HIMACHAL PRADESH

Are schools in the state using renewable energy?

A CSE STATUS PAPER

ANIL AGARWAL 1947–2002

'Environmental literature being generated for schoolchildren is, with some exceptions, in the genre of nature education. It is very important to expose young children to the beauties and wonders of nature. But as they grow older, it is important they begin to understand how human beings and human societies interact with their environment for their survival and their growth, how these human–nature interactions become a part of a society's culture, and why it is important to rationalize our relationship with our environment.'

Anil Agarwal
Founder-director, CSE

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CENTRE FOR SCIENCE AND ENVIRONMENT

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INTRODUCTION

Self-sufficiency in energy is touted as one of the most crucial indicators of the economic growth of a country. While the energy demand of a country directly shows the level of economic development, a lot of such development is also dependent on a country's ability to provide clean and cost-effective energy. With continued economic expansion and urbanization, India's demand for energy rises by five per cent every year. Rapid growth in electricity consumption and carbon footprint is expected as coal production has increased to a staggering 1.5 billion tonnes.

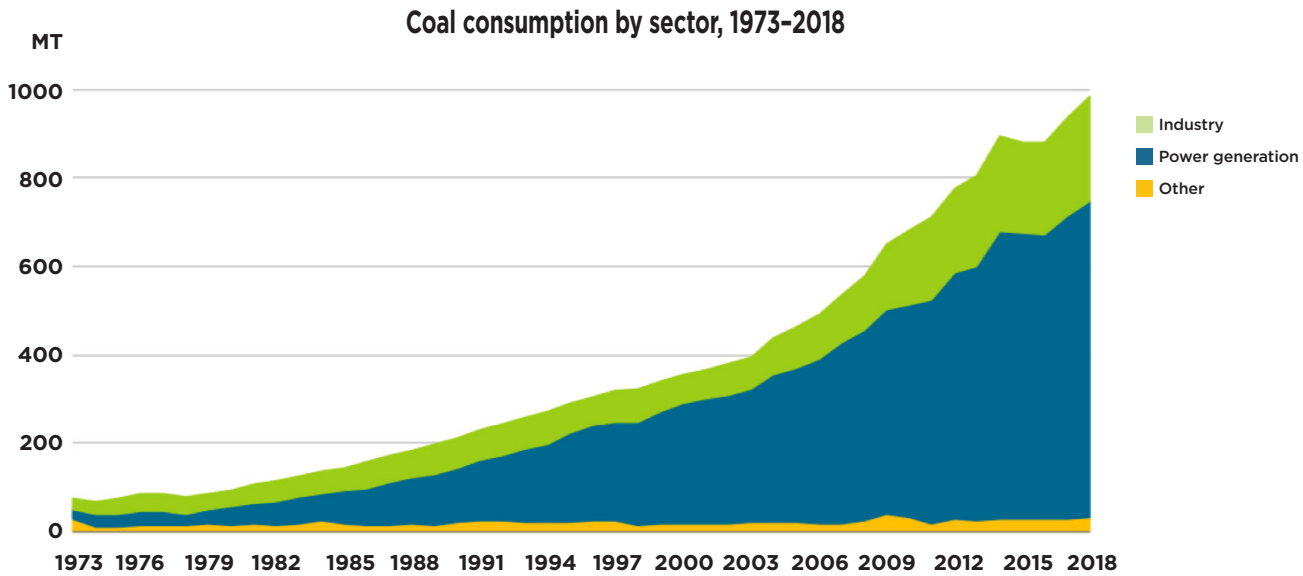
The energy scenario in India has undergone radical changes over the last century. Industrialization marked one such shift with the onset of fossil fuels to produce energy. The diverse and haphazard use of fossils has posed a massive environmental crisis over the years. Carbon-emitting sources remain the biggest sources of energy. In fact, 72 per cent of the world's greenhouse gas emissions come from the energy sector. The average atmospheric carbon dioxide (CO_2) level has now crossed 350 parts per million (ppm), which is the permissible limit, to as much as 415 ppm. This adds tremendously to global warming, which in turn, worsens climate change. The year 2020 has been a witness to the most disastrous extreme weather events occurring frequently across the world due to climate change. All these factors signal the need for another major shift in the way energy is consumed: clean, renewable energy is the need of the hour. The Intergovernmental Panel on Climate Change (IPCC) has also stated in its 2018 Report on Global Warming that staying within 1.5°C would require all coal-powered electricity to zero out by 2050.

