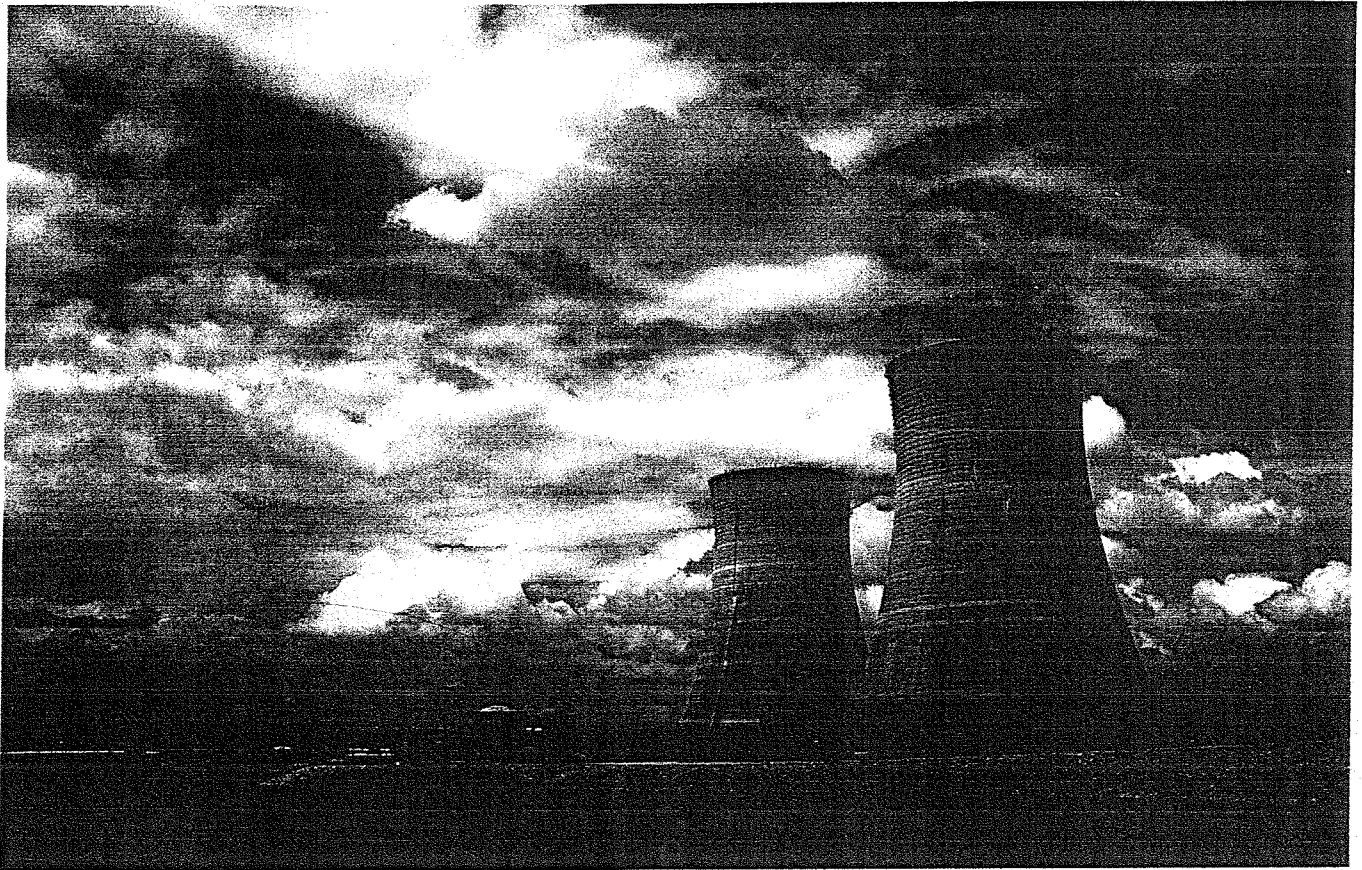


## Nuclear New Zealand?



*Compared with the smokestacks of fossil fuel-burning power stations, the cooling towers of nuclear plants look huge, but they emit none of the undesirable carbon dioxide produced by combustion.*

EARLY DEVELOPMENT of nuclear-powered thermal stations was driven by rising demand for electricity and the need for security of supply. The oil crisis of the early 1970s moved France and some other countries to invest heavily in nuclear power development, so that today France generates about 80 per cent of its power using nuclear reactors.

