

# Concentrating solar power in India

Shirish Garud,  
Fellow and Area Convenor, Renewable  
Energy Technology applications,  
TERI



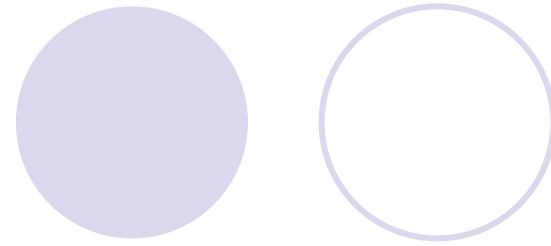
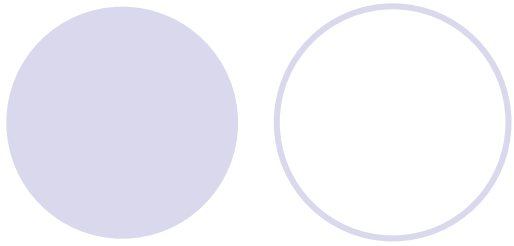
# Over view

- Solar energy in India- A brief review
  - CSP Technologies
  - Other solar technologies
- Solar mission
  - Initiative for R & D
  - Identified focus areas for research
- Way forward
- TERI's role in CPS sector

# Solar energy in India



- Development started in 1970s with National Physical Laboratory starting development of solar cookers and flat plate collectors.
- Research and development of solar PV technologies – mainly products and applications
- Variety of technologies developed
  - Vacuum tube collectors by IBP in 1980s
  - Scheffler dish based solar cookers and steam generation by Gadghia Solar
  - Solar flat plate collectors, solar stills, solar box cookers
  - Solar concentrating dish technology by IIT Bombay and Clique
  - Solar dish technology by IIT Chennai
  - CLFR technology by KG group, Coimbatore
  - Solar air heating and drying systems by PEN (Planters Energy Network), Coimbatore
  - Solar pond by TERI
  - Solar desalination systems by TERI
  -



- Largest solar pond in Asia

Solar water heating system



# ARUN Solar Concentrator

ARUN160: Fresnel Paraboloid concentrator with cavity receiver with 2-axes tracking having 160 m<sup>2</sup> aperture area installed under IIT-Bombay -Clique R & D Project sponsored by MNES for milk pasteurization at Mahanand Dairy, Latur, INDIA

Feb 16, 2010



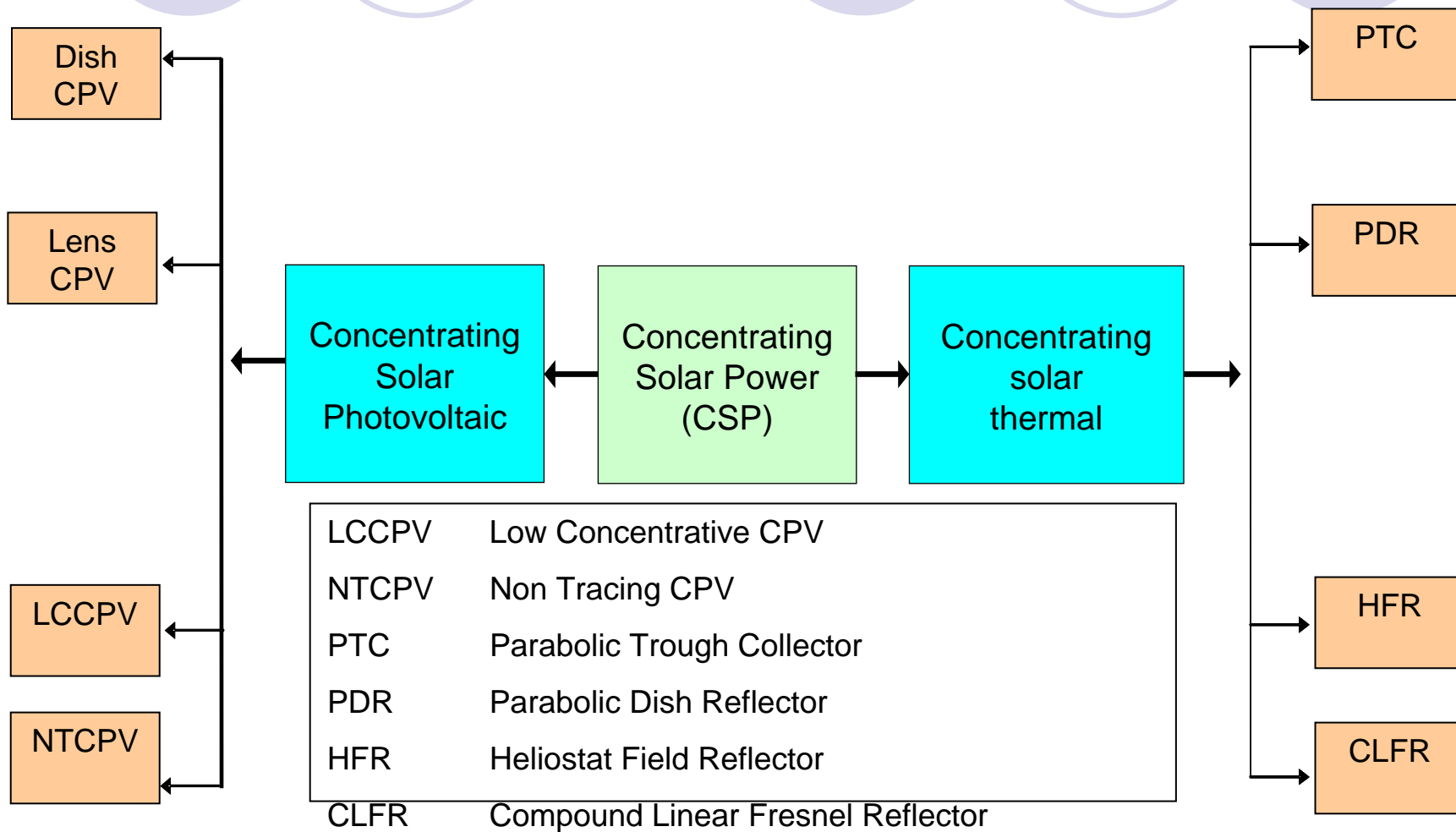
# Solar cookers and stem generation systems



