiency-projects-version-1-0/, April 2013.

34 Presentation "Energy scenario, energy policies and legislation" (December 2012)

35 More accurate would be to have the fuel mix used per industrial subsector, but data are sketchy and would differ anyhow per company

36 These include: Top Glove (Klang), Vegetable Oil Products (Kuantan),

High-temperature applications:

Sector	Process heat (GJ)	Savings (% of current use)	Savings (GJ)	Average investment/ facility	Number of facilities targeted	Total savings (GJ/yr) - all target facilites	Total savings (US$/yr)	GHG reduction tCO2
Cement	7,185,667	7.5%	538,925	648,000	3	1,616,775	13,150,469	108,906
Iron and steel	1,055,750	15.0%	158,363	192,000	4	633,450	5,152,334	42,669
Ceramics	129,000	15.0%	19,350	30,000	3	58,050	472,165	3,910
Glass	1,333,333	10.0%	133,333	156,000	3	400,000	3,253,506	26,944
Pulp and paper	846,667	10.0%	84,667	96,000	2	169,333	1,377,318	11,406
Chemical								
					Total number of facilities		**15**	
					Investment		3,462,000	USD
					Annual savings		23,405,793	USD
					Fuel savings (unsubsidised)		36,431,159	USD
					Lifetime		10	years
					Lifetime savings		28,776,083	GJ
					Cumulative CO2 avoided		1,938,357	tCO2

Solar thermal applications:

Irradiation	4.96	kWh/m2/day			
	1810.4	kWh/m2/yr			
Efficiency	43%				
Efficiency fuels	85%				
Net annual solar gain	500	kWh/m2/yr			

	Installed m^2 per facility	Investment per m^2 (USD)	Number of facilities	Total investment	Fuel substitution per year (GJ)
Food & beverages	1000	250	5	1,250,000	9,000
Textiles	1000	250	2	500,000	3,600
Chemicals	1000	250	1	250,000	1,800
Plastics / rubber	1000	250	2	500,000	3,600

	Total number of facilities	**10**	
	Total investment	2,500,000	USD
TOTAL	Total installed m2	10,000	
	Fuel savings	18,000	GJ
	Fuel savings	146,408	USD/yr
	Fuel savings (unsubsidised)	227,884	USD/yr
	Lifetime	20	yrs
	Lifetime substitution	360,000	GJ
	Lifetime CO2 reduction	24,250	tCO2

The total energy savings/substitution and corresponding GHG emission reduction can then be summarized as follows:

Investment	**9,962,000**	**USD**
Lifetime energy saved	**40,963,583**	**GJ**
- solar thermal	360,000	
- energy efficiency	40,603,583	
Lifetime CO2 reduction	**2,759,307**	**tCO2**
- solar thermal	24,250	
- energy efficiency	2,735,057	

Indirect emission reduction:

There will also be a significant amount of indirect CO2 emission reduction after the project's end as a consequence of the implementation of the GEF-supported activities as detailed in the 'outcomes and outputs' section. Indirect emission reductions are based on the methodology described in the GEF Manual[37] and the range is given by bottom-up and top-down estimates.

In the bottom-up approach, a replication factor (RF) is used. Assuming a conservative market penetration replication factor (RF) of two' (based on post-project market transformation), indirect emissions reduction follows from $CO_{2\text{indirect BU}} = CO_{2\text{ direct}} * RF =$ **5,518,614 tCO_2**.

In the top-down approach, one looks at how emissions from industrial electricity and fuel consumption will develop during the project implementation and post-project influence period (10 years; 2015-2024) in Malaysia comparing the baseline scenario with an EE alternative scenario. The difference between the alternative and baseline scenarios (CO_2 emission reduction) can be partly attributed to the project's capacity building, technical assistance and demonstration activities.

Compared to the baseline scenario (see the table below), emissions reduction will cumulatively be 51,584 ktCO2, of which 40% can be conservatively attributed to the project's interventions (see table on the next page). This provides an upper limit to indirect emission reduction impacts of 21,500 $ktCO_2$.

The scenarios are presented in the table below.

