Integrated Knowledge Partnership Workout

How Energy/AIT can Support Indonesia CoE with ADB

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Outlines

- Core competency of Energy Field of Study, AIT
- Energy/AIT's research work relevant to Indonesia
- How Energy/AIT can support COE with ADB

Key Facts: Asian Institute of Technology

- Founded in 1959, located 40 km north of Bangkok, Thailand
- 1,741 Students from 42 Countries/Territories
- 21,375 Alumni from 100 Countries/Territories
- 30,000+ Short-term Trainees from 70+ Countries/Territories
- 78 Internationally recruited Faculty from 20+ Countries
- 101 Adjunct Faculty/ Visiting Faculty
- 600+ Research and Support Staff from about 43 Countries
- Approximately 450 Sponsored Research Projects – 1.6 Billion THB

Asian Institute of Technology (AIT)

3 different Schools

- School of Environment, Resource and Development (SERD)
- School of Engineering and Technology (SET)
- School of Management (SOM)

Fields of study

- Agricultural Systems and Engineering
- Aquaculture and Aquatic Resources Management
- Environmental Engineering and Management
- Food Engineering and Bioprocess Technology
- Gender and Development Studies
- Natural Resources Management
- Pulp and Paper Technology
- Regional and Rural Development Planning
- Urban Environment Management
- Energy

- Electric Power System Management (1994)
- Energy Economics and Planning (1983)
- Energy Business Management (2012)
- Energy Technology (1979)

AIT's Goals in Energy Sector!

- **Knowledge and research focus in areas of**
  - renewable and energy efficient technologies in Asia including central region, specially for improving energy access
  - regional energy integration and energy security, especially in ASEAN region given upcoming AEC
  - smart electrical energy infrastructure development system from supply to customer side management
  - policies and market for carbon-constrained and an efficient energy system

Core competency of Energy Field of Study, AIT

Teaching

- **Doctoral degree**
- **Master's degree**
- **Certificate**
- **Others:**
  - **research fellowship**
  - **special students**

Applied Research

- **Sponsored**
- **Students**

Outreach

- Training/Workshop
- Conference
- RERIC Publications
- Testing

Alumni / Ongoing Students

30+ countries

• Afghanistan	1
• Bangladesh	34
• Bhutan	16
• Cambodia	20
• China	57
• Denmark	3
• Finland	3
• France	4
• Germany	1
• Indonesia	25
• India	55
• Kazakhstan	5
• Kyrgyzstan	1
• Kiribati	1
• Korea	3
• Lao PDR	27
• Malaysia	11
• Maldives	2
• Mongolia	1
• Myanmar	32
• Nepal	47
• Netherlands	1
• Pakistan	46
• Philippines	56
• Singapore	5
• Sri Lanka	54
• Thailand	297
• Tonga	1
• Vietnam	177
•Timor-Leste	1
•Other	200+

Graduates (1981 to May 2015)

• Master's degree	= 956
• Doctoral degree	= 63
• Other (D,S,C,F)*	= 169
TOTAL	= 1,188

Master Ongoing

Total = 22
MBA-EB = 5

Doctoral Ongoing

Total = 19

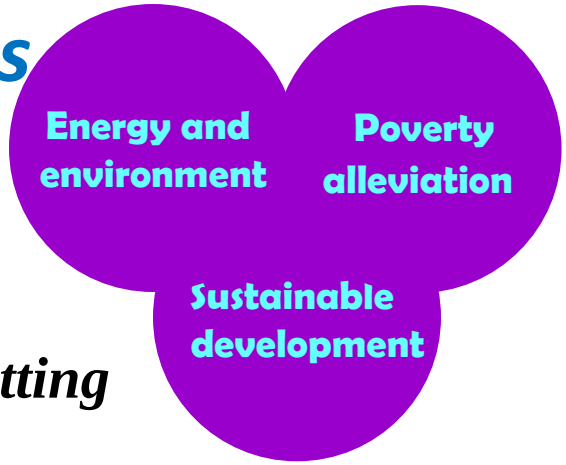
*Diploma, Special Program, Certificate and Research Fellow

UPDATE June 2015

Energy research at AIT

- **International initiatives**
  - UNEP, UNIDO, UNDP, ADB, etc (energy access, energy efficiency, etc)
- **National priorities**
  - Ministries of Energy, Industry, Environment, etc (policies, energy related emissions, etc)
- **Development Agencies**
  - SIDA, USAID, etc (energy and sustainable development)
- **Sponsorships**
  - Industries (cleaner production, testing of equipment)
- **Faculty/student interest**
  - Energy conservation, sustainability, etc

AIT addresses following energy issues



- ***Energy and climate change***
- ***Solar thermal and photovoltaic conversion***
- ***Energy management in buildings and industries***
- ***Biomass energy conversion, gasification and briquetting***
- ***Renewable energy and energy efficiency***
- ***Restructuring of energy industries***
- ***Demand-side management***
- ***Integration of renewable energy sources***
- ***Rural electrification and distributed generation***
- ***Smartgrid and Microgrid***
- ***GHG emissions and energy related planning and policy strategies and modeling***
- ***Energy demand and supply analysis and policies***
- ***Energy conservation policies***
- ***Energy pricing under deregulation and privatization***
- ***Environmental implications of energy development***
- ***Urbanization, cities and climate change mitigation***

ENERGY Field of Study

FACULTY

KUMAR, SIVANAPPAN
Professor and Vice President Academic Affairs
(Solar energy, energy and climate change, energy and sustainable development)

ONGSAKUL, WEERAKORN,
Associate Professor
(Power system economics, analysis and computing, power system restructuring and deregulation)

P. ABDUL SALAM
Associate Professor and Acting Leader of Energy Environment Thematic Area
(Bio-energy, Renewable Energy)

JAI GOVIND SINGH
Assistant Professor and Coordinator Energy FoS
(Power System Planning, Operation and Control, FACTS, Smartgrid and Microgrid, Deregulation, Renewable Energy Generation & Integration of)

SHOBHAKAR DHAKAL
Associate Professor
(Energy Economics, Planning and Policy Analysis, Climate Change, Cities and Urbanization Issues)

ENERGY Field of Study

VISITING / ADJUNCT FACULTY

BRAHMANAND MOHANTY

(Energy Efficiency and Management)

AUMNAD PHDUNGSILP

(Energy, Environment and Climate Change: Issues and Strategies)

RAM MANOHAR SHRESTHA

Energy and Environmental Policy, Energy and Electricity Economics, Energy-economic Modeling)

Recent Indonesia Student's research work at AIT

- Ms. Happy Aprillia (Indonesian, 2014): **Performance Enhancement of an Unbalanced and Harmonically Distorted Three Phase Radial Distribution Network by Optimal Placement of a Capacitor Using DSA**
- Mr. Stevanus Ronald Hasiholan Panggabean (Indonesian, 2014): **A Study on the Steam Generation System in a Pulp and Paper Mill**
- Mr. Gunawan Damanik (Indonesian, 2013): **Combustion of Mixed Fuel in Circulating Fluidized Bed Boiler**
- Mr. Dedi Yandri (Indonesian, 2013): **A Study on Efficiency of Power Boiler**
- Mr. Andri Setiyo Wibowo (Indonesian, 2012): **Status of and Improvement Opportunities for Energy Usage in a Kraft Pulp and Paper Mill**
- Mr. I Made Wartana (Indonesian, 2012, Doctoral): **Optimal Placement of FACTS Controllers and Distributed Generation for Maximization of the System Loadability**
- Ms. Hafsah (Indonesian, 2011): **Potential of Oil Residue for an Energy Based System in South Sumatera**

Publication and workshop related to Indonesia

- B. Mohanty, **Sustainable energy financing: IFC's eTool for buildings and industries**, National Annual Energy Efficiency Conference, Jakarta, Indonesia, 11-12 June 2012.

- Mr. Wichien Tunyasrivorakul (Thai, 2013): **Time Series and Panel Data Analysis of Crude Oil Consumption for Indonesia, Malaysia and Thailand.**
- Miss Karabee Das (Indian, 2013): **A Generic Methodology for Geographical Assessment of Microalgae Potential**

- **SE4ALL Energy Efficiency Workshop: Indonesia**

  Date and location: 25 November 2014, Jakarta, Indonesia

  Organizer: AIT, Pathumthani, Thailand

  Supported by: UNEP Risoe Centre

  Number of Participants: 22

Selected sponsored research projects completed by AIT

- Technology Needs Assessments in Asia for Climate Change Mitigation. (TNA)
- Preparation of four issue papers on Renewable Powered Microgrid/Off-grid Generation System in Thailand, Philippine, India and Indonesia.
- Pilot Appraisal of Low Carbon Technology Innovation and Diffusion in Thai Manufacturing Sectors.
- Actions towards Resources-efficient and Low carbon cities in Asia.
- E-learning course on Renewable energy and energy policy.
- Green House gas emission mitigation at AIT: Reducing GHG Emission Through Energy Conservation.
- Bio-energy for Rural Development and Poverty Alleviation
- Energy Efficiency using RETScreen and Integration of RETScreen Version 4 in education and Training.
- Microhydro – PV Hybrid System.
- Capacity Development on Clean Coal Technology and Carbon Sequestration.
- Biomass Gasification study in the Mekong Region. (EEP Mekong)
- Energy and Sustainable Development: Issues and Strategies (ESD)
- Climate Compatible Urban Development
- Water-Energy-Carbon Nexus in Asian Cities

Some master thesis research projects (2013)

- Impact of Renewable Power Source Integration on Voltage Stability in Southern Power System Network of Afghanistan
- Macroeconomic and Environmental Benefits Due to Wind Energy Policy: A Case Study of Gujarat Wind Energy Sector
- Time Series and Panel Data Analysis of Crude Oil Consumption for Indonesia, Malaysia and Thailand
- Integrated Audit in a Small Meat-Drying Enterprise in Cambodia
- Sustainable Extraction and Usage of Coal in Jamalganj Coal Field, Bangladesh
- Panel Cointegration and Causality Analysis on CO2 Emissions in Selected Asean Countries
- Life Cycle Analysis of Solar (Thermal and Photovoltaic) and Wind Technologies
- Multi-Objective Power Distribution System Planning Considering PEVs by NSPSO
- Combustion of Mixed Fuel in Circulating Fluidized Bed Boiler
- Hydro-Thermal Coordination Using Pseudo-Gradient Particle Swarm Optimization Considering Wind Power Uncertainty: A case of Vietnam
- Optimal Operation of Cascade Hydropower Plants: A Case study of IALY Hydropower Company in the central Region of Vietnam
- Design of Framework to Estimate Job Co-Benefits of Renewable Energy Technologies Using Life Cycle Assessment
- A study of Green Roof Technology

Some master thesis research projects (2014)