India has an immense renewable energy potential with more than half a year of sunny days, its free-flowing rivers, and a coastline of over 7,500 km. In 2015, India formalized an ambitious plan to increase its renewable energy capacity to 175 GW by 2022 and generate 40 per cent of its electricity from non-fossil resources by 2030. This growth was expected to be powered by solar (100 GW) and wind (60 GW), followed by biomass and small hydro at 10 GW and 5 GW respectively. India has made some great strides, and its installed renewable energy capacity now stands at 89.63 GW as of October 2020, of which solar and wind have the biggest shares.

RENEWABLE ENERGY IN INDIA

With an estimated population of 1.38 billion, India's per capita electricity consumption was 1,181 kWh or 0.6 tonnes of oil equivalent (toe) as of 2018–19, as stated by the Ministry of Power. That is only one-third of the average global per capita energy consumption. India has 18 per cent of the world's population, and it uses only around six per cent of the world's primary energy. In fact, as per the US Energy Information Administration (EIA), the per capita primary energy consumption in the US was about 305 million British thermal units (Btu) or 7.6 toe. This data is enough to imply that India needs to increase its per capita energy consumption by a considerable margin.

FIGURE 1: COAL CONSUMPTION IN INDIA

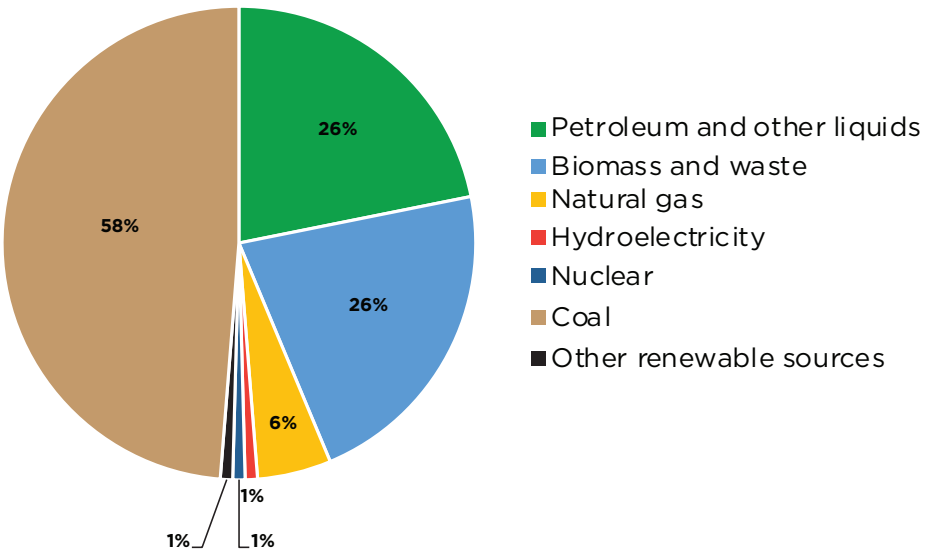


Source: International Energy Agency (IEA), 2019

According to Dharmendra Pradhan of the Ministry of Petroleum and Natural Gas (MOP&NG), per capita consumption of energy in India will reach as high as 1.19 toe in the next two decades owing to increasing modernization and industrialization. A sizeable portion of India's economic development depends on being able to provide clean and sustainable energy to its citizens. Sustainable Development Goal 7 (SDG 7) calls for 'Ensuring access to affordable, reliable, sustainable and modern energy for all', and it can only be realized when energy access and redressal of energy related environmental pollution are made policy priorities.

