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Nuclear Power, Risk Management and Democratic Accountability in Indonesia: Volcanic, regulatory and financial risk in the Muria peninsula nuclear power proposal

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Introduction by Geoff Gunn

Introduction

In late 2009 Indonesia revived a proposal to build a nuclear power facility on the seismically active Muria Peninsula of north central Java over sustained civil society opposition including the voice of moderate Islam. The following assessment by Richard Tanter, Arabella Imhoff and David Von Hippel poses a range of issues about siting decisions in light of state-society relations and nuclear power feasibility. The issues are as relevant to mature democracies as to "emerging democracies," as Indonesia is now sometimes styled. Muria poses formidable challenges to Indonesian democracy while posing equally important questions about the nation's developmental trajectory.

The siting of airports, dams, and nuclear power plants, are all examples of major siting decisions and contestations. As Daniel Aldrich observes in Site fights: Divisive Facilities and Civil Society in Japan and the West (Cornell University Press, 2008), even within democracies, some targeted communities have low potential for resistance. More generally, he terms siting decisions targeting vulnerable social elements, as "public bads," as opposed to "public goods," the latter conferring public benefits. Rather than neutral technocratic grounds, he shows, official frequently single out localities with weak civil societies for controversial siting decisions. Moreover, coercive measures are frequently employed, as opposed to incentive packages such as those frequently cited in the NIMBY literature. Only intense societal resistance obliges the state to adopt soft solutions.

Aldrich examines site selection and state response to opposition to nuclear power projects in Japan, the US, and France. But how comparable is Indonesia's nascent civil society, including its large religious-based constituencies, and how professional or autonomous are Indonesian officials compared with those of Japan, France and the US?

Aldrich draws on hundreds of cases of successful and unsuccessful siting, noting the global trend toward intensified local and sometimes national resistance to nuclear power, big dams, and other projects. By the mid-1990s, for example, opposition to dams in Japan gained widespread local and extra-local community support and may have eventually contributed to the 2009 electoral victory of the Democratic Party of Japan (DPJ). National, as opposed to local politics in Indonesia, by comparison, is not issue-oriented but, rather, revolves around cliques (including retired military), personalities and money.

In Indonesia, where the military is the major enforcer, not only of last resort, but any resort, there is reason to doubt whether civil resistance to major state projects will be handled as a mere policing issue. Quite the contrary, given Indonesia's recent history, as in Papua and Aceh. But is the Indonesian state prepared to stay the course employing persuasive as opposed to coercive means, especially given the strong custodial role of the military in politics and society? Reflecting on Japan, Aldrich highlights the respective public relations "toolboxes" of both the authorities and civil society resisters. Faced with growing resistance in the 1960s, the state employed all kinds of soft social control measures alongside buyouts and other sharper practices. Recently, the DPJ annulled, a large slush fund earmarked for nuclear power plant siting propaganda. In the face of sectional, regional and even Islamic concerns over nuclear power, will the Indonesian state offer persuasive guidance from above?

In Japan, dubbed by Gavan McCormack as a "plutonium superstate", there is nothing like an earthquake and radioactive leak to set public alarm-bells ringing (See Ishibashi Katsuhiko on earthquake damage and risk). Meanwhile, the troubled Japanese nuclear power industry casts its eyes on potential contracts in more congenial civil society environments in Southeast Asia. (See author's Southeast Asia's Looming Nuclear Power Industry)

Japanese civil society has repeatedly exposed bungles, coverups, and just plain corruption associated with nuclear power and big dam projects, sometimes derailing them. But what of Indonesia, a polity hardly known for its technocratic prowess, where professional bureaucratic decision-making is often questionable, and where the level of transparency and accountability is frequently questioned, not only by a vocal civil society honed in the reformasi movement leading to a new democratic space, but even by the country's most loyal creditors?

Geoff Gunn

Synopsis

Richard Tanter, Arabella Imhoff and David Von Hippel of the Nautilus Institute write that Indonesia's handling of its proposal for a large nuclear power plant on the Muria peninsula in Central Java "is a test of the power of public opinion in a new democracy and the capacity of government to assess risk appropriately and make key decisions transparently". While noting other issues including proliferation risk, they concentrate on assessments of volcanic and seismic risk, regulatory risk, and financial risk. In each of these areas of risk assessment, they argue, there are very serious weaknesses that need to be addressed to ensure democratic accountability. Tanter, Imhoff and Von Hippel conclude that "after almost a year in which electoral concerns drove advocacy for the project underground, a new and more powerful coalition of government players has emerged to move the proposal forward."