- Improvement of Uncertain Power Generation of Rooftop Solar PV Using Battery Storage Energy Management System
- A Study on Street Lighting in the AIT Campus
- Optimal Placement of Vehicle-to-Grid Charging Station in Distribution System Using Particle Swarm Optimization with Time Varying Acceleration Coefficients
- Offshore Wind Energy in Thailand: A Case Study on Koh Tao
- A Study on Electricity Generation using Biogas from Anaerobic Co-Digestion of Napier Grass and Poultry Manures in Thailand
- Operational and Economic Assessment of Microgrid: A Case Study of Mae Sariang, Thailand
- A Study on the Steam Generation System in a Pulp and Paper Mill
- The Effectiveness of Energy Management System Training Program and Improving the Energy Performance of Thai Industries
- Electric Vehicle as a Transport Option for Vientiane: Impact on Transport Energy Demand, GHG Emission and Implications for Electric Planning
- Agricultural Waste to Energy: A Case Study on Nakhon Si Thammarat Province
- Performance of Parabolic Trough Solar Collector

Some master thesis research projects (2015)

- Power Quality Improvement of Different Load Models in a Micro-Grid System
- Energy Consumption and CO2 Emission of Hotel Buildings in Thailand
- Optimal Day-Ahead Scheduling of a Smart Distribution Network: Considering the Effect of Demand Response, Electric Vehicles and Network Reconfiguration

Some doctoral thesis research projects (recent)

- Hybrid solar home connected energy efficient community grid **(on going)**
- Energy and Environmental Conservation Policy Options in Pakistan: an Investigation under the Recursive Dynamic Computable General Equilibrium Framework **(completed in 2015)**
- A Study on CaO-Based Catalytic Tar Reforming for H2-Rich Gas Production in Chemical Looping Gasification **(completed in 2015)**
- Studies on Steam- Air Mixture Condensation in a Vertical Tube to Enhance Heat Transfer with/without Thermal Energy Storage **(completed in 2015)**
- Optimization and Characterization of Palm Ethyl Ester Produced by Mechanical Agitation and Ultrasonic Assistance **(completed in 2015)**
- Assessment of Climate Change Impacts on Hydrology and Hydropower Generation in Belu Chaung Basin of Myanmar **(on going)**
- Stochastic optimal energy management in a radial utility distribution microgrid based on affine arithmetic **(on going)**
- Load flow methods for isolated microgrids based on droop control using PSO **(on going)**

Energy Research Laboratory

Renewable energy applications

Why?

- To promote renewables to address climate change mitigation efforts
- To address the intermittency of solar and make systems fully renewable
- To showcase applications of renewables in various sectors – farming and in cities (smart cities)

What did we do?

- Applications in drying and in air conditioning
- Collaboration with communities and municipalities

How did we do?

(a) Phd, Masters students research and (b) collaboration with partners (Sida and local partners)

Renewable hybrid (Solar-Biomass) system for space cooling and water heating applications

- This system uses solar collector to absorb solar energy for heating the water as a working fluid, and biomass boiler works as auxiliary boiler when solar energy is not enough or not available.

Modern energy access

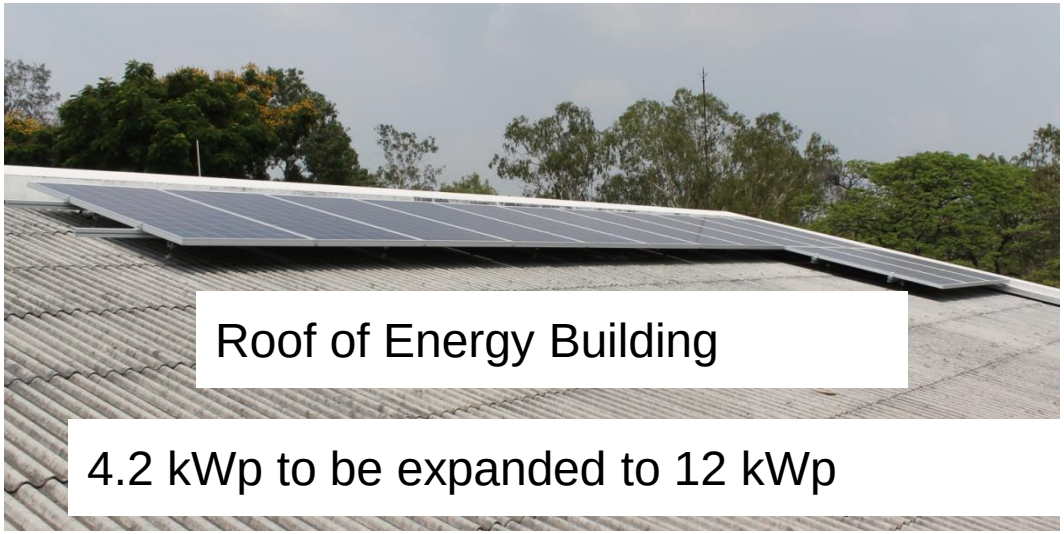
Biomass briquetting system, AIT

Commercial type biomass gasifier stove, AIT

Institutional type biomass gasifier stove, AIT

Domestic type biomass gasifier stove, AIT

Solar PV grid connected system



Roof of Energy Building

4.2 kWp to be expanded to 12 kWp

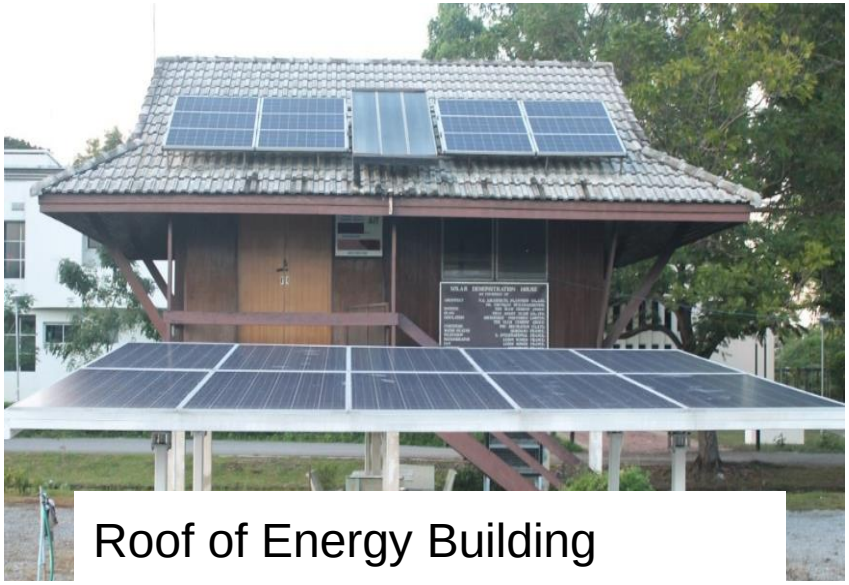
Selected Details

Started: 9 April 2015

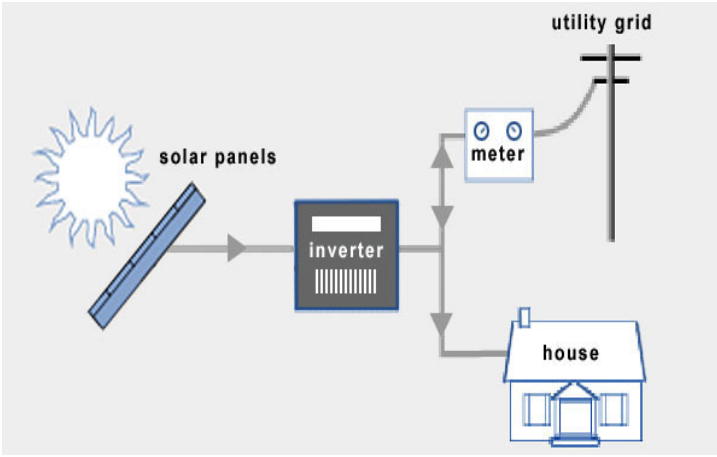
Generated (as of 15 December 2015): 5040 kWh

