

PV for Community Services

Erik Lysen



IEA-PVPS workshop on international PV collaboration and market developments PVSEC, Fukuoka, Japan, 1 December 2011



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Summary of message

- 1. PV systems offer a practical and often leastcost way to run low-power high-value appliances and equipment: lamps, refrigerators, TVs, water pumps,...
- 2. But: sustaining PV systems to operate in remote (and often poor) communities can be problematic
- 3. Technical problems are limited and focus on the system as a whole; major problems are organisational, financial and social.

Note: focus is on off-grid applications (i.e. not micro-grids)





The PV pioneers of Bell (1954)



Looking for an energy source for **remote telephones**:

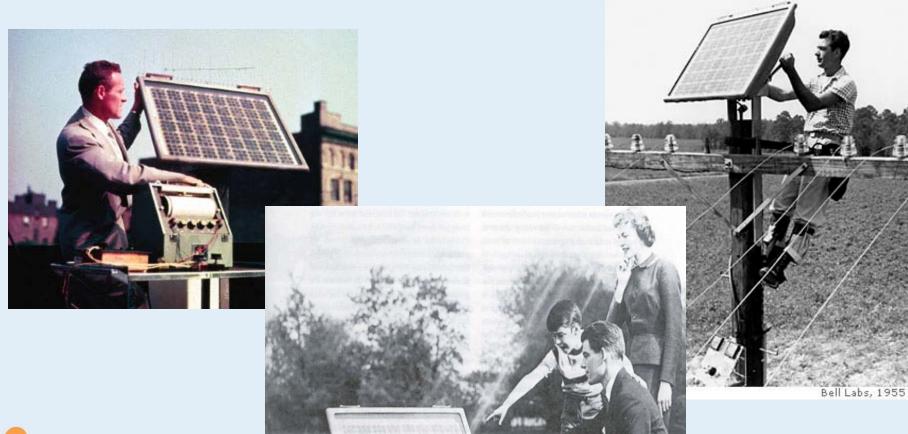
Pearson, Chapin en Fuller (1954) produce a crystalline silicon cell with 6% efficiency

PVPS

Source: "From space to earth". J. Perlin, 1999



Bell Solar Battery 1954-1955





PHOTOVOLTAIC POWER SYSTEMS PROGRAMME





The Dutch 'Terschelling' PV & Wind project (1983)

- 1983: First large scale PV project in Europe
- EG demonstration project, support Min Econ Affairs
- Initiative of Holecsol BV, later managed by Ecofys
- Autonomous system with 50 kW PV, 75 kW wind
- Lessons learned: effects of salt and UV on cables
- 1995: Diesel added
- 1998: System dismantled

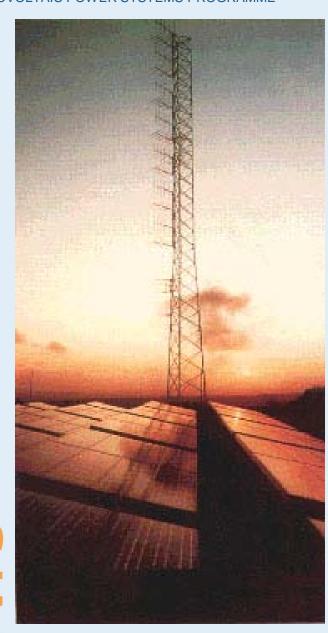






Curaçao 1984

- March 1984: Radio Hoyer begins radio broadcasts from the Tafelberg (Table Mountain) at Curaçao island
- Transmitter fed by PV system, with battery and small emergency diesel engine
- Fully commercial operation
- 5.5 kWp, 4400 Ah battery, 3 kW diesel
- Consumption: 18 kWh/day
- Probably the oldest PV hybrid system in the Caribbean







Which (off-grid) community services?

