



# Lessons learnt from Solar PV pumping in India

---

A presentation by

K.S.Sridharan  
Consultant  
IT Power India Pvt.Ltd. New Delhi

AT

PVSDCPW Workshop  
June 28, 2007, Bangkok, Thailand



## Presentation structure

---

- About IT Power India
- Power Scenario in India
- Renewable Energy Development
- Solar Energy Programmes
- Solar PV Water Pumping Programme
- Issues & Barriers
- Lessons Learnt
- Summary
- Way Forward





# IT Power India Pvt. Ltd.

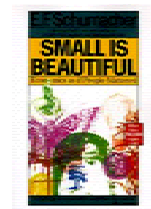
*Sustainable Energy and Environment Management*



## ITPI

Social responsibility, environmental  
commitment and sound business practice

- Focus on RE and Environment Management
- Operations from 1997
- Over 120 projects (2005) in 23 countries
- Head Office: Pondicherry
- Regional Offices: New Delhi and Pune



## The Team

- Multi-disciplinary, multi-national in-house team;
- Strong pool of highly experienced Indian and overseas experts as associates;
- Technical expertise from IT Power Ltd. UK



9/07/2007



## ITPI Expertise

- Renewable Energy Advisory services
  - Solar Photovoltaics
  - Micro-Hydro
  - Solar Thermal
  - Wind Energy
  - Bio-energy
  - Waste to Energy
- Climate Change
- RE Fund management
- RE for Health
- Management Info. Systems
- Training & Capacity Building





## India -- At a glance

---

Population - 1080 Million

Growth of Population - 1.93% p.a.

Share of Urban Population - 28%

GDP - US\$ 3319 Billion

GDP Growth – 8.9% Industrial Growth - 7.2%

Service Sector Growth- 8%

Inflation Rate -4.56%

Prime Lending Rate - 13%-13.5%



## Energy Sector Overview

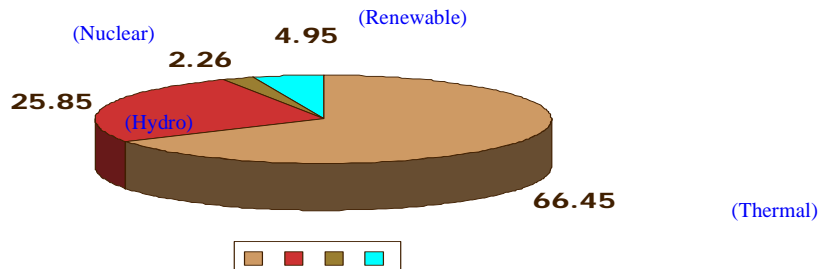
---

- Per capita energy consumption: 610 units/yr
- Normal & Peak power shortage :7 and 11%
- High projected economic growth requires growth in energy supply
- Limited Fossil fuel (Coal/Oil/Gas) reserves
- 6th largest Greenhouse gas emitter in the World
- Disparity between energy consumption pattern in Urban and Rural segments



# India Energy Scenario as on 28.02.2007

Category of Energy Mix - Share in Percentage  
(Total Installed Capacity - 1,26,839 MW)



# Status of Electrification in India

- 84% villages & 43.5% rural homes connected to grid
- About 95,498 census villages remain to be electrified ( as per CEA data of 31.3.2003)
- About 77 million households use kerosene for lighting
- 126,800 MW power generating capacity. Demand for power increasing @ 9% per annum



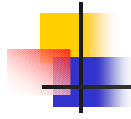
# RENEWABLE ENERGY DEVELOPMENT



## Institution Building

- 1981: Constitution of Commission for Additional Sources of Energy (CASE) in Department of science & Technology
- 1982: Constitution of Department of Non-conventional Energy Sources (DNES) in Ministry of Energy
- 1987: Incorporation of Indian Renewable Development Agency Limited (IREDA)
- 1992: The DNES converted into full fledged Ministry of Non-Conventional Energy Sources





