TCR Supplementary Appendix for GEF Projects

TA 7798-REG: Promoting Energy Efficiency in the Pacific, Phase II

1. GEF Background

The project, titled Promoting Energy Efficiency in the Pacific (GEF Project ID 3641), hereinafter referred to as PEEP-2 to be consistent with TCR and other ADB documents relating to this project, received GEF approval on Project Identification Form (PIF) on 14 September 2009 and approval on Request for Project Preparation Grant (PPG) totalling to USD 200,000 on 01 March 2010. The GEF CEO Endorsement was granted to the project on 10 February 2011 and followed by the approval by ADB as GEF agency on 31 March 2011.

The total project cost was estimated to be USD 12,421,545 equivalent, consisting of GEF financing of USD 5,254,545 (exclusive of PPG financing of USD 200,000), co-financing of USD1,000,000 from ADB as GEF agency, co-financing of USD1,000,000 from the Government of Australia, co-financing of USD 1,500,000 from the Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility, co-financing of USD 2,047,000 equivalent (in-kind) from the governments of the participating pacific DMCs, and co-financing of USD 1,620,000 equivalent (in-kind) from the power utilities in the participating pacific DMCs.

The PEEP-2 project was conceptualized and designed to address issues associated with demand-side energy efficiency application and promotion, with a particular focus on lighting and buildings in the participating pacific DMCs, which was a subject fitting well with GEF-4 Climate Change Focal Area Strategic Objective 1, i.e. to promote energy-efficient technologies and practices in the appliance and buildings sectors. The planned activities and expected outputs of PEEP-2 were well aligned with the Strategic Program 1 in support of the long-term Strategic Objective 1. The target sectors and areas of PEEP-2, including residential, commercial and government buildings as well as street and public lighting, fell within the scope of the Strategic Program 1, which were defined to cover the entire spectrum of the building sector, including the building envelope, the energy-consuming systems and appliances used in buildings for heating, cooling, lighting, including appliances and office equipment, as well as building operation and energy consumption during building operation. In addition to implementing energy efficiency programs in these target sectors and areas (component 3 of PEEP-2), the PEEP-2 intended to undertake activities and deliver outputs relating to sectoral energy use database (component 1), mainstreaming of energy efficiency practices into government policies and regulations (component 2),

and capacity building and public awareness raising (component 4). Collectively these activities and outputs were expected to create synergies leading to the successful direct outcomes of Strategic Program 1 and ensuring the progress towards the realisation of long-term sustainable post-project impacts of Strategic Objective 1 in the context of the participating pacific DMCs of PEEP-2.

As per project design, the PEEP-2 project was expected to deliver global environmental benefits (GEBs) in the climate change mitigation focal area directly through implementation of energy efficiency programs and projects as part of the PEEP-2 as well as energy efficiency investments leveraged as a result of PEEP-2 during the supervised implementation period of PEEP-2 and indirectly through the establishment of enabling policy and regulatory environment for energy efficiency practices and investments and other catalytic actions for replication and scaling-up. On aggregate, annual energy savings totalling to 66,850MWh and annual GHG emission reductions totalling to 42,851 tCO_2e were expected to be achieved by PEEP-2.

It was designed that the GEF financing accounted for a significant percentage of the total cost of PEEP-2. Therefore the substantial value added by GEF involvement was considered to be essential to the effective implementation of the planned activities and the timely and quality delivery of the expected outputs with high sustainability, replicability and scalability.

2. Implementation

ADB's Pacific Department (PARD), through the Transport, Energy and Natural Resources Division (PATE), served as the Executing Agency (EA) responsible for coordinating, supervising, and implementing all project activities under PEEP-2. The in-country Implementing Agencies (IAs) of the respective participating pacific DMCs included: (i) Energy Department, Cook Islands; (ii) Department of Petroleum and Energy, PNG; (iii) Ministry of Natural Resources and Environment, Samoa; (iv) Tonga Energy Road Map Implementation Unit, Prime Minister's Department, Tonga; and (v) Energy Unit, Ministry of Lands and Natural Resources, Vanuatu.

An ADB steering committee was established with the view of providing overall coordination and facilitation of PEEP-2 implementation. In addition to PARD as the specific EA department responsible for PEEP-2, other ADB departments including Sustainable Development and Climate Change Department (formerly known as Regional and Sustainable Development Department), Southeast Asia Department (SERD) and South Asia Department (SARD) were invited to join the steering committee to share experience and lessons from similar activities undertaken in their respective regions and offer inputs and suggestions to PEEP-2.

In each participating PDMC, a national steering committee was set up. Chaired by the IA in the PDMC, the national steering committee comprised high-level official from relevant ministries, the GEF focal point, power utilities, ADB, and representatives from other bilateral and multilateral programs and projects. The primary roles of the national steering committees were to provide overall guidance to the implementation of the PEEP-2 project activities in the applicable PDMC and to ensure the necessary coordination among participating agencies and other organizations.

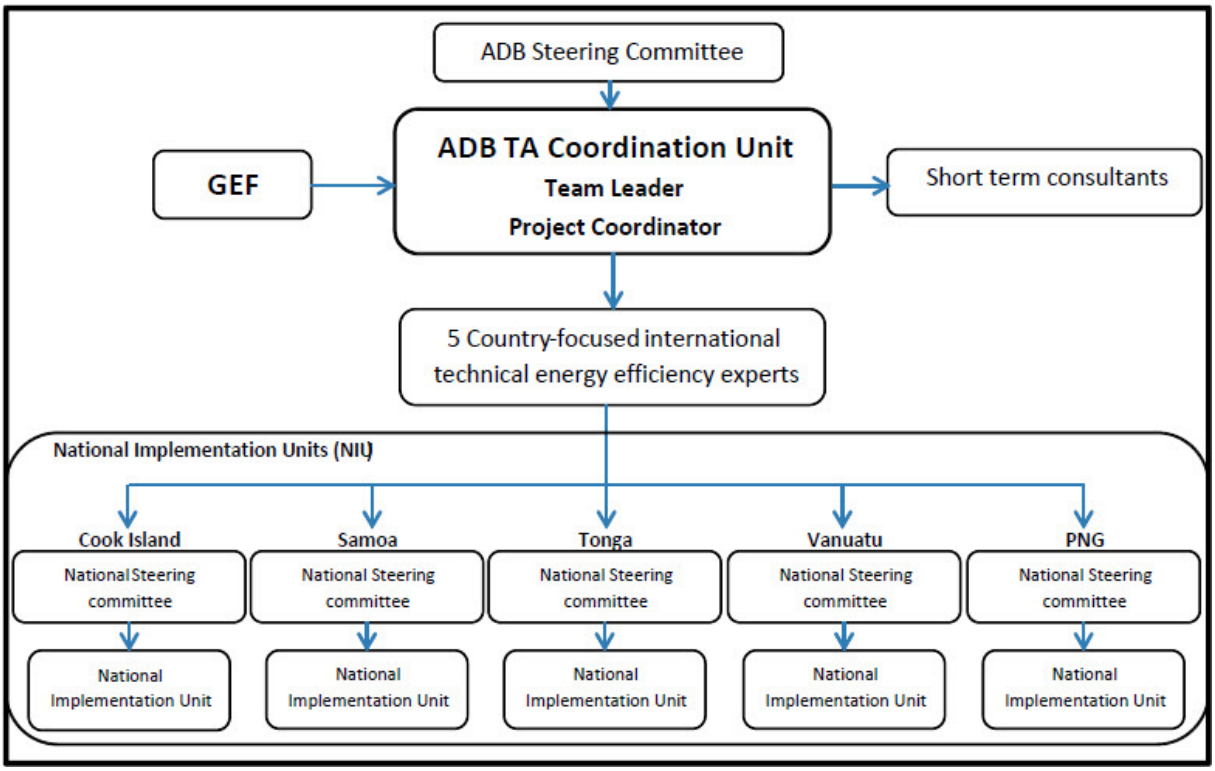
A TA coordination unit (TCU) was created by ADB to be responsible for the overall operational management and implementation of project activities. Staffing-wise, the TCU comprised a full-time program coordinator responsible for overall coordination, budget, contracting and output measurement issues, and a half-time team leader/EE technical expert responsible for overall strategic, technical and implementation project matters. The project implementation was closely co-ordinated with ADB's Pacific Subregional Office, Pacific Liaison and Coordination Office, Sustainable Development and Climate Change Department (formerly known as Regional and Sustainable Development Department), resident missions in relevant participating pacific DMCs, the Secretariat of Pacific Community as the lead agency for coordinating energy activities in the Pacific, and other development partners.

In each of the five participating PDMCs, project activities were led by a National Implementation Unit (NIU) on a day-to-day basis. The NIU comprised a national project coordinator reporting to the TCU through the PDMC IA, and a part-time international country-focussed energy efficiency technical expert providing technical and administrative support to ensure the technical soundness and operational timeliness and quality of PEEP-2 implementation in the PDMC concerned.

A consulting firm, International Institute for Energy Conservation (IIEC), was engaged by ADB in accordance with established rules and guidelines of ADB, to serve as the program management consultant. As the lead firm reporting to the TCU, IIEC supplied its in-house international experts and external sub-consultants (both international and national), who collectively rendered the consulting services relating to in-country program management and implementation of all technical and administrative tasks and activities on a day-to-day basis in collaboration with the IAs in the five participating PDMCs.

The above-mentioned implementation arrangements are schematically shown in the following figure.

Figure 1: Implementation Arrangements of PEEP-2



3. Relevance, Impact, Outcomes and Outputs

(a) Relevance

The PEEP-2 was highly relevant to national and regional environmental priorities, plans and policies of the participating PDMCs as well as fully consistent with ADB's strategies and core operational focus areas.

End-use energy efficiency was well recognized by many PDMCs' governments and regional agencies as a least-cost priority that had great potential to effectively address the issues relating to fossil fuel dependence, high power tariffs and GHG emissions of the power sector. At the national scale, all participating PDMCs of PEEP-2 set forth national policy statements emphasizing the importance of demand-side energy efficiency measures as a means to reducing national dependence on fossil fuels. For example, the Tonga Government already incorporated energy efficiency recommendations from PEEP-1 into the Tonga Energy Roadmap (TERM). PEEP-2 was also in line with the Cook Islands National Energy Policy which aimed to decrease its per capita energy consumption by 20% through increasing efficiency in energy use through the adoption of new technologies and energy conservation. At the regional level, PEEP-2 is in line with the Framework for Action on Energy Security in the Pacific (FAESP) which was adopted by leaders of the Pacific Islands in 2010. FAESP supported the promotion of energy efficiency and productivity through a whole-of-sector approach and through the premise of “many partners one team one plan”. End-

use energy consumption and energy efficiency activities were highly prioritised as a guiding theme of FAESP.

Prior to PEEP-2, there were a series of national and regional programs and projects undertaken to assist the participating PDMCs of PEEP-2 in building national GHG emissions reporting capacities, formulating policies and plans on climate change mitigation and adaptation, and identifying opportunities for energy efficiency and renewable energy development opportunities. Typical relevant regional programs and projects included (i) the Pacific Islands Energy Policy and Strategic Action Plan (PIESAP), 2004-2007 which assisted PDMCs in drafting and adopting national energy policies; (ii) the Pacific Islands Renewable Energy Project (PIREP), 2003-2006 which conducted energy sector assessments in 15 Pacific countries and identified GHG emission reduction opportunities in both renewable energy and energy efficiency; and (iii) the UNDP-managed Second National Communication project which assisted Pacific countries in preparing their Second National Communications and respective GHG inventories.

