

# A Legal Analysis of Governing New Energy Related-Technology through Public and Private Regulations in Indonesia

Puji Atma  
Jakarta, Indonesia  
puji.atma.16@aberdeen.ac.uk

**Abstract**— The shortage of electric power, the decline in oil and gas reserves and the impacts of climate change are among the issues affecting the Indonesian energy sector. New energy related-technology therefore needs to be adopted to address these issues. However, as a civil law system country and because of how long it takes to enact laws and regulations, the technology has developed much faster than the legislation and Indonesia sometimes suffers under a legal vacuum regarding the development of new technology. New energy related technology is continuously developing, and such includes the safe ways to use of the energy sources. However, for certain types of energy, if they are not carefully managed, their use can instead be harmful. For instance, the use of nuclear power given the damage it may cause. Indonesia only uses it for research despite its great energy potential. In fact, under its latest energy policy, the Indonesian government has set nuclear energy as the last option for meeting the demand for electric power. This decision however does not withstand scrutiny as the use of nuclear power has long been developed since the 1950s by the Indonesian Nuclear Regulatory Agency. Internationally, the use of nuclear energy is heavily regulated. This paper provides a critical view and concludes that Indonesia has sufficient tools to adopt new energy related technology of nuclear power and therefore can exploit its resources up to their fullest potential to resolve the continuing energy issues. This paper focuses on the nuclear technologies and provides an analysis of the existing regulations and offers solutions to certain issues that appear to be causing hesitation regarding the use of such energy through a combination of public and private regulations. The solutions are expected to be workable and to allow Indonesia to embrace the modern technology in other sectors

**Keywords** — *energy technologies, nuclear energy, public regulations, private regulations.*

## I. INTRODUCTION

Indonesia has ample natural resources: this includes but not limited to various types of fossil fuels (i.e. oil, gas, and coal) and renewable energy (i.e. water, solar, tidal, wind, etc). However, it remains unable to resolve the shortage of energy such as electric power. [1] To tackle this issue, Jokowi Widodo, Indonesia's President, launched an accelerated program to build 35,000 MW power plants in 2015. However, to the best of the author's knowledge, it has yet to give significantly impacts to the prolonged power shortage problem. [2]

Indonesia also faces other energy issues: energy security and climate change. As regards energy security, electric power generation in Indonesia keep relying on fossil fuels although the resources are declining. [3] Therefore, Indonesia must find a more sustainable solution to cope with this potential energy scarcity problem. Apart from decline on oil and coal reserves, Indonesia also pledges using more renewable and low-carbon sources for combating climate change. In relation to this, Indonesia has ratified several international agreements related to climate change. Under these agreements, in brief, Indonesia has committed to lowering greenhouse gas emissions up to a certain level. Nevertheless, the fact shows that Indonesia is still far from meeting its commitments.

In response to the above energy challenges, the government issued Government Regulation No. 79 of 2014 on National Energy Policy ("GR 79/2014"). [4] From which. Indonesia committed on energy autonomy by, among others, aiming to establish an energy mix strategy. [5] GR 79/2014 sets ambitious targets to meet the energy demand: doubling the use of gas, tripling the coal use and increasing the use of renewables eleven fold. [6] All of which are to be achieved by 2025. [7] Moreover, it stipulates that the whole of Indonesia will have full access to electricity by 2020. [8] This is an objective considered by some as difficult to achieve. It is also important to note that, according to the GR 79/2014, Indonesia considers nuclear energy as the last option. [9]

Setting nuclear power as the last energy resort might be not surprising given robust public resistance to the development of nuclear power plants. [10] The main grounds for public resistance to the use of nuclear energy relates to safety concerns and Indonesia's geographic (i.e. situated on the 'Ring of Fire'). [11] Coupled with the distrust of the public to the government authorities, deriving from allegations of rampant corruption practices and past incompetence in responding to natural disasters, [12] hence in certain regions of Indonesia, the use of nuclear power is declared "Haram" (forbidden). [13] Those factors drive down the possibility of developing the first nuclear power plant until today.