Average: 20 kWh/day

Saved: About US$650



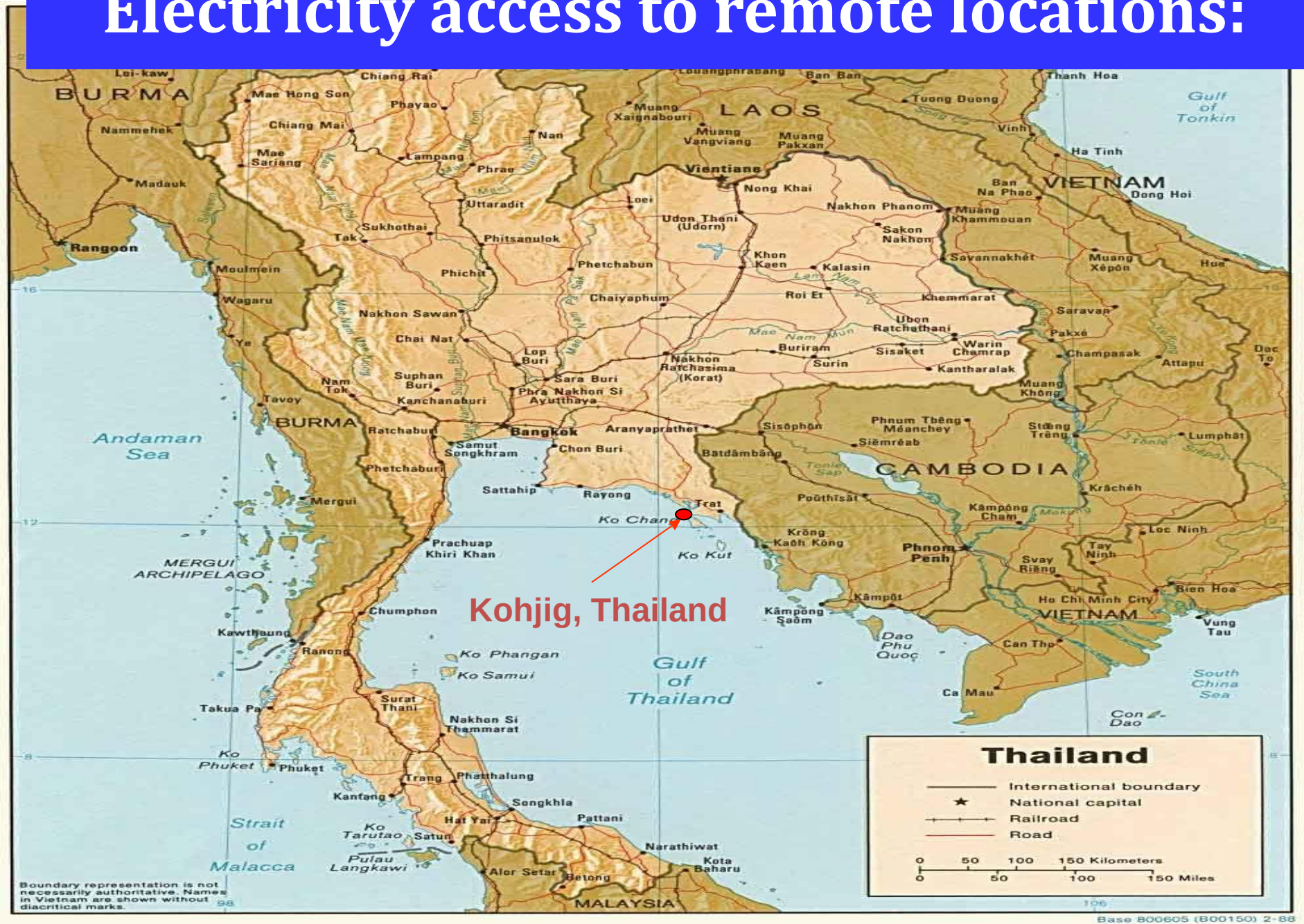
Roof of Energy Building



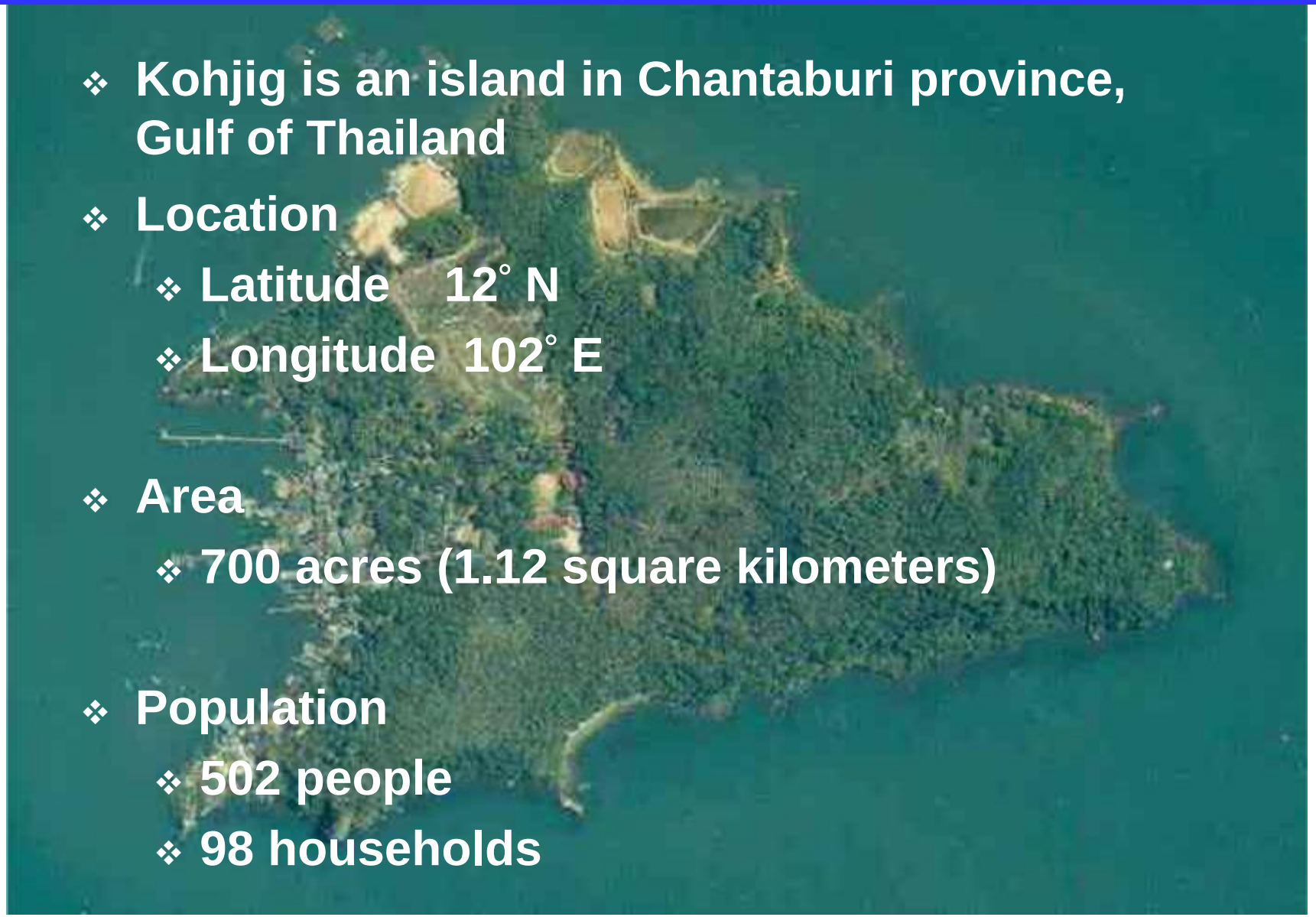
Renewable electricity – technical and financial models

- PV (Bangladesh, Vietnam, Myanmar and Thailand)
  - especially for the poor
  - SHS, Battery charging stations and roof top systems
- PV – diesel hybrid systems for remote locations
  - Small islands
- Micro hydro system with pump as turbine
  - Laboratory studies
- Improved cooking stoves using biomass gasification
  - Laboratory and field studies

Electricity access to remote locations:

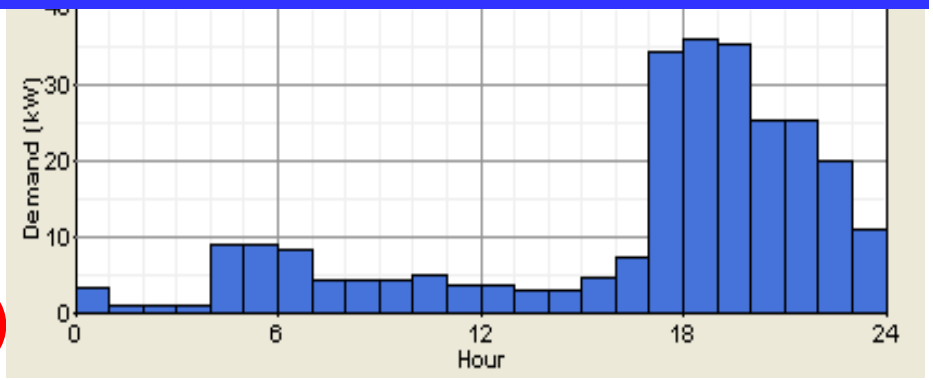


Electricity access to remote locations

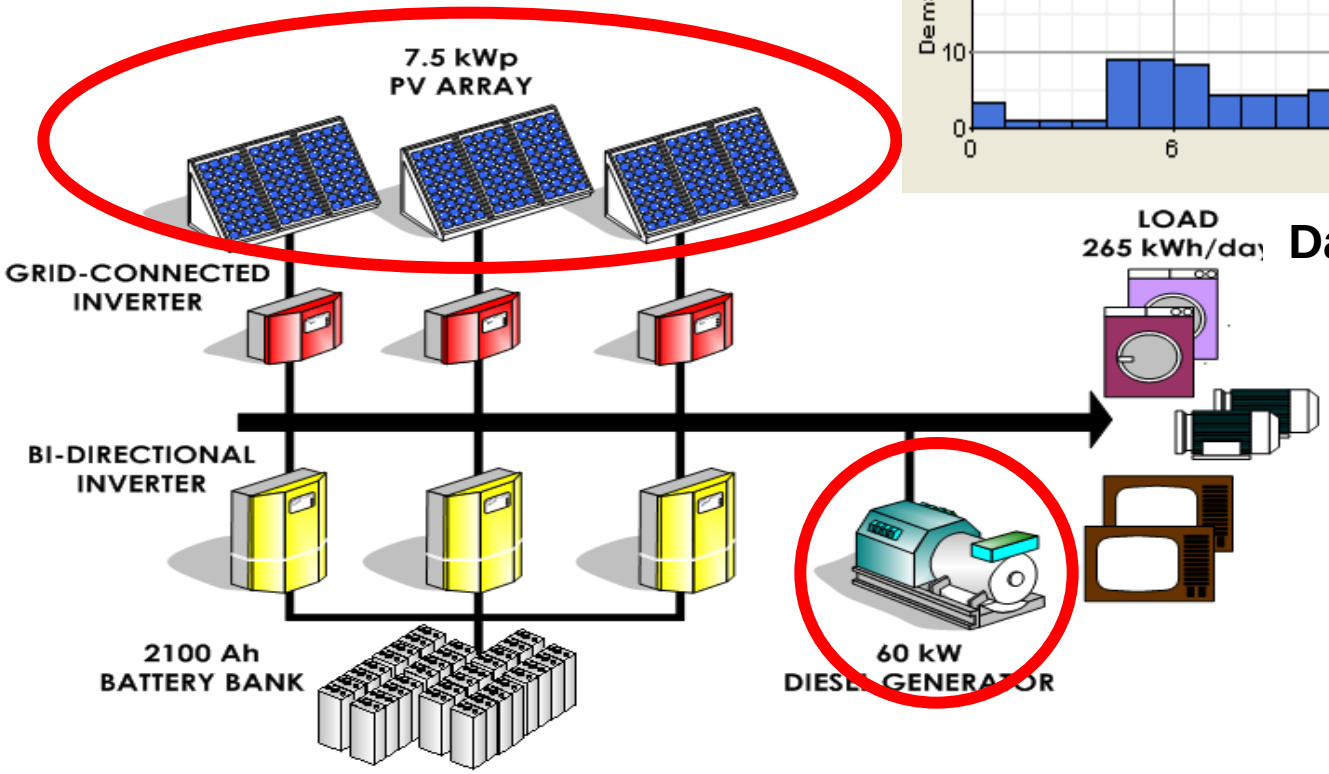


- Kohjig is an island in Chantaburi province, Gulf of Thailand
- Location
  - Latitude 12° N
  - Longitude 102° E
- Area
  - 700 acres (1.12 square kilometers)
- Population
  - 502 people
  - 98 households

