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Power Play: The Japanese Situation

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Chapter 21
Conclusion: The Japanese Situation

The Japanese electricity industry is currently being gradually deregulated in the hopes that high electricity prices can be reduced. At the same time the government is keen to encourage more use of nuclear power. It is aiming to reuse nuclear fuel in order to close the nuclear fuel cycle and thereby reduce Japan's reliance on imports to fuel electricity generation.[1] However deregulation in other parts of the world has not brought prices down, nor has it been conducive to investment in nuclear power. More importantly, the competitive pressures encouraged by deregulation do not encourage reliability and safety, issues which are very important to the Japanese people, particularly in the wake of a series of nuclear accidents over the past decade.

HISTORY

During the early part of the 20th Century some 700 electricity companies were set up in Japan. These were merged after the first world war into just five. During the second world war the government combined these five into one generating company, Nihon Hassoden KK, and nine distribution companies. Electricity infrastructure was badly damaged during the war but electricity production accelerated again after the war.[2]

In 1951, whilst still under American occupation, Japan's electricity industry was reorganised according to the US model of state-regulated privately-owned monopoly utilities. The country was divided into nine regions and in each region a single privately-owned utility was given a monopoly to supply electricity. (In 1972, when Okinawa was returned to Japan, the number of general electric utilities (GEUs) was increased to ten.) These GEUs are vertically integrated to include generation, transmission, distribution and retail supply. They are:

- Hokkaido Electric Power Co., Inc.,
- Tohoku Electric Power Co., Inc.,
- Tokyo Electric Power Co., Inc.,
- Chubu Electric Power Co., Inc.,
- Hokuriku Electric Power Co., Inc.,
- Kansai Electric Power Co., Inc.,
- Chugoku Electric Power Co., Inc.,
- Shikoku Electric Power Co., Inc.,
- Kyushu Electric Power Co., Inc., and

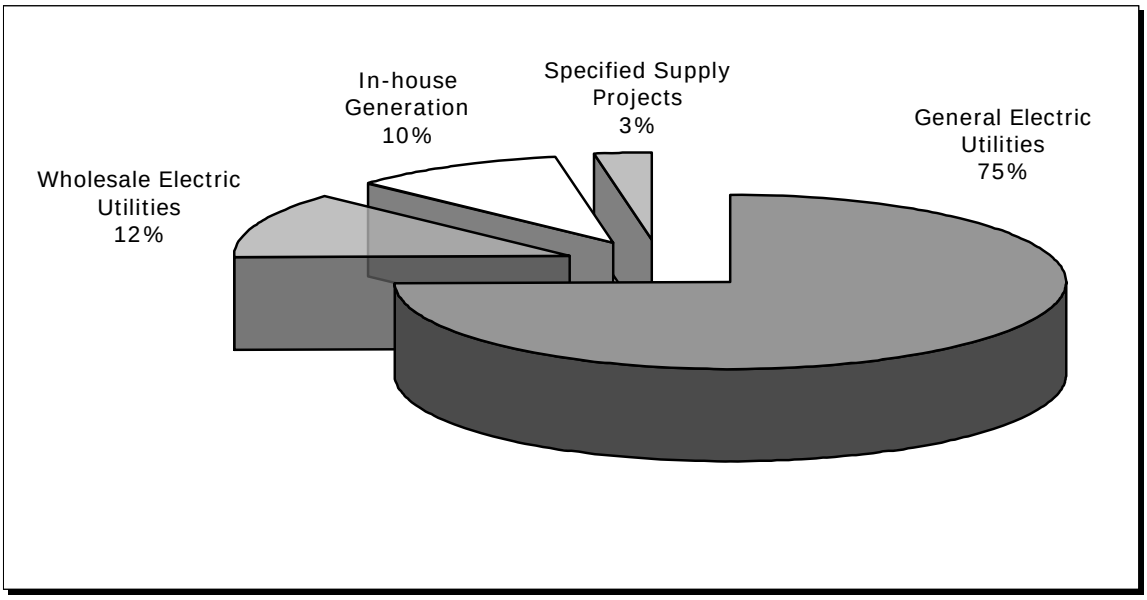
- Okinawa Electric Power Co., Inc.

