

How Corporate World can help in developing sustainable rural energy

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Talk arrangement

■ Three parts

- Sensitize to the plight of rural poor.
- Discussion on the technologies.
- How corporate world can help.

Introduction

- 60% of rural population (~400 million) in India live in primitive conditions. Almost no electricity and primitive cookstoves. Around 300,000 deaths/yr. take place because of pollution. Modern technology has not touched their lives even 60 years after independence.
- 54% of India's population is below 25 years' of age and most of them live in rural areas with very little employment opportunities.
- Increased aspirations because of mass media is leading to social unrest. Migration to cities.



Introduction (cont..)

- Around 260 million people in India (1/4th of population) live on less than Rs 50/day.
- Poverty in rural areas has resulted in large number of farmers' suicides. In last 10 years about 150,000 farmers have committed suicide. Poor support prices, increased input costs and aspirations. Also no long term agriculture policy.
- Serious energy crisis in India. In rural areas ~ 60 kWh/yr per capita electricity consumption. HDI is directly linked to electricity. In Maharashtra ~6000 MW shortage resulting in 12-15 hours daily blackouts in rural areas.

Introduction (cont..)

- Last year India imported more than Rs. 1 lakh crore worth of petroleum products. Serious balance of payment problems. 8-9% growth.
- Most of these problems have come because of non-governance. Governance is the first casualty of corruption.
- With proper governance one of the best technological solutions is energy production via agriculture.
- Will provide rural wealth and create employment.
- Unless the lives of 60% of these rural poor are improved we cannot become an economic super power.

Energy production

- Agriculture can produce three types of fuel
 - Liquid fuels like ethanol, biodiesel or pyrolysis oil.
 - Gaseous fuel like methane (biogas)
 - Electricity
- In any agriculture 25-40% of produce is food and rest are residues. No remunerations from residues, hence farming is uneconomical.
- India produces ~ 600 – 1000 million tons/yr of residues. Mostly burnt. Fuels from these residues can take care of major requirements of energy for India.



Energy production (cont..)

- Residues can produce 156 b l/yr of ethanol which is 42% of India's oil demand in 2012; or 80% of oil demand via pyrolysis oil; or 80,000 MW of electric power.
- Can provide 120 million jobs.
- With increased industrial demand for fuel and electricity large tracts of farmlands may come under fuel crops only.
- Food vs. fuel debate. Need to do R&D on multipurpose crops.
- NARI's pioneering work on sweet sorghum.
- Farms and farmers are the backbone of any nation since they can produce food, fuel and wealth from the land.



Water Issues

- Increased farming will require adequate water supply.
- Rainwater harvesting provides the best solution. Need for setting up water utilities.
- Issue of ownership of water bodies needs to be resolved. Water Act similar to Electricity act needed.
- Use of flue gases from power generation can provide potable water. Combined electricity/water plants.

Energy Devices

- High technology needed for rural areas.
- Resources and energy in dilute forms.
- Very efficient devices allow maximum energy and materials to be extracted for useful purposes. Biomimicry as mantra for design.
- Hallmark of evolution is size reduction; increase in complexity and efficiency; and “dynamic” equilibrium with the surroundings.
- Examples of high technology for lighting and cooking since 75% of total household energy is used for this purpose. Similar examples are for almost all other areas.

Strategy for lighting

Liquid fuel lighting

- ◆ Simple hurricane lanterns used presently. Very poor light output.
- ◆ Noorie lantern a major improvement.
- ◆ Presently mantle efficacy ~2-3 lm/W; light bulb ~10-15 lm/W and CFL ~ 50-70 lm/W. Need to match mantle efficacy with that of light bulb.
- ◆ Power plant-to-light efficiency (PPL) point of view **liquid fuel lighting can be superior to electric lighting**. PPL of CFL is ~ 12-14 lm/W. With increased T&D losses PPL will further reduce.