Demand profile and proposed system



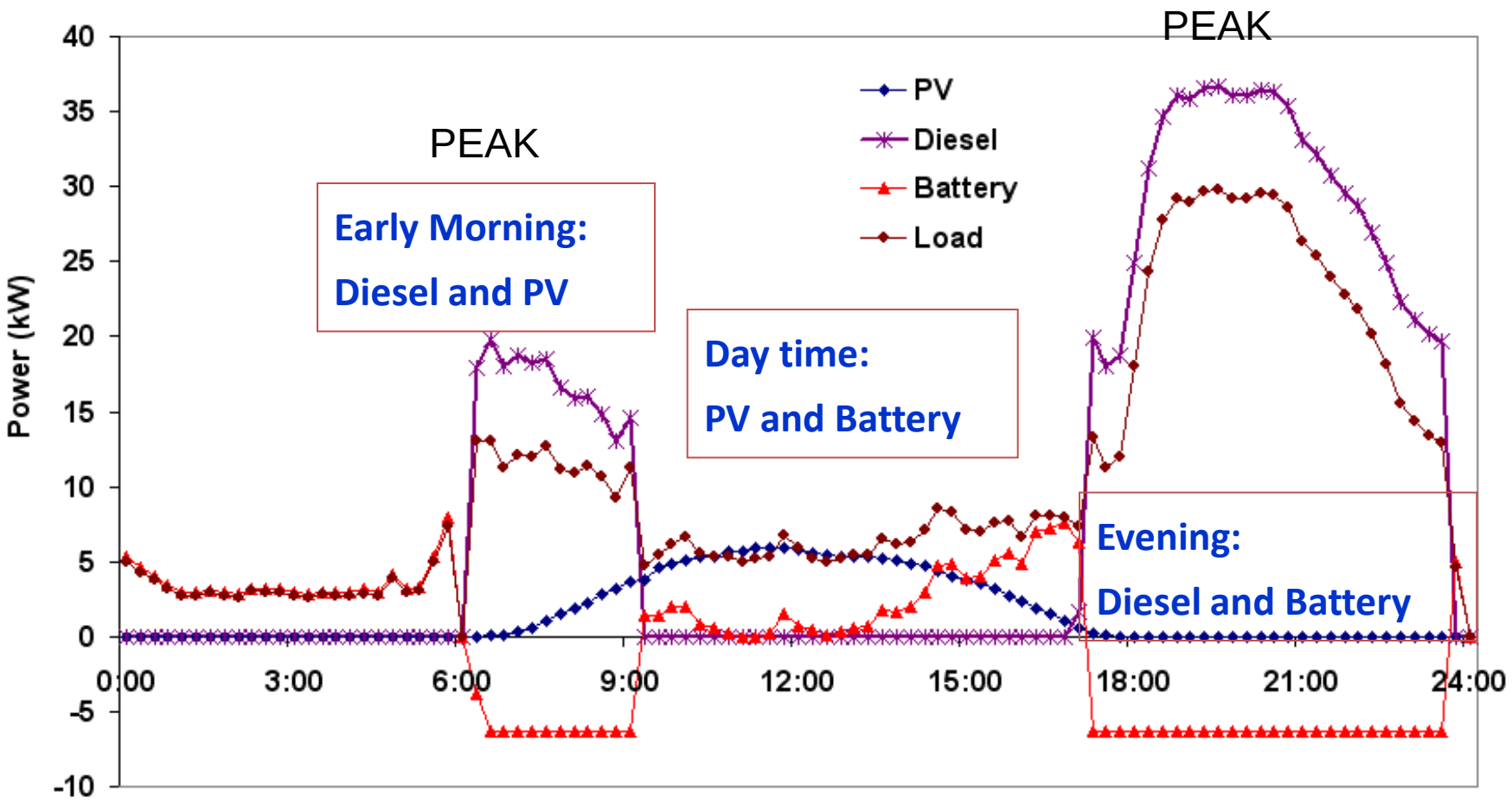
Daily load of the island



Installed in 2004

Managed by Rural Energy Service Company (RESCO)

Working of the PV diesel system



- Electricity supply during a typical day when using the PV hybrid system

User responses of the system

- **Best thing with the PV hybrid system**

Lighting	60%
Entertainment	51%
Study and reading at night	30%
Save money	19%
Improving living standard	8%
Other	5%

- **What a user can do that was not possible before having the PV hybrid system**

Study and reading at night	69%
Entertainment	56%
Working hour extended	19%
Cooking at night	19%
Using light at night	12%
Other	9%

Note: The question was open-ended,
Some gave more than one answer, making the total more than 100%.

Pump as turbine in Microhydro system

Electricity access to the BOP: Myanmar

Principle: To enable BOP to pay for electricity by providing them the possible means for that payment.

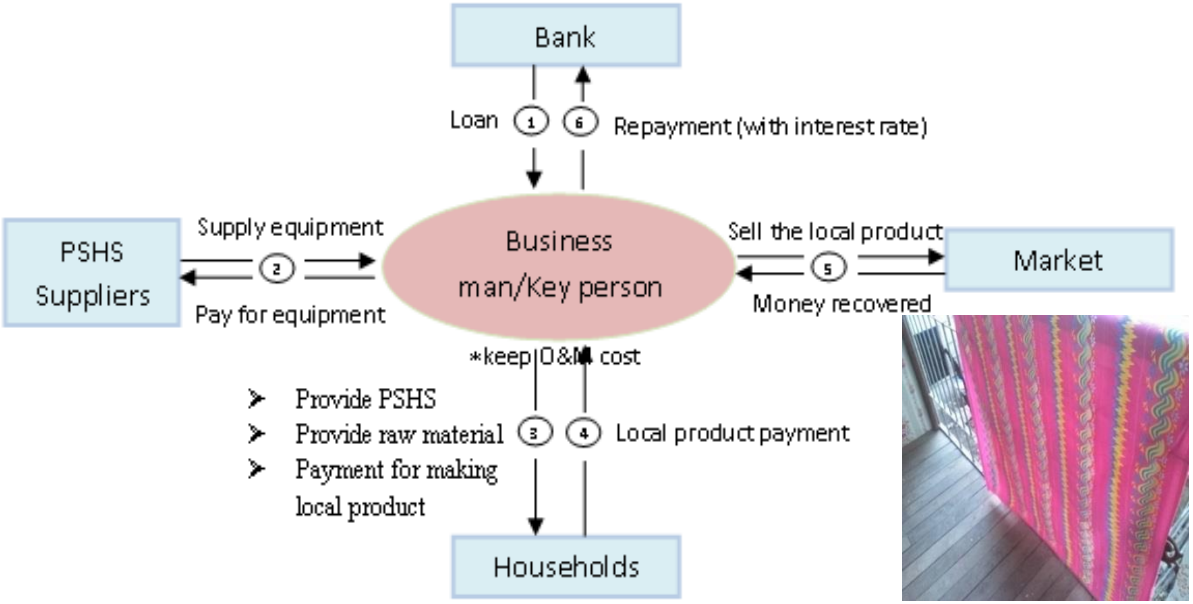
Money Flow

A. Before production of longyi

1. Bank lends money to Key person
2. Key person uses this money to buy PV system from supplier, and raw material from market

B. After production of longyi

1. Key person receives money from market (by sale of longyi)
2. Key person pays to households
3. Key person pays to Bank
4. Key person keeps profit



Goods Flow

A. Before production of longyi

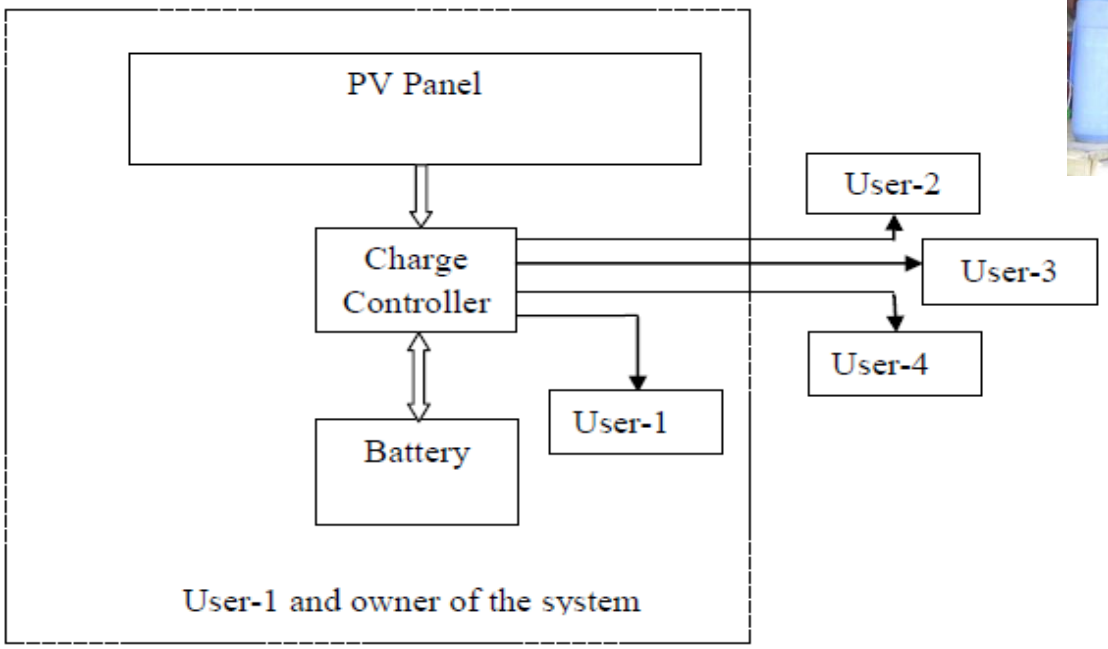
1. Key person buys raw material from market

B. After production of longyi

1. Key person receives longyi from household
2. Key person sells longyi to market

PV micro utility in Bangladesh

- **Access to electricity: 47% of the population**
- **Even with electricity access, many hours of load shedding**
- **Initiated in early 2000.**
- **No of solar home systems: > 1,200,000**
- **No of micro utilities: From less than 5 to 10,000**
- **Around 63% of micro utility owners used 50 Wp.**



PV micro utility in Bangladesh

- System design and actual performance
- The overall efficiency was of the order of 5-6% for each system type.

System Wp	Design energy output (Wh /day)	Actual energy used (Wh/day)
40	84	70 - 80
50	112	80 - 105
60	140	135
65	140	135
80	196	146 - 150
85	224	178 - 200

- Payback

System size (Wp)	40	50	60 - 65	80 - 85
Simple payback (years)	6.3	5.7	5.3	4.2

• Energy usage varied mainly because of the difference of the time of use. Some users in the rural market places used their system up to 11 pm while others was till 9 pm.

