



RESEARCH ARTICLE

PROCESSES AND CHALLENGES TO MAKE A 100% SOLAR POWERED VILLAGE

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ABSTRACT

The PM has recently announced that 1 crore houses will be fitted with rooftop solar panels to generate clean energy. India wants to create 50% of its power needs from clean energy by 2030, with solar power leading the drive. This article looks at the first 100% round the clock solar powered village, Modhera in Gujarat to understand how we can move towards this goal and what would be the Challenges that we will face.

Key words:

Solar Power, 100% Solar Powered Village, Challenges to Solar, Solar Economics.

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INTRODUCTION

India is the fourth largest generator of renewable energy in the world now¹. It wants to generate 50% of its power needs from renewable and hence clean energy by 2030. The main driver for this will be solar power. Currently 70 GW of solar power is generated by India³. The PM has recently announced that 1 crore houses will be powered with rooftop solar systems. India aims to create a solar power capacity of 280 GW by 2030. With such a strong emphasis on solar energy², it is important to understand how it works. Solar energy can be generated by ground-mounted solar, rooftop solar, floating solar, and canal top solar 2030⁴. In this article, we will talk about the first two that are relevant for villages – ground mounted and roof top solar. Modhera is the first village in India to go round the clock 100% solar powered in March, 2023 with the roof top solar (power is generated by installing solar panels on the roof). The nearby complex of the historic Modhera sun temple is powered by the ground mounted solar (panels are installed on the ground). There are solar street lights on the highway to the temple. The temple complex even has solar EV charging machines. We visited both these places to understand how the place known for the Sun Temple, became the first solar village.

The process to make the village 100% solar powered: Both Modhera village and the Sun Temple were electrified many years ago.

When they were made solar powered, the solar panels are connected to the existing grids (the thermal power grid lines). Solar panels contribute power to the grid. Thus, it contributes to the total power supply for the area. The houses always had electricity meters that measure the power consumed by the household. Now they also have meters connected to the roof-top solar panels that measure the power generated that goes into the grid. The difference between the power production and power consumption by the household is the amount in the electricity bill. If production is more than the consumption, the bill will have a credit amount. If consumption is more, then the consumer has to pay that excess consumption amount. The government installed solar panels in all houses for free and bears the maintenance cost too. Rs. 800 million were spent for building the roof top and ground based solar of the capacity of 8.5 MW (7.5 MW from the ground based solar and 1 MW from the roof top solar) – the 12 hectare land was given free by the state government. If 8.5 MW was to be produced from coal, at Rs. 83.4 million a MW, it would have costed Rs. 70.89 Million. The installation cost thus is somewhat higher for the solar technology. But given that there will be no input cost (of coal), other maintenance costs and much lesser environmental costs, the cost benefit analysis tilts in favour of solar. The investment is worth making.

Multiple solar panels are fixed on the top of all the government buildings in Modhera (bus stop building, schools, aanganwadi,

etc.). This not only ensures self sufficiency in power for these entities; but since the power generated is more than needed, it adds to the total power supply for the area. This was a good step taken to reduce the dependence on thermal power.

Is the village actually 100% solar powered?

The simple answer is, Not yet. The concrete houses with sharply slanting rooftiles could not be fitted with solar panels on the top – it was not structurally feasible. Similarly, all the houses of the poor, made with thatched roof of grass were too fragile to take the load of rooftop solar panels. So they also could not be fitted with the panels. Thus almost 30% of the houses in Modhera are not solar powered, for technical reasons.

If the village is claimed to be 100% solar powered, all those with the solar panels should not have to pay electricity bills. Villagers in Modhera talk about getting bills of lesser amount, but most still have to pay some amount. That means that their power consumption is more than their solar production. Thus, the village cannot be called 100% solar powered.

Other challenges: The villagers complain about frequent tripping of line of the solar inverter. They say that the line trips around 8-9 am in the morning and does not work till almost 4 pm. Their frequent complaints to the Gujarat Electricity Board and solar power agencies have given no result. We suspect, although we are not sure, that this may happen because the inverters installed by the contractor might be of lesser capacity. That means, the capacity of the inverter to handle the power is less than the power generation capacity of the solar panels. There can be other reasons too, but it seems that the installed capacity of the solar panels is under-utilized. That means, the villagers might not be getting full benefit of the solar panels. This needs to be investigated. If this problem is taken care of, maybe the electricity bills of all villagers will become zero.

The villagers also complain about increased fluctuations in the voltage. There can be many reasons for this, but we feel that one small reason might be that the grid is not adjusted adequately to handle excess power that is now supplied by the solar panels. One villager complained that his air conditioner got burnt and so was his washing machine. The Gujarat Electricity Board should check its grid balance and control systems to prevent voltage surges.

The maintenance of the solar panels can pose an additional problem. No villager seemed to be cleaning the solar panels. One man jokingly said that the rains have been helping them in keeping the panels clean. One woman reported honestly, “it is difficult to reach these panels to clean them”. The capacity of the solar panels to generate power deteriorates drastically, if they are covered with dust. Given the dust and the bird shit problems in India, these panels will generate lesser and lesser power after 2-3 years.

Solar park for Modhera temple: There is an important difference between the rooftop panels in Modheravillage and the solar park for the Modhera Sun temple. Since the solar park is run by the electricity board office right beside the park, the technical faults like line tripping and power surge will be immediately noticed and addressed. Maintenance, like cleaning the panels, also will be well taken care of. Solar parks pose different challenges. They require a large field. The land for this field is generally a waste land. If this land was a land reserved for grazing, then the communities that used this land for their cattle would suffer. The cattle herders of Sujjanpura village, that houses the 12 hectare solar park for the Sun Temple, complain of the loss of grazing land. The stray animals and wild animals depending on these open lands must have suffered too. Discarded solar panels can be difficult to manage. They are too large to be transported and their debris can create many problems if left at the site. Also, the long term effects of the heat generated by 100s of solar panels will become evident only in future.

It is important to be aware of all these factors while celebrating the first round the clock solar powered village of India.

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