The significant energy efficiency potential in the five participating PDMCs of PEEP-2 was explored and confirmed by a number of previous regional studies undertaken by ADB. The Renewable Energy and Energy Efficiency Program for the Pacific (REEP) conducted case studies of energy efficiency potential in Fiji Islands and Samoa and supported the removal of policy and institutional barriers to energy efficiency and the promotion of private sector participation in energy management and demand-side services. Likewise, the ADB PEEP-1 initiative implemented five pilot scale energy efficiency projects of relevance to PEEP-2, and identified a range of further energy efficiency options for tangible follow-on implementation by PEEP-2 or similar project activities. Observations and findings from these previous initiatives contributed substantially to identifying and ascertaining main limitations, barriers and challenges across various dimensions that prevented energy efficiency implementation from being scaled up in the Pacific. PEEP-2 was conceptualised and designed to address some of the key issues and provide assistance in creating an enabling environment for catalysing large-scale deployment of energy efficiency measures in key sectors in the target participating PDMCs and beyond.

The overall objectives of PEEP-2 were fully consistent with ADB's core operational focus areas in the Pacific as well as ADB's Strategy 2020 which calls for the promotion of energy efficiency through an integrated mix of supply-side and demand-side measures. In addition, PEEP-2 was consistent with ADB's Pacific Approach 2010-2014, which identified the energy sector as one of the four ADB operational priorities for the Pacific region and highlighted the pivotal role of energy efficiency in lowering energy costs, alleviating dependence on fossil fuels and reducing GHG emissions in the context of Pacific. Improving energy efficiency was a strategic objective consistently identified by ADB Country Partnership Strategy for each of the five participating PDMCs. Consistency was also ensured between PEEP-2 and ADB's Pacific Regional

Operations Business Plan 2010-2013, in which the ADB co-financing component of PEEP-2 was explicitly included in the list of indicative assistance pipeline for non-lending products and services.

PEEP-2 was designed to deliver global environmental benefits in climate change mitigation through implementing national-scale energy efficiency programs relating to street and public lighting, energy efficient lighting in the residential buildings, and energy efficiency measures in commercial and public buildings. GHG emission reductions were also expected to be achieved through the development and enforcement of effective minimum energy performance standards and energy labelling to suppress the sale and use of high-energy-consumption appliances and equipment in the participating PDMCs. In addition to the direct GHG emission reductions, indirect GHG emission reductions were expected to be achieved after project completion as a result of the enabling environment for energy efficiency practices and investments created by PEEP-2 activities through capacity building, policy frameworks, standards and other catalytic actions for replication.

(b) Assessment of outputs, outcomes and impacts

PEEP-2 was structured to consist of four major components, the implementation of which was expected to generate the designed outputs collectively leading to the anticipated outcomes and impacts that PEEP-2 was aimed at achieving. This section provides a holistic and in-depth assessment on the outputs that the implementation of each PEEP-2 component was able to generate by its completion in July 2015. For each component, the assessment is structured to include (1) a brief introduction of its original design and expected outputs; (2) a critical review of the actual implementation of tasks and activities and the relevant deliverables and outputs; (3) discussion on the extent to which the applicable performance targets as set out in the DMF have been achieved; (4) identification of and analysis on the gap and deviation where appropriate; and (5) rating.

Component 1: Establishment of comprehensive database of energy use by appliance/equipment type in each participating country.

This component aimed to complement the analysis and pilot projects already undertaken under PEEP-1 and the PEEP-2 project preparation activities funded by GEF Project Preparation Grant (PPG) by conducting surveys to complete the picture of existing and projected appliance and equipment characteristics, patterns of use, and useful lifetimes in the participating PDMCs. The main output was designed to be an accessible database of energy use by sector and major appliance category in each participating PDMC. It was also expected that resources would be used to train and build the capacity of local government energy units in maintaining and updating the database so as to ensure that the provision of reliable data would be sustainable over the medium to long-term. To further ensure sustainability, it was agreed that the

database would be hosted by government departments which would contribute co-financing to the activity during the project and over the longer term after completion of the project.

Output 1: An accessible database of energy use by sector and major appliance category in each participating PDMC

A thorough stock-taking was performed by IIEC in cooperation with IAs and relevant government agencies and stakeholders in the participating PDMCs to identify existing data resources relating to energy end use and determine the need and scope for conducting surveys to collect additional data to fill the gap in data quantity and quality. For PNG, Samoa, Tonga and Vanuatu, the scope of surveys covered household appliance and energy use, energy consumption of large energy end-users (commercial and public buildings), and lighting quality of public and street lighting. For Cook Islands, no household appliance and energy use survey was conducted due to the existence of national census data available at the Statistics Office. Based on critical review of survey-related documents and extensive interview with IAs and relevant government agencies involved in the surveys in the PDMCs, it can be cogently concluded that the design of survey approach, methodology and plan was technically sound and robust and practically feasible with local circumstances duly taken into consideration, and the actual in-country survey activities were organised and implemented in an effective and efficient manner.

The key sectoral and end-use energy use baselines and energy efficiency indicators, the establishment of which was the purpose of the collective efforts of in-country surveys and stock-taking of existing data resources, are found to have been clearly defined and technically relevant in the particular context of PEEP-2. The results of household appliance and energy use surveys were used to establish a range of key parameters including, amongst others, saturation of electrical equipment, appliances and lighting products in households, models and sizes of electrical equipment, appliances and lighting, usage patterns, energy consumption, energy efficiency, origin of manufacture, and consumer preferences and perceptions. For street and outdoor lighting, a complete inventory of all street and outdoor lighting light points was established and the key performance indicator, namely the weighted average lame efficacy of all street and outdoor lighting (lumen per watt), was determined for each participating PDMC. Surveys targeting buildings as large energy end-users in the participating PDMCs were carried out to collect data necessary for establishing energy efficiency indicators including historical energy consumption, floor areas, occupancy rate and equipment inventory. Typical building types covered by the surveys included government office buildings, hotels and resorts, hospitals, commercial buildings and retailers. However, given the numbers of buildings surveyed, the building energy use index (EUI) in kWh/m2/year established for each participating PDMC should only be regarded as being preliminary and therefore subject to adjustment depending upon additional survey data that might become available in the future.

Using the survey results and relevant existing data resources, the energy end-use database was established as part of the PEEP-2 website (http://ee-pacific.net/index.php/database). The overall system architecture and database design are found to be generally acceptable as they enable the provision of the most basic functions meeting the minimum requirements reasonably expected in the context of PEEP-2. However, as compared with the original design concept proposed in the Technical Proposal submitted by IIEC, the database is found to have been considerably simplified in respect of its major components and functionality. For example, instead of the proposed core sub-database for energy supply and core sub-database for energy policies and action plans of the participating PDMCs, only brief summary in the form of webpage was delivered on these subjects. No core sub-database for energy efficiency projects implemented under Component 3 of PEEP-2 was developed as planned. Rather, the website only provided a list of the 34 projects, without project-specific details on design, implementation, monitoring and evaluation. User interface targeting different types of users and reporting interface for different report generation options were not found to have been provided by the website. The functions of information search and tracking and data sorting were not provided, either. Whilst technically these components and functionalities are not paramount, their absence suggests an evident gap between the Technical Proposal and the actual work by IIEC, resulting in an under-delivery of committed deliverables.

Component 2: Mainstreaming of EE practices into government processes, policies, and procedures

The PEEP-1 had conducted an initial assessment of the energy efficiency needs, potentials and opportunities in relevant PDMCs and developed a set of policy recommendations. With the view of taking forward the work by PEEP-1, this component of PEEP-2 was designed to involve (i) establishment of practical and implementable EE targets and their incorporation into national energy policies, sector roadmaps and plans; (ii) suppression of high energy consumption appliance and equipment sales and use, and the phase-out of inefficient technologies (e.g. incandescent light bulbs and non-inverter air-conditioning units) through import regulations brought about by the development, adoption and enforcement of effective minimum energy performance standards (MEPS) and/or energy labelling; (iii) improvement of EE best practices for newly built residential, commercial, government, and social buildings, including the establishment of simple, effective and enforceable EE provisions in building codes for new buildings; (iv) developing and implementing training programs for local experts in undertaking energy audits and in providing EE products and services, and the effective communication of their benefits to decision makers; and (v) supporting the development of motivated and organised EE service providers that have incentives to implement EE activities.

Output 1: National EE targets established and incorporated into national energy policies

For each of the five participating PDMCs, a step-wise approach was taken to establish country-specific EE targets for years 2020, 2025 and 2030 under various policy intervention scenarios. Basically, the business-as-usual (BAU) energy consumption of key sectors (residential, commercial, government, hotels, etc.) was forecasted by conducting regression analysis involving historical data on electricity consumption, number of customers, GDP, and other relevant variables, as well as results of end-use surveys. The technical potential for energy efficiency was estimated based on review of best available technologies and existing reports from studies and projects carried out in the Pacific including PEEP-1. The technical potential was converted to economic potential by taking into account factors relating to costs, financing, and other barriers and constraints. Three levels of policy interventions, namely conservative, moderate, and aggressive, were defined to be applied to the economic potential for energy efficiency to work out the achievable potential for energy efficiency. The EE targets were then established based on the sectoral BAU energy consumption and the achievable potential under different level of possible policy interventions by the governments of PDMCs concerned.

Overall, the methodology for establishing the EE targets is believed to have been task-oriented, well articulated and technically sound. The results are considered reasonable and relevant in the context of the participating PDMCs. Based on discussions with the IAs and other relevant government agencies of the PDMCs, it is understood that the efforts in establishing the proposed EE targets were well recognised. Specifically, the government of PNG has acknowledged the proposed EE targets and in principle accepted to include the targets as national targets. For Cook Islands and Samoa, the EE targets have been reviewed by the relevant agencies and accepted as realistic and will be incorporated when the energy policies are revised. For Vanuatu and Tonga, their energy roadmaps developed with support from the World Bank were already in place and effective prior to the start of PEEP-2. However, the EE targets established for both countries under PEEP-2 were still submitted to the relevant government agencies for reference and believed to have been well received and acknowledged.

Output 2: Minimum energy performance standards (MEPS) and labeling programs developed and enforced

Tasks and activities under this output were considered overlapped with the Pacific Appliance Labelling and Standards (PALS) program, which was funded by the Australian Government and implemented by the Secretariat for the Pacific Community. Endorsed by 11 Pacific island countries and territories including the five participating PDMCs of PEEP-2, the PALS program focused on developing regulations for minimum energy performance standards (MEPS) for a range of electrical appliances based on Australia and/or New Zealand standards. As a result, to avoid overlap, it was decided

that technical assistance in this regard would only be provided by PEEP-2 to the focal points in the five participating PDMCs upon request. As confirmed by the IAs and IIEC, no formal requests for assistance were made from any of the five participating PDMCs. Therefore, no activities relating to MEPS were actually carried out in the context of PEEP-2, although it was understood that a representative from IIEC was included in the PALS steering committee to attend the regular meetings.

It shall be pointed out that a caveat was made by IIEC in this regard before IIEC was engaged and PEEP-2 started. In its Technical Proposal submitted to ADB, IIEC highlighted its awareness of PALS and the potential impact of PALS on PEEP-2. The excerpt follows:

"*Finally it is noted that there have been discussions regarding a possible Australian-funded Pacific Islands regional program on minimum energy performance standards (MEPS) and labelling for appliances (A/C, refrigeration and possibly lighting). If this eventuates, there is scope for considerable coordination/cooperation with PEEP-2.*"

However, the fact that no real activities relating to MEPS were carried out under PEEP-2 has substantial implication to the overall performance of PEEP-2 with respect to GHG emission reductions. According to the original design of PEEP-2 as detailed in the GEF CEO Endorsement Document, the introduction and enforcement of MEPS for imported appliances was expected to contribute the most significant GHG emission reductions amongst all components of PEEP-2. Out of the estimated total emission reductions of 30,720 tCO2e per year that the PEEP-2 was expected to achieve, an amount of approximately 11,758 tCO2e per year (38%) was expected to be attributable to the planned MEPS initiative in the residential sector targeting appliances having high ownership rates and high energy saving potentials in the five participating PDMCs. Therefore, the cancellation of MEPS related activities has led to a significant decrease in the Global Environmental Benefits that PEEP-2 can deliver.

Output 3: Energy efficiency building codes for residential, commercial, and public buildings established

Under this output, a series of activities were carried out to develop a set of deliverables that are technically complementary and collectively contribute to the identification of building energy efficiency technologies and best practices potentially applicable to relevant building categories in the PDMCs concerned.