Southeast Asia looms large in talk of a "global nuclear renaissance." Indonesia, Malaysia, Thailand and Vietnam have all notified the International Atomic Energy Agency (IAEA) of their interest in developing nuclear electric power generation, and the IAEA has collaborated with the Philippines in a study of the possibility of finally turning on the scandal-ridden Bataan Nuclear Power Plant, which was completed in 1984.[1]

Of these, the Indonesian plan to build four 1,000 MW plants on the Muria peninsula on the north coast of the densely populated – and seismically active -region of Central Java is the most advanced.[2] For Indonesia, a country that is barely a decade out of the shadow of dictatorship, the handling of the Indonesian nuclear power plan is a test of the power of public opinion in a new democracy, and of the capacity of government to assess risk appropriately and make large infrastructure decisions transparently.

A key political lesson of recent years in Indonesia is that energy policy, and power generation policy in particular, is a locus of conflict over a remarkably wide range of significant issues. These involve the direction, process and transparency of economic policy and institutional reform; the realisation of constitutionally-mandated decentralisation of power; climate change policy; equitable

burden-sharing for electricity generation; and the role of civil society and market-led inputs into policy formation. Accordingly, risk assessment of large-scale infrastructure planning should be treated not only as a matter for technical assessment by government specialists, but also one requiring meaningful public input. Enabling such input requires making available the public information and institutional resources necessary to ensure requisite levels and modes of democratic accountability, based on close scrutiny and well-informed participation by a range of actors in government and civil society able to exert countervailing power.

Fully addressing the range of risks attached to the building of a nuclear power station on the Muria peninsula is far beyond the scope of this paper. Such a list of issues to be addressed would include, but not be limited to the following: site selection and assessment issues; environmental impact assessment – local, national and international; facility design, safety and security; proliferation risk, direct and indirect; security impacts beyond proliferation risk, including human security and human rights concerns; appropriateness in relation to national energy requirements; appropriateness of analysis of risk and its representation; economic and financing matters, including the use of vendor country export credit; liability issues for both purchasing countries and vendor countries; adequacy of institutional structure; robustness and reliability of regulatory frameworks; adequacy of public information provision; transparency of all aspects of decision making; and open and appropriate forms of community consultation.

This brief paper provides an introduction to three areas central to the assessment of the appropriateness and viability of the Muria peninsula nuclear power proposal: volcanic and tectonic risk; regulatory risk, and financial risk. The first area of concern is the suitability of the site in terms of risks to the facility from volcanic activity and from earthquakes. Given that Java is one of the most earthquake-prone regions of the world, and the Ujung Lemah Abang site proposed for a suite of four reactors is just 25 km from the multiple peaks of the 1,625m high Gunung Muria, and 4.5 km from the nearest volcanic vent, this is as a primary concern. The approach here sets aside questions of design to mitigate assessed risks, and focuses on problems with the process of assessment to date of both volcanic and tectonic risks. Secondly, the paper considers the Indonesian government's capacity to effectively regulate a nuclear facility in the face of persistent and widespread governmental corruption and a governmental culture of impunity from accountability and prosecution. And lastly questions of financial risk are examined, particularly in a context of not only a local and specific lack of reliable financial information about the Muria proposal available to Indonesian legislators and the public, but also the endemic levels of secrecy and lack of transparency characteristic of the nuclear power industry worldwide.

The Muria plan: there and back again

The new-found power of public opinion in democratic Indonesia was on display during the recent Indonesian presidential elections. At a meeting in April in the heartland of Central Java, the eventual electoral victor, incumbent president Susilo Bambang Yudhoyono, was asked a stage-managed question about his administration's long-delayed plans to construct a large nuclear power station in the village of Balong near Jepara, on the north coast of Central Java. To the surprise of many, the president said: "Nuclear development is impossible in areas with opposition", adding that "if there are still other alternatives, we will not take nuclear resources".[3]

The widely reported Presidential backdown was attributed to the controversy that the Muria peninsula nuclear power project has attracted, particularly following a 2007 declaration by the largest Islamic organisation in the country that the project was considered *haram* or forbidden under Islamic jurisprudence. This fatwa followed a September 2007 convocation of more than a hundred scholars and teachers of Nahdlatul Ulama who listened to government ministers, scientists, and other researchers before deciding that on balance, the positive benefits of the Muria nuclear power plan were outweighed by the negatives.[4] The *fatwa* shocked both the Indonesian government and the nuclear industry. It crystallized concerns amongst scientists, researchers, community groups and even the nuclear industry itself about seismic hazards for a nuclear facility in an earthquake zone on the edge of a large volcano, concerns about safety and regulatory risk in a country notorious for corruption, and concerns about transparency in the financing of the project.[5] By the time of the 2009 election campaign, no candidate spoke in favour of the government's longstanding plan. In a country only a decade beyond a three-decade period of extreme authoritarian rule, and conducting general elections for only the fourth time in its six-decade history, the presidential acknowledgement of the power of public opinion was a remarkable turnaround.