- 1. Private services: lamps, radios, mobile phones, TVs, refrigerators, computers, VCRs, ...
- 2. Public services: street lighting, power for schools, community centres, hospitals, ..
- 3. Commercial services: water pumping, telecom stations, battery charging, ...





Private services









Sukatani, 1988







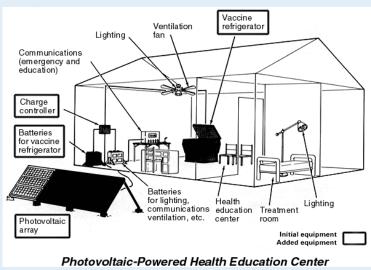
Lebak, 1991





Public services

- Examples of system sizes:
 - Vaccine refrigeration: 250 Wp
 - Dispensary: 60 Wp
 - Health Centre: 500 Wp
 - Secondary School: 460 Wp
 - Dormitories: 190 Wp
 - Staff Houses: SHS 75-90 Wp
- Examples of services
 - Lighting
 - Communication
 - Vaccine refrigeration
 - Water supply





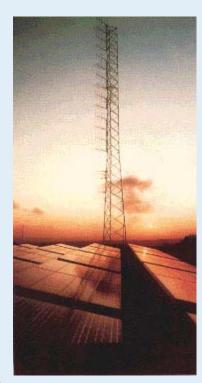




Source: SSMP, ECON Sweden, 2010



Commercial services















Pitfalls in projects

- Aim: reliable and cost-effective operation of PV system over design lifetime, serving the community
- Usual procedure: identify need, fight for budget, technical design, procurement and installation
- Then: Enthusiastic experts leave after the opening celebrations; after first breakdown: system stops
- Usually forgotten: prior consultation of local community, setting up organisational framework for post-installation maintenance and funding, and a small budget for performance monitoring





Initiatives that worked

- PVPS recommended practices
- Sustainable Solar Markets Packages (SSMP) by World Bank in Philippines, Tanzania, Zambia
- Picosol programme in Cambodia
- WHO programme solar refrigerators

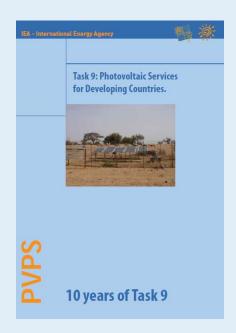




PVPS: Recommended practices

PVPS reports, some examples:

- Institutional frameworks
- Financing mechanisms
- Models for implementation of SHS
- Guide to capacity building requirements
- Role of quality management, training
- Sustainable rural water supply systems



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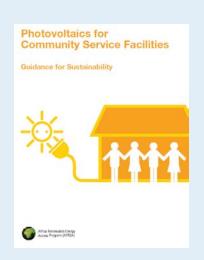


Sustainable Solar Markets Package (SSMP)

- Rapid Assessment (1-4 weeks)
- 2. Preparation PV Implementation Plan (1-3 months)
- 3. Procurement and Contract Management (1 year)
- 4. Long-term Operation (20 years)

Source: "PV for Community Service Facilities", by Africa Renewable Energy Access Program (AFREA), funded by The Netherlands, via ESMAP, World Bank, Dec 2010







Has this approach worked?

- Yes it has been piloted in a number of villages in the Philippines
 - Smallest package 2 villages- USD 75 000
 - Largest package 16 villages USD 700 000
 - Preparation underway for expansion covering 1000 villages in 2007/2008
- Preparation of three packages in Tanzania, covering 80 villages in total, started in March 2007
- Preparation of one package in Zambia started August 2007, covering 20-25 villages



