Social cost comparative analysis to derive an optimal energy mix plan in India; Current Hurdles and Future Planning

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***Abstract*—Currently, in India the contribution of fossil fuels in the energy mix is 81.9% (2018). India's trade deficit has been -108.5 billion USD (2017) while it's import of oil and coal itself was worth 108.1 billion USD (2017). Such heavy reliance on imported fossil fuels for electricity generation, transportation fuel and process heat is clearly worsening India's trade deficit and is apparently the main cause behind the depreciating rupee. Additionally, India emits 2055 million tonnes of carbon dioxide (2017) yearly which is quite an alarming fact given India's carbon emission goals. On the other hand, India's Nuclear Power Program is ready to fully meet the energy demand of transportation fuel, drinking water (through desalination), base-load electricity and process heat for industries with the least carbon footprint, for centuries. Moreover, the river-interlinking project of India with canal-top solar power plants, backed-up with pumped-storage hydroelectricity stations, can fully meet the irrigation and electricity demand in the agriculture sector.**

It is a well-known fact that Human Development Index (HDI) is statistically correlated with the per-capita electricity consumption. HDI (2018) for India is 0.639 and the per-capita electricity consumption is 1149 kWh which is well-below the world average of 3000 kWh. India has had an ambitious plan to generate 5000 kWh per-capita. To achieve this in a sustainable manner, in this report, we have derived and compared the actual social cost of generating electricity from different sources of electricity generation in India taking into account factors like green house gas emissions, levelized cost of electricity (LCOE), fatalities and land requirement. Through our study, Nuclear, Solar and Biogas comes out to be the best 3 sources having the least social cost (in increasing order). Additionally, we have proposed a town level planning for the installation of these 3 sources for the state of Rajasthan. India with its indigenous Nuclear Energy program itself can generate 3000 kWh per capita for the next 900 years.

We will also explore the 2 scenarios in Japan & Germany respectively and discover that the Government only with a strong - reliable & sustainable growth target having an unbiased approach to Energy policy and backed up with the required support from the aware citizens tries to achieve the desired targets of the economy.

We hope, our analysis will help India (a multi-party democratic country) derive a socially viable energy plan. We will also show how the currently dead Nuclear Power Plant sites like 6600 MW Mithivirdi (Gujarat), 9900 MW Haripur (West Bengal), 8000 MW Kudankulam (Tamil Nadu), 6600 MW Kovvada (Andhra Pradesh), 6000 MW Markandi (Orissa) and other Pressurized Heavy Water Reactors, Fast Breedor Reactors & Advacned Heavy Water Reactors can be immediately brought back to commercial operation or construction with pre-project awareness activities (through an unbiased extension network) in the regional public and right evaluation of compensation money in time.

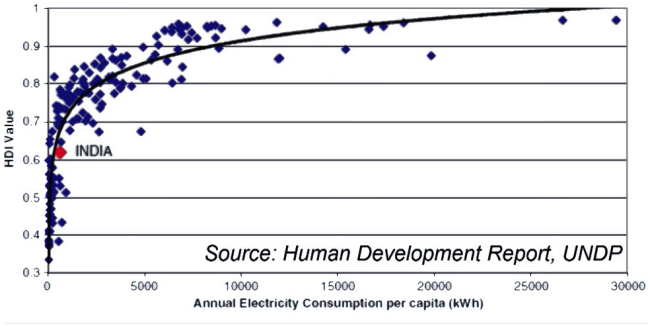


Fig. 1. shows the strong correlation between per-capita annual electricity consumption (kWh) and Human Development Index when studied across countries.

Resource	Amount (GW)	Electricity Potential (GW-Years/yr)
Hydro	150	69
Wind (80 m height)	102	26
Biomass Energy	25	20
Small Hydro	20	6
Solar (3% wasteland)	750	150

Fig. 2. shows India's renewable energy sources and their peak-level capacities.

464 kWh max can come from Hydro, 175 kWh from wind, 134 kWh from biomass, 40 kWh from small hydro and 1010 kWh from Solar. India also has this ambitious plan to install 10,00,000 MW of solar power plants across India which can be realized immediately with the above said recommendations.

Thus a total of 1823 kWh per capita can come from the renewable sources. 177 kWh per capita from the indigenous fossil fuels can complete the 2000 kWh milestone for 342 years. But still, to achieve the 5000 kWh per capita target we need to think of the rest 3000 kWh per capita. (1.5 billion population assumed).