PD-ACA-516

The Philippines Renewable Energy Project

Final Report

Reporting Period: January 1, 1999 – September 30, 2001

A project funded by the U.S. Agency for International Development

Project Managed by the National Renewable Energy Laboratory

January, 2002

NREL
National Renewable Energy Laboratory

January 18, 2002

Rosario Calderon
Office of Environmental Management
US Agency for International Development
8th Floor, PNB Financial Center
Roxas Boulevard
1308 Pasay City, Manila, Philippines

SUBJECT: PHILIPPINES RENEWABLE ENERGY PROJECT FINAL PROGRESS REPORT

Dear Ms. Calderon,

With the conclusion of the Philippines Renewable Energy Project, we are pleased to provide this final report, and to highlight several important accomplishments of the project:

- Development of a strategic framework for DOE's role in rural electrification
- Policy reform facilitation, including legislative language, draft DOE policy documents, and policy analyses
- National renewable energy resource atlases for wind, solar, hydropower, and biomass, with data in GIS form to facilitate analysis and planning
- Capability development for economic analysis of rural electrification options, sample analyses, and national databases of input files
- Identification of priority sites and wind measurement at these sites for hybridizing diesel-powered mini-grids with wind energy

Enclosed you will find the details of these and many other accomplishments in our final progress report for the USAID – USDOE/NREL interagency agreement. This final report describes the Philippines Renewable Energy Project, including all task deliverables, exchanges, indicators and budget expenditures of the project between January 1999 and September 30, 2001. We would welcome your comments on the contents and distribution of this report. The complete report takes up two CD's: the first contains the report itself, and the second contains all of the Resource Assessments completed during the project. We have enclosed two complete sets.

The Philippines Renewable Energy Project provided valuable technical assistance to the Government of the Philippines to advance the use of renewable energy at this critical time in the Philippines energy sector. We are pleased to have contributed to this important USAID effort, and would be happy to assist further USAID's goals and the energy objectives of the Government of the Philippines.

Thank you very much for the opportunity to assist USAID/Manila's Office of Environmental Management.

Sincerely,

Roger W. Taylor

Manager, International Programs
National Renewable Energy Laboratory

enclosures: Final Report, Appendices, Trip Reports (two copies of entire report on CD)

cc: Griffin Thompson, USAID – Global w/CDs
Patricia Flanagan, USAID – Global w/CDs
Reuben Quejas, NCED w/CDs
Ron Benioff, NREL

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Table of Contents

Acronyms iii

Overview 1

Introduction to the Project 1

Project Status and Highlights 1

Contributions to USAID Performance Indicators 2

Project Summary Data 4

Task Reports 9

Task 1. Renewable Energy Market Infrastructure 10

Task 2A. Wind Farm Analysis 12

Task 2B. Diesel Mini-Grid Retrofit 14

Task 3. Biomass—Bioenergy and Combined Heat and Power 17

Task 5. Analysis of Alternatives for Rural Electrification 20

Task 6. Policy Analysis and Assistance 22

Task 7A. Technology Cooperation Agreement Pilot Project 26

Task 7B. Micro-hydro and Solar Resource Assessment 30

Task 7C. Geographic Information System for Targeting Renewable Energy Deployment in the Philippines 33

Task 8A. Management and Coordination 35

Task 8B. Capacity-Building and Training-Needs Assessment 35

Task 8C. Strategic Framework Development 36

Appendices

Trip Reports

List of Tables

Table 1. Contributions to USAID Performance Indicators for 1999 3

Table 2. USAID-brokered Exchanges 4

Table 3. Deliverables Status, September 1999–March 2000 5

Table 4. Financial Status 8

Acronym List

ADB	Asian Development Bank
AED	Alternative Energy Development
ANEC	Affiliated Non-Conventional Energy Center
BCSE	Business Council for Sustainable Energy
BEP	Barangay Electrification Program
ARD	Associates in Rural Development
CAFO	Concentrated Animal Feeding Operations
CEAIT	College of Engineering and Agro-Industrial Technology
CEPALCO	Cagayan Electric Power & Light Company
CHP	Combined Heat and Power
CIDA	Canadian International Development Agency
COP	Conference of the Parties (to the United Nations Framework Convention on Climate Change)
CPC	Community Power Corporation
CSR	Climatological Solar Radiation
DBP	Development Bank of the Philippines
DEM	Digital Elevation Model
DENR	Department of Environment and Natural Resources (Philippines)
DOE	Department of Energy (Philippines)
DOE GISD	Department of Energy's Geodata and Information Services Division
EIC	Econergy International Corporation
EO	Executive Order
EPIR	Electricity Power Industry Restructuring
ER	Energy Regulation
ERAP	Energy Resources for the Alleviation of Poverty
ESMAP	Energy Sector Management Assistance Program
FAO	Food and Agriculture Organization
FCCC	Framework Convention on Climate Change
FFHC	First Farmers Holding Company
GIS	Geographic Information System
GOP	Government of the Philippines
HNEI	Hawaii Natural Energy Institute
HOMER	Hybrid Optimization Model for Electric Renewables
IACCC	Inter-Agency Committee on Climate Change
IRP	Integrated Resource Planning
IRR	Implementing Rules and Regulations
LPG	Liquefied Petroleum Gas
MERALCO	Manila Electric Company

NAMRIA	National Mapping and Resource Information Authority
NAPC	National Anti-Poverty Commission
NCED	Non-Conventional Energy Division
NEA	National Electrification Administration
NFA	National Food Authority
NGO	NonGovernmental Organization
NIA	National Irrigation Authority
NPC	National Power Corporation
NPS	Northern Power System
NRE	New and Renewable Energy
NREL	National Renewable Energy Laboratory (U.S.)
OTEC	Ocean Thermal Energy Conversion
PALECO	Palawan Electric Cooperative
PAGASA	Philippine Atmospheric, Geophysical, and Astronomical Services Administration
PEI	Preferred Energy, Inc.
PNOC	Philippines National Oil Company
PREP	Philippines Renewable Energy Project
REAP	Renewable Energy Association of the Philippines
REAP-C	Resource-Efficient Agricultural Production
REC	Rural Electric Cooperative
RESCOs	Rural Energy Service Companies
RFA	Rapid Field Appraisal
RPM	Regional Planning Model
RPS	Renewables Portfolio Standard
RWEDP	Regional Wood Energy Development Program
SIBAT	Wellspring of Science and Technology (Sibol ng Agham at Teknolohiya)
SO5	Strategic Objective 5
SOW	Statement of Work
SPUG	Strategic Power Utilities Group
SRC	Sugar Regulatory Commission
TCAPP	Technology Cooperation Agreements Pilot Project
TOR	Terms of Reference
TRMM	Tropical Rainfall Measurement Mission
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
UPLB	University of the Philippines Los Baños
USAID	U.S. Agency for International Development
US-AEP	U.S.-Asian Environmental Partnership
USDOD	U.S. Department of Defense
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
VICMICO	Victorian Milling Company
ViPOR	Village Power Optimization Model for Rural Electrification

Overview

Introduction to the Project

Through the Philippines Renewable Energy Project (PREP), the United States Agency for International Development (USAID) funded technical assistance to the Government of the Philippines (GOP), under the management of the National Renewable Energy Laboratory (NREL), during January 1999 - September 2001. This is the final, cumulative report for the project.

NREL is a U.S. Department of Energy (USDOE) national laboratory that specializes in renewable energy and energy efficiency research and development. NREL has provided support to countries throughout the world to use renewable energy technologies for rural economic development.

NREL's technical assistance project supported the analysis, development, implementation, and evaluation of the USAID/Manila Mission's Climate Change Mitigation program, with emphasis on renewable energy activities. This assistance was provided within the framework of USAID/Manila's support to the GOP on Strategic Objective 5 (SO5), "Climate Change Mitigation," and also supported achievement of the goals and objectives of the GOP's Inter-Agency Committee on Climate Change (IACCC). Specifically, it supported reductions in the use of fossil-fuel-based energy through cleaner fuel technologies and/or increased efficiency in energy generation, transmission, and/or distribution. NREL's technical assistance simultaneously supported the GOP's poverty alleviation efforts by identifying opportunities for renewable energy to be used to contribute to economic development.

