

## Research & Development Initiatives

The management environment for OEPC is becoming increasingly severe. Not only do we have to comply with commitments to reduce carbon dioxide emissions under the Kyoto Protocol, new Japanese legislation directly covering the electric power utilities obligates us to develop new energy sources. In addition, the market in which we operate is threatening to become more competitive as a result of the entry of independent power providers into the newly deregulated power market. The research staff of OEPC are conducting a variety of studies aimed at finding effective solutions to these urgent issues that face the Company's management. These research initiatives are described below.

### Biomass energy

The term "biomass energy," also called simply "biomass," refers to the solar energy stored by plants through the process of photosynthesis, by means of which they utilize sunlight to create their tissues. Unlike fossil fuels, biomass is a renewable energy source. No matter how many times biomass is converted into other forms of energy and utilized by mankind, the carbon dioxide thus released was originally taken from the atmosphere by the plants to form their mass. The process thus does not constitute the addition of any further carbon dioxide to the atmosphere.

We are currently studying the various forms of biomass available for use in Okinawa Prefecture. One likely candidate is wood chips and sawdust, mixed with the sludge left over after the combustion of coal. Studies are ongoing into the design of a generation plant utilizing such fuel.



Carbonized sewage sludge



Wood chips

### Research into redox flow cell storage battery systems

Although electricity is a very versatile form of energy that can be easily utilized for a wide variety of purposes, its biggest drawback is that it cannot easily be stored. Redox flow cell batteries, however, are capable of storing a considerable amount of electricity, and can

be effectively employed to store power at night, when demand is low, for use in the daytime. This is a very efficient way of utilizing a power supply system. At OEPC, we are also studying ways of utilizing redox flow cell batteries to overcome the principal drawback of such natural and renewable energy sources as wind power and solar energy, namely, that the level of power fluctuates almost constantly. Storing the electric power in redox flow cell batteries for use later would be one way of leveling-out such fluctuations in power supply, opening up the way to more extensive employment of clean and renewable energy.

OEPC aims to utilize redox flow cell battery systems to assist in load-leveling and generally promote greater stability in the Company's power supply system. Specifically, we hope to curb excessive fluctuations in power generation output, reduce the amount of power generated that goes to waste, and utilize research into redox flow systems to design an optimum system for the use of new (i.e. clean and renewable) energy while minimizing fluctuations in output.



### Research into new energy sources

Wind-powered electricity generation is a classic example of "clean" energy, in that it employs a renewable natural energy source. The drawback is that it is dependent on the force of the wind, which varies almost constantly. Thus, if wind-power generation facilities are added to a small-scale power supply system, the stability (i.e., the reliability) of the power supply would be compromised. Because of this, at our Iheya wind-powered generating station, we have installed the world's first wind direction and wind-speed prediction system utilizing a laser beam device. Staff at the station are conducting research into ways of controlling wind-powered generation to produce a leveled-out power output through the accurate forecasting of fluctuations in wind strength.

Additionally, from fiscal 2001 to fiscal 2004, OEPC participated in joint research carried out by Japanese

and Thai researchers under the aegis of Japan's New Energy Development Organization (NEDO), and in collaboration with NEDO, OEPC staff conducted verification studies on a solar power generation system that is believed to a prime candidate for practical introduction by Japanese industry.



An international joint research project into solar power generation (Thailand)



Field tests on an industrial solar power system are being carried out at a facility on Kita-Daito Island.

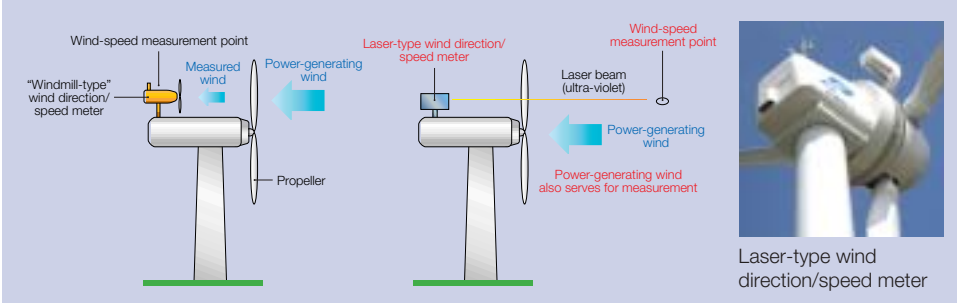
**Utilizing coal ash to make organic fertilizer**

Coal ash left over after the combustion of coal at thermal power stations contains constituent substances that have been shown to be effective in promoting plant growth. To turn it into a practical fertilizer, the ash is mixed with organic materials such as rice bran, fish meal, and oilseed husks, and then allowed to ferment. By reusing what would otherwise be solid waste produced by our operations, we are contributing to the preservation of the environment.



Growing vegetables using coal ash as fertilizer (Kin Town)

**Wind power generators – comparison of conventional direction-control system and laser-type system**



**New Energy Facilities** (As of March 31, 2005)

**Wind Power Generation Facilities**

Name	Capacity (kW)	Started
Miyako Wind Power Research Facility	600	March 2003
Makiminato Wind Power Research Facility	170, 80	Sept. 1998
Ishikawa Wind Power Research Facility	130	Sept. 1998
Ginoza Wind Power Research Facility	250, 500 x 2	Sept. 1998
Tarama Wind Power Research Facility	280	July 1999
Hateruma Wind Power Research Facility	280	July 1999
Aguni Wind Power Research Facility	250	March 2000
Tonaki Wind Power Research Facility	250	March 2001
Yonaguni Wind Power Research Facility	600 x 2	March 2002
Iheya Wind Power Research Facility	300	Aug. 2003

**Solar Power Generation Facilities**

Name	Capacity (kW)	Started
Tokashiki Solar Power Research Facility	204	April 1988
Zamami Solar Power Research Facility	46	May 1988
Miyako Solar Power Research Facility	750	Sept. 1994
Urasoe Branch Solar Power Generation System	10	May 1998
Naha Branch Solar Power Generation System	12	Dec. 1999
Miyako Branch Solar Power Generation System	10	Jan. 2001
Yaeyama Branch Solar Power Generation System	10	March 2001
Kita-Daito Solar Power Research Facility	40	March 2001
Solar Power Generation EV Station Testing Facility	2	March 2003