ENVIS BULLETIN

JANUARY 2015
ENVIS Centre, Environment Department.
Government of Maharashtra, Mumbai

SOLAR ENERGY

Supported by: Ministry of Environment, Forest and Climate Change, Government of India, New Delhi 110003
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Editorial

Fossil fuels are infinite, unsustainable source of energy. It is estimated that by 2030, 80% of primary energy mix will be dominated by fossil fuels, wherein oil will remain the dominant fuel and demand for coal will rise more than that of any other fuel in absolute terms. There is a worldwide concern over increased in coal usage, will lead to greater Carbon dioxide (CO_2) and Greenhouse emissions from coal combustion will exacerbate climate change.

Renewable energy sources can play an important role in providing energy services in sustainable manner and in particularly in mitigating climate change.

Renewable energy can contribute to "social and economic development, energy access, secure energy supply, climate change mitigation, and the reduction of negative environmental and health impacts"

Solar power is an excellent energy resource. The sun gives us free rays, so why not use them as a power source. It has two big advantages over fossil fuels. The first fact is that it is renewable; it is never going to run out. The second is that they contribute little or no pollution to environment. Development of affordable, inexhaustible & clean solar energy technologies will have a huge long term benefits. It will increase energy security of the country and also enhances sustainability, reduce pollution, lower the costs of the mitigating global warming and keep fossil fuel prices lower than otherwise.

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Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, the energy sector assumes a critical importance in view of the ever- increasing energy needs requiring huge investments to meet them. Demand for energy and associated services, to meet social and economic development and improve human welfare and health, is increasing. All societies require energy services to meet basic human needs (e.g., lighting, cooking, space comfort, mobility and communication) and to serve productive processes.

Electricity production in India is projected to expand dramatically in the near term to energize new industrial development, while also easing the energy shortages throughout the country. Much of the new growth in electricity production will be fueled by domestic coal resources; however, there is worldwide concern about increased coal use, as greater carbon dioxide (CO2) emissions from coal combustion will exacerbate climate change. At the same time, there are now a number of different existing and emerging technological options for coal conversion and greenhouse gas (GHG) reduction worldwide that could potentially be useful for the Indian coal-power sector.

Energy is the prime mover of economic growth and is vital to the sustenance of a modern economy. Future economic growth crucially depends on the long-term availability of energy from sources that are affordable, accessible and environmentally friendly.

India will continue to experience an energy supply shortfall throughout the forecast period. Rising oil demand of close to 10 percent per year has led to sizable oil import bills.

India ranks sixth in the world in total energy consumption and needs to accelerate the development of the sector to meet its growth aspirations. The country, though rich in coal and abundantly endowed with renewable energy in the form of solar, wind, hydro and bio-energy has very small hydrocarbon reserves (0.4% of the world's reserve).

Energy Conservation and its Importance:

Today, 85% of primary energy comes from non-renewable and fossil sources (coal, oil, etc.). These reserves are continually diminishing with increasing consumption and will not exist for future generations.

Energy Conservation and Energy Efficiency are separate, but related concepts.

Energy conservation is achieved when growth of energy consumption is reduced, measured in physical terms. On the other hand Energy efficiency is achieved when energy intensity in a specific product, process or area of production or consumption is reduced without affecting output, consumption or comfort levels.

Energy efficiency is often viewed as a resource option like coal, oil or natural gas. It provides additional economic value by preserving the resource base and reducing pollution.

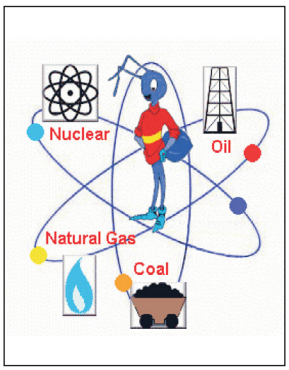
Very simply, energy efficiency means using less energy to perform the same function.

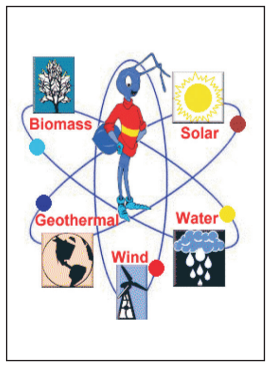
Energy can be classified based on the following criteria's:

Renewable and Non-Renewable Energy

Renewable energy is energy obtained from sources that are essentially inexhaustible. Examples of renewable resources include wind power, solar power, geothermal energy, tidal power and hydroelectric power.

