

FINAL EVALUATION REPORT

Malaysian Building Integrated Photovoltaic Project (MBIPV)

**Government of Malaysia
United Nations Development Programme
Global Environment Facility**

August 2011



LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AG	Attorney General
ASEAN	Association of South-East Asian Nations
ASEF	Asian Solar Energy Forum
ASEI	Asian Solar Energy Initiative
APR-PIRs	annual project implementation reviews
BIPV	building integrated PV
CETREE	Centre for Education and Training in Renewable Energy and Energy Efficiency
CO ₂	carbon dioxide
DOS	Department of Statistics
EC	Energy Commission (= <i>ST</i>)
EE	energy efficiency
EPP	Entry Point Project in the Economic Transformation programme
EPU	Economic Planning Unit (of Prime Minister's Office)
ESCO	energy services company
ETP	Economic Transformation Programme
FDI	Foreign Direct Investment
GCPV	grid connected PV
GEF	Global Environmental Facility
GHG	greenhouse gas
GTM	Malaysia Green Tech Corp (previously <i>Pusat Tenaga Malaysia</i> - Malaysia Energy Centre)
i.a.	inter alia (among other things)
IEA	International Energy Agency
IEA-PVPS	IEA Implementing Agreement on Photovoltaic Power Systems
IEM	Institution of Engineers of Malaysia
IKRAM	IKRAM Structure Assessment Sdn Bhd
k	kilo
kW	kilo Watt
kWp	kilo Watt peak
MBIPV	Malaysian Building Integrated Photovoltaic Project
MEPA	Malaysian Energy Professionals Association
MEGTW	Ministry of Energy, Green Technology and Water (= <i>KeTTHA</i>)
MPIA	Malaysian Photovoltaic Industry Association
MIDA	Malaysian Industrial Development Agency
NPD	National Project Director
NPL	National Project Leader
NSC	National Steering Committee
OPP3	Third Outline Perspective Plan (2001-2010)
PEMANDU	Performance Management and Delivery Unit, Prime Ministers Department
PRC	Project Review Committee
PV	Photovoltaic
PVMC	PV Monitoring Centre, UiTM
RM	Malaysian Ringgit
REEF	Renewable Energy & Energy Conservation Fund
SEDA	Sustainable Energy Development Authority
SIRIM	Standards and Industrial Research Institute of Malaysia
SREP	Small Renewable Energy Programme
ST	<i>Suruhanjaya Tenaga</i> (= EC)
tCO ₂	tonnes of CO ₂
TNB	<i>Tenaga Nasional Berhad</i>
UNDP	United Nations Development Programme
UNITEN	<i>Universiti Tenaga Nasional</i>
UiTM	<i>Universiti Teknologi Mara, Malaysia</i>
US\$ / USD	United States dollar; at time of evaluation 1 USD ~ 3 MR
ZICO	Zaid Ibrahim & Co. (Advocates and Solicitors)

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1. EXECUTIVE SUMMARY

Renewable energy at the national level was first stated in the Eighth Malaysia Plan (2001-2005), and in the Third Outline Perspective Plan 2001-2010. Renewable energy is again explicitly addressed in the Ninth Malaysia Plan (2006-2010), and in the current Tenth Malaysia Plan (2011-2015) targets for and instruments to promote the use of renewable energy have been set. This has further been minted out in the Renewable Energy Act 2010, which inter alia details a feed-in-tariff scheme for renewable energy electricity as well as in the Sustainable Energy Development Authority Act defining a new Sustainable Energy Development Authority (SEDA). In the Economic Transformation Programme (ETP) of September 2010 compiled by the Prime Ministers Department the “Building Up Solar Energy Capacity” has been nominated as an Entry Point Project (EPP), one out of total 10 EPP’s in the Malaysian energy sector; the ETP identifies in total 131 EPP’s.

Photovoltaic (PV) technology is one the fastest growing renewable energy technologies on the world market with a recognized huge potential given the expected cost reductions are met. Many countries and regions have introduced enabling frameworks for PV in anticipation of its growing competitiveness and importance as an environmental benign source of electricity. Without such an enabling framework many barriers hamper the deployment of PV and building integrated PV (BIPV) being a major PV application:

- Still relative high cost; cost reductions have been ongoing and are expected to continue leading to grid parity in many regions in the coming years;
- Limited awareness of PV technologies and their added values associated with building integrated applications;
- Limited access to information on PV technologies and performance benchmarks for PV technologies;
- Limited ability to share information between key market actors;
- Unwillingness of investors to incur what are perceived to be the ‘high-cost / high-risk’ transactions;
- Insufficient linkages to or synergies with energy conservation measures;
- Insufficient energy regulations;
- Few PV technology demonstration projects, if any;
- Inadequate and low-quality local PV industry and support services;
- Lack of financiers that are prepared and interested in financing PV investments as well as appropriate financing/support mechanisms;
- Lack of a coherent, recognized and approved national renewable energy policy and action plan with sufficient mid to long term range;
- Insufficient financial resources for the adequate staffing of the implementing agencies involved as well as for the implementation of PV enabling measures.

To address such barriers to the introduction and deployment of BIPV in Malaysia, the Government of Malaysia initiated the **Malaysian Building Integrated PV Programme (MBIPV)** in 2005 with planned completion by end of 2010. Support and funding has been provided by the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) as well as the Government of Malaysia and the private sector. UNDP is the project’s implementing agency on behalf of the GEF. The Ministry of Energy, Water and Communications (MEWC), now Ministry of Energy, Green Technology and Water (MEGTW) was appointed the project’s executing agency, whereas Pusat Tenaga Malaysia (PTM), now Malaysia Green Tech Corporation (MGTC), was the designated implementing

agency. Due to the change of mandate in MGTC, the project team was directly managed by MEGTW on January 2010.

The MBIPV is intended to induce the long-term cost reduction of the non-emitting GHG PV technology via integration of the PV technology within building designs and envelopes. It is aimed at creating a sustainable BIPV market in Malaysia that will generate widespread BIPV applications. The MBIPV project will specifically focus on the market development for BIPV technology, and building the national capacities on three major areas: (a) policy and education; (b) technical skill and market implementation; (c) technology development support. The project will catalyze BIPV technology acceptance among the public, policy makers, financiers and building industry, which will lead towards a sustainable BIPV market beyond the completion of the project. The project objectives will be achieved via a multi-pronged approach: (1) BIPV information services, awareness and capacity building programs; (2) BIPV market enhancement and infrastructure development; (3) BIPV policies and financing mechanisms program; (4) BIPV industry development and technology localization program.

In accordance with regulations of UNDP and GEF, a Final Evaluation has to be carried out under the responsibility of the GEF-implementing agency (i.e. UNDP), of which the results are presented in this report. An international consultant was fielded from 05-15 June 2011 to undertake the evaluation in collaboration with a local consultant. During the mission, extensive discussions were held with the MBIPV project team and representatives from inter alia UNDP Malaysia, UNDP Asia Pacific Regional Centre, Ministry of Energy, Green Technology and Water (MEGTW), Economic Planning Unit (EPU), Malaysia Industrial Development Authority (MIDA), Energy Commission (EC), Tenaga Nasional Berhad (TNB), Embassy of the Federal Republic of Germany, industry and end users. Relevant project documents were also analysed.

The MBIPV project started in July 2005 and was planned to finish by December 2010. However, to ensure a smooth transition towards an operational Sustainable Energy Development Authority (SEDA), the NSC decided to let it continue until May 2011.

The **main achievements** of the project can be summarised as follows with target figures indicated being original targets:

- Overall Project Goals and Objectives
 - 2,054 kWp awarded/ commissioned¹ against a target of 1,545 kWp ; at ~1100 kWh/kWp/y GHG emissions reduced by 1,400 t/y the electricity generating mix. of Malaysia @ 0.62 t CO₂/MWh; project overachieved main target of PV capacity by 33 %;
 - Cost reduction of 39 % (to USD 6,374 /kWp) against a target of 20 %; cost reductions favored by international market trends;
 - Capacity building (policy, planning, institutional, industrial, technical and financial) carried out in the public and private sectors beyond numerical final targets - overachievement;
 - Efforts to integrate a national BIPV program in the 10th Malaysia Plan very successful, see start of Executive Summary; PV now firmly embedded in national planning in Malaysia underpinning a sustainable post-project development;
 - As to milestone reports, major publications, public references and other outreach work significant overachievement as to numerical targets; very successful website (+224,500 hits & ~18,000 downloads);
 - Industry & Localization effort achievements well beyond final targets; since 2004 foreign direct investments (FDI) in the PV sector at +4 billion USD (~5,000 jobs);

¹ Commissioned by end of project ultimo 2010. In Suria a time delay of 12 months is accepted from award to commissioning for retrofits and 24 months for new buildings; follow up on awarded projects takes place regularly at quarterly intervals on the initiative of originally MBIPV, now interim SEDA/SEDA .

not all to be credited MBIPV, but MBIPV in general found to be instrumental/ supportive; local industry promotion results found more difficult to assess.

- **Objective 1: BIPV Information Services, Awareness and Capacity Building Programs**
 - MBIPV (PTM), Energy Commission and TNB have processed BIPV project applications rather smoothly; set-up for a post-project continuation in place;
 - Local industry implements up to 50 BIPV projects/year, against a target of 3;
 - Building owners and developers are aware of MBIPV: 7 Suria calls implemented;
 - Malaysia Photovoltaic Industry Association (MPIA) established with about 40 member companies against a target of 21; 37 meetings arranged against a target of 2; however the MPIA is found not to exhibit the full functionality of an efficient industry association;
 - No. of participants enrolled at training at 139 against an accumulated target of 60;
 - No. of Approved Service Providers at about 30 against a target of 3;
 - MBIPV website exhibits +200,000 hits against a target of 120; almost 18,000 downloads against a target of 50;
 - Brochures produced and distributed, media events, seminars and participation in international events all significantly beyond targets.
- **Objective 2: BIPV Market Enhancement and Infrastructure Development Program**
 - Standard for BIPV electrical installation compiled (MS 1837-2005); standard for PV in housing transferred to IKRAM;
 - 6 showcases implemented at 140 kW against a target of 125 kW;
 - 19 demonstration projects awarded/implemented at 390 kW against a target of 205 kW;
 - 7 Suria calls implemented resulting in 1,524 kW being awarded/implemented against a target of 1,215 kW;
 - Monitoring center established at Universiti Teknologi Mara (UiTM) presently monitoring 77 BIPV systems against a target of 35; monitoring centre contracted for 3 years post-project, and centre itself expects ongoing operation.
- **Objective 3: BIPV Policies and Financing Mechanisms Program**
 - PV (and RE) is by end of project firmly embedded in the 10th Malaysia Plan;
 - The Renewable Energy Bill 2010 (D.R.47/2010) has been passed defining a feed-in-tariff (FIT) scheme for RE in Malaysia, establishing a RE Fund for the funding of the scheme and the setting of national targets for RE deployment incl. PV;
 - The Sustainable Energy Development Authority Bill (D.R 43/2010) has been passed defining a new Malaysian authority (SEDA) under the MEGTW dedicated to the RE sector;
 - The Malaysian RE Policy and Action Plan of February 2009 underpins the above regulatory framework encompassing similar priorities in its five strategic thrusts;
 - Import duties and sales tax has been waived for PV, for the time being up to 2015; MIDA expects an extension;
- **Objective 4: BIPV Industry Development and Technology Localization Program**
 - MBIPV cannot alone be credited for all the PV associated FDI around and during the MBIPV project period (see also below under Multi-objectives), but has been instrumental/facilitating a significant share i.a. by conducting 12 international collaboration programs, 8 international industry missions, 11 matchmakings between international and local industry and about 30 seminars and workshops for international and local industry;
 - About 30 companies have been established as Approved Service Providers under the MBIPV project (also mentioned under Objective 1);
 - Take up of local production of PV system components is difficult to verify/assess; some successes are reported;
 - Business models developed and described, but local take up may have been delayed by the lack of a more firm national enabling framework for the sector, which has only recently been in place (see also Objective 3); increasing interest from local industry is thus expected;
 - Testing center for PV inverters established at the Universiti Teknologi Malaysia (UTM). A Mounting Structure Quality Control test center for support structures (MSQCC) has been established at the IKRAM.

- Multi-objectives – not envisaged during project design and inception
 - PV is one out of 10 energy Entry Point Projects (EPP's) in the Economic Transformation Plan (ETP);
 - Malaysia Green Technology Corporation (formerly Pusat Tenaga Malaysia-PTM) is commissioned by the MEGTW to mint out Green Technology Policy, which is found to be in support of sustainable RE and PV development in Malaysia;
 - MBIPV has performed excellent capacity building in and support to MEGTW and other institutions;
 - Since 2004 Malaysia has benefitted from FDI of more than 4 billion USD in the PV sector up till now creating about 5,000 jobs.

In overall terms the MBIPV project can be said to exhibit considerable overachievement and to be highly successful both on a national and international level.

Major **conclusions** resulting from the evaluation analysis are as follows:

The MBIPV project, in the view of the Evaluator, has made important and real contributions to removing barriers for BIPV, in particular awareness creation and capacity building in important areas such as benchmarking, best practices, monitoring and not in the least demonstration of BIPV technology and demonstration of cost reduction. MBIPV has in particular towards its end played a crucial role in getting RE and PV on the political agenda in Malaysia, and in getting a national regulatory framework in place underpinning a sustainable post-project development. Other projects and activities have also contributed to this, but MBIPV has played a key role as mover. MBIPV has thus had considerable impact on key actors affecting decision-making concerning PV and renewable energy at several levels, e.g. government, parliament, agencies and institutions, utilities, academia and industry as well as consultancies, architects, developers and other professionals. Primarily during the MBIPV project period international PV industry have established operation in Malaysia in terms of FDI of more than 4 billion USD; all this cannot be credited to MBIPV alone, but the project has played a crucial role in contacting, facilitation and promotion. The MBIPV project has generated insights into the environmental, technical and economic potential for PV and RE technologies in Malaysia and the options available to politicians and government to realise same potential.

In addition, a main barrier to increased use of PV and RE in Malaysia remains the subsidised prices of conventional (fossil) sources of energy. However, the now established FIT scheme for RE and PV scheduled to go in operation by September 1 2011 and the establishment of a new statutory body (SEDA) under the MEGTW to be responsible for i.a. same FIT scheme is found - seen in context with the Malaysian decision to reach market prices on energy inside relative few years - as very appropriate instruments to handle a gradual and smooth deployment of RE and PV technology in Malaysia in concert with the ongoing political discussions on national climate and energy policy.

The project was initiated mid 2005 and was intended to be finalized by end of 2010. However, the project was extended by the NSC up to May 31 2011 to facilitate the establishment of the SEDA, to mint out the FIT scheme in supporting regulations and to ensure the competence of the project core team would be available to the MEGTW. The Evaluator finds this extension very appropriate. From start to January 2010 the MBIPV project was anchored at the PTM (now Malaysia Green Tech Corp²), following which the project was put under the supervision of the MEGTW. Later the project team was physically moved to the government building of the MEGTW, and is later expected to move as a nucleus for the new SEDA to the refurbished facilities for same. Thus a reasonably even transition from project level to the

² Also the launching of the Green Technology Fund Scheme under the Malaysia Green Tech Corp, where the GOM has allocated MR 1.5 Billion for the green project, however the take-up rate appears to be very low.

level of national sustainable action has been established without the loss of the considerable national competence of the project core team.

The success of the MBIPV project is, in the view of the Evaluator, to a very large extent contributable to the competence, dedication and skills of the project core team (management and team). The core team has not only reached overachievement of original project targets, but has taken on additional assignments en route, e.g. activities in off-grid PV technology, preparation of a FIT / SEDA website and in particular extensive support to the Malaysian government. The Evaluator further finds, that the core team has been very effective in adapting to recommendations and in the handling of project risks by quickly identifying risks and by creating alternative plans to accommodate same risks.

The success of the MBIPV project is very much also due to the willingness by the current Malaysian Parliament, Government and in particular MEGTW staff to receive and accept recommendations in the fields of RE and PV.

Also the quick and ongoing uptake of the BIPV technology by Malaysian developers and builders has contributed to underpin the MBIPV success.

Furthermore, the success of the MBIPV project can to a certain extent also be allocated to the dramatic reduction in the world market prices of PV technology in particular experienced during the second half of the project; a small study is recommended to identify the impact of the MBIPV on the market price development.

The MBIPV project is now completed and is found highly successful by the Evaluator. The evaluation process itself is, again by the Evaluator, found suitable for a project of the character of the MBIPV and no improvements can be suggested.

