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**Taiwan's Nuclear Dream**

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Christian Schafferer:

## Taiwan's Nuclear Dream<sup>1</sup>

In spite of the declining demand for nuclear power plants in the western world, Taiwan sees in them the key to economic growth and closer (political) ties with the USA. This paper examines the nuclear policy of the Taiwanese government, the environmental problems caused by the country's nuclear power plants, the public attitude toward the nuclear option and the current discussion on the expansion of the nuclear power generating industry.

### 1. Nuclear energy production in Taiwan

The construction of Taiwan's first nuclear power plant started in November 1970 and was completed seven years later. It is located on the north-eastern tip of the island and installed with two 636 mw steam turbine generators. Each generator has a boiling water reactor furnished by *General Electric* (USA).<sup>2</sup> Prior to its completion, electricity had been produced by 29 hydroelectric and 16 thermal power stations. In 1977, 0.3 percent of total power generation was produced by the first nuclear power plant.

The construction of the second nuclear power plant began in September 1974. The plant is closely located to the first one and has two units, each with a *General Electric* boiling water reactor nuclear steam supply system<sup>3</sup> and a turbine generator unit furnished by *Westinghouse*<sup>4</sup> (USA).<sup>5</sup>

The construction of the third nuclear power plant started in January 1978. It is situated in the far south of the island and has two 951 mw steam turbine generator units. The nuclear steam supply system of each unit consists of a pressurised water reactor and three steam generators made by *Westinghouse*. The steam turbine generators were furnished by *General Electric* and designed for reheat and regenerative cycle operation. Each turbine generator consists of a tandem-compound four flow reheat steam turbine and a hydrogen conductor cooled synchronous generator.<sup>6</sup>

	1955	1960	1965	1970	1975	1980	1985	1990	1995
Hydro	77.90	56.90	40.10	21.50	22.80	12.00	8.90	9.90	7.50
Therm.	22.10	43.10	59.90	78.50	77.10	73.70	34.50	51.80	63.70
Nucl.	0	0	0	0	0	19.20	52.40	38.30	28.80

Table 1: Power generation (relative, in percent) 1955–1995<sup>7</sup>

In 1980, just less than 20 percent of power generation was nuclear (Table 1). One year later, Taiwan's second nuclear power plant went into operation and in 1984 the third one. In the following year, the share of

nuclear power generation peaked at 52.4 percent of total power generation; over the next few years it fell steadily, reaching 28.8 percent in 1995. In absolute figures, however, nuclear power generation has constantly increased from about 7 billion kwh in 1980 to approximately 34 billion kwh fifteen years later (Table 2).

	1955	1960	1965	1970	1975	1980	1985	1990	1995
Hydro	1,531	2,065	2,585	2,846	5,235	2,905	6,900	8,167	8,858
Therm.	435	1,563	3,876	10,367	17,659	30,096	18,110	42,629	75,071
Nucl.	0	0	0	0	0	7,812	27,546	31,554	33,930
Total	1,966	3,628	6,458	13,213	22,894	40,813	52,556	82,350	117,85

Table 2: Power generation (absolute) 1955-1995<sup>8</sup>

All three nuclear power plants were planned and are operated by *Taipower*, the solely responsible company for developing, generating, supplying and marketing electric power in Taiwan. The company is almost entirely (94 percent) owned by the state and, with an installed capacity of more than 20,000 mw, is the fourteenth largest power generating company in the world.<sup>9</sup>

## 2. Public knowledge and acceptance

In the 1980s, *Taipower* began to plan the construction of a further nuclear power plant<sup>10</sup> with six units in Yenliao, about 40 kilometres north-east of Taipei. Land acquisition was completed in 1983. In the same year a nation-wide survey was carried out on the knowledge about nuclear power plants and the perception of potential dangers posed by them. The survey was repeated a year after a fire had broken out in the third plant. The accident may have contributed to the increase in the number of people knowing that there were actually nuclear power plants in operation in Taiwan (Table 3).

Q1	1983	1986
Yes	53.8%	80.7%
No	46.2%	19.3%

**Q1: Do you know if there is a nuclear power plant in Taiwan?**

Table 3: Survey on nuclear power plants (1983 and 1986)<sup>1</sup>

In 1983, only half the people interviewed knew that nuclear power plants existed in Taiwan.

Q2	1983	1986
A lot	3.0%	4.5%
A little	23.3%	44.1%
Very little	37.8%	27.0%
Nothing	36.0%	24.5%

**Q2: How much do you know about nuclear power plants?**

Table 4: Survey on nuclear power plants

After the accident in the third plant, eight out of ten citizens were aware of their existence, and many more had a greater understanding of nuclear facilities (Table 4), considering nuclear power plants and waste to be dangerous (Table 5 and 6).

**Q3: Do you consider there is any danger or safety problem in using nuclear power plant?**

**Q4: Do you consider there is any danger or safety problem in storage and treatment of nuclear waste?**

Q3	1983	1986
Very dangerous	3.0%	10.4%
Dangerous	25.5%	52.4%
Not dangerous	23.0%	9.7%
Not dangerous at all	5.8%	2.7%
Don't know	40.6%	24.8%

Q4	1983	1986
Very dangerous	5.3%	9.7%
Dangerous	25.9%	48.0%
Not dangerous	20.4%	10.4%
Not dangerous at all	3.2%	1.7%
Don't know	45.2%	30.2%

Tables 5 and 6: Survey on nuclear power plants (1983 and 1986)<sup>11</sup>

In addition, the attitude towards the need for nuclear power plants changed considerably: About 25 percent of the people interviewed in 1983 felt that nuclear power plants are absolutely necessary to Taiwan's electricity production. Three years later, only eight percent expressed this view (Table 7).

**Q5: Do you think it is necessary to have nuclear power plants to supply Taiwan's electricity needs?**

Q5	1983	1986
Absolutely necessary	25.2%	8.1%
Necessary	40.4%	49.2%
Not necessary	4.4%	13.0%
Absolutely not necessary	0.4%	3.9%
Don't know	29.6%	25.8%

Table 7: Survey on nuclear power plants (1983 and 1986)<sup>12</sup>

After the Chernobyl disaster in 1986, public concern increased even further and parliament, consequently, did not approve the budget for the construction of the fourth nuclear power plant (FNPP) in 1987. Nevertheless, reliable public opinion polls showed that in the same year only 21 percent strongly opposed the construction of a further nuclear power plant, whereas 43 percent expressed their support. Public support for the FNPP increased steadily in the following years. Opposition, on the other hand, first fell slightly and regained momentum in the early 1990s (Table 8). In a survey by *Gallup* in 1994, more than half the interviewees supported the construction of the FNPP.<sup>13</sup>

Year	Institution	in favour	opposing
1987	Chinghua University	43%	21%
1988	<i>United Daily News</i>	41%	11%
1989	<i>China Times</i>	54%	14%
1989	Public Opinion Poll Foundation	58%	13%
1990	<i>United Daily News</i>	59%	9%
1991	Chinese Institute	56%	14%
1994	<i>Gallup</i>	58%	20%

