

Energy & Energy Policy, India

- Energy source and magnitudes
- Status of electrification
- Technology options
- – with renewable sources
- Policies – Accelerated Depreciation (AD), Generation based Incentive (GBI) and Renewable Energy Certificates (REC)

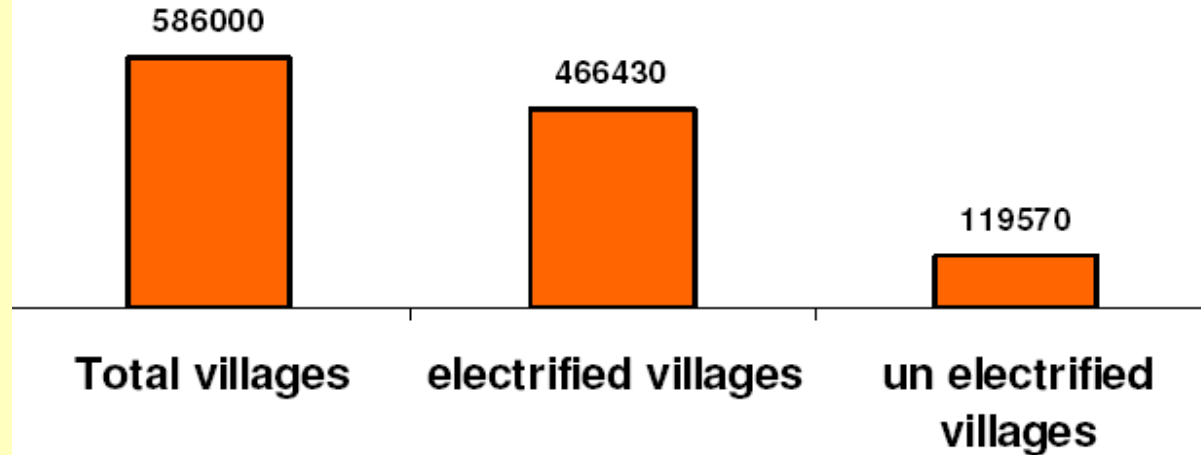
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Minato-ku, Tokyo 1045-0014

Energy from fossil fuels & biomass

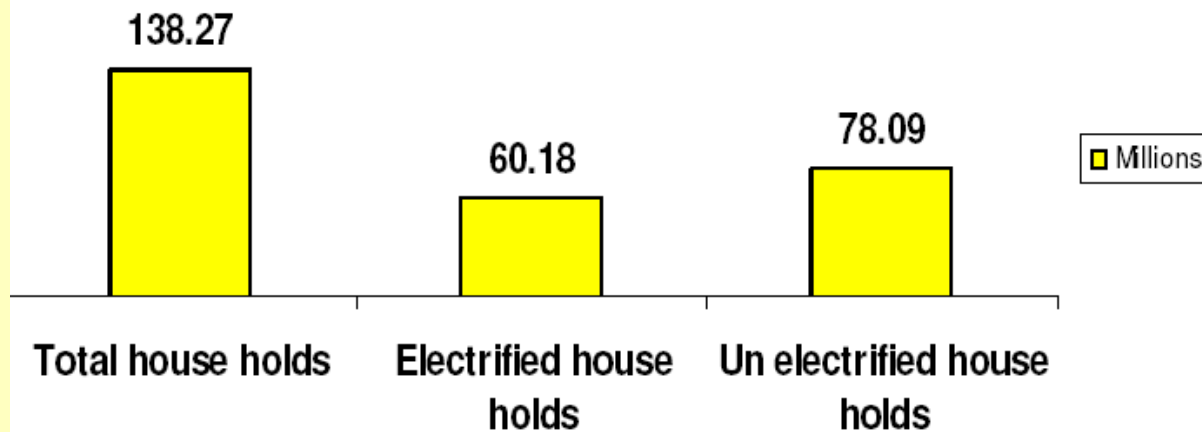
Item	Amount mmt	Energy billion kWh	Efficiency, %
Coal	500	550	33 (avg), 36.5
Furnace oil	8	30	40
Biomass	1.4	1	~27
Biomass	465	Cooking	~10, ~ 20(FW)

Cooking efficiency can be at least doubled, may even be more at moderate costs of investment; this releases substantial amounts for distributed electricity generation

status of village electrification



Status of rural house holds electrification



Rural electrification division of the Ministry of Power is examining the subject and is trying out various strategies towards mitigation – distributed power generation is the essence of this effort

Technology options

- Distributed power generation is normally thought of as being at small power levels – 100 kWe class. This need not be.
- Between 100/1000 MWe and 100 kWe, there can be generation capacities of 1 to 5 MWe involving high efficiency systems, some IGCC class as well.
- These can be devoted primarily to meeting the demands of local communities first and any excess energy to be pumped into the grid. These can also act as tail-end grid stabilizing systems. The challenges relate to technology as well as economics. New ideas need to be explored to make these systems possible.

