



**Asia-Pacific
Economic Cooperation**

**APEC 21st Century Renewable Energy Development
Initiative (Collaborative VIII):**

**Information Sharing on Financing Public Sector Energy
Efficiency & Renewable Energy Projects**

Expert Group on New and Renewable Energy Technologies

Expert Group on Energy Efficiency & Conservation

APEC Energy Working Group

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The views expressed in the report are those of its authors and do not necessarily reflect the views of other individuals and other agencies.

1. ABOUT THE PROJECT

1.1 Project Overview

In recent years, the APEC Energy Working Group (EWG) has supported a number of projects under the Collaborative of the 21st Century Renewable Energy Development Initiative. Several APEC initiatives and reports, such as “Developing Market Capacity to Commercialize Financing of Clean and More Efficient Energy Projects”, “Sustainable Financing System for Energy Efficiency”, and the “Guidebook for Financing New and Renewable Energy Projects”, have been influential in bridging or narrowing the large gap between the investment community and Energy Efficiency and Renewable Energy (EE&RE) project developers. Several past projects have been extremely successful in laying the foundations and the related infrastructure for the harmonization of renewable energy standards. In addition, public and private organizations are gaining considerable experience on energy efficiency and renewable energy finance through other APEC sponsored projects. However, much of this information on best practices, model language and key lessons learned has not yet been effectively compiled, documented, and shared with key stakeholders and decision-makers among the APEC member economies.

The project on *Information Sharing on Financing Public Sector Energy Efficiency (EE) & Renewable Energy (RE) Projects* is an ideal follow on to the previous projects, and it aims to lay a strong foundation for long-term sustainability of the region’s energy efficiency and renewable energy industry by *producing an Initial Project Finance Information Sharing System* that could be used to help reduce cost and effort needed to obtain essential information on project financing within member economies. The intended beneficiaries of this project are both the APEC government agencies and the private sector companies whose knowledge and awareness of energy efficiency and renewable energy financing options will be enhanced by the use of “standardized technologies” in combination with “standardized” financing language.

The Prototype Information Sharing System comprises a collection of previously developed reports, best practices, and project financing information collected by the project team from the APEC experts. More importantly, the system allows easy addition of new information into its core data base in the future with the minimum efforts from the developers team. This report describes in detail the web-based system design, the process of the information collection for the database, and also makes recommendations to APEC for future measures to maintain and update the information system and enhance its effectiveness.

1.2 Project Implementation

The project was carried out in six phases:

Phase 1. Review Previous Energy Financing Projects and Related APEC Linkages

The Project Team review previous energy financing projects and related APEC workshops and other linkages, which included the following documents: “Developing Market Capacity to Commercialize Financing of Clean and More Efficient Energy Projects”; “Sustainable Financing

System for Energy Efficiency”; and Guidebook for Financing New and Renewable Energy Projects (1998)”. The project team prepared a report providing a summary of an initial compilation, review, synthesis of existing information on EE&RE project finance.

Phase 2. Needs Assessment

The project team prepared an information needs survey in order to identify what information is of importance to target beneficiaries, the mechanisms by which this information is sought, and what information gaps are typically identified. The survey form (see Appendix 1) was distributed to the members of all APEC economies with the help of the EGNRET and EGEEC expert groups. The response to the survey was modest, but it helped design the system elements.

Phase 3. Workshop to Review Information System Design

The project team presented the developments of the web-based information system at the Knowledge Management Panel of the Asia Clean Energy Forum in Manila Philippines in June, 2007, in accordance with the Scope of Work of the Project and based on the approval from the EWG. By using the Forum podium, the project developers delivered the information about the new portal to a broad range of the energy sector players from APEC economies and received their feedback on the system design and information content.

The presentation explained the project background and objectives, addressed basic concept and system design issues, and discussed the expected outcomes of the project. The issue of the Information Needs Assessment of project developers from APEC economies was also a focus of the presentation. The report about the presentation and the discussion was submitted to EWG.