Assumptions: Industrial emission growth has been 6% over the past 15 years (Second National Communication) and emissions will grow accordingly in a business-as-usual scenario. In the alternative, more energy-efficient scenario, GDP growth will be the same, but emissions will grow less at 5.3% annually.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BaU (ktCO2)	45,910	48,663	51,581	54,674	57,952	61,427	65,110	69,014	73,153	77,539	82,188	87,116	92,340	97,877
Reduced emissions		299	633	1,003	1,413	1,867	2,367	2,919	3,525	4,190	4,920	5,719	6,593	7,547
Alternative (ktCO2)	45,910	48,364	50,948	53,671	56,539	59,560	62,743	66,096	69,628	73,349	77,269	81,398	85,747	90,330
Cumulative (ktCO2, 2010-2024)		299	932	1,935	3,349	5,216	7,583	10,502	14,026	18,216	23,136	28,855	35,448	42,995

- Of the savings 80% will be due in thermal systems.

- This gives the final figure of $CO_{2\text{indirect TD}}$ = 17,197, 936 tCO_2

[37] Manual for Calculating GHG Emissions of GEF Projects: Energy Efficiency and Renewable Energy Projects

ANNEX H – MONITORING AND EVALUATION

H.1 Project start

A Project Inception Workshop will be held within the first four months of project start with those with assigned roles in the project organization structure. The Inception Workshop is crucial for building ownership for the project results and for planning the first year annual work plan. The Inception Workshop should address a number of key issues including:

- Understand objectives & other outputs and activities;
- Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNIDO and of the project stakeholders vis-à-vis the Project Management Unit. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting, communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed;
- Based on the project results framework and the relevant GEF Tracking Tools, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks;
- Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements; the M&E work plan and budget should be agreed upon and scheduled;
- Discuss financial reporting procedures and obligations, and arrangements for annual audit;
- Plan and schedule Project Steering Committee meetings; roles and responsibilities of all project organization structures should be clarified and meetings planned. The first PSC meeting should be held within the first 12 months following the inception workshop.

The Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided upon during the meeting.

H.2 Semi-annual reviews

Will consist of:

- Summary of progress made during the most recent six-month period;
- Based on the initial risk analysis submitted, the risk log shall be regularly updated. Risks become critical when the impact and probability are high;

H.3 Annual review

Annual Project Review/Project Implementation Reports (APR/PIR): These key reports are prepared to monitor progress made since project start and in particular for the previous reporting period. The APR/PIR includes UNIDO/GEF requirements and includes, but is not limited to, reporting on the following:

- Progress made toward project objective and outcomes - each with indicators, baseline data and end-of-project targets (cumulative);
- Project outputs delivered per project outcome (annual);
- Lessons learned/good practices;
- AWP and other expenditure reports;
- Risk and adaptive management;

UNIDO will conduct visits to project sites based on the agreed upon schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the PSC may also join these visits.

H.4 Mid-term of project cycle

The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation. The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced

implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the Project Management Team and the management response and the evaluation will be uploaded to the UNIDO Evaluation Group website.

H.5 End of project

An independent Final Evaluation will take place three months prior to the final PSC meeting and will be undertaken in accordance with UNIDO and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNIDO Evaluation Group. The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response. The GEF Focal Point will be involved in this Final Evaluation.

Monitoring of energy reduction results in the 40 plants will be a standardized approach, following the ISO 50001, Energy Management Standards and the process heat assessment guidelines to be developed and trained on during the project implementation. GHG emissions reduction will be calculated based on the energy saving amounts. It will involve monitoring of energy reductions in terms of GJ per year or GJ per unit of production, actual monitoring or measurement of NOx at the production levels during the base line and modified system, and the type of energy used. The type of energy used has a major impact on CO2 emission per unit of energy used. For example, use of commonly used natural gas discharges 56 kg CO2 reduction per GJ of energy used or reduced, while use of commonly used bituminous coal may give approximately 100 kg per GJ of energy used or saved. Since there is no simple relationship between NOx emissions and the type of energy used or saved, NOx emissions from fuel fired systems depend on the type of combustion equipment and their operation in addition to the type of energy source (fuel) used. Hence, actual measurements of NOx emissions in terms of kg of NOx per GJ of energy use are used to estimate reduction of GHG emissions related to NOx emissions. Hence, monitoring of the three parameters (energy use or reduction, type of energy or fuel source and NOx emissions during the plant energy audit) would provide the necessary GHG reduction data required for comprehensive monitoring of project results.

