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Review

The case against nuclear power development in Indonesia

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Despite the ongoing environmental and health dangers related to the Fukushima I nuclear meltdowns in Japan, some Asian nations are still entertaining the notion of developing nuclear power from scratch. Indonesia is one such example. It has been said that Indonesia needs more power for its growing industrial sectors. And the world as a whole needs eco-friendly power sources to stop climate change reaching globally catastrophic levels. So, to encourage these endeavors, should Indonesia develop nuclear power? The answer is 'no'. If nuclear power is forced upon Indonesia by its Government and industries, then the people there and their environment as well will not only be just as vulnerable to climate change, they will also be subjected to costly catastrophic accidents, chronic radioactive pollution and the threat of nuclear terrorism.

Key words: Indonesia, nuclear, energy, development, pollution, disaster.

INTRODUCTION

Indonesia's nuclear energy plans

The rapidly developing nature of many East Asian economies is making governments there concerned about securing their future energy supplies (Manning, 2000; Lall, 2008). Indonesia's gross domestic product (GDP) is forecast to grow at around 5 to 6% over the coming decade (Handa and Kahsay, 2011) and the power demand is rising at an average of about 9% per year (Asif and Muneer, 2005). Because of such trends region-wide, numerous East Asian countries have tried to rethink and reinvigorate their power supply strategies in order to circumvent problems associated with rising domestic demand, climate change and the desire to secure energy in a more self-sufficient way. Indonesia is among those countries with a clear aim to develop new power sources including nuclear power (Smith, 2007).

At this moment, given the impending initiation of an Indonesian nuclear 'New Build', there is a need to debate whether the country should go forward with its plans. This paper attempts to encourage this debate by clearly and succinctly enunciating the reasons why Indonesia should forego the nuclear power option.

Indonesia's main source of energy is its diesel-operated power plants, along with coal plants and gas plants. Together with these sources, both domestic and international make up over 90% of Indonesia's electricity generation. This is a worry for the Indonesian government for a number of reasons, since:

(1) It ties Indonesia's industrial future to the eventual reduction of domestic reserves.
(2) It makes Indonesia dependent on the pricing policies and geopolitical interests of certain supplier nations.
(3) It makes Indonesia a high greenhouse gas emitter.

For these reasons, Indonesia's energy plans involve the development of an atomic power plant (with some four working reactors within it) so that nuclear power will be able to contribute around 2 to 5% of Indonesia's electricity by 2025. So, what is wrong with 2 to 5% nuclear?

NO SOLUTION TO CLIMATE CHANGE

Firstly, the 2 to 5% Indonesian nuclear power option may contribute only very little to halting global climate change. Perhaps this truth will, in due course, be uncovered by

Indonesian people if it were not for the ongoing promotion of nuclear power by Indonesia's nuclear energy agency: Badan Tenaga Atom Nasional (BATAN). BATAN publicly advertises the need for nuclear power for climate change reasons. 2 to 5% nuclear power, though, is far too small to have any meaningful impact in slowing down the greenhouse effect, especially given that oil, coal and gas will still provide the bulk of Indonesia's electricity by 2025.

To produce a noticeable reduction in global carbon dioxide emissions, a nuclear 'New Build' strategy would have to be worldwide, with at least 2,000 new nuclear reactors splashed across the entire globe (Makhijani, 2002). This is a huge number when we recall that there are only some 440 reactors operating today throughout all the countries of the world and that only sixty more are currently being built.

If BATAN continues to advertise the climate-saving potential of nuclear power, then they will soon need to admit that it will only work if there is an impossibly quick expansion in nuclear power at the global level. However, each and every atomic power plant takes some 12 to 15 years to get going; from the breaking of new ground to the production of electricity. One of the reasons it is so slow is that the safety checks are excruciatingly time-consuming. In order to assure safe construction practices by trustworthy contractors, a massive global nuclear 'New Build' would have to be 'staggered' over many years (say 100 to 400 reactors per decade for 40 years). But even such a 'staggered' program of 'New Build' is totally unprecedented, and there had been a great risk of compromising safety if it was to occur. If East Asian states cooperatively embarked upon a massive nuclear 'New Build' whence new reactors are speedily built all over the continent through the next 15 to 20 years, the chances of catastrophe in the order of Fukushima and Chernobyl increase many times, since all the safety checks could not possibly be completed.

The saving grace is that no country is thinking of such a massive nuclear expansion, let alone promoting it as global imperative. China and India are certainly hoping to expand their civil nuclear programmes but they will be far short of building 100 to 400 reactors over the next decades. They would not be able to afford them anyhow and there would probably not be enough uranium on the planet to keep them working (Meserve, 2004; Marshall, 2005; Shrader-Frechette, 2011).