Non-renewable energy is the conventional fossil fuels such as coal, oil and gas, which are likely to deplete with time.





Why solar energy is beneficial in India:

Considering the most important feature of renewable energy is that it can be harnessed without the release of harmful pollutants, solar energy is more reliable. This means that reliability can be acquired day by day. One can expect to continue getting power and energy from the sun for several decades without having to recharge batteries or keep purchasing new parts. Even though the energy may not always be readily available during cloudy days or at night, the availability is still there every day. The solar energy supply will be available as long as the sun is exists.

Solar energy is non- polluting when compared to oil, as oil burning will release carbon dioxide plus other greenhouse gases into the air. The energy provided by the sun is readily available and free.

Status of solar energy in India:

With about 300 clear, sunny days in a year, India's theoretical solar power reception, on only its land area, is about 5000 Petawatt-hours per year (PWh/yr) (i.e. 5,000 trillion kWh/yr or about 600,000 GW). The daily average solar energy incident over India varies from 4 to 7 kWh/m2 with about 1,500–2,000 sunshine hours per year (depending upon location), which is far more than current total energy consumption. For example, assuming the efficiency of PV modules were as low as 10%, this would still be a thousand times greater than the domestic electricity demand projected for 2015.

Techniques to utilize Solar Energy

1. Solar water heater

A solar water heater is a device that uses heat energy of the sun to provide hot water for various applications. A domestic solar water heater, with a capacity of 100 lpd (litres per day), is sufficient for a family of four or five members. It can easily replace a 2-kW electric geyser and can save up to 700 units of electricity a year. It pays back the cost in three to five years depending on the electricity tariff and hot water use in a year. After this, the hot water is available almost free of cost during the remaining lifespan of the system, which can be more than 15-20 years.

The system is generally installed on the terrace and requires minimum maintenance. It works automatically and one does not have to operate any part of the system. Typically, a surface area of 2 sq m is required to install it. The system should be installed on a North-south direction for optimum Heat Gain.

Two types of systems are being promoted—one based on FPC (flat plat collectors) and the other on ETC (evacuated tube collectors).The life of FPC-based systems is generally 15–20 years, and they are costlier than ETC-based systems. The cost of solar water heaters, with a capacity of 100 lpd, varies between Rs 10000 to Rs 15000.

Design Criteria: At least 1/5 of the Design capacity as per ECBC

2. Solar PV for Home Inverters/DG sets

Use of solar panels to charge Home Inverter system could be an attractive option as standby power supply system during load shedding hours. The power supply situation in most part of the India is very poor. It is a device that can be used to power lights, fans, and small TV sets etc.

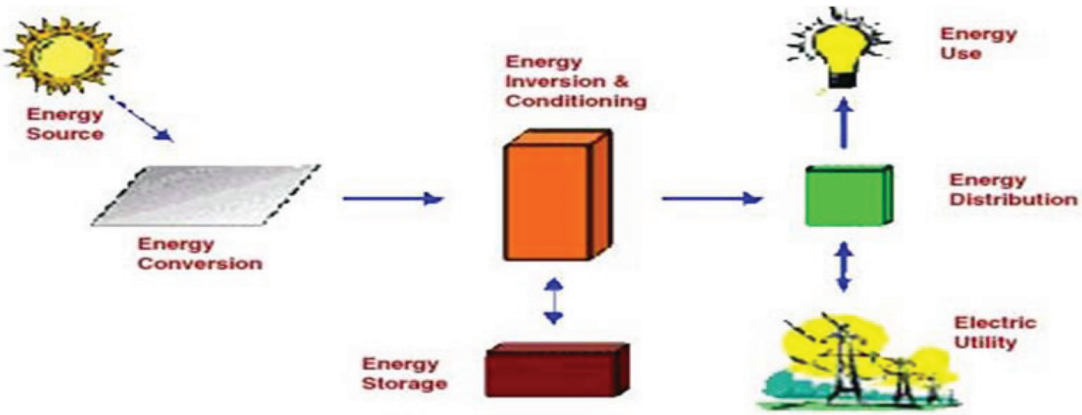
Solar PV power packs can be used to replace those polluting generator sets with high operating cost. A 1000 Wp solar PV power pack is more than sufficient for an average household where electric supply is intermittent. In this way if each house has its own electricity back-up there won't be any need to have a centralized DG set. This would not only prevent the dependency on fossil fuels but also eliminate the Air and Noise pollution caused by Gen-sets.

