

GUEST COLUMN

Salute the sun

By Amit Kumar



It was the first oil shock of the early 1970s that drew public interest to renewable energy technologies. Suddenly solar cookers, solar water heating systems, solar photovoltaic cells, wind electricity generators, wind pumps, biomass gasifiers and biogas plants became topics of interest.

However, when oil prices came down to manageable levels, the attention waned. They again came back when climate change mitigation policies and booming oil prices took centre stage. At present, renewable energy technologies are being utilised on a much larger scale. The annual growth rate of wind power is 24 per cent, solar water heaters 20 per cent and grid-connected solar photovoltaics around 55 per cent.

Obviously, the world is investing in developing efficient, convenient and reliable technologies that can meet the demands of future. For instance, thin-film crystalline silicon solar cell is one of the new concepts developed in recent years. These cells are only 5- to 50-micrometre thick. The thickness of conventional wafer-based solar cells is 300 micrometres. The new cells are expected to have high efficiency and longer life.

Besides these, dye-sensitised solar cells and organic polymer cells are emerging as the new solar cell technologies. They need improvement to compete with conventional solar cells. Intermittency hampers wide acceptance of solar energy-based power generation. Intermittent power cannot be dispatched. Now when solar energy is not available, electricity is produced using backup fuel. However, instead of going in for fossil fuels, options such as biomass, including agro-wastes, are being tried.

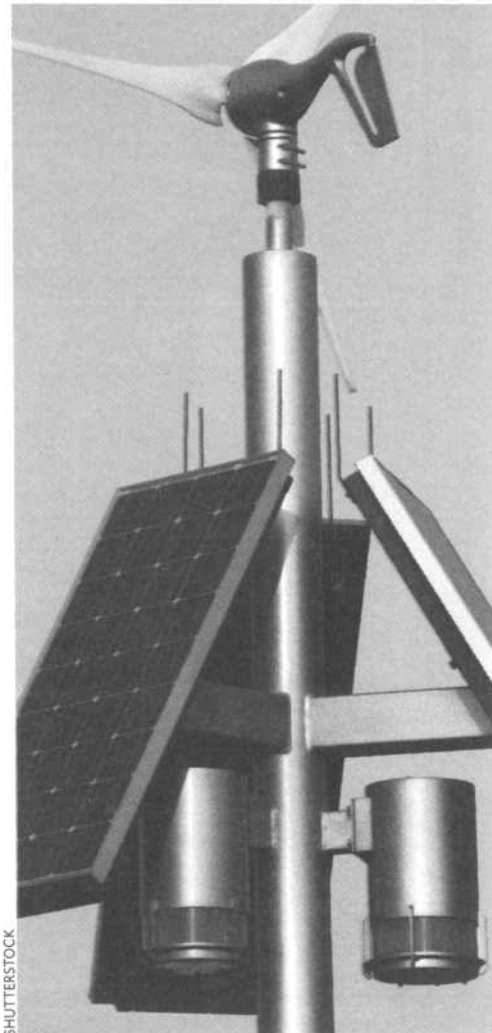
Then there is the solar chimney. In a solar chimney, sunrays pass through glass or transparent plastic sheet and strike the ground. This heats the air, which is channelled to rise through the chimney. The rising air spins wind turbines in the chimney, and they produce electricity.

The energy tower developed by the Israel Institute of Technology produces electricity in arid areas. The hollow tower has a diameter of about 400 metres and is over 1 km high. It can produce up to 388 megawatt. Turbines are installed along the lower edge of this tower. Water—usually seawater or brackish water—is sprayed from the top of the tower. The water partially evaporates and cools the air in the tower. The cooled air descends and powers turbines as it escapes.

In recent years concerted research endeavours have been mounted to develop bio-fuels. Bio-ethanol and bio-diesel are primarily derived from corn, sugarcane, palm oil, soy oil, as well as from non-edible oil seeds like jatropha. However, the diversion of edible crops and arable land for fuel production has contributed to global food shortage. Besides, in countries like Indonesia and Malaysia, a lot of forests have been cleared to plant these crops. In that case, rather than being environment friendly, bio-fuels may end up accelerating the climate change.

Second-generation bio-fuel technology like the biomass-to-liquid (BTL) technique seeks to correct this imbalance. The feedstock for BTL includes lignocelluloses like rice straw, switch grass, marine algae and other agro-residues.

In wind to electricity conversion technologies, we already have a single wind turbine capable of generating five megawatt. Given the logistic issues, such large wind turbines are more suited to offshore applications.



Hybrid saviour: A wind turbine with solar panels utilises both energy sources

Recently a maglev wind turbine, which works on magnetic levitation, was unveiled at the Wind Power Asia exhibition in Beijing. It has vertically suspended blades, thus cancelling need for ball bearings. Reportedly, the maglev turbine can use wind with speeds as low as 1.5 metres per second as against the 4 metres per second required by ordinary wind turbines.

Even in the case of renewables-based power generation, the focus is now on co-generation or tri-generation where, along with electricity generation, the energy is put to use for cooling, water heating, desalination and drying. This helps in improving overall efficiency of the system and maximises economic benefits.

The writer is director of Energy-Environment Technology Division, TERI.