

Harnessing nature's power



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The development and utilization of renewable energy sources has been accorded high priority in India for more than two decades. Renewable energy offers a clean and sustainable energy option to meet rural energy needs, for decentralized applications, and grid power.

In 1992, a full-fledged MNES (Ministry of Non-conventional Energy Sources) was created, symbolizing India's deep commitment to providing an impetus to renewable energy. The MNES coordinates a series of wide-ranging programmes covering R&D, demonstration, extension, and commercialization of renewable energy systems through financial and fiscal incentives, institutional arrangements, manpower development, information dissemination, and industrial production.

Major achievements

Today, India has one of the largest renewable energy programmes in the world (Table 1). About 3700 MW, i.e. more than 3.5% of the grid capacity in the country, is now based on renewable energy sources. With an installed capacity of 1700 MW, India is among the five leading nations in wind power production. Small hydropower generation, which is

particularly suitable for remote, hilly regions, such as Ladakh and the north-eastern states, is being expanded. The world's largest bagasse-based cogeneration programme is being implemented in Indian sugar mills. There is also considerable scope for extracting energy from urban and industrial waste.

The government attaches utmost importance to providing sustainable energy in rural areas. A programme has been launched for the electrification of 18 000 remote and inaccessible villages by 2012 through decentralized application of solar energy, biomass, and small hydropower systems.

Considerable emphasis is being placed on biogas and improved woodstove programmes for cooking, which

Table 1 Renewable energy technologies: estimated potential and achievements

Technology	Potential	Cumulative installation up to 31 March 2002
Power from renewables		
Wind power	45 000 MW	1617 MW
Small hydropower (up to 25 MW)	15 000 MW	1437 MW
Biomass	19 500 MW	
Power		381 MW
Gasifier		51 MW
Energy recovery from waste	1700 MW	22 MW
Solar photovoltaic power		1.9 MW
Decentralized energy systems		
Family-size biogas plants	12 million	3.31 million
Improved cookstoves	120 million	34.3 million
Solar photovoltaic	20 MW/km ²	
Solar street-lighting systems		41 403
Solar home-lighting systems		187 000
Solar lanterns		396 000
Solar photovoltaic power plants		1188 kWp
Solar water heating systems	140 million m ²	600 000 m ²
Solar cooking system		
Box-type solar cookers		518 000
Concentrating-type community solar cookers		175
Solar photovoltaic pumps		4500
Wind pumps		793
Hybrid systems		127.5 kW

MW – megawatt; kWp – kilowatt peak; kW – kilowatt

Source MNES (2002)

constitutes 85% of rural energy demand. It is estimated that an improved cookstove saves about 375 kg of biofuel and three litres of kerosene per year. The biogas plants installed in the country so far are estimated to save 4.2 MT (million tonnes) of firewood and about 1 MT of urea (MNES 2001).

India also has the world's largest deployment of solar PV (photovoltaic) systems, comprising about 920 000 systems in 30 different applications. Solar lanterns and home lighting systems are being used in over 600 000 homes, and are contributing to substantial savings in kerosene. Other applications include water pumping, power for telecommunications, railway signalling, offshore oil platforms, and television transmission. These are being increasingly used for meeting electrical energy needs in remote villages, hamlets, hospitals, and households in hilly areas, forest regions, deserts, and islands. Grid-interactive solar PV projects are also being implemented for voltage support at the tail end of rural grids, diesel saving on islands, and for peak shaving / demand-side management in urban centres.

Solar thermal energy is being used for a variety of applications like water heating, cooking, air heating, and in energy-efficient buildings.

The MNES also supports the development of new technologies, including fuel cells, hydrogen energy, electric vehicles, geothermal energy, and ocean energy.

A large domestic manufacturing base for renewable energy systems and products has been established in India. Biomass gasifiers capable of producing power up to 500 kW have been indigenously developed. Work has also been initiated on the development of 100% producer gas engines and high-pressure gasification systems coupled with gas turbines. India is also the fourth largest producer of single crystal silicon solar cells. About a dozen Indian companies are active in the assembly and production of wind turbine equipment, and about 50 companies produce solar thermal systems.