Tokyo Electric Power, which includes Tokyo in its region of supply, serves 24 million customers and is the world's largest privately-owned electric utility and one of Japan's most profitable companies.[3]

The generation of wholesale electricity in Japan is mainly done by the GEUs (75%) but it is supplemented by other electricity generators, referred to as wholesale electric utilites (see Figure 21.1). The largest is the Electric Power Development Company or J-Power, which was created in 1952 by the government to augment electricity supplies nation-wide at a time when the GEUs did not have the financial capacity to meet electricity demand. It is government owned and funded and builds transmission lines as well as power stations. It operates 67 power stations. [4]

The other major wholesale utility is Japan Atomic Power Co (JAPC) was created in 1957 as a joint venture of the GEUs, J-Power and industry interests, to promote the commercialisation of nuclear energy and import nuclear reactors. It owns four of the nation's 52 power stations (one of which is no longer in operation).[5] In addition thermal power plants were built ''during the postwar high-growth period'' as joint ventures between GEUs, steel makers and other industrial users. Municipal governments also operate their own generating plants, particularly hydroelectric plants.[6]

Figure 21.1 Generating Capacity by Ownership - 1994



Source of data: Kibune, Hisabe. 'Regulatory Reform and Its Effect in the Japanese Electric Utility Industry.' *Economic Analysis Series*(142). December 1995: 89-122, p. 93.

In 1994 GEUs supplied 90 percent of the nation's retail electricity market. Ten percent was supplied by in-house power producers. These are paper and pulp, chemical, steel and oil refining industries that generate their own electricity, often with steam that is a by-product of their manufacturing processes. Industrial users generated about 28

percent of their own electricity requirements as a way of keeping their costs down.[7]

Specified Supply Projects supply about 3 percent of electricity directly to particular customers. These include municipal councils supplying their own departments, companies supplying electricity for housing or buildings they own, and electricity supply from one company to another with a close relationship.[8]

Until 1995 the industry was closely regulated, under the Electric Utility Industry Law (1964) by the Public Utilities Department of the Agency of Natural Resources and Energy. This regulation was supposed to protect the public interest; to guard national security; to prevent pollution; to promote adequate development of the electricity sector; to ensure that the private GEU's did not take advantage of their monopoly position to extort consumers, and to ensure safety. Although the regulations did not guarantee monopolies to GEUs the rules required that, before it could be licensed, a GEU had to show that it could supply enough capacity to meet demand in an area and not duplicate existing capacity. This essentially prevented the establishment of competing utilities within each region.[9]

GEUs, in turn, were obliged to meet demand at rates that had to be approved by the Ministry of International Trade and Industry (MITI). This rate was based on cost of production plus a fair rate of return, as was the case for US electricity utilities. The ten companies cooperated to ensure that demand could be met, by exchanging and supplying each other with electricity in times of need. The regional grids were linked by interconnections to facilitate this. The GEUs also cooperated on research and development of new technologies and systems of procurement.[10]

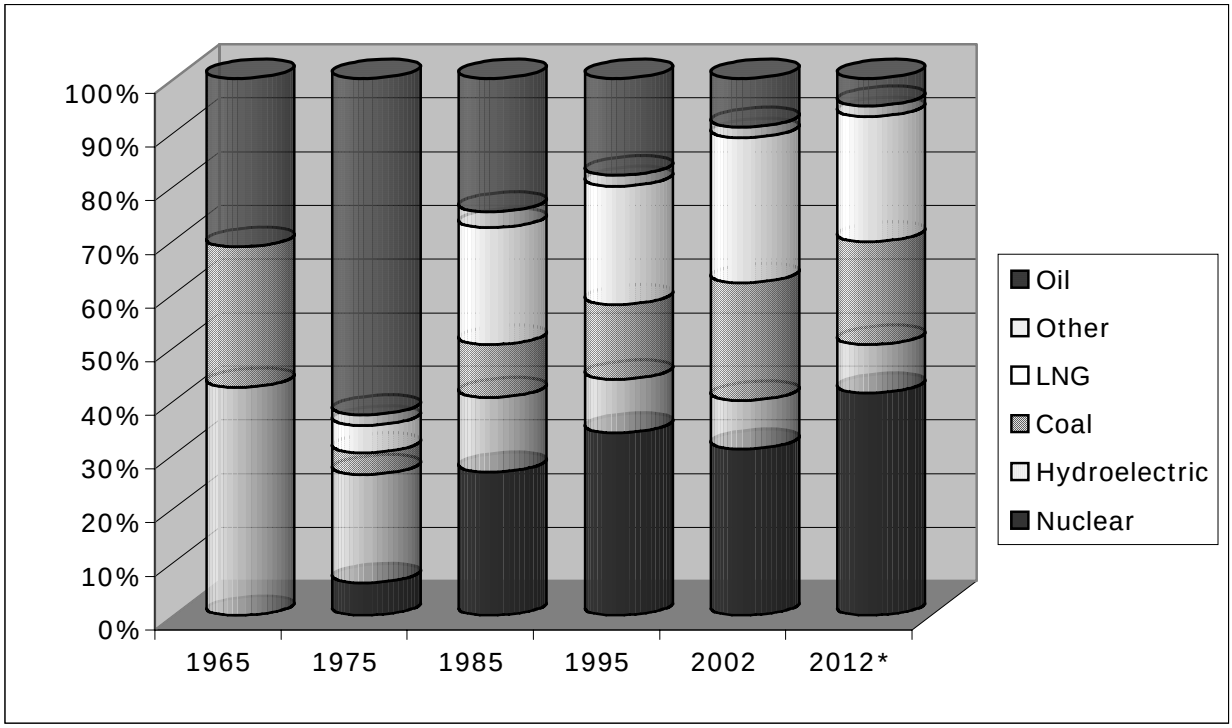
Japan has little in the way of indigenous resources for generating electricity, apart from hydroelectric power, and is therefore very dependent on imports. As can be seen from Figure 21.2 below, the main sources of electricity until the 1970s were oil, coal and hydroelectricity. Japan relied mainly on hydroelectric power until the 1950s when the use of oil expanded because at the time it was cheap and oil power stations could be built quickly to keep up with post-war growth. Oil supplied a peak of 74% of electricity in 1973 when the first oil crisis hit but declined rapidly after that.[11]