## Institution Building: outcome

---

- Promotion through
  - R & D
  - Demonstration Projects
  - Programmes supported by Government subsidies
- Overcoming financing barrier through
  - The catalytic role of IREDA
  - Innovative financing mechanism
  - Success stories for commercial Banks to follow



## Fiscal Financial and Promotional Initiatives

---

- Nil or concessional import duty
- Excise duty and sales tax exemption
- Accelerated depreciation
- Soft loans
- Capital and Interest subsidy
- Tax holiday on power generation projects
- Guidelines to states for RE power purchase
- States advised to modify building bye-laws to promote solar water heating





## Legal Initiatives

---

- The Electricity Act 2003 with an objective towards competition, protection of consumers interests & power for all areas
- Energy conservation Act-2001 – Comprehensive legislation laying roadmap for improvement in energy efficiency in the country.
- State Electricity Regulatory Commissions
- Renewable Energy Policy underway



## Electricity Act 2003 on Renewable Energy

---

- Stand alone RE systems from rural area
- Open access
- Cogeneration from renewables
- Generation delicensed
- Minimum percentage from renewables
- T & D in rural areas delicensed







## RE Potential and achievement

Sources/Systems	Estimated Potential	Cumulative Achievements (31.1.2007)
Grid-interactive renewable power	84,776 MWe	9372.95 MW
Distributed renewable power		
Solar Power		2.92 MW
Others		
Total Installed		9497.05 MW



## India's Position in RE Development

- Largest decentralized Solar Energy Programme
- Second largest Biogas and Improve Stove Programme
- Fourth largest Wind Power Programme
- Substantial Manufacturing Base - Variety of RETs



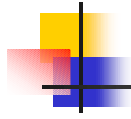
# SOLAR ENERGY PROGRAMME



## Solar Energy in India

- Solar Radiation over India 5000 trillion KWH/year 300 sunny days in a year
- Average daily solar energy incident over India 5.5 KWH/Sq.mt
- MNRE implementing SPV programme for the last decades
- Indian SPV Programme is world's largest programme





# MNRE Programme in SPV

- Aim: Cost reduction, large scale deployment
- Programme components: R & D, Demo and Utilization, Testing & Standardi- zation, Promotion
- Systems covered: Home lighting and Street lighting systems, Stand alone PV power plants, SPV water pumping systems
- MNRE programmes are implemented through IREDA



# Decentralized Energy Systems

Sources/Systems (As on 31.1.07)	Estimated Potential	Cumulative Achievements
Solar PV programme	20 m sq.km	
Street lighting		54659 nos.
Home lighting		301603 nos
Lantern		463058 nos.
Power Plants		1859.80 kWp
Solar Thermal Programme		
Water Heating		1.66 million sq.m collector area
Cookers		0.6 million
SPV pumps		7068 nos.



# SOLAR PV WATER PUMPING PROGRAM



## Scenario in 1993-94

- SPV pumping systems technically proven
- Considered suitable for replacing Diesel pumps in un electrified locations
- Motivation for use erratic and uncertain power
- High initial cost was found to be a barrier
- Technology up gradation and volume production could bring down cost in 3 to 4 years
- To facilitate a programme for deploying 50000 SPV pumping systems over 5 years conceived by the MNRE





# SPV Pumping Programme Objectives

---

- Commercialization
- Strengthen production base
- Technology up gradation
- System cost reduction
- Facilitate marketing infrastructure