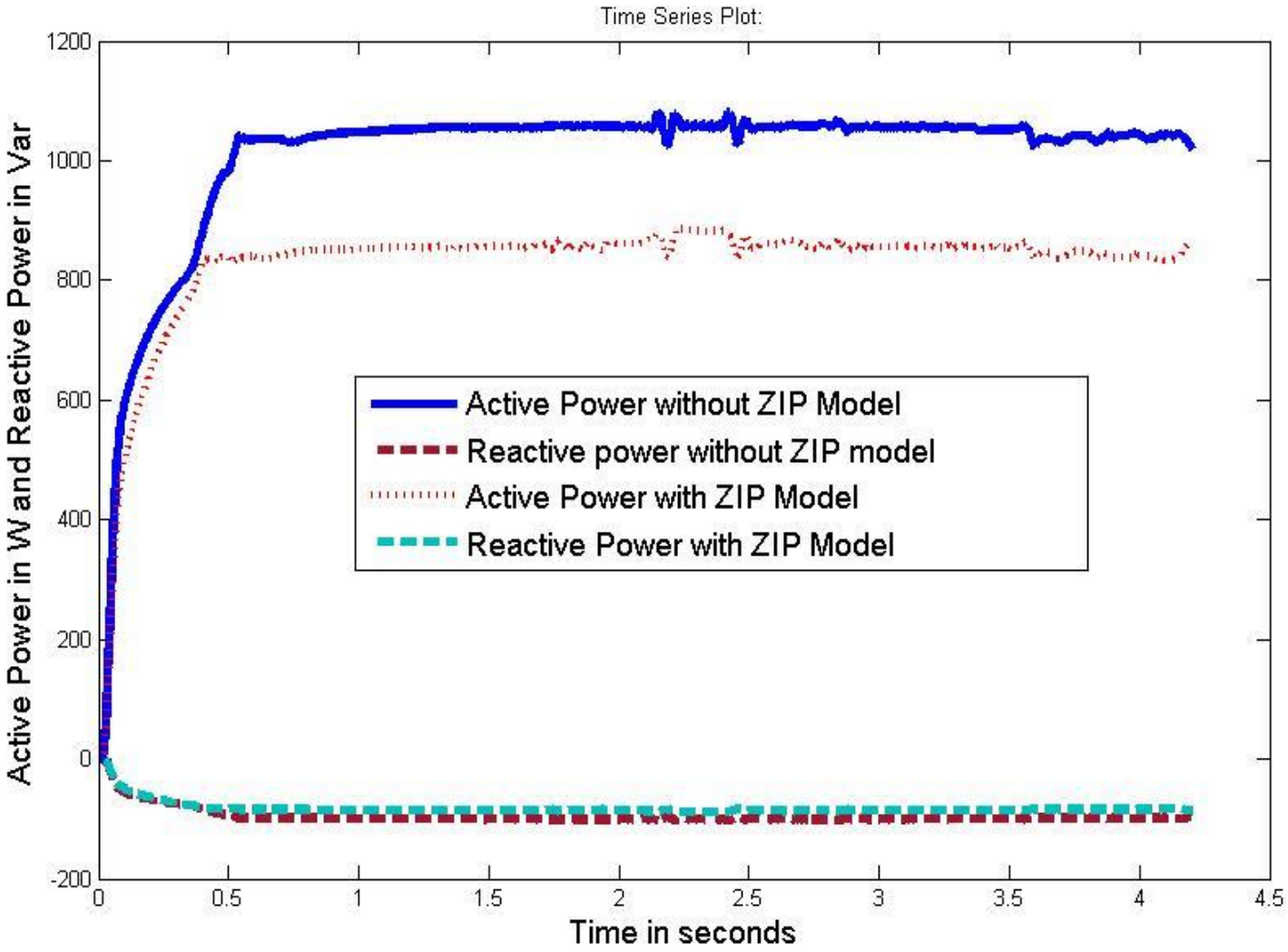
A Homegrid study at AIT

Solar House in Energy Park in AIT, Thailand

A Homegrid study at AIT

Equipment in Solar House in Energy Park in AIT, Thailand

A Homegrid study at AIT



Load modeling with conventional and static ZIP

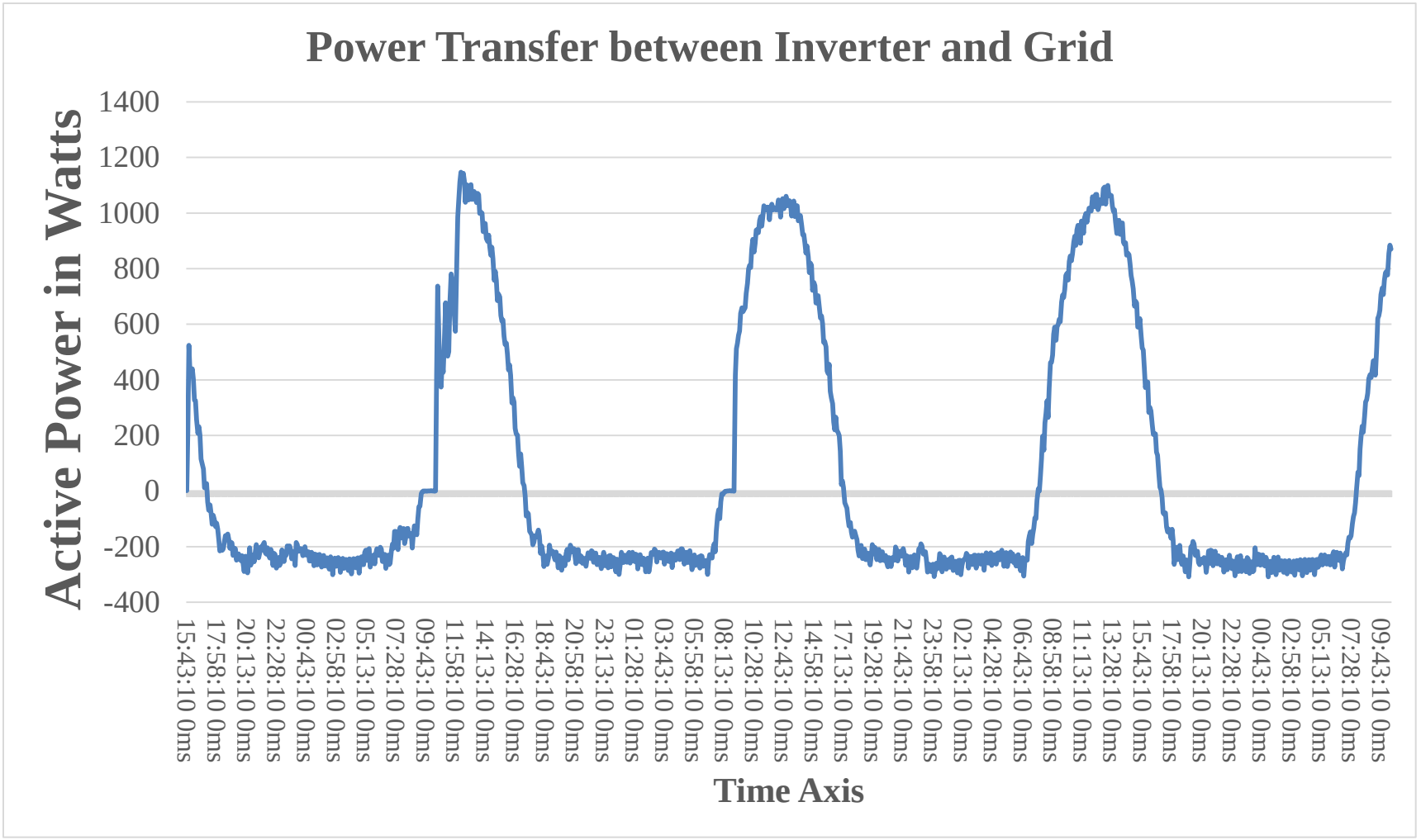
Outcome of Homegrid study at AIT

- When battery was connected to DC side, the efficiency was 95.36%, but when connected to AC terminal efficiency was 82.76 %,
- Further, voltage and current THD were found to be higher by 0.4 % and 20 %, respectively when battery was connected on AC side compared to DC side.
- Lighting system efficiency was improved by 19% when connected to DC side compared over AC side.
- Current Harmonic reduction was also found to be around 27 %.

Additional outcome:

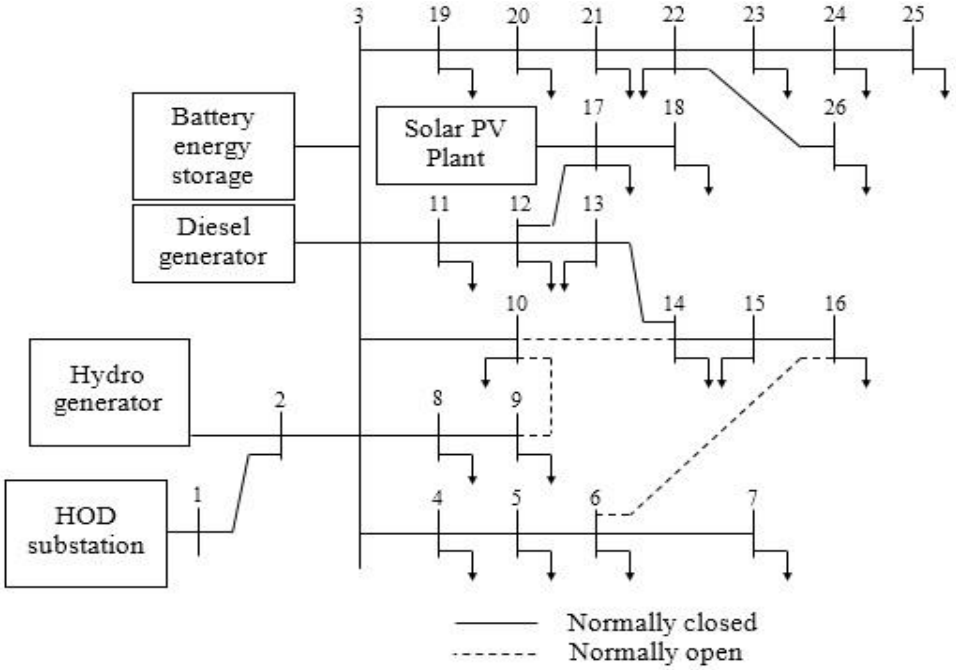
Nikhil Sasidharan, Nimal Madhu M., Jai Govind Singh, Weerakorn Ongsakul (2015). An approach for an efficient hybrid AC/DC solar powered Homegrid system based on the load characteristics of home appliances. Energy and Buildings, *Elsevier*, 108:23–35. (IF=2.884)

Towards Net Zero Energy Building study at AIT



A Microgrid study in Thailand

- This scenario assumes that an interruption occurs in the transmission line between HOD substation and the Mae Sariang power system.
- Initially, the Mae Sariang power system operates in grid-connected mode, where the HOD substation and the solar PV plant are supplying electricity to load, 0.8 MW from substation and 2.0 MW from the solar PV plant.



