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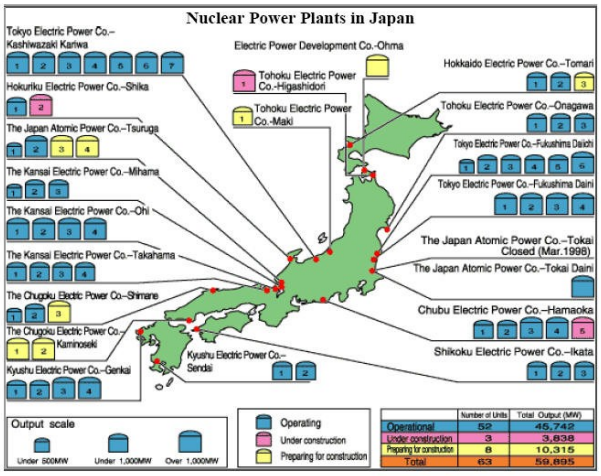
By Tony Barrell

Nuclear power stations now produce about 17% of the world's electricity. In France and Lithuania nearly 80%, in Britain about 25%. Popular attitudes to nuclear power in other countries vary from apathy and indifference to fear and loathing. For the most part it would be fair to say, that as long as they don't contaminate the environment, and there are no blackouts, nuclear reactors must be a good thing. What has been the record of the countries that have been using nuclear power for decades?

Nuclear power station at Leibstadts, Switzerland

Japan's Nuclear Power Industry

The one country I know something about is a front line nuclear power – Japan. There are now 55 working nuclear power stations — known in Japan by the acronym *genpatsu* — which generate about a third of the country's electricity. The first genpatsu came on line in 1966, the most recent forty years later, in March 2006. A dozen more are planned to be operational in the next decade. So far, only one reactor has been decommissioned and the Japanese government is racing to expand nuclear power.[1]



Although in principle plans were devised in the 1950s, in 1973 Japan's genpatsu building program was defined as a 'national strategic priority'. The nuclear industry is dominated by nine regional power utilities and several big conglomerates like Mitsubishi, Toshiba and Hitachi, which construct power plants, and they are closely aligned to the central bureaucracy at the Ministry of Economics Trade and Industry (METI — which used to be MITI). As in France, there are generous government subsidies for research and development — much more than for renewable energy projects — and other significant costs are not included in the unit

price of electricity, such as the eventual expense of decommissioning, a cost which is discreetly assumed taxpayers will fund to the tune of several billion dollars. Other costs such as spending on remote communities to persuade them to accept a genpatsu — or four — are also defrayed. Japanese nuclear power is not cheap by any measure. By the year 2010 it will be the most expensive (measured per kwh) in the world.

Not Blessed by the Gods

The central government, led by METI, has for decades made it a matter of unquestionable logic that Japan needs nuclear power for more and more of its electricity. This is usually explained in terms of a visionary response to Japan's poor natural inheritance, that because it has few energy resources (no oil or gas and only now unworkable coal mines) Japan has never been 'blessed by the gods'. There is a mix of aggrieved nationalism, self-pity and mysticism informing this often-repeated phrase. It implies that the Japanese are entitled to compensate for having been treated badly when the natural wealth of the world was divided amongst the nations. In the past, Japan's nationalists, like their counterparts in other colonial nations, assumed it was their right, and destiny, to make up for their mother country's deficiencies by seizing resources of those countries which did not know how to use them. They exercised that destiny first in Korea then China (where there was abundant coal) and later, as the Pacific War approached, the 'lesser nations' of Southeast Asia, like Indonesia (where there was oil and timber).

Whatever its origins, in the decades since Japan was stripped of the empire, 'not blessed by the gods' has endured and recurred in many documents, which explain Japan's energy/security problem. This is particularly the case since the late 1960s, Sometimes, it's in a preface or preamble at the beginning of an official speech or paper to explain and justify whatever assertions follow, and has been repeatedly expressed in various versions of METI's many instalments of Japan's 'Long Term Program' for energy and in numerous expositions by the Ministry of Foreign Affairs.