Table 8: Public Opinion on FNPP (1987–1994)<sup>14</sup>

Opponents of nuclear energy have founded several civic organisations and staged numerous demonstrations over the last ten years. The Parade and Assembly Law permits peaceful demonstrations on condition that these have been approved in advance and do not advocate communism or Taiwan's independence.<sup>15</sup> However, anti-nuclear activists have repeatedly been prosecuted and fined for organising demonstrations which appeared to be excessively noisy to the authorities or which 'slandered' public officials.<sup>16</sup> Moreover, because government approval of environmental demonstrations is said to be difficult to obtain, civic organisations do not always file an application or they simply ignore the authorities' refusal.<sup>17</sup> In recent years, several anti-nuclear activists have been prosecuted for organising 'illegal' anti-nuclear demonstrations. For example, Chang Kuo-lung, a professor of physics at National Taiwan University, was sentenced to 30 days forced labour or required to pay a fine of NT\$ 9,000. Professor Chang organised an illegal demonstration in 1994, which was aimed at recalling legislators supporting the construction of the FNPP.<sup>18</sup>

### 3. Education on nuclear energy

It should be noted that public opinion on nuclear power plants has been strongly influenced by massive propaganda campaigns financed by *Taipower* and government agencies<sup>19</sup>: *Taipower*, for example, has distributed thousands of books, flyers, posters etc. to all groups of society. Even primary school pupils are provided with 'educational material'.<sup>20</sup>

During the 8th Pacific Basin Nuclear Conference, *Taipower* representative Tony Liao stressed that the incorporation of basic nuclear knowledge in preliminary school educational material is of vital importance to the company's propaganda efforts. Most of the 'educational' books are full of funny cartoon characters admiring nuclear power. For instance, in a twenty-four page book entitled *Where does electric power come from?*<sup>21</sup> a young girl, Wa-wa, looks at a toaster during breakfast and asks how the bread can get toasted and why the milk is kept cold in the refrigerator. Wa-wa's father tells her that it's all to do with electricity. He then ex-

plains the different kinds of energy production. On the next pages, the reader learns that nuclear power plants do not create pollution and that they are cheaper and more efficient than other types of plants. Nuclear power stations are simply magnificent. In another cartoon-style book<sup>22</sup>, a character called "Superelectron" tries to educate people and calm their fears about nuclear energy; it also emphasizes the need for an adequate energy supply. On page 26, for instance, people are very angry at a cinema following an electricity cut. Superelectron flies through the sky and a group of people welcome him. Superelectron explains that *Tai-power* is aware of the electricity supply shortage and wants to build a further nuclear power plant. On page 30 and 74, the question "Are nuclear power plants safe?" is asked and nuclear power plants are compared with atomic bombs. Superelectron explains that where atomic bombs are designed to explode, power plants are not, and stresses that a repeat of Chernobyl is not possible in Taiwan because nuclear power plants there use more advanced technology.

Page 46 shows a nuclear power plant. In front of it, a mother is playing with her child, the father is swimming and the dog is drinking apple juice while Superelectron is reading a book. The picture is titled "Is nuclear radiation safe?"<sup>23</sup> Superelectron comes to the conclusion that the level of radiation exposed by nuclear power plants is extremely low and does not affect human health. On page 52, the question „Are nuclear power plants expensive?“<sup>24</sup> is raised. Superelectron states that they are cheap in comparison with other plants. And finally, the most interesting question about what to do with nuclear waste is dealt with and answered by Superelectron: "Just bury it! A nuclear waste storage facility will do and nobody has to worry."

*Taipower*'s latest marketing concept is based on playing cards<sup>25</sup>: The 7 of ♦ depicts a number of happy nuclear power plants and states that 30 countries already operate them and that all these countries have a strong economy. The 3 of ♣ shows a female body with a miniature smiling nuclear power plant in it. The message is that a nuclear power plant can be built within eight to nine months. The 5 of ♠ shows a contented farmer with a selection of fruit and vegetables, and says that radiation is also very useful, making them bigger and easier for the farmer to plant. Other playing cards stress the safety, cleanness and necessity of nuclear facilities.

Apart from *Taipower*, the *Atomic Energy Council (AEC)* also publishes educational material. *AEC* was founded in 1955 as a cabinet-level agency and is in charge of safety regulation, radiation protection, waste administration, and R&D for civilian nuclear applications.<sup>26</sup> In its development strategies for the advancement of atomic energy application, the agency includes an item calling for the promotion of atomic energy education and the establishment of public consensus.<sup>27</sup> Furthermore, it states that:

Ignorance of the public about nuclear energy and radiation comes from the inadequacy of publicity and education work. From now on *every method will be used* to make the public understand correctly, with special focus on school education.<sup>28</sup>

The educational books designed for children convey messages similar to those in *Taipower's* publications. On the very first pages of a book called *Explore Nuclear Radiation*<sup>29</sup>, for example, a dinosaur („Dino“) learns that nuclear radiation is to be found everywhere in nature and that the radiation level to which the little dinosaur is exposed in the vicinity of a nuclear power plant is over one hundred thousand times lower than if he were being x-rayed.<sup>30</sup> On the following pages, the history of nuclear development is briefly described, and on page 14 Dino is about to board his nuclear-powered aeroplane to take a holiday trip. Elsewhere, a dinosaur-farmer smiles happily about how easy his work has become with advanced radiation technology, and on page 22 Dino complains about the hot weather which has been caused by CO<sub>2</sub> emissions. The final pages depict human beings in a paradise-like world. The message is clear: They live there because they use nuclear technology.

Despite the Dino story, Taiwan's society has been confronted with the negative effects of radiation for several years now: There are more than 90 radioactive buildings in the Taipei area and about 5,000 on the whole island, most of which are heavily contaminated. Apart from that, several roads in Taoyuan County have also been found to be radioactive.<sup>31</sup> Newspaper reports on the island-wide usage of radioactive steel bars in buildings first appeared in August 1992. The *Atomic Energy Council (AEC)* had already known in 1985 about the abnormally high levels of radioactivity but decided neither to further investigate the contamination nor to inform the residents of these buildings. In July 1992, one of *Taipower's* own buildings (a dormitory located in Taipei City) was found to be contaminated with Co-60. Only then was the issue taken more seriously. It has been revealed that Hsin Jung Steel & Iron Corporation was the manufacturer of steel bars used in the construction of these buildings.

*AEC* states that nearly 7,000 tons of irradiated steel bars have been discovered so far and that 13,000 tons are still unaccounted for. According to *AEC*, there is no need to demolish the contaminated buildings. It has however set up the "Radioactively Contaminated Rebars Group" to conduct a survey on contaminated buildings. Radioactive steel bars are said to have been used from 1982 to 1984. Thus, only buildings constructed in that period of time have been included in the survey. By the end of 1996, several thousand apartments had been checked and a detailed evaluation had been made of about one thousand radiated apartments (Table 9).