Energy Efficiency Technology Assessment. A comprehensive study on potential energy efficiency technologies relating to building sector was undertaken to identify and assess technology appropriateness and cost effectiveness in the particular context of the PDMCs. Methodologically, a spreadsheet-based model was developed to enable the assessment of technologies in terms of cost of conserved energy (CCE), net present value (NPV) and internal rate of return (IRR). For assessment of each

specific technology, two hypothetical scenarios were defined, namely (i) replacement of old technologies by new technologies; and (ii) purchase of new technologies for new installations. Country-specific climatic conditions, prevailing practices in building sector, and fiscal and trade policies were taken into consideration by the assessment. Major target technologies included air-conditioning, refrigeration, and water heating including heat pump, which were highly relevant in the context of the Pacific.

International Best Practices for Energy Efficiency Building Codes. A thorough review of the existing building codes in the five participating PDMCs was undertaken, with the view of identifying opportunities to incorporate energy efficiency attributes into the codes. The review considered the climatic conditions, construction practices, material use and operational parameters of prevalent building types in the PDMCs. The building codes were found to be old, with limited applicability and weak enforcement. To address this issue, the following activities were proposed and carried out by IIEC:

(a) Identification of an appropriate energy efficiency building code for customization and adaptation based on inputs from relevant stakeholders in the PDMCs. Based on a desktop review and comparative analysis of building codes and regulations enforced and implemented in countries having similar climatic and geographical conditions and/or regional economic ties with the PDMCs, it was recommended that the Australian building energy efficiency code should be chosen as the reference code for customization and adaptation.

(b) Broad guidelines and recommendations on integrating energy efficiency into building design and construction in the context of the Pacific region. These included not only the macro-level building design notion, process and approaches emphasizing building energy performance, but also a fairly comprehensive set of specific building energy efficiency strategies, measures and techniques. In addition, general recommendations on the general framework for building code compliance and the roadmap for adoption, enforcement and implementation were also provided by making reference to publicly available literatures on relevant topics.

Green Hotels Rating Scheme for the Pacific. This activity aimed to identify a green hotel certification scheme suitable for implementation in the Pacific. A comparative review on eight major schemes was carried out. Three out of the eight schemes were analysed in detail, leading to the recommendation that EarthCheck would be the most suitable scheme for adoption and implementation in the five participating PDMCs of PEEP-2. The potential roadmap for implementation, institutional arrangements and funding mechanisms were also discussed in the report dedicated to this particular activity.

Green Commercial Buildings Rating Scheme for the Pacific. This activity aimed to identify a voluntary green building rating scheme suitable for adoption and

implementation in the Pacific. A comparative review on six major internationally recognised rating schemes was carried out, covering Building Environmental Assessment Method (BEAM) of Hong Kong, Building Research Establishment Environmental Assessment Method (BREEAM) of UK, Comprehensive Assessment System for Built Environment Efficiency (CASBEE) of Japan, Green Mark of Singapore, Green Star of Australia, and Leadership in Energy and Environmental Design (LEED) of USA. Based on the reviewing findings, Green Mark, Green Star and LEED were selected for further detailed analysis. Based on assessment against factors including applicability in the Pacific, institutional structure, technical criteria, evaluation and quality assurance procedure, ease of use and implementation, and costs, it was recommendation that LEED would be the most suitable scheme for adoption and implementation in the five participating PDMCs of PEEP-2.

Energy Efficiency Assessment Guidelines, Framework and Scorecard. This activity was dedicated to developing an EE Assessment Framework and Scorecard with accompanying Guidelines to enable the PDMCs to understand and independently evaluate their respective EE-related policies, provide guidance on how the PDMCs can improve EE, and establish a set of criteria and indicators for tracking progress. The existing EE Framework and Scorecards developed by the World Bank for the Western Balkan countries was selected as the most appropriate reference based on which customization and adaptation were made to develop the EE Assessment Framework and Scorecard relevant and applicable to the PDMCs. Key elements included in the Framework and Scorecard were enabling EE legislation, EE policies and regulations, market characteristics, financing and implementation, capacity and awareness building. General guidelines were prepared for policy makers to facilitate the understanding and use of the Framework and Scorecard. Based on the results of assessment undertaken for the PMDCs, general recommendations and country-specific recommendations were made to assist the PDMCs in identifying, understanding and addressing the barriers across various dimensions to scaling up the implementation of EE activities.

The above summarised activities are found to have well responded to the general tasks and requirements of output 3. In fact, the scope of work, specific activities, and the technical deliverables can be fairly assessed to have well achieved the objectives, and arguably exceeded what could be reasonably expected from output 3 as one of the five outputs under Component 2. The deliverables, including (1) assessment of EE technologies for the Pacific; (2) building EE guidelines and codes for new construction; (3) green hotels rating schemes; (4) green building rating schemes; and (5) EE assessment guidelines, framework and scorecard for the Pacific islands, were technically complementary and collectively contributed to producing a solid basis for establishing EE building codes with high relevance and applicability in the participating PDMCs.

Output 4: Training in energy audits and EE products and services

To build the capacity of professionals in the participating PDMCs, a comprehensive energy audit training program targeting the whole energy project development cycle covering all major steps involved in the course of project identification, planning and implementation was designed and implemented in 2013 and 2014. The training program consisted of four modules, including walk-through energy audit training (basic level), technical and financial evaluation (intermediate level), contracting, project management and measurement & verification (intermediate level), and detailed investment grade energy audit (advanced level). Each of the basic and intermediate level modules included a combination of classroom training, field visits, and assignments during or after the field visits. The advanced module focused on hands-on training, measurement of energy use, analysis of measurement results, and preparation of investment grade audit reports.

The training modules were effectively delivered and well received by the trainees in each of the five participating PDMCs. Good learning outcomes from the training modules were achieved as demonstrated by trainees' feedback to training evaluation which clearly indicated greatly enhanced knowledge and understanding of the concepts, facts and techniques relating to energy audit.

Output 5: EE service providers motivated and incentivised to implement EE activities

As per the original design, this output was about supporting the development of motivated and organised EE service providers that have incentives to implement EE activities. In effect such service providers referred to entities functioning as ESCOs. In its Technical Proposal, IIEC pointed out that it would be very challenging to set up and operate ESCOs in the PMDCs based on its own knowledge and experience as well as the findings from PEEP-1 in 2011 and ADB RETA-6102 Renewable Energy and Energy Efficiency Program for the Pacific in 2006. According to IIEC's proposal, an ESCO mechanism serving both PNG and Vanuatu might be more practical than national arrangements. A separate ESCO could serve Samoa and Tonga but might not be viable without the participation of Fiji, which is not a participant of PEEP-2. As for Cook Islands, the country being small and geographically relatively isolated would make a full-fledged ESCO serving the country unviable and services from outside the country costly. Based on these considerations, IIEC suggested in its proposal that this particular output would not be interpreted as requiring support to develop fully-fledged ESCOs in each participating PDMC, but rather practical arrangements considering local capacities.

During the implementation of PEEP-2, no activities relating to this output were carried out. In general there was a lack of demand for ESCO services in the PDMCs. According to IIEC and IAs in the participating PDMCs, despite several attempts during stakeholder meetings and workshops, no serious EE services providers that would be a prospective ESCO could be identified.

Component 3: Implementation of national-scale energy efficiency programs

As analysed and piloted in the PEEP-1 project, this component was designed to involve a number of tangible EE implementation initiatives, including (i) upgrading of street lighting using energy efficient and long-life technologies; (ii) roll-out of energy efficient lighting systems to the residential sector; (iii) energy audits in hotels and other non-residential private buildings and the subsequent implementation of recommended EE improvements in air conditioning, lighting, refrigeration, water heating, and management schemes; and (iv) energy audits in the government building sector and the subsequent implementation of recommended EE improvements in air conditioning, lighting, refrigeration, water heating, and management schemes.

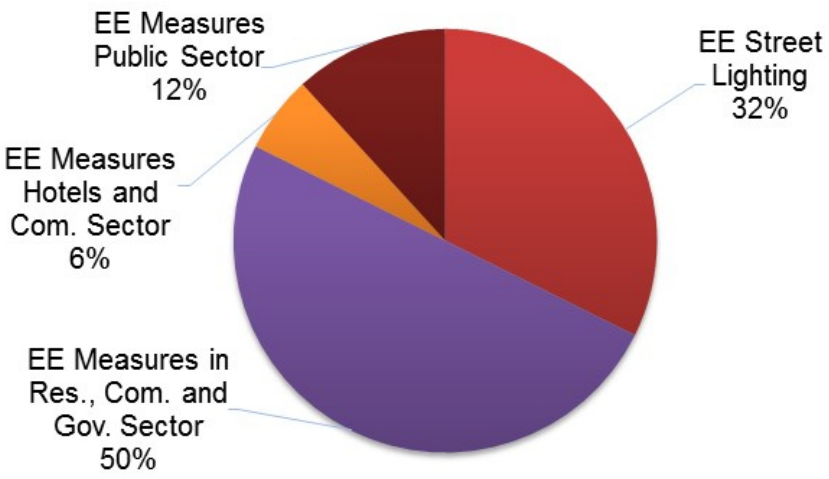
During the implementation of PEEP-2, a total of 34 EE projects were developed in the five participating PDMCs. The scope of the projects covered EE street lighting, EE lighting for residential, commercial and public buildings, EE measures in hotels and commercial buildings, and EE measures in government buildings. The following table and figure provide an overview of the costs and types of projects distributed across the five PDMCs.

Table 1: Summary of EE Projects Implemented under PEEP-2

Summary by Project Location			Number of Implemented Projects by Type				
Country	**Contract Value (US$)**	**Share**	**EE Street Lighting**	**EE in Res., Com. and Gov. Sector**	**EE in Hotels and Com. Sector**	**EE in Public Sector**	**Total**
Cook Islands	616,582	32%	4	2	1	2	9
PNG	316,978	17%	2	3	0	0	5
Samoa	349,895	18%	1	4	1	1	7
Tonga	261,478	14%	2	2	0	0	4
Vanuatu	311,950	16%	2	5	0	1	8
All+	55,599	3%	-	1	-	-	1
TOTAL	**1,912,481**	**100%**	**11**	**17**	**2**	**4**	**34**

+Note: This refers to a lamp waste management project implemented in all five PDMCs.

Figure 2: Share of Types of Implemented EE Projects



The full list of the 34 projects implemented under PEEP-2 is given in the following table. Whilst it was originally planned that all projects would undergo the full process of data gathering, design, procurement, installation, and monitoring and verification (M&V) during the implementation of PEEP-2, significant delays in procurement and installation were encountered, resulting in most projects being completed just before or even after the official completion of PEEP-2 in July 2015. Accordingly, only limited M&V activities were conducted. Project-specific completion and M&V status is summarized in the following table.