The Evaluator has the following **recommendations**, not to the completed project, but as follow up measures:

- As a direct follow up of the MBIPV project it is recommended to carry out two minor studies:
 - One to highlight the impact of the MBIPV project on cost reductions of GCPV in Malaysia in a scene of changing world market price reductions and exchange rate fluctuations;
 - One to map out the impact of the MBIPV project on the relevant local industry.
- At the time of the evaluation the SEDA was not firmly established with the project core team acting as an “interim SEDA”. Taking into account the short time until the FIT scheme shall go operational (01.09.11) and the associated outstanding measures to be completed, the envisaged negative effect on the public by an eventual postponement of the FIT scheme and the risk of “depletion” of the core team, it is recommended to formalise the effective establishment of the SEDA very quickly.
- As the PV market has shown to be very volatile it is recommended to investigate the PV FIT at least every 6 months and to adjust same in a fully transparent manner.
- For companies MIDA administers a set of basically tax holidays at present in force up to 2015. It is recommended to investigate the viability of a continuation in one form or another in order to provide companies with a more long term signal.
- In more general terms the local PV industry and commercial sector in Malaysia is perceived as having “suffered” from the lack of official long term PV market targets and indicators resulting in a relative slow local take up. These market targets, indicators and instruments are now in place as explained elsewhere, and it is recommended to develop and initiate suitable instruments to promote the development of a Malaysian PV related industry, which e.g. could encompass low iron PV glass, module assembly incl. tailor made PV modules for BIPV, electronics, DC switch gear and tai-

lor made support structures and integration packages. In this context a more open collaboration between universities and industry in Malaysia should be encouraged.

- The MEGTW has taken the commendable initiative to create awareness of PV and RE in the banking sector in Malaysia to facilitate future loans for such installations, it is recommended, as an eventual supplementary action, to activate the expertise of the ADB in this, as the ADB currently is executing its major Asian Solar Energy Initiative (ASEI), which includes capacity building in the banking sector.
- While regional (ASEAN) dissemination of the MBIPV via the NRE-SSN has taken place with perceived limited impact – not due to effort of the MBIPV, it is recommended with the above mentioned ADB ASEI in full deployment including its knowledge platform the Asian Solar Energy Forum (ASEF), to enhance the use of this new knowledge platform to disseminate the very successful MBIPV project regionally.
- The MBIPV project has successfully addressed individual BIPV installations. As a natural follow up it is recommended to investigate the possibilities of establishing a new project targeting a concentrated BIPV deployment in a large scale development, say 500-1 000 low energy houses or more. The overall implementation principle should reflect integrated energy design. Such an “Eco Village concept” will partly be a very visible demonstration of BIPV combined with energy conservation measures (housing of the future), partly enable Malaysian market actors, in particular TNB, to obtain experience with high penetration of PV in grids, as the “Eco Village” periodically can be expected to be a net producer of electricity (Smart Grid functions). A very first step could be to identify an interested and suitable developer and to investigate funding options.
- With the expected success of the RE FIT scheme the penetration of RE generators, some of which are intermittent/stochastic of nature, in the Malaysian grid system will increase. International experience clearly shows, that with increasing penetration of intermittent generators a Smart Grid approach to grid management is needed in order to avoid unnecessary increase of conventional generating capacity and to keep balance and quality of the grid system. Although a high penetration of RE in the Malaysian grid system might take time, it is recommended to initiate suitable Smart Grid actions in a combination of local actions (see also point above) and international collaboration in order timely to build Malaysian capacity in this complex field and to avoid unnecessary investments.
- The PV System Monitoring Centre (PVMC) at the UiTM is doing an important service in providing national data on BIPV system performance in Malaysia. Such data are important for future analysis of trends and for future decision making. It is recommended to make certain, that the PVMC can continue providing this service – also following the three year period after MBIPV completion as per present contract – and it is recommended to investigate the possibilities of extending the scope of work of the PSMC to include a representative selection of the many off-grid PV systems in Malaysia thus building a national PV performance database.
- As the MBIPV project has been highly satisfactory only a couple operational recommendations can be given:
 - For projects dealing with/focusing on a single technology it should be emphasized to ensure a sufficiently broad interphase to the surroundings in terms communication and dissemination to prevent the project from being “isolated” and this way maybe create unnecessary animosity.

- When/if conflict of interest is encountered communication efforts shall be increased and base for ownership broadened, not the opposite.

One **lesson learned** is that even if a project such as the MBIPV by definition must have a sharp focus, care must be taken not to focus only on a single RE technology or applications such as BIPV and GCPV. RE and for that matter energy conservation present a palette of options to be addressed in a coordinated manner, and as such project planners and executors should look into the bigger perspective when implementing projects. A broader approach, in particular with regard to dissemination, communication and ownership, may contribute to reduce the competitive/critical landscape otherwise easily created around a successful project. The MBIPV project has successfully adapted such a broader approach since mid of project.

A second lesson learned is that – at least in Malaysia – the time to introduce new legislation (the regulatory framework necessary for a sustainable continuation of the MBIPV initiative) can be considerably reduced by involving private sector legal expertise to carry out the necessary drafting of bills and subsequent regulations instead of relying exclusively on the often overworked office of the Attorney General (AG) and the line ministries involved.

A third lesson learned is, that the crucial and costly competence and skills build up in the project core team during the project execution can be (and should be) transferred intact to ongoing activities if at all possible. In this case the core team has after project completion as “interim SEDA” provided the MEGTW with invaluable services, and the core team is expected to form the nucleus of the new SEDA. Carefully build competence and skills are thus kept intact for the benefit of the country instead of, as often is the case, being dispersed and “lost” by end of project.

A fourth lesson learned is, that because of many demonstration projects have been applied at high cost residential houses, PV is often perceived to be suitable for the high income/rich people. A continuous awareness effort will be required to educate the public and to get rid of this perception. The above mentioned Eco Village concept could be seen in this context.

A fifth lesson learned is, that the ‘Suria 1000’ programme has been very successful in creating awareness and PV demonstration projects. The innovative bidding mechanism of the programme instead of a grant approach has led to good value for money and as a result overachievement of the PV capacity targets set. The MBIPV programme can thus be regarded as a best practice and the approach can be replicated in other coming projects and in other developing countries as well.

2. INTRODUCTION

2.1 Background

Renewable energy at the national level was first stated in the Eighth Malaysia Plan (2001-2005), and in the Third Outline Perspective Plan 2001-2010. Renewable energy is again explicitly addressed in the (current) Ninth Malaysia Plan (2006-2010). Photovoltaic (PV) technology is one of the fastest growing renewable energy technologies on the world market with a recognized huge potential given the expected cost reductions are met. Many countries and regions have introduced enabling frameworks for PV in anticipation of its growing competitiveness and importance as an environmental benign source of electricity. Without such an enabling framework many barriers hamper the deployment of PV:

- Still high local cost; global cost reductions have been ongoing and are expected to continue leading to grid parity in many regions in the coming decade;
- Limited awareness of PV technologies and their added values associated with building integrated applications;
- Limited access to information on PV technologies and performance benchmarks for PV technologies;
- Unwillingness of investors to incur what are perceived to be the ‘high-cost / high-risk’ transactions;
- Insufficient linkages to or synergies with energy conservation measures;
- Insufficiently energy regulations;
- Few PV technology demonstration projects, if any;
- Inadequate and low-quality local PV industry and support services;
- Lack of financiers that are prepared and interested in financing PV investments as well as appropriate financing/support mechanisms;
- Lack of a coherent, recognized and approved national renewable energy policy and action plan with sufficient mid to long term range;
- Insufficient financial resources for the adequate staffing of the implementing agencies involved (such as PTM) as well as for the implementation of PV enabling measures.

To address such barriers to the introduction and deployment of building integrated PV (BIPV) in Malaysia, the Government of Malaysia initiated the **Malaysian Building Integrated PV Programme (MBIPV)** in 2005. Support and funding has been provided by the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) as well as the Government of Malaysia and the private sector. UNDP is the project’s implementing agency on behalf of the GEF. The Ministry of Energy, Water and Communications (MEWC – now MEGTW), was appointed the project’s executing agency, whereas Pusat Tenaga Malaysia (PTM – now Malaysia Green Technology Corporation) was the designated implementing agency.

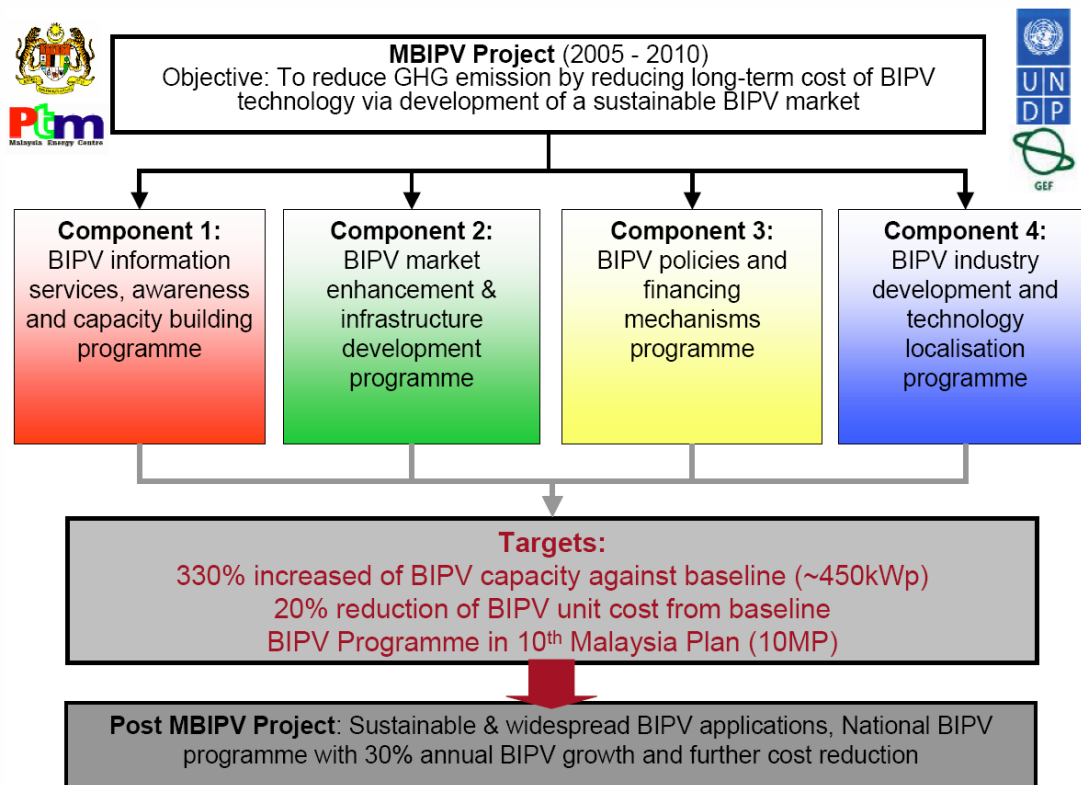
2.2 Project objectives and strategy

The MBIPV intends to induce the long-term cost reduction of the non-emitting GHG PV technology via integration of the PV technology within building designs and envelopes. It is aimed at creating a sustainable BIPV market in Malaysia that will generate widespread BIPV applications. The MBIPV project will specifically focus on the market development for BIPV technology, and building the national capacities on three major areas: (a) policy and education; (b) technical skill and market implementation; (c) technology development support. The project will catalyze BIPV technology acceptance among the public, policy makers, financiers and

building industry, which will lead towards a sustainable BIPV market beyond the completion of the project.

The project objectives will be achieved via a multi-pronged approach: (1) BIPV information services, awareness and capacity building programs; (2) BIPV market enhancement and infrastructure development; (3) BIPV policies and financing mechanisms program; (4) BIPV industry development and technology localization program.

The structure of MBIPV project is illustrated below.



The Project Document and the Inception Report further details that these objectives are to be achieved through the four Project Components with the immediate objectives as listed below.

Component 1: BIPV Information Services, Awareness and Capacity Building Programs

- Relevant GoM agencies processing applications for BIPV project implementation by Yr3.
- Local PV industry implementing at least 3 BIPV projects each year starting Yr3.
- Building owners and developers consider the incorporation of BIPV systems in their planned building projects starting Yr2.
- MPIA established as an umbrella organization and leader of BIPV quality program by Yr1.
- At least 3 BIPV projects implemented annually by trained PV service providers, engineers and BIPV designers by Yr3.

Component 2: BIPV Market Enhancement and Infrastructure Development Program

- Developed BIPV standards and guidelines enforced by Yr4.
- Locally manufactured BIPV products comply with standards by end Yr5
- 4 BIPV showcases and 4 BIPV demonstration projects implemented starting Yr2.

- BIPV demonstration projects operated and monitored for performance starting Yr2
- About 20 prospective clients apply for BIPV projects (as part of the National BIPV program) each year starting Yr2.
- Information on BIPV showcases and demonstration projects disseminated through seminars and the national BIPV campaign starting from Yr3.

Component 3: BIPV Policies and Financing Mechanisms Program

- BIPV policy and institutional framework supported with financing mechanism for a sustainable follow-up program integrated in the 10th Malaysian Plan by Yr4, and implemented by Yr5.
- About 30% annual increase in BIPV applications spurred by policy implementation supported with appropriate financing mechanism starting from Yr5 until end of 10th Malaysian Plan.

Component 4: BIPV Industry Development and R&D Enhancement Program

- At least 2 business partnerships and technology transfer for harnessing enhanced R&D activities for two locally manufactured BIPV products established and implemented by Yr5.
- Developed business models for at least 5 local BIPV entities successfully implemented by Yr5
- Established BIPV testing facility providing quality control with possible upgrade towards certification center by Yr 5.

The document of the full-size project was formally signed in May 2005 with a total budget of US\$ 24.96 million with GEF financing of US\$ 4.70 million, government co-financing in cash of US\$ 8.84 million and in-kind of US\$ 3.71 million and private/international sector cash contributions of US\$ 3.86 million and in-kind US\$ 3.85. Implementation of the project started in 2005 and was expected to be completed by end of 2010.

2.3 Evaluation methodology and structure of the report

In accordance with regulations of the UN Development Programme (UNDP) and the Global Environment Facility (GEF), a Mid Term Evaluation of the MBIPV has to be carried out under the responsibility of the GEF-implementing agency (i.e. UNDP). The results of the evaluation are presented in this report. The **purpose of the final evaluation** is to **review, rate the performance** of the project and **provide recommendations**. The review will include evaluating the:

1. Progress in project implementation, measured against planned outputs set forth in the Project Document/Inception Report with latest revision in accordance with rational budget allocation, and
2. An assessment of the overall impact of the project to the country, and
3. Recommend lessons learned and best practices which could be applied to future activities and other on-going/new projects.

The Terms of Reference (TOR) of the final evaluation is attached in Annex A.

An international consultant, Mr. Peter Ahm (Denmark) and a local consultant Mr. Ghazali Talib (Malaysia) hereinafter referred to as the “Evaluator”, was engaged by UNDP-Malaysia to conduct the evaluation. The Evaluator conducted a mission in Malaysia from June 5 to June 15 2011. During the mission, extensive discussions were held with the project management and the project core team, and with representatives from i.a. UNDP Malaysia, Ministry of Energy, Green Technology and Water (MEGTW), the Economic Planning Unit (EPU), the

Energy Commission (EC), the Tenaga Nasional Berhad (TNB), the Malaysia Industrial Development Authority (MIDA), , Zaid Ibrahim & Co. (ZICO), the GEF regional representative in Bangkok, the PV Monitoring Center; a number of brief “ad hoc” meetings were carried out with representatives from e.g. the German Embassy, the Japanese Embassy, the Energy Conservation Center Japan and the Clinton Foundation. Also important private sector stakeholders, such as beneficiary companies (Approved Service Providers & developers) and end users were briefly met. The list of people met is provided in Annex B.

During the mission, the Evaluator drew up an agenda that covers the issues to be addressed as mentioned in its Terms of Reference (see Annex A) and follows the structure of this report:

- Introduction (project description and evaluation method);
- Findings on project progress
 - Project’s performance in terms of results (achieving objectives and outputs in terms of realised activities and inputs used) and impacts, quantitatively and qualitatively measured by indicators (as set in the project document and the annual project review documents),
 - Description of awareness raising and other project impacts,
 - The Evaluator’s assessment of the project design and execution;
- Conclusions and recommendations
 - Conclusions taking into account sustainability and replicability issues;
 - Lessons learned and recommendations for ongoing activities.

The Evaluator adopted the following **methodology of evaluation**:

- i) Review of project reports, in particular the Project Brief, the Project Document, the Inception Report, APR-PIRs (annual project implementation reviews), minutes of meeting of the National Steering Committee (NSC) and the Project Steering Committee, as well as other background information such as Audit Reports, Quarterly Reports, reports and documents produced so far under the MBIPV and media/publication articles;
- ii) Meetings with the main project partners and stakeholders in Malaysia;
- iii) Site visits.

The report is divided into four sections. This first section provides an Executive Summary. The second section the general background of the project, purpose of evaluation, project implementation setup, partners/stakeholders and evaluation methodology. The third section dwells on findings derived from analysis of selected reports and from interactions with the stakeholders interviewed. The evaluation findings are described following the logical framework design of the project of outputs and indicators, as given in the APR-PIRs. In the fourth section, conclusions from the observations and findings are discussed in the context of the project objectives. These also pertain to sustainability and replicability of project. Section 4 ends with lessons learnt and some general recommendations.