The World Energy Race

In recent years Japan's trading infrastructure conglomerates have scoured the world for cheap energy and have often driven hard bargains with host countries. An example would be the current development of oil and gas offshore of Russia's Sakhalin island, a joint venture by Shell, Mitsui and Mitsubishi (who share the Woodside LNG venture in Western Australia) to develop undersea oil and gas in the sea of Okhotsk. Before the Second World War Japanese companies (including Mitsui) were involved in the mining of Sakhalin's oil and coal. The Sakhalin consortium's Production Sharing Agreement with Russia was drawn up, in 1994, so that all costs (suddenly doubled in 2005 to US $20 billion) must to be paid off before any rewards need be shared with Russia or Sakhalin, and royalties have been set at a stingy level. Critics like Ian Rutledge of the Sheffield Energy & Resources Information Centre suggest the Sakhalin PSA is worse (for the host) than some deals done with very inexperienced third world countries. The project has recently been threatened by the Russian government, ostensibly for 'environmental' reasons, but certainly in part to force a re-negotiation of the original PSA deal. Shell, Mitsubishi and Mitsui have expressed outrage at the threat, but have no choice but to comply.

Russian Greenpeace activists hold a banner reading,
"Stop the financing of Sakhalin oil" in June 2005, Moscow.

In all the current discussion about the realities, the prospects, the economics and the environmental impact of nuclear power generators, it's easy to forget what a reactor is and does. It makes steam and irradiated spent fuel — plutonium — but because the fission process generates temperatures way in excess of the boiling point of water, a great deal of the engineering technology in a power reactor goes into its cooling system.

In the 1970s, a Fast Breeder Reactor (FBR) program, was proclaimed as a means by which Japan could break with the curse of the gods, and make for itself an everlasting supply of 'indigenous' fuel. By creating re-usable plutonium in a suite of FBRs Japan could, by burning this material in conventional reactors, become independent of uranium suppliers like Australia. In short, a possible technical solution to destiny's disdain.

The *Genpatsu at Work*

I have visited a few genpatsu over the past decade or so, especially on the Japan Sea coast, where one region, the prefecture of Fukui is known unofficially as the 'nuclear Ginza', because it has genpatsu whose numbers rival the department stores in Tokyo's Ginza shopping precinct. Japan's only FBR is on the sea front overlooking the port of a tiny village in Fukui, and is one of the few genpatsu that has an official nickname — Monju. It is currently in mothballs but, eventually, if it works as planned, Monju will create a supply of plutonium in quantities greater than it consumes. When it was operating, briefly in the 1990s, Monju was cooled by liquid sodium, but the pipes constructed to circulate it through the reactor were sub-standard. Or the welds were, because in December 1995, one of them ruptured and out flowed liquid sodium which, although it wasn't radioactive, burst into flames at around 1500ºC, melted some of Monju's steel structures, then solidified into several tonnes of useless, metallic gunk.

Monju reactor was shut down in 1995 after a serious accident.

Corners had been cut in Monju's construction and the company responsible (the Power Reactor & Nuclear Fuel Development Corporation —a corporatised government body widely known outside Japan as a 'quango') was found to have covered up the accident, gagged its employees and cut incriminating scenes from a Closed Circuit security tape of the incident. Such behaviour on the part of the authorities and the industry has dogged the image and credibility of Japan's nuclear industry for decades, where almost every accident (always an 'incident' in official statements in Japan as

elsewhere) has been followed by attempts to hide it or play it down. Many people who might normally support nuclear power have been alarmed by this tendency, and, as people's enthusiasm for grass roots democracy has grown in Japan over the past two decades, 'citizens movements' which oppose the proliferation of genpatsu, have made the industry's, secretive responses to relatively minor crises the central focus of their opposition.