A Microgrid study in Thailand

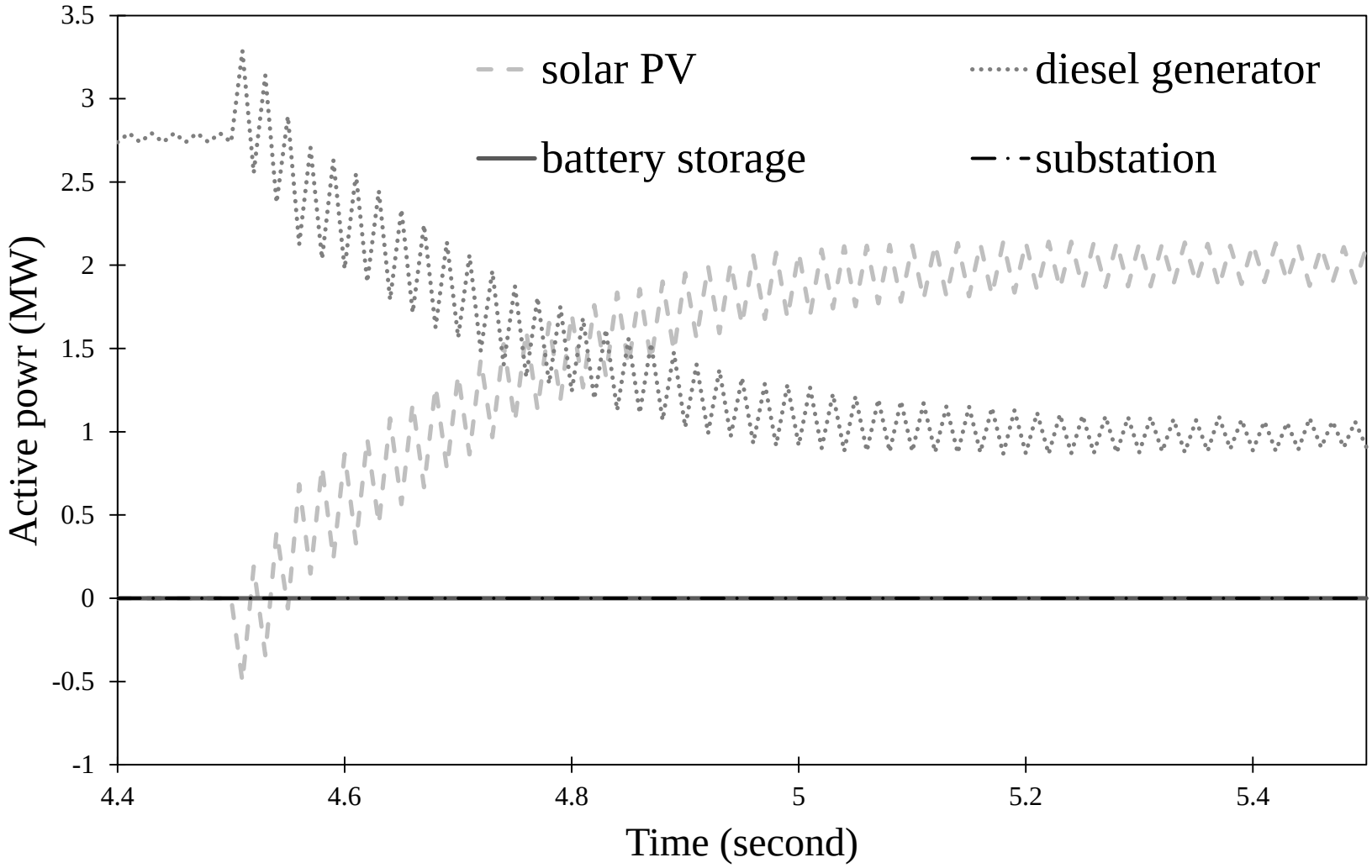


Figure: Active power generation from DGs in the microgrid

Cost of EV can be reduced by time-based pricing

- Assuming vehicles are “used” during normal business hours (8am-5pm), approximately 73% of frequency regulation value is retained
- Southern California remuneration for 2011 was approximately $168/kW for storage available 24/7
- 15kW bi-directional capability

ICE Sedan	V2G Sedan
Lease price=$174/month	Lease price=$200/month
Operating cost($.145/mile)=$145/month	Operating cost($.06/mile)=$60/month
	V2G value=$150/month
Net cost=$319/month	Net cost=$100/month

Net Saving for V2G=$209/month

Bottom line

- Bi-directional capacity alone can reduce the monthly lease price of a EV sedan by about 72%
- More savings expected with the increase in fuel prices

Renewable electricity access

Outputs and Impacts

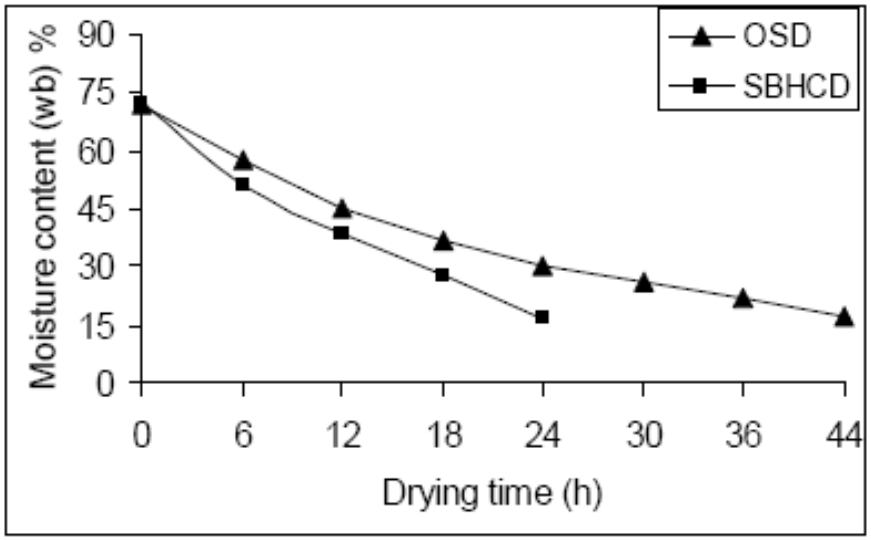
- N. Phuangpornpitak,S. Kumar, User Acceptance of Diesel/PV Hybrid System in an Island Community, Renewable Energy, Vol.36, Issue 1, Page 125-131, January 2011
- M. Ibrahim, M. Anisuzzaman, S. Kumar, S.C. Bhattacharya, Demonstration of PV micro-utility system for rural electrification, Solar Energy, Vol. 72, No. 6, June 2002, pp 521-530.
- Najmul Hoque and S. Kumar. Performance of Photovoltaic microutility systems, Energy for Sustainable Development, 17, 424-430, 2013. (IF: 2.221)
- Somticha Panich and Jai Govind Singh (2015). Impact of Plug-in Electric Vehicles on Voltage Unbalance in Distribution Systems (2015). *International Journal of Engineering, Science and Technology,* 7(3):76-93.
- Vivek Mohan, Jai Govind Singh, Weerakorn Ongsakul (2015). An efficient two stage stochastic optimal energy and reserve management in a microgrid. Applied Energy, *Elsevier*, 160:28-38. (IF=5.613)

Solar-biomass technologies

Solar-Biomass Hybrid Tunnel Dryer

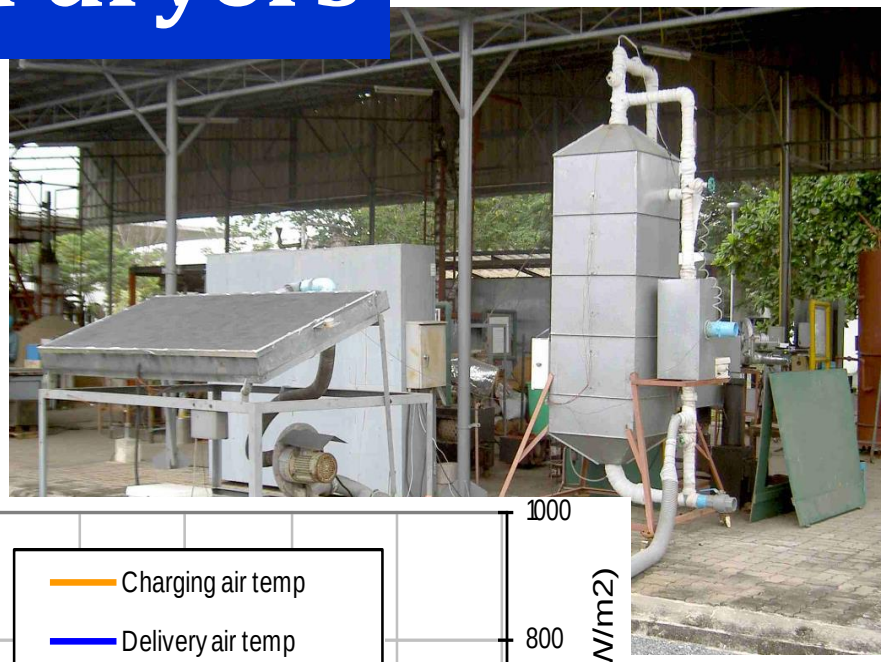
Solar – Biomass Hybrid Cabinet Dryer

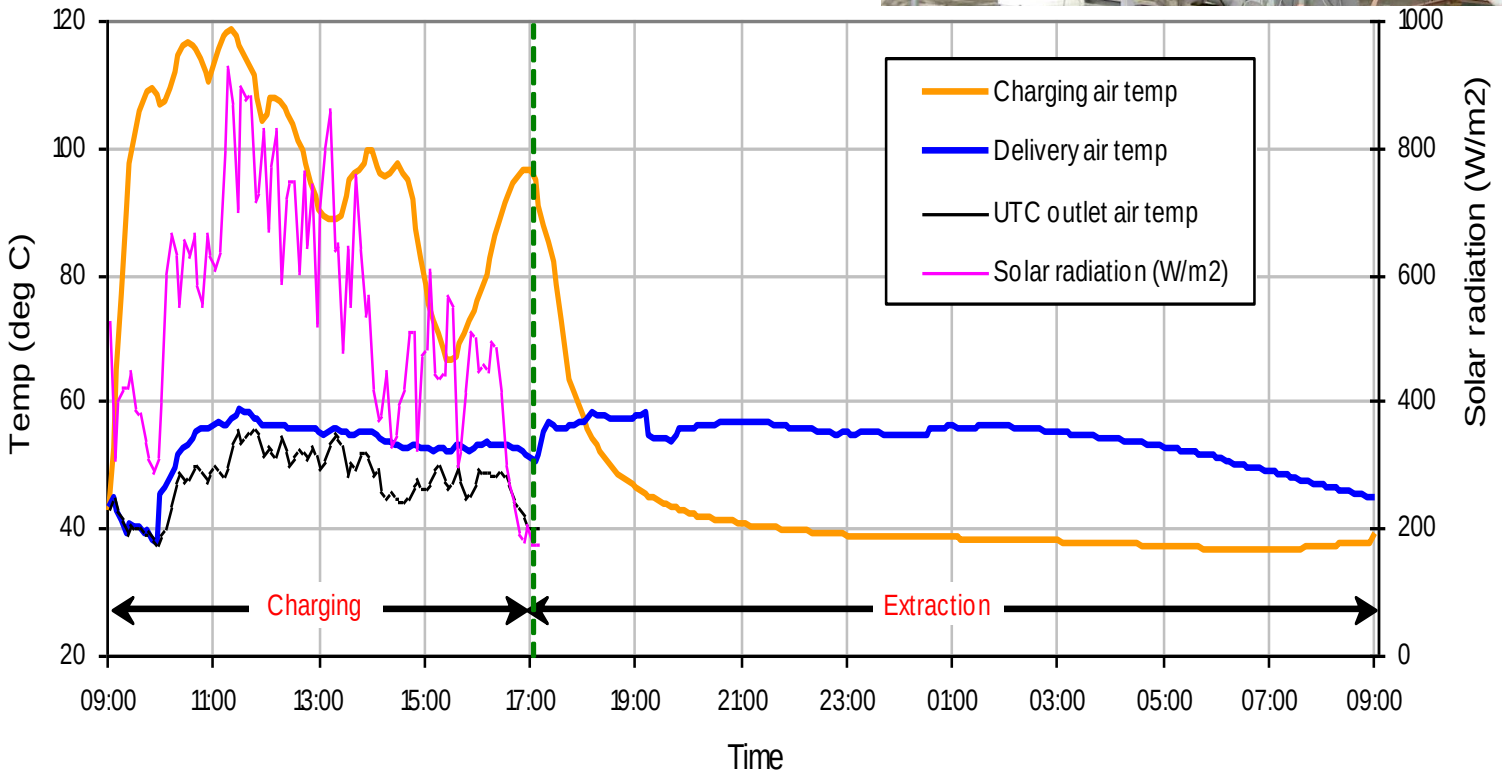
Drying curves of mackerel in S-BHCD and OSD