Phase 4. Develop and Launch of Initial Project Finance Information System

Drawing on the results of the previous phases, the project team produced an initial information system on public sector project financing and hosted it at the server:

<http://demo.fivevision.com/apec/>.

Phase 5. Draft Final Report

A draft report containing the main findings and recommendations on future actions was developed and provided to the review of the EGNRET and EGEEC, and project overseers. In addition, a presentation of the system was made at the meeting of EGEEC expert group. The comments from the expert group members were incorporated in the final design of the system.

Phase 6. Final Report

The final report was prepared based on the comments to the draft report and presentations. The prototype information sharing system is published at <http://demo.fivevision.com/apec/>. The next steps will include the discussions with the APEC EWG of the plan to maintain the website, collect and upload more documents to populate at the database. As an option, the website could be hosted at EWG website, or at the websites of the EWG expert groups.

2. SYSTEM DESIGN AND DEVELOPMENT

The Project Finance Information Sharing System is the primary output of the *APEC project on Information Sharing on Financing Public Sector EE&RE Projects*. The information system was designed as a web-based information system to support public sector decision-makers as well as project sponsors and developers in APEC economies to understand the relevant financing mechanisms and options and to develop the enabling policy, legislative and/or regulatory frameworks to facilitate and accelerate large-scale financing and implementation of EE&RE projects.

Given these considerations, we have constructed a relational database to store the sequence of Public Sector EE & RE Projects, Financing Mechanisms and associated information from multiple studies published to date. The information was provided by the APEC experts, and consisted of the reports, presentations, best practice case studies, as well as the information about available financing sources for public sector EE&RE projects.

2.1 System Design: Basic System Requirements

Since the Information Sharing System is required to be dynamic and simultaneously accessible from multiple locations, the web-based database is an ideal solution for the system. The web-based structure for the system is written and run by using three main open source components as follows:

- Apache Webserver – <http://www.apache.org>
- PHP – <http://www.php.net>
- MySQL Database – <http://www.mysql.com>

The information sharing system can be viewed and managed with most major web browsers including: *Internet Explorer* (version 5.5 and higher), *Netscape* and *FireFox*.

Any static contents in the Information Sharing System are created using Content Management System (CMS) software, which is simple for even non-technical users to add or edit content, upload and add images. Any user with basic word processing skills can easily learn to manage the static contents in this system.

While the information on energy efficiency and renewable energy financing can be consolidated and entered to the system by the system administrator, the users, through the system user interface, can perform category search within the predefined data categories, which include the following: (1) Type of projects; (2) Type of financing mechanisms; and (3) Economies. System users can also perform dynamic data queries in a manner similar to the other web-based systems.

2.2 System Development

2.2.1 Reviewing of Existing Information

The web-based Information Sharing System is designed and developed to provide easy-to-use interface, navigational structure, standardizing page layouts, to facilitate efficient site maintenance and to allow users to quickly locate desired information. To achieve such design and development objectives, the project team conducted reviews of existing information, documents and experience from prior public sector EE & RE projects and programs in APEC economies, as well as selected relevant non-APEC countries. Following completion the review, the project team prepared a draft working paper outlining overview of database of financing public sector EE & RE projects (Appendix 2). This draft working paper serves as a key guideline for the project team to create actual data tables in the database and to identify main data categories that would assist users to navigate the information system and retrieve data as desired. The draft working paper also summarizes a set of predefined keywords generally referenced by public sector EE&RE projects and their financing related activities.

2.2.2 Database Design and Structure

Database of the Information Sharing System is designed and developed with MySQL database management system. As it is described in the draft working paper, the two major types of data/information in the Information Sharing System include: 1) Projects, and; 2) Financing Mechanisms.