Feb 16, 2010

3rd India – Japan Energy Forum  
Delhi

# Overview of CSP technologies



# Markets for CSP technologies



CSP technologies

Grid connected plants  
Roof top and  
MW scale

Smart minigrids /  
off grid  
CPV  
Dish Sterling

Off Grid Applications  
Military  
Irrigation pumping  
Village electrification  
Telecom towers



# Potential markets for CPV/ Dish thermal technologies



Customer segments	Potential use of CPV	Capacity	Technical configuration
Independent power producer	Power augmentation	1-5 MW	Ground system, Grid connected
Residential townships	Backup power	300-500 kW	Roof top system, Off grid
Commercial / Industrial establishments	Backup power	50-500 kW	Roof top system, off grid
Military	Stand alone power supply with diesel generator backup	40-50kW	Robust and reliable system which can withstand extreme fluctuating weather conditions

# Jawaharlal Nehru National Solar Mission



<b>Application segment</b>	<b>Target for Phase I (2010-13)</b>	<b>Cumulative Target for Phase 2 (2013-17)</b>	<b>Cumulative Target for Phase 3 (2017-22)</b>
Grid solar power incl. roof top	1,100 MW	4,000 MW	20,000 MW
Off-grid solar applications (incl. rural solar lights)	200 MW	1,000 MW	2,000 MW
Solar collectors	7 million m <sup>2</sup>	15 million m <sup>2</sup>	20 million m <sup>2</sup>

# Jawaharlal Nehru National Solar Mission



- Proposed targets
  - 20 GW by 2022
  - Immediate target 1GW by 2013
  - Four pronged strategy
    - Power plants development
    - Industrial development
    - Focus on R & D
    - Human resource development
  - 100 GW by 2030 or 10-12% of total power generation capacity estimated for that year
  - 4-5GW of installed solar manufacturing capability by 2017

# R & D thrust areas for CPV



- Design and development of concentrator solar cells (concentration ratio of 200 sun and more) and modules (efficiency ~ 25 – 30%) and testing of concentrating PV system in Indian conditions.
- Development of two axis tracking system suitable for high concentration PV system.
- Design and development of heat sink for mounting of solar cells under high concentration
- Design and development of optical systems to achieve concentration ratio of 200 suns and more, with minimum optical aberration.
- Development of silicon and GaAs based solar cells suitable for use under high concentration (200 sun or more)

# R&D thrust areas in CST



- Research, design, testing, demonstration, evaluation and application of concentrating solar thermal power systems covering various technologies viz. parabolic troughs, central receiver systems and dish / engine systems
- Development of components for parabolic trough technology indigenously with a goal to design, install and commission a MW-range plant
- Central receiver technology
- Development of large area solar dish with an appropriate engine to produce power in the capacity range of kW-range
- Indigenous development of the engine with appropriate balance of system including solar dish and controls

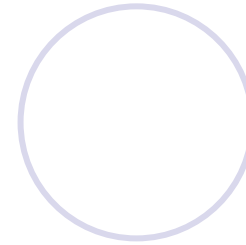
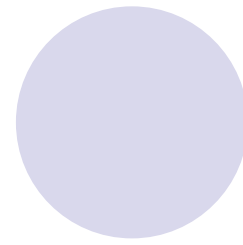
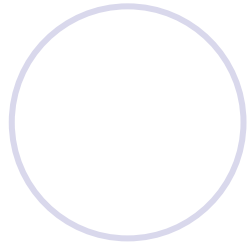
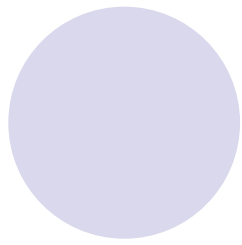
# Way forward



- Joint program for development of centers of excellence
- Joint projects in strategic R & D in CPV technologies
- Collaborative demo projects with Indian industry
- Training and capacity building in technology development and deployment

# TERI's activities

- Feasibility studies/ detailed project reports for solar power plants
  - Four projects under finalisation
- Institutional Expertise in
  - Simulations
  - Solar radiation analysis
  - Development of technologies,
  - Strong R & D capabilities
- Think tank for the Government
- Working on solar park concept



# Thank you!!!

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Contact:

- [shirishg@teri.res.in](mailto:shirishg@teri.res.in)
- [www.teriin.org](http://www.teriin.org)