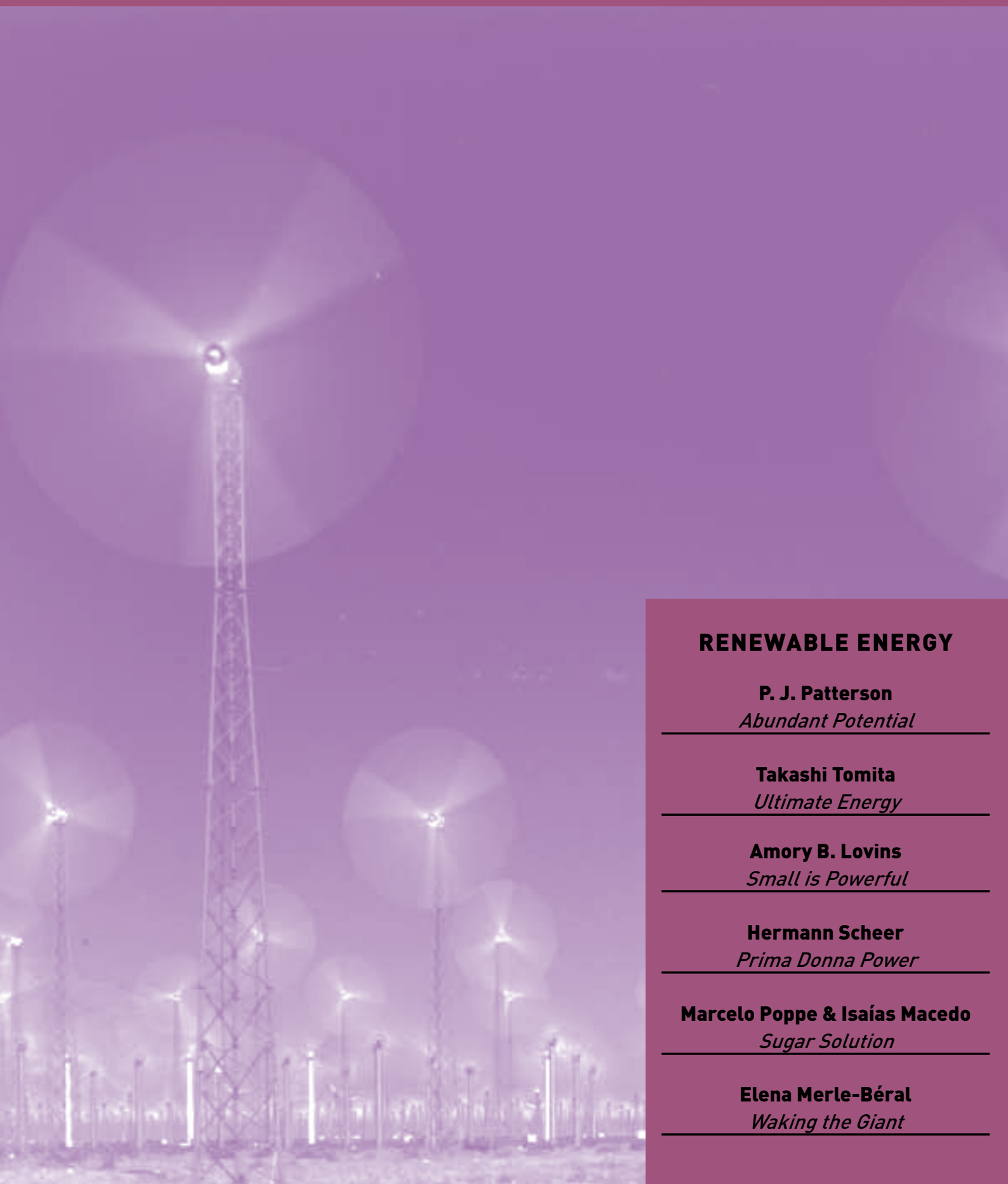




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Our Planet

The magazine of the United Nations Environment Programme



RENEWABLE ENERGY

P. J. Patterson

Abundant Potential

Takashi Tomita

Ultimate Energy

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Small is Powerful

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From the desk of

KLAUS TOEPFER

United Nations
Under-Secretary-
General and
Executive Director,
UNEP

fuels. These developments both save carbon and create new jobs and industries: some half dozen new silicon wafer factories are being built around the world to support the boom in solar panels.