Yet within a month of the President's July 8th victory, it became clear that government supporters of nuclear power were determined to press their case. The retiring Minister for Research and Technology announced, somewhat implausibly, that the nuclear power plan was still on track with a 2016 target date for the first reactor to come on line; that, despite election-period prevarication, the Muria peninsula site was still appropriate; and that all that was needed was for the government to enter into dialogue with its critics in the region.[6] Within a month of the make-up of a new cabinet being announced, his successor confirmed his support for the nuclear project, saying that the "the plan to build the nuclear power plant must go on," most likely on the Muria peninsula site,[7] and the heads of the Atomic Energy (BATAN) and the Nuclear Regulatory Agency (BAPETEN) repeated their long-standing calls for a nuclear answer to Indonesia's chronic electricity difficulties.[8]

Following the confirmation of a new cabinet, these representatives of small state ministries and dedicated government nuclear agencies, very much the usual nuclear energy proponents, were soon joined for the first time by much more serious and powerful players in Indonesian decision-making. On December 3, the new Minister for Energy and Natural Resources, Darwin Zahedy Saleh, told a parliamentary commission that not only was the National Energy Council (DEN), of which he was the executive director, actively assessing the role of nuclear energy in establishing national energy resilience in accord with Law 17/2007 "Concerning National Long-Term Development Plan 2005-2025", but that the country's president, Susilo Bambang Yudhoyono, would preside over a meeting of the council in December to deal with recommendations about nuclear power.[9]

In other words, during the parliamentary and presidential election campaigns, no serious political figure wanted to be associated with a nuclear solution to Indonesia's electricity problems, especially in Central Java, where opposition was wide-spread, well-informed, and of long-standing. That opposition was cited as a reason to postpone a decision, or to consider – somewhat implausibly after decades of preaching the virtues of the chosen site – alternative sites. In fact, the president's precise words in his apparent backdown allowed room for a reconsideration of the Muria site. After the election, in the context of widespread public anger over the inability of the State Electricity Company (PLN) to avoid frequent blackouts in the capital, a new and more powerful coalition of government supporters of the proposal not only provided a chorus urging government action, but also succeeded in placing the issue on the president's immediate agenda through the National Energy Council. Through all of this, however, the perceived risks underlying public criticism of the plan were left unaddressed.

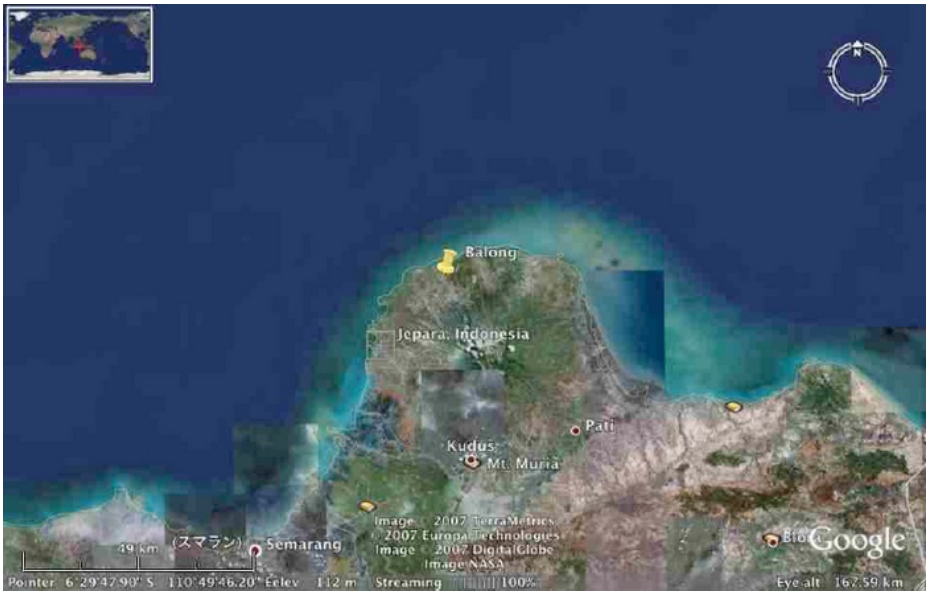
The BATAN proposal to build the first of four 1,000 MW pressurised water reactors at Ujung Lemah Abang in the village of Balong, about 20 kms northeast of Jepara, is its third attempt at getting government commitment to a nuclear plant on the Muria peninsula since the early 1980s.[10] Since at least the mid-1980s, BATAN's preferred nuclear power plant site has been located on the Muria peninsula on the northern coast of Central Java, and since at least 1996, Ujung Lemah Abang has been the preferred site. The process of searching for and deciding on an appropriate site for Indonesia's first nuclear powered electricity generating plant commenced in the early 1970s. Fourteen sites were proposed in 1975 by the Location Sub-committee of Nuclear Power Plant Construction Preparation Committee, of which five key candidates were selected subsequently in the same year. Sites mentioned in

