

## RURAL INDUSTRIALISATION : CHALLENGES AND PROSPECTS

### Post-Industrialisation Mindset – Bigger the Better

The paradigm of centralized power for industry and consequently centralized industry has been the dominant method of organizing large-scale industry for the last 200 years. Alongwith 1 unit of electrical power produced, there are 2-3 units of waste heat (thermal power) which are lost. When the scale of production of electrical power is of the order of 500 MW or above, the quantities of waste heat (even if recoverable) are of the order of 1000 MW. It is not feasible to utilise such huge quantities of waste heat thermal power in a centralized format.

### Mega-scale Process Industries : Avoidable Costs

The availability of decentralized power enables local value addition to natural materials produced in the rural areas and makes huge saving of fossil fuels otherwise involved for transporting these materials for centralized processing. In any case, the waste arising out of natural materials processing has to travel back to rural areas for utilization (eg oil cake from oil seed). Decentralised processing of natural materials obviates the need for two way transportation of natural materials from rural to urban areas and the waste from urban areas to rural areas. In addition, there is huge saving in the form of management costs and trade margins owing to the absence of traders, brokers and middlemen.

Rural entrepreneurs and consumers suffer

Developing nations such as India have adopted the Western mode of centralized power generation and transmission to far flung areas. The consumer of power has for long been desiring freedom from the centralized grid owing to

- Red tape involved in obtaining a connection,
- Unreliability of the power supply and
- Prohibitive cost

Rural entrepreneurs and producers suffer irrespective of whether their production is bountiful or scarce owing to market manipulation. Being small producers, they are manipulated by market forces and make losses both during selling and buying transactions.

Small is Beautiful : A dream of the 1970s

In the 1970's, there was a worldwide movement for transition to small decentralized production systems with E F Schumacher's slogan "small is beautiful". However, for a large part, this has remained a dream which could not be implemented in the developing world owing to a variety of reasons.

One development that makes both rural industrialization as well as decentralized power generation economical is that the cost of electronics and controls, which was prohibitive in the early 1950's, has now substantially decreased. Control systems are now within the reach of the small producer.

Another development which gives a boost to research in areas related to natural engineering materials with all their inhomogenities is the fact that vast computing power is now both available and affordable. This makes it possible to take up the challenges of the design, analysis and

process control involving inhomogeneous natural materials. This was either not available or unaffordable even a decade ago.

At another level, the latest developments in micro - machining technology provide new possibilities of producing novel and efficient miniature machines and micro-level processing.

Route to true freedom for the masses : National Security

Empowering rural masses through rural industrialization would strengthen national security as it would free them from depending on the little mercies of political powers of the time. And this requires energy generation and processing cum production units at micro level with locally available renewable resources.

Micro-level Renewable Resources : Energy Security

There is abundant biomass which is available all over the widespread rural areas of the country. This biomass (including animal waste) is a potential source of decentralized power through the process of gasification. In any case, transporting the biomass for centralized power production is neither feasible nor cost-effective. However, it is eminently feasible to develop units with capacity of 2 kW to 10 kW of electric power along with twice that as waste heat which are adequate to meet the power requirements of a domestic household, small farm and any associated small industry requirements. As an example, for say a 2 kW of electrical power generated and the 4 kW of waste heat recovered can be put to good use and this is what makes the decentralized systems cost competitive

with the centralized power generation and transmission systems.

Draught animal power to the extent of 100,000 MW which is available nationwide could be harnessed for rural industrialization activities through several novel means.

Bottling technology for methane from biogas and hydrogen from producer gas could be used for local automobile transportation or even exported to urban consumers.

These energy sources could be complemented by solar, thermal, wind, micro-hydel and solar photovoltaic.

Viable Rural Enterprises with Micro-level biomass, cattle power & other renewables : Food security

Various value-addition activities such as food processing, oil extraction, milk processing and packaging etc could be carried out in rural areas provided decentralized local power generation is possible. Post-harvest processing of agricultural produce such as grains, fruits and vegetables along with cold storage facilities would give increased returns to small producers.

There is a huge potential of utilizing green building materials such as bamboo for new value-added products for local and distant markets.

Various small enterprises such as small irrigation, bio-fertilisers, bio-pesticides, medicinal plants, herbal extracts etc become viable.

All these in decentralized renewable energy and micro level processing pose formidable engineering and technology challenges requiring S&T inputs of highest caliber. But the

efforts are worth while as all these could catalyze wealth generation in the rural economy in an ecologically sustainable way.

## Rural Industrialisation : Challenges and Prospects

- Post-Industrialisation Mindset – Bigger the Better  
Power Production – 500 MW to 1000 MW and above single units  
Recoverable Waste Heat – 1000 MW to 2000 MW is not utilizable
- Rural entrepreneur / consumer has been suffering owing to  
Red tape, unreliability of the power supply and its prohibitive cost
- Mega-scale Process Industries  
2-way transport of raw materials (to processing units) and by products (to rural areas)  
Management costs and trade margins owing to traders, brokers, middlemen etc
- Small is Beautiful : A dream of the 1970s  
New possibilities for realizing this dream  
Dramatic reduction in cost of process control electronics – key to modern engg processing

Affordable Computing power at affordable cost can solve research problems of inhomogeneous natural engg materials

- Routes to Rural Industrialisation

Biomass Gasification : 2 kW elec to 10 kW elec plus Recovered Waste Heat of 4 kW thermal to 20 kW thermal

Harnessing Draught Animal Power (nationwide 100,000 MW)

- Potential economically viable Rural enterprises which can utilize biomass power

Food processing

Oil extraction

Milk processing

Green Building Materials

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