Table 2: Full List of EE Projects Implemented under PEEP-2

Code	Project Name	Country	Type	Status of Completion	M&V
1	**Energy Efficient Lighting in Rarotonga Airport**	Cook Islands	Energy Efficient Street Lighting Program	Based on information provided by Airport Authority Completion: February 2015 Change from design: Minor (unit capacity of installed LED luminaire is 50 Watts, instead of 54 Watts as designed) Energy saving: 23.7kWh/day.	Yes, but only preliminary
2	**Energy Efficient Street Lighting Project for the Punanga Nui Market**	Cook Islands	Energy Efficient Street Lighting Program	No information adequate for ascertaining project status has been made available to this evaluation.	NA
3	**Energy Efficient Fridge/Freezer Replacement Program**	Cook Islands	Residential Energy Efficient Program	No information adequate for ascertaining project status has been made available to this evaluation.	NA
4	**Energy Efficient Air-Conditioning System Using Variable Refrigerant Volume/Flow Technologies**	Vanuatu	Implementation of EE Measures in the Public Sector	Visited sites: **Ministry of Finance and Economic Management (MFEM)** The AC unit was installed at the Ministry of Finance and Economic Management (MFEM) by the end of 2014. The MFEM building was severely damaged by a cyclone in March 2015. Since then, the building has been left as damaged, without any repair or reconstruction activities undertaken but just the closure of the	No

Code	Project Name	Country	Type	Status of Completion	M&V
				site. Currently negotiations are going on between Vanuatu Government and Chinese government with regard to a grant of USD 6 million in support of the demolition and reconstruction of the building over the next 5 to 10 years. It is understood that no real plan has been made to deal with the AC unit which is currently being left unattended on the site. The original supplier of the AC unit, Supercool Vila Ltd., has scheduled a site inspection in August 2016 as requested by the government.	
5	**Energy Efficient Street Lighting Project in Residential Streets of Port Moresby**	PNG	Energy Efficient Street Lighting Program	Based on information provided by PNG Power: Completion: Nov 2014 Change from design: Minor (unit capacity of installed LED lamp is 32 Watts, instead of 30 Watts as designed) Energy saving: No data available.	No
6	**Energy Efficient Lighting in Marina and Wharf**	Cook Islands	Energy Efficient Street Lighting Program	Visited sites: **Ports Authority – Marina area and wharf area** Completion: July 2015 Change from design: Minor (16 Solar LED luminaires installed rather than 19 as originally designed) Energy saving: Reduction of bills by 500 to 600 NZD/month at Marina area where 11 luminaires	No

Code	Project Name	Country	Type	Status of Completion	M&V
				were installed. No data available for the wharf area.	
7	**Energy Efficiency Program in Public Buildings**	Cook Islands	Implementation of EE Measures in the Public Sector	Detailed information on the inventory of the buildings covered by this project and building-specific EE lighting installation and operation has not been made available to this evaluation to ascertain project status.	NA
8	**Energy Efficient Lighting at Papua New Guinea Power Limited (PPL) Head Office**	PNG	Energy Efficient Lighting in Residential, Commercial and Government Sectors	Based on information provided by PNG Power: Completion: July 2015 Change from design: No Energy saving: 239,042 kWh/year (calculated based on monitoring of 2 weeks of operation before and after installation)	Yes, but only preliminary
9	**Implementation of Energy Efficient Lighting in Public Sector Buildings**	Vanuatu	Energy Efficient Lighting in Residential, Commercial and Government Sectors	Visited sites: **(1) Port Vila Municipal Council** Completion: Dec 2014 Change from design: No Energy saving: approximately 15% (based on difference in pre-project bills and post-project bills). **(2) Ministry of Finance** Completion: Dec 2014 Change from design: No Energy saving: approximately 15% (estimated provided by staff interviewed)	No

Code	Project Name	Country	Type	Status of Completion	M&V
				(3) Parliament Completion: Dec 2014 Change from design: No Energy saving: approximately 15% (estimated provided by staff interviewed) **(4) Meteorology** Completion: Dec 2014 Change from design: No Energy saving: approximately 15% (estimated provided by staff interviewed) **(5) Department of Energy** Completion: Dec 2014 Change from design: No Energy saving: approximately 15% (estimated provided by staff interviewed) **(6) Port Vila Library** Completion: Dec 2014 Change from design: No Energy saving: approximately 15% (estimated provided by staff interviewed) **(7) Port Vila Hospital** Completion: Dec 2014 Change from design: No Energy saving: approximately 15% (estimated provided by staff interviewed)	

Code	Project Name	Country	Type	Status of Completion	M&V
10	**Energy Efficient Street Lighting Project in Apia, Samoa**	Samoa	Energy Efficient Street Lighting Program	Some of the sites covered by this project were visited. However, detailed information on the inventory of street lights covered by this project has not been made available to this evaluation to ascertain project status.	NA
11	**Energy Efficient Lighting in Government Buildings, Samoa**	Samoa	Energy Efficient Lighting in Residential, Commercial and Government Sectors	Some of the sites covered by this project were visited. However, detailed information on the inventory of the buildings covered by this project and building-specific EE lighting installation and operation has not been made available to this evaluation to ascertain project status.	NA
12	**Energy Efficient Street Lighting for Outer Islands, Tonga**	Tonga	Energy Efficient Street Lighting Program	No information adequate for ascertaining project status has been made available to this evaluation.	NA
13	**Energy Efficient Street Lighting for Tongatapu, Tonga**	Tonga	Energy Efficient Street Lighting Program	No information adequate for ascertaining project status has been made available to this evaluation.	NA
14	**Lamp Waste Management Technology – Bulk Purchase of Bulb Eaters**	All	EE Lighting Activities	Completion: July 2015 Change from design: No	NA
15	**Energy Efficiency in Edgewater Resort & Spa**	Cook Islands	Energy Efficiency Measures in Hotels and Commercial Buildings	Visited site: **Edgewater Resort & Spa, Rarotanga** Completion: July 2014 Change from design: No	No

Code	Project Name	Country	Type	Status of Completion	M&V
				Energy saving: approximately 15% (estimated by hotel manager based on difference between pre-project bills and post-project bills)	
16	**Energy Efficiency Rooftop Retrofit at Papua New Guinea Power Limited (PPL) Head Office**	PNG	Implementation of EE Measures in the Public Sector	This project was cancelled because no bids were received.	NA
17	**Residential Energy Efficient Lighting Program**	Cook Islands	Energy Efficient Lighting in Residential, Commercial and Government Sectors	As of July 2016, no distribution and installation of the procured lamps under this project were carried out due to the lack of additional funding to enable the engagement of a contractor. All lamps are currently being stored at Cook Island Investment Corporation (CIIC). Currently there is no firm plan or timetable about how to deal with the lamps.	NA
18	**Energy Efficient Street Lighting Project in Luganville, Vanuatu**	Vanuatu	Energy Efficient Street Lighting Program	No information adequate for ascertaining project status has been made available to this evaluation.	No
19	**Residential Energy Efficient Lighting, Luganville**	Vanuatu	Energy Efficient Lighting in Residential, Commercial and Government Sectors	No information adequate for ascertaining project status has been made available to this evaluation.	No
20	**Energy Efficient Street Lighting Project in Port**	Vanuatu	Energy Efficient Street Lighting Program	No information adequate for ascertaining project status has been made available to this	No

Code	Project Name	Country	Type	Status of Completion	M&V
	Vila, Vanuatu			evaluation.	
21	**Household Energy Efficient Lighting, Port Vila**	Vanuatu	Energy Efficient Lighting in Residential, Commercial and Government Sectors	No information adequate for ascertaining project status has been made available to this evaluation.	No
22	**Residential Energy Efficient Lighting in the Outer Islands, Tonga**	Tonga	Energy Efficient Lighting in Residential, Commercial and Government Sectors	No information adequate for ascertaining project status has been made available to this evaluation.	NA
23	**Energy Efficient Street Lighting Project in the Outer Islands, Cook Islands**	Cook Islands	Energy Efficient Street Lighting Program	No information adequate for ascertaining project status has been made available to this evaluation.	NA
24	**Energy Efficient Luminaires in Government Buildings, Samoa**	Samoa	Energy Efficient Lighting in Residential, Commercial and Government Sectors	The site of **National University of Samoa** was visited. The site of the Development Bank of Samoa was not visited. For either site, detailed information on the inventory of lighting installation and the operation performance data (electricity consumption) has not been made available to this evaluation to ascertain project status.	NA
25	**Demonstration of Energy Efficient Air-Conditioning Technologies in Samoa**	Samoa	Implementation of EE Measures in the Public Sector	Visited sites: (1) **Mapufagalele – Little Sisters of The Poor** Completion: Dec 2014	Yes, but only limited.

Code	Project Name	Country	Type	Status of Completion	M&V
				Change from design: No Energy saving: 40%-50% (based on difference in pre-project bills and post-project bills) (2) **National University of Samoa (NUS)** Completion: Dec 2014 Change from design: No Energy saving: No results can be directly reported because the EE measures on this site involved both ADB PEEP-2 activities (replacement of AC units and replacement of EE lighting) and similar activities funded by other agencies and stakeholders carried out in parallel with ADB PEEP-2. No sub-metering equipment exists. (3) **Ministry of Natural Resources and Environment (MNRE)** Completion: Dec 2014 Change from design: No Energy saving: No data available.	
26	**Energy Efficient Lighting in the Commercial Sector, Samoa**	Samoa	Energy Efficient Lighting in Residential, Commercial and	Visited site: **Yazaki (EDS) Samoa Limited** Completion: June 2016	Yes, but no data was

Code	Project Name	Country	Type	Status of Completion	M&V
			Government Sectors	Change from design: No Energy saving: approximately 10 to 15% (estimated provided by staff interviewed). No detailed monitoring results were provided.	provided.
27	**Energy Efficient Air Conditioning in Hotels, Samoa**	Samoa	Energy Efficiency Measures in Hotels and Commercial Buildings	Visited site: **Pacific Pearl Hotel** Completion: January 2016 Change from design: No Energy saving: approximately 45 to 50% (estimated provided by staff interviewed). No detailed monitoring results were provided. The other project site, i.e. Vaisala Hotel, was not visited. Detailed information on the inventory of AC installation and the operation performance data (electricity consumption) has not been made available to this evaluation to ascertain its status.	Yes, but no data was provided.
28	**Residential Energy Efficient Lighting in Samoa**	Samoa	Energy Efficient Lighting in Residential, Commercial and Government Sectors	No information adequate for ascertaining project status has been made available to this evaluation.	NA
29	**Energy Efficient Lighting in Public Sector**	Tonga	Energy Efficient Lighting in Residential,	No information adequate for ascertaining project status has been made available to this	NA

Code	Project Name	Country	Type	Status of Completion	M&V
	Buildings, Tonga		Commercial and Government Sectors	evaluation.	
30	**Energy Efficient Lighting for Provincial, Local Public Sector and School Buildings in Vanuatu**	Vanuatu	Energy Efficient Lighting in Residential, Commercial and Government Sectors	Some of the sites covered by this project were visited. However, the majority of the sites (a total of 40) under this project were not visited due to time and logisticis constraints. Detailed information on the inventory of the buildings covered by this project and building-specific EE lighting installation and operation has not been made available to this evaluation to ascertain project status.	NA
31	**Residential Energy Efficient Lighting in Tongatapu, Tonga**	Tonga	Energy Efficient Lighting in Residential, Commercial and Government Sectors	No information adequate for ascertaining project status has been made available to this evaluation.	NA
32	**Energy Efficient Street Lighting Project in Residential Streets of Alotau**	PNG	Energy Efficient Street Lighting Program	Based on information provided by PNG Power Completion: June 2015 Change from design: Minor (unit capacity of installed LED luminaire is 32 Watts, instead of 30 Watts as designed) Energy saving: No data available.	No
33	**Energy Efficient Lighting for Port Moresby General Hospital**	PNG	Energy Efficient Lighting in Residential, Commercial and Government Sectors	Based on information provided by PNG Power Completion: February 2016 Change from design: Project location changed from Port Moresby General Hospital to Alotau	No

Code	Project Name	Country	Type	Status of Completion	M&V
				General Hospital. No change to number and models of installed luminaires as compared to original design. Energy saving: No data available.	
34	**Energy Efficient Lighting and Ventilation at Science Faculty Building (Science 1), University of PNG**	PNG	Energy Efficient Lighting in Residential, Commercial and Government Sectors	Based on information provided by PNG Power Completion: June 2015 Change from design: No Energy saving: No data available.	No
35	**Solar Water Heaters for Rarotonga Hospital, Cook Islands**	Cook Islands	Implementation of EE Measures in the Public Sector	No information adequate for ascertaining project status has been made available to this evaluation.	NA

The costs and benefits of the 34 EE projects are summarised in Table 3. On aggregate, the projects, if developed and operated as designed, will deliver the benefits of annual energy savings of 3,411MWh and annual CO_2 emission reductions of 3,204 tCO_2e.

However, in the absence of M&V activities for the majority of the 34 EE projects as aforementioned, there are substantial uncertainties associated with the extent to which the estimated energy savings and CO_2 emission reductions from these projects can be achieved in reality.