Renewable energy sources constitute a small portion of primary energy consumption in India. However, the RE capacity of the country is significant, viz. solar, wind, and small hydro. India's economy is based on fossil fuels as more than two-thirds of the country's energy needs are met through coal and petroleum. Over the years, the power sector has been the biggest user of coal followed by industries. A shift to renewable energy inevitably means zeroing out coal and increasing access to clean energy for people.

FIGURE 2: INDIA'S PRIMARY ENERGY CONSUMPTION

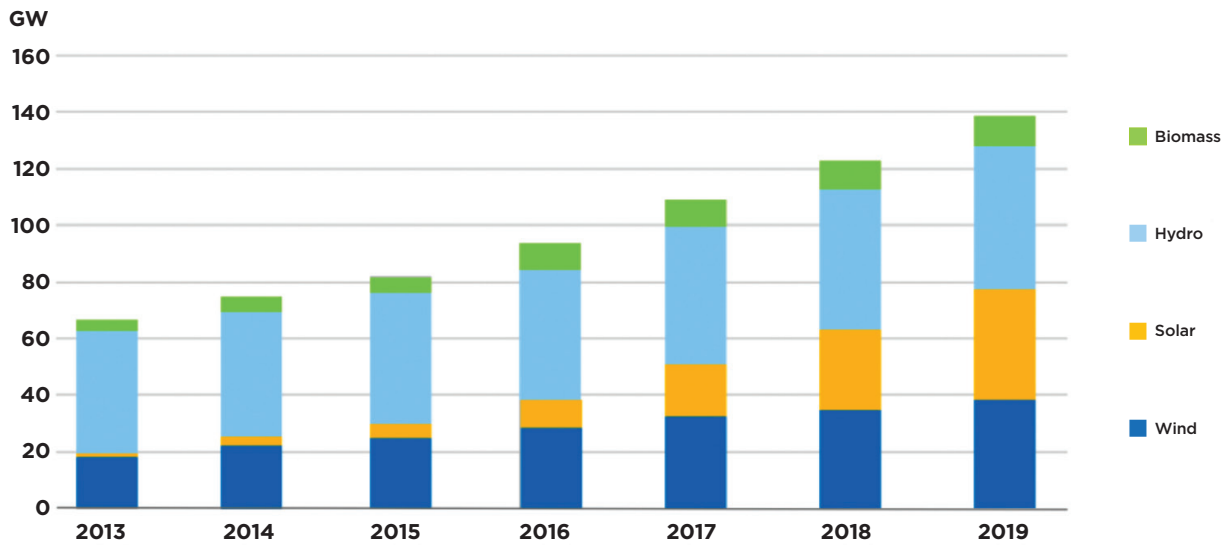


Source: International Energy Agency (IEA), 2019

In 2015, the Government of India announced a target of 175 GW cumulative renewable power installed capacity by the year 2022. Owing to policy interventions made to achieve the target, India currently holds fourth and fifth positions globally in wind and solar power deployment respectively. As per a monthly report released by the Ministry of New and Renewable Energy (MNRE), a total of 6083.48 MW of renewable energy capacity was added during the year 2019–2020.

India's installed renewable energy capacity has progressed substantially after the announcement of its RE target. However, the worldwide supply chain restrictions due to the novel coronavirus pandemic have derailed solar installations to a great extent. India majorly relies on China for solar photovoltaic equipment and the process has come to a halt in the absence of imports. The manufacturing base for wind energy equipment, however, is strong in India.