On the contrary to the Indonesian people's common perception on nuclear power, it should be fully acknowledged that nuclear industry has heavily learned from its past bad experiences in calculating and responding to the

fatal nuclear accident. Nuclear safety has been improved and advanced technology has been found to ensure the stable construction and operation costs and to fix safety problem inherited in the old design power plants (Generation I and II). Not to mention that the international agency supervising the use of nuclear power has been working in codifying essential principles and code of conduct to ensure the nuclear safety.

In fact, nuclear energy is not a totally new source of energy in Indonesia. Its limited use for researches has been started since 1950. [14] Several small nuclear reactors have been erected in various places such as Bandung, Yogyakarta, Serpong and Pasar Jumat, Jakarta. [15] Also, nuclear power was once set out as part of energy mix pursuant to old presidential regulation in 2006 to contribute to 2% of energy production. [16] However, public opposition again halted the actual development of the nuclear power plant projects.

Moreover, some energy experts believe that nuclear energy is still relevant and should be part of Indonesia's energy mix. [17] Generally, the involvement of nuclear energy as part of the energy mix and the solution for abating climate change is positively viewed by some scholars in energy sectors. [18] Nuclear energy can produce a massive amount of electric power without emitting greenhouse gases or causing air pollution. [19] Thus, it can be regarded as a suitable means by which to (a) achieve the reduction in greenhouse gases emissions that Indonesia has committed, (b) alleviate the forthcoming problems regarding scarcity of energy sources and (c) hopefully to answer the picking up national energy demand.

This article's position is that the Government's decision, as manifested in GR 79/2014, [20] to consider nuclear energy only as a last resort is questionable. Followed by the opinion that Indonesia has the enough tools available to have a full 'control' of the new energy related technology-yet potential harmful like nuclear power. If not, the combination of public regulation and private regulation is offered to effectively regulate such technology.

Analysis of the existing Indonesian law and regulations will be first. The analysis will focus only on nuclear safety; assessing whether currently Indonesia has a sufficient legal framework to safely develop its first nuclear power plant. Furthermore, international-level conventions on nuclear energy to which Indonesia is a party will be evaluated to assess whether they could assist in supporting and improving nuclear safety in Indonesia. Second, the application of public and private regulations is suggested to fill any available loop hole to effectively mitigate the risk that may cause from the use of the technology.

Finally, the paper will conclude on (1) how Indonesia could guarantee nuclear safety in a bid to gain public acceptance, enabling the state to accelerate the development of nuclear power plants by taking the benefits from the public and private regulations and (2) whether the current position under GR 79/2014 of nuclear energy being an option of last resort in the context of Indonesia's energy mix strategy is appropriate. Eventually, this article suggests that nuclear energy has a great potential for addressing energy problems. The use of the nuclear energy together with the renewable energy would reduce Indonesia's dependency on the use of fossil fuels and coal.

## II. NUCLEAR ENERGY TECHNOLOGY(IES) AND POTENTIAL

### A. *Pros and Cons Nuclear Energy in Indonesia*

It is generally acknowledged that nuclear power can be an option for (i) diversify their energy supplies away from the use of fossil fuels, [21] (ii) producing a significant amount of base-load electricity. [22] They are indeed the potentials that Indonesia require in the context the energy scarcity. The needs for electric power in Indonesia are increasing over the years. The growth of population rate, economic growth as well as the current rapid development of industry sectors are the primary causes of the increasing demand for electric power. Oil and coal are currently the dominant sources for the electric power production in Indonesia. Although Indonesia has abundant natural resources, they are not unlimited; rather the significant decrease in oil reserve raises national concerns. Due to the imbalance ratio of the fuel consumption and the oil production, Indonesia keeps depending on the import of crude oil to support its domestic needs and already lost its membership at the Organization of Petroleum Exporting Countries (OPEC). [23] Coal price volatility also effects Indonesia from using this dirty resource while international concern pushing Indonesia further to start thinking on reducing its greenhouse gas emissions.