ANNEX I – TIMELINE OF ACTIVITIES:

Output	Year 1	Year 2	Year 3	Year 4	Year 5
1.1 National counterparts supported to develop three policy papers on solar thermal energy					
1.2 Two financial incentive schemes focusing on solar thermal application developed					
2.1 Training programme on energy savings based on process heating and cooling conducted.					
2.2 Training programme on solar thermal technology conducted.					
2.3 Awareness raising events organized.					
3.1 Energy saving measures and investment projects implemented in about 40 factories.					
3.2 10 factories implement solar thermal demonstration projects.					
3.3 Case studies prepared and presented.					

ANNEX J: TERMS OF REFERENCE OF KEY STAFF

Job Description: National Project Manager

TITLE : National Project Manager

ORGANIZATION: Project Management Unit (PMU)

CONTRACTING PARTY: UNIDO

REPORTS TO: PSC and UNIDO

DURATION: 5 years (one-year renewable)

REMUNERATION: Commensurate with qualifications, skills and experience

REQUIREMENTS:

Applicants must have post-graduate training in any one of the following fields of study:

- Development economics with a strong energy systems planning and management component and/or industrial engineering with energy systems planning focus and/or economics background;
- Work experience with energy efficient technologies, in particular in industry;
- Have an extensive knowledge of industrial energy efficiency and present status and needs of Malaysian industry;
- At least ten years of experience in the area of energy efficiency; knowledge of thermal systems an advantage;
- At least seven years work experience at senior management level with demonstrable program or project level management skills and ability to coordinate activities involving a large contingent of professional consultants drawn around the country and/or internationally.

RESPONSIBILITIES:

Directing activities of the PMU:

- Day-to-day management and co-ordination;
- Budgeting;
- Forward planning;
- Liaising with project participants and stakeholders;
- Preparation and presentation of project status reports to the Project Steering Committee;
- Preparing subcontractors terms of reference and contracts;
- Supervision of contracts;
- Technical assistance; and
- Project execution of all tasks identified under the project specified in the Project Document.

DUTIES:

- Lead, manage and coordinate the day-to-day management of the PMU, including administration, accounting, technical expertise, and actual project implementation and reporting;
- Lead the development of detailed project design including preparation of subcontractors' terms of reference, identification and selection of national, regional and international subcontractors, cost estimation, time scheduling, contracting, and reporting on forward planning of project activities and budget;

- Coordinate activities of consultants and subcontractors including contract management, direction and supervision of field operations, logistical support, review of technical outputs/reports, measurement/assessment of project achievements and cost control;
- Supervise the selection of the sites, profiling, feasibility analysis and actual installation and follow-up evaluation of energy efficient options in buildings;
- Assist in the design, supervision and where possible, delivery of the training and outreach activities of the project and take a lead role in the organization of project workshops and dissemination of results of the projects;
- Plan and coordinate various workshops identified in this Project Document;
- Work closely together with the Project Steering Committee (PSC), UNIDO and the Malaysian counterpart organizations;
    - Allocation of the contribution of GEF and other co-financiers according to the annual work plans and financial reports;
    - Preparation of annual work plans, quarterly financial and progress reports and the annual APR (annual project implementation review report);
    - Inform PSC and UNIDO on project progress and budget variations, and advise on the policy direction at PSC meetings;
    - Maintain records/minutes of proceedings of the PSC.
- Take responsibility for the quality and timing of project outputs;
- Assist in overall project monitoring and evaluation; and
    - Undertake other management duties that contribute to the effective functioning of the project.

DELIVERABLES:
Finalized Terms of Reference for PMU staff and subcontracting consultants:

- Quarterly work plan and financial reports;
- Annual progress reports;
- Minutes of PSC meetings;
- Agenda for project workshops and meetings.

ANNEX K: INDUSTRIAL PROCESS HEATING SYSTEMS OPTIMIZATION

Process equipment in industrial production can be optimised, including internal heat recovery. A very good example is the pasteurisation of milk operating at 72°C, where the incoming cold milk (4°C) has to be heated up while the outgoing milk (72°C) has to be cooled down to 6°C. By combining these two streams in a heat exchanger, the incoming cold milk can be pre-heated to a temperature of around 67°C, resulting in a remaining heating demand from 67°C up to 72°C. On the other hand the cooling demand is reduced to the remaining cooling of the pasteurised milk from 9°C to 6°C. This approach can significantly reduce the energy demand and as this heat recovery is realised within one process (e.g. the pasteurisation) it is referred to as *internal heat recovery*.