Power from the sun: Sagar Islands

Sagar Islands are located in the Sunderbans area of the Ganga delta, an area characterized by mangrove swamps and islands interwoven by a network of rivers and waterways. Extension of the main power grid to these islands is not feasible and prohibitively expensive. As an alternative, diesel generators were used to provide limited amounts of energy.

In 1993, the West Bengal Renewable Energy Development Agency approached the local Zila Parishad (district council) about the possibility of setting up decentralized solar power plants. A Rural Energy Cooperative was established with the beneficiaries to maintain and operate the plant. Today, Sagar Islands get electricity from 9 such solar power plants with an aggregate capacity of 250 kW, and two biomass-based power systems of 500-kW capacity each in Gosaba and Chhotomollakhi islands. The Rural Energy Cooperative successfully runs these plants and also supplies solar lanterns through rural entrepreneurs on a rental basis.

Institutional support

The MNES implements its programmes through nodal agencies at the state level. All major states have set up energy agencies, which mobilize the participation of local institutions, non-governmental organizations, and village-level organizations for implementing non-conventional energy programmes.

IREDA is the financing arm of MNES. Created in 1987 to facilitate the commercialization and market development of renewable energy, it has emerged as one of the main instruments for promoting development and financing renewable energy technologies and projects. It has been able to tie up funds from leading multilateral agencies, bilateral organizations, and domestic financial institutions for lending to end-users, manufacturers, financial intermediaries, and entrepreneurs—predominantly in the private sector. IREDA has financed commercial power generation renewable energy projects, totalling a capacity of over 1800 MW.

The promotional policies and programmes of the government are backed by a strong R&D base aimed at reducing costs and enhancing efficiency. The MNES has set up three specialized institutions – (1) the Solar Energy Centre, (2) the Centre for Wind Energy Technology, and (3) the Sardar Swaran Singh National Institute of Renewable Energy – to provide a range of technical services, including testing and standardization of devices, upgradation of production technology, improving

field performance, and organizing programmes for skill upgradation and human resource development.

Power from the wind: Tamil Nadu

One of the largest wind farms in the world is located in the village of Aralvoimozhy in Tamil Nadu, India. This wind farm feeds nearly 450 MW of electricity to the south India grid, and comprises a large number of independent projects set up by different developers. The most remarkable benefit of this wind farm has been the transformation of the local economy of the area. Investments of nearly 400 million dollars have been made since 1990, stimulating economic activity and enhancing employment opportunities in the Nagercoil and Tirunelveli districts.

Outreach and cooperation

The MNES's programme of dissemination of information and generation of public awareness plays an important role in popularizing the use of renewable energy systems in India. Under the programme, mass awareness is created about the multiple benefits, design features, product availability etc. of renewable energy products and devices. Target groups in all sections of the society are influenced through electronic (radio and television) and print media, postal stationary, and outdoor media, including static and mobile exhibitions, folk arts, song, and drama. A recent initiative by the government is the concept of energy parks – usually organized in educational institutions, consumer forums, and large public places – to demonstrate the benefits of renewable energy systems and devices amongst students, teachers, and rural and urban citizens. Information on technological development and the government's promotional efforts is also widely disseminated through the Internet as well as seminars and workshops.

India realizes the vital need for international cooperation and interaction with other countries and international agencies at bilateral and multilateral levels for sharing experience and technical expertise. The country has strengthened international cooperation by mobilizing financial resources from multilateral and bilateral agencies as well as facilitating foreign direct investment and acquisition of state-of-the-art technologies. India is participating in the Asian Development

Bank's regional assistance project, PREGA (Promotion of Renewable Energy, Energy Efficiency, and Greenhouse Gas Abatement). India has also provided technical assistance and consultancy services to many countries such as Cuba, Morocco, Sri Lanka, Bhutan, Mali, Nepal, Myanmar, Senegal, and Namibia (MNES 2002).