Hybrid dryers

Applications where continuous constant temperature (air) is needed may require hybrid plus storage systems





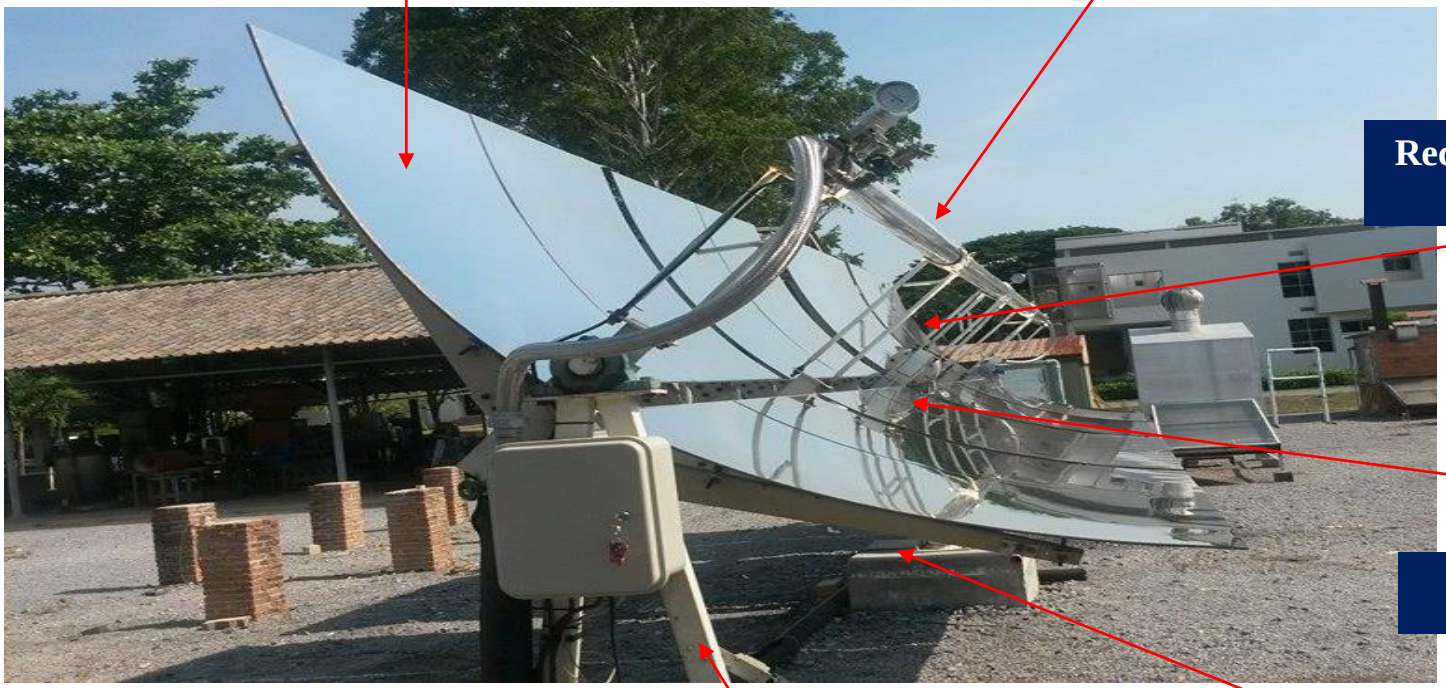
Solar – biomass air conditioning

- Building energy needs – 30%. About 60-65% are for air conditioning.
- Need for solar air conditioning and the need for auxiliary support for solar.
- Theoretical and experimental studies were conducted – feasibility and applicability

- Collector area: 54 m2
- Absorption chiller: 7 kW
- Tank: 1000 litres

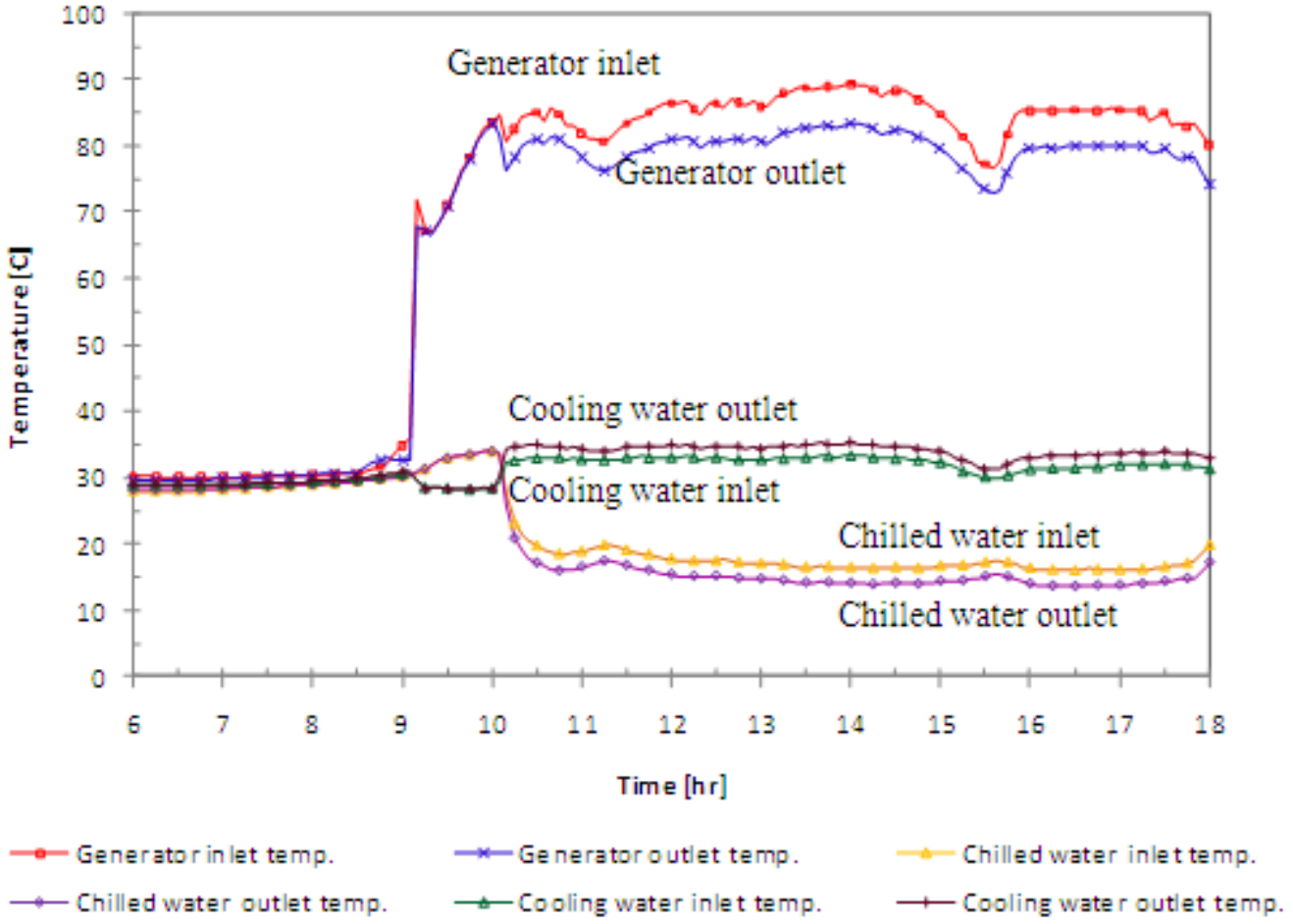
- Boonrit Prasartkaew and **S. Kumar**, Design of a Renewable Energy Based Air-conditioning System, Energy and Buildings, 68, 156 – 164, January 2014.

Solar – biomass air conditioning



Solar – biomass air conditioning

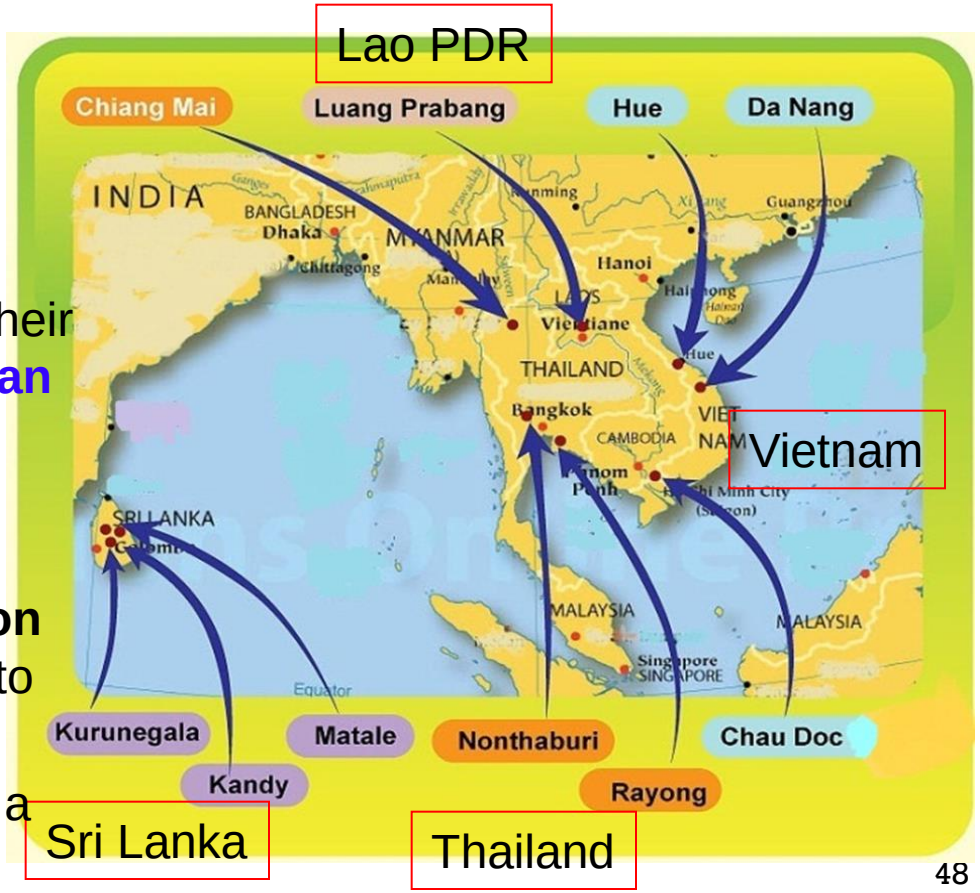
- Experimental observations of various temperatures at inlet and outlet