>15 mSv	5 to 15 mSv	1 to 5 mSv	0 to 1 mSv	0 mSv
13%	9%	26%	35%	17%

Table 9: Distribution of radiated apartments (1,111) according to contamination level<sup>32</sup>

People living in apartments with a contamination level of more than 15 mSv will receive compensation to the tune of NT\$ 500,000 and be given free health check-ups. *AEC* has undertaken to purchase these apartments at the current market price. Residents of buildings with contamination levels between 5 and 14 mSv will receive NT\$ 200,000 and free health check-ups, while no compensation will be offered to those living in apartments with a contamination level below 5 mSv.<sup>33</sup>

A number of organisations have been founded by the victims themselves, one of these being the *Association of Radiation Safety*<sup>34</sup> (*ARS*). The *ARS* has discovered several dozen radioactive buildings and roads in Taiwan and assisted victims in their attempts to get financial compensation from the construction companies as well as from the government. The organisation also publishes lists of radioactive buildings in Taiwan.<sup>35</sup> Its chairman, a victim himself, has taken several cases to court. One of these was the famous Minsheng case which culminated in a ruling by the Taipei District Court in October 1997 that *AEC* should pay more than NT\$ 38 million to 48 residents<sup>36</sup> of the contaminated Minsheng Villa in Taipei and cover 35 percent of their legal fees. It was the first time that residents of contaminated buildings had successfully filed a law suit.<sup>37</sup>

#### 4. Academic discussions on nuclear energy

The issue of nuclear energy has been frequently discussed in Taiwan's academic circles and a number of seminars have been held to evaluate the government's nuclear policy. After the Chernobyl disaster in 1986, discussions in academic circles focused mainly on possible technical failures of nuclear facilities and their possible effects on Taiwan's population. In the early 1990s, however, the general attitude among participants of academic seminars was that nuclear energy is necessary, and there was general acceptance of *Taipower's* interest in building further nuclear facilities. The discussions then centered on ways of persuading the public to have more confidence in nuclear energy. In doing so, very little importance was attached to the development of alternative energy sources, the promotion of energy saving appliances, the creation of a consumer society that uses energy resources carefully or even voices concern about the nuclear option. Moreover, environmental experts and other critics of nuclear energy found themselves persistently excluded from participating in any form of dialogue and were considered to be contributors to public unrest and chaos.

*Taipower* has been very actively sponsoring such academic seminars during the last few years. It has even set up a foundation<sup>38</sup> for 'educational' and similar purposes. From February 1989 to June 1996 the foundation spent about NT\$ 12 billion on so-called community projects.<sup>39</sup> For example, in May 1995, the Institute of Public Policy at the National Chungsin University hosted a seminar on nuclear power policy, crisis management and social participation. Attendees were scholars from the most prestigious academic institutions in Taiwan such as Academia Sinica and National Taiwan University, all of whom were engaged in one of the following fields: economic research, public policy, public administration, resource management, or sociology. Wu Tsai-yi of the Taiwan Economic Research Institute<sup>40</sup>, for instance, said in his paper on nuclear policy that compared to other forms of energy generation nuclear energy is the cleanest and most efficient one. He acknowledged the problem of nuclear waste and thus stressed the need for a government policy to tackle the issue. He also urged the government to set up a policy on how to give the public more confidence in nuclear energy.<sup>41</sup> Rather unusual at academic seminars are papers like the one presented by Prof. Hsue Cheng-tai<sup>42</sup> in which he called for a Social Impact Assessment Law that would require the evaluation of the possible negative effects of planned construction projects before they can receive approval.<sup>43</sup> However, even such progressive papers are far from critical of the government's nuclear policy.

### **5. Nuclear energy: The cheapest form of energy production?**

Nuclear energy is by no means the cheapest form of energy production and does nothing to make a country less dependent on foreign resources. The International Energy Agency (IAEA) wrote in its 1995 *World Energy Outlook* about nuclear power:

The highly capital-intensive nature of this energy form, its technological complexity, and the shortage of suitable trained personnel, imply a very high reliance upon external sources and a subsequent serious drain on scarce hard currency earnings which only a handful of [...] countries can seriously contemplate.<sup>44</sup>

The experience of the Philippines highlights the inefficiency of the nuclear option:

The Philippines has already constructed a nuclear power facility, although the plant has never been operational because of serious design flaws which create unacceptable safety risks. Despite its complete inoperability, it was estimated that by 1992 the Philippines was paying US\$ 300,000 per day in interest repayments on the plant. The loan to construct the power station is the single biggest foreign debt incurred by the Philippine Government. There have been serious allegations of bribery by *Westinghouse* to ensure that they received the construction contract. The Philippines' reactor also had massive cost overruns characteristic of nuclear developments world-

wide. The two proposed plants were initially expected to have a combined cost of US\$ 500 million, yet by 1981 the estimated cost of one single plant was raised to US\$ 1,900 million. The Philippines' experience is a textbook example of the problems of nuclear power and the misinformation provided by nuclear power companies and their sponsoring governments. If it serves no other purpose, the lessons from the Philippines ought to be instructive to other Southeast Asian states contemplating nuclear power. Indeed, despite obscuration by the nuclear industry, the decline of nuclear power world-wide is the 'writing on the wall' of which the states of Southeast Asia should take note.<sup>45</sup>

Moreover, it is estimated that the nuclear-generating capacity of OECD countries will have declined significantly by 2010, a view supported by Greenpeace and the World Bank. One of the major reasons for this tendency are the high costs of nuclear facilities. The World Bank states in its 1992 *World Development Report* that

the costs of nuclear power stations have risen for a variety of reasons: long lead times and delays in seeking approval, meeting environmental safeguards, and constructing the plants; the costs and risks of disposing of radioactive waste; and the prospective costs of decommissioning plants.<sup>46</sup>

It is all too obvious that in the western world no one can any longer seriously justify the use of nuclear energy production. The declining domestic demand in the nuclear industries of Canada, France, Japan and the USA is a crucial stimulant for the search for new markets. Southeast Asia seems to be their latest target. Taiwan's fourth nuclear power plant and the above-mentioned Philippines case are just two examples. Another is the People's Republic of China, which is said to have signed agreements with General Electric and *Westinghouse* potentially worth US\$ 60 billion, after the Clinton-Jiang summit in October 1997 paved the way for nuclear technology transfer between the countries.<sup>47</sup>

## 6. Nuclear waste

With regard to nuclear waste, up to 90 percent of Taiwan's nuclear waste is stored on Orchid Island, which is the home of one of the nine aboriginal tribes in the Taiwan area, the Yami.<sup>48</sup> The island was chosen because of its small population and easy access to the sea. *Taipower* began storing nuclear waste on the island in 1982. The government told the people of the island that it was setting up a canning factory.<sup>49</sup> Currently, Orchid Island is polluted with 97,672 barrels of low-level nuclear waste. Environmentalists claim that several thousands of the waste containers are rusted. Between the years 1983 and 1993, AEC commissioned the National Scientific Committee on Problems of the Environment (Academia Sinica) to carry out seasonal biological, ecological, chemical (including radionuclides) and hydrographical surveys of the coastal and near-shore area surrounding the site. No obvious impact was reported by the Committee. A review of past studies made in March 1993

even recommended that most surveys be terminated. Thus, the *AEC* commissioned the Marine Science Research Centre of the National Sun Yat-sen University to carry out the much reduced survey of the Orchid Island storage facility. Only basic hydrological and chemical (including radionuclides) data of the nearby coastal area have been monitored twice a year since then. According to the reports no man-made nuclides have been found, which is said to indicate no leakage of radionuclides from the nuclear waste storage facility on Orchid Island.<sup>50</sup>