1. **Projects:** Information on each project in an economy, displays the financing mechanism, type of projects, sectors, funding sources, sponsors related to the project.
2. **Financing Mechanisms:** Information on financial mechanism relevant to public sector EE&RE projects of APEC economies.

These two types of data are designed and managed as a relational database system, in which redundancy of data is avoided, and relationships between attributes allow for complex and integrated querying of the database. In addition to the two core tables (Projects and Financing Mechanism), the database structure also consists of several related tables (see Appendix 3) that complement operations of the whole Information Sharing System.

The principle relationships between the two core tables and the logical structure of the data are: (i) each financing mechanism comprises one or many EE and/or RE projects; (ii) each project has exactly one related financing mechanism. These two core tables are associated through a predefined table as shown in Figure 2.1. The predefined table is designed to define the transactional relationship between Financial Mechanisms and Projects transaction and to assure the data entry will not be placed in redundant/ inappropriate positions. This table entry is stored as the predefined project information from Financing Mechanisms table. It includes the following information:

- Economy
- Type of Financing Mechanism
- Funding Source – Primary
- Funding Source - Other
- Type of Projects
- Sectors
- Type of Project Sponsors or Developers

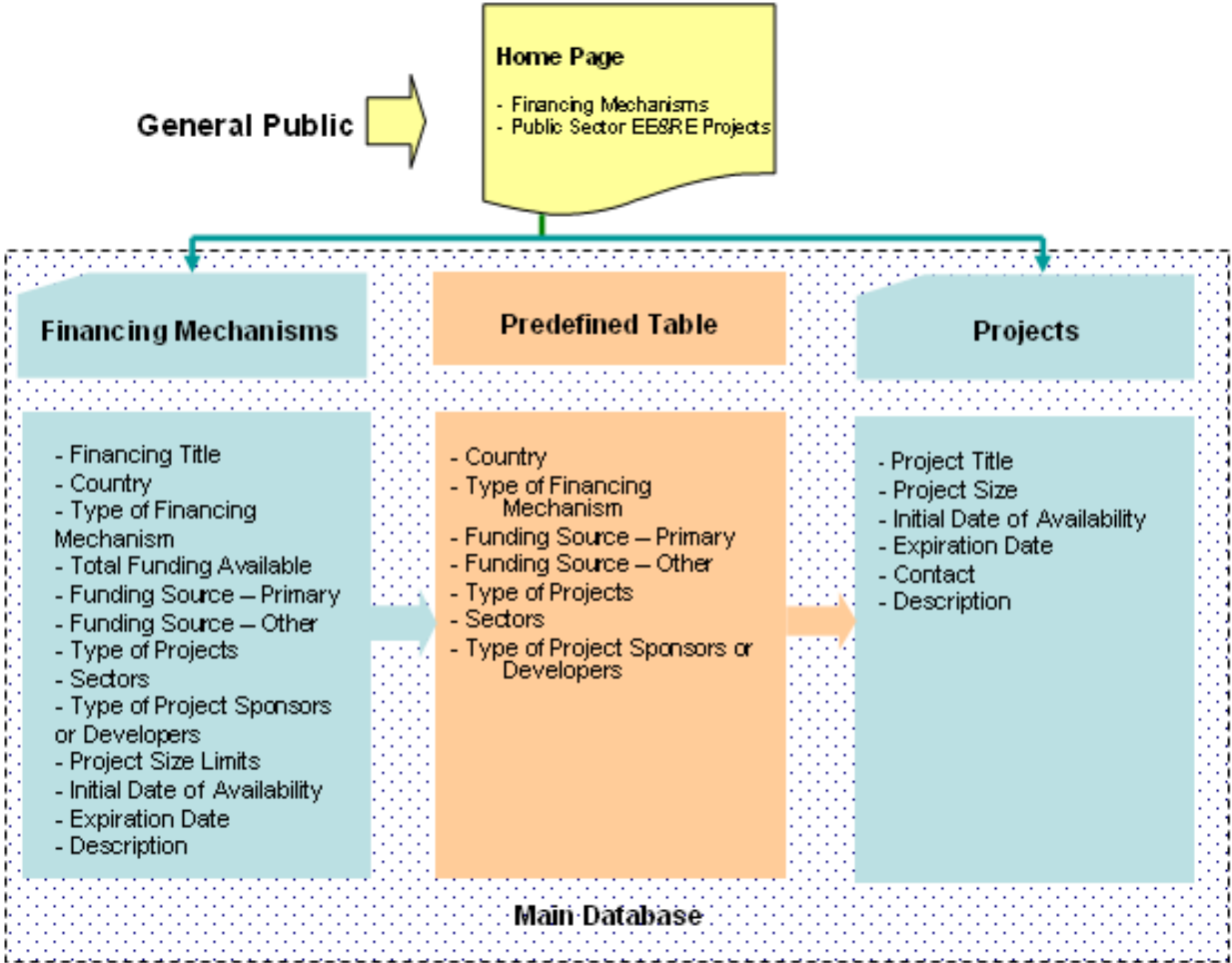


Figure 1. Schematic Diagram of the Information Sharing System Database

3. INFORMATION ACCESS AND SYSTEM MAINTENANCE CONCEPT

The complete and operational prototype of the Information Sharing System is accessible at <http://demo.fivevision.com/apec/>. The system prototype however contains only limited information on public sector EE&RE project financing that the project team compiled and enter

into the database during the development phase. Additional reports, case studies and other information can be added to the system during the next phase, in order for the prototype system to become a comprehensive website that can be used with a maximum efficiency by all APEC economies.

3.1 Information Access

Through the front-end of the system (homepage), users can browse all type of projects, financing mechanisms and Economies in the prototype of Information Sharing System via top bar menu (see Figure 3.1). On the system homepage, users can quickly glance through a list of popular keywords and click on a specific one to retrieve related as needed. Also, to find information on EE&RE projects in a single or multiple APEC economies, users can simply query the Information Sharing System via a keyword search box shown on the left pane or use the Advanced Search page which allows users to restrict their search to selected fields e.g. economies, financing mechanisms, type of projects and sectors.