As a result of the oil crises of the 1970s, oil became an expensive fuel source and Japan sought to diversify its sources of electricity, relying more on nuclear energy and liquid natural gas (LNG). All the GEC's except Okinawa Electric Power Company constructed nuclear facilities. Today, hydroelectric power, nuclear power, coal and natural gas are used for base load and mid-range load whilst oil is used for peak loads together with pumped storage hydroelectric power.[12]

The 52 existing nuclear rectors operating in Japan supply one third of the nation's electricity, giving it the third largest stock of nuclear power plants in the world, after the US and rapidly catching up with France.[13] It is predicted nuclear power will provide 41% of Japan's electricity by 2012, (see Figure 21.2). Three more reactors

are currently under construction and 8 in advanced stages of planning.[14]

Figure 21.2 Composition Ratio of Generated Electricity by Fuel in Japan



* ProjectedSource of data: 'Electricity Review Japan.' The Federation of Electric Power Companies of Japan, 2004 http://www.fepc.or.jp/english/erj/erj2003-2004.pdf, p. 8.

NUCLEAR ACCIDENTS

The government goal of more nuclear power is despite widespread public opposition to nuclear power. A series of nuclear accidents and cover-ups have raised public concerns about nuclear power (see Table 21.1).

Table 21.1 Accidents[#] and Revelations of Mismanagement in the Industry 1995-2004

Year	Place	Owner	Incident	Radiation Exposure	Scale *	Status
1995	Monju fast-breeder reactor prototype	PNC	Massive coolant leak			still closed
1997	Tokaimura fuel reprocessing	PNC	Fire and explosion	37 workers	3	closed 3

	plant					years
1997	Tokaimura uranium fuel production plant	PNC	False alarm warning that fuel reached critical mass		?	
1997	Fugen advanced thermal reactor	PNC	Radioactive tritium leaked	11 workers	?	temp. closure
1997	Tokaimura radioactive waste storage facility	PNC	Revelations of low-level radiation leaks over 30 years		na	
1999	Tsuraga nuclear power plant	JAPC	Worst ever radioactive coolant leak		1	temp. closure
1999	Tokaimura uranium processing plant	JCO	uncontrolled nuclear chain reaction	>600 people 2 workers die 300,000 residents ordered to stay indoors	4	still closed
2000	Fugen advanced thermal reactor	JNC	Controlling rods in incorrect position		?	temp. closure
2000	Joyo experimental reactor	JNC	Controlling rod malfunction		?	temp. closure
2000	Mihama nuclear power plant	KEPCO	Cracked pipe, coolant leak		1	temp. closure
2001	Hamaoka nuclear power plant	CEPCO	2 unrelated radioactive leaks		1	temp. closure
2002	Fukuishima Daiichi nuclear power plant	TEPCO	Core shroud cracks		1	temp. closure
2002	Tokyo Electric Power Company	TEPCO	Admits it falsified data on maintenance checks		na	temp. closure of all reactor
2002	For a full list of incidents during 2003 see Citizens Nuclear Information Centre (CNIC) at http://cnic.jp/english/newsletter/nit95/nit95articles/nit95significant.html					
2003	For a full list of incidents during 2003 see Citizens Nuclear Information Centre (CNIC) at http://cnic.jp/english/newsletter/nit101/nit101articles/nit101siginc.html					
2004	Tsuruga nuclear power plant	JAPC	Workers sprayed with contaminated water	8 workers	?	
2004	Mihama nuclear power plant	KEPCO	Burst pipe containing high-pressure steam	5 workers killed 6 in hospital	0+	temp. closure

* International Nuclear Event Scale (INES) - from 0 to 7 (Chernobyl=7, Three Mile Island=5)
# Technically only an event of 4 to 7 is an accident, the others are incidents
PNC = government-owned Power Reactor and Nuclear Fuel Development Corp or Donen
JNC = Japan Nuclear Cycle Development Institute, a reformed version of PNC
JCO = private company, wholly owned subsidiary of Sumitomo Metal Mining Co Ltd.
CEPCO = Chubu Electric Power Co.
TEPCO = Tokyo Electric Power Co.
KEPCO = Kansai Electric Power Co.

