Capacity Building for Renewable Energy Technologies
in Selected Developing Countries of Asia

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INTRODUCTION

• A regional research and dissemination programme, ‘Renewable Energy Technologies (RETs) in Asia’, is being implemented in six Asian countries.
• Period: 1997-2004 (in three Phases)
• Six countries: Bangladesh, Cambodia, Lao PDR, Nepal, Philippines, Vietnam (13 national institutions)
• Three research areas: Photovoltaics (6 NRIs), solar drying (4 NRIs), and Biomass briquetting (3 NRIs)
• Activities are carried out in the six countries as well as at AIT.
• Funded by the Swedish International Development Cooperation Agency (Sida); coordinated by AIT.
INTRODUCTION

• Broad aim of the project: to promote selected mature and nearly mature renewable energy technologies (RETs) in selected countries of Asia.

• Major activities carried out within the programme include
  a) Adaptive research,
  b) Demonstration,
  c) Capacity building/training, and
  d) Dissemination.

This presentation illustrates the capacity building activities carried out since 1997.
CAPACITY BUILDING ACTIVITIES CARRIED OUT

✓ The 13 national research institutions (NRIs) in the six countries and AIT played key roles in capacity building.

✓ Capacity building was done at two levels:
  (i) FOR the collaborating institutions, and
  (ii) BY the collaborating institutions.

Additionally, Regional Training Workshops were conducted at AIT where technicians outside the RETs in Asia Programme, from the Asian region also participated.
CAPACITY BUILDING ACTIVITIES CARRIED OUT

Training FOR the collaborating institutions:

**Aim:** to impart the required capacity to the NRIs to conduct applied technical research to adapt RETs to local conditions

Involved the following:

- Institutional Research Capacity Building
- Special Study/ Fellowship Programmes
- Training of Junior Researchers (intra-institutional)
- Technology Transfer through Inter-institutional Training
- Mutual Visits
INSTITUTIONAL RESEARCH CAPACITY BUILDING

• Researchers from the 13 institutions were trained on various aspects to enhance their research capabilities.
• Assistance was provided to establish laboratories (with basic research instruments and equipment) for conducting limited adaptive research.

- E.g.: PV laboratories - instruments such as variable power supply, oscilloscopes, Ampere-Volt-Ohm (AVO) meters, lux meters, soldering irons & other tools for conducting research where PV accessories could be designed, fabricated & tested.

• Books & Periodicals acquired
As a result, a number of PV accessories were developed by the collaborating institutions in their respective countries. Non-relay regulators using semiconductor switches (transistor/MOSFET), ballasts for both fluorescent & CF lamps, high effy. true sine wave DC-AC inverter, efficient ballasts, and smart charger for PV battery charging station, are some of the accessories thus developed.
Similarly, several modifications to existing designs of solar dryers used in the region were carried out systematically, through extensive studies. (E.g.: UPLB introduced an air distributor to a hybrid cabinet dryer by conducting computer analysis of air flow patterns inside the drying cabinet).
INSTITUTIONAL RESEARCH CAPACITY BUILDING

- Improvements introduced to traditional heated-die screw-press biomass briquetting machines
  - to reduce the briquetting energy consumption
  - to increase the screw life, and
  - to reduce smoke in the operator vicinity.
INSTITUTIONAL RESEARCH CAPACITY BUILDING

- Also, a number of briquette stoves were designed and developed by the NRIs.
- Some developed at AIT; designs transferred to NRIs - Gasifier stove series (IGS2, CGS3, DGS), top-burning stove, charcoal making stove.
SPECIAL STUDY PROGRAMME

✓ Key staffs of the participating institutions attended short courses (for 3 months each) on their respective research areas, at AIT.

✓ The programme contained lectures and practical experiments on system design & performance analysis.

✓ Field visits were also arranged as part of the programme.

✓ Participants prepared individual reports on their activities - to enhance report-writing skills.
  
  • The reports included details of experiments conducted by individual participant, observation & results analysis.

✓ 40 researchers from these institutions participated.

✓ English language training to selected participants in the form of bridging courses (2 months) – by CLET/AIT.
FELLOWSHIP PROGRAMME

• Shorter duration (1-2 months), for senior researchers from the participating institutions, also at AIT.
• 7 participants so far.
• Sample research areas:
  - design and development of dryers to suit the specific needs of a product/community/country.
  - design adaptation of selected PV systems/devices for specific applications.
  - effect of screw profiles in briquette production/energy consumption.
  - RE policy review in selected countries, and formulation of policy recommendations.
• Research topics finalised by the NRIs in consultation with AIT
TRAINING OF JUNIOR RESEARCHERS

- Knowledge dissemination between researchers in a particular institution.