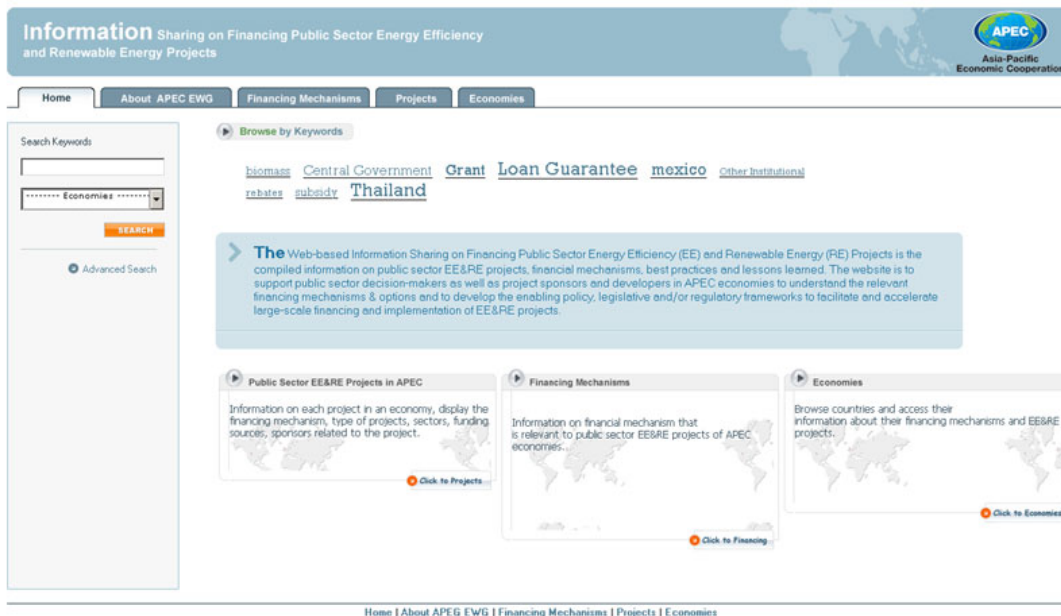


Figure 2. Front-End (Homepage) of the Information Sharing System

The bottom half of the homepage provides category searches for users and the information is divided into the similar 3 main categories as the top bar menu, i.e. types of projects, financing mechanisms and Economies.

The search keywords are formatted dynamically; their size increases or decreases depending on the frequency of the usage. It is the developers' opinion that this provides indirect feedback to the APEC about the importance of the particular issues for the project developers in various economies, as well as makes the web-page design look modern and dynamic.

Figure 3.2 below illustrates a result of a category search by project with selection of the projects in the Information Sharing System. The information in the summary table can be sorted by any column. At the same time, the structure of the data base allows for incomplete information about the projects. For example, if a project does not have information about the size of investment, it can still be entered in the data base and found through the search criteria.

Economies	Project Title	Financing Mechanism	Sector	Sponsor	Project Size
- Thailand	- High Efficiency Equipment - Dyeing Machine	Loan	- Industrial	- Central Government Agency	
- Thailand	- 2.75 MW Gas Turbine Co-generation	Loan	- Industrial	- Central Government Agency	200 million Bah
- Viet Nam	- Vietnam's Financial Analysts & Investment Appraisal Training	Grant	- Commercial	- Central Government Agency	
- India	- Morjee Mills	Grant	- Industrial	- Energy Service company	
- India	- Framework for Promoting Decentralized Biomass Based Energy Systems in South Asia	Grant	- State Government Office	- State Government Agency	\$20,028
- India	- Developing Cost-effective IT Based Energy Management Systems in Rice Mills	Grant	- Small and Medium-Sized Enterprises (SMEs)	- State Government Agency	\$18,955
- India	- Promotion of Entrepreneurship in the Renewable Energy Sub-sector in South Asia: Case of India and Bangladesh	Grant	- State Government Office	- State Government Agency	\$20,000
- Thailand	- 6MW Power Generation Using Rice Husks	Loan	- Industrial	- Central Government Agency	
- Thailand	- Two New Chillers each 150 Tons Refrigeration	Loan	- Commercial	- Central Government Agency	
- India	- Youth in Water Conservation for Energy Conservation	Grant	-	-	\$23,610

Figure 3. List of Projects - Screenshot of the Information Sharing System

3.2 System Maintenance Concept

The key challenge for any database systems is how to pursue ongoing maintenance and updating of the database system. The purpose of the system maintenance was therefore designed to provide a simple means for managing website content (CMS) for use by people with little or no training in HTML or web page design, as well as easily maintain overall integrity of the look and feel of the website while editing.

4. CONCLUSIONS AND RECOMMENDATIONS TO APEC EWG

The prototype web-based information system developed by this project can be used at this point openly by the APEC economies. It is fully functional, but the system database itself has only partially been populated with relevant financing mechanisms and options, and project information. Due to limited project resources, only limited amount of the collected information could be analyzed, indexed and entered into the data base. At the same time, another reason is difficulty to acquire detailed information related to EE and RE financing and projects in the public sector throughout the APEC economies and limited numbers of public sector EE and RE projects themselves. To support the objectives of this Information Sharing System in enabling public sector decision-makers as well as project sponsors and developers in APEC economies to

understand the development of the policy, legislative and/or regulatory frameworks to facilitate and accelerate large-scale financing and implementation of EE&RE projects, it is important for APEC to review and expand scope of this web-based system so that more data can be added and the system will become a stronger and more efficient tool. In practice, a more comprehensive set of information as well as lessons learned from both public and non-public sector case histories will be more beneficial to public sector decision-makers as well as project sponsors and developers in APEC economies than limited information on the public sector.