After the Chernobyl tragedy in 1986, the population of Orchid Island started to protest against the dumping of nuclear waste. On March 9, 1991, the Legislative Yuan<sup>51</sup> conducted a hearing dubbed "Who wants the nuclear devil?", at which several scholars and Yami were present and the dangers of nuclear deposit sites discussed. About two years later, the problems of nuclear dumping and potential genocide were reported not only by Taiwan's media but also by a Japanese TV station. Under public pressure, *Taipower* decided in 1995 not to enlarge the storage facilities on Orchid Island. Moreover, after a *Taipower* freighter containing 186 barrels of nuclear waste was prevented from entering Orchid Island harbour by the Yami a year later, *Taipower* finally decided not to send any more nuclear waste to the island and promised to remove all nuclear waste stored there by the year 2002.<sup>52</sup> The Green Party and DPP<sup>53</sup> are demanding that the government should provide residents of Orchid Island with regular health checks free of charge and conduct long-term follow-up studies on their health; also that the medical insurance of all residents should be funded by *Taipower*.<sup>54</sup>

Currently, Taipei County stores more than 60,000 barrels of nuclear waste at the first and second nuclear power plants. None of the storage facilities at the nuclear power plants has been subjected to environmental impact assessment as required by law. Environmentalists, especially TEPU<sup>55</sup>, have organised demonstrations outside the plants against the illegal storage of nuclear waste within them. On May 19, 1992, for instance, about one thousand people joined a demonstration outside the second nuclear power plant. Similar demonstrations were held in the following months in three villages located between the first and second nuclear plant: Kinshan, Shimen and Kuangli. The demonstrations were supported by the mayors of these villages and were each attended by about 1,000 people.<sup>56</sup>

To make things worse, it is assumed that with the FNPP in operation and the decommission of existing plants, Taiwan will have one million barrels of low to medium-level nuclear waste and 90,000 barrels of spent fuel. Orchid Island's storage facilities have a capacity of about one-tenth of the possible amount of low to medium-level nuclear waste.<sup>57</sup> In order to find a solution to the waste problem, *Taipower* has been seeking deposit sites in Taiwan as well as abroad. In August 1996, the organisation announced that it would offer NT\$ 3.2 billion to villages accepting

dumping sites. On October 11, 1996, Taipower confirmed that two towns had agreed to provide land for nuclear waste storage facilities. One of the towns is said to be in southern Taiwan, the other in the east of the country. *Taipower* officials refused to release the names of the towns so as not to cause problems for local authorities. In addition, a number of landowners in eastern Taiwan and Penghu island had offered private land as nuclear dumping sites. However, local governments had not refused permission for such facilities.<sup>58</sup>

Russia, China and the Marshall Islands could be alternatives abroad: On September 23, 1996, a *Taipower* official announced that agreement had been reached with Russia on the shipment of 5,000 barrels of nuclear waste to storage facilities there. The official spoke of a trial run, which would determine whether a long-term deal with Russia could be reached, but failed to mention how much money had been offered to Russia in compensation.<sup>59</sup> In addition, Vice President and Premier Lien Chan mentioned that Taiwan had already reached an agreement with the Marshall Islands on the disposal of nuclear waste.<sup>60</sup>

At the beginning of 1997, news emerged that *Taipower* had signed a contract with the North Korean government for the shipment of 60,000 barrels of nuclear waste. In addition, North Korea offered to store up to 200,000 barrels of nuclear waste in the future. No information on the price tag and the storage site was disclosed. However, environmentalists claimed that *Taipower* had offered US\$ 227.6 million. Consequently, about 40 environmental activists staged a protest outside the representative office of Taiwan in Seoul. They opposed the deal as they feared it could turn the Korean peninsula into a nuclear waste disposal site. The protest was rather patriotic, especially when an effigy of President Lee Teng-hui was burned. At the end of January, several groups of South Korean environmental activists and parliamentarians travelled to Taipei to voice their concern about the deal. The four South Korean parliamentarians carried a protest letter signed by 165 South Korean government officials and called the nuclear deal immoral. On January 29, six members of Green Korea, one of South Korea's largest environmental groups (about 13,000 members), began a five-day hunger strike outside the headquarters of *Taipower*.

The activists met angry *Taipower* union members, including the leader of the union, Yao Chiang-lin, who said that the Koreans should go back to their own country and not interfere in the affairs of others. The six protesters on hunger strike were requested by immigration authorities to leave Taiwan voluntarily or face deportation, since their activities appeared to be inconsistent with their stated purpose of entry. The burning of an effigy of President Lee Teng-hui by South Korean activists contributed to further tensions. In revenge, Taipei County Council Deputy Ching Chia-shou (NP) ripped away protest banners and set them on fire, and the leader of the Patriotic Union, Chou Ching-chun, took a

pair of scissors and cut in two a South-Korean flag during a public hearing.

Attempts by the South Korean government to ask the United Nations, United States, European Union (EU), China, Japan and the International Atomic Energy Agency to put pressure on Taiwan failed to influence the policy of state-owned *Taipower*. Only the United States expressed concern about the deal. The European Union released a statement saying that the EU attaches great importance to nuclear safety and, consequently, understands the South Korean concern. The EU further pointed out that the transport and storage of such nuclear waste should take place in full respect of international safety standards and IAEA guidelines, and held that IAEA should be invited to advise on and, possibly, monitor compliance with such guidelines.<sup>61</sup>

Vice-President and Premier Lien Chan again defended the nuclear agreement by describing it as a legal commercial act based on the prerequisites of safety and complying with international norms, and ruled out any government interference.<sup>62</sup>

## 7. Deformed fish

Apart from the waste problem, there are concerns among residents of Yenliao<sup>63</sup> about the effects of the FNPP on ocean waters and what residents could do if there were an accident.<sup>64</sup> Since 1979, biological, ecological, chemical (including radionuclides) and hydrographical surveys have been carried out periodically to determine the impact of the nuclear power plants on the surrounding area. Until 1993, the surveys had been carried out by the National Scientific Committee on Problems of the Environment (Academia Sinica) and since then by the Marine Science Research Centre of the Sun Yat-sen University at a reduced level. Both institutions were commissioned by AEC and *Taipower* to carry out these surveys. In all the survey reports, a number of possible negative impacts are admitted.

The plant needs a large amount of seawater for cooling purposes. The intake and discharge of the cooling water, plus the release of chlorine, trace metals and some radionuclides could potentially cause some impact on the marine environment: coastal circulation may change, surface water temperature and turbidity may increase, and biota may suffer due to elevated temperature, impingement and entrainment.<sup>65</sup>

Furthermore, the reports state that the water temperature at the cooling water outlets are generally up to 4°C higher than the water near the inlets and up to 2.4°C higher than the average temperature of the area. Caesium-137 was occasionally found in low concentration around the third nuclear power plant. The report claims that this may not necessarily have any effect on the marine ecology of the area. However, some marine samples taken from waters adjacent to the northern Taiwan nuclear power plants were found to contain artificial radionuclides and

malformed fish (*Therapon jarbua*) were found along the outlet channel of the second nuclear power plant.<sup>66</sup> Since the end of July 1993 deformed fish have also been found by members of the North Coast Chapter of TEPU in the same area. The fish had twisted bodies. There is scientific evidence that the mutation had been caused by high-temperature radioactive effluent from the second plant. *Taipower* and *AEC*, however, argued that the deformation of the fish had been caused by the high temperature of the effluent only. Although *Taipower* reconstructed the warm water outlet to reduce the temperature of the effluent as requested in 1994, more deformed fish have since been caught along the coast near the plant.<sup>67</sup>