If hot or cold streams from different processes or waste heat streams of equipment (such as boilers, waste heat of the flue gas, or chillers, waste heat of cooling air) are used for heat recovery or optimisation of energy efficiency, it is named *system optimisation.* Besides the suitability of streams based on their temperature levels, mass flow, the type medium, etc., limiting factors such as operating times and local distances have to be considered for the setup of so-called heat recovery networks. Nevertheless, the potential for the optimisation of energy efficiency is very high; especially when the heating demand can be supplied using a thermal storage where different hot and cold streams can be combined.

A very good example can be found in the dairy industry, especially in the cheese production line. There, the whey (a by-product of the cheese fermentation that is often used as animal food) has to be concentrated. A waste heat stream of this equipment is the vapour condensate at two temperature levels (70°C and 50°C). This can be used to pre-heat the water for the curd washing (from 10°C to 65°C using the 70°C condensate) and to pre-heat the fresh water for the steam boiler (from 10°C to 45°C using the 50°C condensate). Another example for system optimisation is the necessary cooling of the whey after the fermentation while the milk has to be preheated before the fermentation. Just realising these three suggested heat exchangers reduces the total energy demand of the dairy by around 22% leading to a significant increase in energy efficiency.

In order to reduce the overall energy demand significantly and to contribute to optimisation in a noticeable way, it is necessary to reduce the demand of the processes themselves, while at the same time developing a holistic energy concept (including heat integration and the possible integration of renewable sources of energy as well). An evaluation of the energy consuming processes, the energy supply system and the distribution of energy use within a production system will allow an overview of the situation and for further guidance on the development of new concepts. Based on real data acquisition and its evaluation and developed flow sheets, a holistic energy utilization concept can be developed. This is done by using an energy balance (how much energy goes where and potential for minimizing losses), pinch analysis, and by identifying the theoretical potential for heat integration and the minimum heating and cooling demand/losses along the production chain. The derived heat management or recovery system, including heat exchanger network connected to a system, can use waste heat streams (from processes and equipment, such as boilers, chillers, etc.) to recover and apply heat to processes to meet the demand and thereby reduce the overall energy consumption of production significantly.

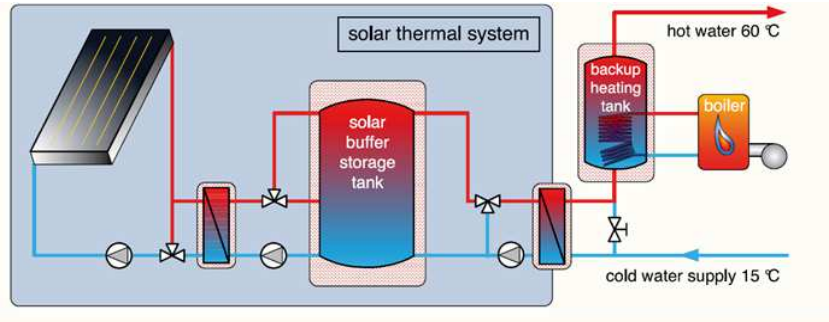
ANNEX L: SOLAR THERMAL USES IN INDUSTRIAL PROCESSES

Industrial sectors vary in structure and heat demand; the application of solar thermal systems in industry incorporates energy efficiency optimization as a primary step. The minimization of the heat demand of an industry can be achieved by:

- Applying changes to the process (application of competitive energy technologies);
- Applying changes to the energy distribution system (application of the heat integration systems); and
- Applying changes to the energy supply system (application of heat pumps/co-generation systems and/or application of solar thermal systems).