The major components of the next phase activities would include collecting additional documents from APEC economies relevant to the EE&RE project financing, analyzing and indexing the new and previously collected documents and entering them into the database, turning the system (website) over from the developers team to a long-term website maintenance group (unless the developers team is chosen to continue the work), training the website maintenance group, and hosting the website. The following recommendations are proposed for considerations by APEC EWG:

- 1. Organize an official release of the prototype of the web-based information system.** It is important for APEC EWG to register an official domain name for the information system and organize an official release of the prototype system to enable all APEC member economies to experience usefulness and relevance of the information system. Improvement of the information system is an ongoing process; and feedback from APEC member economies will be crucial for the upgrading the prototype.
- 2. Enhance scope of the information system to cover non-public sector and populate the system with additional information.** Given limited information on public sector EE and RE financing and project, the information system should expand its scope of information to include non-public sectors also. Considering the relevance of information, it is recommended that the priority should be given to EE and RE financing and project information in the commercial sector, focusing on the similar to public sector facilities, such as buildings, lighting systems, water supply and treatment etc.
- 3. Establish a mechanism to maintain the information system over the next 12 to 18 months.** Although the information system was designed to provide a simple means for managing website contents and maintaining overall integrity of the look and feel of the website, it still requires support from a web administrator to compile and populate the database. Hence, to overcome this key challenge in pursuing ongoing maintenance and updating of the database system, APEC EWG should establish a funding and management mechanism to support ongoing updates of the information system. The system prototype will be maintained at the current URL (<http://demo.fivevision.com/apec/>) during the next 6 months with minimum maintenance, but to properly maintain and keep information in the system up-to-date, a team of two administrators, including a web manager and an information coordinator, is required.

Appendix 1. Information Needs Assessment Form

INFORMATION NEEDS SURVEY: APEC: Information Sharing on Financing Public Sector Energy Efficiency

The Alliance to Save Energy in partnership with the International Institute for Energy Conservation (IIEC) and the Efficiency Valuation Organization (EVO) are developing a web-based Information Sharing System and Database on Financing Public Sector Energy Efficiency (EE) and Renewable Energy (RE) Projects, providing the members of APEC the information helping you make efficient decisions on project design and financing.

The Alliance to Save Energy wishes to ensure that the database we supply is complete and useful to you. **YOUR HELP IS ESSENTIAL FOR ALL FUTURE USERS OF THE SYSTEM.** By completing the survey below, you will help identify what information is of importance to target beneficiaries, the mechanisms by which this information is sought, and typical information gaps. The System Prototype is located at <http://demo.fivevision.com/apec/>. At the present time it has only a limited amount of the information, but contains all categories of documents that can be uploaded. Please take **FEW MINUTES** from your busy day to answer **NINE QUESTIONS** to help us understand how to best serve your information needs and enhance the System design.

Your Name: _____

Organization Name: _____

Your Position in Organization: _____

Organization Address: _____

Phone Number: _____

E-Mail Address: _____

APEC economy:

1. How often do you develop EE&RE projects in public sector?

___ 1 – 5 PER YEAR

___ MORE THAN 10 PER YEAR

2. How many EE&RE projects have you implemented using external financing?

of projects _____ in [economy] _____

3. What web-based resources do you use to identify relevant financing type for your EE and RE projects? _____

4. What local and international financial institutions do you consider for EE&RE projects?

5. What, in your opinion, are the most efficient financing mechanisms for EE&RE projects in public sector?

- Grant/Subsidy
- Rebate
- Royalty Financing
- Equity
- Loan
- Loan Guarantee
- Equipment lease (lease-purchase)
- Building lease (lease-purchase)
- Other (please specify)