Java to this point included Pasuruan, Bondowoso, Lasem, three sites on the Muria peninsula (Ujung Grengganan, Ujung Watu and Ujung Lemah Abang), Tanjung Pujut, Ujung Genteng, Pangandaran and Malang Selatan.11 The joint BATAN-NIRA study selected the Muria peninsula as its preferred location in 1983.12 A fullscale feasibility study by the Japanese consulting group, NewJEC, focused on the Muria peninsula sites.13 Ujung Lemah Abang emerged as the preferred site amongst all possible sites in Java because, according to BATAN, apart from other advantages in terms of land and sea access, relatively low population density and location, and ground characteristics, Ujung Lemah Abang had the most favourable ranking in terms of volcanic and seismic hazards.[14]

Sites considered as possible candidate nuclear power plant locations from 1974 to 2008 (Google Earth)

The latest version of the Muria proposal emerged in 2002-3, and gathered strength in the following years, fed by three pressures. The first driver was the possibility that nuclear power could reduce concerns about the greenhouse gas emissions of the coal-fired electricity plants on which Indonesia presently relies, and of which, in the absence of alternatives, more would be built.[15] The second was the inadequacy of existing electricity supplies in Java, and especially in the industrialised region around Jakarta, even after an attempted "crash program" from 2006 to expand the number of coal-fired stations. The third was the hunger of Japanese, Korean, and French nuclear power plant manufacturers, and their governments, to find export markets to help recover the costs of their long-running large investments in nuclear power research and development and construction of existing facilities, and to maintain their national nuclear industries' role in the highly concentrated and competitive global nuclear industry.

After the re-election of President Yudhoyono for another five-year term, all three of these pressures remain in play. Yet, despite the claimed merits of nuclear power in addressing climate change and Indonesia's electricity woes, without a comprehensive and transparent analysis of the risks associated with the plan, strong public opposition to the plan is likely to remain, casting doubt on whether the global nuclear industry can regain its footing based on sales in countries such as Indonesia.

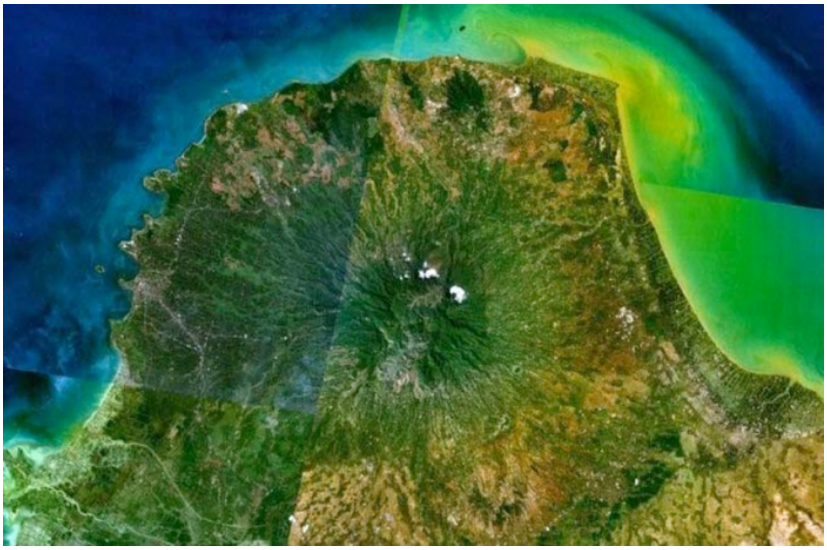


Muria peninsula (Google Earth)

Volcanic and seismic risks

Despite concerns that the proposed nuclear power plant site is located in close proximity to the volcano Gunung Muria and known seismic fault lines on the notoriously volatile Island of Java,[16] the Indonesian government has long stressed that the Muria Peninsula remains the safest site on Java.