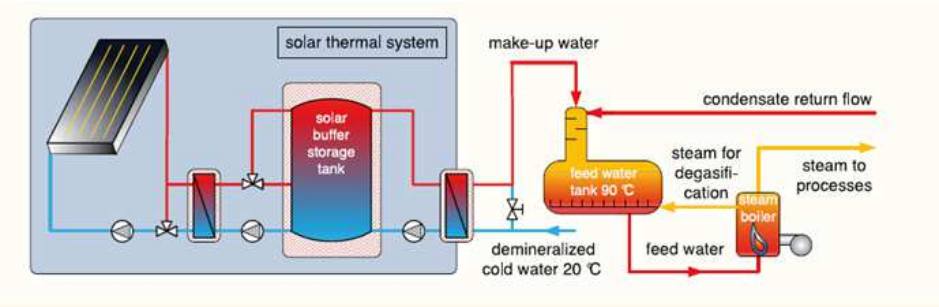
Solar thermal systems vary in layout and design and this determines their suitability for application to the energy supply in production processes; two possible integration schemas are described below:

The supported system for hot water preparation for cleaning processes is an open system without heat recovery, since cleaning water is usually contaminated and cooled down by the cleaning process. Cold water (in this example 15 °C) is heated up to 60 °C. In plants with stochastic cleaning water demand and very high flow rates, the backup heating system is usually equipped with a hot water storage that is heated by a boiler. With the installation shown below the solar thermal system can be integrated easily via an additional heat exchanger (can be a fresh water module). Whenever cold water has to be heated up, it is (pre-) heated by the solar thermal system before it enters the hot water storage.



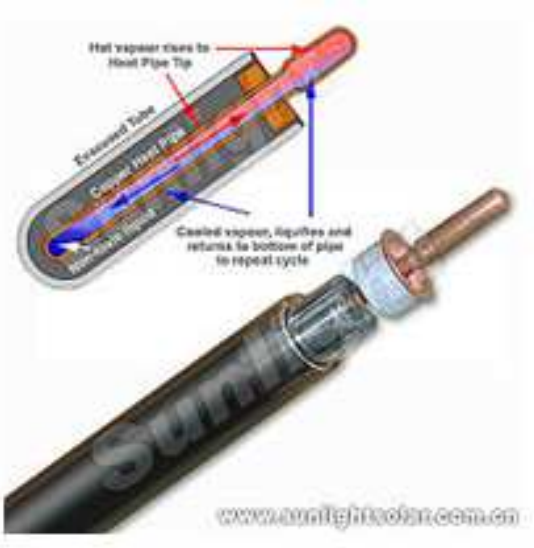
The solar support of process steam generation is usually only economical when a significant part of the steam is used in the processes directly (the steam network is an open or partly open system). Solar heating of the additional, demineralised make-up water can be attractive; heating of the condensate return flow or the feed water directly is more expensive because of the high temperatures. Additionally, at state of the art installations the feed water is usually pre-heated by an economizer.

In (partially) open steam networks, the demineralised make-up water is usually mixed with the returning condensate and has to be degassed before it can enter the steam boiler. This degasification is usually done thermally using process steam from the steam boiler. With this steam, the feed water tank has to be heated up to 90 °C, often also up to slightly over 100 °C, when the feed water tank operates at an overpressure of 0.2 or 0.3 bar. It is, therefore, a good solution to pre-heat the decalcified, additional make-up water before it is mixed with the condensate and before the mixture has to be heated up. This way, less steam is consumed for degasification and since the steam supports many different processes in the factory, the solar thermal system can cover a significant fraction of the overall heat demand very elegantly just by adding one single heat exchanger.



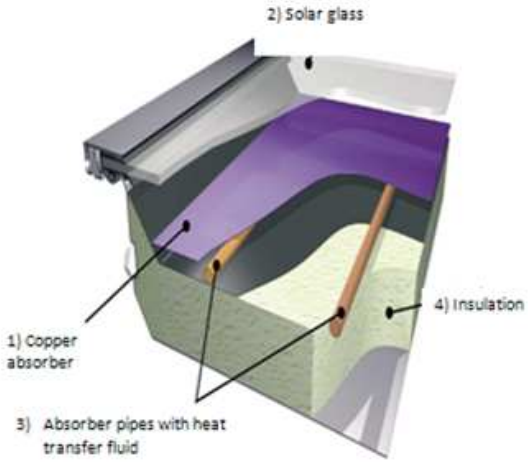
ANNEX M: FLAT PLAT COLLECTORS AND EVACUATED TUBE COLLECTORS

Flat plate collectors are the most common type of solar collectors. They consist of: (i) a dark flat-plate absorber of solar energy; (ii) a transparent cover that allows solar energy to pass through but reduces heat losses; (iii) a heat-transport fluid (air, antifreeze or water) to remove heat from the absorber; and (iv) a heat insulating backing. In order to reach higher temperatures with a good level of efficiency, advanced flat plate collectors will be applied for providing process heat. These collectors will be improved by the use of transparent covers to assure high transmittance and high durability, new absorber material, high temperature residence insulation and casing which ensures stability and protects the absorber and the insulation against environmental impacts.