As well as the problems indicated previously, it can also be stated that the climate-saving potential of nuclear power is somewhat of a myth. Whilst Indonesia's proposed nuclear power plant might produce negligible amounts of greenhouse gases during its working lifetime, all the other stages before and after the operating phase (like uranium mining, uranium enrichment, power plant construction and nuclear waste management) will involve the release of greenhouse gases in amounts almost equivalent to gas or coal-powered plants (Smith, 2006, 2007; Caldicott, 2007; Shrader-Frechette, 2011).

The only reason that BATAN can promote nuclear power as 'climate-friendly' is by ignoring the rest of the nuclear cycle.

BATAN currently works with other nuclear agencies throughout the world to have nuclear energy introduced as an eco-friendly option in any future carbon-accounting scheme. If this comes to pass, then any nation building nuclear power plants would have those plants counted in their favour when their total greenhouse gas emissions were tallied up. This would have two important consequences:

(1) All sorts of subsidies would come to the assistance of Indonesian nuclear power plant builders since a number of international aid programs are trying to encourage developing nations to go green as they develop energy plans.
(2) If a uniform international carbon-trading mechanism was set up; nations with nuclear power plants would end up having a lot of carbon credits to trade. They could sell these for profit or use them to offset their own greenhouse gas-producing activities.

Despite all the money the nuclear industry worldwide spends on lobbying governments to agree about the environmental friendliness of nuclear power, they have not been effective when it comes to enacting law or signing treaties (Smith, 2006). Nobody who has built a nuclear power station has yet been able to claim eco-funds for doing so, and this situation looks unlikely to change. Therefore, Indonesia is unlikely to get any benefit--environmental or economic--from the supposed 'climate-saving' features of its future nuclear reactors.

INDONESIA'S FUTURE NUCLEAR WASTE

To get to that 2 to 5%, Indonesia will need to build and operate around four nuclear reactors. Over the course of a 50 to 60 year life time, these reactors will produce some 5000 tons of radioactive waste, both low level and high level, liquid as well as solid. All of it is dangerous and life threatening. The high level waste can cause instant physical harm and takes up to a million years to decay. The low level waste can cause cancers if ingested or inhaled and can last up to 300 years or longer (Vandenbosch and Vandenbosch, 2007). Any electricity produced by an Indonesian nuclear power plant in the year 2025 will generate waste that will very probably still be harmful in the year 20,025 AD.

There are two main management options that might be able to be deal with Indonesia's projected radioactive waste. The first option would be for the high level waste (used uranium rods, for instance) to be transferred to another country. Russia, for example, seems particularly keen on the business of taking other nations' nuclear waste (Dawson and Darst, 2005). The second option is for Indonesia to store and dispose of its own waste. Both

these options are fraught with problems as outlined as follows:

Option 1 would involve the dangerous transport of radioactive material through third countries or across international seas, thus inviting thieves and terrorists to target what may well be an inadequately-secured nuclear cargo (Allison, 2005; Marshall, 2006). Even when it gets to Russia, the sometimes horrific conditions of nuclear waste facilities there burdens the local environment with probable contamination, not just for the near future, but for the many generations to come (Bridges and Bridges, 1995; Marshall, 2007).
Option 2 is also a major problem since Indonesia has no disposal facilities for highly radioactive waste and it is extremely limited in being able to process low-level waste.

Having said this, it should probably be acknowledged that no nation in the world has actually solved the problem of how and where to dispose of nuclear waste. In Western Europe, for example, nuclear waste has been sitting around in temporary storage for 50 years or more whilst every single plan to dispose it permanently has been thwarted by 'Not-In-My-Back-Yard' (NIMBY) politics and technological uncertainties. In Eastern Europe, it has been more a lack of funding and also regulatory negligence, rather than local protest that has stopped the construction of appropriate disposal facilities. Instead, in the post-socialist states, the waste is often dumped illegally into seas, landfills or abandoned areas. Given the fact that BATAN has no experience in these matters, the future of Indonesian waste management is sure to emulate either the Eastern European or Western European experiences, neither of which solves the waste problem.

If Indonesia ever managed to move high level waste from temporary storage to permanent disposal, it is probable the waste that will one day find its way back to human communities either by:

(a) Natural events (such as flooding from tsunamis or storms, or seismic activity produced by Indonesia's numerous volcanoes and earthquakes), or by
(b) Man-made events (such as inadvertent excavation or by proactive salvaging).