2.4 Project set-up and stakeholders

The project is executed by the MBIPV team (or the NPT) hosted at the Ministry of Energy, Green Technology and Water (MEGTW, formerly known as Ministry of Energy, Water and Communications) on behalf of same Ministry, which represents the Government of Malaysia, and in co-operation with key national beneficiaries and stakeholders.

MEGTW is the National Executing Agency (NEX) for this project where the Secretary General of MEGTW will serve as the Chairman of the National Steering Committee (NSC). The NSC is established to provide overall guidance for the successful implementation of the project. In addition to the MEWC, the NSC consists of nominated representatives from the key Government agencies, professional institutions, industry representatives, non-

governmental organizations (NGOs), research institutions, Malaysian Green Technology Corporation (formerly known as Pusat Tenaga Malaysia, PTM), and UNDP. The NSC will review the project on a bi-annual basis. During the project period, the NSC meeting was consistently carried out and the last meeting (9th meeting) was carried out in 3rd June 2011.

A Project Review Committee (PRC) is established to provide technical advice and specific recommendations to improve the project impact and implementation to the National Project Team (NPT). The PRC will monitor and evaluate the implementation and success indicators of the project activities and outcomes. The Chairman of Energy Commission (EC) will chair the PRC. Total of 11 PRC meetings was conducted throughout the project.

Pusat Tenaga Malaysia (PTM) executes the Full Project activities on behalf of MEGTW and the Chief Executive Officer (CEO) of PTM is appointed as the National Project Director (NPD) until 2009. However due to the changes in MGTC portfolio and restructuring of MGTC, the responsibility to execute the project activities was taken over by the MEGTW and the role of NPD was entrusted to the Under Secretary, Sustainable Energy Division of MEGTW. MEGTW has mobilized a National Project Team (NPT) or the MBIPV Team to be responsible for the overall operational and financial management and reporting of the UNDP-GEF funds in accordance with the rule and regulations for nationally executed project till the closing of the project. The NPT will also be responsible for the human resource, planning and implementation of project activities, provide mechanisms and technical inputs necessary to integrate the results of various activities, ensure satisfactory performance of the project members and contractors, and provide official reports to the NPD, the PRC and the NSC as required.

3. FINDINGS

3.1 Implementation: assessment of progress of outcomes and outputs

For each of the four components including sub-components this section assesses the progress in the implementation of the project's outcomes and outputs and provides recommendations for follow up actions if any, following the format as given in the ToR, see annex A.

Overall objective	Planned overall targets	Actual	Status/Actions
1. Project Goal			
<p>1. The annual growth rate of GHG emissions from fossil fuel fired power generators is reduced via the widespread implementation of BIPV application to replace part of the current fossil fuel use in Malaysia, and via the cost reduction of the BIPV technology.</p>	<ul style="list-style-type: none"> • GHG emissions from fossil fuel-based power generation in the country is reduced by 65,100 tons CO₂ over the lifetime of the installed PV capacity by the year 2010, relative to the baseline in year 2005. • GHG emissions avoided from forecast replications beyond the MBIPV project are about 868,000 tons CO₂ over the lifetime of the total installed PV capacity in the year 2020. 	<ul style="list-style-type: none"> • Calculated with electricity generating mix. of Malaysia at 0.62 t CO₂/MWh. • 2,054 kW commissioned/awarded against a target of 1,545 kW; at ~1100 kWh/kW/y GHG emissions reduced by about 1,400 t/y • Forecast replication exceeded.. 	<ul style="list-style-type: none"> • Deployment of BIPV over-achieved by about 33 %. • Reduction in GHG emissions overachieved correspondingly.
2. Project Purpose			
<p>2. The overall capacity (technical, policy, planning, institutional, fiscal, financial) both in government and the private sectors, to develop, design and make use of the BIPV energy potential and to develop local industry is significantly improved.</p>	<ul style="list-style-type: none"> • Increased installed BIPV capacity by about 330% and a unit cost reduction of 20% by the year 2010. • A National BIPV program is integrated in the 10th Malaysian Plan enabling about 30% annual growth in installed BIPV capacity from the end of the project to Year 2020, leading to a further 30% BIPV unit cost reduction within the 10 year period. 	<ul style="list-style-type: none"> • Increase from baseline of 439 % against a target of 330 %. • Cost reduction of 39 % (to USD 6,374/kW) against a target of 20 % . • Efforts to integrate a national BIPV program in the 10th Malaysian Plan are more than successful. RE FIT scheme introduced as well as SEDA • 183 references available; website at +200,000 hits against a target of 120; + 450 media articles against a target of 8; very successful outreach. • Industry & Localization effort achievements in general well beyond targets. 	<ul style="list-style-type: none"> • PV and RE now firmly embedded in the Malaysian planning system. A FIT scheme introduced along with a fund for financing and a new authority for administration (SEDA). Long term national targets for PV and RE set. • The awareness, training and outreach activities are found overachieved considerably. • FDI at +4 billion USD impressive; not all credit goes to the MBIPV, and a small study to highlight this is recommended

Overall objective	Planned overall targets	Actual	Status/Actions
Component:	Activity/output planned:	Activity/output actual	Status/Action
Component 1: BIPV Information Services, Awareness and Capacity Building Programs	<ul style="list-style-type: none"> • Relevant GOM agencies processing applications for BIPV project implementation by Yr3. • Local PV industry implementing at least 3 BIPV projects each year starting Yr3. • Building owners and developers consider the incorporation of BIPV systems in their planned building projects starting Yr2. • MPIA established as an umbrella organization and leader of BIPV quality program by Yr1. • At least 3 BIPV projects implemented annually by trained PV service providers, engineers and BIPV designers by Yr3. 	<ul style="list-style-type: none"> • Processing of +2 MW established. • Local PV industry implements more than 100 BIPV projects each year. • Building owners and developers fully aware of BIPV and of the benefit of BIPV, e.g. the developer Setia is planning several hundred BIPVs. • MPIA established with now ~40 members. • +100 BIPV projects implemented/y by Approved Systems Providers. 	<ul style="list-style-type: none"> • Overachieved
1.1. Integrated information and awareness building program on BIPV	Creation and operation of a BIPV cell in the information center at PTM by Q2 Yr1, where one staff is able to become a BIPV spokesperson.	10 MBIPV staff has acted as resource persons/spokespersons. IEA PVPS participation in 20 meetings.	<ul style="list-style-type: none"> • Achieved
	BIPV website developed by Q3 Yr1 and operational by Q4 Yr1, with average 120 hits per annum.	Website very successful at ~240,000 hits versus a target of 120; ~18,000 downloads vs. a target of 500; a new website for the use of SEDA and the FIT scheme almost completed.	<ul style="list-style-type: none"> • Overachieved
	Mechanics for the information exchange and promotion activities set-up by Q3 Yr1, where BIPV information and facts are readily available.	+400 media articles published; +18,000 brochures distributed; very successful website.	<ul style="list-style-type: none"> • Overachieved

	Rollout of the national BIPV campaign targeting the public starting Q3 Yr1. Five seminars or workshops, five conferences, one road show, two exhibitions conducted by end of project.	Every year conferences and seminars. One big annual event by component 1 – other components their own workshops. 14 events organized. Exhibition with MPIA members. No. of publications > 200; +60 media advertisements; +100 public talks.	<ul style="list-style-type: none"> • Overachieved
1.2. National BIPV database	Creation of a publicly accessible BIPV database and link to website by Q3 Yr1, and fully operational by Q4 Yr1, with average 50 users accessing the database annually.	Concept of database is integrated in the website: follows the components of the project. Operational since beginning 2007. + 14.000 downloads.	<ul style="list-style-type: none"> • Overachieved.
1.3. BIPV training courses	In-house training course for support staff (PTM) completed by Q2 Yr1 with at least 1 staff member fully trained.	Two workshops by Geoff Stapleton and Arsenal, ISP ³ training in 2006. ISP accreditation received. 17 staff fully trained to act as resource person. Technical training manuals compiled and handed over to UiTM..	<ul style="list-style-type: none"> • Overachieved
	Design and preparation of training materials completed by Q1 Yr2 and updated a month before each training course.	Two training manuals developed in accordance with ISP and localized. Minor updating continuously. Materials handed over to the PVMC at the UiTM.	<ul style="list-style-type: none"> • Achieved
	2 training courses on BIPV for service providers, architects and engineering consultants in Yr2 and Yr3 each. More than 80% of the local PV industry in the country trained on BIPV application by Q4 Yr5.	Training only started 2008: Contract with outside partners fell through – restart – reallocation of budget. Training of trainers twice. Now 12 trainings completed with ~140 participants. Passing grade 30 % initially, passing grade 63 % in average by end of project.	<ul style="list-style-type: none"> • Overachieved
1.4. MPIA	Representation from NGOs, academia, government, industry, consumers, etc. meet twice a year starting from Q1 Yr1, with at least 10 representations for the first meeting.	May 2006, first AGM in November 2006. In total 37 meetings organized. MBIPV provided some seed-money in a two phases. About 40 members by end of project.	<ul style="list-style-type: none"> • Local industry's interest in PV may have suffered from lack of national commitment and long term targets in PV. This may have changed sig-

³ ISP: Institute for Sustainable Power

		MPIA not found a totally efficient organization at end of project.	nificantly now with a regulatory framework in place. It is recommended to continue efforts to development local industry.
1.5. Quality control programs for local industry	National PV Council implementing BIPV user watchdog scheme by Q3 Yr2 with at least 1 consultant appointed.	Two consultants trained. For Approved Services Providers; quality control rests with MBIPV. Random check of installations. If fault found: go and fix it, or - -. 4-5 staff trained in doing so. 9 systems checked.	<ul style="list-style-type: none"> Overachieved.
	National PV Council (now MPIA) approves (in long-term – accredits) local service providers who completed and passed the required training course. Implementation of one-stop concept for BIPV service providers by Q4 Yr2. Four applications received by Q4 Yr2. At least eight local PV industries (engineering firms and service providers) are registered as one-stop service provider by end of the project.	MBIPV is the custodian. Has been left to the MPIA, but they could not implement. In reality it is shared task with MBIPV. Approved Service Providers act as a one stop shop for customers. 26 registered Approved Service Providers.	<ul style="list-style-type: none"> Redirected and achieved.
	Annual award ceremony for BIPV installations starting from Yr3 with at least one winner.	First ceremony was targeted for 2009 and second for 2010. No award ceremonies carried out as found inappropriate.	<ul style="list-style-type: none"> Achieved.
1.6. Capacity building and awareness programs for policy makers and financial sector	Ten government officials and decision makers from the finance sector completed in total 5 visits to local BIPV demonstration projects and 2 study tours to countries with outstanding BIPV installations by end of the project.	Three overseas study trip. Local capacity building by visiting local plants, 7 visits with in total 94 participants.	<ul style="list-style-type: none"> Achieved, however participation of finance sector could be improved. Banking sector now targeted by MEGTW. It is recommended to strengthen this effort, by e.g. involving ADB/ASEF.
1.7. International BIPV event for decision makers	An international BIPV event is hosted in Malaysia every 2 years starting from Yr2 with at least 50 participants.	Two events hosted with in total 1,700 participants.	<ul style="list-style-type: none"> Achieved
1.8. Disseminate information	BIPV incorporated into ASEAN plan of ac-	Ten presentations given. Sharing of les-	<ul style="list-style-type: none"> Achieved, but end result not

and lessons learn to regional ASEAN countries	tion via NRE-SSN with Malaysia as the focal country by Q3 Yr1. Malaysia reports progress during annual NRE-SSN meeting for dissemination of information starting Q1 Yr2.	sons learned, however impact appears low. Regional dissemination effort using NRE-SSN vehicle not found very effective.	very satisfactory. This is not found due to the MBIPV effort, but rather to the limited effectiveness of the NRE-SSN forum. Regional dissemination could maybe be enhanced via the ADB/ASEF.
1.9. Impact assessment of BIPV technology development	Initial survey conducted by Q4 Yr1 and final survey by Q2 Yr5. Survey results identify minimum 20% BIPV cost reduction and assess BIPV replicability beyond project scope.	Two surveys – baseline and later impact. Baseline done in 2006, the final survey in 2010 not carried out as found superfluous.	<ul style="list-style-type: none"> Achieved.
Component 2: BIPV Market Enhancement and Infrastructure Development Program	<ul style="list-style-type: none"> Developed BIPV standards and guidelines enforced by Yr4. Locally manufactured BIPV products comply with standards by end Yr5 4 BIPV showcases and 4 BIPV demonstration projects implemented starting Yr2. BIPV demonstration projects operated and monitored for performance starting Yr2 About 20 prospective clients apply for BIPV projects (as part of the National BIPV program) each year starting Yr2. Information on BIPV showcases and demonstration projects disseminated through seminars and the national BIPV campaign starting from Yr3. 	<ul style="list-style-type: none"> Electrical installation standard compiled (MS 1836-2005). Standard on PV in buildings transferred to IKRAM and done. 6 showcases implemented at 140 kW against a target of 125 kW. For demonstration projects 58 applications received, 19 applications approved and in total 390.6 kW awarded/ commissioned against a target of 65 kW 7 Suria calls launched, 177 applications approved corresponding to 1,524 kW against a target of 1,215 kW. Monitoring center established at UiTM; 77 systems under monitoring. Monitoring to continue at least three years after MBIPV project. 	<ul style="list-style-type: none"> Overachieved. It is recommended to expand monitoring to stand-alone systems, this way providing a more complete database on PVs in Malaysia to be used in future decision making.

2.1. Standards and guidelines development	Dept Standard Malaysia (DSM) publishes PV Code of practice by Q4 Yr1. Code of practice is integrated in training courseware and website, and utilized by service providers.	PV standard for installation in Sept. 2006. Conform to the IEC. Requirement to follow the standard, but not mandatory.	<ul style="list-style-type: none"> • Achieved. • It is recommended to review standard periodically.
	Standard on building practice (MS 1525) is revised by Q3 Yr5 and utilized by building developers	Transferred to IKRAM and completed.	<ul style="list-style-type: none"> • Achieved. • It is recommended to review standard periodically.
2.2. Review and final design of the planned BIPV show-cases	Confirmed/approved designs of the technically and economically feasible BIPV applications completed by Q2 Yr1. Detailed engineering designs completed by Q3 Yr1. Tender documents are out by Q3 Yr1.	No. of tender docs. reviewed at 6 against a target of 5.	<ul style="list-style-type: none"> • Achieved.
2.3. Hardware installation and operation of the BIPV show-cases	Showcases to be completed by Q4 Yr2 <i>Targets revised from 100 to 125 kW</i>	6 showcases implemented at 140 kW in total against a target (revised) of 125 kW.	<ul style="list-style-type: none"> • Overachieved.
2.4. Evaluation of demonstration sites	Target for demonstration projects: 205 kW. Proposed demonstration sites and newly identified sites are evaluated by Q2 Yr3.	19 demonstration projects at 390 kW awarded/ commissioned against a target of 205 kW.	<ul style="list-style-type: none"> • Overachieved.
2.5. Design and evaluation of technical and commercial viability for the demonstration projects	Evaluation report and detailed engineering designs completed by Q3 Yr3. Tender documents available by Q3 Yr3. Project developers able to secure financing.	58 applications for demonstration projects received and evaluated; 19 projects approved.	<ul style="list-style-type: none"> • Achieved.
2.6. BIPV demonstration implementation and operation at government and private buildings	Construction of all demonstration projects (400kWp) completed by Q2 Yr5 where BIPV systems are commissioned and operational. <i>Revised from 400 to 205 kW; may later be revised in a balance with Suria.</i>	19 demonstration projects at 390 kW awarded/ commissioned against a target of 205 kW.	<ul style="list-style-type: none"> • Overachieved.
2.7. Review and promotion of national PV program "Suria 1000"	Revised bidding concept for the national program and approval by Q3 Yr1.	5 review reports prepared, 12 adverts published and 7 calls launched.	<ul style="list-style-type: none"> • Achieved.
	Extensive marketing campaign to launch the program 'Suria 1000' targeting the public sector is carried out by Q4 Yr1. At least 20 interested bidders are identified.	177 applications awarded.	<ul style="list-style-type: none"> • Achieved.