Evacuated tube collectors (ECTs) can be classified into two main

Direct flow tubes: the fluid of the solar loop is also circulated through the piping of the absorber. If a single evacuated glass tube is used, the whole interior is evacuated. For this configuration the flat or curved absorber, as well as fluid inlet and fluid outlet pipes, are inside the vacuum; the absorber is coated with a selective surface. Currently, the most common type is the Sydney tube collector, consisting of two glass tubes fused together; the vacuum is located between the two tubes. The outside of the inner tube is usually coated with a sputtered cylindrical selective absorber (Al-N/Al), while inside the heat is removed by copper u-tubes embedded in a cylindrical (aluminium) heat transfer fin. Because the absorber is applied completely around the tube, a CPC-reflector is often placed under the tube to also use the radiation that passes between the parallel mounted tubes. This radiation is reflected to the absorber.



Heat pipe tubes: the absorbed heat is transferred by using the heat pipe principle without direct contact to the heat transfer fluid of the solar loop. In this case there are two different forms of connection: (i) the "dry" connection, where the heat has to be transferred from the condenser through the material of the header tube. This way the installation and removal of the tubes is much easier than with direct flow pipes brazed to the header. On the other hand, heat-conductive paste often has to be used, thus requiring that the pipes be installed professionally; and (ii) the "wet" connection, where the fluid of the solar loop directly flows around the condenser of the heat pipes. In this case, no heat-conductive paste is needed, but the exchange of tubes is more difficult.

For temperatures over 150-200^{o}C, *concentrated solar power* designs are required. Worldwide, industrial applications of concentrated solar power are very rare[38] and are thus considered beyond the scope of this project.

[38] By 2009, approximately 200 systems were installed in industrial applications (source: IEA, Task 33).

ANNEX N: CAPACITY BUILDING ON HEATING SYSTEM ENERGY EFFICIENCY (EE) IMPROVEMENTS AND INTEGRATION OF SOLAR SYSTEMS

The proposed project will build technical capacity at three levels: ***Experts***, ***Users*** and ***Vendors***.

The **Two-day Users Training** is targeted at facility engineers, operators and maintenance staff of enterprises, equipment vendors and service providers and is designed to teach how to assess process heat requirements, waste heat availability and possible uses within the plant energy systems, information on solar systems, available solar heat estimates, possible uses of waste/solar heat combinations, integration of solar systems and preliminary economics.

The two-day user training will include the following content:

- *Solar thermal basics* - Solar resources (solar radiation); solar thermal system designs (pumped and thermo-syphon systems); types of collectors with a specific focus on solar process heat collectors (materials, performance criteria); other components of a solar thermal system (storage tank, piping, expansion vessels, controls), integration schemes for the integration of industrial applications.
- *Industrial processes* - Specification of promising industrial sectors; unit operations, state of the art process technologies; emerging process technologies; benchmarks.
- *Heat Integration* - Energy balance; design of heat exchanger networks; types of heat exchangers, methodology and possibilities of heat recovery.
- *Standardized procedure for solSar thermal integration in combination with energy efficiency* - Energy audits; presentation of software tools and internet platforms such as the Energy Efficiency Finder.
- *Economics and Subsidies* - Basic economic calculations with consideration of GHG savings and other environmental impacts, including possible subsidies, incentives and financing possibilities.
- *Best practice examples* - Presentation of a worldwide overview of best practice examples from different industrial sectors.