The natural disasters aforementioned may possibly be mitigated by good management but given the massive expense of nuclear waste management (amounting to hundreds of millions of dollars per ton of waste over its lifetime) and given Indonesia's limited government resources and less than perfect governance, the practice of good management maybe but a forlorn hope. In turn, the man-made events maybe even more of a risk in a terrorist-prone and theft-vulnerable state like Indonesia.

All this could work to spread nuclear material far and wide including into the hands of domestic terrorists and enemy states (Potter and Kukhatzanova, 2010).

Since March 2011, several Indonesian ministers are now expressing intentions to rethink nuclear power. BATAN itself though is going into an offensive PR mode, suggesting that:

(1) The Japanese Fukushima plant was built on a known earthquake and tsunami zone but Indonesian nuclear plants will not be.
(2) The Japanese reactors were of an old design and Indonesian nuclear power plants will be of a newer safer design.

The retorts to these two points are as follows:

Firstly, no place in Indonesia is totally safe from seismic catastrophe, whether it be caused by earthquake, tsunami or volcano. Some places may seem quite safe but that is only because our scientific knowledge of these areas may be incomplete.

Secondly, the 'new design' power plants may not be the ones chosen by the Indonesian government and even if they are, they are still subject to grand safety problems (Macalister, 2009) including vulnerabilities to theft and sabotage.

VULNERABLE TO ACCIDENTS

BATAN is involved in an ongoing PR effort to assure its citizens that all necessary safety aspects are taken into account to ensure a safe and healthy working environment within and outside future nuclear plants. The authorities cite the safe 40 years operation of a series of small research reactors to indicate how safe future nuclear power will be in Indonesia. If and when the four commercial reactors are up and running, they will dwarf the power of these small research reactors by many times. Thus, perhaps the Indonesian population should expect the scale of safety to be upgraded by many times.
Despite the promises of safety and the small scale of past nuclear operations in the country, there have been numerous nuclear incidents in Indonesia from leaks to radiological trafficking, as documented by the International Atomic Energy Agency (IAEA). In other East Asian nations with nuclear programs, nuclear accidents have also been common (Condon, 1998; Yi-Chong, 2011). In Taiwan and Korea, for example, there have been numerous shutdowns, leaks, fires and accidental exposures. In Japan, explosions, fires, earthquakes and management negligence have led to numerous radiation deaths over the years even before the disastrous events of Fukushima-Daichi. In China, despite the deep secrecy of the Chinese nuclear industry, there are numerous reports of major accidents also, many involving deaths or leakages (Condon, 1998). It is highly likely that a scaled-up nuclear program in Indonesia will encounter similar problems, and that the workers and local community members will be most vulnerable (Amir, 2009).

If and when Indonesia builds its reactors, they will have

to be located in coastal areas in order to get enough water for daily operations. These locales are themselves problematic for a number of reasons. Firstly, they are precisely the zones most susceptible to flooding via tsunamis and tropical storms. The 2011 seismic events hitting Eastern Japan have shown the vulnerabilities of nuclear facilities located on the coast. And if the December, 2004 Asian tsunami happened to wash around a nuclear facility on Sumatra or Java, radioactive material could have washed up and down the coasts for hundreds of kilometers, vastly increasing the effects of the disaster, and possibly wiping out any sustained industrial and agricultural use of coastal land for decades. This could yet be the case for those areas surrounding the Japanese Fukushima plant. And we have to acknowledge the warning systems, evacuation protocols, and safety mechanisms are not likely to be anywhere near as advanced in Indonesia as they are in Japan.

NUCLEAR WILL NEED PUBLIC FINANCIAL SUPPORT

The nuclear industry in Indonesia is not large but BATAN is looking to make it so, citing the fact that an operational nuclear power plant can provide slightly cheaper base-load power compared to any and all alternatives. However, a fully operational Indonesian nuclear plant will be reliant on the following:

(1) Government-sponsored capital outlay of nuclear plant construction (to the tune of two to six billion dollars over 20 years),
(2) Government-funded research and development (to the tune of hundreds of millions of dollars per year),
(3) Government-funded storage and disposal of nuclear waste (to the tune of billions of dollars over the lifetime of a plant, and for hundreds of years after it is decommissioned),
(4) Government-funded training of nuclear staff (to the tune of hundreds of millions of dollars for the first decades of construction and operation),
(5) Government-funded purchase of uranium fuel (to the tune of hundreds of millions of dollars for each reactor per year),
(6) Government-sponsored insurance in case of accidents (to the tune of hundreds of millions of dollars per year during the lifetime of a plant).