2.8. Implementation and operation of "Suria 1000"	Launch of the program by Q1 Yr2. First equipment procurement and delivery contract signed by Q3 Yr2. End of the program with 1 MWp installed by Q4 Yr5.	1,524 kW awarded/commissioned against a target of 1,215 kW	<ul style="list-style-type: none"> Overachieved.
2.9. Monitoring and evaluation of BIPV projects	Monitoring campaign for all BIPV projects starting Q2 Yr2 and ending Q4 Yr5. Monitoring equipment in place 2 weeks after commissioning of the PV system.	One monitoring centre established at the UiTM. The support in kind from the UiTM is considerable. 77 GCPV system under monitoring; 3 annual monitoring reports issued.	<ul style="list-style-type: none"> Overachieved. It is recommended to let end users have access to monitoring data, e.g. by an annual newsletter. Data are available on the website of the monitoring centre, but some end users find this difficult.
2.10. Dissemination and promotion of demonstration program results	The results of evaluated showcases and demonstration projects are disseminated through information service (PTM) starting Q1 Yr3, generating visitation from interested stakeholders and public.	Results displayed on the website of the monitoring centre and are being updated monthly. 3 reports issued. + 1,000 participants in workshops.	<ul style="list-style-type: none"> Achieved.
2.11. Sustainable follow-up program design	Based on the activities and outcomes from component 3, a follow-up program is designed for the 10th Malaysian Plan by Q3 Y4 and submitted to EPU.	One comprehensive RE & PV follow-up programme submitted to the EPU.	<ul style="list-style-type: none"> Overachieved.
Component 3: BIPV Policies and Financing Mechanisms Program	<ul style="list-style-type: none"> BIPV policy and institutional framework supported with financing mechanism for a sustainable follow-up program integrated in the 10th Malaysian Plan by Yr4, and implemented by Yr5. About 30% annual increase in BIPV applications spurred by policy implementation supported with appropriate financing mechanism starting from Yr5 until end of 10th Malaysian Plan. 	<ul style="list-style-type: none"> PV and RE policy now firmly embedded in Malaysian planning, e.g. 10th Malaysian Plan, Economic Transformation Plan, Malaysian RE Policy and Action Plan, the Renewable Energy Bill and the Sustainable Energy Development Authority Bill. 	<ul style="list-style-type: none"> Overachieved. A new overall enabling and regulatory framework for RE and PV has been put in place including funding measures and long term target. All credit does not go to MBIPV alone, but MBIPV has been instrumental in bringing about concrete changes.

3.1. Techno-economic analysis for grid-connected BIPV	Completion and submission of assessment report highlighting cost benefits of BIPV, peak tariff and technical issues to NSC by Q3 Yr1. Report becomes reference for other project activities	Report done but delayed to mid 2007. Reason: contract with a university defaulted. One report submitted to the NSC.	<ul style="list-style-type: none"> Achieved.
3.2. Design and implementation of government incentives to utility and manufacturing industry	Recommendations of incentives for the grid-connection of BIPV and the power production by Q4 Yr1, incentives for local manufacturing by Q1 Yr2. Endorsed by NSC by Q2 Yr2.	Industrial promotion activities “transferred” to MIDA.	<ul style="list-style-type: none"> Achieved or “N/A”.
3.3. Analysis on existing and new financial mechanism and fiscal incentives	Assessment report and recommendations for supportive fiscal incentives and financing mechanism for BIPV submitted to NSC by Q3 Yr2.	One assessment report and to proposals/recommendations submitted to the NSC.	<ul style="list-style-type: none"> Achieved.
3.4. Implementation of a fiscal and financial framework for a sustainable follow-up program	An appropriate framework for BIPV, encompassing fiscal aspects and financial mechanism, including favorable power tariff and industry support policy is formulated and submitted to NSC by Q4 Yr3.	RE & PV policy formulated and submitted to the NSC. Later approved by the GOM. FIT scheme, RE fund and SEDA under implementation.	<ul style="list-style-type: none"> Overachieved.
3.5. Study on past experience and impact on international regulatory schemes	Findings of different regulatory schemes worldwide regarding BIPV and recommendations completed and submitted to NSC by Q3 Yr2. Findings report becomes reference for other activities.	One report submitted to the NSC.	<ul style="list-style-type: none"> Achieved.
3.6. Review and integration of BIPV in existing regulatory schemes	Evaluation report of the SREP, solar roadmap and other existing regulatory schemes to determine contextual relevance to BIPV completed and submitted to NSC by Q4 Yr1.	One report submitted to the NSC. 112 BIPV systems registered under the SREP (small renewable energy program) against a target of 84 systems. 96 BIPV systems registered and commissioned by the power utility against a target of 84. One report/recommendations submitted to the MEWC (now MEGTW)	<ul style="list-style-type: none"> Overachieved. Delayed somewhat, but no negative effect of delays
3.7. Implementation of an institutional and policy framework for a sustainable follow-up program	An appropriate institutional and policy framework for a sustainable follow-up BIPV program is formulated and submitted to MECM by Q1 Yr4.	One policy formulated and submitted to the MEWC (now MEGTW), same policy endorsed by the GOM.	<ul style="list-style-type: none"> Overachieved. Delayed somewhat, but no negative effect of delays

3.8. Policy and financial framework implementation, monitoring and impact assessment	An annual assessment of the policy implementation supported with an appropriate financing mechanism starting Yr5 until end of 10 th Malaysian Plan.	Found N/A due to delay in implementation.	<ul style="list-style-type: none"> • “N/A”
3.9. Government liaison and dissemination of results	A final seminar targeting the policy sector with all relevant stakeholders and the utility presenting the policy framework and the financial schemes by Q2 Yr4, with minimum 50 participants.	More than 150 participants in workshop/seminars.	<ul style="list-style-type: none"> • Overachieved.
Component 4: BIPV Industry Development and R&D Enhancement Program	<ul style="list-style-type: none"> • At least 2 business partnerships and technology transfer for harnessing enhanced R&D activities for two locally manufactured BIPV products established and implemented by Yr5. • Developed business models for at least 5 local BIPV entities successfully implemented by Yr5 • Established BIPV testing facility providing quality control with possible upgrade towards certification center by Yr 5. 	<ul style="list-style-type: none"> • Foreign Direct Investment (FDI) of more than 4 billion USD established in the PV sector in more or less the same the period as the MBIPV project. 4,000 jobs created. MBIPV not to get all credit for this, but certainly to facilitate and support the process. • One MoA signed for product development • 9 pre-commercial inverters produced against a target of 6. • Two pilot inverters tested against a target of one. • One MoU industry collaboration established. • Business models developed and reported; awaits enabling framework. • Testing of inverters established at the UTM. Testing of support structures established at the IKRAM 	<ul style="list-style-type: none"> • Achieved. • Take up of local industry could be better, but is difficult to assess. It is recommended to conduct a small study to highlight the actual impact of the MBIPV on this. Such a study can also form the base for the below recommendation. • Take up of local industry may have been influenced by the lack of an enabling and regulatory framework – now in place. Measures to stimulate local industrial take up are recommended.
4.1. R&D activities enhancement on cost reduction of local BIPV products and system optimization for local	2 research projects from universities and industry on BIPV starting Q2 Yr1, with at least 2 universities and 2 industries are involved.	Focus on inverter. Contract to Univ. Malaya (UM) – ongoing – two prototypes. Industry not really involved. Not very successful as pointed out in quarterly	<ul style="list-style-type: none"> • Partly achieved, see also 4. above. • It can be recommended to initiate measures stimulating

condition		reports. Funding from the Malaysian government – no GEF funding involved. Min. of Science does its own R&D. Lack of collaborative atmosphere between universities and industry – each side appears to “hoard” its know-how.	direct collaboration between R&D centres and industry. As at least four ministries are involved in higher education and research and as local governments are stakeholders it is beyond the scope of the evaluation to provide more concrete recommendations.
4.2. International collaboration and transfer technology program	Three international collaborations and transfer technology schemes established by Q4 Yr2. At least 2 collaborations between international and local partners materialized.	12 international collaboration programmes materialized against a target of 1. 8 international industry missions executed against a target of 3. 11 matchmakings between local and international industry established (MoU). Against a target of one. 30 workshops, seminars and events executed with local and international industry against a target of 12. Facilitating more than 15 international collaborations/transfers against target of 4. 7 matchmakings generated against target of 5.	<ul style="list-style-type: none"> • Achieved. • Some overlaps with activities 4.2, 4.3 and 4.4.

4.3. Upgrading local industry capabilities	Assessment of capabilities of local industry and manufacturers completed by Q2 Yr2. Report becomes reference for further industry development activities.	One report on local industry's capability submitted to the NSC. 4 industrial research activities conducted against a target of one. Three business plans for manufacturers developed against a target of same. Three business plans for service providers developed against a target of same. 10 companies assisted in industry growth programmes against a target of 6	• Achieved.
	Three business opportunity meetings for the local industry with international participation held once a year starting in Yr3. At least 2 matchmakings generated.	See 4.2 and 4.3 above.	-
	Business development models are developed and implemented by local industry by Q4 Yr5. At least 2 companies implement the model.	See 4.2 and 4.3 above.	-
	One commercial (BIPV mounting structure) and one pre-commercial (10 inverters pilot tested) product are available in local market by Q4 Yr 5.	See 4, 4.1 and 4.2 above.	-
4.4. Testing facility, with potential to upgrade as certification institute	A testing facility for R&D activities on local manufactured products, as well as for quality control of imported PV components is established by Q4 Yr5.	Two test centres established against a target of same: UTM tests inverters. UTM and Arsenal MoU. Australian input to UTM. Persons training. UTM does good work with business perspectives. Test on mounting structures (IKRAM) IQCC & MSQCC operational by mid 2008.	• Achieved.

	Collaboration with international certification bodies is established by Q1 Yr4. National testing facility is upgraded and testing of at least 15 products carried out annually.	Two international collaboration established against a target of one: Both on IQCC & MSQCC have international collaboration been established in 2008: UTM to Arsenal (Austria) and IKRAM to BSD (Singapore)	<ul style="list-style-type: none"> • Achieved • Test of mounting structures appears not really needed/ appreciated by the approved service providers.
4.5 Building Codes & BIPV	Start in 2009. MSQCC.	Transferred to IKRAM and implemented.	<ul style="list-style-type: none"> • Achieved.

3.2 Implementation: Assessment of Budget Utilisation

For each of the four components including sub-components this section assesses the (GEF) budget utilisation and recommend actions if any, following the format as given in the ToR, see annex A. The below overview is per May 2011.

Project Strategy	Objectively Verifiable Indicators	GEF Fund (USD) \$ 4,699,420	Performance Budget Mid Term		Performance Budget Final	
			Total Expenses	%	Total Expenses	%
Project Strategy	Objectively Verifiable Indicators	\$2,187,721	\$1,439,346	66%	\$2,405,885	110%
National Project Team mobilisation & inception report	Stakeholders workshop, preparation of inception report and updating project planning matrix, for submission to NSC	\$37,235				
	Establishment and mobilisation of national project team	\$1,462,086	\$1,000,507	68%	\$1,716,554	117%
	Mobilisation of international consultants	\$688,400	\$438,839	64%	\$689,330	100%
	Establishment of NSC (meets every 6 months) and PRC (meets every 3 months)	\$0				
Project Strategy	Objectively Verifiable Indicators					
1. Project Goal						
1. The annual growth rate of GHG emissions from fossil fuel fired power generators is reduced via the widespread implementation of BIPV application to replace part of the current fossil fuel use in Malaysia, and via the cost reduction of the BIPV technology.	GHG emissions from fossil fuel-based power generation in the country is reduced by 65,100 tons CO ₂ over the lifetime of the installed PV capacity by the year 2010, relative to the baseline in year 2005. GHG emissions avoided from forecast replications beyond the MBIPV project are about 868,000 tons CO ₂ over the lifetime of the total installed PV capacity in the year 2020.					
Project Strategy	Objectively Verifiable Indicators					
2. Project Purpose						
2. The overall capacity (technical, policy, planning, institutional, fiscal, financial) both in government and the private sectors, to develop, design and make use of the BIPV energy potential and to develop local industry is significantly improved.	Increased installed BIPV capacity by about 330% and a unit cost reduction of 20% by the year 2010. A National BIPV program is integrated in the 10th Malaysian Plan enabling about 30% annual growth in installed BIPV capacity from the end of the project to Year 2020, leading to a further 30% BIPV unit cost reduction within the 10 year period.					
Project Strategy	Objectively Verifiable Indicators					
3.1. Project Outputs			Performance Budget Mid Term		Performance Budget Final	
Component 1: BIPV Information Services, Awareness and Capacity Building Programs	Relevant GoM agencies processing applications for BIPV project implementation by 2008.	C1 sub-total	Comp 1 Total Expenses	%	Comp 1 Total Expenses	%
	Building owners and developers consider the incorporation of BIPV systems in their planned building projects starting 2007.	\$493,295	\$279,526	57%	\$399,769	81%
	Malaysian PV Industry Association established as an umbrella organization and leader of BIPV quality program by 2007. (watchdog services)					
	At least 3 BIPV projects implemented annually by trained PV service providers, engineers and BIPV designers by 2008.					
1.1. Integrated information and awareness building program on BIPV	Creation and operation of a BIPV cell in the resource center at PTM by Q4 2006, where a staff is able to become a BIPV spokesperson. BIPV website developed and operational by Q4 2006, to achieve 120 average no. of hits per annum. A mechanism for increasing public awareness and generating interest by providing relevant and comprehensive information on BIPV to interested parties. Mechanics for the information exchange and promotion activities set-up by Q4 2006, where BIPV information and facts are readily available. The various channels for information dissemination are to reach target audience more effectively. Rollout of the national BIPV campaign targeting the public. 2006 - 1 seminar (Q1), developer's launching (Q2), SURIA 1000 cum website launching program (Q4). 2007 - developer's launching, PTM new building launching, International tri-conference, 2008 - 1 seminar & 1 roadshow, 2009- 2 seminars 2010 - 1 seminar. Press luncheon will occur at least once a year. The events are to give a more direct and personal approach to educate, draw interest and commitment in targetted segments.	\$294,100	\$175,914	60%	\$191,467	65%

1.2. National BIPV database	Creation of a publicly accessible BIPV database and link to website and fully operational by Q4 2006 with average of 50 hit counts accessing the database annually. Database is to become a knowledge base, it will address information suitable for both technical and non-technical audience.					
1.3. BIPV training courses	In-house training course for support staff (PTM) completed by Q3 2006 with at least 1 staff member fully trained. Design and preparation of training materials completed by Q4 2006. Facilities for training are ready. Train the trainers are ready to be conducted. 1 train-the trainer course in 2006, 2 training courses on BIPV for service providers, architects and engineering consultants in 2007 and 2008 each. 80% of participants who passed the exam able to provide quality services. The result of the training is to create market confidence in the quality of service provided by the PV service providers.	\$65,171				
			\$64,475	99%	\$65,273	100%
1.4. Malaysian PV Industry Association	Representation from PV industry meet twice a year starting from Q1 2006, with at least 10 representations for the first meeting. The establishment of MPIA is to be an extension arm for the MBIPV in terms of driving the PV market and being an advocate to the government.	\$13,492	\$12,400	92%	\$12,400	92%
1.5. Quality control programs for local industry	Malaysian PV Industry Association implementing BIPV user watchdog scheme by Q3 2007 with at least 1 consultant appointed. In doing so, the PV industry is self-regulated with interest of PV service providers and public protected. Malaysian PV Industry Association approves (in long-term – accredits) local service providers who completed and passed the required training course. Implementation of one-stop concept for BIPV service providers by Q4 2007. Four applications for 1-stop service received by Q4 2007. At least eight local PV industries (engineering firms and service providers) are registered as one-stop service provider by end of the project. This will reduce barriers as public do not have to be hassled by co-ordinating the different parties involved in the entire PV installation process. Annual award ceremony for BIPV installations starting from 2009 with at least one winner. The award will give recognition to the PV service providers who have made the initiative and effort to achieve the standards and provide incentives to other pv service providers to attain the same achievements. In turn, the publicity the event generates will create greater public awareness, interest and confidence in the PV technology.	\$11,974		0%	\$10,132	85%
1.6. Capacity building and awareness programs for policy makers and financial sector	Ten government officials and decision makers from the finance sector completed in total 5 visits to local BIPV demonstration projects and 3 study tours to countries with outstanding BIPV installations by end of the project. The tour is to promote awareness of BIPV to decision makers and financial sector so that they are well informed and this in turn, translated into favourable decision making.	\$58,558	\$8,819	15%	\$55,730	95%
1.7. International BIPV event for decision makers	An international BIPV event is hosted in Malaysia every 2 years starting from 2007 with at least 50 participants. The event is to promote Malaysia in the international profile on the use of renewable energy source as a viable energy mix.	\$11,842	\$0	0%	\$12,094	102%
1.8. Disseminate information and lessons learn to regional ASEAN countries	BIPV incorporated into ASEAN plan of action via RE-SSN with Malaysia as the focal country. Malaysia reports progress during annual RE-SSN meeting for dissemination of information starting Q3 2007. The report is to assist other ASEAN countries with experiences and lessons learnt from the MBIPV project which in turn aims to reduce barriers and time delivery in countries interested in using BIPV.	\$7,895	\$0	0%	\$7,348	93%
1.9. Impact assessment of BIPV technology development	Initial survey conducted by Q4 2006 and final survey by Q2 2010. Survey results identify minimum 20% BIPV cost reduction and assess BIPV replicability beyond project scope. The initial survey is create a baseline in which the final survey will benchmarked against.	\$30,263	\$17,919	59%	\$29,209	97%
Project Strategy	Objectively Verifiable Indicators		Performance Budget Mid Term		Performance Budget Final	
Component 2: BIPV Market Enhancement and Infrastructure Development Program	Developed BIPV standards and guidelines by 2010. The quality of BIPV system installations are standardised.	C2 sub-total	Comp 2 Total Expenses	%	Comp 2 Total Expenses	%
	100 kWp BIPV showcases and 400kWp BIPV demonstration projects implemented and monitored for performance starting 2007 and 2008 respectively. This would enhance the awareness among the public and catalyse building industry to incorporate BIPV in future building constructions.	\$1,405,247	\$882,160	63%	\$1,212,960	86%
	At least 15 prospective clients apply for BIPV projects (under Suria 1000 program) each year starting 2007. This could spin off to more market requirement for BIPV systems.					
	Information on BIPV showcases and demonstration projects disseminated through seminars and the national BIPV campaign starting 2008.					