The **One-day Equipment Vendors Training** is targeted at local solar and heating system (boilers, heat exchangers, ovens, dryers etc.) vendors, suppliers and manufacturers. This training is designed to be supplementary to the 2-day User Training or can be self-standing. The purpose is to introduce those key market players to solar and heating system application optimization techniques and service offerings. More specifically, the training will:

- Prepare manufacturers, vendors and suppliers for participation in the reinforcement of the system optimization message of the UNIDO project with their industrial customers. The message includes promotion of waste heat reduction equipment (insulation, combustion control, boiler and oven operations related systems), available solar systems and integration methods with currently used heating equipment, posters or presentation of locally available equipment in the plants etc. This may include demonstrations of available hardware from local suppliers.
- Assist manufacturers, vendors and suppliers in identifying what will be required to reshape their market offerings to reflect a system services approach

The **Experts Training** will be an intensive training delivered by leading international process heating and solar system experts to national energy efficiency experts, service providers, and industry engineers. This training provides more in-depth technical information on application, operations, troubleshooting and making improvements to waste heat recovery systems and solar thermal systems (integrated or self-standing). This training also introduces basic principles for the energy efficient design of heating systems, waste heat recovery systems and solar systems. If possible this will include a site visit or video demonstration of the applications discussed above. National experts are trained through classroom, on-the-job training, webinars and coaching by international experts and are equipped with the expertise, skills and the tools required for the provision of energy efficiency services.

The aim of the “train the trainer” courses is to increase the knowledge on solar thermal systems and applications of “professionals,” focusing on:

- *Engineers from solar thermal companies* - Solar thermal companies will be supported with the optimization and improvement of the solar thermal systems. Furthermore, the major training activities are targeted at this focus group in order to build up or to improve their skills concerning design, installation, commissioning and maintenance of solar thermal systems.

- *Universities and other training centres* - Universities and other training centres will be trained in the design, optimization and monitoring of solar thermal systems. They are also responsible for carrying out the training activities and for dissemination of the results. The focus with this group is to "train trainers" in order to build up or to improve the human and institutional capacity in all participating countries.
- *Energy managers of small and medium enterprises in the target industries* - The energy manager of producing companies will receive knowledge on energy efficiency measurements in their production processes and the possibilities of solar thermal integration. At the end of the training course, the companies will have a detailed concept for energy saving measures and the integration of solar thermal energy. The companies will be selected during the training courses depending on the interest and commitment of the participating companies.
- *Engineering companies and equipment manufacturers for target industries* - These target groups will get professional knowledge of designing a solar thermal system and will use this knowledge to start new business branches. Information on the performance of solar thermal systems under specific conditions (e.g. temperature ranges) will also be shared so that equipment manufacturers will be able to adjust their products in order to reach an optimum synergy with the solar thermal system.

The training courses will include a theoretical part, as well as an intensive training module on practical case studies.

The main content of **Training Course 1 (4 days)** will be:

- *Energy balance* - Energy and mass balance, flow sheets, Sankey diagrams, measurement procedures.
- *Heat integration* - Training on fast assessment software tools, Pinch Analysis, design of heat exchanger networks, detailed calculation of heat exchangers, thermal storage management, and training on heat integration software (Pinch software).
- *Practical work* - Defining case studies on existing cases from targeted industries (groups of participants of the relevant target audiences), discussing the production and starting with the drawing of a flow sheet with the relevant thermal energy information

Training Course 2 (4 days):

- *Solar thermal theory* - Solar resource (solar radiation), solar thermal system designs (pumped and thermo-syphon systems), types of collectors with a specific focus on solar process heat collectors (materials, performance criteria), other components of a solar thermal system (storage tank, piping, expansion vessels, control…), static considerations of roof structures, local manufacturing and assembly possibilities, installation and maintenance, solar air-conditioning and cooling, test procedures, standards and quality requirements.
- *Solar process heat* - Solar integration points – how to identify, system concepts and collector hydraulics, stagnation behaviour of large solar thermal systems, potential applications and system integration of solar process heat, system design of small and large-scale solar thermal systems for residential applications, system design based on computer simulation (T-Sol).
- *Practical work* - Presenting and discussion of energy balances of case studies, discussion of solar thermal system integration.

Training Course 3 (Training on the job: 6 months)

Between training courses the participants will be supported in the optimization of real case studies. The participants of the training course will receive a tutorial for their first steps in the auditing practice and for a project work. A discussion forum will be installed online in order to guarantee a broader discussion on the case studies and an optimal support of the students in their case studies (if confidentiality will allow).

- Participants will work on-site together with companies in order to work out different realization concepts for energy efficiency and solar thermal integration.
- The participants are finishing the expert training course by a report about the different realization concepts, a presentation and discussion of case studies and an examination.