FIGURE 3: DISTRIBUTION OF RENEWABLE ENERGY IN INDIA



Source: International Energy Agency (IEA), 2019

SOLAR IN HIMACHAL PRADESH

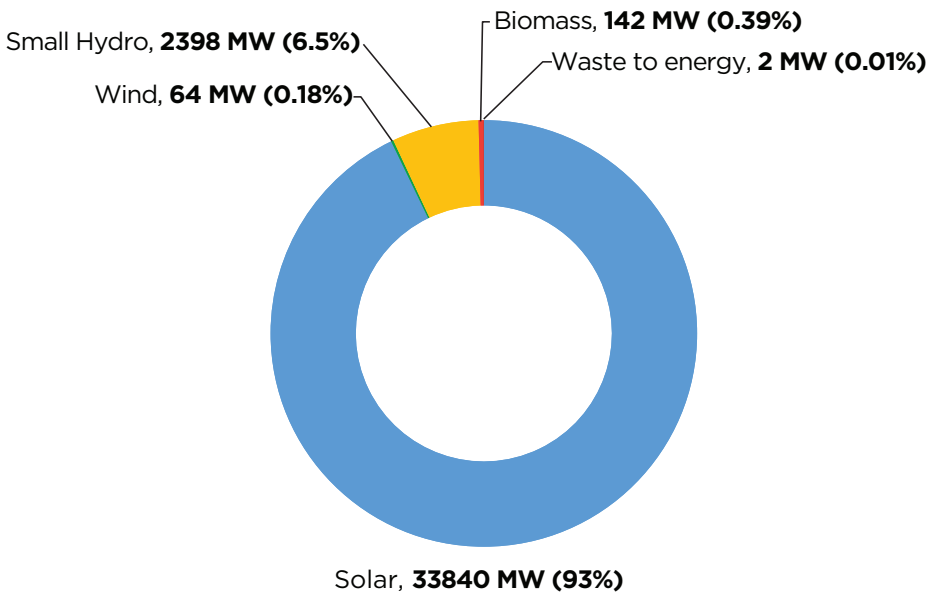
According to MNRE, solar power capacity of all Indian states combined has 'increased by more than 11 times in the last five years from 2.6 GW in March 2014 to 30 GW in July 2019'. Rajasthan, Jammu & Kashmir (before the bifurcation of the state into two Union Territories of J&K and Ladakh) and Madhya Pradesh are the top three states with highest solar energy potential.

Further, India is the world's fourth-largest onshore wind market with respect to installations. It has a potential of over 695 GW at 120 metres hub height. However, a report by Global Wind Energy Council (GWEC), titled 'India wind outlook towards 2022: Looking beyond headwinds, 2020', claims that India's wind energy capacity can only realistically reach 50 GW by 2022. It is evident that while the wind energy sector in India still has many roadblocks to overcome, the solar energy sector has made greater headway in providing clean energy access to Indian states.

With five perennial river basins and 300 sunny days a year, Himachal Pradesh (HP) is emerging as one of the richest states when it comes to RE potential. It has the seventh largest estimated solar potential according to the National Institute of Solar Energy (NISE), an apex institute of MNRE. HP is a hilly state with abundant renewable energy sources, viz. hydel and solar. In fact, solar has the biggest share in the state's RE potential.

NISE has estimated solar power potential of about 34 GW in HP, which covers three per cent of the total wasteland and roof surface area. However, due to