- Boonrit Prasartkaew and S. Kumar. Experimental study on the performance of a solar-biomass hybrid air-conditioning system, Renewable energy, 57, 86-93, 2013. (Impact Factor: 2.989)

Renewables for communities: low carbon cities

- Actions towards low carbon cities with support from the French Environment and Energy Management Agency had the objectives:
  - To assist small and medium cities of Asia in their efforts towards low carbon society through improved resource efficiency and environmental sustainability.
  - To strengthen capacity of city authorities and other stakeholders in climate change.
- Activities
  - Training partner city authorities and relevant stakeholders on using **to estimate city GHG emissions,** its applicability and analysis.
  - Assisting partner cities to develop their **Territorial Climate and Energy Plan** for climate change mitigation and adaptation at the city level.
  - Assisting cities to identify strategic areas for greenhouse gas **mitigation and adaptation** and support them to conduct **pilot activities**.
  - **Disseminating** information among a wide spectrum of stakeholders.



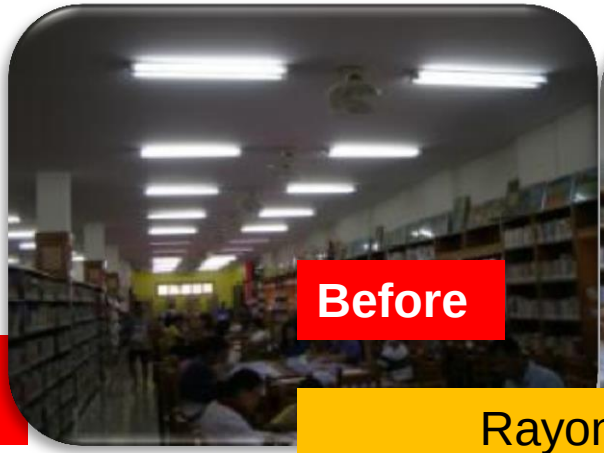
Renewables for communities: low carbon cities

Promotion of Home composting in Matale

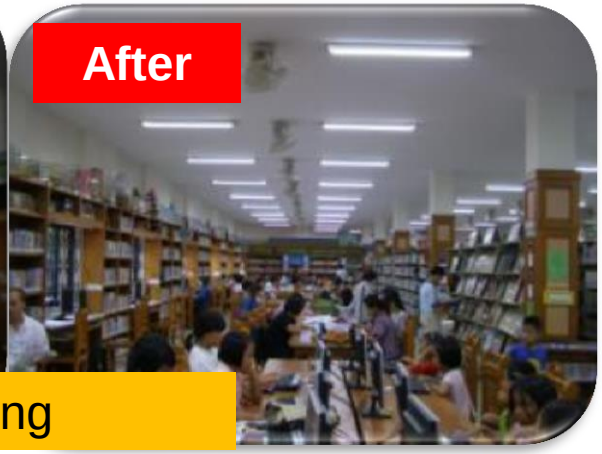
Student using recyclable materials, Danang

Sponsored by ADEME

Calculating GHG emission of UDAA, Luang Prabang, Lao PDR



Before



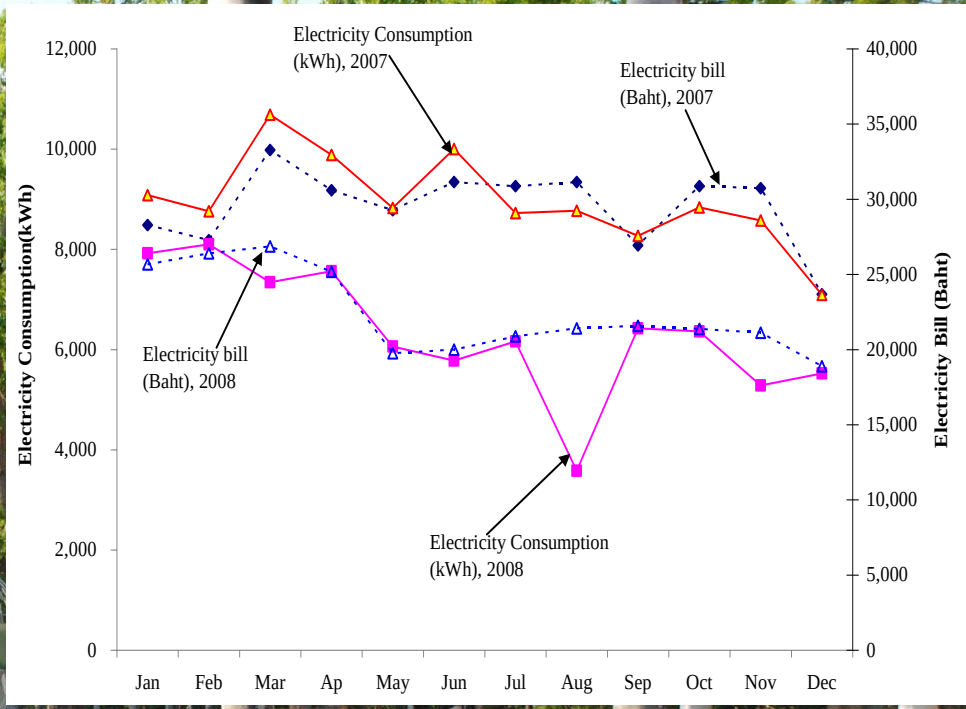
After

Rayong

Energy efficiency – start at home

Energy conservation and efficiency in Buildings: Experience at AIT

- Replacing fluorescent with CFLs
- Replacing lamps with efficient reflectors
- Use of pull switches
- Use of sensors



- Payback period < 1 year
- Illuminance better and above norms

Energy efficiency – start at home

Energy conservation and efficiency in Buildings: Experience at AIT

Continuing energy efficiency improvements through daylighting

(a) Turn off LED

(b) Turn on LED

(c) Light pipe

April 2012

Technology Needs Assessment

Why?

- As part of the global response to climate change mitigation

What did we do?

- Assist countries in developing their TNA and technology action plans
- Assisted already 15 countries and currently to 6 countries in Asia
- Technology needs assessment by mitigation potential and sustainable development goals
- Barrier analysis and enabling environment
- Technology Action Plans and project Ideas

How did we do?

- collaboration with partners (UNEP) and with Ministries of the countries

Technical trainings

Why?

- As part of our mission to promote sustainable development in the region

What did we do?

- Assist countries and institutions depending on their need and requirements
- Countries: Asia

How did we do?

- Collaboration with Ministries of the countries

Outputs and Impacts (some recent ones)

- Sustainable Development of Energy systems, Senior Government Officials, Republic of China (Taiwan), Bangkok, November 2015 – 26 participants.
- Renewable energy and sustainable development for exchange students from Europe and Asia, Bangkok, August 2015 – 15 participants
- Energy and Sustainable development in the Urban context, Asia Pacific Leadership programme, Shanghai, PR China, September 2015 – 30 participants
- Improved Cookstoves Programme, Bangkok, October 2015 – 12 participants

Future Research prospects

- Solar thermal applications for industry and medium temperature applications
- Energy storage (small appliances and large systems)
- Solar PV – DSSC, organic cells, and improving efficiency
- Improving efficiency – production/conversion and end use conversion equipment
- Resource matching (solar, for example)
- Energy and infrastructure
- Energy conservation and efficiency in distribution systems
- Smart energy consumption – using ICT, for example
- Energy models – national plans and sectors
- New ways of doing things – smart cities – work from home, etc

Recent collaborations

Academic	Research
PEA, Thailand EVN, Vietnam Unesco, Jakarta – e learning Sida – NUOL, Sweden CANMET, Canada NoRAD, Norway World Bank – Electric utilities, Pakistan **DIKTI – ITS, Indonesia** **LPDP Indonesia** Climate change – interdisciplinary Energy Business Management – with SOM	GNESD, Denmark UNEP ADEME, France UNIDO, Austria ADBI, Japan EEP in the Mekong **ADB** Lahmeyer NIES, Japan APN, Japan

How AIT can support CoE!

- Since, Indonesia is on path to major Energy resource transition state which would need massive resources in terms of energy, human, technology, materials, and investments.
- Therefore, Energy/AIT would like to actively participate and contribute in Indonesia and the region's indigenous energy development process via available knowledge and expertise in areas of,
  - Renewable energy,
  - Energy efficiency
  - Smart Grid,
  - Energy integration and
  - Energy policy areas etc.

Possible immediate start-up!

- Capacity building programs in specific areas of Indonesia,
  - Trainings/workshops for 1-2 weeks (short term programs)
  - Certificate/diploma programs for 4-9 months (medium term)
  - ADB-JSP in collaboration of AIT is already offering some scholarships in general areas but it could increase its number and dedicated to energy specific areas for Indonesian students. (long term)
  - AIT has maser and doctoral degree programs in Energy Business and suitable for producing human resource for Technology Management as well as for Financial/legal/developer institutions/organizations.

Possible immediate start-up!

- AIT can support some Fellowships to Indonesian applicants for master/doctoral studies depending upon agreement.
- Research and implementations
  - Research works/experts relevant to aim of CoE, e.g., assessment and proper sizing based upon actual consumption.
  - Some Pilot projects implementation for technology transfer
- AIT could assist to mobilize its Indonesian as well as other relevant network/partners to support CoE.
- AIT can use its RSGIS center for mapping.

Quote from the citation of the 1989 Ramon Magsaysay Award for International Understanding

" ….. for shaping a new generation of engineers and managers committed to Asia, in an atmosphere of academic excellence and regional camaraderie. "

For further information, contact:

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Note: *All materials provided in this presentation are for info purposes only and accept apologies for incorrect info, if any.*

Thank you for attention!