Fukui's reactor presence is around the coastline of the wide Wakasa Bay — famous all over the country for its many coves, inlets and beaches, oysters, a particular kind of 'silky' seaweed and sushi made from mackerel — which now has fifteen genpatsu in all (including Monju). In the centre of Wakasa Bay one of Mihama's three Pressurised Water Reactors broods over a beautiful sandy strand from another beach across the water, but in the tourist brochures I saw, there was nothing to disturb the scene. The sea was green, the cloudless sky was blue, seagulls and terns darted over the waves, happy children made sand castles, without a glance over their shoulder at what should have been there. Mihama's No 1 genpatsu had been airbrushed out of existence.

Not many kilometres to the south is Japan's largest freshwater lake, Biwa, from which Kyoto, Osaka and the other cities of Kansai draw their drinking supplies. To get to Fukui from Kyoto you take a semi-express train called 'Thunderbird' which skirts the western edge of the lake to Tsuruga, where there are two genpatsu, one, a Boiling Water Reactor built in 1969, was the first in Fukui. It was closed down for maintenance when I visited, and must be now getting close to the end of its life. Japan's oldest operational power reactor is at Tokai, in Ibaraki prefecture on the Pacific Ocean coast, just north of Tokyo, and started working in 1966. Another, close by, dating from the same year is the only one now being decommissioned — a process which will take seventeen years.

On my visit to Fukui there were no bikinis on the beaches of Wakasa Bay. It was the middle of the coldest January for many years and a blizzard had bottomed temperatures at -20ºC, but although it's crowded here in August, I was amazed to see people in the water in the dead of winter, a day after a blizzard. They were surfers, half a dozen of them, riding the tube in sleet at Takahama, and around the bay, going east towards the prefectural town of Fukui, at the fishing village of Shiraki, protected by a wide concrete jetty, in the lee of Monju, two very hardy young men were waiting out the back for a decent wave. As the solid grey waves crashed I could only guess how cold the water was, the mid-day air temperature was near to -15°C. Of course, they had wet suits, but one of them was barefoot. These Japan Sea riders may well be the hardiest surfers anywhere in the world.

Monju got its name from Monju Bosatsu, or Manjushiri, the *bhodisattva* who sits on Buddha's left as the 'protector of wisdom'. Monju is Japan's second FBR, the first one, an experimental model, also in Fukui, has the name 'Fugen', the bodhisattva who sits at the right of Buddha, and represents 'mercy'. Perhaps these names were chosen by the Power Reactor & Nuclear Fuel Development Corporation (PNC) as another way of linking their industry with the gods. A Buddhist monk in the nearby town of Obama (where there are no nuclear power stations, yet) told me he thought it 'despicable' that such holy names be used to describe 'the devil's furnace'. It's from his famous temple's spring that pure water is sent every year to the Todaiji temple in Nara for a thousand year old Buddhist ceremony. In 2005, Japan's supreme court gave PNC, the operators, permission to re-start Monju in 2008, however anti-nuclear activists in Fukui says it is very risky to start-up any dormant nuclear reactor, but especially a FBR, that has been inactive for more than a decade. It's estimated that so far the Monju project has spent $9 billion and the 2008 startup will cost a further $180 million.

The great spurt of genpatsu-building in Japan followed the oil crisis decade of the 1970s. These days local communities are much more active and have a predictable but effective NIMBY agenda. Not that there aren't supporters. For more than a decade Japan's nuclear industry has led the campaign to characterise nuclear energy as 'green'. In 1997, Keidanren, the peak business group declared that more nuclear power was the only way to reduce CO2 emissions and that solar and other renewable solutions were but 'fantasies', and in 2002 the government adopted Keidanren's position as a way of complying with the Kyoto Protocols.

The reason the industry has been tolerated, if not supported with enthusiasm, by many communities is because each nuclear installation has come with generous infrastructural sweeteners, paid for by the central government: schools, roads, bridges, sewerage systems, to persuade local prefectures, to say Yes. Comparatively poor regions, like remote Fukui, became dependent on handouts to get standard amenities — the main reason for the proliferation of genpatsu 'clusters'. It also has to be said that the cost-plus economics of construction, again with generous government support, encouraged genpatsu builders to keep putting forward proposals for more. It has been very profitable to build genpatsu.