6. Below are the categories of the information in the System. Please rate each category using the following scale:

- 5 - Very Important
- 4 - Important
- 3 - Moderately Important
- 2 - Of Little Importance
- 1 - Unimportant
- Economy (e.g. Chile, China, USA, etc.)
- Sector (e.g. Government, Municipality etc.)
- Type of Technology (e.g. Energy Efficiency, Cogeneration, Renewable etc.)
- Financing Mechanism
- Contact information
- Type of Information Resource
- Type of Facility
- Type of Project Sponsor or Developer
- Financing Source
- Project Capital Cost
- Type of Policy
- Annual Savings
- Date of Completion

What other categories would you like to include? _____

7. What other information/ types of documents would you like to see in the APEC database?

8. Please rank the qualities you value in a database (<http://demo.fivevision.com/apec/>):

- _____ Easy to access
- _____ Easy to use and navigate
- _____ Comprehensive
- _____ Good support system to answer questions
- _____ Simple

9. Additional Comments _____

**Appendix 2. Database of Financing Public Sector EE & RE Projects:
Draft Working Paper**

**DATABASE OF FINANCING PUBLIC SECTOR
ENERGY EFFICIENCY & RENEWABLE ENERGY PROJECTS**

Draft Working Paper

INTRODUCTION

A key objective of the APEC project on Information Sharing on Financing Public Sector Energy Efficiency (EE) and Renewable Energy (RE) Projects is to develop a prototype web-based information system and database that will support public sector decision-makers as well as project sponsors and developers in APEC member countries to understand the relevant financing mechanisms and options and to develop the enabling policy, legislative and/or regulatory frameworks to facilitate and accelerate large-scale financing and implementation of EE & RE projects.

The project will compile, review and document the information and experience from prior public sector EE & RE projects and programs in APEC (as well as selected relevant non-APEC) countries. Due to the wide range of such projects the database will be multi-dimensional, and the information system will have the capability to search using one or any combination of the dimensions.

This Working Paper provides preliminary information on the design of this multi-dimensional database. It is recommended that the database have two separate components - (i) a “Projects” database and (ii) a “Financing Mechanisms” database. Both are discussed below.

DIMENSIONS OF THE PROJECTS DATABASE

The following are the proposed dimensions that can be used to search the information in the Projects database:

1. Economy
2. Type of Project
3. Sector
4. Type of Project Sponsor or Developer
5. Financing Mechanism
6. Financing Source - Primary
7. Financing Sources - Other

8. Project Size
9. Date of Initiation
10. Date of Completion

Country

APEC Member Economy

- Australia
- Brunei Darussalam
- Canada
- Chile
- People's Republic of China
- China, Hong Kong
- Indonesia
- Japan
- Korea
- Malaysia
- Mexico
- New Zealand
- Papua New Guinea
- Peru
- Philippines
- Russia
- Singapore
- Chinese Taipei
- Thailand
- USA
- Viet Nam

Non-APEC Countries

Type of Project

Energy Efficiency [Multiple selection possible]

- Lighting
- Day lighting
- Motors
- Water Pumping
- Water heating
- Wastewater treatment
- HVAC
- Envelope efficiency (insulation, windows, cool roofs, etc.)
- Appliances and office equipment
- Street lighting
- Energy Management Systems
- Efficient vehicles

Renewable/Alternative Energy [Multiple selection possible]

- Solar Thermal
- Solar PV

Wind Energy
Mini-Hydro [define by kW capacity]
Micro-Hydro [define by kW capacity]
Biomass
Methane recovery [landfill or wastewater treatment]
Coal bed methane

Sector

Central Government
Office
Hospital
School
Other Institutional
State Government Office
Office
Hospital
School
Other Institutional
Municipality
Streetlights

Type of Project Sponsor or Developer

Central Government Agency
State Government Agency
Municipal government agency
Energy Service company
Equipment Manufacturer or Supplier
Other Energy Service Provider