### 8. Taiwan's plants and their safety

Taiwan's nuclear power plants have already proved to be not as safe as *Taipower* constantly claims. The fire caused by undue turbine vibration in the third plant in 1985 is one example; another is the radioactive emission of July 7, 1995. On that day, reactor number two of the second plant had a high-level radioactive emission. For the duration of about two hours and twenty minutes residents were exposed to radiation, the total dose of which is said to be more than twice the amount released in the Three-Mile-Island incident of 1979. The leakage was caused by cracks in some of the 30,000 fuel rods.<sup>68</sup> *Taipower* itself admitted during an international conference on nuclear power plant ageing held in San Diego in July 1985 that major material problems had occurred such as intergranular stress corrosion cracking, low-pressure steam turbine stationary vane cracking, sea water intake structure corrosion and radwaste concentrator corrosion.<sup>69</sup>

### 9. Construction of FNPP back on political agenda

After several years of discussions following the Chernobyl disaster, the first two units were approved by the cabinet and the frozen NT\$ 112.5 billion budget was released by the Budget Committee of the Legislative Yuan in June 1992, and two years later by a full meeting of the Legislative Yuan. Public discussion again started when *Taipower* and *AEC* changed the capacity of the light water reactor from 1,000 mw to 1,300 mw and the Control Yuan<sup>70</sup> ruled that such a change would be illegal without an environmental impact assessment and feasibility study for the more powerful reactors. *Taipower* and the *Atomic Energy Council* were then requested to either use 1,000 mw reactors or implement the feasibility study and environmental impact assessment for the 1,300 mw reactors. *Taipower*, however, virtually ignored the Control Yuan's demands, continued the contract bidding process and accepted proposals for 1,300 mw reactors from *General Electric*, *Westinghouse* and *Combustion Engineering*.<sup>71</sup>

On May 24, 1996, opposition parties made use of their constitutional rights: According to the second clause of Article 57, the Legislative Yuan may request the Executive Yuan, the cabinet, to alter any important policy if the Legislative Yuan does not concur with it. Thus, the opposition parties cooperated with one another and outvoted the ruling KMT<sup>72</sup> on a resolution seeking to block any new power plant projects, including the controversial fourth plant under construction. The opposition succeeded in outvoting the KMT because not all KMT legislators were present and others joined the opposition.<sup>73</sup> However, such an initiative alone would not prevent the FNPP from being constructed, as the constitution also says that the Executive Yuan with the approval of the President of the Republic may request the Legislative Yuan to reconsider. If, after reconsideration, two-thirds of the members of the Legislative Yuan present at the meeting uphold the original resolution, the Premier has either to abide or resign. Premier Lien Chan made the decision to request the reconsideration on June 6, 1996 and President Lee Teng-hui approved the decision five days later and sent the request for reconsideration to the Legislative Yuan on June 12, 1996.<sup>74</sup> The Legislative Yuan did not vote on the issue until October 18 of the same year.

In the meantime, there were numerous protests, debates and parliamentary initiatives.

### *9.1. Protests*

Some of the protests were against one of the contractors for the plant: On September 18, 1996, members of the non-governmental *Taiwan Environmental Protection Union (TEPU)* gathered outside *General Electric's* Taipei office to protest against the construction of the FNPP and the company's involvement in it. *General Electric* had received the US\$ 1.8 million bid for the construction of the power plant reactor on May 24, 1996. The protesters called on *General Electric* to abandon plans for the construction of FNPP and to seek solutions for the disposal of reactor waste from plants number one and two, which *General Electric* had also partially constructed, in the U.S. Lung Tai-ping, Power Systems Country Manager of *General Electric*, told the protesters that the standards of their products were high, and if a country like Japan with high standards of safety and quality could accept their products, it was a good indication of *General Electric's* reliability.<sup>75</sup>

On September 23, over 300 protesters mainly from Yenliao, where the FNPP was to be built, rallied at the Legislative Yuan, Executive Yuan and on the steps of *General Electric's* office building in Tunhua North Road. Protesters again demanded that *General Electric* should abandon the plan to construct the FNPP and get out of Taiwan. Taiwan Environmental Protection Union handed over a protest letter, and Green Party members issued an urgent appeal to President Lee Teng-hui, Vice President and Premier Lien Chan and to *General Electric* pleading for a halt



on the construction of the FNPP. The Green Party also said it had launched an anti-*General Electric* campaign world-wide, which should encourage people to boycott the company's products.<sup>76</sup> Protests outside the Taipower offices continued during the following months. Whenever protesters arrived there, eggs were thrown at the buildings and protesters wore yellow bandannas with the words "reject plant number four". Nevertheless, protests were generally peaceful.

Protest continued after the October 18, 1996 vote in parliament. One year later (on October 26, 1997), for instance, approximately 5,000 protesters from all over the island, again wearing yellow headbands, demanded an immediate halt on the construction of the FNPP. The activists called on the government to improve energy efficiency rather than build nuclear power plants.<sup>77</sup>

### 9.2. Debates

With regard to the debates, the Ministry of Economic Affairs argued forcefully for the completion of the FNPP. The Ministry said that the abrupt suspension of the project would waste government resources, claiming that state-owned *Taipower* had already spent US\$ 210 million on the plant. Moreover, by scrapping the project foreign companies under contract would incur losses and the government's reputation would be damaged.<sup>78</sup> Yu Sheng-hsiung, director of *Taipower* Nuclear Communication Centre, argued that the FNPP was necessary so as not to run the risk of being dependent on other countries. He claimed that only five percent of Taiwan's energy supply was produced domestically. With the fourth nuclear plant built, Taiwan could become less dependent on imported energy supply, and the current petroleum share of 21.4 percent of the total energy supply could be reduced. This in turn would bring Taiwan more into line with the UN Framework Convention on Climatic Control Treaty signed in 1994 to reduce global CO<sub>2</sub> levels by the year 2000. Yu Sheng-hsiung's statement has very often caused the misleading interpretation that with more nuclear power plants the ratio of imported to domestically produced energy would change substantially. In fact, further nuclear plants could perhaps make Taiwan less dependent on particular energy imports, such as coal, but not influence the total import/export ratio.

*Taipower* also said that for one percent economic growth the capacity to generate electricity should ideally increase by two percent in order to guarantee an adequate supply of electricity.<sup>79</sup> According to *Taipower*, such a ratio is unattainable unless a further nuclear power plant is built (Table 10).

	1951-1960	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010
(A)	8.0%	9.6%	9.8%	7.9%	6.7%	5.5%
(B)	15.9%	14.3%	12.2%	7.0%	7.2%	4.9%
(B)/(A)	1.99	1.49	1.24	0.89	1.07	0.89

Table 10: Real economic growth (A) and the growth of power generation (B) (1951–2010)<sup>80</sup>

In addition, government officials claimed that hydro, which is preferred by the environmentalists, is too difficult to manage because most sources lie in protected islands and reserves.<sup>81</sup> Vice President and Premier Lien Chan argued that nations typically maintain a 20 percent reserve in their capacity to generate electricity in order to maintain steady economic growth, but the reserve in Taiwan is only 5 percent.<sup>82</sup> He further added that the suspension of the project would result in heavy financial losses, inevitably damage Taiwan's creditability and erect an unnecessary barrier to Taiwan's bid to join the World Trade Organisation (WTO).<sup>83</sup> The government and *Taipower's* stance is simply that nuclear power plants are necessary and safe, and the method of managing nuclear waste is sound. Environmentalists, however, are against nuclear power plants as they are not as safe as governments want them to be and the method of managing nuclear waste is anything but sound (see above).