Table 3: Summary of Costs and Benefits of 34 EE Projects Implemented under PEEP-2 in the Five Participating PMDCs

Country	Budget cost (USD)	Actual Contract Price (USD)	Incremental Cost (USD)	Annual Energy Savings (kWh/yr)	Annual Energy Cost Savings (USD/yr)	Annual Diesel Savings (litres/yr)	Annual CO_2 Savings (tCO_2e/yr)
Cook Islands	671,100	616,582	-54,518	525,223	321,285	153,312	471
PNG	470,325	316,978	-153,347	428,384	122,494	108,190	685
Samoa	528,567	349,895	-178,672	953,681	350,024	250,987	762
Tonga	478,250	261,478	-216,772	638,924	232,021	109,973	582
Vanuatu	578,240	311,950	-266,290	864,595	433,098	249,001	706
All+	56,590	55,599	-991	-	-	-	-
Total	2,783,072	1,912,481	-870,591	3,410,807	1,458,922	871,463	3,204

+Note: This refers to a lamp waste management project implemented in all five PDMCs.

A major observation is the significantly downscaled implementation of EE projects under this component. The original design was aimed at implementing "national-scale" EE programs and projects in the five participating PDMCs as explicitly documented in ADB RETA report and GEF CEO Endorsement Document. Accordingly, the specific performance targets and indicators defined in the Design and Monitoring Framework included: (a) 50% of all public street lighting upgraded using LED or HPS technology; (b) 90% of incandescent bulbs installed in the residential lighting sector replaced with CFLs; and (c) reduction in monthly energy consumption of major public and commercial buildings by 10%. Apparently there is a significant gap between "national-scale" and the scale of the implemented EE projects in each of the five participating PDMCs, therefore leading to these established performance targets and indicators not being fully accomplished.

Consequently, in terms of the benefits of climate change mitigation attributable to Component 3, the estimated annual CO_2 emission reductions of the 34 EE projects implemented in reality are far less than the expected direct CO_2 emission reductions that Component 3 was originally forecasted to deliver as elaborated in the GEF CEO

Endorsement Document. Based on the design of "national-scale" EE programs, Component 3 was forecasted to deliver CO_2 emission reductions of 2,876 tCO_2e/year from EE street lighting, 5,976 tCO_2e/year from EE lighting in residential sector, 5,524 tCO_2e/year from EE measures in hotels and commercial sector, and 4,583 tCO_2e/year from EE measures in public buildings. These figures compare drastically with the CO_2 emission reductions of 3,204 tCO_2e/year that could be potentially delivered by the 34 EE projects actually implemented. Moreover, the latter is subject to likely downward adjustment due to the delayed project completion and incomplete M&V activities.

It is worthwhile highlighting that neither the "national-scale" EE programs nor the quantitative performance targets and indicators defined in the DMF were explicitly referred to in the TOR for the PEEP-2 consultant (IIEC).

Component 4: Public awareness and information sharing

This component was designed to include: (i) information dissemination to public and private stakeholders on the benefits of energy saving technologies and practices through public education programs, workshops, and media; and (ii) leveraging project benefits and information exchange beyond the five participating DMCs using regional workshops, innovative information and communication technologies, and knowledge products in a usable format.

Output 1: EE information dissemination through public education programs

A series of energy saving tips were printed at the back of utility bills issued by Te Aponga Uira (TAU) of Cook Islands. In PNG, a brochure with energy saving tips were produced by PNG Power Limited (PPL) for dissemination to residential customers. Similar initiatives did not materialise in Samoa, Tonga and Vanuatu. Home Energy Guides providing information on electricity costs for common electricity appliances customised to each PDMC (using applicable electricity tariffs) and energy saving tips for each electrical appliance were designed, produced and distributed. A total of 72,000 copies of the Home Energy Guides in English and local languages were produced and distributed in several public awareness-raising events.

Output 2: EE best practice and lessons shared through regional meetings, workshops and knowledge products

EE Guidelines for Hotels in the Pacific, EE Guidelines for Commercial and Public Buildings in the Public, and EE Guidelines for Street Lighting in the Pacific were developed to promote the implementation of EE measures and projects as well as energy audit training activities. The guidelines included energy management, EE measures, EE technologies, international standards, case studies, cost-benefit analysis and checklists. A total of 2,450 copies of the guidelines were produced and distributed.

Three regional workshops were held. The first and second were held in association with the Annual General Meeting of the Pacific Power Association (PPA) in Vanuatu in 2013 and Tahiti in 2014. The third was held in Samoa in March 2015 to disseminate PEEP-2 outputs and formulate policy recommendations for future promotion of EE in the Pacific.

The achievement of outcomes and outputs under each of the four project component are summarized and rated in Table 4 below.

Table 4: Achievement of Outcomes and Outputs in the GEF Project Framework of PEEP-2

Expected outcomes	Expected outputs	Status upon PEEP-2 completion (for Component 3, status as of July 2016)	Rating (HS/S/MS/MU/U/HU)
Component 1: Establishment of comprehensive database of energy use by sector and appliance type in each participating country			
Improved and continuous monitoring of energy end use data to facilitate the rigorous evaluation of EE programs and interventions	(a) Ongoing and comprehensive surveys fielded on energy end use and major energy consuming appliances (b) Database established in each country to record and regularly monitor energy consumption by sector and appliance	▪ A thorough stock-taking was performed in each PDMC to identify existing data resources and determine the scope for surveys to collect additional data. ▪ The survey approach, methodology and plan was technically sound and practically feasible and in-country survey activities were implemented effectively and efficiently. ▪ An energy end-use database was established to enable the provision of basic functions meeting the minimum requirements. However, the database is considerably simplified in respect of its major components and functionalities.	MS
Component 2: Mainstreaming of EE practices into government processes, policies, and procedures			
EE practices mainstreamed in	(a) 2.1 National EE targets	▪ A step-wise approach was taken to establish country-specific EE	S

Expected outcomes	Expected outputs	Status upon PEEP-2 completion (for Component 3, status as of July 2016)	Rating (HS/S/MS/MU/U/HU)
Government energy and environmental policies Suitable guidelines, codes, tariffs, and directives for EE developed and adopted Enhanced institutional capacity developed to harness EE opportunities in both short and long term planning horizons	incorporated into national energy policies by 2012 (b) 2.2 Sales of energy inefficient appliances suppressed through Minimum Energy Performance Standards (MEPS) & labeling programs (c) 2.3 EE of new buildings improved through simple & enforceable EE codes (d) 2.4 Delivery of training programs in energy audits and EE products and services (e) 2.5 EE service providers motivated,	targets for years 2020, 2025 and 2030 under various policy intervention scenarios. Overall, the methodology for establishing the EE targets was task-oriented, well articulated, and technically sound. The results were reasonable and relevant, and well received by the governments. ▪ The task relating to minimum energy performance standards (MEPS) was not carried out due to the Pacific Appliance Labelling and Standards (PALS) program focusing on developing regulations for MEPS for a range of electrical appliances in 11 Pacific island countries and territories, including the five PEEP-2 PDMCs. This resulted in substantial decrease of total GHG emission reductions attributable to PEEP-2. ▪ A fairly complete set of quality knowledge products relating to building sector EE technologies, best practices and rating schemes were developed towards producing a solid basis for establishing EE building codes with high relevance and applicability in the PDMCs. These include: (a) Assessment of EE technologies for the Pacific;	

Expected outcomes	Expected outputs	Status upon PEEP-2 completion (for Component 3, status as of July 2016)	Rating (HS/S/MS/MU/U/HU)
	organized and incentivized to implement EE activities	(b) International best practices for EE building codes; (c) Green hotels rating scheme; (d) Green building rating scheme; and (e) EE assessment guidelines, framework and scorecard for the Pacific islands ▪ A comprehensive energy audit training program was designed and implemented in 2013 and 2014. The training program consisted of four modules, including walk-through energy audit training, technical and financial evaluation, contracting, project management and M&V, and detailed investment-grade energy audit. Good learning outcomes were achieved. ▪ No activities relating to supporting EE service providers were carried out due to the underdeveloped market and non-existence of ESCOs in the PDMCs.	
Component 3: Implementation of national-scale EE programs in each participating country			
Increased market penetration and implementation of key EE technologies, practices and products in the residential, commercial, tourism,	(a) At least 50% of street lighting upgraded using LED or HPS technology (b) Replace all incandescent	▪ A total of 34 EE projects were developed in the five participating PDMCs. The scope of the projects covered EE street lighting, EE lighting for residential, commercial and public buildings, EE measures in hotels, and commercial, and government buildings. Whilst it was originally planned that all	MS

Expected outcomes	Expected outputs	Status upon PEEP-2 completion (for Component 3, status as of July 2016)	Rating (HS/S/MS/MU/U/HU)
government, and social sectors Implementation of national EE initiatives across all 5 participating countries, leading to material annual energy savings and GHG emission reductions	bulbs installed in the residential lighting sector with CFLs (c) Energy audits and equipment retrofits in hotels and other nonresidential private buildings (d) Energy audits and equipment retrofits in major public buildings	projects would undergo the full process of data gathering, design, procurement, installation, and monitoring and verification (M&V) during RETA implementation, significant delays in procurement and installation were encountered, resulting in most projects being completed just before or even after the completion of PEEP-2 in July 2015. Accordingly, only limited M&V activities were conducted. ▪ The 34 projects, if developed and operated as designed, will deliver the benefits of annual energy savings of 3,411MWh and annual CO2 emission reductions of 3,204 tCO2e. In the absence of M&V activities for the majority of the 34 EE projects, there are substantial uncertainties associated with the extent to which the estimated energy savings and CO2 emission reductions can be achieved in reality. ▪ This component was significantly downscaled as compared to the original design which aimed to implement "national-scale" EE programs and projects, and with respect to relevant performance targets and indicators in the DMF. The significant gap between "national-scale" and the scale of the implemented EE	

Expected outcomes	Expected outputs	Status upon PEEP-2 completion (for Component 3, status as of July 2016)	Rating (HS/S/MS/MU/U/HU)
		projects led to these established quantitative targets and indicators not being fully accomplished. Consequently, the estimated annual CO2 emission reductions of the 34 EE projects (3,204 tCO2e/year) are far less than the expected direct CO2 emission reductions that Output 3 was originally forecasted to deliver as elaborated in the GEF CEO Endorsement Document (18,959 tCO2e/year). Moreover, the former is subject to likely downward adjustment due to the delayed project completion and incomplete M&V activities.	
Component 4: Public awareness and information sharing			
Improved public awareness and understanding of EE and the benefits of energy saving policies, activities and technologies	(a) Campaign to increase awareness of EE by population and key stakeholders (b) Information on EE best-practices and lessons learned shared between countries and major stakeholders through regular regional	▪ A series of energy saving tips were printed at the back of utility bills in Cook Islands. In PNG, a brochure with energy saving tips were produced for dissemination to residential customers. Similar initiatives did not materialise in Samoa, Tonga and Vanuatu. Home Energy Guides providing information on electricity costs for common electricity appliances customised to each PDMC (using applicable electricity tariffs) and energy saving tips for each electrical appliance were designed, produced and distributed. A total of 72,000 copies of the Home Energy Guides in English and local languages were produced and distributed in several public awareness-raising events.	S

Expected outcomes	Expected outputs	Status upon PEEP-2 completion (for Component 3, status as of July 2016)	Rating (HS/S/MS/MU/U/HU)
	meetings and workshops	▪ EE Guidelines for Hotels in the Pacific, EE Guidelines for Commercial and Public Buildings in the Public, and EE Guidelines for Street Lighting in the Pacific were developed to promote the implementation of EE measures and projects as well as energy audit training activities. The guidelines included energy management, EE measures, EE technologies, international standards, case studies, cost-benefit analysis and checklists. A total of 2,450 copies of the guidelines were produced and distributed. ▪ Three regional workshops were held. The first and second were held in association with the Annual General Meeting of the Pacific Power Association (PPA) in Vanuatu in 2013 and Tahiti in 2014. The third was held in Samoa in March 2015 to dessminate PEEP-2 outputs and formulate policy recommendations for future promotion of EE in the Pacific.	