Technology options

- Coal and biomass may need to be combined to meet emission norms without having to have elaborate and expensive clean up systems.
- If these are successful, a larger number of entrepreneurs can be found to participate in investment opportunities as the investment costs are not prohibitively large.

Energy sources and comparison

Source	Purpose	Features
Solar thermal -Photo Voltaics	heat electricity	Intermittent, PLF ~ 30 %
Wind	electricity	Intermittent, PLF ~ 30 %
Micro-hydel	electricity	PLF ~ 50 to 70 %
Biomass	liquid fuel, food heat, electricity, chemicals and fiber	Stored solar energy available on demand, PLF ~ 95 %

PLF = Plant load factor = Energy generated per year / Energy possible at nominal power

Technology options

1. It is also important to find alternates to solar photovoltaics at 1 to 5 kWe power level, something that involves lower first cost, but could use some fuel input to ensure wider use for at least quality of life electricity with minor industrial activity.
2. Such systems need to be built in large numbers and the production scale makes these systems accessible.

Electrical energy promotion and regulation

- The formation of central and state electricity regulatory commissions
- (Central Electrical Regulatory Commission , CERC and State Electricity Regulatory Commission, SERC) independent of political control (slowly acquired that status) has been a major development in resolving conflicts, setting and revising tariffs for different sources of energy.
- All analysis is to be set out to this authority and decision sought. It is only sometimes that these are also challenged in the courts of Law with inevitable delay in implementation of new policies.

Electrical energy promotion and regulation

Two recent orders that consolidate the thinking process on nearly all the sources of renewable energy are – one from CERC and another from a SERC – state, Tamilnadu that has set out its order by consolidating and comparing the situation in many other states. They show the process of setting the tariffs to encourage the growth of renewable energy in India.

Electrical energy promotion and regulation

- It is widely known that India has had interest in renewable energy for over 40 years with the central Government having first a department of non-conventional sources of energy (DNES) and later making it a full-fledged ministry, MNES which is now called Ministry of New and Renewable Energy (MNRE).
- The primary reason for this has been that being an oil importing country with most rural dwellings depending on firewood for cooking and kerosene lamps for light needed more modern forms of energy for better quality of life and this could be dealt with nationally through this ministry.
- Support for research and development, capital subsidies for intended users, other direct and indirect tax benefits were conceived.

Electrical energy promotion and regulation – AD, GBI, REC

- Over the last ten years, accelerated depreciation (AD) has been the prime tool for activating private investment. This has worked very well with Wind energy.
- It was clear slowly that capacity addition was saturating. There has been a shift to generation based incentive (GBI) from AD.
- Much of these changes have occurred by several distinguished people examining the international practices (from Australia, for instance) and creating a peer pressure to look at alternatives.
- Currently, GBI has been introduced only for wind power generation. In coming times, it is important to ensure this is introduced for other forms including urban solid waste to ensure source invariant finance supporting strategy.

Renewable Energy Certificates

1. Another mechanism that enables greater renewable energy generation over the country with some states not having enough renewable energy sources to participate in the national goal of a minimum renewable energy generation (Renewable Power Obligation – RPO) is the Renewable energy Certificate.
2. This certificate procured by producing the renewable energy in one state can be traded across the state. This is an important additional incentive for promoting renewable energy generation. A special order on this subject from CERC is also included along with this

A comparison between AD and GBI

Assumptions	Independent Power Producers (IPPs)		IPPs with additional profit making business		CREC norms	
Options	Acc Dep (AD)	Gen based Incentive (GBI)	AD	GBI	IPPs	IPPs with other profit making business
IRR	16 to 17 %	21 to 22 %	>100 %	Unsuitable	About 15 %	
Comments	<p>For independent power plants, AD resulted in marginal benefits since the tax holiday is used to offset such benefit. There is no motivation to operate the system beyond a certain period.</p> <p>Under GBI, however, IRR improves significantly and more importantly, expectations of better performance over a long period will be fulfilled.</p>		<p>When project has equity investment of ~ 30 %, AD on the entire project provides tax shield against profits resulting in very high IRRS thus making GBI not interesting.</p>		<p>CERC regulations imply higher post tax returns, any other benefits (through Ad or GBI) are expected to be subsumed with the tariff structure the projected returns either way will be lower compared to the present situation.</p>	