The Montreal meeting also opened the door for the CDM to take up energy efficiency activities arising, for example, from deliberate public sector measures or private sector initiatives — a potentially significant development in areas from housing to transport. The World Energy Outlook 2004 estimates that energy efficiency alone could account for close to 70 per cent of the energy-related emission reductions “attainable through policies and measures in developing countries.”

Concrete proposals

Many developed nations use about 45 per cent less energy to generate each unit of GDP than in the 1970s, yet there are huge opportunities to go much further. To take just one example, the standby power of electrical appliances ranges from 0.5 to 10 watts. The International Energy Agency believes this could be standardised at one watt — saving an estimated five to ten per cent of total electricity used in developed country homes.

I believe that in Montreal we got back the political will, creativity and flair needed to progress the fight against climate change. Energy will be central to our discussions at the 9th Special Session of UNEP’s Governing Council/Global Ministerial Environment Forum in Dubai, which coincides with this issue of *Our Planet*. I hope that, in the same spirit, we can take the debate forward there, and back it with creative and concrete proposals ■

YOUR VIEWS

*We would like to receive your feedback on the issues raised on this edition of **Our Planet**. Please either e-mail: unepub@unep.org or write to:*

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Across the developing world, countries are beginning to see the way the wind is blowing. Once it was believed that only one per cent of their area was suitable for windpower. Now new satellite and computer modeling under the UNEP Solar and Wind Energy Resource Assessment, shows some nations enjoy much greater potential. Forty per cent of Nicaragua, Mongolia and Vietnam are suitable for example and could provide as much as 40,000 megawatts in capacity — the equivalent of 40 nuclear power plants.

Potential projects

The findings of the almost \$10 million project with funding from the Global Environment Facility are already shaping development policies. Nicaragua’s National Assembly has decreed that wind power should be given priority over other options, while China has used them to boost its windpower target to 20 gigawatts by 2020.

Amid many important decisions at December’s climate change talks in Montreal, Canada, Governments agreed to strengthen and streamline the Clean Development Mechanism (CDM). One of the pillars of the Kyoto Protocol, this allows developed countries to offset some of their greenhouse gas emissions through projects — including renewables — in developing ones. It is clear from the Assessment that there is no shortage of potential projects.

The economics of renewables are improving. The cost of generating electricity from wind

is somewhere around five cents a kilowatt hour, with solar and wave power costing some 18 to 20 cents. These figures are considerably lower than a decade or so ago but generally still higher than those for conventional fossil fuels. But they are only part of the story.

Economic argument

Many developed countries have enacted measures that weight the economic argument towards less carbon intensive energy generation. New business models are emerging that favour renewables, partly to exploit higher and more volatile oil prices. Some new energy companies in the United States, for example, offer big retailers fixed-price electricity contracts in return for installing and maintaining solar panels on the roofs of their supermarkets and warehouses. Moreover, though solar electricity may be more expensive, its price is relatively stable — often a big attraction.

Huge interest

New technologies are making it easier to manage and maximize the advantages of renewables. Newly developed meters allow power companies to charge more during the heat of the day when electricity demand is highest — and when solar generates most electricity. Wind turbines taller than 80 metres — able to catch higher and more stable winds — have also been developed. And the decline in agricultural subsidies is triggering huge interest in biofuels for blending with traditional vehicle

Jamaica is one of the highest energy intensive user countries in the Caribbean, currently 90 per cent dependent on fossil fuel sources to meet its needs. In 2004, it consumed 26.1 million barrels of imported oil valued at \$943.4 million, approximately 23 per cent of the country's GDP. The high cost of oil in the international market means the cost of importing it is projected at \$1billion for 2005. This, coupled with the country's pattern of energy consumption, is unsustainable and presents a major challenge to our social and economic development, as well as the business competitiveness of Jamaica.

At the national level, the impacts have adversely affected the levels of foreign exchange, rates of exchange, inflation, transport, production, national and regional airline viability — and the very quality of life for citizens.

Energy policy

Jamaica has focused on three major approaches in dealing with its energy needs: an energy diversification programme; energy conservation and efficiency; and renewable energy development.

In 2000, a major target of the government's Energy Policy was to produce 12 per cent of electricity requirements from renewable energy sources by 2020. This strategy of small-scale distributed energy was aimed partly at the rural poor who could not access the national grid. Renewables, seen as an insurance hedge against volatility and risk, now provide 5.6 per cent of the country's energy. The environmental benefits of using them are critical to a country like Jamaica where the main foreign exchange earner is tourism. Sound environmental stewardship of the country's natural resources, already subject to major natural disasters, is an important priority.