(c) Likelihood of achieving outcomes and impacts

The mixed level of accomplishment and quality of the specific outputs under the four major components of PEEP-2, as discussed in Table 4 above, has resulted in a similarly mixed level of achievement of the specific outcomes associated with each component. Following a causal pathway, the extent to which the component-level

outcomes have been achieved has directly determined the likelihood of the PEEP-2 program-level outcomes being achieved.

For **component 1,** it was observed that substantial gap existed between the original design concept and the actually developed database in respect of major components and functionalities. Moreover, the database has no longer been updated and also subject to the risk of being inaccessible due to outstanding renewal fees for domain name and host service registration since the completion of PEEP-2 in 2015. These factors compromised the component-level outcome in terms of the continuity of monitoring of energy end use data and the rigor and robustness of evaluation of EE-related programs and interventions. Therefore, due to this moderate shortcoming in effectiveness, the attainment of the anticipated outcome of component 1 is rated moderately satisfactory (MS).

Component 2 had three component-level outcomes. The general recognition of the established national EE targets by all five PDMCs and specific concrete actions of incorporating the targets into national energy policies or roadmaps by some PDMCs contributed significantly to the achievement of the outcome relating to mainstreaming EE practices in government energy and environmental policies and that relating to enhanced institutional capacity to harness EE opportunities in both short and long term planning horizons. However, the non-delivery of outputs relating to MEPS and labeling programs and ESCO sector development as a result of cancellation of relevant tasks and activities had moderate adverse impact on the these two outcomes in terms of effectiveness. Another outcome of component 2, which was regarding developing and adopting suitable guidelines, codes, tariffs and directives for EE, is considered to have been achieved in a highly satisfactory manner on account of the successful delivery of the relevant output. The scope of work, specific activities, and final deliverables can be fairly assessed to have well achieved the objectives, and arguably exceeded what could be reasonably expected as one of the five outputs under component 2. The deliverables, in the form of a series of quality knowledge products, were technically complementary and collectively contributed to preparing a solid ground for establishing EE building codes with high relevance and applicability in the PEEP-2 countries. This particular outcome is considered a major strength and highlight of PEEP-2.

Overall, the attainment of the three anticipated outcomes of component 2 is rated satisfactory (S) across the criteria of relevance, effectiveness and efficiency.

Component 3 was significant downscaled during the implementation of PEEP-2, from the originally designed national-scale EE programs to pilot-scale EE programs consisting of a total of 34 projects in the five PDMCs. Inevitably, the significant change in scale of implementation has led to the quantitative targets and indicators established under this component not being accomplished for the most part. As a result, the anticipated outcomes in respect of (a) increased market penetration and implementation of key EE technologies, practices and products in relevant sectors, and

(b) material annual energy savings and GHG emission reductions have only been achieved on a partial basis. Therefore, due to these moderate shortcomings in effectiveness and efficiency, the attainment of the anticipated outcomes of component 3 is rated moderately satisfactory (MS).

Tasks and activities focusing on EE information dissemination and public awareness raising under **component 4** were carried out successfully. The successful delivery of expected outputs and deliverables has translated into the satisfactory achievement of anticipated outcome. Public awareness and understanding of EE and the benefits of energy saving policies, activities and technologies have been improved in the five participating countries of PEEP-2 and other PDMCs, on account of the implementation of component 4. Therefore, the attainment of the outcome of component 4 is rated satisfactory (S) across the criteria of relevance, effectiveness and efficiency.

Collectively, the above component-level outcomes have contributed to facilitating the achievement of the anticipated PEEP-2 program-level outcome, which was designed to be end consumers using power efficiently in the participating countries. The 34 projects implemented under component 3 as direct beneficiaries of PEEP-2 use power more efficiently than the pre-PEEP-2 scenario, as evidenced by monitoring data of some projects as well as stakeholder interviews conducted by the evaluator. Public awareness raising activities carried out under component 4 are also believed to have positive impacts on behavioural change of end consumers. The roles from components 1 and 2 are also important, but would take a long time to manifest.

However, it shall be pointed out that the tangibility level of achievement of this anticipated PEEP-2 program-level outcome would have been significantly enhanced if the component 3 of PEEP-2 had been implemented at "national-scale" as originally designed. Moreover, due to the downscaling of component 3, the time-bound quantitative performance targets and indicators attached to this outcome are most unlikely to have been achieved. As explicitly defined in ADB DMF for PEEP-2, they included, by 31 March 2015, (i) average monthly power consumption of residential customers reduced by 10% relative to baseline of 125kWh/month, (ii) average monthly power consumption of commercial customers reduced by 10%, and (iii) average monthly power consumption in public buildings reduced by 10%. As no data and information relating to sectoral power consumption in the participating countries was made available to the evaluator despite multiple requests, it was not possible to undertake further evaluation on the historical development trajectories of these indicators and the extent to which their changes could be attributable to PEEP-2.

Apart from the above-mentioned major outcome, PEEP-2 was also anticipated to achieve a series of additional outcomes and objectives, including (a) reduced energy intensity of the economies in question, (b) enhanced energy security, (c) reduced GHG emissions from the power sector, and (d) greater affordability of energy services for consumers. In principle, it can be argued that the implementation of PEEP-2 did play

a role across these aspects in the five participating countries. However, the inherent complexity and quantifiability of these high-level outcomes/objectives and the availability of data and information required for a thorough study has made it technically difficult to assess the actual contributions made by PEEP-2 to these objectives in the five countries.

In summary, the effectiveness and efficiency of PEEP-2 achieving its program-level outcomes is considered to be a moderate shortcoming of the program. Therefore the rating is moderately satisfactory (MS).

(d) Assessment of progress to impact

PEEP-2's expected impact was a reduction in fossil fuel use by the power sector without a corresponding reduction in energy services in the five participating countries. This was expected to be substantiated by quantitative performance targets and indicators to be achieved by end of 2018, including (i) reduction in fossil fuel imports used for power generation by 10% relative to projected growth (2008 baseline of 135 million liters per year), (ii) total energy savings from the power sector of the participating countries of 45,000 MWh/year, and (iii) GHG emission reductions from the power sector of the participating countries of 30,000 tCO2e/year.

These time-bound quantitative performance targets and indicators were established based on the original design of PEEP-2 featuring national-scale EE programs in each of the five participating countries. Inevitably the downscaling of PEEP-2 implementation will lead to underachievement of these targets and indicators.

However, considering the long-term nature of the expected impact, the attainment of some intermediate state between PEEP-2 completion in 2015 and the achievement of the expected impact over long term (most likely beyond 2018) would serve as a reasonable evidential indication of the project following a logical causal pathway and progressing towards achieving its expected impact in the future. The PEEP-2 program-level outcomes and the component-level outcomes that have been achieved upon the completion of PEEP-2 in 2015 as observed by this evaluation can logically establish the intermediate state, which is characterised by, inter alia, strengthened commitment in promoting EE of government agencies and stakeholders, EE mainstreamed into national energy strategies and policies, enhanced institutional capacity to harness EE opportunities, demonstration effects of the pilot EE projects, and improved public awareness and understanding of EE technologies, products and benefits. These intermediate attainments are considered as being integral to the causal pathway through which the long-term impact is expected to take place.

4. Assessment of Global Environmental Benefits (GEBs) and Catalytic Role

Global environmental benefits (GEBs)

As per original project design, PEEP-2 was expected to deliver GEBs in the climate change mitigation focal area directly through implementation of EE programs and projects as part of PEEP-2 as well as energy efficiency investments leveraged as a result of PEEP-2 during the supervised implementation period of PEEP-2 and indirectly through the created enabling environment for EE practices and investments. On aggregate, annual GHG emission reductions totalling to 42,851 tCO_2 (30,720 tCO2 directly, and 12,131 tCO_2 indirectly) were expected to be achieved by PEEP-2.

The actual GEBs as a result of PEEP-2 implementation has been significantly less than the original expectation. A major reason has been the cancellation of MEPS related activities originally planned under component 2. The introduction and enforcement of MEPS for imported appliances was expected to contribute the most significant GHG emission reductions amongst all outputs of PEEP-2 (11,758 tCO_2e/year). Another major reason has been the downscaling of component 3 of PEEP-2, from national-scale to pilot-scale EE programs comprising only 34 projects in the five countries. The downscaling has led directly to the significant decrease of GHG emission reductions on account of component 3. The originally forecasted amount was a total of 18,959 tCO_2e/year from all outputs under component 3, whereas the updated amount decreased to 3,204 tCO_2e/year. Moreover, the updated amount is subject to likely downward adjustment due to the delayed project completion and incomplete M&V activities.

Catalytic role

Notwithstanding the substantially downscaled GEB, it can be observed that the implementation of PEEP-2 has played a strong catalytic role and also generated important multiplication effects as expected. Output 3 under Component 2 of PEEP-2 was aimed at improving energy efficiency best practices for newly built residential, commercial, and government buildings, including the establishment of simple, effective, and enforceable energy efficiency provisions in building codes for new buildings. Extensive activities were undertaken under this output to develop a fairly comprehensive set of technically complementary deliverables of high quality, which collectively contributed to preparing a solid ground and creating an enabling environment to catalyse the development of EE building codes with high relevance and applicability in the context of the five PDMCs. Additionally, the Output 4 under Component 2, namely the delivery of training programs in energy audits and EE products and services, was instrumental in achieving the catalytic role of PEEP-2 from the perspective of institutional strengthening and sectoral capacity building. The 34 EE

projects under Component 3 have offered significant demonstration effects in the five PDMCs. The experience gained and lessons learned from designing, developing and implementing these projects will provide valuable reference for future programs aiming to replicate and scale up EE activities in relevant sectors in the Pacific region.

Key lessons related to the achievement of GEBs

At TA conceptualization and design stage, a holistic and in-depth background study and stakeholder consultation should be undertaken to the extent reasonable to ensure the value and relevance of major components of a TA. Regional initiatives and programs on similar themes and areas carried out by other agencies prior to or in parallel with a proposed TA should be identified and assessed to avoid unnecessary overlapping or repetition and thus increase efficiency, effectiveness, and sustainability. Proposed TA tasks and activities should be critically evaluated and justified before finalization, so as to ensure their relevance and value.

Performance targets and indicators in a DMF should be carefully designed to be realistic and achievable within the scope and timeframe of a TA. Particular care must be taken when it comes to establishing quantitative targets and indicators. To avoid over-commitment, expected deliverables and outputs should be commensurate with defined inputs and should consider country/region specific circumstances relating to enabling policy and regulatory framework, institutional setup and capacity, market conditions and technology penetration.

The detailed tasks and requirements in the TOR for consultants should be clear and aligned with the TA report and GEF document, and where appropriate should make explicit reference to performance targets and indicators. Moreover, consultants' proposed approach and methodology should be critically evaluated in the course of ADB evaluating submitted technical proposals.

5. GEF Tracking Tools

The Tracking Tool for Climate Change Mitigation Projects (for Terminal Evaluation) for PEEP-2 is presented in Table 5. Whilst all qualitative indicators can be evaluated based on PEEP-2 specific information and relevant background information in the participating countries, most quantitative indicators for GHG emission reductions can not be quantified with realistic and reasonable assumptions and accuracy. Quantitative indicator specific description and explanation is given below.

- **Lifetime energy saved.** The majority of the 34 EE projects implemented under component 3 of PEEP2 did not undergo monitoring and verification process at the end of PEEP-2 in mid-2015. Whist this terminal evaluation was able to collect up-to-date project-specific information through site visits and stakeholder

consultations conducted in July and August 2016 and follow-up information requests, there remains a substantial shortage of detailed and verifiable information on project installation and operation that prevents energy savings from being estimated and evaluated with reasonable confidence level.

- **Lifetime direct GHG emissions avoided.** The direct GHG emissions avoided are defined as a function of the energy saved from the EE projects and the applicable CO_2 intensity of the marginal technology (or grid emission factor). Since the energy savings can not be quantified, the direct GHG emissions avoided cannot be quantified, accordingly.