Source of data: Robert Chesal and Tim Fisher. 'Japan's Nuclear Neglect.' *Radio Netherlands* 10 August 2004. http://www.rnw.nl/hotspots/html/jap040810.html; Jon Choy. 'Deregulation Jolting Japan's Energy Sector.' *JEI Report*(33). 29 August 1997. http://www.jei.org/Archive/JEIR97/9733f.html; 'Chronology - Mishaps at Japan Nuclear Facilities.' *World Environment News* 1 October 1999. http://www.planetark.com/avantgo/dailynewstory.cfm?newsid=3944; 'Japan Shuts Reactor as Precaution against Leaks.' *World Environment News* 15 November 2001. http://www.planetark.com/avantgo/dailynewstory.cfm?newsid=13307; 'Japan Utility Says Nuke Reactor Had Crack in Pipe.' *World Environment News* 11 April 2000. http://www.planetark.com/avantgo/dailynewstory.cfm?newsid=6336; 'Japan's Tepco Sees Better Year after Safety Scandal.' *World Environment News* 19 May 2004. http://www.planetark.com/avantgo/dailynewstory.cfm?newsid=25159; 'Two Japan Nuclear Reactors Malfuntion but No Leak.' *World Environment News* 5 April 2000. http://www.planetark.com/avantgo/dailynewstory.cfm?newsid=6259; Philip White. 'Five Killed in Mihama-3 Accident.' *Nuke Info Tokyo* September/October 2004. http://cnic.jp/english/newsletter/nit102/nit102articles/nit102mihama.html; Miho Yoshikawa. 'Accident a Threat to Japan Nuclear Programme.' *World Environment News* 5 October 1999. http://www.planetark.com/avantgo/dailynewstory.cfm?newsid=3990.

There were efforts to cover up several of these incidents or lessen their perceived extent. The operators of the Monju fast-breeder reactor edited videotapes of the leak to cover up the extent of the accident but this became public and did nothing to reassure the public. Managers at the Tokaimura fuel reprocessing plant, where 37 people were exposed to radiation, ''coerced workers into telling a consistent but false timeline of events''. In addition there were revelations about the poor safety measures undertaken at the centre.[15]

In 2002 Tokyo Electric Power Co. (TEPCO) admitted that had not accurately reported damage to its nuclear power plants for some years.[16]

> The first incident involved hiding cracks in the reactor shroud. This was followed by the discovery that Tokyo Electric Power Co. (TEPCO) had also found cracks in the recirculation piping system, but had failed to report them. Then, there was the cover-up of the results of the leak rate inspection test for the containment vessel…[17]

Poor inspection methods and negligence have also been blamed for some of these accidents such as the latest at Mihama power plant which involved a pipe installed in 1976 and not inspected since, despite warnings about it some months before the accident. Other pipes in the plant, including those in more critical areas, have also gone uninspected.[18]

In 1998 the government agency Power Reactor and Nuclear Fuel Development Corp (PNC), which was under fire for its mismanagement of

nuclear facilities, was replaced with the Japan Nuclear Cycle Development Institute (JNC). JNC is now responsible for nuclear research and development in the field of fast-breeder reactors, high-level radioactive waste disposal and spent fuel reprocessing.[19]

In response to growing public concern about nuclear power, the power companies created a Panel for Restoring Confidence made up of the presidents of the 10 GEUs, the JAPC, the EPDC and Japan Nuclear Fuel Ltd (JNFL).[20] One of the more recent arguments made for nuclear power has been that it aids Japan to meet its Kyoto commitments, however no solution has yet been found for disposing of nuclear waste and the government's efforts to close the nuclear cycle by recycling used uranium into plutonium has been less than successful.

The Nuclear Waste Management Organization (NUMO) was formed in 2000 to solve problems associated with disposal of high-level radioactive waste. Japan had been sending its waste to Europe for reprocessing and importing back the reprocessed waste-—which is stored-—and mixed oxide fuel (MOX), a combination of uranium and plutonium oxides. The government has invested billions of dollars in developing its own reprocessing plant. However there have been a number of scandals over MOX, including the discovery in 1999 that MOX fuel rods arriving in Japan from British Nuclear Fuels Ltd had not been properly inspected and the data on them had been falsified. In addition, Japanese efforts to process and use plutonium and highly-enriched uranium in fast-breeder reactors have not been successful so far and have involved various accidents (see Table 21.1). This has all added to public concern about Japan's nuclear program.[21]

THE IMPETUS FOR DEREGULATION

Several factors have contributed to the high cost of electricity in Japan. The first is the high cost of nuclear power, which, as we saw in previous chapters, requires very high initial investments. In Japan, as elsewhere, nuclear accidents have caused the public to be wary of nuclear power plants and to oppose their location near urban areas. This means that they have to be sited remotely and this adds to the transmission costs.[22] In addition, long lead times are lengthened even further by approval processes designed to ensure safety and reassure the public.