FIGURE 4: RE POTENTIAL IN HIMACHAL PRADESH



Source: MNRE Annual Report, 2014

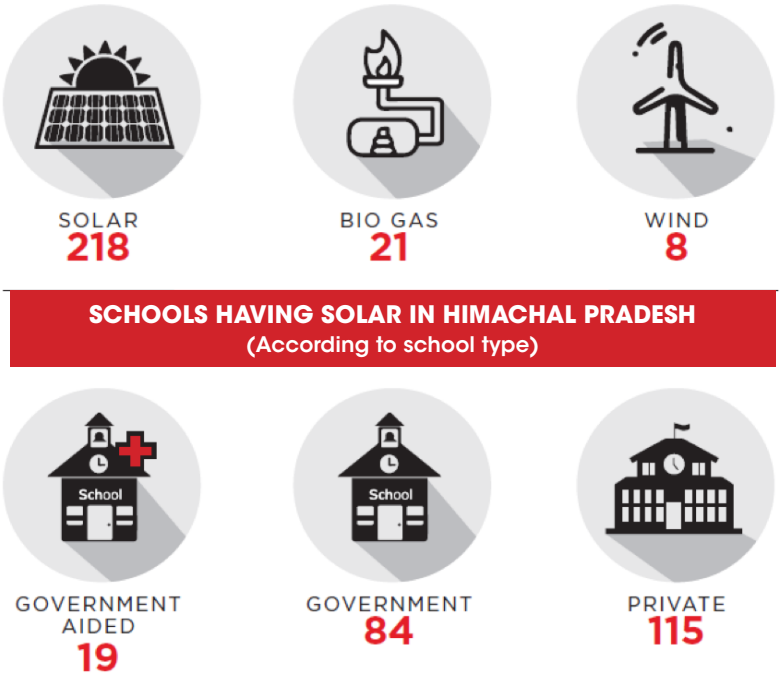
availability of suitable land area, difficulty in construction work and shorter sunny hours in a day, this capacity may be slightly reduced. However, Himachal Pradesh's installed grid-connected solar capacity had only reached 32.93 MW as of March 2020. This implies a huge untapped solar potential in the state. It has many advantages as it is equitably distributed across the state and does not cause any environmental impact during construction and operation.

A combination of different renewables will go a long way in achieving the RE goals. The state and central government have also devised hydro and solar schemes as well as incentives to promote clean energy in HP.

ENERGY CONSUMPTION BY COMMERCIAL SECTOR INCLUDING SCHOOLS

With growing population, rapid urbanization, changing lifestyles, and economic expansion, India's commercial sector is projected to grow at a fast pace and so is the electricity consumption by buildings. Although the residential sector will account for most of this increase in electricity consumption, EIA projects, in the International Energy Outlook 2021 (IEO2021), that India's energy demand will increase more than that of any other country over the next two decade; India at present is the fourth-largest global energy consumer behind China, the United States and the European Union. India will overtake the European Union by 2030 to move up to the third position, it said in the report. According to EIA, 'India's economic growth, rising income and population growth are likely to increase the need for education, health care, leisure, recreation, and other services, which EIA expects will lead to an increase in demand for lighting, space cooling, and office equipment.

As per the data provided by the Bureau of Energy Efficiency in 2009, the residential sector accounted for 25 per cent and the commercial sector accounted for eight per cent of the total electricity consumed. Of this eight per cent, there is no clear data on how much electricity is used by schools and other education institutions. However, recent reports have signalled that access to electricity in schools across the country still remains low.



Source: Solar on School, CSE, 2020

A report tabled by the Parliamentary Standing Committee on Human Resource Development found out that only 56.43 per cent government schools in India have access to electricity.

India has more than 1.5 million schools and around 260 million students across states and union territories. Shortage of electricity in this sector has direct repercussions on the educational and economic achievements of India. With growing commercial energy consumption, the problem of electricity access in schools needs to be solved through efficient and renewable energy solutions. Solar PV in educational institutions can result in environmental, health, and educational benefits. Decarbonizing schools will also contribute significantly towards mitigating climate change impacts and reducing emissions.

An environmental energy audit of 1,873 schools done by Green Schools Programme (GSP) in November 2019 revealed that only 12 per cent schools use solar energy, indicating that the huge potential of solar rooftop at educational institutions remains untapped. Further, only one per cent schools use biogas. Of the schools that use

solar energy, more than 80 per cent schools have at least 75 per cent penetration of renewable energy.