More recent international interest in nuclear power has laid emphasis not only on helping nations meet their energy needs, but also on reducing the production of greenhouse gases. In March 2005, a declaration issued at the end of a two-day conference called Nuclear Power for the 21st Century, organised by the United Nations International Atomic Energy Agency and hosted by the

French government, stated:

"A vast majority of participants affirmed that nuclear power can make a major contribution to meeting energy needs and sustaining the world's development in the 21st century." Nuclear power "does not generate air pollution or greenhouse gas emissions," it said, adding that nuclear power generation was a proven technology that could deliver safe and affordable electricity. Participants agreed that the "health of the environment...is a serious concern that must be regarded as a priority by all governments".

Interest in nuclear power in New Zealand in the late 1950s and 60s was driven by rising demand for electricity. The New Zealand Electricity Department (NZED)

included nuclear power in its range of possible generating sources, and in 1964 an interdepartmental Nuclear Power Siting Committee was established to begin the preliminary selection of possible reactor sites. By 1965 planning was under way for a 1000-megawatt (MW) station in Northland, with a site on the Kaipara Harbour being favoured. Engineering staff of the NZED were enrolled on overseas training courses, and an undergraduate course in reactor engineering was established at the University of Canterbury. During the 1960s and early 70s, several staff of the National Radiation Laboratory undertook training in reactor safety and licensing.

In 1977 hydro generation produced about 80 per cent of the

national electricity supply, geothermal 8 per cent, and fossil fuels, including expensive imported oil, the remaining 12 per cent. The Planning Committee on Electric Power Development, which presented a power plan to the government annually, first introduced nuclear power as being necessary to meet forecast demand in its 1968 plan.

The annual power plan made projections of demand, and proposals for meeting this, 15 years into the future. The discovery of the Kapuni and Maui gas fields and a slowing of consumption growth allowed the proposed introduction of nuclear power to be delayed, but the 1976 plan still saw nuclear power as one of the main options for thermal generation beyond 1990, and, because of the long construction lead times, considered a government "decision in principle" to be required by 1977 or shortly thereafter. However, a decline in the rate of increase of new generating capacity coupled with the availability of gas led, in 1977, to nuclear power being shelved for 15 years.

In September 1976 the National government had set up a Royal Commission of inquiry into nuclear power in New Zealand. The Commission's report, presented in November 1978, stated:

"New Zealand should aim to rely on its own resources for electricity as long as it is economically and environmentally sensible to do so, rather than introduce such a sophisticated and changing technology as nuclear power...However, the chances of New Zealand needing nuclear power for electricity generation early in the next century are real indeed... Nuclear power should be retained as an option for the future with the possible commissioning date of 2005-2007 in mind. This timing may need to be revised as future trends become more apparent."

The Commission considered there was no aspect of the consequences

of a nuclear power programme that should lead to the nuclear option for electricity generation being rejected.

The Royal Commission's recommendations went largely unheeded but have proved prophetic. At the start of 2003, estimates of the gas remaining in operating fields were reduced and price rises for gas and electricity forecast. The reformed electricity supply industry has created multiple operators all concerned with profitability but with no overall coordination of national supply requirements, so that planning for future generation has been inadequate. The electricity supply companies are now scrambling to increase capacity, largely by building multiple small renewable energy plants, particularly wind farms. However, it takes many hundreds of wind turbines to match the power output of a single thermal plant, and then only when the wind is blowing at 50-60 kph.

While Meridian Energy in particular is expanding its wind generation capacity, wind turbines have several other disadvantages. Apart from aesthetic aspects (turbines are said to be attractive to the engineers who design them), bird-strikes and noise can be significant problems. Furthermore, supply can be inconsistent, creating problems for management of the electricity grid load. It is difficult enough coping with anticipated fluctuations in demand that require either bringing extra generating capacity online or reducing it, but random variations in supply caused by changing wind speeds compound the problem of maintaining a stable voltage.

Across the world about 64 per cent of electricity generation depends on the combustion of fossil fuels, with the remainder divided between renewables (mostly hydro) and nuclear. Of the various thermal options (39 per cent coal, 8 per cent oil, 17 per cent gas and 16 per cent nuclear), only nuclear does not generate greenhouse gases. While

natural gas prices have been low and gas turbines relatively cheap and quickly built, gas has been an attractive fuel. It also produces less carbon dioxide than coal, hence is favoured by some to displace coal for baseload power. However, it is also a valuable chemical feedstock for manufacturing, and gas supplies are limited. Present world coal reserves are large, but coal burning is the primary contributor to carbon dioxide production. The only way of effecting a large-scale reduction in greenhouse gas emissions from electricity generation is increased use of nuclear power.