The purpose of SO5 is to reduce the growth of emissions of greenhouse gases in the Philippines through the development of appropriate policies and regulations, and improved access to information and technology, that encourage the use of cleaner fuels and energy efficiency measures in the power sector. Renewable energy is a key component of the program, and has been identified by the GOP as a priority activity as the nation enters the 21st century. In this regard, the GOP's draft "National Action Plan on Climate Change" (November, 1997:1) states that "the first recommendation of this paper...is to shift the energy mix away from fossil fuels towards renewables." This is an activity of the highest priority.

Overall guidance and management of this assistance was provided by USAID's Office of Environmental Management and the SO5 Executive Committee. They worked with NREL to assure that these activities directly support SO5's performance indicators and results targets. At the same time, this assistance responded to evolving GOP needs and capabilities, which were important given the changes in GOP administrations during the project period, and changes in the electric sector. Most of the assistance was complete by December 31, 2000, with final conclusion of all tasks by September 30, 2001.

Project Highlights

The Philippines Renewable Energy Project completed important deliverables that are being used in the Philippines and built capabilities in the Philippines through collaborations with GOP counterparts and other groups that are active in Philippines energy issues.

Throughout the project, NREL task leaders worked closely with counterparts in the Non-Conventional Energy Division (NCED) of the Philippines Department of Energy (DOE), Strategic Power Utilities Group (SPUG) of the National Power Corporation (NPC), and the National Electrification Administration (NEA). Together with these GOP counterparts, the Project engaged the Philippines private sector, nongovernmental organizations (NGOs), and academic institutions in using the products of the various tasks and developing capabilities.

NREL's technical assistance contributed significant deliverables that aid the Philippines' renewable energy development efforts. From the project overall, some of the most important deliverables from NREL technical assistance include:

- A strategic framework for DOE's role in rural electrification (Tasks 1, 6, and 8C)
- Policy reform facilitation, including legislative language, draft DOE policy documents, and policy analyses (Tasks 2A, 2B, 6, and 7A)
- National renewable energy resource atlases for wind, solar, hydropower, and biomass, with data in GIS form to facilitate analysis and planning (Tasks 3, 7B, and 7C)
- Capability development for economic analysis of rural electrification options, sample analyses, and national databases of input files (Task 5)
- Identification of priority sites and wind measurement at these sites for hybridizing diesel-powered mini-grids with wind energy (Task 2B)
- Development and application of a screening process for wind farm sites (Task 2A)
- Opportunities for business investment identified and promoted, especially for wind/diesel hybrids, solar-powered agricultural water pumping, and mini-hydropower (Tasks 1 and 7A)

The Task Reports in the rest of this report will describe these highlights and accomplishments of the project in greater detail.

Contribution to USAID Performance Indicators

NREL contributed to major USAID performance indicators during 1999 and 2000. Achievements included contributions to policy goals, cleaner fuel goals, capacity building tools, and USAID-brokered exchanges. The results for both years are summarized in the following tables, and the specific reports on USAID performance indicators are provided in the previous progress reports.

Table 1. Contributions to USAID Performance Indicators, 1999 - 2000

Performance Indicator	Accomplishments	Contribution from NREL Tasks
Policy Goals for 1999		
Restructuring and privatization	Contributed to work of other AID contractors on restructuring and privatization	Task 6
Executive Order	Completed implementation of Executive Order 232	Task 6 Task 7a
Departmental Circular	Completed implementation of Departmental Circular on Energy Regulation 1-95	Task 6 Task 7a
Policy Goals for 2000		
Legislation Promoting NRE	Provided legislative language for promotion of NRE for NRE Bill and to inform debate on electric sector reform	Task 6
Sustainable Deployment of NRE	Developed strategic framework for sustainable pathways for NRE deployment	
Climate Negotiations on Technology Transfer	Technology transfer decision at COP6.5 in July 2001 favored market development and private investment	Task 7a
Cleaner Fuel	0.005 MW	All Tasks
Capacity Building Tools	Total capacity building tool implementation for the project included 121 points, each representing one tool per utility or government agency per year, exceeding the target of 67 points.	All Tasks
USAID-brokered Exchanges	Total exchanges for the project achieved 40, which exceeded the target of 35.	All Tasks

Table 2. USAID-brokered Exchanges (January 1, 1999 – September 30, 2001)

Personnel	Dates	Accomplishments
Paul Galen	11/30-12/16/98	Held 19 meetings with key electricity sector players
Pat Keegan	12/14-18/99	DOE agreed engage in "fast track" policy reform to improve rural renewable energy markets.
Kevin Rackstraw	2/20-27/1999	(subcontractor for Task 2a) Wind farm site preliminary screening; Technical cooperation with international wind development efforts of USAID, World Bank, Winrock, DOE
Paul Galen	2/26-3/26/99	Analysis of policy environment of the electric industry in the Philippines
Peter Lilienthal	2/27-3/12/99	Demonstrated NREL's Village Power Planning software (HOMER, ViPOR, and the Regional Planning Model) and planned future training activities
Pat Keegan	3/1-11/99	Follow through on the previous policy reform recommendations developed for the DOE.
Dennis Elliott	3/5-16/99	Facilitated and accelerated the large-scale use of wind energy technologies through wind mapping. Assisted in identifying potential sites for large wind farm applications and locations of remote diesel networks with the potential for retrofitting using wind technologies
Larry Flowers	3/6-16/99	Completed wind resource scouting tour with PNOC. Discussed sites and resource estimates for wind/diesel retrofits and wind farm applications with NPC. Discussed NREL's wind resource mapping results at workshop; discussed them with USAID, Winrock, and Philippines organizations.
Ron White	3/8-19/99	Held internal workshop for DOE. Assessed opportunities to work with RECs and ANECs for market development. Provided a linkage between a US-based firm and a provincial government that is highly likely to result in a private investment on the order of $1.0 million.
Liz Brady	3/20-31/99	Established collaborative relationships with local GIS data holders and local experts.
Laura Vimmerstedt	3/22-4/4/99	Addressed issues on work planning, information collection, management and coordination in support of all tasks
Dave Renne	4/9-21/99	Organized the Micro-Hydro/Solar resource subtasks.
Ralph Overend	4/13-24/99	Held meetings to discuss Biomass resource assessment and the availability of indigenous biomass conversion technologies.
Ralph Overend	6/5-16/99	Worked on the Wood Fuel Situation in the Philippines. Attended World Bank Workshop.
Jerome Weingart	6/12-20/99	(subcontractor for Task 1)Trip and associated workshop engaged public sector and private sector leaders in discussions to assist policy development and renewable energy programs to expand renewable energy markets.
Ron White	6/13-26/99	Conducted market analysis and market development work. Participated in a World Bank consultation/workshop. Met and conferred with Provincal officials, USAID representatives, and local private sector firms with respect to the productive uses (i.e. other than illumination) of renewable-generated electricity.
Laura Vimmerstedt	6/13-20/99	Consulted with Philippines counterparts / clients on next steps for the TCAPP and the Philippines Renewable Energy Project, TCAPP Fast-Track Actions recommendations, and TCAPP work plan.
Roberto del Rosario; Ponciano Payuyo	6/18/99	Initial model training at NREL for representatives from two agencies, NEA (del Rosario) and PALECO (Payuyo). (Travel funding for these representatives not from NREL budget.)
Paul Galen	6/21-8/2/99	Follow-up on implementation of Fast-Track policy recommendations. Provided assistance to NCED regarding their Barangay Electrification Planning. Assisted DOE on electric power industry restructuring matters.
Ron White	10/21-11/10/99	Evaluated existing market research and conducted interviews with the