Many initiatives have been taken to promote and install RE in schools in the country. Recently, solar firm Oakridge Energy partnered with Kendriya Vidyalaya Sangathan and Delhi Government to solarize 1000 schools in Delhi by 2020. Many similar schemes have also been offered by SECI that provided aid or rebate to government school buildings for installation of solar rooftops. While this is a great beginning step, it must be borne in mind that there is still a long road to be covered in the RE journey for schools.

Renewable energy in Himachal Pradesh schools

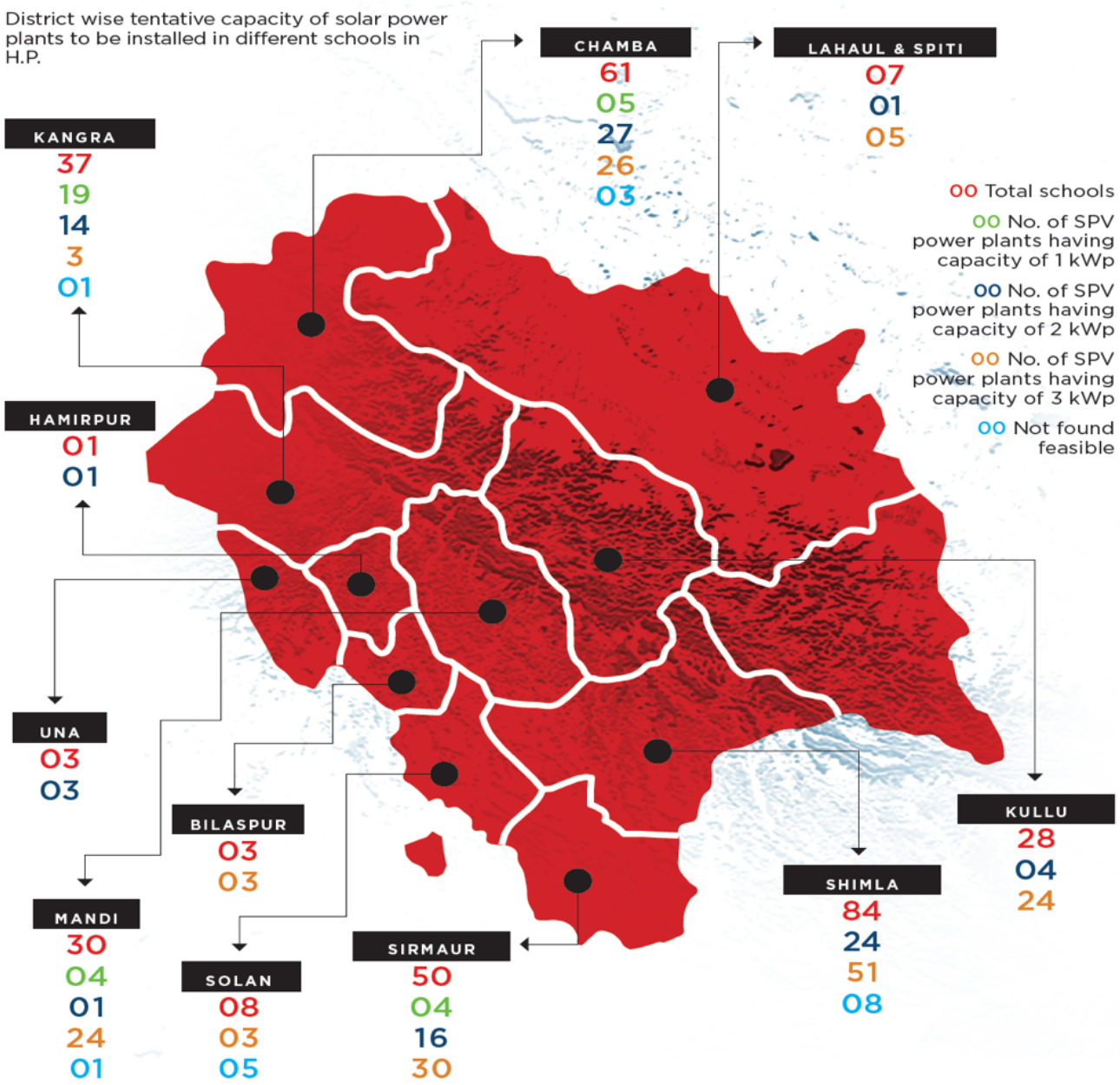
For any long-term environmental change to count in educational institutions, it is imperative that students not only be made aware of their responsibilities towards the environment but also made stakeholders in the process. Schools are not just a place for education but also a number of community activities that can provide basic services, including access to sustainable electricity.

