Wind farms

Technical developments over the past decade have made wind power increasingly attractive to energy authorities; already Denmark, Belgium, Germany, Holland and California produce a portion of their power needs from wind farms, which consist of wind generators linked to electricity supply grids. Wind generators of 300–500 kW capacity, enough to supply electricity to 70–100 homes, are now readily available, at a cost of about $A300 000 each.

Motivated by environmental and economic considerations as well as by an increasing need to reduce greenhouse gas emissions (particularly of CO_2), Australia is now moving to join those nations. In 1990 ELCOM, the Electricity Commission of New South Wales, entered into a contract with CSIRO's Centre for Environmental Mechanics to study wind resources in New South Wales. The Centre's task was to identify suitable sites for wind farms — where wind-generated electricity could supplement power generated by conventional methods.

Centre researchers Dr Frank Bradley and Dr Peter Coppin began by examining all the information that had been gathered in previous studies of wind in New South Wales, and concluded that appropriate sites would most likely be found in the east of the State, especially along the Great Dividing Range or in coastal areas.

To be economically viable, potential sites must, of course, be windy enough. 'Australia's western and southern states have access to the 'Roaring Forties' of the Southern Ocean — the country's only wind farm to date is at Esperance, on the south coast of Western Australia — but New South Wales has to find wind power from the Tasman or through speed-up in hilly terrain,' says Dr Bradley.

Wind accelerates as it flows over objects, which favours elevated regions such as the Great Divide. This area is also free of nocturnal inversion, the 'pooling' of still air close to the ground that is a feature of the plains country in the State's west. Sites must be big enough to support an array of generators (a typical 20-tower wind farm occupies about 2 sq. km) and be free of obstructions to wind flow. Generator sites must also be close to a main electricity supply line, since the cost of transmitting power over long distances is prohibitive.

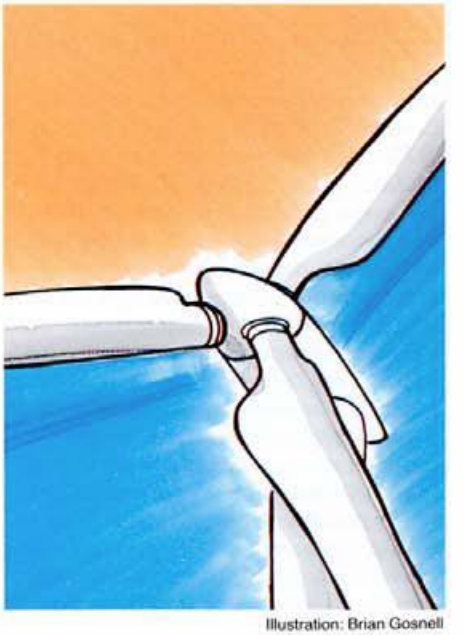

Illustration: Brian Gosnell

Using rugged cup anemometers and vane instruments mounted on 30-metre-high towers to measure wind speeds at the same height as a typical three-bladed wind generator, Dr Bradley and Dr Coppin are presently assessing the potential of six wind-farm sites — near Forster, Kiama, Crookwell, Gundagai, Nimmitabel and Tilba Tilba.

The anemometers will log wind speeds and direction at 5-second intervals to provide information on velocity, reliability and gustiness over 12 months, on which to base an assessment of wind resources and an indication of whether wind will play a part in New South Wales's future power supplies.

Gum leaves it is

Living off gum leaves is no easy feat and koalas need a specialised digestive system (described in *Ecos* No. 51) to do it. Despite that, they live within a tight energy budget because of the intrinsically low energy density of their diet and the toxic compounds in the leaves — hence their characteristic sleepy demeanour. And they can live off only a few species of *Eucalyptus* — perhaps 10–20 — of the more than 600 on the continent. Nevertheless, they have successfully exploited a niche that few other herbivores can fill.

Recent reports speak of koalas eating pine needles in a plantation forest — or even, in at least one case, roses in a garden. According to CSIRO koala expert Dr Steven Cork of the Division of Wildlife and Ecology, these sightings do not mean that the normally fastidious koala has huge new food reserves available.

Dr Cork has seen a koala eating pine needles; he believes that such occurrences generally represent the response of koalas in desperate straits because they have been forced out of prime habitat. This often happens to adolescent males, which set out to find their own 'patch' of good territory.

The probable explanation for the rose-eating is that, where residential areas have been built near koala habitat, a few individuals may wander into gardens and, feeling peckish, try unusual fare. Such behaviour is more than likely

associated, Dr Cork believes, with inadequate 'corridors' of natural habitat through which the creatures can move from one area to another.

Pine needles, like gum leaves, are hard to digest and contain a range of toxins poisonous to most mammals, but koalas may gain some nourishment from them. Recent research has also confirmed that koalas may munch leaves in small quantities from as many as 50–60 different kinds of eucalypt. For their main diet, though, they still rely on just a handful.

Wetlands for waste water: an update

Using artificial wetlands to treat sewage (see *Ecos* 60, Winter 1989) is an innovative and low-cost way of filtering pollutants from waste water that is particularly well suited to

rural communities. The VFW (vertical-flow wetland) system was developed by Mr Peter Breen, Dr David Mitchell and Mr Alan Chick at CSIRO's Division of Water Resources in the 1980s, and has since been patented and is being developed to a commercial scale.

The VFW system has attracted a great amount of interest from State and local government authorities concerned with the rising costs of effluent treatment, and pilot schemes have been set up at Kapooka army barracks in Wagga Wagga and in Griffith, N.S.W.

Cassiro Pty Ltd, a joint venture between CSIRO, Gerard Cassegrain & Co and Coff's Harbour City Council, has established a commercial-scale scheme at Coff's Harbour, on the north coast of New South Wales. Consisting of five 10 000-litre-per-day systems and one 80 000-L-per-day system, the scheme began treating sewage effluent in January this year. Several single-household units and a piggery effluent VFW have also been established in other locations and their performance will be monitored until 1992.

The VFW system removes nutrients (notably phosphorus and nitrogen, the major pollutants of natural waterways) from primary-treated sewage effluent using aquatic macrophytes — large water plants — that thrive in low oxygen levels. Untreated effluent is first pumped into settling tanks (which provide potential for methane production), then the waste water flows to an artificial swamp containing macrophytes planted on a gravel bed.

The plants extract and store up to 50% of nitrogen and 67% phosphorus, as well as other nutrients, while their roots provide a micro-environment for aerobic and anaerobic bacteria essential for further nitrogen removal up to a total of 95%. Some phosphorus is also absorbed by the gravel bed, to a total of some 96%... and clean, treated water flows out from the VFW system.

The secret of the system's success lies in its construction. Hydrologically speaking, conventional trench or longitudinal-flow systems simply don't provide enough areas of contact between waste water and macrophyte roots to make best use of the plants' nutrient-extracting abilities. Setting up a vertical flow in which waste water is pumped deep into the artificial swamp allows effluent to permeate through the entire root zone.

According to Mr Philip Millin, Cassiro's project development officer, the VFW system at Coff's Harbour can be installed in flood-prone areas and in residential buffer zones, provides no free-standing water for pests such as mosquitos, can tolerate 'shock loads' of effluent and — unlike all too many conventional sewage farms — is odourless.