

Rural Energy Systems

- The Abandoned Priority



“An ounce of practice is worth more than tons of preaching”.

Energy Supply Systems

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graph TD; A[Energy Supply Systems] --> B(( )); B --> C[Urban (Industrial & Commercial Activities)]; B --> D[Rural (Household levels)]; C --> E[Important for country's economic development]; C --> F[Largest share of commercial energy consumption (hydro-, thermo-, nuclear-power, or from coal and petroleum products).]; C --> G[Household energy consumption Insignificant compared to Industrial & Commercial Sectors.]; D --> H[Bulk of the energy is consumed at the household]; D --> I[Woodfuel, forms of biomass, biogas, micro-hydro solar and wind power, mostly at a small scale.]; D --> J[Energy is primarily used for cooking food];
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Urban
(Industrial &
Commercial Activities)

Rural
(Household levels)

- ❖ Important for country's economic development
- ❖ Largest share of commercial energy consumption (hydro-, thermo-, nuclear-power, or from coal and petroleum products).
- ❖ Household energy consumption Insignificant compared to Industrial & Commercial Sectors.

- ❖ Bulk of the energy is consumed at the household
- ❖ Woodfuel, forms of biomass, biogas, micro-hydro solar and wind power, mostly at a small scale.
- ❖ Energy is primarily used for cooking food



Rural Energy Consumption Pattern

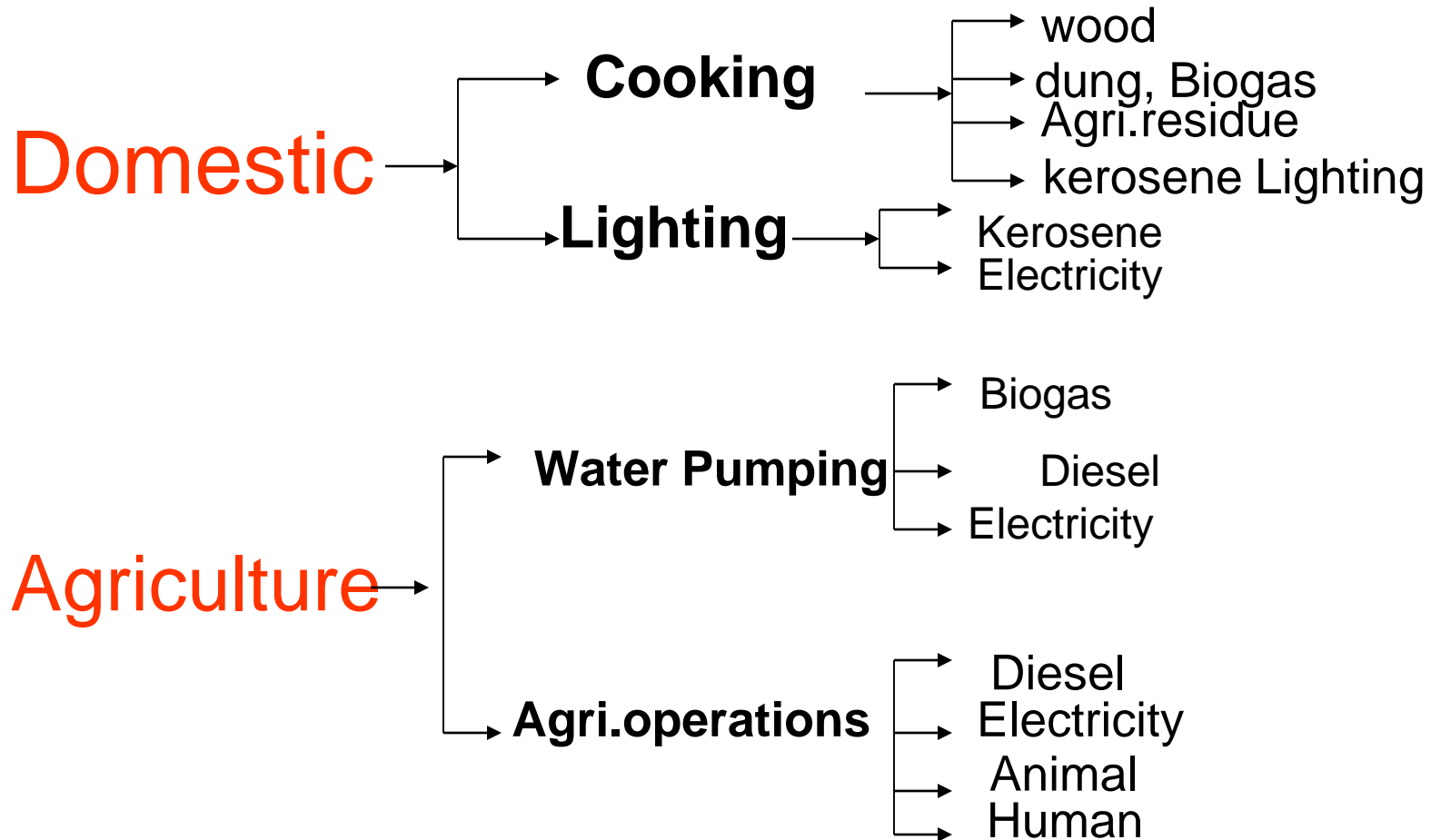
- (1) **Agricultural operations**
 - (2) **Domestic activities** -- gathering fuelwood, fetching water for domestic use particularly drinking, cooking and grazing of livestock
 - (3) **lighting**
 - (4) **Industry** (pottery, flourmill, etc.)
- These activities were achieved with human beings, bullocks, fuelwood, kerosene and electricity as *direct* sources of energy.