Taiwan's opposition parties are united in their fight against nuclear energy. This is particularly true of the Green Party and the DPP. Both parties have their anti-nuclear attitude incorporated in their party programmes. Both request the closure of all nuclear power plants and are against the construction of new ones. They believe that

nuclear power is one of the death-dealing extensions of nuclear weapons. The history of nuclear power shows that the many kinds of harm it generates are cumulative in nature and irreversible. Already there is nowhere to dispose of the nuclear waste produced by Taiwan's three existing nuclear power plants. Environmental calamity – whitened coral and deformed fish – has struck the vicinity of these plants. All around Taiwan, one can find buildings made with materials contaminated by radioactive waste, and the water supplied by the Panchiao-Hsintien Water Plant is also radioactive. In Taoyuan, there are nine radioactive roads. All of these should remind us of the importance of opposing nuclear power.<sup>84</sup>

Despite all the protests, the controversial bill to authorise the construction of the fourth nuclear power plant was finally back on the agenda for the legislature after a day of fierce debate and fisticuffs on October 8, 1996. The bill would thus be reviewed on the following Tuesday and Thursday before being voted on Friday October 18, 1996.<sup>85</sup>

### 9.3. *Legislative initiatives*

Three days later, an alternative anti-nuclear bill, proposed by the opposition parties, failed to pass its first reading in the Legislative Yuan due to the dominance of KMT legislators.<sup>86</sup>

According to Article 62 of the rules of procedure of the Legislative Yuan, the premier is required to attend the legislature to explain the Cabinet's reasons for resubmitting a bill that the legislature has already voted down.<sup>87</sup> Thus, the premier would have had to explain the Cabinet's

reasons on Tuesday October 15, 1996. However, as the premier attempted to enter the northern entrance of the Legislative Yuan at noon, he found himself confronted with a human chain of DPP legislators wearing green bandannas and sashes. After a while of pushing and shoving, the premier called back his bodyguards and returned to his black limousine. Before entering the car, he turned, shouted "you are unreasonable" and gave the DPP legislators the thumbs-down. Later, the premier was quoted as saying that that day had been a black one for democracy, as democracy is a political system which uses reason instead of violence to persuade people, and that the government welcomed any mature policy discussion but not irrational behaviour. At the southern entrance of the Legislative Yuan, more than 10,000 pro-nuclear protesters<sup>88</sup> were kept away from a group of about 100 anti-nuclear protesters by 200 police manning barbed wire fences. The out-numbered anti-nuclear protesters claimed that *Taipower* had managed to get such overwhelming support only by offering NT\$ 1,000 to NT\$ 2,000 to each protester.<sup>89</sup>

Inside the Legislative Yuan, Legislative Speaker Liu Sung-fan dismissed the meeting after the opposition parties won a vote passing such a motion. However, Liu then announced that the bill would still be put to the vote as scheduled on Friday, and the review process would be bypassed. Opposition parties' legislative whips, Shen Fu-hsiung (DPP) and Ju Gao-jeng (NP)<sup>90</sup>, still insisted on the completion of the review process according to Article 62 of the procedural rules, and accused Liu of repeatedly violating the neutrality of his position as chairman. KMT legislative whip Tseng Yung-chuan, on the other hand, argued that the opposition had refused to listen to the premier's report and that the report had been handed in in written form.<sup>91</sup>

#### ***9.4. Final voting in parliament***

On Friday October 18, 1996, the bill was finally passed by a vote of 83 to 0 with 2 votes invalid. DPP and NP legislators boycotted the vote. During the morning of that day, the 108 ruling and opposition lawmakers present agreed by 85 votes to 8 to first review the written report on the power plant, then discuss it and finally to vote at 6 p.m. The DPP, however, soon started to refuse to speak on the issue, occupied three podiums in order to block any registered legislator from speaking, and used megaphones to interfere with the speeches of KMT parliamentarians. Later, the DPP and NP tried to block the vote by preventing KMT legislators from casting their ballots by surrounding one of the two ballot boxes. Nevertheless, voting was completed at 9.30 PM.

During the day, about 2,000 protesters gathered outside the Legislative Yuan. A total of 4,000 police had been deployed around the building. Five anti-nuclear protesters were detained, reportedly beaten by police and later released. Protesters hurled gas bombs, fireworks, steel poles, plastic chairs, stones and garbage at the police, injuring five of them and

setting a police jeep ablaze. Police used water cannons to prevent protesters from breaking through barbed wire fences and to disperse them.<sup>92</sup>

Environmental groups, such as the Taiwan Action Alliance for Opposing Nuclear Plants<sup>93</sup>, were disappointed about the failure of the DPP and NP to prevent the completion of the fourth nuclear power plant and accused the opposition parties of collaboration with the KMT. Furthermore, they said that the DPP and the NP had tried to block the bill mainly because of their anger about Lien Chan's dual role as vice president and premier.<sup>94</sup>

A day later, six Kungliao Township deputies and one Taipei County councillor quit the KMT and joined the DPP, saying they could not agree to the construction of the fourth nuclear power plant in their constituency and would carry out anti-nuclear activities at the construction site.<sup>95</sup>

Although the October 18 vote in parliament paved the way for the construction of Taiwan's fourth nuclear power plant, anti-nuclear activists pointed out that there was still a chance of preventing its completion, since the budget would have to go through more legislative reviews before its eventual completion in 2005.

In fact, the parliamentary battle continued a year later: On November 5, 1997 the budget of the FNPP was frozen again. Three bills were passed by the Legislative Yuan: the first of these targeted the 1998 budget of the FNPP, the second and third requested the discontinuation of the project and the freezing of the previous budget.<sup>96</sup> The legislators of the ruling party voted on the first bill but refrained from voting on the two others, because they could not agree to vote on a budget which had already been approved. According to the Budget Law, the bills must, however, also undergo a second and third reading before becoming effective.<sup>97</sup> A week later, the ruling party blocked the bills from going into the second reading before the city and county magistrate elections scheduled for 29 November 1997.<sup>98</sup> After the election, legislators succeeded in abolishing a special NT\$ 71 million budget relating to the FNPP by 58 votes to 50. NP legislators joined the DPP in voting against the KMT. However, the NP did so because of the fact that *Taipower* had previously failed to provide information on the allocation of the money. *Taipower* Chairman Hsi Shih-chi said that abolition would affect compensation to local residents but not the construction of the plant itself. During the voting procedure, about 200 anti-nuclear activists protested outside parliament.<sup>99</sup>

## 10. Alternatives

Instead of more nuclear power plants, the Green Party and the DPP would like to see some sort of development of alternative energy sources and a reduction of energy consumption. A reduction could be achieved by the introduction of more energy-efficient appliances and the creation of public awareness about energy saving. Such a view was also expressed

in the *Taiwan 2000 Study*<sup>100</sup> by referring to the experience of western countries in energy conservation:

Energy conservation, therefore, serves not only to reduce production costs and decrease vulnerability to instabilities in international energy markets; it is also very effective as a means of reducing environmental degradation. Energy conservation can take three forms: decreased use of services with high energy demand (for example, by turning off lights and air conditioning when not in use); increased efficiency in providing a given level of end-use services (by inventing, for instance, more efficient lighting fixtures and air conditioners); and increased efficiency in production and delivery (e.g., through cogeneration, in which 'waste' heat is utilised rather than becoming an environmental problem, or through the use of heavier-gauge wires to reduce power loss in transmission). Data from the US and the Netherlands show that a large proportion of the anticipated increase in energy demand over the next two decades can be accommodated more efficiently through conservation than through increased supply.<sup>101</sup>

Nevertheless, neither *Taipower* nor any government agency has promoted energy conservation so far. With respect to alternative energy sources, *Taipower* acknowledges their existence in its propaganda material, but refrains from making use of them.