Very little information and data are publicly available to substantiate this position. Almost all official Indonesian and IAEA detailed volcanic and seismic studies have been kept from the public domain over more than three decades. Very limited technical information is publicly available about the precise geological, seismic and hydrological characteristics of the Ujung Lemah Abang site itself.[17]

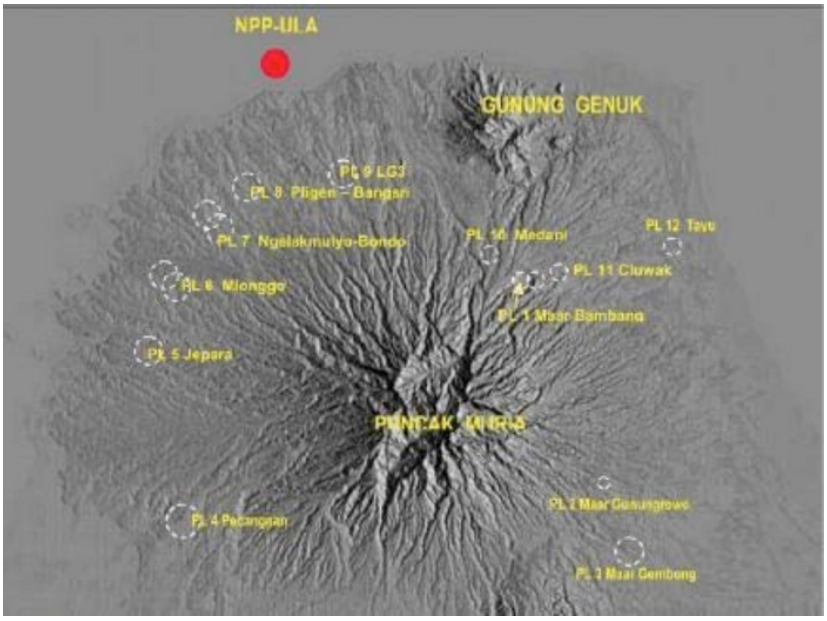


NASA Landsat 7 image of the Muria peninsula, Global Volcanism Program, Smithsonian Institution.

However academic reports by the authors of IAEA studies have presented serious concerns about the seismic and volcanic characteristics of the chosen site. One 2003 academic report by McBirney *et al*, the authors of an IAEA study[18] of the Muria site, is unusual among the available sources for its clear and transparent assessment of data sources, and was sharply critical of the limitations of earlier IAEA and BATAN seismic studies. McBirney *et al* reported that previous seismic datasets in particular were found to be not only incomplete and "of little use for defining seismogenic structures", but also that "the accuracy of these maps was questionable and the detection, characterization, and dating of the faulting are unclear."[19]

In sharp contrast to the government's assertion that Muria is the safest site for nuclear power development, McBirney and his colleagues, while working with and acknowledging the inadequate information and data available to them, were clear that the proposed site faces serious volcanic and seismic hazards from the Muria volcanic complex, which they regarded as "capable of future volcanic and seismic activity" within the expected lifetime of the plant. In the event of significant volcanic activity they found the site would be affected by debris and pyroclastic material (flows of hot gases and rock) from vents, including some as close as 4.5 km from the site. Significantly, analysis of gases in a bore hole 1.5 km from the site revealed radioisotopes of helium similar to those derived from the earth's mantle, and possibly indicating "shallow source of magma capable of producing other types of volcanic phenomena".[20]

Although the authors found no seismic faults directly affecting the site, they concluded that "the assessed seismogenic potential could prejudice the feasibility of the plant". This concern arises from the finding that site is unstable, with highly permeable weathered upper-layers of soil to a depth well beyond the plant's expected foundations rendering the site unsuitable for providing sound structural support for a nuclear power plant.



Volcanic maars on the Muria Peninsula (from Sutikno Bronto dan Sri Mulyaningsih, "Gunung api maar di Semenanjung Muria", *Jurnal Geologi Indonesia*, Vol. 2 No. 1 Maret 2007.)

The concerns raised in the 2003 McBirney report have been subsequently reinforced by further precise mapping of the region by Indonesian researchers that has revealed two major north-south faults through the Muria volcanic complex,[21] and a series of faults offshore from the Muria peninsula[22]. While most of the previously known offshore faults lie off the north-east quarter of the peninsula, some were found to lie closer to the Ujung Lemah Abang site. The precise location of these newly defined offshore faults is still not clear. Nor are there publicly available assessments of the precise character, alignment and segmentation of the faults and their differential implications for site seismic hazards.

The paucity of publicly available data has made the gravity of these new findings difficult to assess. However, the necessity of reconsidering the seismogenic hazards inherent in the Muria proposal became all the more urgent in the wake of the July 16, 2007,

6.8 Richter scale earthquake on the seabed 16 km offshore from the Kashiwazaki-Kariwa nuclear power plant complex in Niigata, Japan[23]. The quake resulted in four of the seven power generators shutting down automatically, radioactive water leakage into the sea from two reactors, a transformer fire that took two hours to put out, and other substantial damage.

The accident led to a comprehensive review of seismic safety standards for nuclear power plants both in Japan and internationally.[24] Since the seismic standards of the feasibility study for the Muria proposal carried out in the early 1990s by the Japanese consulting firm NewJEC had relied on earlier Japanese seismic standards, the clear implication of the substantial revision of seismic standards in Japan and elsewhere was that a new feasibility study of the Muria site is required.[25] Combined with the absence of public access to detailed official studies, little confidence can be placed in Indonesian government assurances that the Muria site is suitable in terms of seismic and volcanic hazard, or that these hazards have been adequately mitigated by plant design.