2.1. Standards and guidelines development	Department Standard Malaysia (DSM) publishes PV code of practice by Q4 2005. Code of practice is integrated in training courseware and utilised by service providers.	\$0				
	Standard on building practice (PV code of practice) is to be revised by Q3 2010 and utilised by the building industry.					
2.2. Review and final design of the planned BIPV showcases	Completion of guidelines and tender documents or approved design for the following BIPV applications:	\$0				
	Office building: PTM ZEO: 40 kWp by Q4 2005					
	Government building: MEWC LEO: 4kWp by Q3 2006					
	Commercial/ Public building: To be confirmed: 20kWp by Q2 2007 Residential property: To be confirmed: 36 kWp by Q1 2007					
2.3. Hardware installation and operation of the BIPV showcases	Showcases are to be completed as follows:	\$763,158	\$636,158	83%	\$674,159	88%
	Office building: PTM ZEO: 40 kWp by Q2 2007					
	Government building: MEWC LEO: 4kWp by Q3 2007					
	Commercial/ Public building: To be confirmed: 20kWp by Q4 2008 Residential property: To be confirmed: 36 kWp by Q3 2008					
2.4. Evaluation of demonstration sites	Guideline development for demo project application by Q2 2006. Proposed demo sites and newly identified sites are evaluated by Q3 2008. Projects are approved for implementation with total capacity of 400 kWp by Q3 2010.	\$0				
2.5. Design and evaluation of technical and commercial viability for the demonstration projects	Evaluation report and detail engineering designs completed by Q4 2008 leading to confirmation of BiPV installations by the building developers.	\$0				
2.6. BIPV demonstration implementation and operation at government and private buildings	Construction of all demonstration projects (400kWp) completed by Q2 2010 where BIPV systems are commissioned and operational. Enhance understanding among building industry on BiPV design and installation methods.	\$521,053	\$196,087	38%	\$444,261	85%
2.7. Review and promotion of national PV program "Suria 1000"	Revised bidding concept for the national programme and approval by Q3 2006.	\$84,211	\$49,915	59%	\$83,935	100%
	Extensive marketing campaign to launch the programme targeting the public sector is carried out by Q4 2006.					
2.8. Implementation and operation of "Suria 1000"	Award of successful bidders starting Q1 2007. Two sessions of award are planned annually until 2010.	\$0				
	First equipment and delivery contract signed by Q4 2007.					
	End of the programme with 1MWp installed by Q4 2011.					
2.9. Monitoring and evaluation of BIPV projects	Establishment of PV monitoring centre by Q3 2006. Guideline for system monitoring developed by Q2 2007.	\$0				
	Monitoring exercise of the system for all completed BIPV projects starting Q3 2007.					
	Annual evaluation report for the demo projects highlighting the operating and economic performance starting Q4 2007. Report is utilised for further system improvement and capacity development.					
2.10. Dissemination and promotion of demonstration program results	The results of evaluated BiPV installations are disseminated through info service (PTM) starting Q1 2008, generating visitation from interested stakeholders and public.	\$34,211	\$0	0%	\$10,606	31%
	A national workshop presenting the results of the demo program and Suria 1000 is held in Q2 2010 with at least 50 participants.					
2.11. Sustainable follow-up program design	Based on the activities and outcomes from C3, a follow up programme is designed for the 10th Malaysia Plan by Q2 2010 and submitted to EPU.	\$2,615	\$0	0%	\$0	0%

Project Strategy	Objectively Verifiable Indicators		Performance Budget Mid Term		Performance Budget Final	
			Comp 3 Total Expenses	%	Comp 3 Total Expenses	%
Component 3: BIPV Policies and Financing Mechanisms Program	BIPV policy and institutional framework supported with financing mechanism for a sustainable follow-up program integrated in the 10th Malaysian Plan by 2009, and implemented by 2010.	C3 sub-total				
	About 30% annual increase in BIPV applications spurred by policy implementation supported with appropriate financing mechanism starting from Yr5 until end of 10th Malaysian Plan.	\$131,579	\$56,416	43%	\$145,376	110%
3.1. Techno-economic analysis for grid-connected BIPV	Completion and submission of assessment report highlighting cost benefits of BIPV, peak tariff and technical issues to NSC by Q3 2006. Report becomes reference for other project activities					
3.2. Design and implementation of government incentives to utility and manufacturing industry	Recommendations of incentives for the grid-connection of BIPV and the power production by Q1 2007, incentives for local manufacturing by Q2 2007 and endorsed by NSC by Q2 2007 for submission to MEWC.					
3.3. Analysis on existing and new financial mechanism and fiscal incentives	Assessment report on existing fiscal incentives and financing mechanism support for BIPV submitted to NSC by Q1 2007 for submission to MEWC to adopt.					
	Assessment report and recommendations for suitable fiscal incentives and financing mechanisms for BIPV submitted to NSC by Q3 2007 for submission to MEWC to adopt.					
3.4. Implementation of a fiscal and financial framework for a sustainable follow-up program	An appropriate framework for BIPV, encompassing fiscal aspects and financial mechanism, including favorable power tariff and industry support policy is formulated and submitted to NSC by Q4 2008 for approval by MEWC.					
	Government endorsement of favorable financing schemes and power tariff policy for BIPV by Q3 2010, based on MEWC approval indicated above.					
3.5. Study on past experience and impact on international regulatory schemes	Findings of different regulatory schemes worldwide regarding BIPV and recommendations completed and submitted to NSC by Q2 2007. Findings report becomes reference for other activities.					
3.6. Review and integration of BIPV in existing regulatory schemes	Evaluation report of the SREP, solar roadmap and other existing regulatory schemes to determine contextual relevance to BIPV completed and submitted to NSC by Q4 2006.					
	Adoption of BIPV in the SREP by Q2 2007. Relevant recommendations on policy improvements or for new regulatory provisions submitted to MECM by Q2 2008.					
3.7. Implementation of an institutional and policy framework for a sustainable follow-up program	An appropriate institutional and policy framework for a sustainable follow-up BIPV program is formulated and submitted to MECM by Q1 2009.					
	A clear GoM policy on the promotion, development and utilization of BIPV is endorsed in the 10 th Malaysian Plan by Q1 2011 (This is beyond the project period to suit 10 MP schedule).					
3.8. Policy and financial framework implementation, monitoring and impact assessment	An annual assessment of the policy implementation supported with an appropriate financing mechanism starting in year 2010 until end of 10 th Malaysian Plan.	\$131,579	\$56,416	43%	\$145,289	110%
	Annual policy impact assessment completed and reviewed by MEWC for further action by 2010.					
3.9. Government liaison and dissemination of results	Dissemination of earlier impact assessment results through third party seminars and workshops, and a final seminar targeting the policy sector with all relevant stakeholders and the utility presenting the policy framework and the financial schemes by Q3 2010, with minimum 50 participants.					

Project Strategy	Objectively Verifiable Indicators	C4 sub-total	Performance Budget Mid Term		Performance Budget Final	
			Comp 4 Total Expenses	%	Comp 4 Total Expenses	%
Component 4: BIPV Industry Development and R&D Enhancement Program	At least 2 business partnerships and technology transfer for harnessing enhanced R&D activities for two locally manufactured BIPV products established and implemented by 2010.					
	Developed business models for at least 5 local BIPV entities successfully implemented by 2010	\$481,579	\$177,167	37%	\$396,141	82%
	Established BIPV testing facility providing quality control with possible upgrade towards certification center by 2010					
4.1. R&D activities enhancement on cost reduction of local BIPV products and system optimization for local condition	Research Project from university and industry to design and develop local BIPV Inverter starting Q1 2006. Pre-commercialize product (inverter) is completed by Q4 2009 and commercialization by Q4 2010.	\$52,632	\$5,158	10%	\$32,459	62%
	Research project from university and industry to design and develop local BIPV mounting mechanism starting Q1 2006. Pre-commercialize product (mounting structure) is completed by Q4 2009 and commercialization by Q4 2010.					
4.2. International collaboration and transfer technology program	International collaboration program and Transfer Technology Scheme between international and local partners established by Q4 2010. At least one (1) collaborative project/program materialised by Q4 2007 and additional one (1) collaborative program materialised by Q4 2009.	\$36,316	\$26,611	73%	\$27,341	75%
4.3. Upgrading local industry capabilities	Market research of capabilities of local industry and manufacturers completed by Q2 2007. Industry Business Development Model are developed based on the finding from market research by Q4 2007. Report becomes reference for further industry development activities	\$255,789	\$143,699	56%	\$237,557	93%
	Three (3) business opportunity meetings for the local industry with international partners held once a year starting in 2008. At least 2 matchmakings generated.					
	Industry business development models are implemented by local industry by Q4 2010. At least 3 companies (service / manufacturing) implement and follow through the business development model.					
	Industry Growth and Development Program are implemented for local industry player. At least 2 industry training and development program conducted every year starting from 2008 (up to Q4 2010)					
	One commercial (BIPV mounting structure) and one commercial (BIPV Inverter) product are available and applied in local market by Q4 2010.					
4.4. Testing facility, with potential to upgrade as certification institute	A testing facility for R&D activities on local manufactured products, as well as for quality control of imported PV components is established by Q4 2010. Product are tested by the facilities.	\$136,842	\$1,699	1%	\$94,206	69%
	Collaboration with international certification bodies is established by Q1 2010. Testing facilities are upgraded to international standard.					
		GEF Fund (USD)	Grand Total Expenses	%	Grand Total Expenses	%
		\$ 4,699,420	\$ 2,834,615	60%	\$ 4,560,132	97%

Overall spending level of the GEF budget component as of May 2011 is at about 97 % with:

- Component 1 at 81 %
- Component 2 at 86 %
- Component 3 at 110 %
- Component 4 at 82 %

In general, the utilization of the GEF funding component is found to be balanced and to reflect the actual project progress. It is noted that the budget utilisation for the National Project Team mobilisation is at 110 %.

Component 1, although perceived to be low in terms of utilisation rate, has consistently delivered its key outputs which include promoting MBIPV primarily nationally but also in regional and international conferences. Beyond establishing the national base for the MBIPV project, this has created an interest from many foreign parties to explore more detail about the project implementation and its successfulness.

Component 2 has achieved more capacity (kW) than expected and has benefitted from accelerated price reductions. It is noted that some CAPEX incentive budget is yet to be spent but is

already committed for the on-going incentive programme under the Suria 1000, which is only expected to be completed by April 2012.

Component 3 exhibits a bit of overspending compared to other components, about 10% or USD 15,000 primarily related to component 3.8. This component has achieved a major key milestone with the establishment of National RE Policy & RE Action Plan as well as National Green Technology Policy by GoM. This was later followed by the endorsement of RE Law (FiT Mechanism) and SEDA Act by the parliament which underpins the successful achievement of the component.

Component 4 exhibits under spending mainly due to low take up of R&D activities by local industry and uncertainties to the local PV market. However with the presence of the latest RE Law, SEDA law and incentives, it is envisaged the local market will grow and improve conditions for both local applied R&D and manufacturing, although stimulus may be needed.

The overall spending in the second half of the MBIPV project period is found in line with the progress reported, in particular in establishing the necessary national enabling framework for BIPV and RE, especially the RE and the SEDA Acts. As previously mentioned some of activities are ongoing with budget committed, e.g. the Suria 1000 programme and the PVMC.

Beyond the above the Evaluator has no further comments on the GEF budget component utilisation.

3.3 Implementation: assessment of the project's impacts

The original closing of the MBIPV project was set at end of December 2010; in order to ensure a smooth transition to an operational SEDA the MBIPV NSC extended the project until end of May 2011 and the final NSC meeting was held June 3 2011. This has allowed the unique national capacity represented by the MBIPV core team to remain intact very much to the benefit of the coming SEDA. In the extension period the MBIPV core team has provided crucial information and data to the MEGTW. However, it is a concern, that SEDA has not yet turned into an operational entity, as the starting date of the FIT has been declared to be September 1 2011, as the necessary regulations to mint out the RE Bill still has to be completed and as there is a risk the MBIPV core team may dissolve. The perceived great public interest in the FIT scheme may suffer, if further delays are introduced.

At the end of the MBIPV project the Evaluator finds the project impact can be summarized as:

- **Political level – enabling framework**

The sustainability of the MBIPV project has been ensured by the passing of the Renewable Energy Bill 2010 (D.R. 47/2010) defining a scheme of RE feed-in-tariffs (FIT) and the establishment of an RE Fund (a levy of 1% on top of the normal electricity tariff) to fund the feed-in-tariffs; in support of this the passing of the Sustainable Energy Development Authority Bill 2010 (D.R. 43/2010) defining a new Malaysian authority (SEDA) under the MEGTW dedicated to the Malaysian RE sector including the FIT scheme. In Malaysia's Economic Transformation Plan of September 2010 aiming at turning the country into a high income economy by 2020 solar energy has been identified as one out of 12 Entry Point Projects (EPP) of the energy

sector. Furthermore the Malaysian RE Policy and Action Plan of February 2009 underpins the above regulatory framework encompassing similar priorities in its strategic thrust 1 and 2. The Green Tech Corp. (formerly the PTM) is entrusted by the MEGTW to mint out the Nation Green Technology Policy, which again is seen as in support of the Malaysian commitment to RE.

- **Key stakeholders and actors**

Interviews with major stakeholders exhibit in general high satisfaction with the MBIPV project for its achievements and its role in pushing the FIT scheme and SE-DA; other UNDP/GEF projects and other relevant actors in Malaysia should however not be forgotten in contributing to the base of this success.

Representatives met from e.g. the MEGTW, the Energy Commission, the TNB, MIDA, academia, industry and developers all expressed respect for and satisfaction with the MBIPV project and its progress, and with the information and support received from the MBIPV team.

- **End users**

End users met, e.g. from the educational system and private households, expressed great satisfaction with their BIPV systems and in particular with the support provided by the MBIPV team. One developer met, SETIA, expressed very ambitious plans for further BIPV installations.

- **Implementation**

The MBIPV project is found to have overachieved both as to targets and time schedule. Despite low local energy cost and initial low PV awareness the MBIPV has managed to deploy more GCPV installations than expected, e.g. 2 054 kW against a target of 1 545 kW and corresponding price reduction to 19 121 MR/kW against a target of 25 128 MR/kW. The associated annual GHG emission reduction is estimated at 1 533 tons against a target of 1 168 tons. MBIPV has among other things, in respond to needs but outside its Project Document, conducted training in off-grid PV's.

At the end of the MBIPV project a national framework (the RE Bill) has been set targeting a PV deployment of 350 MW by 2015, 1 250 MW by 2020 and 4 470 MW by 2030. This development is supported by the FIT scheme – for 21 years having an initial annual degression rate of 8 % - and at least up to 2015 the national PV incentives under the MIDA umbrella (tax holiday etc. up to about 50 % of capex). Before and during the MBIPV significant foreign investments in PV manufacturing in Malaysia have been made, partly facilitated by the MBIPV project; however MBIPV's attempts to stimulate local industry and establish a strong PV industrial association are seen as not entirely successful the most obvious explanation being industry's lack of confidence in a local market and its future development. With the now official long term and transparent PV market development indicators this situation may changed and industry may see new investment opportunities if properly guided.

- **Regional dissemination**

The regional dissemination in the ASEAN framework (NRE-SSN) is found to be weak, not necessarily because of MBIPV action, and not to have the impact expected.

3.4 Implementation: assessment of risk management

The Evaluator finds, that the core team has been very effective in adapting to recommendations and in the handling of project risks by quickly identifying risks and by creating alternative plans to accommodate same risks.

It is the opinion of the Evaluator, that the project risk management both in the overall project implementation and on the component level is well handled by the MBIPV team and that assumptions and identified risks are recognized and discussed freely, e.g. at the monthly project meetings, leading to a quick identification of viable mitigating measures.

Two critical risks had been identified according to PIR 2010. The Evaluator are of the opinion that both risks have been handled effectively and necessary action has been implemented to mitigate the risks. The following are the status of the risks identified in the PIR;

- **Political risk:** Political willingness to introduce and implement the proposed RE Law with Feed-in Tariff and RE Fund mechanism. Discontinuation of MBIPV project efforts and accomplishments.

