National Renewable Energy Laboratory
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Office of Energy Efficiency & Renewable Energy
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Rural Energy Options Analysis Training Development and Implementation at NREL

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Presented at the 2004 DOE Solar Energy Technologies Program Review Meeting
Denver, Colorado
October 25-28, 2004

Conference Paper
NREL/CP-710-37604
January 2005

NREL is operated by Midwest Research Institute • Battelle Contract No. DE-AC36-99-GO10337

Rural Energy Options Analysis Training Development and Implementation at NREL

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ABSTRACT

NREL has developed a rural energy options analysis training program for rural energy decision makers that provides knowledge, skills and tools for the evaluation of technologies, including renewables, for rural energy applications. Through the Department of Energy (DOE) Solar Energy Technologies Program (SETP), NREL has refined materials for the program and developed a module that offers hands-on training in the preparation of data for options analysis using HOMER, NREL's micropower optimization model. NREL has used the materials for training in Brazil, the Maldives, Mexico, and Sri Lanka.

1. Objectives

The international activities of the SETP are designed to be consistent with current U.S. technology, trade, and foreign policy and are carried out in developing countries that both have governments committed to renewable energy and a large market for U.S. products. The objective of rural energy training activities carried out with support of the SETP was to transfer knowledge and skills to public and private sector decision makers to ensure their ability to evaluate renewable energy technologies for rural energy applications. Rural energy technology options analysis training was conducted in Brazil and Mexico. Each of these countries has aggressive government programs to provide rural electrification services using solar and other renewable technologies to populations currently not served by the electric grid and with large potential markets for U.S. products. Rural energy training materials developed under the SETP were also used in workshops sponsored by OWIP and the United States Agency for International Development (USAID) South Asia Regional Initiative - Energy (SARI/E) program in Sri Lanka and the Maldives, by the United Nations Development Program (UNDP) in Chile, and USAID in Mexico and Brazil.

2. Technical Approach

Rural energy options analysis is the process by which decision makers choose technologies for rural energy applications. Growing economies in developing countries are creating a demand for electrification in rural areas. Rural energy applications include the supply of electricity for multiple-use applications (towns and villages) and single-use applications (commercial and industrial facilities, government facilities, and water pumping for irrigation and drinking water supply). Typical rural electrification strategies consider grid-extension and diesel generators as the two viable technology options. Increased awareness of climate and environmental issues and a growing interest in emerging pollutant markets by rural energy decision makers is creating interest in renewable technologies in both government and private sector circles. Experience with pilot projects using renewable technologies has created more confidence in new technologies. Decision makers do not have the knowledge, skills or tools to evaluate new technologies for rural energy applications.

NREL uses the term *rural energy* in place of *rural electrification* to reflect developments in the energy sector of developing countries. Countries are setting program goals that support the creation and strengthening of markets for renewable technology markets. This approach creates a need for private energy service providers to meet the demand for a range of services, from energy efficiency to electricity generation and power system design and installation. In rural areas of developing countries, the majority of energy needs are met by non-electric means through the burning of biomass for cooking and heating. In certain cases, electricity supply systems can displace the use of biomass resources, and in others, biomass can be used for electricity production. Biomass resource assessment is therefore a key component of rural energy planning for both rural electrification and the management of natural resources for non-electric energy needs.

NREL's rural energy options analysis training program draws on the Laboratory's decade of experience in the Renewables for Sustainable Village Power (RSVP) program. Laboratory staff who worked in this program have developed expertise in technical, socio-economic and policy aspects of rural energy. The legacy of the RSVP program includes laboratory expertise in hybrid power systems, computer modeling of small power systems, and access to the network of renewable energy decision makers worldwide, which NREL continues to exploit through its rural energy activities.