The GEUs have also spent much more on pollution control, maintenance and avoiding blackouts than companies in other parts of the world, especially deregulated companies in the US and Britain.[23] Avoiding blackouts is particularly expensive as Japan suffers from fluctuating electricity usage because of rising usage of electricity-hungry air-conditioning and heating that peaks in mid-summer and mid-winter. Because peak usage is so much higher than other times, some power plants are only used for a short time each day at certain times of the year.[24]

By the 1990s the rising yen mean that Japanese businesses, particularly manufacturing companies, were finding it hard to compete with foreign companies on international markets and they blamed high

electricity prices for contributing to this situation.[25] However Hisao Kibune of the Department of Economics at Nagoya-Gakuin University notes that in in the period 1980-1993 Japanese electricity rates decreased by 13% whilst those in Western countries went up by 30-80% and when compared with the general cost of living in Japan, electricity rates were still falling in the early 1990s (see Figure 21.4).[26] In part this was achieved because rates reached an all time high following the oil crises in the 1970s, and subsequently dropped as oil prices went down again.[27] Similarly, *The Economist* stated in 1995 that ''On a purchasing-power basis, Japanese electricity prices compare well internationally.''[28] Nevertheless, the story that Japanese electricity costs are much higher than the rest of the world helped to promote the case for deregulation.

Additionally, companies found that they were able to produce electricity in-house at a cheaper rate that that charged by the GEUs. This was because fuel costs were declining due to the high yen, and in-house generation was not as capital-intensive as the nuclear power plants that the GEUs depended on. Additionally GEUs had to factor into their rates other costs such as transmission and distribution costs. Nevertheless it led Japanese business leaders to believe that deregulation would help lower costs. They claimed that the cost plus fair return did not provide incentives to reduce costs and increase efficiency in the way that competition would. They argued that competition would encourage more decentralised smaller scale electricity generating technologies to be developed. They also believed that safety regulations could be scaled back in a deregulated system, which would also save money.[29]

Deregulation was also driven in part by what has been called the ''winds of deregulation'' which were blowing worldwide as we have seen in earlier chapters of this book.[30] Today Japan ''considers deregulation a key to future economic success''.[31] This view has been encouraged by nations like the US that see business opportunities for their own corporations. For example, the US Trade Representative in 2000, Charlene Barshefsky, stated that deregulation measures in Japan, achieved under the US-Japan Enhanced Initiative on Deregulation and Competition Policy, ''will translate into substantial gains for U.S. firms doing business in Japan'' because lucrative markets would be opened to these US firms. She claimed that Japanese consumers would also benefit from the lower prices, greater choice and increased innovation that would result. With respect to electricity, ''US firms would be able to produce, sell, and trade power in Japan's $135 billion electric power market'' and the lower electricity prices that would ensue would increase economic growth and create thousands of new jobs.[32] All promises familiar to readers of this book from those who advocate deregulation but promises that have consistently failed to materialise in the real world of electricity deregulation.

DEREGULATION

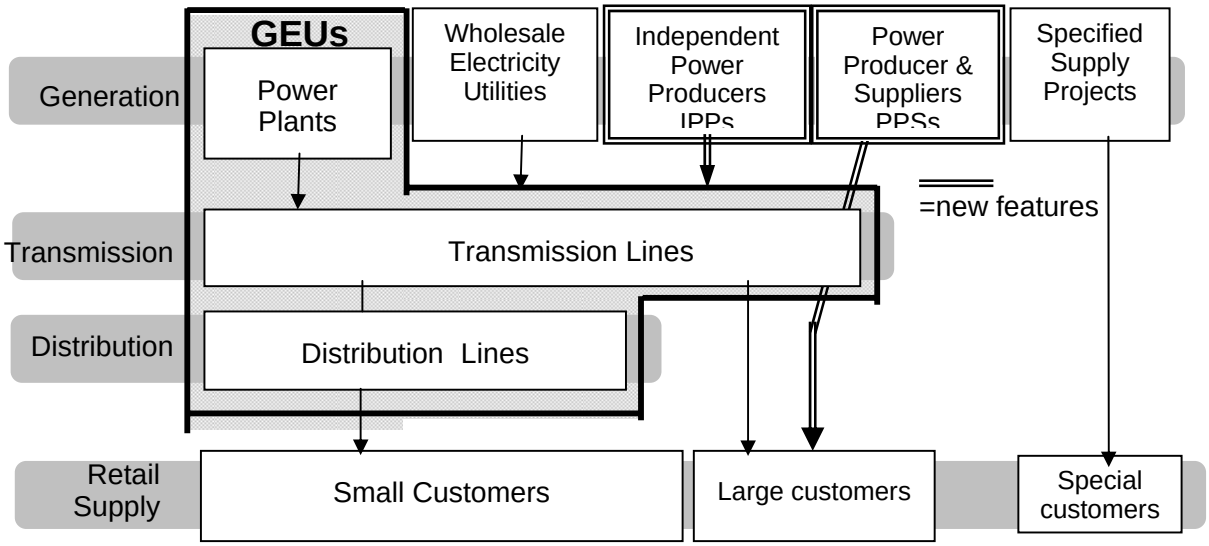
Deregulation in Japan has been fairly gradual. The first step towards deregulation, via amendments to the Electricity Utility Law in 1995,