- Some NRIs (UPLB/Philippines, RECAST/Nepal) assigned undergraduate students to study selected design problems relating to the development of specific technology application (IGS-2, hybrid cabinet dryer, UTC).

- The exposure given to the junior researchers might lead to further research in the same or similar RE areas in the future - additional manpower development.
TECHNOLOGY TRANSFER THROUGH INTER-INSTITUTIONAL TRAINING

- Inter-institutional training was offered in some institutions for staffs from the other participating institutes.

- The programmes consisted of technology description, design considerations, component introduction, fabrication, testing and troubleshooting, repairing and maintenance.

- The participants could successfully replicate the techniques they learned in their home countries after the training.

- Between AIT and the participating institutions
- Between the institutions themselves
TECHNOLOGY TRANSFER THROUGH INTER-INSTITUTIONAL TRAINING

• Researchers from RONAST and IE participated in a one-day training at AIT following the Methodology Workshop in May 99.

• Participants from STEA and MIME visited SolarLab/Vietnam for a training programme on PV Systems & Accessories.

• All the PV group NRIs visited SolarLab for two training programmes, one on Inverters and the other on Charge Regulator (non-relay type).
• Briquetting group NRIs visited IE/Vietnam for a training on design, fabrication, testing and modification of improved briquetting system and briquette stoves.

• Drying group NRIs, during their visit to AIT for the Dryer Design Workshop, were trained on improved drying systems at AIT.

• Designs of improved briquetting system and briquette stoves were transferred to the NRIs through similar workshops at AIT.
TECHNOLOGY TRANSFER THROUGH INTER-INSTITUTIONAL TRAINING

Example:

BIT Training

• A training programme was conducted by BIT in Aug 1999 for the other NRIs involved in briquetting.

• Participants were trained in the complete fabrication of briquetting machine, screws, and dies. Repairing/hardfacing of worn out screws using special welding electrodes was also demonstrated.

• Commercial application of the briquetting technology was also witnessed by the participants by field visits to shops selling briquettes, and small food stalls and restaurants using briquettes in special stoves for cooking.
TECHNOLOGY TRANSFER THROUGH INTER-INSTITUTIONAL TRAINING

BIT Training

Fabrication of Briquetting Screw

Diesel engine-operated Briquetting Machine

Assembling of Briquetting Machine
TECHNOLOGY TRANSFER THROUGH INTER-INSTITUTIONAL TRAINING

BIT Training - Briquettes as alternate fuel to wood

- Briquettes sold in a firewood shop
- Briquettes in carts, sold in the streets
- Briquettes as fuel in roadside foodstalls
- Fabrication of briquette stoves
Following the training, the main components of a sample briquetting machine was supplied by BIT to each of the other NRIs.

From the knowledge gained in the BIT training, the technicians fabricated certain other components which were not supplied by BIT, and assembled their own briquetting machines in their countries.

The research visit/training thus benefited the NRIs by way of transfer of briquetting technology to the respective countries.
Dryer Design Workshop (at AIT)

- Conducted at AIT in Nov 1999.
- Various designs of solar, biomass and hybrid dryers were presented and discussed by the participating NRIs and AIT.
- Suitable designs were selected by individual NRIs for development & dissemination from among the designs presented.
- Further discussions on Dryer Evaluation helped the participants acquire additional knowledge on dryer testing and evaluation, which is critical to the design and development of dryers.
MUTUAL VISITS

Some of the NRIs visited their counterparts in other countries for specific reasons:

- To know the RE policies of the other govt., tax and other fiscal benefits for RE systems and appliances, (SolarLab visited Nepal),

- To learn how the RE systems compete with conventional systems in the market (SolarLab visited Nepal),

- To see the local RE products & applications, production facilities etc. (STEA and MIME visited SolarLab)
In order to improve the research and administrative facilities of the institutions, a host of facilities, tools and equipment were procured by the NRIs. Some of these are:

- ADINA software by UPLB, Philippines
- Screen printing and etching materials by CMES
- Testing and measuring instruments by IE, GS
- Computers, printers, scanners, CD writers, cameras etc.

by all NRIs,
CAPACITY BUILDING ACTIVITIES CARRIED OUT

Training BY the collaborating institutions:

Involved the following:

• Local training programmes
• Workshops/ seminars
• Demonstrations
• Development of Training Manuals
TRAINING PROGRAMMES

- Selected categories of target groups were identified for individual technologies – e.g.: technicians and end users for PV technology (in Bangladesh and Nepal); cooperatives for drying (in Nepal and the Philippines); and entrepreneurs for briquetting (in Bangladesh, Nepal and Vietnam).

- Several training programmes, designed for the specific needs of the individual categories, were conducted by the participating NRIs.
TRAINING PROGRAMMES

- Training programmes were generally conducted on operation, installation, trouble-shooting and maintenance of systems.