Saying No to Nuclear Power

However, some Fukui towns, like Obama have said 'no thank you', and Mihama, which has three aging PWRs has said 'no more'. This upsets some local business people who have complained bitterly that the anti-nuclear faction had stopped a growth industry. As one Obama bar-owner told Rick Tanaka and me (his only customers one weekend evening) 'my place is empty because the seasonal workers who come and clean these places out aren't in here.'

In Niigata, along the coast north from Fukui, there is a cluster of seven BWRs around Kashiwazaki — one of them the biggest in the world — again mostly located on north facing beaches and coves. A little further on, near the seaside town of Maki, there was to have been another. Originally planned more than thirty years ago, local people persuaded the town's mayor to sponsor a (legally non-binding) public referendum of Maki voters, which opposed the plan for the reactor in 1995. I heard from the Citizens Nuclear Information Centre (in Tokyo) that when the power company originally took a lease on the land in 1965, it claimed it was going to build a health resort. While the industry can be less than frank about its real intentions, the anti-genpatsu movement has used tactics you could only describe as devious. After the Maki No vote, the mayor (Takaaki Sasaguchi, a sake brewer) used his power to buy the site at Kakumihama, less than a hectare, nothing more than a bit of crumbling earth cliff, with rough tussocky grass and a sick looking drain running through it directly on to the beach, which he then sold on to the protesters' organization.

On Christmas Eve 2003, the developer, the Tohoku Electric Power Company, abandoned its plans for Maki's genpatsu. The same then happened at Suzu in the Ishikawa prefecture — on the Japan Sea coast between Fukui and Niigata — and in Mie prefecture south of Kyoto on the Inland Sea. All were stopped by similar moves by local citizens.

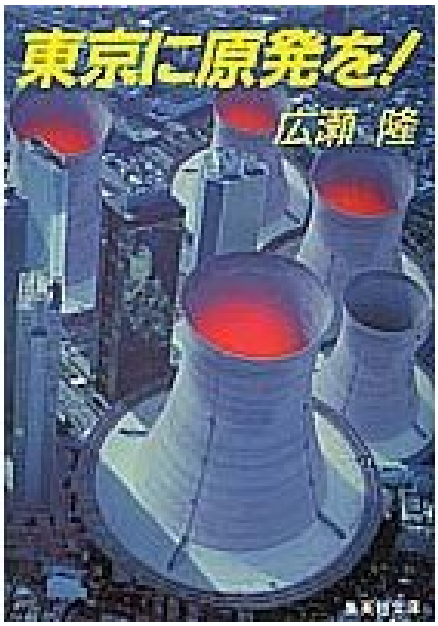
Any Japanese town or prefecture can organise a referendum against a development, a dam, a by-pass, even, in the case of Okinawa, an American base, and although the result doesn't carry any weight in law, politicians are very wary of going against big No votes. Ever since 1999, when the Japanese government admitted it was wrong to use riot police to forcibly evict farmers for the expansion of Tokyo's international airport at Narita in the late 1960s, there's been squeamishness about going against grassroot revolts.

Anti-nuclear march in Japan, Aug. 2006.

Kakumihama is a wild spot. Even in summer there are only well wrapped walkers on the beach, but on a clear day, the Kashiwazaki cluster can be seen on the horizon to the south. This coast reminded me of the shores of East Anglia around Southwold, Dunwich and Warbleswick, in Suffolk, looking towards the great, grey slab of the Sizewell nuclear complex. Japan and Britain are twin souls when it comes to planting nuclear power stations at the seaside. Every single genpatsu is on the coast, from Tomari on the western coast of Hokkaido, to the far south coast of Kyushu at Sendai. The French don't bother about hiding them away. There they are right next to the TGV line between Paris and Lyon. The only serious difference might be the geology — most of Japan is seismic, prone to earthquakes or tremors, and the coast is no exception, another focus of the anti-genpatsu movement.