For New Zealand an option for examination would be two or more new-generation reactors, such as the Westinghouse AP600 (or similar advanced reactors), each generating 600 MW of power, established on a single site, probably north of Auckland—much as proposed in the early 1970s. Such a site could defer major and costly upgrading of the national grid. Economically viable nuclear power requires stable infrastructures with good electricity reticulation and a trained workforce, including nuclear reactor engineers and a regulatory

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agency. It would clearly be better to spread the cost of establishing the required infrastructure over two or more reactors than concentrating it around a one-off development. Nuclear power is good for base loads, and would complement existing hydroelectric capacity well, since this is capable of rapid adjustment with changing supply loads.

In a discussion pamphlet distributed to customers recently, Contact Energy outlined possible alternative sources of additional generating capacity and the advantages and disadvantages of each. It indicated that a balance needed to be struck between security of supply, price and environmental effects. It noted that most new hydro schemes would struggle to produce electricity at competitive prices and that other renewable energies were expensive and would make only a small contribution to total generation in the foreseeable future. It recognised the detriment of greenhouse gas emissions from coal burning, and that this would be an expensive form of generation, particularly if a high carbon tax were imposed. It considered gas-fired thermal plants, currently generating 25 per cent of New Zealand's electricity, to be the best choice for additional generation if more gas could be found. But the Maui gas field is expected to be exhausted by 2010, which is too soon to build major new plants, and it seems that energy supply companies will be stretched to make up the

shortfall.

The option Contact Energy and other suppliers have failed to mention is nuclear generation. The advantages of nuclear are: no greenhouse gas emissions; cost competitiveness, particularly if carbon taxes are imposed; and reduction in transmission costs if appropriately sited. Disadvantages are the relatively large capital cost of the plant, the long construction time, and dependence on security of fuel supply. Also, New Zealand currently has no expertise or infrastructure to support nuclear power reactors, and this would need to be developed. Finally, there is public sentiment, shaped by decades of anti-nuclearism. Concerning reactors (as opposed to weaponry), this has focused principally on the two areas of safety and waste disposal.

In regard to safety, the only nuclear power plant in the world that has suffered a reactor accident resulting in deaths has been the one at Chernobyl, in Ukraine, which was not designed to Western or international standards. Even so, fewer than 50 people died, despite widespread fallout and the need for a large-scale clean-up operation, as documented in the 2000 report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Although media articles have repeatedly claimed "thousands of deaths", the UNSCEAR report found that apart from 1800 cases of thyroid cancer in children exposed at the time of the accident, there is no evidence of increased overall cancer incidence or mortality.

In regard to waste disposal, this is a political issue rather than a technical one, but the costs of disposal need to be factored into the overall cost of plants. Wastes from the operation of the world's 440 or so nuclear power plants in 2002 amounted to some 7000 tonnes of spent fuel, a small amount compared to that arising from other energy sources. If the electricity that flowed

from nuclear plants had instead been generated by the combustion of coal, it would have resulted in millions of tonnes of sulphur dioxide and nitrogen oxides as well as 1600 million tonnes of carbon dioxide, even using the best flue gas-cleaning equipment available. Additionally, there would have been some 100,000 tonnes of poisonous heavy metals, including arsenic, cadmium, chromium, copper, lead and vanadium released. Unlike radioactive wastes, these remain poisonous forever and are not isolated from the biosphere.

Another concern that is sometimes raised about building nuclear plants in New Zealand is the potential for damage by earthquakes. Seismic-design considerations are well established, and there are more than 50 reactors operating in Japan, where experience of earthquakes is at least as great as in New Zealand.

Many existing nuclear plants have obtained licences for extended operating lifetimes, beyond the 30-40 years originally envisaged, and the reliability and capacity factors being achieved have reduced electricity production costs.

The very first full-scale commercial plant, opened by the Queen at Calder Hall, in Cumbria, north-west England, in 1956, remained in operation for almost 50 years. In the USA, as a consequence of the extended operating lives and lower fuel costs compared with coal-fired generation, nuclear power plants are currently producing some of the cheapest electricity available.

Nuclear power should be considered in New Zealand along with all other options. The evidence suggests it is a contender for the supply of baseload power. However, a current impediment to major new plant development is the fragmented state of the electricity supply industry. Electricity supply and availability is a national strategic good and should not be the product of a short-term market model.

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