Impunity, corruption and regulatory risks

Regulation for security and safety is a key element in any new nuclear power proposal. Indonesia has taken appropriate steps to form an independent regulatory regime, devolving its regulatory responsibilities from BATAN to a newly created nuclear safety agreements.[26] However, the strength of such a regulatory regime depends heavily on preconditions such as strong rule of law and the willingness and capacity of the government to follow through with its regulatory commitment. In Indonesia's case two concerns in particular may undermine the nuclear regulatory regime, including the ongoing existence of corruption within the Indonesian government, and the seeming impunity of many senior government officials and political elite in the face of evident conflicts of interest and legal obligation.

Despite a reformist anti-corruption drive in president Yudhoyono's first term, Indonesia is still one of the most corrupt countries on Earth. In 2009, Transparency International's Corruption Perceptions Index (CPI) ranked Indonesia as amongst the most corrupt countries of the world,[27] reinforcing the significance of corruption as a nuclear materials security and safety threat, especially in the critical law enforcement and military-security agencies.

Confidence in the capacity of the Indonesian nuclear regulatory body was undermined in 2007 by the high profile arrests and subsequent conviction of senior BAPETEN officers and a prominent member of the national parliament on charges of bribery and corruption.[28] While the corruption did not reach the core regulatory capacity of BAPETEN, the case provided ample evidence of the fragility of the assumed probity and effectiveness of the nuclear regulatory body and its legislative guardian.[29]

Ominously, the key reforming government institution that secured the BAPETEN fraud and bribery convictions, the Corruption Eradication Commission (KPK), has been under attack in the parliament before and following the presidential elections for "invasion of privacy" of corruption probe targets in the parliament. Before the election the president yielded to pressure from parliamentarians and called on the KPK to take a softer approach in targeting political figures.[30] Immediately following his election win, president Yudhoyono commented publicly that the KPK "seems to be accountable only to God. Be careful".[31] A month later the arrest by police of two deputy chairmen of the KPK sparked large scale public protests, to be followed by greater outrage still when evidence emerged that senior police and prosecutors were involved in framing the two KPK officials.[32]

The potential for such a culture of impunity to undermine the credibility and effectiveness of key regulatory regimes was highlighted in the government's handling of the ongoing Lapindo mudflow disaster which began in 2006 during the oil drilling activities of PT Lapindo Brantas, a subsidiary of the Bakrie Group, which is wholly owned and controlled by Golkar party member Aburizal Bakrie, who was Minister for People's Welfare at the time. Despite recommendations from leading international scientists that PT Lapindo Brantas's activities were the cause of the mudflow[33], the government has been slow to respond and reluctant to pressure PT Lapindo Brantas to compensate the thousands of people affected by the disaster.[34] Many Indonesians have seen Bakrie's close links with the President, then Vice-President Yusuf Kalla and the Golkar party as the reason for the company's immunity in the face of the law.[35] Indonesian Chief Justice Bagir Manan demonstrated the government's unwillingness to follow through with its regulatory responsibilities when he stated that in the Lapindo case "it's more important to compensate those affected for their losses. After that the case will be closed and there's no need to look for suspects".[36] Impunity of office holders from effective prosecution remains a core problem for confidence in an effective nuclear safety and regulatory regime in Indonesia.

Financial risk

Along with safety and regulation, cost is a key factor for decision-making in energy policy. The Indonesian government has concentrated on projections of increasing energy demand and arguments about overall cost advantages of nuclear-generated electricity compared with gas-fired power stations. However, the publicly available data on the proposed costs of the Muria nuclear power plant is extraordinarily thin, to the point where it is almost impossible to make any informed judgment from sources available to the public or even Indonesia's parliamentarians.

Of the various costs associated with building, operating and decommissioning a nuclear power plant, construction costs, together with the associated construction time and capital costs, account for more than two-thirds of the final cost in most cases.

Indonesian government agencies have offered a variety of figures for the total cost of constructing the four proposed nuclear power plants on the Muria site. However, few of these figures are consistent, and fewer still transparent as to which cost elements are included and excluded, or the underlying assumptions. The result is an incomplete and inadequate public explanation of the likely costs, which fails to provide the Indonesian public with the means to assess the level of financial risk involved in the Muria nuclear power plant proposal.