The Citizens Anti-Nuclear Movement

Mostly, people who have been opposing the building of new genpatsu over the past couple of decades are loosely described in Japan as 'citizens groups', local, one-issue coalitions that form alliances against dams, airports, chemical plants, genpatsu. Some are Green Party members, others are just single-minded individuals like Takashi Hirose who travelled the country, solo, addressing small meetings in school and community halls briefing ordinary people on safety and security issues. One of his main themes: if they are safe why not build them out in the open near big population centres, why hide them away on the Japan Sea coast? He had a best seller in 1982, titled *Bring the Nukes to Tokyo*. On the cover: a PWR in the middle of Shinjuku, suggesting that if they were indeed as benign as the industry proclaimed, why hide them in Fukui?

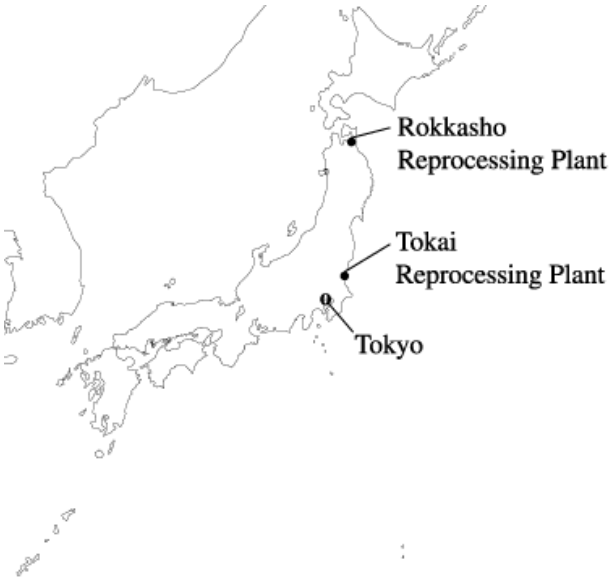


Jacket of Hirose Takashi's *Tokyo ni Genpatsu o (Bring the Nukes to Tokyo)*.

When writer, researcher, translator, Rick Tanaka, and well known Australian documentary film maker Tom Zubricky and I visited the far north eastern corner of the main island of Honshu in January 1989, meeting citizens groups for a film project, we inspected the site of what was to have been a huge 'enterprise

zone' on the peninsula of Shimokita, one of Japan's bleakest regions, in the far north east corner of Aomori prefecture. Around the hamlet of Rokkasho, a new town of factories was to have been built, but no commercial investors found this remote opportunity appealing, so the government decided it could be the ideal location for Japan's nuclear industry to create a fuel-cycle complex: enrichment, reprocessing — Japan would re-process all its spent fuel (instead of sending it to France or Britain by sea) — the production of MOX (a mixture of uranium oxide and spent fuel already used in France, Germany, Belgium and Switzerland), high level waste storage and, planned for 2015, another FBR. The entire project was also the brainchild of METI's Long Term Vision, and put under the tutelage of Japan Nuclear Fuel Limited, which is owned by the power utilities and the nuclear industry.

Way back when it was just a building site, we met local opponents — organic apple farmers, housewives, students —who hated the idea and we wandered around the vast expanse of frosted mud trying to imagine what the finished complex would look like. The only completed building was a well appointed visitors centre with audio-visual aids, brochures, posters, diagrams, and light boxes, much of the material aimed at school children and, as we browsed, a party of fifty or so ten year olds came by in a coach. Outside there was nothing but ice and snow and the occasional fighter-bomber from nearby Misawa US air base diving out of the clouds with a supersonic bang and then climbing vertically — just testing, or showing off. But things have moved on at Rokkasho: the enrichment plant has been working since 1992, the waste storage facilities have been completed, at a cost of US$ 20 billions the re-processing plant is supposed to start working in 2007 and the MOX mixing plant by 2009.



The plan is that enough of Japan's existing 55 genpatsu will be converted to burn all the MOX produced at Rokkasho. There are doubts, however: not all the power utilities are sure their reactors can be adapted for the purpose, and local authorities which host those that have already been designated to burn MOX (only about ten), are not happy that the back roads and byways that lead to remote genpatsu locations will see regular traffic by trucks carrying a cargo that includes plutonium. More aggressive opponents of the MOX option say it will never use up all the plutonium being created in Japan and so will therefore lead, inevitably to a stockpile, which could be used in sweapons.