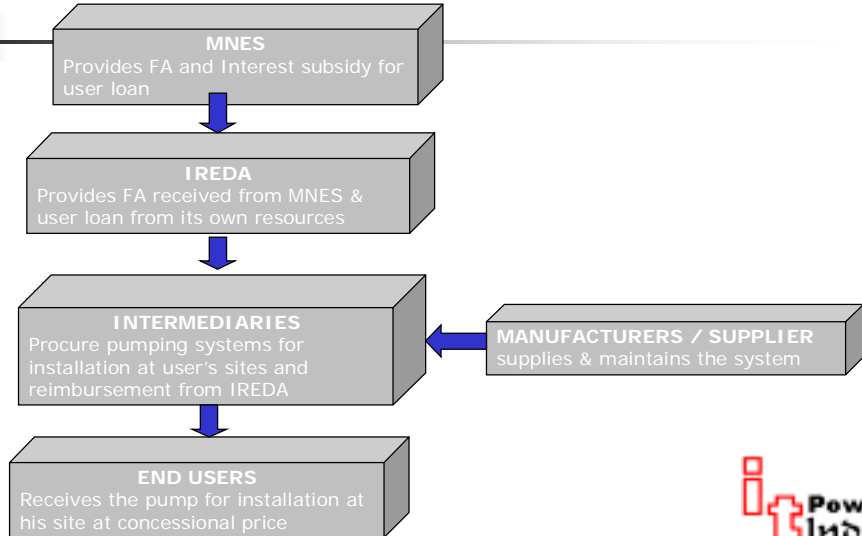
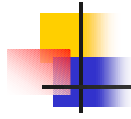
# Demo Project 1993-94

---

- 1000 SPV pumps through IREDA to
- facilitate development of marketing infrastructure
- obtain market feedback
- decide extent of future Govt. intervention
- workout institutional back up requirement for marketing, installation, maintenance and service



# Demo Programme Financing Structure



# Impact of Demo Programme



- Subsidy may have to be eliminated and instead higher accelerated depreciation may be better
- Lesser documentation and stream lined procedures
- Should be more attractive to intermediaries
- High cost is a barrier
- Economies of volume for manufacturer required
- More market orientation
- Better standardization and quality control
- Establish infrastructure for after sales service
- Permit multiple use for the system



# SPV Pumping Programme-Salient Features

- Eligible uses/users/specs as per MNRE guidelines
- Site identification by SNAs/Manufacturers as per MNRE guidelines
- Manufacturers empanelment by IREDA
- Subsidy and soft loan through IREDA
- Promotion campaign by MNRE & IREDA
- Soft loan to manufacturers through IREDA
- Implementation through IREDA & SNAs
- Testing & Certification by Solar Energy Centre/MNRE approved regional test centers
- Training programmes by manufacturers/IREDA/MNRE



## Subsidy-At a glance

Year	Subsidy For Panel Rs./ Wp	Maximum Subsidy for system	Soft loan for unsubsidized system cost thru IREDA
1993-94	170	70% of system cost	5% p.a , 10 yr repayment, 1 yr moratorium
2001-02 2002-03	110	=Rs.0.25 million or 90% of system cost	5% p.a
2003-04 2004-05	75	=Rs.0.2 million	5% p.a
2005-06 Present	30	=Rs.50,000	5% p.a



# Punjab Energy Development Agency (PEDA) - Model

- First phase 500 SPV pump systems successfully installed in 2000-01
- System size 1800 W, 2hp DC motor pump
- Found adequate to irrigate 5 – 8 acres
- Block identification by PEDA
- Selection process to choose applicants based on land holding, water table
- Direct supply to farmers holding 5 acres minimum



## PEDA-Model

- Detailed site survey and site selection by supplier
- Site allocation in clusters to facilitate service and maintenance
- Requirement 5 years maintenance contract by suppliers and open at least one service center in the State of Punjab
- The programme was successfully implemented with repetition of another 500 Nos.