Comments: the risk no longer exist as both RE Law and Feed-In-Tariff are already in place and the GoM has announced that the implementation will start in Q4 of 2011. The MBIPV projects will be sustained and fostered with the presence of this law.

- **Organizational risk:** Reduced motivation and commitment from the project team due to barriers in PTM, in addition to expansion of duties and responsibilities.

Comments: In conjunction with the RE Law, the parliament has also endorsed the bill for the establishment of SEDA Act, which mean the setup of an authority body designated to coordinate and support FiT and all other related RE matters in the country. There are no longer issues on the expansion of duties and responsibilities as this agency is a separate entity from PTM.

3.5 Project relevance, design and country drivenness

3.5.1 Relevance

Generally, Malaysia has to face, and is indeed facing the challenges of future development in a global environment where the spur to growth fuelled by hydrocarbons will proportionally weaker than in the past. Spiralling oil prices, environmental degradation and climate change have made the need for sustainable use of energy more evident. RE technologies including PV and BIPV are high on the international climate and energy agenda.

Thus, the project is relevant to the development objectives of Malaysia. Renewable energy at the national level was first stated in the Eighth Malaysia Plan (2001-2005) by the introduction of Small Renewable Energy Programme (SREP), and in the Third Outline Perspective Plan 2001-2010. Renewable energy is again explicitly addressed in the (current) Ninth Malaysia Plan (2006-2010). The establishment of ministry of Energy, Green Technology and Water reflects the government of Malaysia seriousness in driving the economy through the sustainable development. In terms of climate change, Malaysia has committed to reduce its GHG emissions by 40 per cent of emissions intensity of GDP by 2020. The application of low cost GHG emission technology could be one of the important elements to achieve this aspiration. This make the project very relevant in ensuring the PV technology is affordable. Photovoltaic (PV) technology is one the fastest growing renewable energy technologies on the world market with a recognized huge potential given the expected cost reductions are met. Many countries and regions have introduced enabling frameworks for PV in anticipation of its growing

competitiveness and importance as an environmental benign source of electricity, and as previously indicated Malaysia appears presently to be considering its options, priorities, strategies and instruments as to energy and RE. The MBIPV is proven to have provided a significant input to the 10th Malaysia Plan. With the introduction of RE Law (FiT mechanism) and SEDA Act, this has giving the MBIPV project additional relevance to RE development in the country.

3.5.2 Project conceptualisation

As such, the project document provides a clear, logical structure in four Components. The outputs of each Component are clearly specified and would if achieved meet the objectives of each Component. The original list of targets and activities has changed over time⁴, but this may be expected of a project responding to the fast development of a globally very dynamic sector such as PVs. The four Components themselves are found supplementing each other and interlinked with clear interfaces.

The MBIPV Evaluator finds no major flaws in the project concept and design.

The Evaluator is of the opinion that most of the key barriers that hindered the implementation of PV in Malaysia have been successfully removed by the project. Such barriers identified during the beginning of the project such as follows are no longer an issue.

- Local cost level has been reduced; global cost reductions are on-going and are expected to continue leading to grid parity in many regions in the coming decade;
- Limited awareness of PV technologies and their added values associated with building integrated applications;
- Limited access to information on PV technologies and performance benchmarks for PV technologies;
- Few PV technology demonstration projects,
- Inadequate and low-quality local PV industry and support services;
- Lack of financiers that are prepared and interested in financing PV investments as well as appropriate financing/support mechanisms;
- Lack of a coherent, recognized and approved national renewable energy policy and action plan with sufficient mid to long term range;

It was also noted that there is no new barriers has been identified during the project period. Among the existing barriers that still need to be addressed may be for the future project such as, PV is perceived to be a high-cost and high-risk investment

Incorporating the energy conservation and energy efficiency element in PV installation

It was also noted the challenge faced by the project to create the local demand on PV and its difficulties in supporting the local manufacturing support. It is observed that the project was designed to create the local demand thru market forces mechanism. Although the local manufacturing support activities such inverter and mounting structure has shown some progress, but it is still at pre-commercialisation phase. It is an expected outcome as the local manufacturing activities will only grow in parallel with the local PV demand. However it is envisaged that the scenario will change with the present RE Law and incentives, the local PV demand will grow.

⁴ Project Indicators with Annual Target Values last updated in August 2007

3.6 Assessment of the implementation approach in achieving outcomes and outputs

3.6.1 Progress towards results; adaptive management

Project management

The project management structure is explained in Section 2.2. Overall direction of the MBIPV rests with a National Steering Committee (NSC) chaired by the MEWC (now MEGTW). The NSC met bi-annually. A Project Review Committee (PRC) chaired by the Energy Commission meets quarterly to provide guidance to the MBIPV. Attendance in both Committees appears to have been good and the minutes of meeting are satisfactorily. The National Project Director (NPL) was originally the head of the PTM (since 2008 the deputy head), but was transferred to the MEGTW towards the end of the project. Day-to-day project management is the responsibility of a full-time project manager, the National Project Leader (NPL). A Component Manager or Leader manages each Component.

The Evaluator has found the MBIPV internal management quite effective ensuring a smooth and continuous project operation. Internal management meetings are carried out monthly.

The contribution of the external management structure to the effectiveness of the MBIPV is not clear to the Evaluator.

Delays in project implementation

The MBIPV project has in general been ahead of time schedules. Delays faced in particular in the setting up of a sustainable enabling and regulatory framework has been handled very efficiently, although a minor project extension has been necessary to reach this extremely important objective.

Adaptive management

Adaptive management has been practiced. Changes to the project team and activities are implemented from time to time, and are by the Evaluator found timely and appropriate in execution.

Long-term consultancy

The MBIPV project is found to have experienced three not completely satisfactory mid-long term consultancy contracts:

- On inverter R&D with the University of Malaya, where the Evaluator finds the lack of industry involvement a major flaw. Public-private partnerships in such R&D efforts have proved to be mutually beneficial;
- On the training of Approved Service Providers, where the contract fell through, and the MBIPV team had to restart actions in their own regi;
- On a technical-economic analysis of grid connected BIPV, where the the contract fell through, and the MBIPV team had to restart actions in their own regi.

The long term contract with the international consultant is found to operate excellently and as expected.

3.6.2 Financial planning and delivery of counterpart inputs

The resources under the project as foreseen in the Project Brief come from cash contributions from GEF, the Government and private/international sources as well as in-kind contributions as listed below:

Fund Sources	As per ProDoc	Actual (as at May 2011)	Percentage (Actual vs ProDoc)	Percentage of Actual contribution by agency
GEF (cash)	\$4,699,420.00	\$4,560,132.00	97%	15.46%
Co-financing:				
-MECM (cash)	\$1,014,871.00	\$1,477,407.00	146%	5.01%
-EC (cash)	\$4,250,000.00	\$4,250,000.00	100%	14.41%
-MESITA (cash)	\$918,947.00	\$918,947.00	100%	3.12%
- Agencies of Gov. of Malaysia (cash)	\$2,652,632.00	\$0.00	0%	0%
-Private and international sectors (cash)	\$3,863,160.00	\$8,390,223.00	220%	28.45%
-EAEF	-	\$120,000.00		0.41%
-Gov. of Malaysia (in-kind)	\$3,707,236.00	\$4,595,077.00	124%	15.58%
-Private and international sectors (in-kind)	\$3,852,894.00	\$5,177,775.00	134%	17.56%
Total Full Project Cost	\$24,959,160.00	\$29,489,561.00	118%	100%
** Currency in US Dollar				

The funding contribution under the budget line Agencies of Gov. of Malaysia appears to have been not so encouraging although it was not bring any major impact to the whole implementation of the project. It was also observed the large contributions from Private and international sector in terms of cash. The project also managed to bring additional funding from international fund (EAEF).

The actual in-kind contributions exceeded the committed amount as per the ProDoc. These contributions exhibit high commitment from the GoM in driving the project. The Private sectors contribution in supporting the project was also not to be neglected.

The Evaluator has not been made aware of any other problems as to delivery of counterpart input.

3.6.3 Stakeholder involvement and partnership strategy

In general, the project has formed good example of government agencies, institutes and private sector organisations working hand-in-hand. The feedbacks given to the evaluators during the interview sessions with some major stakeholders are very positive especially on the result achieved by the project. There is no doubt on the involvement of the government agencies and the ministry which led the formation of RE policy and act. The partnership with the housing developer seems to be very strategic when they started to replicate the same business model for the future housing project development.

Contacts with local key stakeholders, such as the MEGTW, EPU, PTM, the Energy Commission, TNB, MIDA, academia (UiTM, UM, UTM), IKRAM, industry (members of MPIA), developers and end users have all indicated satisfactory involvement of stakeholders, although PTM has been somewhat critical in particular during the first half of the project.

The Evaluator also observed that the project has established a regional and international partnership during the project duration. It was perceived that strong linkages has been developed with IEA-PVPS (Effective 22nd October 2008, Malaysia became a full member of IEA PVPS), RE-SSN (ASEAN), Expert Group on New and Renewable Energy Technologies (ENGRET)-APEC. This partnership strategy has attracted interests from many countries. Many parties had made contact to the Ministry and project team, and made MBIPV project as a reference.

3.6.4 Logical framework and monitoring

A logical framework (of outcomes, outputs, indicators and verifiers) is provided in the GEF Project Brief. A set of indicators for the project's achievements following the Project Brief is given in the 'annual implementation review' reports (APR-PIRs) of which the Evaluator has had access to two reports (APR-PIRs 2009 & 2010). The indicators were reviewed and slightly revised in 2007 defining the annual targets for each (as been mentioned during Mid-Term review). There are some changes on the APR-PIR reporting format for the 2010 report, however there is no further changes had been made for the project indicators. The indicators used in this Evaluation Report are taken from both the Project Brief and the last APR-PIR (2010).

The MBIPV monitoring of project consultants / subcontractors work is found efficient, and at the few problems encountered, see section 3.1, corrective measures were quickly put in place.

The internal monitoring system including numerical outputs, also reflected in the periodic APR-PIR and the many outreach actions, exhibits an efficient and detailed follow-up process.

The identification of risks and risk mitigation measures, again as reflected in the APR-PIRs, shows close attention to same risks and in advance contemplated corrective plans/actions.

A brief overview of the Evaluators characterization of the project outputs is listed in Annex C in terms of Highly Satisfactory (HS), Satisfactory (S), Marginally Satisfactory (MS) and Unsatisfactory (U).

3.6.5 Follow-up from Mid-term Evaluation 2007

The Evaluator had the following recommendations as result of the Mid-term review:

1. An increasing risk of awards defaulting or loss of interest in future calls has been found due to the global economic crisis leading to considerations of an extension of the MBIPV. The MBIPV is *recommended* closely to monitor this risk and to take appropriate actions e.g. a project extension , a budget revision of a combination of both.

Comment: The global economic crisis did in fact not impact the deployment of BIPV systems, as they have been implemented/awarded ahead of schedule and over-achieved.

2. The MBIPV is *recommended* to strengthen its flow of information towards other ongoing RE and energy conservation activities in Malaysia in order to facilitate common understanding and coordination among stakeholders.

Comment: The MBIPV management and team have indeed followed this recommendation, ultimately leading to a RE FIT scheme - not a PV FIT scheme. Key market stakeholders have also reported better communications with the MBIPV during its second half.

3. The MBIPV is *recommended* to better structure and strengthen the regional (ASEAN) dissemination via the NRE-SSN; Malaysia has the opportunity to take a leading role.

Comment: The Evaluator finds, that the MBIPV has done what it could in this context, but the NRE-SSN is not found to be an effective vehicle for regional dissemination of RE experience.

4. Interviews with major stakeholders exhibit a rather fragmented situation with regard to creating a decent Malaysian enabling framework (FIT, capital incentives, etc.). It is consequently *recommended* to establish a National PV Working Group with representatives from all major stakeholders, and initially with a 6-months brief from the MEWC to streamline the existing institutional set-up around BIPV implementation, to compile a national PV Strategy and to propose - and eventually later to regulate/adapt - the instruments needed to implement the strategy. If successful such a national PV WG could later be the nucleus of a RE WG or an RE & Energy Conservation WG. (RE & energy conservation measures often goes hand in hand and synergies are obvious).

Comment: An integrated enabling framework has indeed been established.

5. At the end of the MBIPV project a vacuum will be created in the field of GCPV in Malaysia, if nothing is done, and industry and the public will most likely experience a collapse of the now emerging GCPV sector. To avoid this it is *recommended* to start a process leading to a smooth transition of the MBIPV activities and results to the PTM, PTM seen as a natural national anchoring of GCPV and MBIPV facilitating functions in the future. Whether this new PTM entity can/shall manage financial incentives or head externally funded projects has to be determined. The basic role of PTM may have to be redefined in this context. A prerequisite in this context will be to allocate sufficient resources including human resources to the PTM. In parallel the PV Monitoring Center at the UiTM should receive official recognition to enable the centre to continue monitoring (permanent staff) - local data crucial for future policies and strategies - and at the same time be a PV conduit to the educational system. During de-briefing discussions with the MEWC understanding of the necessity of additional resources to the PTM and the UiTM in this context was expressed.

Comment: The Sustainable Energy Development Authority (SEDA) has indeed been established by law, and the unique core expertise of MBIPV is expected to be transferred to SEDA.

6. And as a very general observation: all energy matters could preferably be handled by a single ministry.

Comment: None.

3.7 Additional findings

3.7.1 PV system monitoring

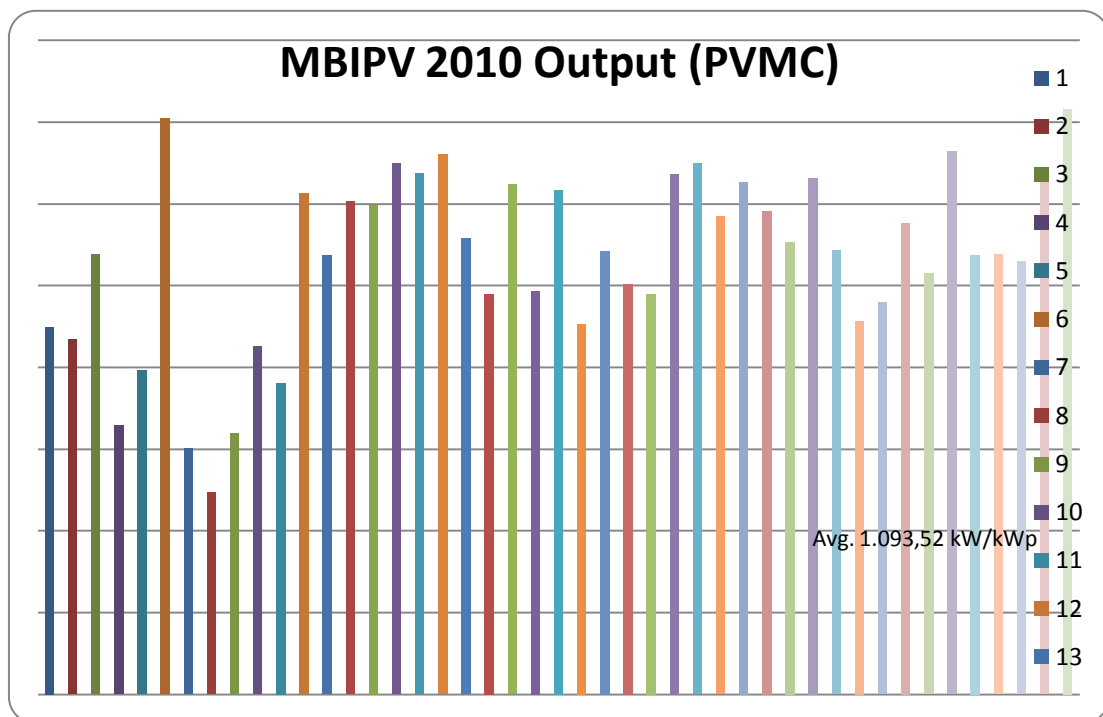
In the MBIPV project it has been assumed as a basic key figure, that 1 kW BIPV installed capacity will in average produce 1,100 kWh/year. This figure has also been used in calculations of the economic performance of BIPV installations in Malaysia.

The below figure is based on the report “Annual Energy Yield in 2010 for the MBIPV Grid-Connected Systems” produced by the Photovoltaic Systems Monitoring Centre (PVMC) at the UiTM. The report lists 113 plants under monitoring or to be monitored, and 34 plants from which data for some reason or another are unavailable.

Of the 113 plants 44 exhibit continuous data for 12 months in 2010; many plants were put up during 2010 and cannot yet provide a full year of data.

The figure illustrates the annual output of the 44 plants, and quite a variation can be seen depending on plant orientation and occasional shadowing effects.

However, the overall annual average is 1,094 kWh/year, which is very close to the basic MBIPV projects basic key figure of 1,100 kWh/year.



This can be seen as an example of the credibility of the data used in the project.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The following summarises the findings of the evaluation. Each of the points discussed below has been dealt with in more detail in the previous chapters.