Renewable sources

Jamaica has abundant potential for the development of its renewable energy resources, including wind, biomass, mini-hydro, photovoltaic and solar energy. Some have been tapped at a minimal level in the past and could

Abundant *Potential*

P. J. PATTERSON

describes how developing renewable sources and energy conservation is charting his country's sustainable energy future

provide greater energy requirements with the use of appropriate technology and financial investments.

Central to the energy policy is the use of cogeneration technologies. They are already exploited by some in the hotel industry and manufacturing, but there is growing consensus that the greatest potential comes from the ailing sugar industry. New international trade rules demand drastic changes in this industry, and these will include energy production for electricity generation and ethanol production for use in the transport sector.

Wind energy

Disused windmills from Jamaica's plantation era show that wind energy has been used in the past, and research indicates that the potential is there for

future exploitation. Since 1995, the Petroleum Corporation of Jamaica has conducted wind speed assessments at various sites. Wigton in the parish of Manchester proved to be most feasible and a 20.7 MW wind power plant was constructed. Twenty-three turbines producing 900kW were commissioned in late April 2004, and now supply the Jamaica Public Service with an average 7 MW of power.

The Executive Board of the Clean Development Mechanism approved and published in September 2004 a new "Consolidated Baseline Methodology For Grid-Connected Electricity Generation From Renewable Sources" for renewable energy projects. It has been developed by combining the techniques of different individual CDM proposals, of which the Wigton Wind Farm is one.

Jamaica has a high solar radiation of approximately 5 kWh/m² per day, or 1,800 kWh per annum, and has market potential for photovoltaic and other solar applications such as solar water heating, electricity generation and solar crop drying.

Solar water heaters (SWH) have been installed in approximately 20,000 of Jamaica's 748,329 homes, and are estimated to save about 2000 kWh of electricity per residence per year. An extensive programme of installing solar water heaters in public hospitals is being undertaken. In the private sector, the hotel industry has begun a major use of



Josef, Beechling/Still Pictures

Jamaica has abundant potential for the development of its renewable energy resources, including wind, biomass, mini-hydro, photovoltaic and solar energy

solar water heating systems in an effort to green their businesses.

Second to solar water heating is the use of photovoltaic technology (PV). Photovoltaic applications, although requiring high initial capacity outlay, are encouraged through tax incentives. Current oil prices will make PV even more competitive. Jamaica is also moving to a regime of encouraging net metering.

Two photovoltaic villages, comprising 45 homes in rural Jamaica, were developed in 1999 with World Bank assistance. Established for approximately \$1700 per household, each was supplied with 120 watts of power in an individual stand-alone system that covers inverter, power converter and battery, and accessory equipment.

It is estimated that another 100 homes in Jamaica are fully solarised. The Scientific Research Council has employed simple technologies to develop a solar dryer that is used by farmers and others for some of their produce.

Energy technologies

Jamaica has various rivers suitable for the exploitation of small-scale hydropower. Small-scale electricity generation by using run-of-river plants has been in operation for over 100 years. Jamaica was one of the first countries in the world outside the United Kingdom to install a hydro plant, just outside Spanish Town in the 1890s.

The Public Utility Company currently operates eight mini-hydro plants, with a total capacity of 21.4 MW, accounting for 4 per cent of the electricity generated in 2003. One other mini-hydro plant is to be established and two reactivated.

Bagasse from sugar cane, charcoal and fuel wood are important biomass fuels. Charcoal is an important source of energy in rural households. Jamaica



Julio Etchari/Still Pictures

has also been involved in experimenting with fast growing fuelwood trees. Such trees could provide one solution to problems associated with deforestation as well as provide a useful supplement to the biomass now used in the sugar industry.

Approximately 600,000 tonnes of bagasse — equivalent to about 940,000 barrels of oil at a value of \$37.5 million — are used per annum (as of 2003) in cogeneration in Jamaican sugar factories. Increasing sugar cane production to about 2.7 million tonnes would be needed for the supply of bioethanol. We estimate that excess electricity of approximately 300 GWh per year would be available with bagasse combustion alone, resulting in about 68 MW of available capacity.

The Scientific Research Council in Jamaica has been involved in the development of biogas plants using animal wastes in the agricultural, small manufacturing, educational and residential sectors. A total of 250 of these plants are in operation across the island, though cultural barriers are still to be

broken in order to gain full acceptance of biogas as a fuel for cooking.

In addition to solar, wind and hydropower, the potential for the conversion of waste to energy, ocean thermal technologies and bio-fuels is being explored.