NREL's rural energy training materials are a set of modules that can be used to design a training program to meet the needs of a range of audiences, from energy policy makers with no prior knowledge of renewable energy technologies, to experienced rural electrification engineers who need tools for understanding how to compare renewable energy technologies to conventional technologies. The rural energy training modules are:

- Introduction to renewable energy technologies
- Technology options for rural electrification

- Data requirements and collection for rural energy technology options analysis
- HOMER training and hands-on options analysis
- Introduction to Hybrid2 and ViPOR (NREL software for hybrid power and mini-grid system design.)
- Hybrid power systems for rural energy applications
- National action plans for rural energy
- Integrated regional rural energy planning

3. Results and Accomplishments

Through the support of the Solar Program, NREL has developed a set of training materials that its staff and partners can use in training workshops for rural energy decision makers throughout the world. As a result of this work, NREL has been able to secure work-for-others funding for training in several countries. Key results and accomplishments are listed below.

Through the Solar Program, NREL developed a hands-on exercise in data preparation for rural energy technology options analysis that complements sets of presentation materials on other topics. The hands-on exercise prepares energy planners and system designers to collect the data required as input by HOMER. In the exercise, participants go through the following steps:

1. Define an options analysis objective
2. Identify an appropriate method for the analysis
3. Determine the appropriate level of detail for the data
4. Describe resource, load, and cost data
5. Identify data sources and collect data
6. Format the data

With the support of USAID, NREL trained seven key decision makers in Brazil's $2.4 billion rural electrification program, *Luz Para Todos*, and is following up with technical assistance in technology options analysis for regional planning and pilot hybrid power systems.

In South Asia, NREL worked through the USAID's SARI/E program to train Maldivian rural energy planners in the evaluation of technologies for rural energy programs, and is providing additional training and technical assistance in rural energy options analysis to the Maldives, Sri Lanka, and other SARI countries.

In Mexico, NREL built local capacity to provide training by preparing a Mexican engineer to provide HOMER training and translate training materials into Spanish. NREL assisted in two workshops organized by SENER, the national energy secretariat, for state rural development planners in which HOMER training was the centerpiece of the workshop. Based on NREL's work in rural energy options analysis in other countries, Mexico has requested that NREL support its rural development efforts by providing additional training and technical assistance in rural energy options analysis. As a result of this work, the Mexican government is able to respond to regional Latin American requests for HOMER training without NREL assistance.

4. Conclusions

NREL's rural energy options analysis training has resulted in the transfer of knowledge and skills in the evaluation of technologies for rural energy applications to over 200 people in Brazil, Mexico, the Maldives, and Sri Lanka. NREL is developing a better understanding of the needs of energy planners in developing countries for technical assistance in the development of clean energy markets. As support for the installation and monitoring of pilot projects wanes, work will focus more on policy support and capacity building, both of which will help to ensure that the policy environment and capacity in developing countries continues to support the development of markets for clean energy technologies and services.

ACKNOWLEDGEMENTS

The author would like to acknowledge the following colleagues for their support and assistance in the work described in this paper: I Baring-Gould, A Ghandour, T Lambert, D Lew, P Lilienthal, C Lowry, D Kline, D Renne, J Renne, A Romero, B Wallace.

NREL is the principal research laboratory for the DOE Office of Energy Efficiency and Renewable Energy, operated by the Midwest Research Institute and Battelle, under Contract No. DE-AC36-99GO10337. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the US DOE's National Nuclear Security Administration under Contract No. DE-AC04-94AL85000."

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
January 2005	Conference Paper	

4. TITLE AND SUBTITLE
Rural Energy Options Analysis Training Development and Implementation at NREL

5a. CONTRACT NUMBER
DE-AC36-99-GO10337

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
P. Gilman

5d. PROJECT NUMBER
NREL/CP-710-37604

5e. TASK NUMBER
PVP49001

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
National Renewable Energy Laboratory
1617 Cole Blvd.
Golden, CO 80401-3393

8. PERFORMING ORGANIZATION REPORT NUMBER
NREL/CP-710-37604

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)
NREL

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

13. SUPPLEMENTARY NOTES

14. ABSTRACT *(Maximum 200 Words)*

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15. SUBJECT TERMS
PV; international activities; rural electrification; rural-energy; module; micropower optimization model – HOMER;

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
Unclassified	Unclassified	Unclassified	UL		19b. TELEPHONE NUMBER (*Include area code)*

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18