was to allow the GEUs to buy electricity from outside sources including company in-house generators that generated more electricity than they needed and independent power producers (IPPs). A system of competitive tendering was introduced and approval conditions eased to facilitate this.[33] It was expected this would enable the GEUs to meet peak demand without building new capital-intensive power plants and to introduce competition into the wholesale electricity market. Additionally the utilities could seek tenders for construction of new power plants from a wider range of firms, including foreign firms.[34]

This was not a very satisfactory situation for newcomers to the market who were expected to compete with well-established GEUs by selling cheaper electricity to them. They could expect sales to be mainly at peak periods. This did not offer much of an incentive to invest in new generating plant, so the new IPPs derive their power from surplus power from in-house generators.[35]

A further amendment to the Law in 1999 meant that from 2000 any electricity company could compete to supply customers using more than 2MW of electricity (see Figure 21.3). This amounted to just under one third of the market (30%). Electricity rates for these large customers were deregulated and transmission lines were opened up for access by third parties, although the GEUs that owned them still set the rates and conditions of their use. GEUs were still obliged to meet the energy demand of other consumers and to supply electricity to the contestable customers if the new companies failed or had a shortfall in their supply.[36]

Figure 21.3 Electricity Supply System in 2000



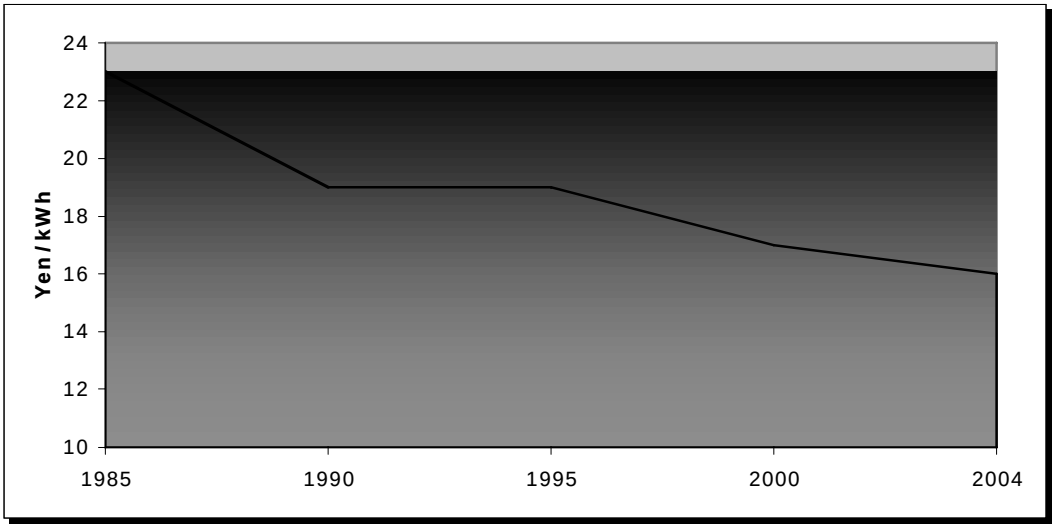
Adapted from: Toshihiko Furuya. *Deregulation of the Electric Power Industry in Japan.* Washington: Tokyo Electric Power Company. http://www.wnfm.com/2001%20Annual%20Meeting%20PPT/Toshihiko%20Furuya%20Presentation.pdf

The GEUs were also now able to supply large customers in other regions but there was little competition between GEUs in this way.[37] The GEUs can also invest in other industries, as their counterparts

in Europe and US can. The market was opened to electricity traders-—companies like Enron-—that buy and sell electricity but don't necessarily produce it.[38] Nevertheless, Masanori Maruo, a utilities analyst with Deutsche Securities foresees that in the long term the number of utilities will be reduced as competition 'weeds' out the smaller electricity producers.[39]

Prices did drop after the 1999 amendment came into play but this can be attributed to lower interest rates, since the price decrease was for both contestable and uncontestable consumers and there were few new entrants into the market and ''little revealed competition between the incumbents''.[40] Also the price drops can be seen as part of a longer trend of falling prices since the 1980s (see Figure 21.4) and as a strategy by the GEUs to undercut potential competitors, even before they get established.[41]

Figure 21.4 Average Electricity Prices for all Japanese Utilities



Source of data: Minoru Takahashi. 'The Current Status of Electric Power Industry Deregulation in Japan and the Influence of the California Crisis.' *Japan and the World Economy* 14, 2002, p. 343; David Pilling. 'Tepco Pre-Empts Dereguation with Price Cut.' *Financial Times*. 1 October 2004, p. 9.