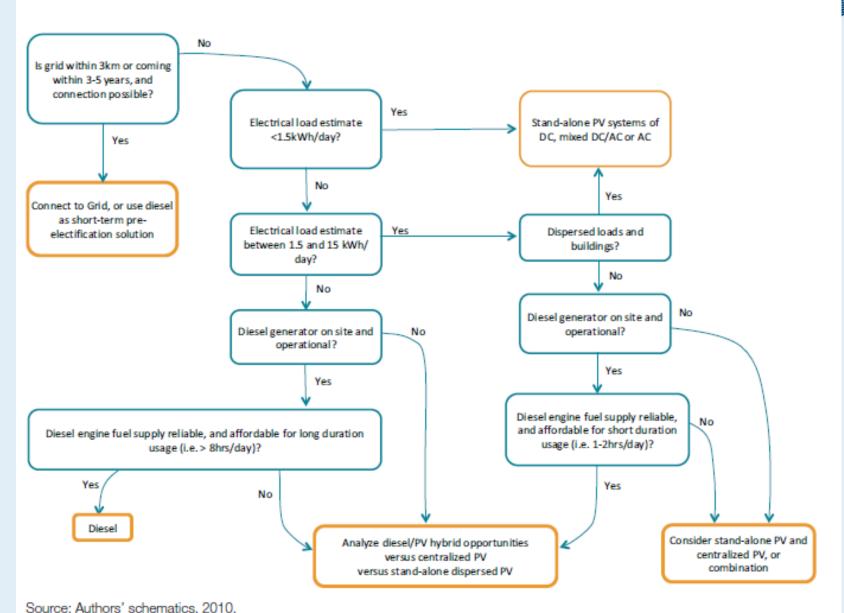
Phase 1: Rapid assessment

- Assess why PV systems are being considered
- 2. Determine which, where, and how many facilities and which services to cover
- 3. Determine the energy requirements and PV system sizes
- 4. Estimate PV system costs and least-cost option
- Decide on implementation model and institutional and technical details



PHOTOVO

FIGURE 4: DECISION TREE FOR LEAST-COST TECHNOLOGY CHOICE

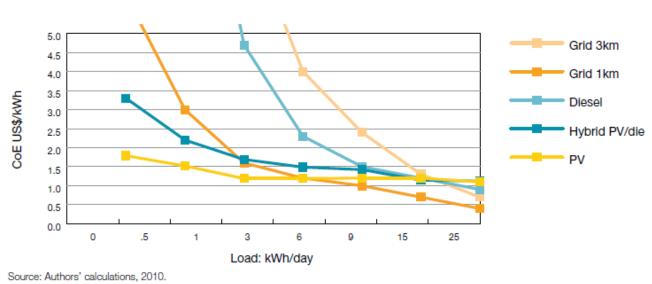




PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

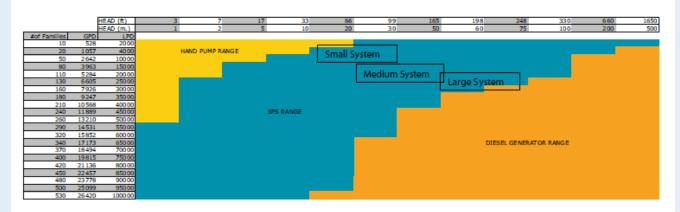






*6% DR; 20 yer life; diesel US\$1.1/litre delivered; grid extension at US\$15,000/km; grid elect US\$0.22/kWh

FIGURE 11: COMPETITIVE RANGE FOR SOLAR PUMPS VERSUS HAND PUMPS AND DIESEL GENERATORS



Source: Walt Ratterman, Jonathan Cohen, and Anna Garwood, Solar Pumping Systems (SPS): Introductory and Feasibility Guide, 2003, Revised, January 2007 (www.greenempowerment.org).