The scenario of Himachal Pradesh is no different. There are more than 15,000 schools in HP. Most of these schools majorly depend on conventional sources to meet their energy requirements and a shift to efficient energy conservation and renewable energy will go a long way in providing environmental and economic benefits.

As per the Bridge to India June 2020 report, the total installed solar capacity in HP is 15 MW. As per the numbers provided by the Himachal Pradesh Energy Development Agency (HIMURJA), as of March 2020, approximately two MW off-grid and ten MW grid-connected solar power plants have been installed in Himachal Pradesh. There has been no installation of grid-connected solar panels in schools but 750 kW off-grid solar is under installation in 292 middle schools.

These solar panels are provided to schools free of cost by the education department, under the aegis of the Government of India. There are no installation and O&M costs for the schools. Finding south facing sites however remains an issue. The map below shows the solar power potential in HP schools.

MAP 1: SOLAR POWER POTENTIAL IN SCHOOLS OF HIMACHAL PRADESH



Source: HIMURJA

SOLAR POLICY IN HIMACHAL PRADESH

Himachal Pradesh State Electricity Board is meeting 100% of its requirement from water sources. Solar policy has been brought by the state government to supplement hydro, as well as the state also has some share in coal and gas power plants. As per the policy, HIMURJA has laid out the steps for an educational institution to initiate the process of rooftop solar photovoltaic (SPV) installation:

- As per the Rooftop Solar Power Policy, any person can establish a Rooftop Solar Power Plant in Himachal Pradesh.
- The beneficiary can install a Rooftop Solar Power Plant with a capacity of 30 per cent of the total load sanctioned to him by HPSEBL.
- The beneficiary will have to first seek consent from HPSEBL on a form available on the website of HIMURJA.
- After obtaining the consent from HPSEBL, the beneficiary will apply to HIMURJA for the installation of the rooftop Solar Power Plant on the proforma, which is available on the website of HIMURJA.
- The beneficiary can also apply directly with the approved channel partner for installing the Rooftop Solar Power Plant.
- The Rooftop Solar Power Plant will be installed on a Net off Subsidy basis.
- The list of firms approved by HIMURJA is also available on the website, along with the rates approved. Nothing extra has to be paid.
- The Bi-directional meter will be installed by HPSEBL and the cost of the meter will have to be borne by the beneficiary.

The salient features of the rooftop SPV scheme for schools are given below:

- What is the capacity of solar photovoltaic panels installed on school rooftop (in kW)?
- What is the connected load of a school (kW)?
- What is the size of invertors associated with the solar photovoltaic panel (W)?
- Do schools have net metering or gross metering?
- Any idea of power generated by existing SRT in schools in a month? (kWh)
- What are the O&M practices adopted? Frequency?

Rooftop solar PV grid interactive system based on net metering

Individual homes, commercial establishment, or institutions can establish grid interactive solar power plants on rooftops or elevated surfaces using the following options:

A. Grid interactive solar PV system without battery
B. Grid interactive solar PV system with battery backup

All the consumers of the Himachal Pradesh State Electricity Board Ltd (HPSEBL) who intend to set up rooftop solar PV plants are eligible to do so provided that the minimum project capacity is one kWp and maximum is one MWp.