Contrary to *Taipower's* claim, solar energy, biomass, and other renewable energy sources are developing rapidly as environmentally and commercially viable energy sources, a view noted by the World Bank in its *World Development Report*.<sup>102</sup> Jon Barnett of the Centre for Resource and Environmental Studies at the Australian National University gave a convincing explanation for the common phenomenon of neglecting alternative energy sources:

The realisation of alternative energies is hampered by the displacement of energy research and development funds into resolving the (seemingly unsolvable) problems of nuclear power. The biggest barriers to the implementation of non-nuclear sustainable energy sources are no longer primarily technical, but are instead political.<sup>103</sup>

The DPP and GPT suggest that alternative energy sources could also be developed by a deregulation of the power generation industry, i.e. the private sector should be allowed to operate power plants.<sup>104</sup> In 1995, Taiwan's government paved the way for the liberalisation of power generation due to its bid to become a full member of the WTO. In the same year, the central government gave permission for the construction of several privately owned power plants with a capacity of about 4,000 mw. One year later, one of Taiwan's leading petrochemical manufacturers, the *Formosa Plastics Group*<sup>105</sup>, started with the construction of Taiwan's first privately owned power plant, which is part of the company's plan to construct a huge petrochemical complex in the industrial zone. The complex will also include Taiwan's sixth naphtha cracker. The annual capacity of the power plant will be about 4.2 million kw, which will be more than the company expects to need for the industrial zone

and has, therefore, signed a contract with *Taipower* for the sale of electricity. Construction of the power plant should be finished by the year 1998.<sup>106</sup>

According to Kao Cheng-yan of the Green Party, the deregulation of the power generating industry will make further nuclear power plants unnecessary, since the total power generation of the private-owned plants is expected to be far higher than the one of the FNPP.<sup>107</sup>

## 11. Conclusion

Currently, about 30 percent of Taiwan's total power generation is nuclear. Taiwan's three nuclear power plants generate approximately 34 billion kwh a year.

Although public knowledge about nuclear energy production has increased tremendously in the last ten years, the general public still considers the nuclear option necessary and safe. Academic discussions on nuclear energy are rare and strongly influenced by state-owned *Taipower* and several government agencies. Anti-nuclear activists are generally excluded from any form of dialogue and frequently considered contributors to public unrest and chaos.

Over the last ten years, numerous anti-nuclear organisations have been founded and protests staged mainly against *Taipower's* nuclear waste policy and the construction of a further nuclear power plant. With regard to Taiwan's nuclear waste, protests finally forced *Taipower* to close down nuclear storage facilities on Orchid Island, an area populated by aborigines.

Taiwan's opposition parties are against nuclear energy. The Green Party of Taiwan is opposed to such facilities for ideological reasons, whereas Taiwan's largest opposition parties, the Democratic Progressive Party (DPP) and New Party (NP), could be described as more anti-government than anti-nuclear. The DPP and NP have frequently (mis)used the nuclear issue to target government officials, such as former Premier Lien Chan, rather than to voice concern about the government's nuclear policy. Nevertheless, the anti-government efforts of the DPP and NP have caused hold-ups in the construction of Taiwan's fourth nuclear power plant. Whether such an approach will in the end bring about the termination of the project is doubtful.

Discussions on alternative energy sources and reduced energy consumption are virtually non-existent. The promotion of an energy-saving consciousness among the general public has been persistently blocked by pro-nuclear forces, such as *Taipower* and government agencies. Moreover, Taiwan is an example of the growing Asian nuclear market, triggered by declining domestic demand in the nuclear industries of Canada, France and the USA. Even though no one can any longer seriously justify the use of nuclear energy in those countries, Asian governments still insist that nuclear power is necessary and safe: What a Faustian bargain.

## Notes

- 1 The author works at National Taiwan University (Department of Sociology) and  
University of Linz, Austria (Institute of Societal Policy). **Note:** 1 US\$ = 30 NT\$.
- 2 TP (1997-3), TP (1997-2).
- 3 GE Model BWR/6.
- 4 Model TC4F-44.
- 5 TP (1997-3), TP (1992-1).
- 6 TP (1997-3), TP (1992-2, 1995).
- 7 SDB (1996: 94).
- 8 SDB (1996: 93).
- 9 TP (1996-2: 6).
- 10 The fourth nuclear power plant (FNPP).
- 11 Ibid.
- 12 Ibid p. 379.
- 13 Hsue (1995: 173).
- 14 Ibid.
- 15 Authorities, however, do not interfere with demonstrations calling for Taiwan's  
independence.
- 16 Chou (interview), Kao (interview).
- 17 Ibid.
- 18 CN (14 January 1997: 1).
- 19 Liao (1992: 11F1).
- 20 A term used by *Taipower*; cf. Shin (interview), Yin (interview).
- 21 *Dian cong na li lai*, TP (1996-1).
- 22 *Wei lu yu he neng*, TP (1994).
- 23 *He dian fu she an chuan ma?*
- 24 *He neng fa dian gui bu gui.*
- 25 August 1997.
- 26 AEC (1996: 2).
- 27 Ibid p. 3.
- 28 Ibid p. 52.
- 29 AEC (1995).
- 30 AEC (1995: 5).
- 31 Wang (interview).
- 32 AEC (1997: 79).
- 33 AEC (1997: 77-85); CN (19 November 1997: 2), AEC (1996: 40-43); Hung (1995: I-  
6-2)
- 34 *Fu she an chuan cu jin hui.*
- 35 Wang (interview); Hsu (interview).
- 36 Wang Yu-lin is one of them.
- 37 CN (16 October 1997: 1,3) .
- 38 *Dian yuan kai fa ji jin guan li wei yuan hui.*
- 39 TP (1996-2: 7).
- 40 *Taiwan jing ji yan jiu yuan suo.*
- 41 Wu (1995: 25, 35).
- 42 Department of Sociology, National Taiwan University.
- 43 Hsue (1995: 176).
- 44 IEA (1995: 45); cit. in Barnet (1997: 363).
- 45 Barnet (1997: 365).
- 46 WB (1992: 122); cit. in Barnet (1997: 364).
- 47 CN (31 October 1997: 1).
- 48 Culturally, the Yami are closely related to the inhabitants of the Batan Islands of the  
Philippines, and the Yami languages and the Ivatan dialect of the Batanes are  
mutually intelligible. YB (1996: 33); about 3,000 Yami live on Orchid Island (46  
square kilometres).