Conclusions SSMP

PV projects:

- have often been too lightly prepared,
- focused inadequately on the institutional issues of maintenance
- have not been sufficiently supervised.
- So their overall sustainability is low

Best practices are needed in three key areas:

- 1. Preparation
- 2. Contract management and supervision of installation and maintenance
- 3. Maintenance and operation





Solar Energy in Cambodia

- PicoSol Cambodia established, initiated by Dutch Picosol company
- Initial focus on small lanterns (Moonlight)



- Now: facilitating the solar market chain
- Solar Road Map for Cambodia
- SWOT analysis for PV

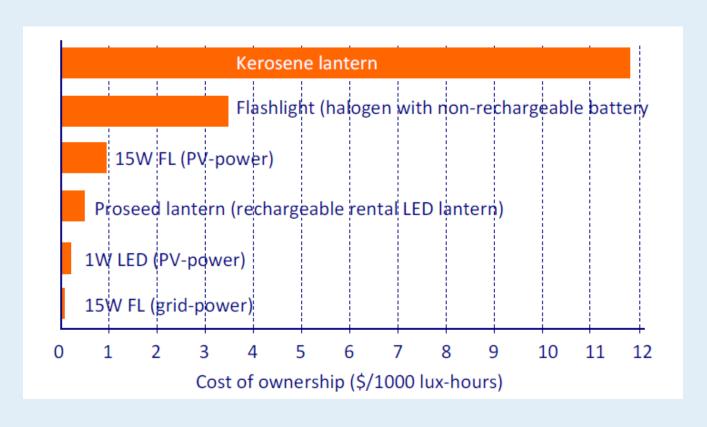


PVPS

Source: www.picosol.nl



Costs of lighting options



PVPS

Source: De Gooijer et al, Solar Power and LED Lighting, Budapest CIE, 2009





Solar SWOT Analysis

Strengths:	Weaknesses:	
 Competitive with other fuels with increasing prices Big market Some people aware Many companies Lots of sun in Cambodia, good location Government policy Solar panels last very long Many players, Companies and NGO's active government Lots of potential (many hh are low on the energy ladder), high potential 	 No local representation: selling points Most sellers do not know well about solar Bad quality panels in the market Limited knowledge on the technology Complicated technology Expensive No solar loans, MFI's charge high interest (20-30% year) No branch organization/association for solar companies (to lobby for interest of the solar companies, sector, about tax). Battery has limited lifetime (about 3 years) Inexperienced sellers can not inform clients well New market, still very small Low awareness of people Lack of financial support from the government 	
Opportunities:	Threats:	
 Shops in every village People want it Economical growth Expensive grid electricity in rural areas Support from the World Bank, government and other donors Many companies invest in solar energy Create 7% solar MFI loans New technology developments Decreasing price of solar compared to increasing price of fossil fuels NAMAs, other support schemes of green technologies Solar branch organization (association) that could lobby for tax reduction and standards 	 Remoteness of servicing Bad reputation of solar made by some people, including some fake and low quality Chinese products High tax Quality and service Other competing Renewable Energy technologies Grid electrification Complexity of technology requires regular servicing to keep solar systems working 	





A Solar Road Map for Cambodia

Developed by Stakeholders





Developed by Pico Sol Cambodia

in cooperation with ETC, EASE and ADB-Energy for All Initiative

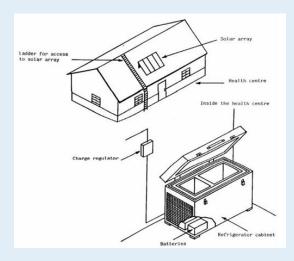
June 2011





PV vaccine refrigerators

- World Health Organisation (WHO) has long-term experience
- Robust and standardised systems
- International system for qualifying equipment
- Training of users and technicians
- Good maintenance discipline
- Tracking of system performance
- Sustained recurrent funding









Summary of message

- 1. PV systems offer a practical and often least-cost way to run low-power high-value appliances and equipment: lamps, refrigerators, TVs, water pumps,...
- 2. But: sustaining PV systems to operate in remote (and often poor) communities can be problematic
- 3. Technical problems are limited and focus on the system as a whole, major problems are organisational, financial and social
- 4. Recommended practices exist (PVPS and others) and good examples of effective approaches, such as the SSMP (WB).