As with other countries, few of Japan's nuclear power plants have been de-commissioned. Some have been shut down for periods because of accidents and refits, or, like Monju, mothballed, but not one has been dismantled and cleaned up. The fact that no-one has decided who will pay for that process, or worked out how much it will cost, has kept some plants going longer than was originally intended. Recent calculations suggest that Britain's old reactors will cost a colossal £90 billion ($175 billion) to decommission. At least ten Japanese reactors are approaching or past their use-by

dates. Decommissioning will most likely end up being a taxpayer's obligation, but that cost has never been included in the price that the Japanese nuclear industry has charged for its electricity. One reason why it is supposedly 'cheaper'. The total cost of nuclear power has never been transparent or tested by the market. Some critics in Japan have suggested that the amount of electricity generated by genpatsu was, for a while in the 1990s, in excess of demand for it, and that as more and more reactors came on line, ways to consume the excess had to be developed in order to use it up. Electricity still can't be 'stored'.

Growing Demand for Power

Since I started visiting Japan more than twenty years ago, I have noticed how as with the rest of the developed world many new electricity-consuming items have come into use in ordinary homes. Air conditioning would be the biggest innovation. Rather than the dead of winter, it's steamy August that now sees the peak of electricity consumption as hundreds of thousands of households switch on their air conditioning units. But there are many smaller energy-greedy items which every home seems to have installed without question. Over the past two or three years, aside from computers in several rooms and sometimes FAX machines, there are HDTV screens, sounds systems, even underfloor heating. I have not been in a Japanese house, including those of NIMBY advocates, political activists, anti-genpatsu campaigners and Greens, that did not have a toilet seat warmer, usually with a complex digital electronic timer and temperature pre-set controls. A small example of the widespread adoption everywhere of user-friendly electrical devices.

On the grander, national scale the great user is the train system, urban, suburban and national. Bullet trains use a lot of grid power, but they may eventually be joined by the ultra high speed magnetic levitation train (travelling at 500 kph) now in its R&D phase along a slow-speed version serving nine stations in Aichi prefecture. It's been calculated by critics (and denied by its promoters) that to run this kind of very, very fast train successfully between Tokyo and Osaka (costing $82 billion to build) a Maglev system might require two or three dedicated nuclear power generators to provide its current.

The Japanese government will have its work cut out for it trying to prove that the Rokkasho complex is dedicated to the creation of 'indigenous' energy through 'plutonium utilisation', rather than proliferation, that all excess or 'surplus' plutonium will be reprocessed. All in all, the government says that Rokkasho can, and will, reprocess 800 tons of spent fuel in a year — the combined output of all nine regional power utilities — and that this will then be blended with MOX and then disposed of completely in reactors around the country. If all works according to METI's plan, there will be no stockpile for use in nuclear weapons. It will all go up in smoke in genpatsu.

But while government and industry say all Japan's surplus plutonium (it already has 40 tons) will gradually disappear, critics say even MOX can become weapons-grade material, and around the remote prefectures that host those 55 genpatsu, there are doubts that they can all be adapted to burn MOX, so even the plutonium already in existence may not disappear. The nine power utilities are not all committed to MOX, and several prefectures don't want it moving through their narrow roads and lanes to reactors on the coast. These doubts and niggles have been there ever since the plan was first announced, years before I trudged around the Rokkasho site in the winter of 1989. Now, says Greenpeace, that reprocessing plant that goes into action next year is, like most nuclear fission planning, 'a relic' of 1950s thinking.