Sustainable future

The need for greater energy conservation is a major thrust of government policy. Incentives are being offered to encourage government agencies to reduce electricity use. A variety of conservation techniques are being encouraged in all offices, homes, businesses, and vehicles. Conservation could mean a substantial reduction in the country's fuel bill. Together with renewable energy technologies, it offers the promise of a sustainable energy future as Jamaica seeks to improve the quality of life for present citizens and future generations alike ■

P. J. Patterson is the Prime Minister of Jamaica.



Frans Lemmens/Still Pictures

The Energy

Numbers Game

MONIQUE BARBUT describes successful attempts to build renewable energy markets and local clean energy enterprises in developing countries

When it comes to energy and development, it's easy to get lost in the numbers: millions here, billions there, and trillions into the future. Consider these four: 2 billion people without modern energy services; 500 billion dollars invested annually in energy infrastructure; and 4 billion tonnes of CO₂ dumped into the atmosphere every year from a 60 trillion dollar global economy. Taken together, they add up to a daunting challenge to the world.

Taken individually and broken down, however, they offer a different, much more immediate perspective. In Africa and India, we see houses without electricity, and smoke from fires of dung and wood. In China, we see vast tracts of slow growing forests disappearing along with the rich biodiversity that supports all life. And in New York, Paris and other developed world cities, we see refrigerators, DVDs and a range of other 'essential' conveniences.

The individual numbers are also frightening — not because they are big, but because they are so small. Less than \$25

buys a better cookstove that cuts in half both the amount of fuel needed to cook and the indoor smoke and soot that kills and incapacitates women and children, causing 5 per cent of global disease.

For less than a thousand dollars — the price of a new high definition television or laptop — a family can purchase a solar home system that uses the sun's clean, renewable energy to power lights and small appliances, and allows the family to extend their children's education or generate a better income.

These sums are not beyond what most families can pay — if they can get an affordable loan. But that is a big if, because most banks consider such loans too risky — either because the technology is unfamiliar or the returns too meagre. So they charge high interest rates, pricing families out of improving their lives.

Innovative partnership

For UNEP's Energy Programme, this is the real scale of the energy challenge. Over the past six years, UNEP Energy

has explored different ways to think big by acting small — small enough to make a difference for a family or village. Its projects and activities are helping to create the 'tipping points' for 'epidemics' of development, which do not have the environmental and social costs that have plagued developed economies.

The price of a tipping point may be quite cheap — as little as the one million dollars UNEP has invested in the Indian Solar Loan Programme. By creating an innovative partnership with two of India's largest banks — the Canara Bank and the Syndicate Bank — UNEP has been able to 'buy down' the cost of loans for solar home systems. Families pay a lower interest rate and banks build new loan portfolios that eventually give them the confidence — and financial returns — to lower the rate on subsequent loans.

In less than three years, the Programme has helped almost 20,000 southern Indian families to buy better energy services using clean, renewable energy. When it finished at the end of 2005, the market for solar home systems had grown and banks — including some that were not part of the original Programme — were ready to lend. UNEP has now expanded the concept to solar water heaters in the Northern Mediterranean.

Building markets

This shows the potential of building markets for cleaner energy services. Promoting new ways to finance these markets is the main focus of UNEP's Sustainable Energy Finance Initiative — or SEFI. Together with the UNEP collaborating centre, BASE — the Basel Agency for Sustainable Energy — it provides financiers with the tools, support, and global network needed to conceive and manage investments in the complex and rapidly changing marketplace for clean energy technologies.

Another successful approach is to build enterprises. Since 2001, UNEP's Rural Energy Enterprise Development Initiative — or REED — has worked with the United Nations Foundation and E+Co to develop new clean energy enterprises in five West and Southern African countries (AREED), Northeast Brazil (B-REED) and China's Yunnan Province (CREED). The programmes provide enterprise development services and early stage seed finance for promising new entrepreneurs with good business ideas to improve energy services, particularly in rural areas.

AREED is the most advanced with ►

debt and equity investments ranging from \$20,000 to \$120,000 in 40 clean energy enterprises. It has helped to develop businesses in solar crop drying, sawmill waste charcoal production, efficient cook stove manufacture, wind water pumping, solar water heating, liquefied petroleum gas (LPG) distribution and energy efficiency. B-REED has invested in eight enterprises that include PV irrigation, solar drying and solar hot water, while CREED is working to address the continuing deforestation and increasing industrial waste in Western China — one of the world's biodiversity 'hotspots'.