4.1.1 Main conclusions

The MBIPV project, in the view of the Evaluator, has made important and real contributions to removing barriers for BIPV, in particular awareness creation and capacity building in important areas such as benchmarking, best practices, monitoring and not in the least demonstration of BIPV technology and demonstration of cost reduction. MBIPV has in particular towards its end played a crucial role in getting RE and PV on the political agenda in Malaysia, and in getting a national regulatory framework in place underpinning a sustainable post-project development. Other projects and activities have also contributed to this, but MBIPV has played a key role as mover. MBIPV has thus had considerable impact on key actors affecting decision-making concerning PV and renewable energy at several levels, e.g. government, parliament, agencies and institutions, utilities, academia and industry as well as consultancies, architects, developers and other professionals. Primarily during the MBIPV project period international PV industry have established operation in Malaysia in terms of FDI of more than 4 billion USD; all this cannot be credited to MBIPV alone, but the project has played a crucial role in contacting, facilitation and promotion. The MBIPV project has generated insights into the environmental, technical and economic potential for PV and RE technologies in Malaysia and the options available to politicians and government to realise same potential.

In addition, a main barrier to increased use of PV and RE in Malaysia remains the subsidised prices of conventional (fossil) sources of energy. However, the now established FIT scheme for RE and PV scheduled to go in operation by September 1 2011 and the establishment of a new statutory body (SEDA) under the MEGTW to be responsible for i.a. same FIT scheme is found - seen in context with the Malaysian decision to reach market prices on energy inside relative few years - as very appropriate instruments to handle a gradual and smooth deployment of RE and PV technology in Malaysia in concert with the ongoing political discussions on national climate and energy policy.

In the Evaluator's view point, the competence, dedication and skills of the project core team (management and team) contributed to a very large extent to the success of the MBIPV project. The core team has not only reached overachievement of original project targets, but has taken on additional assignments en route, e.g. activities in off-grid PV technology and in particular extensive support to the Malaysian government. The Evaluator further finds, that the core team has been very effective in adapting to recommendations and in the handling of project risks by quickly identifying risks and by creating alternative plans to accommodate same risks.

The success and sustainability of the MBIPV project is also very much due to the receptivity and consequent intervention of the GOM, in particular the MEGTW, in getting a RE FIT scheme, a RE fund and the SEDA established inside a very short timeframe, and in getting RE and PV firmly embedded in the national Malaysian planning system.

The MBIPV project is now completed and is found highly satisfactory by the Evaluator.

The evaluation process itself is, again by the Evaluator, found suitable for a project of the character of the MBIPV and no improvements can be suggested.

4.1.2 Project design and project implementation

Project conceptualisation

The Project Brief and Inception Report describes a coherent set of objectives and outputs. Indeed, at the time of writing of the Project Brief (2004) and the Inception Report (2006), awareness and capacity at authorities, industry and other key market actors regarding PV and BIPV in Malaysia was low, and the project rightly addresses this important barrier. Furthermore the competitive bidding model introduced by the MBIPV, versus a more conventional grant model, has proved to be very effective leading to good value for money. The very fast and dynamic development of the global PV sector and the increased global and Malaysian focus on climate issues including RE and PV has enhanced the importance of the MBIPV project in the view of the Evaluator.

Effectiveness of implementation

As stated previously the MBIPV project has been implemented very effectively, well ahead of interim targets and time schedules and final project targets have been overachieved, as also indicated in the APR-PIR's submitted. The final project report is still to be submitted. The main reason for the highly satisfactory project outcome is, in the view of the Evaluator, to be attributed the skilled and dedicated project management and team. Also the dedication of the GOM and in particular the MEGTW is found to have significant impact on the successful project implementation not in the least in terms of the sustainability of the project including a new RE (and PV) dedicated enabling and regulatory framework firmly embedded in GOM planning and targets. The MBIPV project started in July 2005 and was planned to finish by end of 2010, However, to ensure a smooth transition towards the start of a new regulatory framework for RE and PV including the effective start of SEDA, see also below, the NSC decided to extend the project period until end of May 2011.

4.1.3 Impacts, sustainability and replicability

The project, in the view of the Evaluator, has made important and real contributions to removing barriers, in particular awareness creation and capacity building in important areas such as processing of applications, benchmarking, best practices and demonstration of BIPV implementation processes and technology including monitoring. It has generated powerful insights into the technical and economic potential for PV and RE in Malaysia and been pivotal in getting a new enabling and regulatory framework in place for the promotion of RE and PV this way enabling the GOM to realise same potential. The framework is centred around a FIT scheme, a fund to support the FIT scheme and a new authority under the MEGTW to administer the scheme.

These achievements underpin the long term sustainability of the MBIPV project, as both most of the MBIPV core staff and activities will be continued as part of new SEDA setup.

The MBIPV project has, in the view of the Evaluator, a high replication potential in Asia. Spurred on by the dramatic price reductions for PV and regional (ADB – ASEI/ASEF) and national PV promotional actions in many Asian countries, PV can be expected to see a very

strong growth in Asia. The MBIPV can, if properly disseminated, play a strong role as model and inspiration for other countries in the region.

4.2 Recommendations

The Evaluator has the following recommendations as result of the final review.

- As a direct follow up of the MBIPV project it is recommended to carry out two minor studies:
 - One to highlight the impact of the MBIPV project on cost reductions of GCPV in Malaysia in a scene of changing world market price reductions and exchange rate fluctuations;
 - One to map out the actual impact of the MBIPV project on the relevant local industry, this way forming a base for decision on future actions to stimulate local industry take up.
- At the time of the evaluation the SEDA was not firmly established with the project core team acting as an “interim SEDA”. Taking into account the short time until the FIT scheme shall go operational (01.09.11) and the associated outstanding measures to be completed, the envisaged negative effect on the public by an eventual postponement of the FIT scheme and the risk of “depletion” of the core team, it is recommended to formalise the effective establishment of the SEDA very quickly.
- As the PV market has shown to be very volatile it is recommended to investigate the PV FIT at least every 6 months and to adjust same in a fully transparent manner.
- For companies MIDA administers a set of basically tax holidays at present in force up to 2015. It is recommended to investigate the viability of a continuation in one form or another in order to provide companies with a more long term signal.
- In more general terms the local PV industry and commercial sector in Malaysia is perceived as having “suffered” from the lack of official long term PV market targets and indicators resulting in a relative slow local take up. These market targets, indicators and instruments are now in place as explained elsewhere, and it is recommended to develop and initiate suitable instruments to promote the development of a Malaysian PV related industry, which e.g. could encompass low iron PV glass, module assembly incl. tailor made PV modules for BIPV, electronics, DC switch gear and tailor made support structures and integration packages. In this context a more open collaboration between universities and industry in Malaysia should be encouraged.
- The MEGTW has taken the commendable initiative to create awareness of PV and RE in the banking sector in Malaysia to facilitate future loans for such installations, it is recommended, as an eventual supplementary action, to activate the expertise of the ADB in this, as the ADB currently is executing its major Asian Solar Energy Initiative⁵ (ASEI), which includes capacity building in the banking sector.
- While regional (ASEAN) dissemination of the MBIPV via the NRE-SSN has taken place with perceived limited impact, it is recommended with the above mentioned ADB ASEI in full deployment including its knowledge platform the Asian Solar Energy Forum (ASEF), to use this new knowledge platform to disseminate the very successful MBIPV project regionally.
- The MBIPV project has successfully addressed individual BIPV installations. As a natural follow up it is recommended to investigate the possibilities of establishing a new project targeting a concentrated BIPV deployment in a large scale development, say 500-1 000 low energy houses or more. The overall implementation principle should reflect integrated energy design. Such an “Eco Village concept” will partly be

⁵ For a more comprehensive description of the ASEI and the ASEF, please consult Annex D.

a very visible demonstration of BIPV combined with energy conservation measures (housing of the future), partly enable Malaysian market actors, in particular TNB, to obtain experience with high penetration of PV in grids, as the “Eco Village” periodically can be expected to be a net producer of electricity (Smart Grid functions). Same project could also address barriers not in focus of the MBIPV, e.g. “PV is only for the well to do”, integration of PV applications in building codes and energy conservation measures, getting PV in the main stream of new buildings and major retrofits, etc. A very first step could be to identify an interested and suitable developer and to investigate funding options. An outline of such an Eco Village initiative is given in Annex E.

- With the expected success of the RE FIT scheme the penetration of RE generators, some of which are intermittent/stochastic of nature, in the Malaysian grid system will increase. International experience clearly shows, that with increasing penetration of intermittent generators a Smart Grid approach to grid management is needed in order to avoid unnecessary increase of conventional generating capacity and to keep balance and quality of the grid system. Although a high penetration of RE in the Malaysian grid system might take time, it is recommended to initiate suitable Smart Grid actions in a combination of local actions (see also point above) and international collaboration in order timely to build Malaysian capacity in this complex field and to avoid unnecessary investments.
- The PV System Monitoring Centre (PSMC) at the UiTM is doing an important service in providing national data on BIPV system performance in Malaysia. Such data are important for future analysis of trends and for future decision making. It is recommended to make certain, that the PSMC can continue providing this service – also following the three year period after MBIPV completion as per present contract – and it is recommended to investigate the possibilities of extending the scope of work of the PSMC to include a representative selection of the many off-grid PV systems in Malaysia thus building a national PV performance database.
- As the MBIPV project has been highly satisfactory only a few operational recommendations can be given:
 - For projects dealing with/focusing on a single technology it should be emphasized to ensure a sufficiently broad interphase to the surroundings in terms communication and dissemination to prevent the project from being “isolated” and this way maybe create unnecessary animosity.
 - When/if conflict of interest is encountered communication efforts shall be increased and base for ownership broadened, not the opposite.
 - It is recommended that UNDP and the government of Malaysia continue to research and document *the drivers of change*, which can then be shared with other developing economies in implementing projects such as the MBIPV. The Consultant recommends a more in depth analysis study to be undertaken looking at the energy sector as a whole including the RE sector and how institutional arrangements in RE have evolved and shaped during the past 5- 10 years period in order to understand its historical perspective. Such an analysis should focus on political/economy dimensions taking into consideration the various political, socio-economic, and financial aspects and then map out “the drivers of change framework”. Establishing a bigger perspective can be crucial if an institutional narrative to be developed including what reforms

and existing conditions are influencing the climate change agenda at the national level and how the reform process might be best supported given these conditions, with a focus on the renewable energy sector in the overall energy sector. MBIPV case studies such as the Suria 1000 can be analyzed further in determining the influencing factors for reform to happen including the challenges faced during implementation.

4.3 Lessons learnt

One lesson learned is that even if a project such as the MBIPV by definition must have a sharp focus, care must be taken not to focus only on a single RE technology or applications such as BIPV and GCPV. RE and for that matter energy conservation present a palette of options to be addressed in a coordinated manner, and as such project planners and executors should look into the bigger perspective when implementing projects. A broader approach, in particular with regard to dissemination, communication and ownership, may contribute to reduce the competitive/critical landscape otherwise easily created around a successful project. The MBIPV project has successfully adapted such a broader approach since mid of project, and future projects should be designed in such an integrated holistic manner.

A second lesson learned is that – at least in Malaysia – the time to introduce new legislation (the regulatory framework necessary for a sustainable continuation of the MBIPV initiative) can be considerably reduced by involving private sector legal expertise to carry out the necessary drafting of bills and subsequent regulations instead of relying exclusively on the often overworked office of the Attorney General (AG) and the line ministries involved.

A third lesson learned is, that the crucial and costly competence and skills build up in the project core team during the project execution can be (and should be) transferred intact to ongoing activities if at all possible. In this case the core team has after project completion as “interim SEDA” provided the MEGTW with invaluable services, and the core team is expected to form the nucleus of the new SEDA. Carefully build competence and skills are thus kept intact for the benefit of the country instead of, as often is the case, being dispersed and “lost” by end of project.

A fourth lesson learned is, that because of many demonstration projects have been applied at high cost residential houses, PV is often perceived to be suitable for the high income/rich people. This is a common finding, as the introduction of new technologies often starts with a clientele of well educated and well to do people. A continuous awareness effort will be required to educate the public and to get rid of this perception. The above mentioned Eco Village concept should be seen in this context.

A fifth lesson learned is, that the ‘Suria 1000’ programme has been very successful in creating awareness and PV demonstration projects. The innovative bidding mechanism of the programme instead of a grant approach has led to good value for money and as a result over-achievement of the PV capacity targets set. The MBIPV programme can thus be regarded as a best practice and the approach can be replicated in other coming projects.

ANNEX A: TERMS OF REFERENCE OF THE EVALUATION

TERMS OF REFERENCE (TOR)

for Evaluation Consultant on Building Integrated Photovoltaic (BIPV) Project
(Final Evaluation 2011)

BACKGROUND

The Building Integrated Photovoltaic Technology Application (BIPV) Project is intended to induce long-term cost reduction of non-emitting GHG technology (i.e. the photovoltaic or PV) via integration of the PV technology within building designs and envelopes. It is aimed at creating a sustainable BIPV market in Malaysia that will generate widespread BIPV applications. Over the lifetime of the expected installed BIPV capacity from the project, the energy generated will avoid 65,100 tons of CO₂ emissions from the country's power sector in addition to contributing towards national energy policy objectives.

The principal objective of this project is to reduce the long-term cost of BIPV technology within the Malaysian market (GEF Operational No 7), which will subsequently lead to sustainable and widespread BIPV technology applications that will avoid greenhouse gas (GHG) emissions from the country's electricity sector. The project aims to catalyze BIPV technology acceptance among the public, policy makers, financiers and building industry, which will lead towards a sustainable BIPV market beyond the completion of the project. The project will specifically focus on the market development for BIPV technology, and building the national capacities on three major areas: (a) policy and education; (b) technical skill and market implementation; (c) technology development support.

Activities in the BIPV project are as below:

Component 1: BIPV information services, awareness and capacity building programs

Component 2: BIPV market enhancement and infrastructure development

Component 3: BIPV policies and financing mechanisms programs

Component 4: BIPV Industry Development and R&D enhancement program

NATURE OF SERVICE

The purpose of the Final Evaluation is to **review, rate the performance of the projects and provide recommendations**. The review will include evaluating the

- a) Progress in project implementation, measured against planned outputs set forth in the Project Document/Inception Report with latest revision in accordance with rational budget allocation, and
- b) An assessment of the overall impact of the project to the country.
- c) and recommend lessons learned and best practices which could be applied to future activities and other on-going/new projects.

SCOPE OF WORK

The scope of work for the consultancy will include, but not necessarily be limited to, the following activities:

a) Assessment of progress in project implementation

The evaluation will focus on such aspects as appropriateness and relevance of work plan, compliance with the work plan along side with budget allocation; timeliness of disbursements; procurement, quantity and quality of goods and services created; coordination among different project stakeholders. Any issue that has impeded or advanced the implementation of the project or any of its components, including actions taken and resolutions made should be highlighted. Activities to be continued by the executing agency shall also be recommended. The template below shall assist the consultant in reviewing the progress. A critical focus shall be given to post-MTE period.

Review of Activities			
Activities	Planned	Actual	Status / Action

Assessment of Budget Utilization			
Activities	As per ProDoc	Actual Expenditures	Status of Utilization

The following assessments shall be carried out:

- Capacity of risk management in overall project implementation and per component level i.e. whether the assumptions and risks are well recognized and mitigating measures are considered throughout implementation.
- Project design, i.e. whether the project design allowed for flexibility in responding to internal and external changes in the project environment.
- Implementation difficulties, i.e. whether difficulties and barriers, which were not expected at the start of the project, are identified and the approaches for the solutions are considered and implemented effectively.
- Project resources, i.e. whether the project components and activities were logically designed as to content and time frame commensurate with the human and financial resources that were made available.

b) Assessment of project outputs

For both the component and overall project levels, assess:

- Whether the project is implemented in the right direction to achieve the outcomes (i.e. based on the agreed work plan and annual targets).
- The significance of the outcomes so far.
- Whether the project outputs are produced effectively, efficiently and in a timely manner according to the time schedule.
- The quality and credibility of the outputs, as stipulated in the Project Document.
- The project's contributions to the targeted beneficiaries and their effectiveness.
- How effective and efficient the project funds are utilized, and how the expenditures are monitored.
- The credibility of the data used in the project and reliance of the numerical outputs.
- The monitoring and evaluation of the project consultants' work.
- The quality of the internal monitoring system results.