Construction cost	US$ 1,500-1,800 kW[37]
Construction time	5 years[38]
Operational Life	60 years[39]
Decommissioning costs	10% capital costs[40]
Discount rate	10% (nominal)[41]

Indonesian nuclear power plant proposal cost estimates (government sources)

The best estimate available from various Indonesian government sources is set out in Table 1. Data on operational and maintenance costs, fuel costs, and load factor are not available to the public, nor are details of decommissioning. In summary, Indonesian authorities have told the public that it hopes to build four 1,000 MW reactors, the first of which will take five years to build for a cost of US$1.5 – 1.8 billion, with decommissioning costs equivalent to 10% of capital costs, for an operational life time of 60 years, and with a discount rate (nominal) of 10%.

It is not clear how these figures were derived or what elements are included or excluded.[42] Consequently it is not clear whether the government figures include only the price of an engineering, procurement and construction (EPC) contract, excluding owner's costs such as the cost of necessary transmission system upgrades (a certain expensive requirement for the dilapidated Jamali [Java-Madura-Bali] grid) and capital costs, and whether, if they do not, they represent an "overnight" EPC cost in current dollars or whether they have at any point been adjusted for inflation.

MIT Future of Nuclear Power Study, 2003	$2,000/kW
2009 Update of the MIT 2003 Future of Nuclear Power Study	$4,000/kW
Olkiluoto Finland nuclear power plant contract (no details of included elements)	$2,800/kW
Olkiluoto Finland nuclear power plant expected: (no details of included elements)	$4,000/kW
Overnight costs for average actual nuclear power plant builds in Japan and Korea, 1994-2002 (in 2007 dollars)	$4,000 kW
Overnight costs for average actual nuclear power plant builds in Japan and Korea, 2004-2006 (in 2007 dollars)	$3,000/kW

Recent nuclear power plant cost estimates from the *MIT Future of Nuclear Power Study*, 2003, and the *2009 Update of the MIT 2003 Future of Nuclear Power Study*

Estimating costs of constructing nuclear power facilities is also complicated by differences in construction costs between countries, as a function of industry and labour force capacity, labour costs, experience with nuclear construction, degree of standardization of design, regulatory requirements, and site characteristics. Table 2 presents the results of the most systematic review of contemporary nuclear power plant construction costs by the MIT *Future of Nuclear Power* interdisciplinary study from its 2009 update, and its supporting finance study.[43] In addition to its own estimates for possible US nuclear power plant construction based on assumptions specified in detail, the costs of nuclear power study for the MIT 2009 update also presents the known costs for recent European, Japanese and Korean experience. The benefits of standardisation of design and accumulated expertise are evident in the decline in the average actual overnight construction cost (in 2007 dollars) of nuclear power plants built in Japan and Korea between the 1994-2002 period ($4,000/kW) and 2004-2006 period ($3,000/kW). In the United States, on the contrary, estimated overnight costs have doubled over the same time frame – in large part of because no nuclear power plant construction has been started in the US for three decades (and the most recent reactor to come on line did so in the 1990s), with a consequent loss of expertise in nuclear plant construction. Even the East Asian average capital cost (2007 dollars), however, is already between 50% and 100% of the BATAN estimate.

Recent industry literature typically shows other important variations from the BATAN data, with decommissioning costs of up to $500 mn. (nominal)[44]; construction periods of between 5 and ten years; plant lifetime of 40 years, with extensions of 10-20 years not uncommon; and discount rates of 5-13% a year (nominal).

Comparisons between East Asian, European and US costs are difficult to make, but projecting costs in Indonesia is more difficult still. BATAN officials suggest costs would be closer to the East Asian baseline than the US, because the most likely nuclear power plant vendors are Japanese and Korean, and Indonesia would only buy a pressurised water reactor design already in use in those countries. Moreover it is sometimes claimed, since the costs of labour are so much less in Indonesia than any of these countries, the construction cost would be lower still. The latter claim is implausible insofar as the largest labour costs will be those for highly skilled workers with skills relevant to nuclear construction, who are scarce even in the United States, and very much more so in Indonesia: local firms' participation is likely to be limited to the markedly less complex aspects of the project. Moreover, even leaving aside the issue of what is included and omitted from the BATAN estimate, there are certain to be site-and country-specific cost factors not experienced in other countries.

The Indonesian government and the IAEA have carried out studies that reportedly contain detailed descriptions of costs and proposed financing. At some point, some elements of these detailed cost projections will be made available to the Indonesian legislature, and hopefully to the public. However the fact that the BATAN has not released these detailed studies can only raise concerns about the quality of the data within them in the minds of sceptical Indonesians. The end result is that the various important segments of domestic opposition, especially the Islamic leaders who judged the Muria plant to be undesirable, are

unlikely to reverse their position.