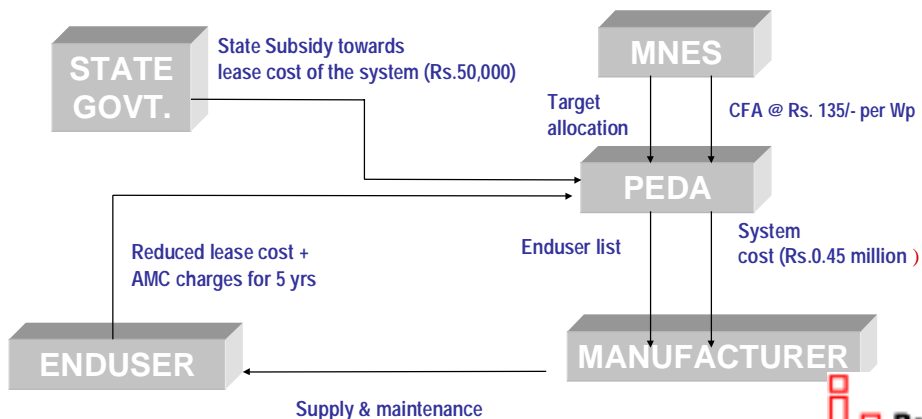


# PEDA-Model

- Pumps used also with drip irrigation & sprinkler
- Following PEDA's success, Haryana, Uttar Pradesh, Rajasthan and Tripura etc taken up projects in their states.
- Uttar Pradesh has taken up for drinking water supply through solar pumps.



# PEDA Model



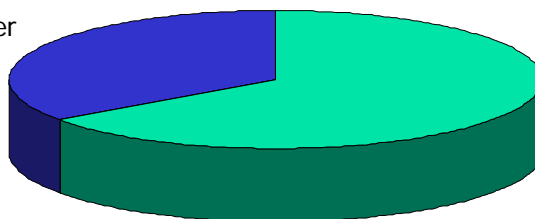
# Solar PV Water Pumping System installed under PEDDA

CAPACITY: 1800 Wp, 2 H.P.



## SPV Pump usage in India

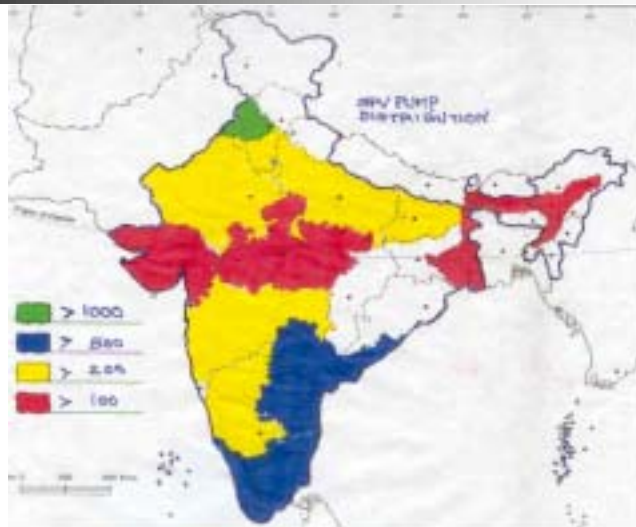
Drinking water  
use 35%



Agriculture use 65%



## SPV Pump Distribution in India



## Programme Highlights

- 900watt system was found in adequate for most of the crops. 1800 watt system with 2 hp DC motor was found adequate
- 9 vendors empanelled
- Subsidy scaled down from Rs170/Wp to Rs 30/Wp in 12 years. Soft loan to users/manufacturers continued
- 29 states covered .Total 7068 systems (31.1.07)
- Agriculture related 65%, Drinking Water 35%
- Efficiency Improvement in solar cells 10% to 16% and pumps 30% to 45/50% achieved
- Programme from 2004-05 onwards applicable only for community drinking water projects





## Issues & Barriers faced

---

- General expectation-regular electricity will be available in near future
- Lack of service net work. Remote locations too expensive for service by manufacturers
- Large variation in product cost and quality
- In adequate network for market promotion
- Lack of awareness among and interest in lending institutions and micro credit facility
- O&M for 10 years too expensive