- CRE, Nepal conducted several training programmes for SHS users, technicians and one for financial institutions. More than 200 persons were trained in these programmes.

- CMES organized consumer-training programs for micro-utility consumers (and potential customers) to familiarize them with the operation of PV systems and appliances.
Training programmes

- Training of unemployed youth with high school certificates - as certified technicians - was seen by Grameen Shakti as an effective way of disseminating PV technology in rural villages.
- Twin benefits: skills development, and employment generation.
- With this view, GS prepared well-organised training modules and manuals for training technicians and has trained several hundred youths so far.
- PV customers are also trained on the basic operation and maintenance of PV systems.
- More than 1,600 users and about 980 technicians have been trained on PV technology alone, since 1997.
TRAINING PROGRAMMES

• Similar training programmes were also conducted by RECAST, UPLB, UPD and ITC on solar/biomass/hybrid dryers in their respective countries.

• Fabrication, operation, maintenance, trouble-shooting and repairing

• BIT, IE and RONAST have also organised training programmes on biomass briquetting and briquette stoves in their countries.

• Generally on machine & stove fabrication, operation, maintenance, trouble-shooting and repairing.

• BIT’s programmes were more on screw fabrication, hard-facing, and repairing.
Workshops/Seminars

- Workshops were also conducted to provide hands-on training.
- Although similar to training programmes, workshops generally contained more practical activities. E.g.:
  - IE conducted a two-day briquetting workshop for private and govt. sector people in Nov. 1999
  - Objective: to disseminate the technology of improved portable briquette stoves and to develop the stove-making skills.
  - 21 participants
  - Consisted of presentations, stove making sessions, demonstrations on proper use & maintenance, and visit to a commercial stove manufacturing facility.
Workshops/Seminars

- BIT conducted a workshop in Khulna on briquette stoves in Nov 2000.
- The programme included stove-making sessions, and demonstrations on stove operation and maintenance.

- Seminars often involved expert presentations and lectures.

Some statistics (on all three technologies):
No. of local seminars/workshops conducted: 46
No. of technicians trained/courses conducted: 1100/48
To assist in the training process, several Manuals on design, fabrication, operation, trouble-shooting and maintenance were developed by the NRIs, many of them in the local language. E.g.:


CRE has assisted the efforts of the govt. in promoting PV technology by developing ‘PV Skills Testing Standards’ for the use of the Council for Technical Education and Vocational Training (CTEVT) of the govt. of Nepal.
MANUALS

✓ Manuals were also prepared at AIT on drying systems, improved briquetting systems and briquette stoves.
✓ These were distributed to the collaborating NRIs to assist in their local training programmes.

➢ A compilation of PV systems and accessories available in the Asian region was prepared at AIT, mainly for the use of technicians.

Manuals for training courses published: 16
(for users, technicians and entrepreneurs)
To train technicians active in their respective technologies in the Asian region on selected technologies developed/adapted within the RETsin Asia programme, regional training workshops were conducted at AIT.

1. RE systems workshop – 24 April 2000
   - Technology descriptions on the drying systems developed/adapted at AIT
   - Fabrication techniques, demonstrations.
REGIONAL TRAINING WORKSHOP

2. Gasifier Stove (IGS2) design – ARECOP – 19-21 Mar 2003

- 14 participants from India, Indonesia, Sri Lanka, Nepal, Philippines and Cambodia,
- Biomass gasification technology
- Stove design and construction
- Fuel preparation, Stove start-up and operation
- Demonstration – stove fabrication, assembly, testing
- Design & operation – demo of other stoves
The effect of these training programmes are already visible in several countries.

- A large number of trained technicians have induced confidence among the general population on the RET involved.

- Installation and use of RE systems and appliances have increased considerably. (E.g.: PV SHS in Bangladesh, hybrid dryers in the Philippines).

- Costs for several PV accessories which were imported earlier have significantly reduced (upto 40%) as these are now locally fabricated.
IMPACTS OF CAPACITY BUILDING

- Availability of after sales service for PV installations are now within the users reach in Vietnam, Lao PDR and Bangladesh.

- A significant technical expertise is available in the collaborating countries on the respective technologies.

- Employment generation has been reported in Vietnam, Nepal and Bangladesh with entrepreneurs starting new business ventures to produce PV appliances (charge controllers, inverters etc.), briquetting machines and briquette stoves.
CONCLUSION

- Over the seven-year implementation period (1997-2004), the *RETs in Asia* Programme has contributed significantly in terms of capacity building for RETs in the six participating countries.

- Impacts of the capacity building activities of the programme can already be observed in several countries; the long-term impact of the programme is expected to be valuable.

- The regional networking approach of the programme is found to provide a unique opportunity to the participating institutions to learn from each other – especially on problems common to the region.
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