These issues of financial risk are of considerable importance to Indonesia, especially as it struggles to consolidate the democratic reform gains of the post-dictatorship period. It is highly unlikely that the cost of a first nuclear power station alone would be less than double the decades-long BATAN estimate of $2bn, and could easily be much more. Even allowing for efficiencies and cost reductions in planning and construction of subsequent power stations, a suite of four 1,000 MW reactors will be a very large capital outlay for Indonesia—very likely easily over $10 billion, and perhaps closer to $20 billion. One requirement of democratic accountability is the capacity of countervailing actors, both within and outside government, to have access to comprehensive, reliable and transparent information. This is a necessity in all large infrastructure projects, but the in the case of the global nuclear industry, whose operations have for decades been protected from the public gaze of layers of secrecy, even more so.

Conclusion

This paper has provided a brief review of three neglected aspects of risk assessment of the current proposal for the Muria nuclear power project in Central Java: volcanic and seismic risk, regulatory risk, and financial risk. As already mentioned, there are other important issues and risks that need stringent assessment, including the risks of direct and indirect weapons proliferation, the probable regional security disturbances (including negative action-reaction of perceptions – and misperceptions – between Indonesia and Australia); environmental impacts; community participation and human security; and the rationality of nuclear power compared to gas-powered and other types of electricity generation in a country with much of the world's reserves of natural gas, and abundant solar and geo-thermal resources.[45]

"Oppose nuclear"[46]: Sign at entrance to the village of Balong, September 2007 (Richard Tanter)

The long-delayed decision by the highest levels of the Indonesian government as to whether or not to proceed with the project hangs in the balance. After almost a year in which electoral concerns drove advocacy for the project underground, a new and more powerful coalition of government players has emerged to move the proposal forward. Formally, a decision to proceed will require legislation, regulations, and allocation of resources by both the president and the legislature, and assessment by new agencies to manage the infrastructure investment risk.

In reality, a great deal will depend on the political dynamics of the second Yuhoyono cabinet. The attitudes of the president and of the new vice-president, Boediono, will be central, as well as that of the new heads of three powerful ministries: Energy and Natural Resources, State Enterprises, and Finance. The previous Minister for Energy and Natural Resources, the long-serving Purnomo Yusgiantoro, came from an oil and gas background, and showed no great enthusiasm for the nuclear option. The fact that his successor, Darwin Saleh, has moved quickly to place the Muria proposal on the agenda of the National Energy Council chaired by the president, marks a distinct shift in fortunes for the proposal.

A presidential decision may not be made quickly, and in any case, the need for a new and comprehensive feasibility study for a Muria peninsula site, and even more so for any other proposed site, means that BATAN's suggested 2016 target for a first plant to come online is quite implausible. More importantly, even if a strong internal government pro-nuclear coalition emerges around the Minister for Energy and Natural Resources, there will certainly be close scrutiny of the proposal from the Ministry of Environment and more importantly – in political terms – from the Ministry of Finance. In the previous cabinet, the president's influence would have been matched by that of the powerful and forceful former vice-president, Jusuf Kalla. The dynamics of the new cabinet without Kalla are not yet clear. The vibrant civil society response to the Muria peninsula proposal to date, especially in Jepara and Central Java, will continue to hold the nuclear proponents to account. There is also a new factor in the form of an Indonesian government statement to the Copenhagen climate change conference that Indonesia intends to expand the role of geo-thermal energy in electricity generation.[47]

Yet even as these new political factors work themselves out, what is important for Indonesia, and beyond that country, for the human security of the region, is that the issues of robust, transparent and inclusive risk management be central to the process of decision-making about the Muria nuclear power proposal. At present, and in the three decades that this plan has been pushed forward by its government and industry proponents, risk management has not been characterised by these qualities, each of which should reinforce the other. Inclusiveness requires a genuine process of consultation and dialogue with all stakeholders – local communities first and foremost, but equally government and civil society stakeholders more broadly, and in both in Indonesia and its neighbours. Transparency and public access to data and the process by which data is generated is necessary for all Indonesian stakeholders – all relevant parts of government, national and regional legislators, the business community, researchers and analysts, journalists and civil society groups. And the level of analysis in each of the areas examined in this paper – volcanic and tectonic risk, financial risk, and regulatory risk – cannot be typically described as robust, and needs to be of a much higher order.

The suggestion that all will be well so long as IAEA and national guidelines are followed simply begs the question of the adequacy of those guidelines. The Indonesian case points to the need for an international process to generate a genuinely comprehensive and fully adequate code of conduct for the safe, effective, and appropriate transfer of nuclear power technology from the point of view of consumer countries.

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Other APSNet policy forums by the authors

• The Muria peninsula nuclear power proposal: state of play, Richard Tanter and Arabella Imhoff, Austral Policy Forum 09-1A, 19 January 2009

• East Timor: the crisis beyond the coup attempt, Richard Tanter, Austral Policy Forum 08-01A, 11 February 2008

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Notes

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