- **Lifetime direct post-project GHG emissions avoided.** PEEP-2 involved no GEF-supported financing facilities or mechanism to support direct investments after PEEP-2 completion, such as EE revolving funds, partial credit guarantee facilities, or risk mitigation facilities. Therefore, no benefits of direct post-project GHG emissions avoided will accrue from PEEP-2.

- **Lifetime indirect GHG emissions avoided (bottom-up).** The indirect GHG emissions avoided (bottom-up) are defined as a function of the estimate for direct and direct post-project GHG emissions avoided and the applicable replication factor. Since the direct GHG emissions avoided cannot be quantified in this case, the indirect GHG emissions avoided (bottom-up) cannot be quantified, accordingly. Moreover, the determination of relevant and justifiable replication factors for the five participating countries of PEEP-2 would require systematic research into the specific policy and regulatory frameworks and market conditions of the countries.

- **Lifetime indirect GHG emissions avoided (top-down).** The top-down approach for quantifying indirect GHG emissions avoided involves multiplying the total market potential for GHG emission reductions by a causality factor. The market potential combines technical and economic market potential for relevant EE technologies within the post-project influence period after the closure of PEEP-2. The causality factors is the percentage of a realised market potential that can be reasonably attributed to the long-term effects of PEEP-2 as the result of overcoming market barriers. The determination of both parameters would require systematic research into the specific policy and regulatory frameworks and market conditions of the five participating countries.

Table 5: GEF Tracking Tool for Climate Change Mitigation Projects (for Terminal Evaluation) for PEEP-2

General Data	Results at Terminal Evaluation	Notes
Project Title	Promoting Energy Efficiency in the Pacific	
GEF ID	3641	
Agency Project ID	44099	
Country	Cook Islands, Samoa, Tonga, Vanuatu, (Papua New Guinea)	
Region	EAP	
GEF Agency	Asian Development Bank	
Date of Council/CEO Approval	February 10, 2011	
GEF Grant (US$)	5,254,545	
Date of submission of the tracking tool	September 25, 2016	
Is the project consistent with the priorities identified in National Communications, Technology Needs Assessment, or other Enabling Activities under the UNFCCC?	1	Yes = 1, No = 0
Is the project linked to carbon finance?	0	Yes = 1, No = 0
Cumulative cofinancing realized (US$)	3,500,000	
Cumulative additional resources mobilized (US$)	-	additional resources means beyond the cofinancing committed at CEO endorsement

Objective 2: Energy Efficiency		
Please specify if the project targets any of the following areas		
Lighting	1	Yes = 1, No = 0
Appliances (white goods)	0	Yes = 1, No = 0
Equipment	1	Yes = 1, No = 0
Cook stoves	0	Yes = 1, No = 0

Existing building	1	Yes = 1, No = 0
New building	1	Yes = 1, No = 0
Industrial processes	0	Yes = 1, No = 0
Synergy with phase-out of ozone depleting substances	0	Yes = 1, No = 0
Other (please specify)		
Policy and regulatory framework	2	0: not an objective/component 1: no policy/regulation/strategy in place 2: policy/regulation/strategy discussed and proposed 3: policy/regulation/strategy proposed but not adopted 4: policy/regulation/strategy adopted but not enforced 5: policy/regulation/strategy enforced
Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds)	0	0: not an objective/component 1: no facility in place 2: facilities discussed and proposed 3: facilities proposed but not operationalized/funded 4: facilities operationalized/funded but have no demand 5: facilities operationalized/funded and have sufficient demand
Capacity building	4	0: not an objective/component 1: no capacity built 2: information disseminated/awareness raised 3: training delivered 4: institutional/human capacity strengthened 5: institutional/human capacity utilized and sustained
Lifetime energy saved	Cannot be quantified	MJ (Million Joule, IEA unit converter: http://www.iea.org/stats/unit.asp) Fuel savings should be converted to energy savings by using the net calorific value of the specific fuel.

		End-use electricity savings should be converted to energy savings by using the conversion factor for the specific supply and distribution system. These energy savings are then totaled over the respective lifetime of the investments.
Lifetime direct GHG emissions avoided	Cannot be quantified	tonnes CO_2e
Lifetime direct post-project GHG emissions avoided	0	tonnes CO_2e
Lifetime indirect GHG emissions avoided (bottom-up)	Cannot be quantified	tonnes CO_2e
Lifetime indirect GHG emissions avoided (top-down)	Cannot be quantified	tonnes CO_2e

6. Sustainability

This sections aims to provide a brief assessment on the sustainability of PEEP-2 outcomes, which is understood as the likelihood of continued benefits after the completion of PEEP-2 in 2015. Due to the substantial uncertainties involved, the emphasis of the assessment is placed upon the analysis of the risks that are likely to affect the persistence of PEEP-2 outcomes.

Financial risks. The evaluation has identified financial risks that may jeopardize the sustainability of some key outcomes of PEEP-2. As originally expected, the energy use database as a key outcome of PEEP-2 was supposed to be updated and improved on an on-going basis even after PEEP-2 completion. However, the current situation is that even the website hosting the database itself is subject to the risk of being inaccessible due to outstanding renewal fees for domain name and host service registration since the completion of PEEP-2 in 2015, let alone the updates of the database. Unavoidably this will compromise the continuity of monitoring and reporting energy end use data and the robustness of baseline establishment used for future EE-related programs and interventions in the countries in question. Similarly, as reported in preceding sections of this evaluation, a major share of the 34 EE projects implemented under PEEP-2 did not undergo any post-installation operation M&V. Lack of financial support has been the key reason. This has created significant risks and uncertainties about the extent to which the project-level outcomes (energy savings and GHG emission reductions) and program-level outcomes (demonstration effects and market transformation) can be achieved and sustained in reality.

In general, while loans, revolving fund, and risk-sharing facilities for catalysing commercial lending have proven to be effective tools to promote EE market

development in many developing countries, they are not considered the most relevant and effective in the current specific circumstances in the PEEP-2 participating countries and other ones in the Pacific. Instead, financing in the form of grant or technical assistance from donor agencies such as GEF and ADB will remain being more appropriate and efficient to support EE promotion activities over the short to medium term. However, as the case of PEEP-2, the heavy reliance on the grant from donor agencies and limited counterpart funding from governments are very likely to place the sustainability of a project's outcomes and benefits in jeopardy.

Socio-political risks. Strong political commitment from the governments and ownership and support from relevant stakeholders in the participating DMCs were amongst the key assumptions during PEEP-2 conceptualization and design. During the implementation of PEEP-2, such expected commitment and ownership was consistently in place and could be regarded as having been a major success factor to the timely delivery of a series of outputs and outcomes of realistically expected quality in the context of the participating countries. Reciprocally, the implementation of PEEP-2 contributed significantly to reinforcing the political commitment and stakeholder ownership. The long-term objectives and impacts of PEEP-2, which are beneficial to the whole society, are well understood and supported by the public sector, private sector and the general public in the countries. The reinforced commitment and ownership is essential to carrying out follow-on programs and activities that will build on the outcomes and outputs of PEEP-2 towards improving the enabling environment for promoting EE and achieving the high-level long-term objectives. Therefore, the potential effect of socio-political risks to the sustainability of PEEP-2 outcomes is assessed to be low.

Institutional framework and governance risks. In general the implementation of PEEP-2 has played a strong catalytic role in facilitating the improvement of the participating countries' institutional arrangements and policy and regulatory frameworks that govern the strategic development of clean energy and climate change mitigation related planning, programming, financing and implementations. The improved institutional setup and governance capacity will contribute significantly to mitigating the risks associated with sustaining project outcomes and benefits over mid to long term. However, the above-mentioned shortcomings in PEEP-2 outcomes, particularly in terms of energy use database and the downscaled EE programs, are clearly indicative of the necessity to strengthen government capacity, accountability and transparency in managing and implementing grant-based initiatives and programs.

Environmental risks. As a program dedicated to promoting EE, PEEP-2 is not subject to direct environmental risks to the sustainability of its outcomes. However, if more EE lighting and air-conditioning projects will be carried out towards achieving national-scale implementation, the large amount of replaced lamps and air-conditioners may pose serious environmental risks and must be handled properly. In particular,

refrigerant from air-conditioners must be disposed of properly to avoid leakage causing climate impacts.

7. M&E Framework and Institutional Arrangements

M&E design. The Request for GEF CEO Endorsement/Approval Document provided a budgeted M&E plan to monitor PEEP-2 implementation results and track progress towards achieving objectives. The M&E plan was designed to comprise a series of specific time-bound activities, including inception workshop and report (within first two months of project start), project implementation report (PIR, annually), periodic status/progress reports (quarterly), mid-term evaluation (at the mid-point of project implementation), final evaluation (at least three months before the end of project implementation), project terminal report (at least three months before the end of project implementation), and measurement of project results (mid and end of project and annually when required). However, no adequate details on baseline, SMART indicators and data analysis systems were provided by the M&E plan.

M&E plan implementation. It can be verified that the inception report, interim report and quarterly progress reports were prepared by IIEC, and annual PIRs were prepared by ADB as planned. As key components of the M&E system, these documents collectively facilitated timely tracking of project implementation progress towards delivering designed outputs and deliverables and achieving expected outcomes and provided the basis for decision-making on necessary amendments and improvements of technical, financial and administrative aspects relating to PEEP-2 implementation performance continually throughout the implementation period.

As highlighted by the original M&E plan, particular emphasis was to be placed on involving decision-makers and other key stakeholders in project monitoring so as to be able to determine and measure energy savings and GHG emission reductions resulting from PEEP-2. And measurement of key project results relating to GHG reductions, e.g. changes in power plant fuel consumption and changes in electricity consumption for residential, commercial and public sectors, were to be undertaken. However, as observed by this evaluation, neither individual project level monitoring of installation and operation performance of the 34 EE projects implemented under PEEP-2's component 3, nor sectoral level monitoring of the key indicators of relevant sectors, was specifically carried out during the implementation period of PEEP-2.

The most critical observation is that the downscaling of component 3 from national scale to pilot scale, which has had a significantly adverse impact on the outputs and outcomes of PEEP-2 (particularly the GEBs), was not found to have been documented in any of the above-mentioned M&E reports. This is considered a major shortcoming of the quality of M&E plan implementation of PEEP-2.

Budgeting and funding for M&E activities. The M&E plan outlined in the Request for GEF CEO Endorsement/Approval Document provided information on budgeting, funding, and responsibility for specific M&E activities. The inception workshop and report was sufficiently budgeted for at planning stage and funded adequately and timely during implementation. No budgets were specifically earmarked to support the production of the quarterly progress reports by IIEC and annual PIRs by ADB. As for the measurement of project results, since no activities were carried out, it is not applicable to assess the adequacy of the original budget (USD 50,000) and the timeliness of disbursement during implementation.

Monitoring of future Impact. Given the fact that the majority of the 34 EE projects developed under PEEP-2 were not monitored at the end of PEEP-2, it is considered necessary to implement a dedicated monitoring and verification program to ascertain the installation and operational performance. This will enable an objective and reasonably accurate assessment on the actual level of output delivery and outcome achievement of component 3, particularly the quantitative indicators relating to energy savings and GHG emission reductions. It is also recommended to monitor the implementation results and assess the impacts of the Pacific Appliance Labelling and Standards (PALS) program. The existence of PALS caused the cancellation of MEPS under component 2, which was originally expected to contribute a significant share of the total GEBs that PEEP-2 could deliver.

Annex A to Supplementary Appendix

Project Identification and Project Data

I. Project Identification

GEF Project ID: 3641
GEF Agency Project ID:44099
Countries: Cook Islands, Samoa, Tonga, Vanuatu
Project Title: Promoting Energy Efficiency in the Pacific
GEF Agency: Asian Development Bank (ADB)

II. Dates

Milestone	Expected Date	Actual Date
CEO endorsement		10/02/2011
Agency approval date	03/2011	31/03/2011
Implementation start	06/2012	06/11/2011
Midterm evaluation	06/2013	
Project completion	06/2015	23/10/2015
Terminal evaluation completion		30/09/2016
Project closing	06/2015	23/10/2015

Expected dates are as per the expectations at the point of CEO endorsement/approval.