## Issues & Barriers faced

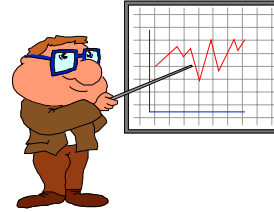
---

- Lack of awareness and interest in Financial Institutions and availability of micro credit
- Repayment obligation to financial institution is difficult to meet
- O&M for 10 years too expensive
- Theft problem-particularly in lease finance cases
- Lack of interest in system protection when not owned
- Fear of misuse of the system lighting/TV-too irresistible



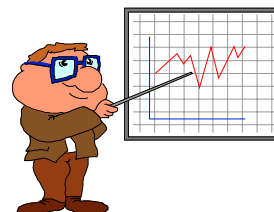
## Lessons learnt

- Commercialization is necessary for sustainable growth. However, commercialization is difficult without government assistance. Subsidies and concessions may have to continue till price reduction of SPV Systems.
- Government programme may have to be more user friendly for creation of additional demand. The cost of infrastructure development for conventional energy may be given as subsidy/ concession for SPV Systems.



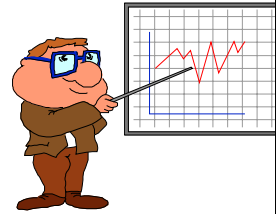
## Lessons learnt

- Affordable financing accessible to rural consumers is essential for selling PV products in rural areas
- Delivering rural PV services needs a partnership between key actors like rural financial institutions, product / service suppliers, consumer groups etc.
- Cost effectiveness, high reliability & quality assurance is necessary through extensive R&D and technology development



## Lessons Learnt

- Training of farmers / users is essential
- Aggressive marketing for awareness creation is a must. Full scale marketing and service network to be established
- Strong policies for development of SPV Pumping Program required perhaps by removing free conventional power and subsidy



## Current Status of SPV Market

- SPV Industry growth rate 25% annually primarily due to growth in export -Germany.
- Shortage of silicon wafers
- Silicon wafer price & system cost increase
- Gradual reduction in subsidy to Rs 30/Wp
- However soft loan facility continues
- Programme restricted to Community Drinking water projects





## New Initiatives of the MNRE

---

- Set up Task force to study
- Task force recommendation
- Bulk procurement of silicon wafers
- Expansion of manufacturing facility for wafers
- R & D for lesser usage of Silicon material
- Examine setting up 2000 TPA poly-silicon plant
- Prepare Road Map for PV technology development



## New Initiatives of the MNRE

---

- Follow up action initiated on Task Force recommendations
- A Group of Experts constituted by the MNRE in 2005 to prepare SPV Road Map





## FUTURE SCOPE

---

- Large village electrification programme through renewable offers ample scope for growth
- Large scale plants are expected to come up soon to realize economy of scale in manufacture and consequent reduction in SPV system cost
- With strong industrial base, successful commercialization of technologies such as wind, SPV, ST, SHP, Biogas and improved biomass stoves, India is in a position to offer “state-of-the art” technology to other developing countries and is poised for a leading role in the global market towards sustainable development



## Summary

---

- The SPV pumping programme of India is the world's largest solar pv based pumping programme
- Private sector has been motivated to exploit the market potential
- IREDA earned Water Globe Award in 2002
- Over 7000 SPV pumping systems installed
- Demonstrated capability to replace Diesel pumps
- Sustainability depends on system cost coming down







## Way Forward

---

- Incentivise usage/power saving in lieu of subsidy
- Technology up gradation and large scale volume production for Silicon/wafers through foreign direct investment
- Encourage Esco model through incentives
- Permit multiple use of system
- Facilitate micro-financing through rural banks/NGOs and financial intermediaries
- Facilitate focus on quality and standardized training – institution accreditation/networking
- Locate low cost finance. Working capital at low interest
- Tax holiday for solar industry
- Explore support through CDM revenue



THANK YOU