CREED has also begun GreenVillage Credit with its partner The Nature Conservancy, providing villagers with two types of credit: one to purchase higher quality energy efficient and renewable energy systems; the other for activities that can generate income using the new and improved energy services, such as vegetable and cash-crop plantations, animal husbandry, and tourism services.

The credit is available in three villages of Northwest Yunnan and will eventually cover six villages and a total of 500-600

For less than a thousand dollars – the price of a new high definition television or laptop – a family can purchase a solar home system that uses the sun's clean, renewable energy to power lights and small appliances, and allows the family to extend their children's education or generate a better income.

households. These households on average consume around 6 cubic meters of wood in fuel each year, and the project expects to reduce consumption by 15,000 to 20,000 cubic meters over the 15 to 20-year life of the installed sustainable energy system. Some households report a 30-60 per cent reduction, in turn helping to protect forest resources, better manage watersheds, and reduce greenhouse gas emissions.

Quantum leaps

Nature often shows how to solve several problems simultaneously. UNEP similarly understands that any approach addressing a single environmental issue can be used to tackle others at the same time. Our collaborating centre, the UNEP Risoe Centre for Energy, Development and Climate, for example, is exploring the many links between outcomes that are good for development and the environment, particularly in reducing the threat of climate change.

There are also many opportunities for developing countries to make 'quantum leaps' to better futures, by-passing mistakes made by developed countries. The energy sector can learn from the way mobile phones have replaced fixed land lines in many developing countries as the technology of choice. They have done so — mostly without government or institutional aid — because they simply provided a superior solution to an increasing need. They also offer new services beyond telecommunications — such as transferring small amounts of money to relatives and friends via phone credits.

UNEP Energy is working through a number of international partnerships and initiatives to make cleaner energy services a similarly superior solution. With funding from the UNF and Telecom Management Partner — a subsidiary of the Norwegian multinational, Telenor — its three-year e-Commerce and Renewable Energy (eCARE) initiative in Ghana is expanding access to both clean energy and modern telecommunications services.

Working with small entrepreneurs, eCARE establishes rural business centres selling voice telephony, internet connectivity and clean energy products and services to rural and peri-urban users. These mobile, self-contained centres have both telecommunications equipment and the solar photovoltaic system to power it. They are deployed through a franchising mechanism managed by Ghana Telecom, the country's first telecommunications service provider. Each qualifying franchisee receives start-up financing combined with a package of tools, training and enterprise development services to start their rural business centers.

All UNEP Energy activities are on a modest scale, but they demonstrate the potential for rapid expansion. If we can harness the potential of a hundred REED or Indian Solar Programmes, we can truly start to make sense of the pressing numbers, the people, who yearn for the better life that sustainable development can bring ■

Monique Barbut is the Director of UNEP's Division of Technology, Industry and Economics.



Small

is Powerful

AMORY B. LOVINS describes how the decentralised and efficient use of renewable energy is the key to clean development

Decentralised renewable energy is finally coming of age and is already serving tens of millions of people. In 2004 nearly 17 per cent of the world's primary energy and 19 per cent of its electricity was renewable. Most renewable energy came from noncommercial biofuels and big hydroelectric dams, but an eighth of the primary energy and a sixth of the electricity came from decentralised renewables. Two million households now have solar lighting, 16 million have biogas, and nearly 40 million have solar water heaters.

Global investment

The remarkable *Renewables 2005 Global Status Report* spells it out. Some 8.2 per cent of the world's hydroelectricity, for example, came from small hydropower (involving units up to 30 million

billion invested in big hydro—and many times the total investments in nuclear power, none of which risked private capital.

Decentralised powersources—both renewables (counting small hydro units only up to 10 MW) and low-carbon fossil-fueled combined-heat-and-power—overtook the capacity of nuclear power worldwide in 2002, and its output in 2005. In 2004, decentralised generators added 2.9 times as much output and 5.9 times as much capacity as did nuclear power; they are expected to add about 160 times as much capacity in 2010. By 2006, or soon thereafter, even the smallest and costliest renewable source—photovoltaics (PVs), which has only about 5 GW of installed capacity, but grew by 60 per cent a year between 2000 and 2004—may add more capacity than new nuclear construction



times over. Fuels made of blends of bioethanol and gasoline are legally required in Brazil, China and India, and already account for 30 per cent of the sales of gasoline in the United States.

Renewable sources

Renewable energy provided 1.7 million direct jobs in 2004, over half of them in biofuels and most of those in rural areas. At least 48 countries—14 of them developing ones—officially promote it.

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