		Philippine Renewable Energy Industry, began draft report on constraints to industry growth, explored joint-venture and investment opportunities.
Paul Galen	10/29-12/21/99	Held several meetings with DOE, USAID/Manila, PNOC, NPC, and PEI.[1] Focused on policy related tasks and GIS.
Peter Lilienthal	11/2-24/99	Held training workshops on NREL's Village Power Planning Models.
Liz Brady	11/3-23/99	Provided training, gathered information in support of the GIS subtask to assist in opening up markets for renewable energy in the Philippines.
Tony DeCastro	11/29/99	Meetings with CPC-Shell[2] (follow-on to Ron White introduction). Meetings with NREL experts on fuel cells, PV testing and standards, crop drying, and hybrid systems. Meetings with USDOE, USEPA[3], and USDOD[4] on the Energy and Environmental Security Initiative.
Laura Vimmerstedt	1/8-22/00	Arranged specific investment actions that the TCAPP will use to advance renewable energy development in the Philippines.
Ron White	2/6-25/00	Conducted market analysis and market development work.
Ron White	3/31-4/19/00	Conducted market analysis and market development work. Discussed strategic framework for rural electrification with renewables.
Roger Samson	4/1-17/00	Identifed challenges and opportunities to enhance biomass energy development.
Ralph Overend	4/15-26/00	Briefed P-DOE on progress to-date; continued gathering information on the sugar industry and Dendrothermal Program of the 1930s; worked on rural electrification issues; met with Univ. of Philippines, Los Banos subcontractor.
Laura Vimmerstedt	06/10-23/00	Reviewed specific plans for TCAPP work with DOE and AID/Manila during next ten months. Agreed on next steps for DOE and DA decision on pilot program for PV-powered water pumping. Planned hydropower market-development actions. Identified possible steps to advance diesel/wind hybrids for isolated grids.
Ralph Overend	06/18-29/00	Met with officials of PDOE, Preferred Energy Inc., and Development Academy of the Philippines on GIS biomass survey. Participated in Philippines-Hawaii Energy Efficiency and Renewable Energy Meeting in Cebu.
Ian Baring-Gould	09/03-09/00	Advanced analysis of wind hybridization of SPUG diesels and explored issues for decision-makers at NPC and NEA regarding such hybridization.
Ralph Overend	09/10-16/00	Provided technical support to Biomass Policy Workshop organized by US-AEP and others to establish a coordination mechanism for biomass development in the Philippines.
Laura Vimmerstedt	09/17-29/00	PREP indicators and wrap-up. Gathered information during two workshops related to planning for World Bank lending. Discussed with USAID/Manila implementing a renewable energy strategy for rural electrification.
David Renne	10/22-29/00	Conducted a solar resource assessment workshop to review draft final report of the solar resource assessment developed for the Philippines. Conducted a micro-hydro resource assessment workshop obtaining stakeholder feedback.
Ian Baring-Gould	11/25-30/00	Prime presenter at Technical Training Seminar on wind/diesel hybrid power systems sponsored by NREL TCAPP and hosted by Philippines NEA, PDOE, and NPC of the Philippines.
Laura Vimmerstedt	03/10-17/01	Met with cooperators in Manila to take next steps on TCAPP investment actions. Discussed how future TCAPP work can best complement and support overall work program of USAID/Manila.
Timothy McCoy	04/16-25/01	Global Energy Concepts (GEC) met with stakeholders to tailor and streamline the site screening criteria for the Philippines, and visited 6 sites in Luzon to apply screening criteria.
Kevin Smith	04/16-25/01	Global Energy Concepts (GEC) met with stakeholders to tailor and streamline the site screening criteria for the Philippines, and visited 6 sites in Luzon to apply screening criteria.

Ian Baring-Gould	05/15-26/01	Keynote speaker at the Renewable energy and Rural Electrification Workshop held by USEA and USAID and sponsored by PDOE, USAID, and NEA. Discussed with NPC, PDOE, and USAID about renewable technologies for diesel retrofit projects.

Project Summary Data

Table 3, below, summarizes outcomes for major project deliverables and milestones. Table 4 provides a financial summary. The Task Reports section provides greater detail, and the Appendices provide copies of the documentation of the deliverables and milestones.

Table 3. Deliverables Summary

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
1	D1- Capacity Building: Initialization Workshop Report	1	Completed 3/1/99. Developed renewable energy market assessment capabilities.	Background Materials for NCED Internal Workshop (paper copy)	
1	*World Bank Presentation	1	Completed 6/24/99. Informed World Bank project development process.	Addressing Market Barriers to Renewable Energy Commercialization	624Barriersr2.ppt
1	D5- Capacity Building on Value Chain Analysis	1	Completed 6/17/99. Developed value chain analysis capabilities.	Renewable Energy Market Infrastructure, Value Chain Workshop; Summary of Value Chain Workshop	D5attach.ppt; Deliverable5.rtf
1	D2 – Market Analysis Plan (revised deliverable)	3	Completed 7/9/00. Recommended approaches for analysis of off-grid renewable energy applications.	Market Analysis for Off-Grid Renewable Energy: An Approach to Better Analysis	Deliv2.rtf
1	D3- Rapid Field Appraisal Assistance	1	Completed 10/25/99. Supported use of field data to improve electrification program design.	Assistance in the design and conduct of a Rapid Field Appraisal to support deployment of Solar Home Systems in Unelectrified Barangays	Deliverable3.rtf
1	D6 - Value Chain Analysis	3	Completed 4/18/00. Documented value chain concept and Value Chain Workshop.	Photovoltaic Value Chain Analysis	Deliv6.rtf
1	D4 Report on market		Cancelled		

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
	distortions				
1	D7 & D8 - Draft and Final description of value-chain constraints		Cancelled		
1	D9 – Recommendations for market development based on Value Chain Analysis		Cancelled		
1	D10 & D11 - Summary of discussions: investments and needed analysis	2	Completed 2/21/00. Identified potential for shallow tubewells, rural energy services, and photovoltaic module assembly and public investment that could contribute to attracting private investment	Summary Discussions: Investments and Needed Analysis	Deliverable10.rtf
1	D12 & D13 - Summary of discussions with lenders	2	Completed 3/1/00. Assessed the issues in matching renewable energy projects with lenders	Summary of Discussions with Lenders	Deliverable12.rtf
1	D14 – Letter reports on financing and joint ventures		Cancelled		
1	* Lecture and associated materials on sustainability	3	Completed 6/15/00. Responded to USAID request for tutorial to define the concept of sustainability.	Sustainability: Measurements and Approaches	Sustainability.rtf
2A	Wind-Specific Policy Brief	3	Completed 3/8/01. Assessed policy issues for grid-connected wind farms.	Appendix A, Philippine Wind Farm Analysis and Site Selection Analysis	AppendixAed-1.rtf
2A	Site Screening Results	3	Completed 8/28/01. Evaluated six sites for wind farm potential.	Philippine Wind Farm Analysis and Site Selection Analysis	Final_Task2A_30934ed-1.rtf; AppendixAed-1.rtf; Appendix B.rtf; AppendixC.rtf; AppendixD.rtf
2A	Wind Farm Investment Opportunity Project Description	1	Completed 3/5/99. Assessed opportunity for wind farm project development.	Philippines Wind Farm Project Scoping Analysis	PHILNREL.rtf

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
2A	World Bank Presentation	1	Completed 6/24/99. Informed World Bank project of wind farm potential.	Philippines Wind Farm Project Scoping Analysis (presentation)	Philippines WB Slides.ppt
2B	Identify Candidate Diesel Mini-grids for Analysis	1	Completed 3/1/99. Selected best mini-grids for hybridization with wind generation.	Status Report, NPC/SPUG	PhilAID 9-99 report.rtf
2B	Installation of Anemometers at Selected Sites	3	Completed 7/2000. Installed anemometers and collected 1 year of wind data at each of 12 sites.	NPC/NREL/USAID anemometer for the islands program: Status Report	9-month review of sites.doc
2B	Analysis of Retrofit Economics		Cancelled.		
2B	Presentation of Results and Recommendations		Cancelled.		
2B	Draft Project Report		Cancelled		
2B	*Assessment and Processing of Anemometer Data	3	Completed 5/2001. Assisted SPUG in processing and assessing data that they collected from the installed anemometer stations.	Description of Arrangements between NREL and NPC-SPUG regarding Wind Data; Clarification of wind speed monitoring issues; NPC/NREL/USAID anemometer for the islands program: Status Report	Contractual arraignments between NREL and NPC.doc; Clarification of wind speed monitoring issues.doc; 9-month review of sites.doc
2B	*Additional Data Collection Equipment and Spare Parts	3	Completed 7/21/00. Modified the contract with NRG to provide more data collection equipment and spare parts.	No cost modification to Contract AAM-0-30202-01 for NRG Systems Inc	NRG Philippines MOD-00.doc

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
2B	*Policy Analysis for Diesel Retrofits	3	Completed 12/2000. Developed policy statements on issues important to diesel retrofit projects.	Issues for the use of wind with large diesel based power systems in the Philippines; The effects of Renewable Energy Penetration and Spinning Reserve on Power Grids: Summary memo prepared for Paul Galen	Concepts for large wind diesel based power systems final.doc; Effects of RE and Spinning Reserve on Power Grids.doc
2B		3			DOEmeeting5_17_01.doc
2B		3			PhilMay_01report.doc
2B		3			PREP Task 2b final assessment.doc
3	Intermediate Report on GIS Database		Completed 12/2000. Developed GIS data of biomass resources.	Biomass Energy Resource Atlas of the Philippines	see CD-ROM "Resource Assessments"
3	World Bank Presentation	1	Completed 6/24/99. Informed World Bank project of biomass / bioenergy potential.	Biomass and Bioenergy in the Philippines	WBPh6-24.ppt
3	Final report on biomass and bioenergy potentials.	3	Completed 9/25/01. Quantified biomass and bioenergy resource base and identified priority uses to promote economic development	Strategies for Enhancing Biomass Energy Utilization in the Philippines	FinalRpt092501.rtf
4	Assessment of Economically Feasible Ocean Energy Technologies		Cancelled.		