By 2001 there were 41 IPPs and 9 new entrants to retail supply called Power Producer & Suppliers (PPSs).[42] By the end of 2003 PPSs supplied less than 1 percent of the market (1.7 percent of the contestable market) and by October 2004 TEPCO, for instance, had only lost 1 percent of its electricity sales to competitors. Some customers avoided PPSs because of their inability to promise reliable supply because they lacked a backup supply in case of emergency.[43]

Because of the risks involved, newcomers to the market tend to have backers with deep pockets such as Diamond Power, owned by Mitsubishi, and Ennet, owned by Nippon Telegraph and Telephone (NTT). The only

PPS proposing to build a major power plant at this stage is a joint venture of Tokyo Gas and Royal Dutch/Shell. [44]

A bill passed in 2003 will enable electricity suppliers to compete from 2005 for customers using more than 50kW of electricity such as small and medium businesses and apartment buildings. This means almost two thirds (63%) of electricity sales will be contestable. Complete contestability, covering all consumers, is planned for 2007. An independent organization will be set up to govern transmission and distribution, which will remain in the ownership of the ten GEUs.[45] Currently if two GEUs want to trade power they have to pay transmission fees to each of the GEUs geographically located between them and the price for this is set by the GEUs themselves.[46]

A Power Exchange will be soon established to facilitate wholesale trade and price setting. This is welcomed by the large GEUs which see it as a way of postponing the need to invest in new power plants.[47] They may also see an opportunity to use their market power to influence prices in the way large power companies have done in the US and Britain. It is also expected that some of Japan's large trading companies such as Mitsubishi Corporation, Mitsui and Marubeni, will become involved in electricity trading.[48]

THE FORECAST

Whether householders and small businesses will gain from the deregulation of retail electricity supply remains to be seen. As we have seen in the rest of the book, in most places where electricity was deregulated, retail electricity prices increased, often dramatically, for households and small businesses. In particular where a power exchange is in place and there are a number of large powerful companies market manipulation has taken place and there is no reason to suppose that Japan will be immune from this phenomenon, once its power exchange is up and running. Only an excess of supply would prevent this and it is evident that the rate of investment in power plants has slowed considerably with deregulation.

Service and reliability have also declined world wide in deregulated, privatised electricity systems because the service obligations of regulated electricity companies are replaced by short-term commercial goals. The emphasis on energy security and reliability, which was maintained at a high level by the GEUs, gave way to a concern with costs.[49] According to the International Energy Agency deregulation of the energy sector in Japan ''has resulted in increasing cost sensitivity and conflicts between the objectives of economic efficiency, environmental protection and energy security.''[50] Capital investment in the sector has fallen.[51]

The supposed efficiency gains to be made by private, competitive companies, are usually made through short term cost savings, which include cutting the quality or level of service rather than offering the same level of service for less money. Sometimes return on investment has been increased by charging more for the service. Often cost savings have been made by lowering rates of pay and conditions

for workers and making thousands of electricity workers redundant. Full-time permanent employment has been increasingly replaced by part-time and temporary work.[52] In this way private enterprises may seem to be more efficient but the gains to shareholders are at the expense of workers and consumers, who suffer a decline in service levels.

Another easy way to cut costs, although short-sighted, is to cut safety, maintenance, training and research budgets. Old equipment is not regularly serviced nor replaced in advance of likely failure. As a result, accidents and equipment-related blackouts increase as do blackouts related to network congestion because planning and responsibility for network maintenance and development is not a market priority.

This is of particular concern for nuclear power stations. In Japan the companies that own aging nuclear reactors are having to compete with newer companies that have cheaper sources of electricity and are so seeking to cut their own costs. One way of doing this is to reduce inspections or carry them out whilst the reactors are still operating, which is how the workers died in the Mihama plant accident in 2004.[53] The Japanese Citizen's Nuclear Information Center said of the accident:

> first lesson is that NISA and the Japanese power companies don't learn lessons, certainly not ones that are likely to cost them money. Profits are consistently given greater priority than safety. One would expect this tendency to be even more pronounced in a competitive electricity market.[54]

Blackouts have also increased worldwide as a result of lower reserve levels of generation capacity caused by the perverse incentives of the market system that give greater profits to private generating companies during times of electricity shortages. These perverse incentives not only discourage investment in new generation capacity but encourage withholding of electricity during times of peak demand to send prices higher.