Thus, any nuclear-produced electricity is only able to be competitively-priced because of the existence of massive subsidies. No other power option in Indonesia receives subsidies on such grand scales and these subsidies are not calculated into the final cost of the electricity when BATAN announces the price per energy unit of their nuclear program.

To pay for these subsidies, Indonesia will have to go into a special nuclear-made debt program. A bevy of environmentalists and economists (Makhijani and Scott, 1999; Caldicott, 2007; Lovins et al., 2008; Sovacool, 2011) believe a much better (and far cheaper) investment option is to develop a power conservation program which would effectively dismiss the need for the construction of any nuclear plant.

NUCLEAR PROLIFERATION IN EAST ASIA

Indonesia's nuclear ambitions have been approved by the IAEA (The United Nation's (UN's) atomic energy agency). Before reading too much into this, it should be noted that the IAEA only start making noises about nuclear projects in extreme circumstances when a broad array of powerful countries express coordinated dismay. It should be noted that the IAEA is a two-headed watchdog. Although, it acts to minimize potential proliferation concerns, the IAEA is actually charged with spreading peaceful nuclear power around the globe, and as its membership (and its staff) comprise pro-nuclear organizations and pro-nuclear individuals from around the world; so the IAEA generally works to expand the virtues of nuclear power and spread nuclear technology. So, it happens with Indonesia where the IAEA are giving millions to BATAN to do preliminary studies on commercializing nuclear power.

So, would a peaceful civil Indonesian nuclear program lead to an increase in proliferation risk? The answer is 'yes'. Despite the rhetoric of BATAN spokespeople that nuclear energy and nuclear bombs are two different sets of technology (and despite the international safeguards that the IAEA try to police), the governments of East Asia know that a commercial nuclear power program encourages atomic weapons knowledge amongst its nuclear professionals and a commercial nuclear power plant produces material able to be converted into a weapon-form. As is often the case in East Asia, what one nation does with nuclear projects often unnerves others (Beng, 2004; Law, 2008) and it has been acknowledged that Japan, the Koreas, Burma and Thailand are being prompted to acquire nuclear weapons technologies as a guard against other nations' nuclear developments (Bracken, 1999; Solingen, 2007; Potter and Kukhatzanova, 2010).

Another proliferation risk is associated with the increased amount of nuclear material and nuclear technology in the region (and the transport of these via land and sea). If this material and technology is not secured to the best possible degree it could be subject to theft by those wishing to develop nuclear or radiological weapons. The more nuclear material there is lying around the more chances it can be seized or stolen by Indonesia's enemies and terrorists.

PUBLIC ACCEPTANCE OF NUCLEAR ENERGY

According to BATAN surveys, public acceptance of

nuclear power plants was growing for the last few years up to a high of almost 60%. This is not surprising since BATAN has been systematically promoting nuclear power in a public manner and the government at large has been announcing they will consider and approve nuclear plants in principle. For those Indonesians that trust the government and its organs, any official approval will be evidence of the project's sagacious nature.

However, not all Indonesians trust their government. Many admit their country has a corruption problem, with weak governing institutions and a lack of coordination between regulatory agencies – problems that will be amplified by a big expensive project like a nuclear plant. This background of distrust, coupled with the media exposure of the Fukushima disaster will challenge the acceptance of Indonesian nuclear power in the coming years.

Even before Fukushima though, there was public disquiet and dissent. A 1990s proposal to build a nuclear power plant in the Muria Peninsula on Java Island was shelved after protests from environmentalists and the local population. These stakeholders were concerned with a myriad of issues, including those outlined above, plus they were also concerned about the potential of nuclear disaster based on the area's peculiar geology. Gunung Muria, the volcano 30 km from the proposed site has been dormant for centuries but some scientists admit their worries that it could still erupt without warning, as other 'dormant' Indonesian volcanoes have (Amir, 2009). The effect of volcano-induced quakes upon a nuclear facility may indeed be catastrophic, as was the Japan quake of 2011 and there are few safety features that could be engineered to fully deal with such an event of uncertain scale.

CONCLUSION

In general, it can be concluded that Indonesia's aspirations to develop a peaceful nuclear power program are not suitable given its governance problems and its financial problems, and also for reasons of safety, proliferation and potential pollution. Firstly, the costs of such an endeavor are immense and the money could be used better in the area of power conservation, let alone the development of renewable energy, both of which are likely to be cheaper and more environmental friendly. Secondly, an Indonesian nuclear power station will be prone to natural or man-made disasters. From typhoons to tsunamis through to theft and terrorism, a nuclear plant will, for many years beyond its operating lifetime, increase the vulnerability of Indonesia to catastrophic events.

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