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
5	Main Training in Manila	2 / 3	Completed 11/30/99. Trained government, industry, NGO, and academic representatives on use of computer models for rural electrification options evaluation.		PR2_Trng_par.rtf; PR3_Trainings in Philippines.doc

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
5	Initial Training at NREL	1	Completed 6/18/99. Trained Philippines analysts on HOMER tool.	*HOMER Training;* HOMER Training Manual	draft2.ppt; HOMERManual5.rtf
5	Interim Report on Data Analysis	3	Completed 8/28/01. Completed internet-published sample analysis of Sicud, Palawan, and HOMER input files of Philippines solar and wind resource data.	Sicud; Luzon, Visayas, and Mindanao Solar Resource Data; Philippines Wind Data	HOMER Sample Files (folder); HOMER Resource Files (folder) (also may be downloaded from http://www.nrel.gov/international/tools/homer/download.html)
5		1			HOMERManual5.rtf
5		2			Task5 correspondence.rtf
6	Draft Report on the Policy Environment: Before and After	1	Partially completed September 1999. The "Before" version of the Report on the Policy Environment was a chapter of the ESMAP report. "After" portion cancelled.	Institutional and Policy Framework for Renewable Energy Technologies	11_Chap3fin.rtf See PR3_ESMAPAll
6	Fast Track Recommendations (filed with Task 7A)	1	Completed 3/16/99. Identified high-priority policy changes.	Proposed Fast-Track Actions to Promote Renewable Energy Development	Pei38a2.rtf
6	Fast Track Next Steps (filed with Task 7A)	1	Completed 3/24/99. Identified steps to make high-priority policy changes.	Outcome of March 16, 1999 Meeting with Secretary of Energy Tiaoqui on Fast Track Action Recommendations, Executive Summary: Proposed Fast Track Actions To Promote Renewable Energy	FTFllwup.rtf; FTFpsum.rtf

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
6	*Presentation to Legislators	1	Completed 3/12/99. Presented renewable energy policy issues to Philippines legislators.	Universal Levy/Renewable Technology Application	01_Subic1.ppt
6	Comments on NRE Bills (Omnibus Bill is a separate item, below)	1	Completed 12/17/98. Commented on draft NRE bills.	Summary of NREL Comments of Draft DOE NRE Bill; Comments on the Philippines DOE Proposed Renewable Energy Bill	02_Nresum1.rtf; 03_Philcomts.rtf
6	*Revision of Draft NRE Bill	1	Completed 4/2/99. Provided draft language for NRE Bill.	House Bill 4329	04_Nrebill4.rtf
6	Comments on Electric Power Industry Restructuring Act – September 1, 1999 Version (Successor Bill to the Omnibus Bill)	1	Completed 9/23/99. Commented on draft bill.	Initial Thoughts on Administration's Proposed Omnibus Electricity Bill HB 4579; Comments of Russell Profozich, Office of International Policy, U.S. DOE, and Paul S. Galen, Senior Policy Analyst, International Programs, U.S. DOE / NREL	05_Omnibus1.rtf
6	Paper on RPS Concept	1	Completed 2/11/99. Introduced Renewable Portfolio Standard concept.	Thoughts on Purpose and Design of a Renewables Portfolio Standard (RPS) for the Philippines	07_PhilRPS1.rtf

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
6	Report on RPS	1	Completed 6/1/99. Summarized RPS issues for the Philippines.	Implementation Issues and Benefits of Adopting a Renewable Portfolio Standard in the Philippines *(Discussion Paper and Summary);* Appendix A: Guide to Designing a Renewable Portfolio Standard Policy	08_Summfin.rtf; 09_Rpsfin.rtf 10_Appendix.rtf
6	Report on the Policy Environment: Before and After	3	Completed 9/17/99. Assessed renewable energy policy issues.	ESMAP Report Chapter 3, "Institutional and Policy Framework for Renewable Energy Technologies"	11_Chap3fin.rtf PR3_ESMAPAll
6	*World Bank Presentation	1	Completed 6/24/99. Informed World Bank project on renewable energy policy issues.	Key Issues Affecting use of New and Renewable Energy Resources	12_Phwb1.ppt
6	*Barangay Electrification Planning	1	Completed 7/21/99. Clarified role of NRE for electrification.	Initial Thoughts on Providing Integrated Assistance to NCED Regarding Planning and Implementation of Barangay Electrification; Near Term Barangay Electrification Options	13_Ncedmatr1.rtf; 14_Barelcopt.rtf
6		3			ESMAPAll.doc

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
6		1			06_RPPGcomt.rtf
7A	Policy Reform through DOE Memos and EO: Draft Fast Track Implementing Documents See also Task 6 (Fast Track Recommendations, Fast Track Next Steps)	1	Completed 8/30/99. Provided draft implementation documents for DOE's consideration.	Amending Certain Provisions of Executive Order No. 462; Amending Certain Provisions of Energy Regulations No. 1-95	EO462amd.rtf; ER195amd.rtf
7A	Investment Action Areas (revised deliverable instead of Investment Solicitation)	2	Completed 1/5/00. Identified and described Investment Action Areas.	TCAPP Investment Action Opportunities; Proposed TCAPP Investment Action Areas;	TCAPP Investment Action Opportunities.rtf; TCAPPIAO.rtf;
7A	Investment Action Areas (detail on Wind/Diesel Hybrids)	2	Completed 1/5/00. Identified and described Investment Action Areas.	Trip to San Diego for BreezElectric Technical Assistance	BreezeElectric Technical Assistance.rtf
7A	Investment Action Areas (detail on Hydro)	2	Completed 1/5/00. Identified and described Investment Action Areas.	Phils. Mini and Small Hydro Data Collection	Hydro.rtf
7A	Investment Action Areas (detail on PV Agricultural Water Pumping)	2	Completed 1/5/00. Identified and described Investment Action Areas.	Water Pumping from Shallow Tube Wells in Central Luzon	pumpconcept.rtf
7A	Capability Building Summary	2	Completed 1/3/00. Documented TCAPP's contribution to Capability Building.	Capability Building Summary: TCAPP	Capability Building Summary.rtf
7B	Microhydro Resource Assessment Training	3	Completed 10/27/00. Trained technical staff on resource assessment and resource measurement techniques.	Trip Report Sections: Solar Resource Assessment Workshop and Micro hydro Resource Assessment and Training Workshop	See Trip Report: renne-10-00.doc
7B	National-Level Microhydro Resource GIS Atlas	3	Completed 11/24/00. Developed national GIS data on hydropower potential of each watershed	CD of Resources	see CD-ROM "Resource

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
					Assessments"
7B	Regional Microhydro GIS		Cancelled.		
7B	National-Level Solar Report and Resource Maps	3	Completed 1/10/2001. Provided full set of national solar resource map images on Resource Atlas CD-ROM.	Assessment of Solar Resources in the Philippines	Solar-report.pdf
7B	HOMER files of Solar Resources (with task 5 - revised deliverable replaced Solar Resource Report)	3	Completed 8/28/01. Converted complete national solar resource data into files that can be used in HOMER analyses.	Sicud; Luzon, Visayas, and Mindanao Solar Resource Data; Philippines Wind Data	HOMER Sample Files (folder); HOMER Resource Files (folder) (also may be downloaded from http://www.nrel.gov/international/tools/homer/download.html)
7B	National-Level Solar Resource GIS Atlas	3	Completed 11/24/00. Developed national GIS data on solar resource	CD of Resources	see CD-ROM "Resource Assessments"
7C	Institutional Assessment Interim Report	1	Completed 11/18/99. Assessed institutional environment for implementation and long-term effectiveness of a renewable energy GIS	Institutional Assessment of Geographic Information System Activities Within the Republic of the Philippines	gisint.rtf
7C	Needs Assessment Interim Report		Cancelled.		
7C	Technical Assessment Interim Report		Cancelled		
7C	Renewable Energy GIS Plan		Cancelled		
8A	Newsletters (Public)	1-3	Completed four of eight editions 6/00. PREP Talk, Volume I, Issues 1 – 4	PREP Talk, Volume I, Issues 1 – 4	Prep 1.doc; Prep 2.doc; Prep 3.doc; Prep 4.doc
8A	Work Plan	1	Completed 7/99.	The Philippines Renewable Energy	workpln3.rtf