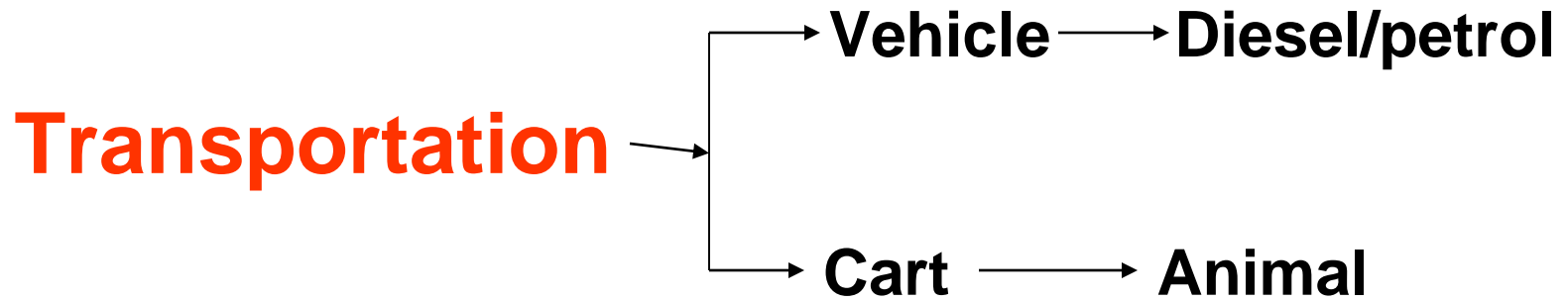


Energy Distribution Pattern

- **Human energy** was distributed between **domestic activities** (grazing livestock, cooking, gathering fuelwood, fetching water), agriculture, and industry.
- **Bullock energy** was used wholly for **agriculture** including transport.
- **Fuelwood** was used for **cooking and heating** bath water in the domestic sector & to a small extent in industry.
- **Kerosene** was used predominantly for **lighting**, and to a small extent in industry.
- **Electricity** flowed to **agriculture, lighting, and industry**.

ENERGY CONSUMPTION PATTERN IN RURAL AREAS





Several Features of Energy Consumption Pattern

1. Overwhelming portion comes from *fuelwood*. conventionally referred non-*commercial* energy, i.e., kerosene and electricity accounts for a trivial fraction - inanimate energy used in the village.
2. Fuelwood must be viewed as a *non-commercial* source (only a small amount of the total fuelwood requirement was purchased as a commodity, the remainder being gathered at zero private cost).
3. *Animate* sources, viz., human beings and bullocks, represent most of the energy used in agriculture.
4. Village's energy consumption comes from *traditional renewable sources*.
5. However, the environmental soundness of this pattern of dependence on renewable resources was achieved at the exorbitant price of *very low productivity* especially in agriculture.

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6. And large amounts of human energy are spent on *fuelwood gathering* (on the average, several hours per day per family and several kilometres of walking to collect a head load of about 10 kg of fuelwood).
7. *Fetching water* for domestic consumption also utilises a great deal of human energy (*an average of 1.5 hr and 1.6 km per day per household*) to achieve an extremely low per capita water consumption of less than 20 litres per day.
8. A great deal of the human energy is spent on *grazing livestock* that are a crucial source of supplementary household income.
9. There is a strong gender bias in fuelwood gathering and fetching water both these activities are primarily the traditional burden of women.
10. Only a fraction of the houses in typical “electrified” Indian villages have acquired domestic connections for electric lighting, the remaining houses depend on *kerosene lamps*. Thus, *village electrification does not mean home electrification*

Rural Energy systems

- Rural energy systems - an abandoned priority.
- Rural energy is not getting the importance it deserves.
- Upsurge of interest in 1970s triggered by appropriate technology movement and the enthusiasm for the application of science and technology to rural areas.
- However, the emphasis shifted to renewable energy.
- *Rural energy invariably implies renewable energy*, the converse is *not* true.
- Primary focus in the rural energy work was on *cooking*.

Rural Energy Systems

- Population of India – 1.324 billion people (2016)
- **Rural Population nearly – 67.25 %** (85 crore, 2015). So, Rural Energy needs are important.
- Rural poor do not have the purchasing power to articulate their needs through market demand.
- Attention, therefore, should turn to those sections of the population.
- In world about 2.5 billion people cook with traditional biomass/ fuel-wood and about 1.7 billion people are without electricity.
- Most live in rural areas without access to modern energy carriers. What they need above all *energy services* is for efficient, safe and clean cooking and electric lighting.