The maximum peak capacity of the rooftop solar system to be installed should not exceed 80 per cent of the sanctioned load, i.e. the maximum load that can be utilized by the plant.

The responsibility of operation and maintenance of the solar photovoltaic generator and other apparatus lies with the consumer, i.e. the school in this case.

CONCLUSION

Renewable energy is regionally diverse, so it is crucial to choose the appropriate system of renewable energy in a region. Himachal Pradesh is a region with big hydro potential but even bigger solar potential. With a wide network of schools across the state—from urban to rural areas—the dream of clean energy can be realized by encouraging and facilitating schools to adopt renewable energy measures, with solar energy being most prominent.

As of 2020, a very small section of schools has adopted solar energy in the form of SPVs. Some schools are using a combination of different types of RE like solar and biogas. With the state's policy on rooftop SPV installation for institutions and focused environmental education and awareness, the schools can be made energy efficient by adopting SPVs to provide clean electricity. Most school buildings have a flat roof area which is ideal for installing rooftop solar panels. In addition, while the large-scale programmes supported by the government are inevitable, ground awareness and facilitation for schools is also equally important. This will not only offset the monthly utility bills but will also bring the community a step closer to clean energy for all.

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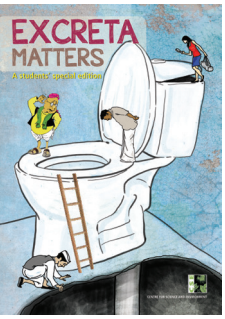

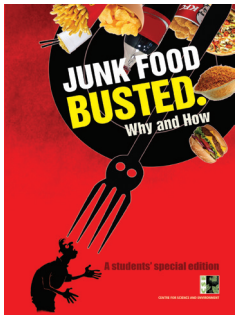

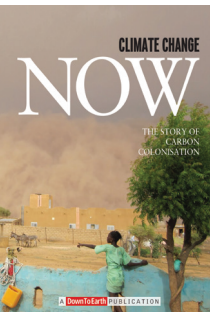

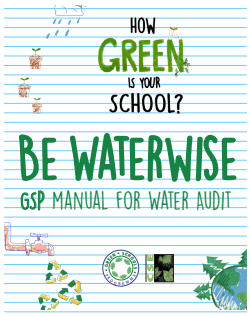

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Centre for Science and Environment (CSE) is a non-governmental, independent policy research institution based in Delhi that was started in 1980 by the late Anil Agarwal, a leading figure in India's environment movement.

For more than three decades now, CSE has helped shape policies and build public awareness to bring change in areas of pollution mitigation and public health security, low carbon development, natural resource management and livelihood security to make growth sustainable and inclusive.

CSE's public advocacy and research efforts have delivered path-breaking results—from championing equity in **climate change** negotiations, to supporting public transport and **sustainable mobility** practices in cities (CNG in Delhi), and mobilizing the country through a water literacy programme that catalyzed important policy changes on decentralized **water and wastewater management.** CSE programmes have achieved important public health outcomes by strengthening regulatory oversight in the use of **pesticides and heavy metals,** while its innovative **industry ratings** programme that certifies environment performance, serves as an alternative model of civil society governance to control industrial pollution and resource efficiency in India.

Today, CSE is well recognized for its path-breaking role in **capacitating public institutions** and regulatory agencies, while its **environmental education** efforts across a vast network of schools helps build a cadre of knowledgeable, committed environmental actors.

CSE's brand of knowledge-based activism has won it wide respect for its campaigns, research and publications and it is regarded as among India's most influential environmental NGOs. Prestigious national and international awards include the 2005 Stockholm Water Prize and the Prince Albert II of Monaco Foundation Water Award in 2008. The annual Global Go To Think Tank Index of the University of Pennsylvania in the US ranked CSE as the 17th most influential environmental think tank in the world in 2014 and a leading environmental think tank of the developing world.

Such is our footprint.

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