Task #	Deliverable or Milestone	Progress Report	Final Outcome	Documentation Title	Electronic File Name
				Project Final Work Plan	
8A	Email Reports	1-3	Completed periodically rather than monthly.		
8A	Semi Annual Reports (USAID / Manila, DOE)	n/a	Completed 7/99 and 3/00.		
8A		3			stakeholders.xls
8B	Capability Building Plan		Completed through individual tasks		
8C	Strategic Framework Report on Institutional Pathways		Cancelled	Institutional Pathways and Recommendations for the Sustainable Delivery of Rural Energy Services	
8C		3			matrix.xls
8C		3			Philippines framework (Adobe)

*These milestones and deliverables were added after the work plan was complete.

Table 4. Task Contact Information

#	Task Name	NREL Contact	Telephone	Email
1	Renewable Energy Market Infrastructure	Roger Taylor	303-384-7389	roger_taylor@nrel.gov
2A	Diesel Mini Grid Retrofit	Larry Flowers	303-384-7021	ian_baring-gould@nrel.gov
2B	Wind Farm Analysis	Yih-Huei Wan	303-384-7025	yih-huei_wan@nrel.gov
3	Biomass - Bioenergy and Combined Heat and Power	Ralph Overend	303-275-4450	ralph_overend@nrel.gov
4	Ocean Power	Roger Taylor	303-384-7389	roger_taylor@nrel.gov
5	Rural Electrification Analysis of Alternatives	Peter Lilienthal	303-384-7444	peter_lilienthal@nrel.gov
6	Policy Analysis and Assistance	Paul Galen	202-646-5053	paul_galen@nrel.gov
7A	Technology Cooperation Agreement Pilot Project	Laura Vimmerstedt	303-384-7346	laura_vimmerstedt@nrel.gov
7B	Micro-hydro and Solar Resource Assessments	Dave Renne	303-275-4648	david_renne@nrel.gov
7C	GIS for Targeting Renewable Energy Deployment	Liz Brady	303-384-4698	liz_brady@nrel.gov
8	Coordination Task	Roger Taylor	303-384-7389	roger_taylor@nrel.gov

Table 5. Final Project Financials

#	Task Name	NREL Task Leader	Total Budget (3/1/00)	Final Actual Project Spending	Percentage Spent
1	Renewable Energy Market Infrastructure	Ron White	$245,000	$247,630	101%
2A	Wind Farm Analysis	Yih-Huei Wan	$84,000	$95,991	114%
2B	Diesel Mini-Grid Retrofit	Larry Flowers	$90,000	$91,093	101%
3	Biomass—Bioenergy and Combined Heat and Power	Ralph Overend	$210,000	$205,240	98%
4	Ocean Power	Desikan Bharathan	$ -	$ -	-
5	Rural Electrification Analysis of Alternatives	Peter Lilienthal	$104,000	$104,602	101%
6	Policy Analysis and Assistance	Paul Galen	$158,000	$158,000	100%
7A	Technology Cooperation Agreement Pilot Project	Laura Vimmerstedt	$100,000	$100,140	100%
7B	Micro-hydro and Solar Resource Assessment	Dave Renne	$100,000	$92,035	92%
7C	GIS for Targeting Renewable Energy Deployment	Liz Brady	$100,000	$98,380	98%
8A	Coordination Task	Pat Keegan /	$197,163	$195,747	99%
8B	Capacity-Building and Training Needs Assessment	Paul Galen	$25,000	$25,000	100%
8C	Strategic Framework Development – New 2/00	Roger Taylor	$25,000	$25,000	100%
	Total		$1,438,163	$1,438,858	100%

Task Reports

Task 1. Renewable Energy Market Infrastructure

Task Leader: Ron White[1]

Major Accomplishments

The major accomplishments of this task included:

- Development of capability in the Philippines to analyze renewable energy markets;
- Analysis of Philippines rural renewable energy markets;
- Identification and analysis of a major barrier to rural renewable energy markets: the need for sustainable institutional pathways for implementation of renewable energy as a component of rural electrification.

The capability to analyze renewable energy markets can be used to clearly identify priority issues and barriers, which is especially important when scarce public resources are devoted to market development. A series of workshops increased renewable energy market analysis capability in the Philippines, especially the DOE, through hands-on market analysis activities and introduction to the research literature. (Please see Appendix 1 - Renewable Energy Market Infrastructure: Value Chain Workshop [D5attach.ppt]; Summary of Value Chain Workshop [Deliverable5.rtf]; Photovoltaic Value Chain Analysis [Deliv6.rtf]). Written guidelines for future market analysis were provided to encourage the use of the market analysis capabilities that the workshops started to develop. (Please see Appendix 1 - Market Analysis for Off-Grid Renewable Energy: An Approach to Better Analysis [Deliv2.rtf]).

Analysis of rural renewable energy markets provided specific examples for the development of market analysis capability, established a framework for analysis of renewable energy technologies that can be applied in future analyses, and identified major barriers to market development. (Please see Appendix 1 - Summary Discussions: Investments and Needed Analysis [Deliverable10.rtf]).

The need for sustainable institutional pathways for rural renewable energy use was a key insight of this task. Development of the Strategic Framework followed directly from this insight, and contributed to DOE's rural electrification program design. (See task 8C)

Final Status of Deliverables

Most deliverables for this task were completed as originally planned. Two new deliverables were added in response to USAID and DOE requests. These new deliverables (not identified in the original work plan) replaced four that were canceled because they were determined to be lower priority.

Deliverables Added	*Deliverables Cancelled*
World Bank Presentation	D4 – Report on market distortions
Sustainability: Measurements and Approaches	D7 & D8 – Draft and Final description of value-chain constraints
	D9 - Recommendations for market development based on Value Chain Analysis
	D14 – Letter reports on financing and joint ventures

[1] Because Ron White is not working at NREL, please direct all inquiries about this task to Roger Taylor or Laura Vimmerstedt.

Task 2A. Wind Farm Analysis

Task Leader: Brian Parsons[2] and Yih-huei Wan

Major Accomplishments

The major accomplishments of this task included:

- Communication of the enormous potential for wind energy use
- Establishment of utility-scale wind generation as a high-priority option in the minds of government and industry decision-makers.
- Identification of policy concerns for wind farm development
- Development of the Wind Farm Site Assessment Methodology
- Assessment of six sites to identify wind farm development potential and establish priorities for site-specific wind data collection

This task improved some of the fundamental conditions for wind farm development: decision-makers' knowledge of wind energy potential; understanding of policy issues for wind energy; and in-country knowledge of potential sites and their evaluation. This task used the data from the wind mapping activity (a separate project) for outreach and communication to various stakeholders, government officials, and wind industry players. The wind map of the Philippines was completed in 1999, and published in final form in 2001. This first national-level wind resource assessment was sponsored by Department of Science and Technology's Philippines Council for Industry and Energy Research and Development (DOST/PCIERD), PNOC, USAID, USDOE , and Winrock with Preferred Energy, Incorporated, in collaboration with the National Power Corporation.

Before mapping and communication of the mapping results, the Philippines' wind resource was widely believed to be poor due to the country's location in the tropics, where wind speeds are often low. The mapping and results communication through this task successfully challenged that conventional wisdom, such that key decision-makers for wind farm development now recognize the enormous wind resource potential in the Philippines.