Rural Energy Challenges



- ❑ Access to electricity and the services it provides (illumination, mechanical power, cooling) is extremely limited
- ❑ Majority of heat energy needs come from traditional biomass (cooking, heating, agricultural processing) such as wood, agricultural residues, charcoal and dung
- ❑ Family energy needs met largely by women and girls
- ❑ Fuel and water collection limit girls participation in school, impact literacy, fertility and economic options
- ❑ Low levels of public services (education, health, etc) impacted by lack of energy
- ❑ Rural jobs and agricultural value added limited by lack of energy



Goals of Rural Energy Systems

1. *Must be instruments of sustainable rural development.*
2. Must advance rural economic growth that is economically efficient, need-oriented and equitable, self-reliant and empowering, and environmentally sound.
3. For an energy system to be in the interests of the rural poor, it must qualify from three points of view.
 - It must increase the access of the rural poor to affordable, reliable, safe and high quality energy.
 - It must strengthen their self-reliance and empower them.
 - It must improve the quality of their environment (starting with their immediate environment in their households).

Features of Rural Energy

- ✓ *Reduction of arduous human labour* (especially the labour of women) for domestic activities and agriculture.
- ✓ *Modernisation of biomass* as a modern energy source in efficient devices,
- ✓ *Transformation of cooking* into a safe, healthy and less unpleasant end-use activity,
- ✓ *Provision of safe water* for domestic requirements,
- ✓ *Electrification of all homes* (not merely villages),
- ✓ *Provision of energy for income-generating activities* in households, farms and village industries.

Characteristics of Rural Energy Systems

- Supply sources
- Energy mix patterns
- Problems & Potentials for development

Characteristics is vary from place to place, depends on numerous factors such as :

- Availability
- Accessibility
- Affordability
- Alternatives
- income level
- socio-cultural practices
- climate, etc.

Technologies Used in Rural energy

- Construction of **biogas plants** to meet the heat energy requirement
- Adoption of efficient **cooking stoves** and **smokeless Chullas**
- Erection of the **gasifiers units** to produce renewable energy to meet the rural electricity demand for various productive activities like irrigation, lighting etc.
- Decentralised generation from biomass and from the intermittent sources of wind and/or small hydel, **solar photovoltaic** and solar-thermal devices. New possibility - micro-turbines.

Technological Sources and Devices

SOURCE	NEAR TERM	MEDIUM TERM	LONG TERM
Electricity	Biomass-based generation via IC Engines/ Micro-turbines	Biomass-based generation PV/Wind/ Small Hydel/ Solar Thermal	Fuel Cells for baseload power
Fuels	NG/LPG/ Producer Gas/Biogas	Biofuels/ Synthetic DME/LPG	Biofuels

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TASK	NEAR TERM	MEDIUM TERM	LONG TERM
Cooking	Improved Woodstoves/ Producer Gas/Biogas	LPG/Biogas/ Producer Gas/NG/ DiMethyl Ether (DME) Stoves	Gaseous biofuelled Stoves/Catalytic Burners/ Electric Stoves
Safe Water	Filtered/UV radiated/Treated Water	Safe piped/Centralised/ Decentralised Treated Water	Ultra Safe piped/ treated water
Lighting	Electric Lights	Fluorescent/Compact Fluorescent Lamps	Fluorescent/Compact Fluorescent Lamps
Motive Power	IC Engines/Electric motors	Biofuelled prime movers/Fuel cells/ Micro-turbines/ Improved motors	Biofuelled prime movers Improved motors

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TASK	NEAR TERM	MEDIUM TERM	LONG TERM
Appliances	Electric appliances	Efficient appliances	Super-efficient appliances
Process Heat	Electric Furnaces/ Producer Gas/ Cogeneration/NG- fuelled/ Solar Thermal	Induction Furnaces Biomass-fuelled Solar Thermal	Biofuels/ Solar
Transport	Petroleum/NG-fuelled Vehicles	Biomass-fuelled vehicles	Fuel-cell driven vehicles

Rural Electrification

- *Rural energy for rural self reliance*
- Rural electrification which was equated with *village* electrification.
- According to Electricity Act 2003, even *one pole* near a village qualifies it as an *electrified village*.
- Agricultural consumers dominated the priority list of electricity end-users - *irrigation pump-sets*.
- Rural electrification was understood as *grid electrification*

Village Electrification

Earlier definition:

A village is classified as electrified if electricity is being used within its revenue area for any purpose what so-ever.

New definition:

- ❖ The basic infrastructure such as distribution transformer and or distribution lines is made available in the inhabited locality within the revenue boundary of the village including at least one hamlet/Dalit Basti as applicable.
- ❖ Any of the public places like Schools, Panchayat Office, Health Centres, Dispensaries, Community centers etc. avail power supply on demand.
- ❖ The number of household electrified should be minimum 10%.

Thank You