Privatisation often occurs as a way of reducing public debt and the money raised from electricity asset sales is often presented as if it is all bonus revenue for a government. However governments only gain in the long-term if the savings in interest repayments from reduced budget deficits, together with the tax payments from the new private companies, exceed the lost dividends, plus the additional costs resulting from market failures and abuses of power by the private companies. This is a dubious assumption at best.

J-Power is to be privatised and will be another competitor in the electricity generation market. The share floatation for the company, which is 83% owned by the government and 17% owned by the GEUs, is expected to yield $2 billion. The sale is expected to reduce Japan's public debt, although the government will also lose the profits from the company.[55]

Private companies, freed from social obligations, are able to undertake profitable activities whilst the government continues to

pay for unprofitable aspects of electricity supply like environmental protection and equitable access. Previously governments were able to subsidise the unprofitable activities with the profitable ones. The inability to spread costs across a whole service means more expense to taxpayers and savings to industry.

Nuclear power is expensive and requires government support. Nuclear waste has to be stored or reprocessed. Reprocessed uranium is much more expensive than conventional uranium and the GEUs ''have privately welcomed the public hostility to MOX fuel, promising not to introduce it against the wishes of local residents''.[56] Yet the government has invested billions of dollars (trillions of yen) in the project and has stockpiles of plutonium with no other use, apart from weapons.

When bankruptcies are threatened governments have to be prepared to step in and bail out private companies so as to secure the electricity supply, particularly when nuclear power stations are involved as has been seen with British Energy in the UK where the government is paying billions of dollars to keep it going.[57] Taxpayers clearly get the worst of both worlds. They no longer reap dividends from electricity production when it is profitable, but they still have to pick up the bill when it is not.

The folly of relying on markets for fostering renewable energy has been recognised in many countries with 'liberalised' electricity systems and governments are again resorting to regulations to increase renewable energy use. In California utilities are now required by the government to meet 20 percent of their supply with renewable sources.[58] Similarly in Japan, wind and solar power are minimal and their development depends on government support. When the market decides on the fuel source there is no incentive to take account of the environmental costs of that fuel source, nor does it take account of issues that have been important to the Japanese government such as reduced dependence on fuel imports.

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[1] Jon Choy. 'Deregulation Jolting Japan's Energy Sector.' *JEI Report* (33). 29 August, 1997
[2] FEPC. 'Electricity Review Japan.' The Federation of Electric Power Companies of Japan 2004, p. 1.
[3] Bayan Rahman. 'Japan Plans Deregulation of Electricity.' *Financial Times*. 27 February, 2003, p. 1.
[4] Hisabe Kibune. 'Regulatory Reform and Its Effect in the Japanese Electric Utility Industry.' *Economic Analysis Series* (142). December, 1995, p. 93.
[5] JAPC. 'The Japan Atomic Power Company.' The Japan Atomic Power Company. Accessed on 8 October 2004. http://www.japc.co.jp/english/index.htm.
[6] Kibune. 'Regulatory Reform.' , p. 93.
[7] Ibid., , pp. 92-3.
[8] Ibid., , p. 94.
[9] Ibid., , pp. 94-5.
[10] FEPC. 'Electricity Review Japan.' , p. 3.
[11] Kibune. 'Regulatory Reform.' , p. 99.
[12] FEPC. 'Electricity Review Japan.' , p. 9.
[13] Robert Chesal and Tim Fisher. 'Japan's Nuclear Neglect.' *Radio Netherlands* 10 August, 2004
[14] FEPC. 'Electricity Review Japan.' , p. 11.
[15] Choy. 'Deregulation Jolting Japan's Energy Sector.'

[16] Miho Yoshikawa. 'Tepco Scandal Puts Focus on Japan Nuclear Policy.' *World Environment News* 4 September, 2002
[17] Kazuyuki Takemoto. 'Looking Back over a Year of Tepco's Cover-Up.' *Nuke Info Tokyo* September/October, 2003
[18] Chesal and Fisher. 'Japan's Nuclear Neglect.'
[19] 'Two Japan Nuclear Reactors Malfuntion but No Leak.' *World Environment News* 5 April, 2000
[20] FEPC. 'Electricity Review Japan.' , p. 11.
[21] Bethan Hutton. 'Quiet Revolution Slowly Transforms Generating Sector.' *Financial Times*. 10 June, 2002, p. 4; 'A Pox on Mox; Nuclear Power in Japan.' *The Economist* 2 June, 2001, p. 3.
[22] Kibune. 'Regulatory Reform.' , p. 99.
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