The policy environment for wind farm development, another crucial factor, was assessed at the beginning and end of this task, documenting significant improvements even as remaining challenges were noted. This assessment can serve as a guide if the government chooses to promote wind energy through further policy development. Major changes include passage of the Electric Power Industry Reform Act of 2001 (R.A. 9136), the strong interest of PNOC, refinement of policies regarding the government's participation in wind resource development under E.O. 462, streamlining of requirements under Energy Regulation 1-95, and development of a draft model power purchase agreement. Remaining issues include major policies that are uncertain because they are subject to negotiation on a case-by-case basis, barriers to foreign developers because of requirements for domestic Philippines equity, the small size of tax incentives, unavailability of "take-or-pay" contracts for wind farms, incomplete wind rights policies, and high costs of grid failure to Independent Power Producers. (Please see Appendix 2A – Appendix A, Philippine Wind Farm Analysis and Site Selection Analysis [AppendixAed-1.doc]).

The Wind Farm Site Assessment Methodology and the assessment of six candidate sites provide a systematic method for screening sites for their development potential, and establish priorities for site-specific wind data collection. Based on this work, further site evaluation could be conducted and sites selected for resource data collection. Selection of good sites for wind farms is a critical step in their development, because of the local variability in factor such as wind resource, the appropriateness of the location with respect to other pre-existing land uses or environmental characteristics, and suitability of the site for grid access, accessibility, terrain, ownership, and soil conditions. The site assessment products of this task will help decision-makers use systematic, quantitative processes for site selection. (Please see

[2] Please direct all inquiries to Yih-huei Wan.

Appendix 2A - Philippine Wind Farm Analysis and Site Selection Analysis [Final_Task2A_30934ed-1.rtf; AppendixAed-1.rtf; Appendix B.rtf; AppendixC.rtf; AppendixD.rtf].)

Final Status of Deliverables

All of the deliverables for this task were completed as originally planned.

Task 2B. Diesel Mini-Grid Retrofit

Task Leader: Lawrence Flowers[3] and E. Ian Baring-Gould

Major Accomplishments

The major accomplishments of this task included:

- Identification of diesel mini-grids with good opportunities for retrofit with wind energy
- Installation of 12 wind resource monitoring stations at the likely sites, with extra equipment
- Collection, quality control, and dissemination of wind resource data from the stations
- Use of data from wind resource monitors by a private developer to select sites and islands with good resources for further exploration
- Assessment of policy issues with major technical components, especially spinning reserve

This task paved the way for the retrofit of diesel mini-grids with wind energy, contributing directly to efforts of BreezElectric with Philippines Hybrid Energy Systems, Inc. (PHESI) to develop about 40 MW of wind for these grids. Selection of good diesel mini-grids for exploration, wind resource data collection, and NREL's independent assessments all contributed to the advancement of this development opportunity.

Fourteen mini-grids were selected for exploration, based on wind resources and grid characteristics such as generating capacity and daily duration of operation. Remote diesel mini-grids represent one of the most cost-effective applications of wind energy because cost of diesel generation, already relatively high, is even higher due to fuel transportation. Where wind resources are good enough, a wind energy retrofit will reduce the overall cost of generation. These retrofits are most cost-effective where generating capacity is relatively large and where the grid operates 24 hours per day. (Please see Appendix 2B - Status Report, NPC/SPUG [PhilAID 9-99 report.rtf]).

Site-specific wind resource data is essential to verify the resource before an investment can be made in wind project development. In close collaboration with NPC-SPUG, this task purchased and arranged for installation of 14 wind resource monitoring stations, including extra backup equipment (Please see Appendix 2B - No cost modification to Contract AAM-0-30202-01 for NRG Systems Inc [NRG Philippines MOD-00.doc]). The task then ensured that quality wind data was produced. This provided on-the-ground, site-specific data that has been used by BreezElectric / PHESI, and also improved in-country capabilities within NPC-SPUG to collect and use wind data. This capability development includes use of the Hybrid2 hybrid power system simulation software. (Please see Appendix 2B - NPC/NREL/USAID anemometer for the islands program: Status Report [9-month review of sites.doc]).

Assessment of the site-specific wind resource data shows that five sites have good resources for continued development, two islands appear to have good resources for continued development on the island though perhaps not at the selected site, and wind resources on another five are insufficient at the selected site and may also be insufficient on the entire island. The remaining two monitoring stations were damaged or their components stolen, and did not produce data for analysis. BreezElectric/PHESI has relied on the wind resource data and the analysis provided by this task to plan its proposed project, which is in advanced pre-feasibility stages as of October, 2001. (Please see Appendix 2B - Description of Arrangements between NREL and NPC-SPUG regarding Wind Data [Contractual arraignments between NREL and NPC.doc]; [Clarification of wind speed monitoring issues.doc]; and NPC/NREL/USAID anemometer for the islands program: Status Report [9-month review of sites.doc]).

[3] Please direct all inquiries to E. Ian Baring-Gould.

Final Status of Deliverables

Two of the five deliverables for this task were completed as originally planned. Three were cancelled, and substitute deliverables completed instead, as summarized below and described in "Deliverables for Philippines Renewable Energy Program – Task 2b – Diesel Mini-Grid Retrofit" (PREP Task 2b Final Assessment.doc in Appendix 2B).

Deliverables Added	*Deliverables Cancelled*
Assessment and Processing of Anemometer Data	Analyze retrofit economics
Additional Data Collection Equipment and Spare Parts	Present results and recommendations to SPUG and NCED
Policy Analysis for Diesel Retrofits	Draft project report

Task 3. Biomass—Bioenergy and Combined Heat and Power

Task Leader: Ralph Overend

Major Accomplishments

The major accomplishments of this task included:

- Development and publication of the Biomass Energy Resource Atlas of the Philippines (including a biomass GIS), with biomass resource data and maps for rice hulls, coconut wastes, animal manure, sugarcane bagasse, forestry residues and wastes, and urban solid wastes
- Detailed analysis of biomass and bioenergy potential, including *resources* from agricultural residues and dedicated energy crops, and *applications* for household, electricity generation, and agricultural energy use

This task developed comprehensive national information on biomass resources and their potential. Biomass resource data is essential to efficient, sustainable use of bioenergy. The Biomass Energy Resource Atlas of the Philippines provides detailed data on the geographic location of the resources, and includes GIS format to facilitate analysis. Bioenergy project planners can use this data to identify good project locations and to calculate initial estimates of the appropriate project size. Project location is a major factor in bioenergy projects because of the expense of transportation of the biomass feedstock. (Please see CD-ROM named "Resource Assessments," "BioAtlas" folder and "Reports\Biomass: folder.)

The analysis of biomass and bioenergy potential quantifies the potential biomass resource base, and identifies several uses for biofuel that would increase household energy security, promote self-reliant agricultural practices, and improve human and environmental health. These include household use of multi-fuel stoves, generation of electricity from bagasse or sugar cane trash, and agricultural uses such as sugar cane trash for thermal processing in sugar mills. Identification of beneficial bioenergy uses is particularly important in the Philippines, where a rapidly expanding population and rising fossil fuel energy costs mean increased pressure on the use of biomass resources for energy generation. The analysis produced by this task could help set priorities for research and development to expand the biomass supply and enhance energy conversion technology. (Please see Appendix 3 - Strategies for Enhancing Biomass Energy Utilization in the Philippines [FinalRpt092501.rtf]).

Final Status of Deliverables

All of the deliverables for this task were completed as originally planned.

Task 4. Ocean Thermal Energy Conversion, Tidal, and Wave Energy

This task was originally planned as a very small effort to review commercially available Ocean Thermal Energy Conversion, current, tidal, and wave energy technology. This task was not pursued because other outside work was being done that reduced the need, and because an appropriate counterpart was not identified.

Task 5. Analysis of Alternatives for Rural Electrification

Task Leader: Peter Lilienthal

Major Accomplishments

The major accomplishments of this task included:

- Development of capability among Philippine energy planners to evaluate alternative approaches for the delivery of rural electric services
- Training of Philippine energy agency staff on the use of NREL's village power planning models
- Establishment of an in-country training capability for NREL's models
- Analysis of Philippines-specific village power applications, and the use of these analyses for project development and for instruction

This task developed capability and completed analyses that contribute to effective planning for rural electrification, which is crucial to use wisely the funds that are available for the Philippines government's ambitious rural electrification goals. Through a series of workshops and meetings, the task helped high-level Philippines energy planners understand how to improve evaluation of rural electric service alternatives. This included consultation and dialogue on tailoring these evaluation techniques to the Philippines institutional arrangements.