49 Yang (1996: 92).  
 50 TR (19: 7); TR (23: 7).  
 51 Lower house of parliament.  
 52 Fu (1996: 1).  
 53 Democratic Progressive Party, Taiwan's largest opposition party.  
 54 Yang (1996: 93).  
 55 Taiwan Environmental Protection Union, one of Taiwan's largest NGOs of its kind.  
 56 Fu (1996: 3).  
 57 Fu (1996: 3).  
 58 CN (12 October 1996: 2).  
 59 CN (24 September 1996: 3); it was later revealed that Taipower considered buying  
 isotope chemicals in exchange for the right to dump nuclear waste in Russia. CN (14  
 January 1997: 1).  
 60 FCJ (24 October 1996: 1).  
 61 Bulletin EU ½-1997.  
 62 CN (2 October 1996: 2).  
 63 Site of the FNPP.  
 64 CN (2 October 1996: 2).  
 65 E.g. TR (24: 11).  
 66 TR (20: 12, 15); NSCPE (1995).  
 67 Kao (1995: 2).  
 68 Ibid.  
 69 Chen (1985: 227).  
 70 The Control Yuan belongs to one of the branches of government exercising the  
 powers of impeachment, censure and audit.  
 71 Kao (1995: 4).  
 72 Kuomintang, Taiwan's ruling party.  
 73 76-42 with one abstention.  
 74 FCJ (14 June 1996: 2).  
 75 CN (9 September 1996: 2).  
 76 CN (24 September 1996: 3).  
 77 CP 27 Oct 1997, p. 20: "Thousands protest against nuclear power plant".  
 78 FCJ (14 June 1996: 2).  
 79 TP (1997-1: 2), Chen (interview).  
 80 TP (1997-1: 3).  
 81 CN (12 October 1996: 2).  
 82 FCJ (24 October 1996: 1).  
 83 FCJ (18 October 1996: 2).  
 84 Yang (1996: 91).  
 85 CN (9 October 1996).  
 86 CN (12 October 1996:2).  
 87 CN (10 October 1996: 2).  
 88 Organised by the labour union of *Taipower (Tai dian gong hui)*.  
 89 CN (16 October 1996: 1).  
 90 New Party, Taiwan's second largest opposition party.  
 91 CN (16 October 1996: 2).  
 92 CN(19 October 1996: 1).  
 93 *Taiwan fan he xing dung lian meng*.  
 94 Before Lien Chan was elected vice president in March 1996, he had received legis-  
 lative approval to serve as premier. With his inauguration on 20 May the same year,  
 he also became vice president. Although the constitution does not explicitly prohibit  
 officials from holding more than one post concurrently, the opposition considered  
 Lien Chan's dual role unconstitutional and requested the Council of Grand Justices  
 for a constitutional interpretation. On 31 December 1996, the Council of Grand  
 Justices declared that Lien Chan's dual role was *not apparently incompatible* but *not*  
*totally in line* with the original constitutional intent. Two of the sixteen members of



the Council of Grand Justices, however, were of the opinion that the dual status is unconstitutional.

95 FCJ (24 October 1996: 1).  
 96 62 vs. 52; 56 vs. 0.  
 97 GPT (7 November 1997).  
 98 UEN (13 November 1997: 3).  
 99 CN (3 Dezember 1997: 2).  
 100 Taiwan's intellectuals began to seriously analyse the island's environmental situation in the early 1980s, when a group of academics decided to form a study group to focus on environmental issues. The so-called *Taiwan 2000 Study* was the result of the group's efforts. *Taiwan 2000* was financed by the Council of Economic Planning and Development (Ministry of Economic Affairs), Asia Foundation and the Rockefeller Brothers Fund. The study covered four areas: environmental pollution, natural resources, economic aspects and sociological issues. Foreign institutions, such as the Massachusetts Institute of Technology (MIT), were included in the research efforts. A committee, the Steering Committee, comprising scholars from the National Taiwan University and Academia Sinica, was set up to coordinate the efforts.

101 T2000 (1989, 25).  
 102 WB (1992: 116).  
 103 Barnet (1997: 368).  
 104 Yang (1996: 91), GPT (1996).  
 105 One of Taiwan's top 50 groups (total assets).  
 106 FCJ (20 December 1996: 3).  
 107 Kao (1995: 4), Kao (interview).

## 12. Appendix

### 12.1 Abbreviations

<b>AEC</b>	Atomic Energy Council
<b>CN</b>	<i>China News</i>
<b>CP</b>	<i>China Post</i>
<b>DM</b>	District Magnitude (max. number of candidates elected in one district)
<b>DPP</b>	Democratic Progressive Party
<b>FCJ</b>	<i>Free China Journal</i>
<b>FNPP</b>	Fourth Nuclear Power Plant
<b>GPT</b>	Green Party Taiwan
<b>IEA</b>	International Energy Agency
<b>KMT</b>	Kuomintang
<b>MVR</b>	Minimal Vote Ratio [MVR=(votes received)/(votes necessary)]
<b>NC</b>	number of candidates contesting in one electoral district
<b>NP</b>	New Party
<b>NSCPE</b>	National Scientific Committee on the Problems of the Environment, Academia Sinica, Taipei
<b>SDB</b>	<i>Statistical Data Book</i>
<b>TEPU</b>	Taiwan Environmental Protection Union

<b>TP</b>	<i>Taipower</i>
<b>TR</b>	<i>Technical Report</i> (see Chung Shan University)
<b>T2000</b>	<i>Taiwan 2000 Study</i>
<b>UEN</b>	<i>United Evening News (Lianhe wanbao)</i>
<b>WB</b>	World Bank
<b>YB</b>	<i>The Republic of China Yearbook</i>

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9 October 1996. "Nuclear plant is back".

10 October 1996. "Fight shaping over nuclear bill", p. 2.

12 October 1996. "Legislature stalls on nuclear power", p. 2.

12 October 1996. "*Taipower* defends firm stance on fourth nuclear power plant", p. 2.

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Chang Kuo-lung	張國龍
Chen, David Y.W.	陳于衛
Chou Ching-shun	周清順
Chou Frances	周和君

#### **D**

Democratic Progressive Party	民主進步黨
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#### **F**

<i>Fushe anquan cu jinhui</i>	輻射安全促進會
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#### **H**

Hsu, Smith S.M.	許思明
Hsue Cheng-tai	薛承泰

#### **J**

Ju Gao Zheng	朱高正
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#### **K**

Kao Cheng-yan	高成炎
Kinshan	金山
Kuangli	光里
Kuomintang	國民黨

#### **L**

Lee Teng-hui	李登輝
Leu, James W.S.	呂文賢
Lien Chan	連戰
Liu Sung-fan	劉松藩
Lung Tai-ping	龍台平

**N**

New Party

新黨

**S**

Shen Fu-hsiung

沈富雄

Shimen

石門

Shin Jun

辛潤

**T**

Tang Kao-yeong

唐高永

taiwan fan he xing dung lian meng

台灣核行動聯盟

Tsai Wan-chi

蔡萬吉

Tseng Yung-chuan

曾永權

**W**

Wang Yu-lin

王玉麟

Wu Tsai-yi

吳財義

**Y**

Yenliao

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