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Residential solar installations driven economy to reduce carbon emissions

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Abstract
The rapid economic growth and the depleting fossil fuels direct the Indian economy towards renewable energy sources. Among the renewable, the most sought after technologies are nuclear energy and solar energy. The paper compares nuclear energy to solar energy to choose a more viable option, given the abundant incident solar flux. Also, the paper proposes a negative green taxation regime to aid replace the solar panels after their lifetime.

Keywords: GDP, green taxation, solar energy, nuclear energy

1. Introduction
Given the plans for rapid economic growth (GDP) with increase in population, India demands energy growth especially in the sectors-agriculture, commercial, industrial, residential and transport [1]. Beyond 2030, nuclear power could see thorium based reactors upto an estimated potential of 530GW [1]. Since 2010, electricity generation increased at a pace of 7 percent per annum and India emerged among the top five LNG importers in the world [2]. By 2035, India's energy demand is expected to grow by 128 percent, accounting for eight percent of global energy demand [2]. By 2035, although nuclear and renewables replace fossil fuels, coal remains the primary energy contributor accounting upto fifty percent demand [2]. By 2035, the renewable consumption is expected to increase by twenty seven percent per annum in solar and thirteen percent per annum in biofuels [2]. The gap between demand and supply of Indian energy needs persists at forty percent [2].

2. Literature Survey
Nearly, one-third of world's population, living in rural areas, is yet to gain access to electricity [3]. This needs panchayats to assess and improve relatively poor quality of life of seventy percent rural population of India [3]. Annual solar radiation to India, with 300 clear sunny days could possibly generate 20MW solar power/sq.km [3]. Energy consumption in household domestic sector accounts for nearly seventy five percent of the energy [3]. India's GDP in energy and emission intensities have decreased by more than twenty percent in the previous decade. India's percapita emissions account to 1.6 tons of carbon-di-oxide, being 6.4 percent of the global share [4]. As per IEA, India improved its energy efficiency through 2000-18 to avoid an additional fifteen percent energy demand [4]. By 2040,with improved energy efficiency, India could save almost half of its current power generation [4]. Indian urbanization rate is 2.4 percent per year [4].

3. Methodology
By 2030, at 9 percent GDP growth rate, the energy demand will approximately peak at 295,000Mega watts [5]. The most sought after technologies to meet the demand are nuclear energy and renewable (solar) energy. Nuclear energy emits less green house gases compared to the rest of conventional power generation technologies [6]. An average fuel sample remains for 3 years in the reactor and one third of it is removed annually. The nuclear reactor is shutdown for one month every eighteen months [7]. Annually, the global electricity consumption is 1695 GWyr and nuclear energy accounts for seventeen percent of the global demand [7]. The average global electricity consumption growth rate is 2.7 percent per annum

[7]. The average solar energy flux on the earth's surface is 200W/m^2 [7]. To collect 1GW of incident solar energy, 5km^2 area is required [7].

The table compares nuclear energy to solar energy to choose a more cleaner and economic option to generate energy.

Table 1: Comparative parameters of nuclear energy to solar energy

Parameter	Nuclear power plant	Solar power plant
Plant life	40 years [6]	25 years
Extended life	20+10 years [6]	
Maintenance cost	High [7]	
Cost per kwh	0.23 cents/KWH [7]	0.06 cents/KWH [5]
Time of construction	5 -7 years [7]	5-7 days [8]
Average annual Radiations	2.9 milli Sievert [7]	
Fuel Recycle/waste disposal	PUREX, UREX/Deep geological deposition [7]	Photons
Safety	High risk [7]	Safe
Fuel to electricity conversion percentage	33 percent [8]	30-40 percent
Annual projections upto 2040 [9]	7.4 percent increase	10 percent increase

Every residential house could be installed with a roof top solar power plant. The solar power plant could be installed in PPP-public private partnership. It is a benchmark that each kilowatt hour installation costs one lakh rupees. The maximum rooftop installation is of 5KWH. The payback period would be three to five years [10].

The total area of India is 32, 87, 782 square kilometers [11]. This area could collect a solar electricity of 6,57,556.4 giga watts annually. Thus, the available solar capacity is 22.29 percent in abundance.

A negative taxation regime called green tax would benefit common man society through the lifetime of solar panels. This tax to be calculated at a specified rate and exempted from annual income tax. This tax is an additional benefit other than subsidy on solar panels.This green tax is a financial aid to replace the solar panels after their lifetime. The green tax helps reduce carbon emissions in conventional electricity generation, thus reducing global warming. This would reduce the carbon emissions on a scale of 0.85kg per KWH [12].

4. Conclusion

The urbanization of India attracts more carbon emissions in the form of increased use of civic amenities. Thus, the urban Indian should be conscious of pollution control. Thus, domestic solar consumption would defy pollution. When compared to nuclear energy, solar energy would be less costly when given the parameters in the above table. Every household installed with minimum one kilowatt solar power plant would boost the energy security of India. This also generates employment to youth.

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