Outputs of the BIPV are as below:

Overall Project Goals and Objectives

- a) The amount of annual GHG emissions avoided from fossil fuel-based power generation – in tons CO₂ of the cumulative installed PV capacity
- b) Project Purpose: The overall capacity (technical, policy, planning, institutional, fiscal, financial) both in government and the private sectors, to develop, design and make use of the BIPV energy potential and to develop local industry is significantly improved.
- c) % of increased installed BIPV capacity against baseline (inclusive of awarded Suria1000)
- d) % of BIPV unit cost reduction against baseline
- e) No. of National BIPV program integrated into the 10th Malaysian Plan

Objective 1: BIPV Information Services, Awareness and Capacity Building Programs

- 1.1. Integrated information and awareness building program on BIPV
- 1.2. National BIPV database
- 1.3. BIPV training courses
- 1.4. Malaysian PV Industry Association
- 1.5. Quality control programs for local industry
- 1.6. Capacity building and awareness programs for policy makers and financial sector
- 1.7. International BIPV event for decision makers
- 1.8. Disseminate information and lessons learn to regional ASEAN countries
- 1.9. Impact assessment of BIPV technology development

Objective 2: BIPV Market Enhancement and Infrastructure Development Program

- 2.1. Standards and guidelines development
- 2.2. Review and final design of the planned BIPV showcases
- 2.3. Hardware installation and operation of the BIPV showcases
- 2.4. Evaluation of demonstration sites
- 2.5. Design and evaluation of technical and commercial viability for the demonstration projects
- 2.6. BIPV demonstration implementation and operation at government and private buildings
- 2.7. Review and promotion of national PV program "Suria 1000"
- 2.8. Implementation and operation of "Suria 1000"
- 2.9. Monitoring and evaluation of BIPV projects
- 2.10. Dissemination and promotion of demonstration program results
- 2.11. Sustainable follow-up program design

Objective 3: BIPV Policies and Financing Mechanisms Program

- 3.1. Techno-economic analysis for grid-connected BIPV
- 3.2. Design and implementation of government incentives to utility and manufacturing industry
- 3.3. Analysis on existing and new financial mechanism and fiscal incentives
- 3.4. Implementation of a fiscal and financial framework for a sustainable follow-up program
- 3.5. Study on past experience and impact on international regulatory schemes
- 3.6. Review and integration of BIPV in existing regulatory schemes
- 3.7. Implementation of an institutional and policy framework for a sustainable follow-up program
- 3.8. Policy and financial framework implementation, monitoring and impact assessment
- 3.9. Government liaison and dissemination of results

Objective 4: BIPV Industry Development and Technology Localization Program

- 4.1. Activities on cost reduction of local BIPV products and system optimization for local condition
- 4.2. International collaboration and transfer technology program
- 4.3. Upgrading local industry capabilities
- 4.4. Establishment of BIPV Quality Control Centre

For each output, compare and apply the following rating system concerning outputs, which reflects the degree to which an output's targets have been met:

- **highly satisfactory** (HS), i.e., output/indicator fully on track (progressing fully as planned or beyond plan);
- **satisfactory** (S), i.e., output/indicator mostly on track (progressing mostly as planned);
- **marginally satisfactory** (MS), i.e., output/indicator partially on track (progressing behind schedule); and,
- **unsatisfactory** (U), i.e., output/indicator substantially off track (progressing substantially off-schedule).

The rating system serves as a proxy assessment of how successful the Project has been in achieving its outputs. The four ratings are meant to reflect the degree of achievement of outputs by comparing with the baseline (i.e., the non-existence of the output) with the target (i.e. the production of the output).

c) Assessment of project impact

- Capacity Development - The effects of the project activities on strengthening the capacities of MEGTW and other related stakeholders and the PV industries.
- Sustainability - Efforts undertaken to ensure that the results of successful projects are sustained beyond the period of GEF financing will be evaluated, as well as the project's existing mechanisms. It is imperative to confirm whether the policy recommended by the projects is well embedded in the current national policies or future policies.
- Leverage - The project's effectiveness in leveraging local or other international resources / funds that would influence larger projects or broader policies to support its goal will be assessed.
- Awareness Raising - The Project's contribution to raise awareness about the use of PV and renewable energy in Malaysia as a whole should be examined, as well as the project's contribution to promote policy or advocacy activities and collaboration among stakeholders.
- Lessons Learned and Best Practices - Both good, bad experiences and lessons learned from the implementation of the project thus far will be identified and evaluated. There shall be a document the integration and application of experience from the various components of the project (holistic approach).
- Operational recommendations- Recommendations will be developed to help the executing agency and project partners improve its operational and support activities in implementing such projects. The recommendations would aim to:
 - I. Help executing agency and partners improve the project implementation and to address operational lapses and gaps;
 - II. Strengthen the work of the project management team and Project Steering/Advisory Committee/s and how the activities shall sustain under the government's initiatives;
 - III. Enable UNDP /GEF to provide effective support in future ;
 - IV. Improve ways to draw, share and document lessons learned and best practices experience to the various stakeholders; and

- V. Provide effective operational guidance for effective implementation of the remaining part of the project and onwards for future project prospect/s.

EXPECTED OUTPUTS AND REPORTING REQUIREMENTS

The evaluation report shall highlight important observations, analysis of information and key conclusions including its recommendation/s. As a guideline, the format of the report shall consist as below:

1. Title Page
2. List of acronyms and abbreviations
3. Table of contents, including list of annexes
4. Executive Summary (max 3 pages)
5. Introduction, Scope, and Purpose of the evaluation
6. Methodology including description of the work conducted and Key questions
7. Findings and Observation (at component level, at project level, project targets, capacity building)
8. Recommendations for the remaining part of the project including lessons, generalizations, alternatives for sustainability of the activities
9. Budget Utilization (% against actual, component level and project level)
10. Conclusion (max 3 pages)
11. Annexes

The draft Evaluation Report that will be produced under this assignment must be available on or before **31 May 2011**. The report shall be in Word and Adobe Acrobat format and must have no restriction in access. The Consultant is free to use what he/she thinks is the most appropriate structure of the Evaluation Report.

DURATION & TIMELINE

Period: suggested timeline of 2 weeks mission in Malaysia and 1 week home-based for follow-up.

METHODOLOGY

The evaluators will review relevant project documents and reports related and conduct focused individual/group discussions on topics and issues that relate to the implementation and impact of the project. The evaluators are expected to become well versed as to the objectives, historical developments, institutional and management mechanisms and project activities. More specifically, the evaluation will be based on the following sources of information:

- I. **Review of documents** related to the project such as project document, quarterly and annual progress reports, other activity/component specific reports and evaluation. as described.
- II. **Structured interview** with knowledgeable parties, i.e., NPD, Project Staff members, Sub-Contractors, International/National Consultants, UNDP, members of the National Steering/Advisory Committee/s, Project Beneficiaries or grantees, etc.
- III. **Site visits** to specific projects, if feasible. The site visits should be discussed with the NPL and the UNDP Country Office.

Key documents to be reviewed are as below:

- GEF-approved BIPV Project Brief;
- UNDP/GEF BIPV Project Document;
- Inception Report
- All output reports and documents produced under BIPV
- Policy reports produced
- Minutes of Project Steering Committee Meetings and National Steering Committee meetings.
- Amendments to the inception report (if any)
- Mid-Term Evaluation 2007
- Latest Project Implementation Report PIR (2010)
- Latest NEX audit reports or any other audit reports
- Past consultancies' assignments and summary of the results
- Quarterly reports
- Pictures of equipment, installations and sites if any
- Newspaper/publication articles

The evaluation team shall meet and interview the following:

- National Project Director
- National Project Leader
- Finance Officer
- Component Managers / Technical Advisers (all)
- Relevant officers from the executing agency, (Ministry of Energy Green Technology and Water (MEGTW))
- Economic Planning Unit (EPU) officers
- Representative from Energy Commission
- Representative from industrial association (MPIA)
- Representative from the academia
- Selected members of the NSC meeting
- Consultants
- Participating industries
- Installed PV facilities
- Equipment suppliers
- Other project partners

The evaluator will conduct an opening meeting with the NPD and relevant executing agency staff to be followed by an "exit" interview with UNDP CO to discuss the findings of the assessment prior to the submission of the final report.

TERMS OF PAYMENT

50% upon contract signing

50% upon satisfactory completion of the report

EXPERTISE REQUIRED

The consultant(s) shall have the necessary expertise in but not limited to:

- Have involved in Solar PV industries. Individual who has experienced in **grid-connected solar PV environment** will be highly preferred.
- Prior evaluation experience of similar UNDP projects and familiar with **UNDP GEF monitoring and evaluation** requirements.
- Familiar with project management framework including output/outcome and impact analysis.
- Have sound knowledge in policy and project financing
- Have tertiary education in engineering, science, business, economics or any development qualification. Post-graduate or with relevant professional qualification is preferred.
- More than 10 years of working experience in the areas addressed with a good knowledge of the state-of-the-art approaches and international best practices;
- Have not involved with any of the MBIPV project activities except evaluation exercise
- Fluency in English

COMMISSIONING PROCESS AND COMMUNICATION

The commissioning tasks shall be conducted according to standard UNDP GEF Monitoring and Evaluation policies with the advice from UNDP/GEF Regional Centre Bangkok as per following guidelines:

- Full compliance to the terms of reference (TOR) above in consultation with key partners and stakeholders.
- Selection of the evaluator(s) on a competitive basis and through a transparent process in line with UNDP's procurement procedure;
- Brief the evaluator(s) on the expectations for the evaluation and on the code of conduct ;
- Review the first draft of the [evaluation report](#) and give relevant stakeholders a chance to provide feed back on factual errors or omissions;
- Disseminate the main evaluation findings, conclusions and recommendations to audiences internal and external to UNDP

More info at:

UNDP/GEF Evaluation: <http://www.undp.org/gef/monitoring/policies.html>

GEF Evaluation: http://www.thegef.org/gef/about_evaluation_office

Project WebSite: <http://www.mbipv.net.my/>

ANNEX B: LIST OF PEOPLE MET

Datuk Loo Took Gee, Secretary General, MEGTW
Mrs. Badriyah Abd Malek, Under Secretary (Sustainable Energy Division), MEGTW
Mrs. Aizah (Incentives Division), MIDA
Mr. Francis Xavier Jacob, Director (Energy Efficiency), Energy Commission
Mr. Asfaazam Kasbani, Asst Resident Representative, UNDP Malaysia
Mr. Sansubari Che Mud, Manager, TNB
Mr. Mohd Sukri Jusoh, Deputy Director (Energy Division), Economic Planning Unit
Dr. Ernst Roeder-Messel, Counsellor for Economic, German Embassy
Mr. Tan Giin Ling, Sr Project Manager, SP Setia Group
Ms Toh Beng Suan, Zaid Ibrahim & Co. (Advocates and Solicitors)
Mr. Shahril Irwan Sulaiman, Phovoltaic Monitoring Centre, UiTM
Ms Rafiza Abd Rahman, Photovoltaic Monitoring Centre, UiTM
Staff at the Sekolah Menengah Kebangsaan Sri Aman, PJ (4.4 kW)

Teleconference with: Mr. Manuel Soriano, GEF Coordinator (in Bangkok)

National Project Team

Mr. Ahmad Hadri Haris, Nat. Project Leader, MBIPV
Mr. Mohd Hafiz Mohd Suib, Financial Officer, MBIPV
Ms. Chen Wei Nee, technical advisor (communication), MBIPV
Ms. Azah Ahmad (Senior Officer)
Ms. Nor Radhiha Mohd Ali (Senior Officer)
Ms. Gladys Mak (Senior Officer)

ANNEX C: CHARACTERIZATION OF THE PROJECT OUTPUTS

MBIPV Outputs	Rating
<u>Overall Project Goals and Objectives</u>	HS
a) The amount of annual GHG emissions avoided from fossil fuel-based power generation – in tons CO ₂ of the cumulative installed PV capacity	HS
b) Project Purpose: The overall capacity (technical, policy, planning, institutional, fiscal, financial) both in government and the private sectors, to develop, design and make use of the BIPV energy potential and to develop local industry is significantly improved.	HS
c) % of increased installed BIPV capacity against baseline (inclusive of awarded Suria)	HS
d) % of BIPV unit cost reduction against baseline	HS
e) No. of National BIPV programs integrated into the 10th Malaysian Plan	HS
<u>Objective 1: BIPV Information Services, Awareness and Capacity Building Programs</u>	HS
1.1. Integrated information and awareness building program on BIPV	HS
1.2. National BIPV database	HS
1.3. BIPV training courses	HS
1.4. Malaysian PV Industry Association	S
1.5. Quality control programs for local industry	HS
1.6. Capacity building and awareness programs for policy makers and financial sector	S
1.7. International BIPV event for decision makers	HS
1.8. Disseminate information and lessons learn to regional ASEAN countries	S
1.9. Impact assessment of BIPV technology development	S
<u>Objective 2: BIPV Market Enhancement and Infrastructure Development Program</u>	HS
2.1. Standards and guidelines development	S
2.2. Review and final design of the planned BIPV showcases	S
2.3. Hardware installation and operation of the BIPV showcases	HS
2.4. Evaluation of demonstration sites	HS
2.5. Design and evaluation of technical and commercial viability for the demonstration projects	S
2.6. BIPV demonstration implementation and operation at government and private buildings	HS
2.7. Review and promotion of national PV program "Suria 1000"	HS
2.8. Implementation and operation of "Suria 1000"	HS
2.9. Monitoring and evaluation of BIPV projects	HS
2.10. Dissemination and promotion of demonstration program results	S
2.11. Sustainable follow-up program design	HS
<u>Objective 3: BIPV Policies and Financing Mechanisms Program</u>	HS
3.1. Techno-economic analysis for grid-connected BIPV	S
3.2. Design and implementation of government incentives to utility and manufacturing industry	S
3.3. Analysis on existing and new financial mechanism and fiscal incentives	S
3.4. Implementation of a fiscal & financial framework for sustainable follow-up program	HS
3.5. Study on past experience and impact on international regulatory schemes	HS
3.6. Review and integration of BIPV in existing regulatory schemes	HS
3.7. Implementation of an institutional and policy framework for a sustainable follow-up program	HS
3.8. Policy and financial framework implementation, monitoring and impact assessment	N/A
3.9. Government liaison and dissemination of results	HS
<u>Objective 4: BIPV Industry Development and Technology Localization Program</u>	HS
4.1. Activities on cost reduction of local BIPV products and system optimization for local condition	S

4.2. International collaboration and transfer technology program	HS
4.3. Upgrading local industry capabilities	S
4.4. Establishment of BIPV Quality Control Centre	S
4.5. Revising of building codes	S

ANNEX D: BACKGROUND NOTE ON THE ASEI/ASEF

ANNEX E: AN OUTLINE OF AN ECO-VILLAGE INITIATIVE

The MBIPV project has successfully addressed individual BIPV installations. As a natural follow up it is recommended to investigate the possibilities of establishing a new project targeting a concentrated BIPV deployment in a large scale development, say 500-1 000 low energy houses or more. The overall implementation principle should reflect integrated energy design. Such an “Eco Village concept” will partly be a very visible demonstration of BIPV combined with energy conservation measures (housing of the future), partly enable Malaysian market actors, in particular TNB, to obtain experience with high penetration of PV in grids, as the “Eco Village” periodically can be expected to be a net producer of electricity (Smart Grid functions). Furthermore such a project could contribute to lessen the impact of the MBIPV project as PV and BIPV is primarily for well to do people in Malaysia.

An outline of such a concept can include, but not be limited to, the following elements:

1. A new development of about 1000 houses or more, all designed as low energy houses using the integrated energy design process (IDP). The IDP aims at minimizing:
 - The building takes little advantage of the potential benefits offered by solar gain during the heating season, resulting in greater heating demand;
 - The building may be exposed to high cooling loads during the summer, due to excessive glazing exposed to summer sun;
 - The building may not be designed to take advantage of its daylighting potential, due to a lack of appropriately located or dimensioned glazing, or inappropriate glazing types, or a lack of features to bring the daylight further into the interior of the building;
 - Occupants may be exposed to severe discomfort, due to excessive local overheating in West-facing spaces or glare in areas without adequate shading.

Solutions in practice are often simple and relative low cost in terms of shadowing, daylight control, passive ventilation of building including attic, insulation, advanced glazing, etc.

2. The development shall include as many eco-features as economically feasible, e.g. rain water collection, waste water treatment, safe waste collection and disposal, etc.
3. All 1000 houses to be fitted with BIPV designed to produce at least the annual average electricity consumption of the community; the sizing and cost of the BIPV systems will benefit from the above low energy housing design process.
4. All houses shall be equipped with individual displays highlighting PV electricity production and electricity consumption in general this way stimulating energy conservation through voluntary change of attitude and “competition” with neighbors. Surplus PV electricity production to be remunerated.
5. Towards the grid the new housing development shall appear as one installation, basically one metered grid hook-up. During midday the new housing development may act as net electricity producer this giving the utility the possibility to gain experience with smart grid aspects, e.g. handling reverse flow of electricity, controlling voltage increases, etc. Active involvement of the local utility/utilities will be crucial.
6. Further smart grid aspects could be introduced by active and automatic demand side management systems to switch on/off suitable appliances according to the need of balancing the grid or according to the actual cost of electricity (price signal).
7. A project concept note to be developed in order to:
 - a. Identify and engage all relevant national authorities and institutions

- b. Identify relevant private sector key market actors (developers, builders, industry, financiers, etc.)
- c. Present the project concept for potential international funding schemes
- d. Plan next steps.