Photovoltaics (PV) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic power generation employs solar panels composed of a number of solar cells containing a photovoltaic material. Materials presently used for photovoltaics include monocrystalline silicon, polycrystalline silicon, amorphous silicon, etc.

Solar cells produce direct current electricity from sun light which is stored in Batteries. An inverter is used to convert this DC current into AC.

Major system components

PV module – converts sunlight into DC electricity.



Solar charge controller – regulates the voltage and current coming from the PV panels going to battery and prevents battery overcharging and prolongs the battery life

Inverter – converts DC output of PV panels into a clean AC current for AC appliances or can be fed back into grid line.

Battery – stores energy for supplying to electrical appliances when there is a demand.

Load – Is electrical appliances that connected to solar PV system such as lights, TV, computer, Fans, etc.

3. Solar water Pumping

A solar water pumping system is essentially an electrically driven pumping system. Electricity, in this instance, is produced by the sunlight energizing photovoltaic (solar) modules.

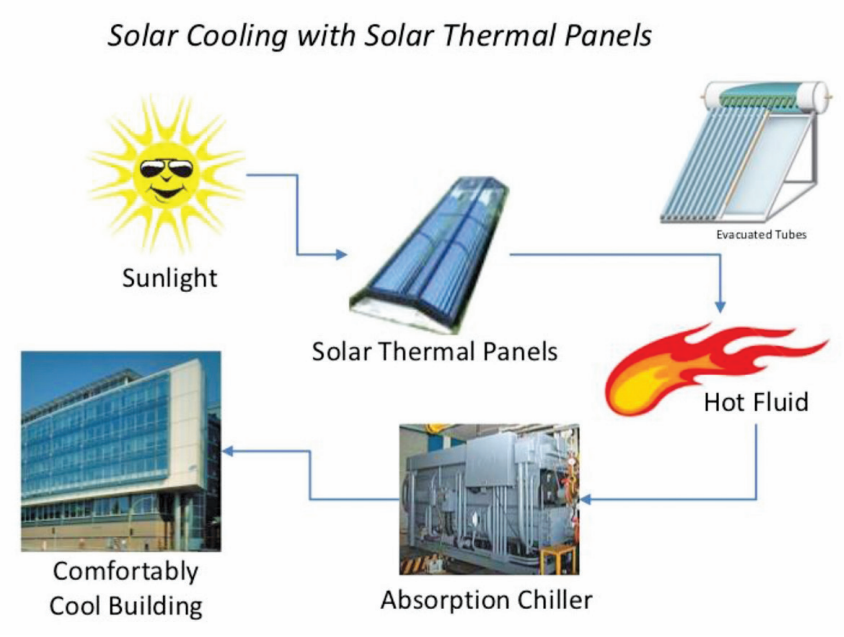
Solar water pumping systems are reliable and need little supervision requiring only periodical checking. Solar pumps can automatically start soon after sunrise and continue to work unattended until sunset. Its application is similar to that used for operating Solar PV based Lights wherein we can also store the energy in Batteries. It may find its application for sprinkler irrigation of Landscapes and Gardens, pumping excess water to drains or distributing water on Roads through a network of nozzles and pipes.

4. Solar for Outdoor lighting/Landscaping areas

The stand alone/independent solar lighting kits are completely self contained, each Solar lighting kit generates its own electricity from the solar modules during the day, which is stored in deep cycle maintenance-free batteries for night time use. Requiring no electricity line extensions and are maintenance-free, making them ideal for locations where utility power is irregular and best suitable for renewable energy show case. The solar lighting should be used in combination with Lights operation on normal Electricity. The distribution of Normal & solar combination can be kept in the range of 40-60% as is a Designers choice. An LED light pole of 20 watt is more than sufficient to illuminate the roads in evening time.

5. Solar Thermal for cooling

Solar energy can be used for the cooling purposes in place of conventional air conditioners used in large commercial buildings now a day. The commercial establishments particularly hospitals, hotels and other institutional buildings use huge amount of conventional energy to power the air conditioners used for the cooling purposes in these commercial premises. Application of renewable energy for the cooling purposes can save a substantial amount of energy and the resultant emissions.