Japan's Quest for Nuclear Weapons

So, the elephant in the *tatami* room is, of

course, nuclear weapons, or at least the capability and capacity that the exponential generation of spent fuel, and its re-processing might enable, if Japan were to make the political decision to become a true nuclear power — closer now than it has been at any time since the Nakasone era of the mid-1980s. Not everyone believes Japan will *not* stockpile plutonium, a perception which could undermine Japan's record as an enthusiastic supporter of nuclear non-proliferation, one already tarnished by its dogged support for US nuclear policies. Anti-nuclear campaigner Takashi Hirose recently claimed that the only reason North Korea had thrown its scarce resources into developing nuclear bombs and rocketry, was because it perceived Japan to be a definite nuclear threat. India on the other hand, still a non-signatory to the Nuclear Non-Proliferation Treaty, has not been criticised let alone penalised for its nuclear expansionism, and Japan is now actively seeking contracts for "civilian" nuclear power in India.

On the Japan side, the more nationalist politicians have consistently played up the North Korean menace, the more likely their constituents might be to accept the abandonment of the antique but enduring 'three non-nuclear principles', first declared by prime minister Sato in 1967, when he decided Japan would never possess, create or, import nuclear weapons. For that Sato got the Nobel Peace prize.

It isn't just China and North Korea who complain about the drift by Prime Minister Koizumi's government towards a more nationalistic and perhaps militaristic posture. South Korea, a long time Cold War consort, if not ally, frequently criticises Japan for re-adopting imperialistic attitudes and ambitions, and sees the legal rehabilitation of the paraphernalia of Empire — the flag, the national anthem, the provocative tribute to war criminals honoured at the Yasukuni shrine in Tokyo, and the persistent effort by conservatives to 'reform' the 1947 constitution which commits Japan only to self-defence and non-armed involvement overseas — as deliberate, calculated provocations. So far Prime Minister Abe has made it clear he does not intend to make high profile visits to Yasukuni, but a lot of diplomatic damage control needs to be done for his posture to be convincing.

South Korean protesters shout slogans at an anti-Japan rally in front of the Japanese embassy in Seoul June 17, 2005. Dozens of civic leaders demanded that Japan's Prime Minister Koizumi Junichiro stop visiting Yasukuni Shrine in Tokyo.

I remember first visiting Japan in autumn 1983 and discovering with some surprise that Tokyo had a schedule of official planned blackouts, an energy-saving policy instituted after the oil price shocks over the previous decade. The Japanese seemed to be very co-operative even compliant, as compulsory two-hour power cuts came into

force every afternoon. It reminded me of the three-day week in Britain, without the grumbling.

In those days there was not much obvious waste. Old men would slowly wander around Tokyo neighbourhoods collecting swathes of cardboard piled on to trolleys for recycling, and the only things people threw away were perfectly usable but outmoded TV sets, sound systems and fax machines, neatly arranged next to their pot plants on the pavement.

Traditional attitudes (pre-war if you like) were imbued with the habit of abstemious re-use: recycling paper, glass, everything, was a normal household activity for centuries. Only two Japanese generations have grown up to be unconscious consumers who expect power to be available at the flick of a switch. Despite the collapse of the property bubble and the comparative stagnation of the 1990s, the Japanese became eager consumers and waste-makers; so we now read in the *Australian Financial Review* that the recent revival in the Japanese economy is mostly due to a significant rise in domestic consumption, and for the USA, China is maligned for dumping cheap exports on the world market.

In Japan, no aspect of the development of the nuclear industry was ever put to the people at any election and the Liberal-Democratic coalition was easily able to develop it without scrutiny, doing it through deals made by the bureaucracy with interested industries, who all agreed they were acting in the national interest. Australians may not get to decide through the democratic process either. Except in terms of how we should get the benefit from uranium enrichment as a form of 'value adding', the public discussion in Australia, so far, has taken little notice of the nuclear fuel cycle. Other nations would do well to ponder the price, and the risks, of nuclear power.

Tony Barrell is a British-born Australian writer and broadcaster who now lives in Sydney, Australia. He is the author of The Real Far East: Way Beyond Siberia*. His recent radio series about rice in Asia, which includes a program about Japan is Rice Bowl Tales.*

Posted at Japan Focus on January 28, 2007.

[1] Figures in this essay come from the Uranium Information Centre, Japan Nuclear Fuels Ltd, and Citizens Nuclear Information Centre.