One resource for managers of rural electrification programs is a trained energy agency staff, capable of using village planning models to quantify and characterize electrification alternatives. This task directly trained staff of at least 10 agencies to use HOMER, HOMER Express, and ViPOR, NREL's suite of models. (Please see Appendix 5 – Training Participants List [Trng_par.rtf]). One trained analyst has since presented and trained 162 people on using the models. (Please see Appendix 5 -Trainings in Philippines.doc). The Asian Development Bank has directly funded Philippines organizations to provide additional training and user support.

In addition to developing analytic capabilities in the Philippines, this task also developed data and completed analyses, including development of HOMER files for renewable resources for Luzon, Visayas, and Mindanao. In cooperation with NREL, a HOMER analysis for a feasibility study was developed by the Philippine DOE's Affiliated Non-Conventional Energy Center at the State Polytechnic College of Palawan for the electrification of the Sitio Sicud in Palawan. This task also developed HOMER analysis files for representative village electrification situations using Philippines data. The data and analysis files constitute the Interim Report on Data Analysis, and they were also distributed to training participants as instructional material. (Please see Appendix 5 - HOMER Sample Files (folder) and HOMER Resource Files (folder).

Final Status of Deliverables

Three of the four technical deliverables for this task were completed as originally planned. The fourth deliverable, a Draft Electrification Plan and Planning Process Report, was originally intended to develop a plan for a single region of the Philippines. Because the project did not select a regional focus, this report was not completed.

Deliverable Cancelled
Draft Electrification Plan and Planning Process Report

Task 6. Policy Analysis and Assistance

Task Leader: Paul Galen

Major Accomplishments

The major accomplishments of this task included:

- Development of draft legislative language and recommendations and comments on legislative language, especially during development of the New and Renewable Energy Bill and of the bills leading to the Electric Power Industry Reform Act of 2001 (R.A. 9136)
- Assessment of policy issues and development of draft policy language leading to modification of EO 462 and ER 1-95.
- Review and recommendations regarding DOE's Rural Electrification Program, contributing to the development of the Strategic Framework for Rural Electrification
- Analysis of a Renewable Portfolio Standard as an option to promote renewable energy in the Philippines, leading to ongoing serious consideration of an RPS

This task assisted policy change through input to decision-makers on priority renewable energy issues by clarifying the alternatives and facilitating the steps necessary to achieve such change. This included consultation and written recommendations and analyses, and development of draft regulatory and legislative language for consideration. Recommendations on the NRE bill provided a clear rationale for legislative action that focussed on the economic development and energy security benefits as well as the environmental benefits of NRE. Recommendations also identified a Renewables Portfolio Standard at the distribution level as an important policy option to promote renewable energy; suggested legislative action to ensure transmission and distribution access for all power sources; acknowledged the benefits of hybrid NRE plus fossil-powered generation and recommended their promotion, and identified numerous clarifications and changes to ensure internal consistency and implementation efficiency. (Please see Appendix 6 - Summary of NREL Comments of Draft DOE NRE Bill [Nresum1.rtf]; Comments on the Philippines DOE Proposed Renewable Energy Bill [Philcomts.rtf]).

Electricity sector reform culminated in the Electric Power Industry Reform Act of 2001 (R.A. 9136), but the work under this task addressed issues affecting renewable energy in earlier versions of the legislation. The development of the reform package faced the challenge of privatizing the NPC and introducing competition in wholesale and retail supply, even as the government sought (and continues to pursue) dramatic extensions of electrical service to unelectrified populations. The interactions between these sometimes contradictory goals were a major topic of analysis under this task. This included evaluation of the effects on NRE of policies proposed to privatize and restructure the electric power sector, in order to identify the ways in which electric sector reform could assist, or at least not impede, NRE technologies that may contribute substantially to meeting poverty alleviation and universal service goals. (Please see Appendix 6 – [Omnibus1.rtf]).

A series of recommended DOE policy changes, known as the *Fast Track Action Recommendations*, were largely implemented through modification of Executive Order (EO) 462 and revision to ER 1-95. This task, working with task 7A, supported DOE to make the changes. These new regulatory documents improve the policy/regulatory framework to promote increased penetration of renewables, by clarifying the government's share in renewable energy projects (EO 462, revised in EO232), streamlining corporate track record requirements for new and renewable electricity generation projects, providing greater regulatory flexibility on spinning reserves, removing the thermal efficiency requirements for cogeneration facilities using new and renewable energy, eliminating the requirement for a Power Purchase Agreement, and removing the requirement for project review and approval under the power development plan (revised ER 1-95). (Please see Appendix 7A – documents from first Progress Report.)

The review and recommendations on DOE's Rural Electrification program responded to immediate needs of DOE decision-makers by assessing the near term options that were available to meet electrification goals, and also contributed to the development of a longer-term approach through the Strategic Framework for Rural Electrification (Please see task 8C).

This task analyzed and applied the RPS concept within the Philippines renewable energy and electric power sector context. A Renewables Portfolio Standard creates a market for renewable resources, while allowing market forces to operate in the electricity supply market to bring consumers the economic efficiency and service quality benefits of competition. Clear documentation of the benefits of an RPS contributed to decisions to include it in several versions of the NRE bill, and to its continued consideration as an important element of DOE's emerging NRE policy, even though no legislative or regulatory implementation had established an RPS as of October 2001. (Please see Appendix 6 - Thoughts on Purpose and Design of a Renewables Portfolio Standard (RPS) for the Philippines [PhilRPS1.rtf]; Implementation Issues and Benefits of Adopting a Renewable Portfolio Standard in the Philippines [Summfin.rtf; Rpsfin.rtf; 10_Appendix.rtf])

Final Status of Deliverables

All of the deliverables for this task were completed. Substantial flexibility was designed into the original work plan in order to be responsive to the dynamic policy environment.

Task 7A. Technology Cooperation Agreement Pilot Project

Task Leader: Pat Keegan[4] and Laura Vimmerstedt

Major Accomplishments

The major accomplishments of this task included:

- Implementation of recommended policy reforms
- Investment – promoting actions for three renewable energy applications: for solar-powered agricultural water pumping, wind/diesel hybrids, and hydropower

This task advanced opportunities for private-sector investment through policy reforms to improve business conditions and actions that directly encouraged investment in specific renewable energy applications. The activities funded through this task of the PREP complemented TCAPP activities that were funded through USAID/Global, which continued after this task was complete.

The policy recommendations (the *Fast Track Action Recommendations*) and their implementation were a cooperative effort with task 6A, and are described above.

Investment-promoting actions encouraged investment in solar-powered agricultural water pumping, wind/diesel hybrids, and hydropower, with close collaboration with the private sector in each area. In solar-powerd agricultural water pumping, this task cooperated with task 1 and WorldWater Corporation to develop and propose a pilot program approach to the Department of Agriculture. This pilot program would identify the best applications for solar-powered water pumping to replace diesel pumps in government-subsidized agricultural water pumping program. The collaborative efforts of this task and WorldWater led to DA's official expression of interest in exploring the technology, as shown by the signing of a MOU among WorldWater, DA, and NREL in 2001.

For wind/diesel hybrids, this task identified issues for market development and possible approaches to advancing private investment. This market development and investment emphasis complemented the technical work of task 2B. TCAPP worked directly with a private developer, BreezElectric, Incorporated, to support a review of their approach to a diesel/wind hybrid proposal at many of the sites identified in task 2B. This led to BreezElectric's active development of the project, which was ongoing and continues to receive TCAPP assistance as of October 2001.

For hydropower, this task improved the quality of information about existing and possible new hydropower sites, to help private-sector project proponents evaluate opportunities. This task used the new database to identify retrofits and upgrades of existing mini-hydropower facilities as an important market, and to identify technically promising sites. TCAPP has continued to develop these sites as model commercial projects, and was preparing pre-feasibility assessments as of October 2001. (Please see Appendix 7A - [TCAPP Investment Action Opportunities.rtf]; Proposed TCAPP Investment Action Areas [TCAPPIAO.rtf]).

[4] Because Pat Keegan is not working at NREL, please direct all inquiries about this task to Laura Vimmerstedt.

Final Status of Deliverables

All of the deliverables for this task were completed. The investment-promoting actions were pursued instead of the originally planned investment solicitation, because they were more appropriate to the status of market development and the level of information available.