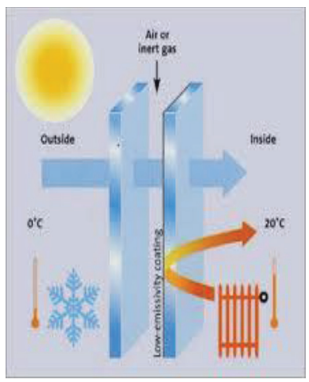


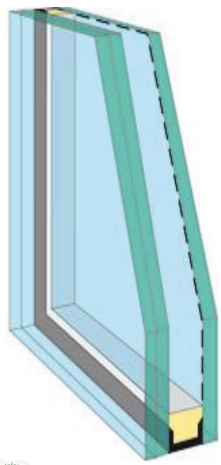
The installation of solar cooling system is a unique combination of parabolic reflecting mirrors, heat receivers, insulated plumbing, boilers for storing the steam and vapour absorption machine (VAM). The mirrors with high reflectivity are focused on receivers containing water through a tracking system. The parabolic mirrors are capable of generating steam. The steam is routed through boilers for storage and getting the desired pressure to be fed in to the Vapor Absorption Machine. The VAM with lithium bromide absorbers chills the water and steam which separates the absorbent from the water. The chilled water is circulated through the ducts cooling the air flowing in it. The circulation of steam, air and water can be ensured with a pump. As hot water is generated as a by-product it can be used for bathing, laundry and other uses.

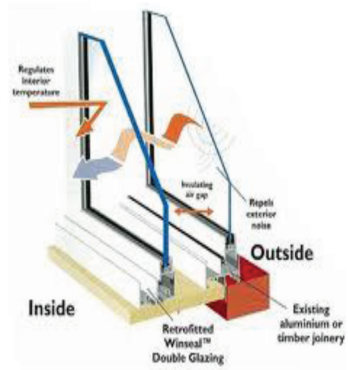
6. Solar Day lighting

Daylighting is a kind of solar energy lighting. It is described as the use of natural light to illuminate the house. Good day lighting provides the right light to all your rooms, while minimizing costs in utilities and electricity. Appropriate daylighting can be achieved by sizing and positioning the windows so that natural light freely enters the home. These factors should be considered by Architects while designing buildings to have the right orientations. This would not only help in natural lighting but also reducing the Electrical load.

Day lighting should also be done for Basements which have services areas. Care should be taken to avoid the glare effect. The







light radiation will also help to prevent the damp spaces.

7. Sunshades

These are generally installed at the top of windows/doors to obstruct sunrays from entering the building during summers and allowing them in during winters. This helps protect the building from overheating during summers, and keeps it warm during winters, thereby reducing the electricity consumed by room coolers. Windows on the east, west, and south of the house should be adequately protected by chajjas and sunshades. This can also be done by providing PV Panels for Terraces, Bunglows, and Clubhouses etc.

8. Double glazed windows

This type of Insulation helps reduce heat gain into, and heat loss from, a building. Double glazed windows with air gaps can act as a good insulation. The insulating air gap lowers the heat gain of the building. It should be used for air-conditioned spaces. BEE (Bureau of Energy Efficiency) has recommended specifications for glazing in air-conditioned spaces in the Energy Conservation Building Code 2007 (www.bee-nic.in). Most homes usually have single clear glass. Double glazed windows, with sun control (coatings, shading, and so on), should preferably replace single glazed windows to reduce energy used for air-conditioning.

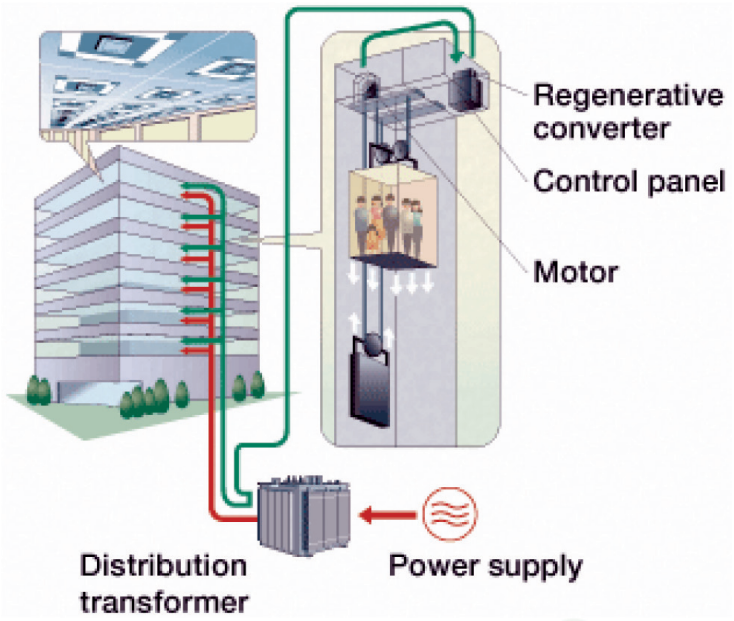
9. Regenerative Lifts

In a typical non-regenerative drive, energy is dissipated as heat in a set of resistors when braking occurs, resulting in reduced efficiency and creating additional waste-heat loads in the building. ReGen drives feed this energy back into the building's internal electrical grid where it can be used by other loads or users connected to the same network. ReGen drives reduce energy usage by up to 20 percent compared to non-regenerative drives.