III. Project Framework

Project Component	Activity type (TA or INV)	GEF financing ($)		Co-financing ($)	
		Approved	Actual	Promised	Actual
1. Establishment of comprehensive database of energy use by sector and appliance type in each participating country	TA	220,000		355,500	

Project Component	Activity type (TA or INV)	GEF financing ($)		Co-financing ($)	
		Approved	Actual	Promised	Actual
2. Mainstreaming of EE practices into government processes, policies, and procedures	TA	894,000		1,123,500	
3. Implementation of national-scale EE programs in each participating country	INV, TA	3,400,000		4,393,000	
4. Public awareness and information sharing	TA	292,000		379,000	
5. Project management	TA	448,545		666,000	
Total		**5,254,545**		**6,917,000**	

Activity types are investment (INV) or technical assistance (TA).
Promised co-financing refers to the amount indicated at the point of CEO endorsement/ approval.

IV. Co-financing

Source of co-financing	Type	Project Preparation ($)		Project Implementation ($)		Total ($)	
		Expected	Actual	Expected	Actual	Expected	Actual
Governments of Cook Islands, Samoa, Tonga and Vanuatu	**In-kind**			1,797,000		1,797,000	
Power Utilities	**In-kind & cash**			1,620,000		1,620,000	
ADB	**Cash**			1,500,000		1,500,000	
Government of Australia	**Cash**			1,000,000		1,000,000	

Government of Japan	**Cash**			1,000,000		1,000,000	
Private Sector							
NGO							
Other							
Total co-financing				**6,917,000**		**6,917,000**	

Expected amounts are those submitted by the GEF Agencies in the original project appraisal document.

Co-financing types are grant, soft loan, hard loan, guarantee, in kind, or cash.

Annex B to Supplementary Appendix

Project Results Framework

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
Impact Reduction in fossil fuel use by the power sector without a corresponding reduction in energy services in the participating countries	**By end 2018:** Reduction in fossil fuel imports used for power generation by 10% relative to 2008 baseline of 135 million liters per year Total energy savings from the power sector of the participating countries of 45,000 MWh per year GHG emission reductions from the power sector of the participating countries of 30,000 tCO_2e per year	Annual national statistics and economic publications Power utility annual reports Surveys of monthly power bills and utility billing system	**Assumptions** • Stable macroeconomic conditions in the participating countries • Technology mix for power generation remains stable • Strong commitment from PDMC governments • Strong stakeholder support from public and private sector **Risks** • Insufficient capacity in IA to sustain EE initiatives over time • Governments slow to implement effective regulation • Lack of data and difficulty in establishing accurate baseline
Outcome End consumers use power efficiently in the participating countries	**By 31 March 2015:** Average monthly power consumption by residential customers reduced by 10% relative to baseline of 125 kWh/month Average monthly power consumption by commercial customers reduced by 10% Average monthly power consumption by public buildings reduced by 10%	National budget reports & statistical publications National EE roadmap implementation progress reports Power utility reports Surveys of monthly power bills and utility billing system	**Assumptions** • Rational power pricing is sustained and enhanced • Affordable EE equipment and appliances are available in the local market • Private sector is willing to invest in EE **Risks** • Low enforcement capacity • Few local partners participate • Energy inefficient appliances continue to be imported from overseas and sold locally
Outputs 1. Stakeholders have access to comprehensive information on energy use by sector and appliance	**By 31 March 2013:** Comprehensive database of major energy consuming equipment and appliances exists in each participating country	Appliance, equipment and awareness survey Customs and Excise import data records National census data Statistical data generated by sector and household surveys	**Assumptions** • Strong commitment and willingness of government to participate in the initiative and to establish effective regulation • Adequate human and financial resources are made available • Close coordination with other development partners • Necessary local skills are available to supervise and implement initiatives • Strong involvement from power utilities and private sector stakeholders

2. EE practices have been mainstreamed into government processes, procedures and policies in the participating countries	**By 31 March 2013**: National EE targets incorporated into national energy policies Schemes to reduce importation of low EE equipment and appliances adopted in the 4 countries EE building codes for residential, commercial & public buildings established	National energy policy documents and government policy decisions National legislative documents National building codes and regulations Syllabus of EE courses developed and given to the private sector and local technical institutes	• Capacity within government to enforce EE reforms **Risks** • Reforms are delayed by legislative process • Political support is weak • Elections bring new government(s) with different priorities • Counterpart funding gap • Lack of energy audit and associated EE service capacity • The process of providing subsidies and/or grants for EE initiatives is subject to manipulation or corruption by local stakeholders
3. EE programs implemented effectively and sustainably in each participating country	**By 31 March 2015**: 50% of all public street lighting upgraded using LED or HPS technology All incandescent bulbs installed in the residential lighting sector replaced with CFLs Reduction in monthly energy consumption of major public and commercial buildings by 10%	Project managing contractor reports Economic analysis reports (demand, least-cost, benefit) of individual EE programs Annual household appliance surveys Power utility reports Global Environment Facility mid-term review report	
4. Information on EE has been shared and public awareness of the benefits of energy saving has improved	**By 31 March 2015**: At least 50% of population aware of EE initiative and benefits of energy conservation	Public awareness survey data and published materials Regional workshops presentations and attendees list	
5. Effective project management has been established	**By 31 March 2015**: Program of activities implemented on time and to budget	Minutes of Steering Committee Global Environment Facility mid-term review report Annual work plans and quarterly progress reports	
Activities with Milestones 1.1. Carry out detailed survey of energy consumption, duration of use, and life expectancy for each major energy consuming equipment and appliance type by Feb 2012 1.2. Establish a database of energy use by sector for major equipment and appliance			**Inputs** • ADB: $1,000,000 • Governments: $1,797,000 • Global Environment Facility:

types in each country by end Apr 2012 1.3. Hold raining on database development and management in each country by Apr 2012 1.4. Ensure the database is sufficiently robust to assist with determining energy baselines by Oct 2012 1.5. Build survey capacity and ensure database and survey data is updated and kept relevant by Apr 2013 2.1. Initial drafts of EE policies and targets prepared by Oct 2012 2.2. Initial drafts of appliance EE schemes, EE components of building codes, and EE fiscal legislation prepared by Oct 2012 2.3. Implementation and enforcement of appliance EE schemes from Apr 2013 2.4. Implementation and enforcement of EE in building codes from Apr 2013 2.5. Preparation and establishment of a training program for energy auditors and EE specialists in each country by Oct 2012 2.6. Enabling legislation regarding EE passed by governments and enacted by Apr 2013 3.1. Preliminary design of national scale EE programs (residential EE lighting; street lighting; commercial/public building sector) in each country by Apr 2012 3.2. Finalization of EE bidding documents by Jul 2012 3.3. Tendering and evaluation of EE bids by Oct 2012 3.4. Finalization of procurement, shipment, and inspection of EE lighting products by Apr 2013 3.5. Roll-out of energy efficient lamps and installation between Apr 2013 and Apr 2014 3.6. Energy audits performed on major public and commercial buildings by Apr 2013 3.7. Agreement with building owners and implementation of recommendations from energy audits between Apr 2013 and Apr 2015 3.8. Assessment of eligibility of EE programs and activities for CDM by Apr 2013 4.1. Launch of public awareness campaign by Apr 2012 4.2. Information dissemination and advertising in local media between Apr 2012 and Apr 2013 4.3. Development of ICT program to facilitate regional workshops to exchange information on EE best-practice and lessons learned between countries by Apr 2013 4.4. Conduct regional workshops for results dissemination and to share project benefits with all PDMCs 5.1. Establishment of Steering Committee with representatives from ADB and a regional entity from the Pacific by Apr 2011 5.2. International team leader/technical expert and national program coordinator appointed by Jul 2011 5.3. International advisor and national energy efficiency manager appointed in each country by Oct 2011 5.4. Program management and administrations systems established and functioning by Oct 2011 5.5. Review background material (TA-6485, government statistics, and power utility records to build a picture of energy consumption by sector by Oct 2011 5.6. Inception workshop held in each country by Feb 2012 5.7. Establishment of an energy efficiency function within all 4 IAs and training program for personnel devised by Apr 2012 5.8. Develop an "ideal" scenario for each country and perform a gap analysis to identify the necessary steps required by Apr 2012 5.9. Annual work plans and quarterly progress reports provided on time 5.10. Annual reviews of performance and agreements for managerial changes 5.11. TA completion report prepared by Apr 2015	\$5,254,545 • Government of Australia: \$1,000,000 • Government of Japan: \$1,500,000 • Power utilities: \$1,620,000 • 196.5 person-months of international consulting services and 313 months of national consulting services from individual consultants directly engaged by ADB

Annex C to Supplementary Appendix

Cost Estimates and Financing Plan
($'000)

Item	ADB* Amount	ADB* %	Government of Australia[b] Amount	Government of Australia[b] %	GEF[c] Amount	GEF[c] %	Total Amount
A. ADB, Government of Australia, and GEF[d]							
1. Consultants							
a. Remuneration and per diem							
i. International consultants (159 person-months)	523.0	16	523.0	16	2,101.5	68	3,147.5
ii. National consultants (265 person-months)	180.0	13	180.0	13	988.0	74	1,348.0
b. International and local travel	62.0	24	62.0	24	136.0	52	260.0
c. Reports and communications	20.0	26	20.0	26	35.0	48	75.0
2. Equipment	155.0	8	155.0	8	1,690.0	84	2,000.0
3. Workshops, training, seminars, and conferences	0.0	0	0.0	0	80.0	100	80.0
4. Surveys	0.0	0	0.0	0	80.0	100	80.0
5. Miscellaneous administration and support costs	10.0	16	10.0	16	40.0	68	60.0
6. Contingencies	50.0	25	50.0	25	104.0	50	204.0
Subtotal (A)	**1,000.0**	**14**	**1,000.0**	**14**	**5,254.5**	**72**	**7,254.5**
B. Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility[e]							
1. Consultants							
a. Remuneration and per diem							
i. International consultants (32 person-months)							630.0
ii. National consultants (48 person-months)							310.0
b. International and local travel							50.0
2. Equipment							370.0
3. Workshops, training, seminars, and conferences							40.0
4. Contingencies							100.0
Subtotal (B)							**1,500.0**
C. Government and Power Utility Financing[f]							
1. Office accommodation and transport							500.0
2. Remuneration and per diem of counterpart staff							700.0
3. Equipment							1,100.0
4. Workshops, training, seminars, and conferences							300.0
5. Surveys and studies							300.0
6. Miscellaneous administration and support costs[g]							350.0
7. Contingencies							417.0
Subtotal (C)							**3,667.0**
Total (A+B+C)							**12,421.5**

ADB = Asian Development Bank, GEF = Global Environment Facility.

* Financed by ADB's Technical Assistance Special Fund (TASF-IV).

[b] Financed through the Memorandum of Understanding on Channel Financing (Technical Assistance Program) between the Government of Australia (Pacific Region Infrastructure Facility) and the Asian Development Bank. Administered by the Asian Development Bank.

[c] Administered by the Asian Development Bank.

[d] To be disbursed on a cost-sharing basis.

[e] Established by the Government of Japan, and administered by the Asian Development Bank on a parallel, untied basis. The funds will pay for the cost of TA implementation in Papua New Guinea.

[f] Relates to in-kind contributions from governments and power utilities (all government-owned except for UNELCO in Vanuatu). Contributions are substantiated by letters of support and will be made in the form of in-kind parallel contributions. Governments will provide the following contributions: Cook Islands, $250,000; Papua New Guinea, $250,000; Samoa, $1,047,000; Tonga, $250,000; and Vanuatu, $250,000; the power utilities will contribute $1,620,000.

[g] Includes support staff costs, communication and transport costs, public awareness campaigns, reports, publications, and knowledge products.

Source: Asian Development Bank estimates.