Noorie lantern

- Lightweight. 2 kg
- Light output ~ 1350 lm
- Runs on kerosene, diesel or low conc. ethanol
- Lighting and cooking
- Low cost. ~ Rs. 450/-

Strategy for lighting (cont..)

- ◆ Present T/L mantles are 1880's vintage. Use 99% Thoria and 1% Ceria.
- ◆ Nanotechnology can help in developing new mixtures of rare earth or other oxides which can glow at lower temperatures (1000-1500 °C) with higher luminous efficacy.
- ◆ R&D required in developing sturdier mantles. Could be ceramic cloth based, carbon-carbon composites etc.
- ◆ Need to copy bioluminescence technology of firefly. Biomimicry as a mantra for most designs.
- ◆ With rural grid electricity still a distant dream efficient liquid fuel lighting needs to be encouraged.

Electricity based lighting

- ◆ Biomass or coal based taluka level plants (10-20 MW capacity)
- ◆ Small scale plants (10-500 kW_e range):
 - ◆ Ethanol or biodiesel powered ICE, gasifiers, modern steam engines.
 - ◆ Stirling engines, biomass gas turbines, low cost PV, etc.
 - ◆ Nuclear power for micro utilities.
 - ◆ Two wheeler hybrids as rural power plants?
- ◆ Micro scale power units:
 - ◆ Thermoelectric elements for cook stoves for 40-50 W power.
 - ◆ Need R&D in efficient batteries like ultracapacitors and LED units. Paper thin batteries?
 - ◆ 10-30 W micro engines? No batteries needed.
 - ◆ Human-powered small PMDC generators. Real play radios.



Cooking Energy Strategy

- ◆ Biogas and ethanol are clean and excellent fuels for cooking.
- ◆ 50% ethanol/water is easy to distill and very safe mixture.
- ◆ Excise laws need to be modified for use of ethanol for cooking/lighting.
- ◆ R&D required for biodiesel and pyrolysis oil in stoves.
- ◆ R&D required in high tech biogas reactors and storage of biogas in hydrate, porous carbon, etc.
- ◆ Scenario of a small utility in rural areas which processes waste into biogas and supplies it in small gas cylinders lined with storage materials.



NARI alcohol stove

- 50% (w/w) ethanol
- 0.7 - 2.5 kW_{th} capacity
- Controllable flame
- Silent and easy to light

Role of Corporate World



- Corporate World should be directly involved in rural development. Have managerial and other resources.
- In Energy production via renewables:
 - Taluka based systems of 10-20 MW capacity.
 - 500 kW power/water systems for individual villages.
 - Utilities for liquid and gaseous fuels. Fuel production either with dedicated crops or residues
- Water utilities in a village using rain water harvesting and supply for both irrigation and household uses.
- Model of joint stock company. Walchand model.

Corporate World (cont..)



- Need to look beyond business and financial gains only. Rural energy industry could be Rs.50 K cr/yr.
- Make money but reduce margins for rural work.
- In this era of enhanced communication, creation of rural wealth is in the interest of corporate India.
- Need for corporate world (CW) and NGOs to work together for common good. NARI's work with NFCL and Tata.
- Technologies developed by science NGOs can be commercialized by CW.
- Spend a year or so in rural areas for sensitization.

Corporate World (cont...)



- The captains of corporate world need to reduce their consumptive lifestyle. It is unsustainable.
- A decent lifestyle is possible with energy consumption of 50-70 GJ/person/yr. In India avg. consumption is 18 GJ/person/yr. US is 350 GJ/p/y.
- If every citizen of the India follows US lifestyle we will need all the resources of the world to sustain it.
- Spirituality can help in curbing the greed and making us sustainable.
- Becoming sustainable in our personal lives and giving something back to the society will help India become a holistic and sustainable country.

Thank You



Useful sites

- www.nariphaltan.org
- www.nariphaltan.org/USF2007.pdf
- www.nariphaltan.org/writings.htm
(articles on spirituality, technology and sustainability)