Other ways of reducing Energy consumption include:

- By having Automatic car light operation to turn off the lights when the car is not in use and on again when the car is called.
- Corridor illumination control which would automatically control the light on the destination floor.
- To set the power stage of the drive to sleep mode when not in use.
- Turning off the car fan when the elevator is not in use.

In addition to above solar energy can also be utilized through employing techniques such as solar chimney, Solar Vehicle, Roof top treatment and Variable speed drivers in Hydro-Pneumatic Water Pump systems.



News

Maharashtra Govt to launch Integrated Policy for Renewable Sector

Mumbai, 2nd Jan 2015, The Times of India

In order to reduce the state's carbon footprint and give a boost to the renewable energy sector, Maharashtra government has decided to come up with an 'Integrated Policy for Renewable Sector' in the New Year.

The state government has roped in experts from various sectors to give their inputs to the team in-charge of making the draft of the policy.

"Our state has never had a definite policy for the renewable energy sector. Though we, to some extent, derive power from solar and wind energy, the sector remains unstable in the absence of a policy. This needs to be changed," state Energy Minister Chandrashekhar Bawankule told PTI.

"For compiling a policy draft, we have brought in experts from various sectors and sought their participation in the making of the new policy. Nuclear scientist Anil Kakodkar, Prakash Godbole from finance sector and Arvind Karandikar, who has in-depth knowledge of global solar industry, are some of the people who will be included in the committee," he said.

All the special invitees have given their consent to be on the panel, he said.

"We have also requested the Rajasthan and Chhattisgarh state governments to assist us as their policies on renewable energy sector are considered one of the best in the country," Bawankule said.

The state energy department will frame the policy with the technical support of the Maharashtra Energy Development Agency (MEDA) that works towards promoting and developing non-conventional and renewable sources of energy.

The new policy will include ways to generate power from renewable sources of energy like solar, wind, biogas, bagasse and co-generation, he said.

"We have decided to make the draft ready by January 15. Suggestions will then be taken till January 30 from organizations and the public who wish to give us inputs. Thereafter, we expect the Cabinet nod before February 15," he said.

"The policy will stress on both grid connected and off-grid power supply. Grid connected power supply is where power that is generated will be connected to the power station, from where it can be transmitted. Off-grid power means that the energy generated will be used for self-use purposes like housing societies, government offices, etc. The solar power generated by installing solar panels on the roofs of buildings is also a kind of off-grid power," Bawankule said.

Installed solar capacity crosses 3 GW

January 21, 2015, The Hindu News

New capacity addition in the clean energy sector was up nine per cent during the first 9-month of this fiscal. The total installed capacity of solar power in the country crossed 3,000 MW during the 3rd quarter.

Renewable energy sector added 2,104 MW of new capacity during first three quarters of this fiscal when compared with 1,922 MW a year-ago.

This year's new capacity target has been fixed at 3,770 MW when compared with the previous year's target of 4,325 MW. So, the clean energy sector has achieved only 56 per cent of the capacity addition target during the 9-month period. Wind and solar segments contributed about 1,333 MW (1,096 MW in a year-ago period) and 431 MW, while small hydro power and bagasse cogeneration contributed 187 MW and 152

MW respectively, according to Union Ministry of New and Renewable Energy (MNRE).

As of December 31, 2014, India's cumulative grid-interactive renewable energy installed capacity rose to 33,792 MW, up from 29,989 MW on December 31, 2013.

Wind sector accounted for 66 per cent (22,465 MW). Small hydro power accounted for 3,991 MW, while solar was in third position with a capacity of 3,063 MW. Bagasse cogeneration and biomass contributed 2,800 MW and 1,365 MW respectively.

Solar, wind power to become cheapest energy source in Asia

BEIJING, JAN 15, The Hindu News

Renewable energy sources such as solar and wind power will become the cheapest energy for consumers in Asia in next 10 years, scientists say.