Financing Mechanism [Multiple selection possible]

Grant
Subsidy
Equity
Loan
Commercial Terms
Subsidized (“soft loan”)
Subordinated debt
Loan Guarantee
Interest Buy-Down
Equipment lease (lease-purchase)
Building lease (lease-purchase)
Rebate
Subsidized Tariff
Other

Financing Source - Primary

Central Government Agency
State Government Agency
Energy Service company
Equipment Manufacturer or Supplier
Other Energy Service Provider
Multilateral Donor Agency
Bilateral Donor Agency
Commercial Financial Institution
Public Sector Financial Institution

Financing Sources - Other

Central Government Agency
State Government Agency
Energy Service company
Equipment Manufacturer or Supplier
Other Energy Service Provider
Multilateral Donor Agency
Bilateral Donor Agency
Commercial Financial Institution
Public Sector Financial Institution

Project Size

Total investment (US\$ and Local Currency)

Date of Initiation

Year

Date of Completion

Year

Contact: (name, org., address, phone, email)

Website

DIMENSIONS OF THE FINANCING MECHANISMS DATABASE

The following are the proposed dimensions that can be used to search the information in the Financing Mechanisms database:

1. Economy
2. Type of Financing Mechanism
3. Total Funding Available
4. Funding Source - Primary
5. Funding Sources - Other
6. Types of Projects Covered
7. Types of Sectors Covered
8. Types of Project Sponsors or Developers
9. Project Size Limits

10. Initial Date of Availability

11. Expiration Date

Economy

This field will list the countries eligible for financing: [Multiple selection possible]

APEC Member Economy

Australia

Brunei Darussalam

Canada

Chile

People's Republic of China

China, Hong Kong

Indonesia

Japan

Korea

Malaysia

Mexico

New Zealand

Papua New Guinea

Peru

Philippines

Russia

Singapore

Chinese Taipei

Thailand

USA

Viet Nam

Non-APEC Countries

Financing Mechanism

Grant

Subsidy

Equity

Loan

Commercial Terms

Subsidized ("soft loan")

Subordinated debt

Loan Guarantee

Interest Buy-Down

Rebates

Royalty Financing

Subsidized Tariffs

Total Funding Available

Less than \$10 Million

\$10 to 50 Million

\$50 to 100 Million

Over \$100 Million

Funding Source - Primary

Central Government Agency

State Government Agency

Energy Service company

Equipment Manufacturer or Supplier

Other Energy Service Provider

Multilateral Donor Agency

Bilateral Donor Agency

Commercial Financial Institution

Public Sector Financial Institution

Funding Sources - Other [Multiple selection possible]

Central Government Agency

State Government Agency

Energy Service company

Equipment Manufacturer or Supplier

Other Energy Service Provider

Multilateral Donor Agency

Bilateral Donor Agency

Commercial Financial Institution

Public Sector Financial Institution

Types of Projects Covered [Multiple selection possible]

Energy Efficiency

Lighting

Motors

Pumping

HVAC

Street lighting

Energy Management Systems

Multiple measures

Renewable Energy

Solar Thermal

Solar PV

Wind Energy

Mini-Hydro

Micro-Hydro

Biomass

Types of Sectors Covered [Multiple selection possible]

Central Government

Office

Hospital

School
Other Institutional
State Government Office
Office
Hospital
School
Other Institutional
Municipality

Streetlights

Types of Project Sponsors or Developers [Multiple selections possible]

Central Government Agency
State Government Agency
Energy Service company
Equipment Manufacturer or Supplier
Other Energy Service Provider

Eligible Project Size Limits

From \$___k to \$___k

Initial Date of Availability

Month/Year

Expiration Date

Month/Year

Contact: (name, org., address, phone, email)

Website

Appendix 3. Entity-Relationship (ER) Diagram: Public Sector EE & RE Projects Financing Database

ER Diagram : Database of financing public sector EE & RE Projects