Deliverables Added	*Deliverables Cancelled*
Assessment and Processing of Anemometer Data	Analyze retrofit economics
Additional Data Collection Equipment and Spare Parts	Present results and recommendations to SPUG and NCED
Policy Analysis for Diesel Retrofits	Draft project report

Task 7B. Micro-hydro and Solar Resource Assessment

Task Leader: Dave Renne

Major Accomplishments

The major accomplishments of this task included:

- Data gathering, quality control, modeling, mapping, GIS development, and printing of maps to show estimated hydro resources in each watershed and to show estimated solar resource
- Microhydro training seminar, including resource assessment and resource measurement techniques, and solar resource assessment training seminar

This task completed the assessment of NRE resources, so that wind, biomass, hydro, and solar resources all are estimated with national geographic coverage. To accomplish the hydro assessment, the task needed to undertake extensive data gathering of datasets that included rainfall, topography, and existing streamflow measurements. The task addressed significant data quality issues with these datasets, and applied innovative modeling techniques to estimate the hydro resource. (Please see Trip Report for Task 7B named "renne-10-00.doc.")

Similarly, for the solar resource assessment, the task gathered existing solar measurements. Modeled estimates based on cloud cover data were reconciled with the actual measured solar radiation data from the three stations that collect it. Unfortunately, most of the PAGASA stations collect only sunshine data, which was not useable for this assessment. Using advanced resource assessment approaches, both global horizontal and tilt-at-latitude resource estimates were completed. (Please see Trip Report for Task 7B named "renne-10-00.doc.")

For both hydro and solar resource assessments, the data resides in an ArcView GIS format which allows further analysis. The task also provided a full set of resource maps on CD. The solar resource has also been converted into HOMER input files (along with the Wind Atlas data). (Please see Appendix 5\HOMER Resource Files\Solar Resource and Appendix 5\HOMER Resource Files\Wind Resource.)

Training seminars presented the resource assessment data to NRE analysts in the Philippines. These seminars included discussion on resource assessment approaches, data issues, modeling techniques, data management, and use of GIS-based resource data. (Please see Trip Report for Task 7B named "renne-10-00.doc.")

Final Status of Deliverables

The national-level microhydro and solar maps and atlases, as well as training seminars for both microhydro and solar resource assessment were completed as originally planned. The regional-level atlas was not pursued because the project did not select a regional focus. A formal solar resource report was not completed; however, the purpose of this deliverable was fulfilled because the complete solar resource data set was converted into files that can be used in further analysis using the HOMER software.

Deliverables Added	*Deliverables Cancelled*
HOMER files of Solar Resources	Solar Resource Report
	Regional Microhydro GIS

Task 7C. Geographic Information System for Targeting Renewable Energy Deployment in the Philippines

Task Leader: Laura Vimmerstedt and Liz Brady

Major Accomplishments

The major accomplishments of this task included:

- Assessment of institutional issues, needs, and technical issues for the development of a renewable energy GIS
- Development of a GIS with resource assessment data including comprehensive national data for wind, solar, biomass, and hydro
- Trained management and technical staff from government institutions on the use of GIS for renewable energy planning and analysis

Development, maintenance, and application of a national renewable energy GIS in the Philippines is an ambitious goal, requiring significant attention to the institutional environment, beyond just the technical needs. Human resources, data resources, and funding all are crucial to long-term success. This task reported on the institutional environment, including the status of these resources within Philippines institutions, in the report, "Institutional Assessment of Geographic Information System Activities." This report is useful for planning the national renewable energy GIS because it identified both strengths and opportunities for improvement within existing institutions. (Please see Appendix 7C - Institutional Assessment of Geographic Information System Activities Within the Republic of the Philippines [gisint.rtf]).

This task coordinated the publication of a single coherent GIS data set, based on the national data for wind, solar, biomass, and microhydro that was developed through other tasks and projects. This task published the data in collaboration with PA Consulting, for distribution at Philippines Energy Week 2000. The Philippines now has the national-level data to determine where each renewable energy resource can best contribute to meeting energy needs. Some of the data can also support initial analyses at a more detailed level, for example, the wind and solar resource data is ready to be used in HOMER analyses of specific electrification projects. (Please see Appendix 5, folder of HOMER Resource Files.)

Training of management and technical staff on GIS developed initial in-country capabilities and networks to plan, develop, maintain, and use a renewable energy GIS through an introductory workshop. Continued development of this human resources is vital for an effective GIS. (Please see Trip Reports - Task7B_lb1199tr.rtf)

Final Status of Deliverables

The Institutional Assessment Interim Report was completed as originally planned. The remaining Interim Reports, and the GIS Plan, were not completed. Instead of the Needs Assessment Interim Report, this task provided an in-depth hands-on GIS training seminar to address capability needs. In consultation with USAID and DOE during Dave Renne's October 2000 travel to Manila, it was determined that a substantial effort was needed to compile all of the renewable energy resource data for solar, wind, and microhydro that was developed through other project tasks into a single integrated format, and published this on compact disk in cooperation with PA Consulting. This task undertook these activities instead of the Technical Assessment Interim Report and GIS Plan that were planned as original deliverables

Deliverables Added	*Deliverables Cancelled*
Comprehensive GIS data for solar, wind, biomass, and hydro resources	Needs Assessment Interim Report
Deliverables added: Introduction to GIS Workshop	Technical Assessment Interim Report
	Renewable Energy GIS Plan

Task 8A. Program Management and Coordination

Task Leader: Laura Vimmerstedt

and

Task 8B. Capacity-Building and Training Needs Assessment

Task Leader: Paul Galen

This is a combined task report for Tasks 8A and 8B, and is abbreviated because it is a management task.

Major Accomplishments

The major accomplishments of this task included:

- Ensuring responsiveness to changing needs of DOE and USAID
- Integration of capability building activities throughout the project
- Completion of the project within budget
- Communication of the results through newsletters and progress reports

Final Status of Deliverables

Fewer communication deliverables were provided than originally planned. These changes included periodic, rather than monthly, emails of task-specific highlights; Four newsletters instead of eight, and three progress reports instead of four. The capability building deliverables were completed through individual tasks without the development of the capability-building plans that were originally anticipated.

Deliverables Added	*Deliverables Cancelled*
	Newsletters 5 – 8
	Semi-Annual Progress Report #3
	Comprehensive Capability Building Plan

Task 8C. Strategic Framework Development

Task Leader: Roger Taylor

Major Accomplishments

Major accomplishments of this task included:

- Characterization and documentation of the diverse institutional approaches ("pathways") under consideration for rural electrification in the Philippines
- Systematic screening of the institutional pathways to identify the ones that DOE might wish to use its resources to promote
- Communication of the strategic framework to rural electrification decision-makers in the Philippines
- Decisions within DOE about rural electrification program design that take into account the strategic framework results.

This task provided a framework for decision-making about allocation of scarce DOE resources to promote one or more institutional pathways to rural electrification. DOE (Reuben Quejas) and an NREL team

worked together to characterize the different institutional pathway options identified possibilities including: Retailers/ Individual Entrepreneurs linked to Manufacturer, Traditional Rural Electric Cooperatives, Privatized ECs, Barangay Power Association, Rural Energy Service Companies, SPUG, PNOC, publicly- or privately-funded NGO, Franchise Model, Informal Generators, Super Concession (RESCO over several RECs), and Local Government Unit with a Municipal Utility. For each of these institutions, its implementation of rural electrification was described, including factors such as: Capitalization, Leadership/ management, Market/product identification, Sales to customers, Installation/service, Financing to customer, Revenue collection, Access to DBP funding, Inherent Customer Density, DOE Influence, Pre-existing Institution, "National" coverage or adequate scale, and overall likelihood of success.

Using this characterization, the institutional options for rural electrification were screened to select those that appeared most promising because of their funding options, service coverage, and connection to DOE. Based on this screening, electrification through rural electric cooperatives or rural energy service companies were selected as the most promising pathways. (Please see Appendix 8C – Matrix xls)

The results of the strategic framework activity were communicated and discussed through a workshop in Manila in April 2000 and a presentation to then-Secretary Tiaoqui, in May 2000. This outreach, along with the efforts of Reuben Quejas, appears to have successfully incorporated the major lessons learned from this task into Philippines DOE planning for rural electrification. (Please see Appendix 8C – Philippines Framework.pdf)

Final Status of Deliverables

This task was added after the beginning of the project to respond to DOE needs. A final report contemplated during task development, *Institutional Pathways and Recommendations for the Sustainable Delivery of Rural Energy Services*, was not completed.