A joint project conducted by Finnish Technical Research Centre (VTT), the Lappeenranta University of Technology and the University of Turku has successfully modelled a comprehensive energy systems based entirely on renewable energy sources for China, South Korea and Japan.

According to Pasi Vainikka from VTT, China has become the world's largest investor in solar and wind energy, Xinhua News agency reported.

"China possesses significant wind and solar energy resources, so a power network based on renewable energy sources has the potential to become profitable very quickly," Vainikka said.

Researchers predict that the price of solar electricity will drop by half within 10 or 15 years, so that the relative industries will become more profitable.

Make 'Renewable Energy' in India

IBNLIVE Feb 04, 2015

Renewable energy has been one of the identified sectors under National Programme on 'Make in India'. Make in India lists out vast potential of renewable energy resources in the country, its facilitative measures, and its import dependency as some of the drivers for this sector, and rightly so.

In fact the federal government's ambitious goals of having 100,000 MW of solar energy and 50,000 MW of wind energy by 2020 - not to speak of biomass and small hydro etc.- are indicative of large domestic demand being created that can benefit from indigenous manufacturing besides providing the manufacturing industry a ready-to-tap market.

India being strategically located thereby having access to the emerging renewable energy markets, renewable energy manufacturing sector is certainly poised for greater heights if some key fundamentals are kept in mind during planning and execution.

India, while as a result of efforts made during the past over two decades in promoting renewable energy, does have a certain level of manufacturing capabilities. It lacks, however, a strong and vibrant manufacturing ecosystem. It lacks scale at which economies of scale kicks in. The other fundamental that needs to be set right is integrated manufacturing along the complete value-chain (the only exception being the wind sector). In today's globalized scenario, it is imperative for any industry to be competitive. For renewable manufacturing to be truly competitive, the industry as well as government must start doing things differently. For this to happen, country needs to graduate from likes of 'domestic content requirement' to policies that facilitate and incentivize industry to acquire latest technologies, state-of-the-art manufacturing setup, and economic scales of operation.

The large-scale adoption of locally produced products would then be a natural - and sustained - progression rather than an artificially created one. And it is not that this will lead to only big manufacturing plants. Far from it. Automobile industry is a good example where large manufacturing plants are linked to so many ancillary units that are actually small and medium enterprises. The key is to focus on the complete value-chain, on components, balance of systems, and products as well.

Now 'Make in India' would not be a sustainable phenomenon in a long run if simultaneous attention is also not paid to indigenous R&D and technology development, which depending upon the requirements, may very well be collaborative. The maximization of value addition is possible with self-developed technologies and products.

For brand 'Make in India' to make its mark, assuring highest levels of quality cannot be overemphasized. And towards that, the government will have to invest heavily in creating enough testing and certification facilities of global standards that can cater to sharply increased demand arising out of this campaign. Now, the biggest challenge in tackling all of these will be to have right kind of human resources for given tasks, that too in large numbers. Thus, gearing up our education and skill development systems will hold the key if such potential is to be unlocked.

Considering the fact that one is talking of manufacturing of clean energy technologies and products, it may not be out of place to suggest that the equal attention is paid to `greening' of these manufacturing lines so that the energy intensity as well as wastage of resources is minimized to the fullest extent possible. The collateral benefit would be ultimately the reduced cost of production, and therefore, increased competitiveness.

Massive amounts of investments would be required for setting up the plants, for modernization of the existing production lines, and towards the working capital etc. While some of these could come from the existing schemes, there will still be a need for mobilization of funds on a large scale. The government, therefore, will have to create an environment that encourages `people-public-private- partnerships', thereby leveraging public resources many times over.

The deliberations in the fifteenth edition of Delhi Sustainable Development Summit (DSDS) would be around `Sustainable Development Goals and Dealing with Climate Change'. The role of renewables in this whole discourse is central, and so is their local production in order to achieve the scale most cost-efficiently.

During his recently concluded India visit, President Obama pledged $2 billion of leveraged financing for renewable energy investment and $1 billion in loans for small and medium businesses. Both of these put together could help not only in pushing US-India collaboration in the field of renewable energy to the next level, but also in giving concrete shape to some essential contours of `Make in India' vision.

A well designed `Make RE in India' programme would not only help bring down the costs of renewable energy systems through economies of scale and encourage introduction of the latest technologies/ processes; it generates millions of jobs at various levels. And that is how India's demographic dividend can be used in a `green' manner.

Dear Reader,

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