On the contrary, uranium has not been massively exploited by Indonesia since the sources have only been used for research. [24] Furthermore, because nuclear will be able to produce a large amount of energy, [25] the careful and fullest use the nuclear power in Indonesia will address not only the issue on energy mix but also to relieve the pressure arising from increasing demand for oil and coal. [26] Indonesia can also start contributing to the climate change issue considering nuclear is one of clean energies available on earth.

Nevertheless, from economic point of view, it is understood that the overnight costs of nuclear power are quite huge but given the life span of the nuclear power is longer than coal or gas power, the government can recoup the cost spent upfront with the revenue they can earn during the operation period. Even if the government at first would be required to subsidise the development of the nuclear technology but considering the amount of energy that nuclear can produce, [27] Indonesia may see growth of the investment in Indonesia as the energy is met. Therefore, the development of nuclear energy is expected not to hurt the Indonesia's state budget.

As briefly mentioned, nuclear power is a low carbon technology. It is therefore appropriate for Indonesia to contribute in the abatement of climate change. As a party to climate change agreements, Indonesia has an obligation to reduce their greenhouse gas emission in compliance with the intended nationally determined contribution. [28] However, so far, according to the climate change performance index, Indonesia dropped its rank for its effort to abate the climate change and thus require significant improvements.

As for the cons of nuclear power, Indonesian anti-nuclear parties deem nuclear energy as 'the destroyer of human nature'. [29] Nuclear energy has a unique risk character. Even though severe nuclear accident is considerably rare, the risk associated with the nuclear activities is transboundary which means that the damage will not only occur to people, property, and environment surrounding the installations but

also to those located off-site the installations. Therefore, if a catastrophic nuclear accident happened in Indonesia, it would affect neighbouring states or even further away. [30]

However, the nuclear industry has learned from its past bad experiences in calculating and responding to the fatal nuclear accidents. Nuclear safety has been improved, and advanced technology has been found to fix safety issues inherited in the old design power plants (Generation I and II). [31] Nowadays, it is accepted that Gen III/III+ nuclear system has a design that improves the safety system. A proposal to use a smaller nuclear reactor(s) (SMR) including floating nuclear power plants has also been developed and discussed to minimise the common risks of large nuclear power plants. [32] Moreover, after the Fukushima accident, IAEA is constantly updating the standards to ensure nuclear safety.

The optimism to establish nuclear power plant in Indonesia is also challenged by the view that Indonesia has a unique geographical condition. Indonesia is part of the most active volcanoes chain (the 'Rim of Fire'). [33] As such, learning from Fukushima accident, public concern about the leak of radiation from the reactors. However, this fear can be anticipated by appropriate analysis of the site before the nuclear power plant is established. Several studies also reveal that, from a geographical perspective, Indonesia has less risk than Japan regarding the earthquake. [34] Therefore, the risks of nuclear substance leakage as the result of a potential earthquake is not as dangerous as Japan and with an appropriate and careful analysis/assessment combined with the current advanced technology, the risks may be well predicted and/or minimised. [35]

Furthermore, about the suitable location for nuclear power plant project, the National Nuclear Energy Agency (BATAN – Badan Tenaga Nuklir Nasional) with the assistance of NEWJEC has conducted feasibility studies over the suitable nuclear sites. The result of which is promising: (i) no hindrance in integrating the nuclear power plant into Jawa-Bali network system, (ii) several locations are appropriate for Indonesia to start building its first power plant namely Ujung Grenggengan and Ujung Watu. [36] Recent studies also highlighted more alternative locations that are believed to be feasible for the nuclear power plants i.e. Muria, Banten, Bangka Belitung, and Banjarmasin. Given this, the geographical condition of Indonesia is not a hindrance for developing nuclear power as long as the site is chosen carefully and by this way, the benefits of using nuclear power can be reaped for addressing Indonesia's energy challenges.

From the above evaluation, in brief, nuclear power has the enormous benefits, and it also can be an alternative for Indonesia to address the protracted energy challenges. Solutions are also offered to take advantage of existing nuclear energy technology. However, without the support from the government as well as from the public, nuclear power will never be materialised in Indonesia.

BATAN is working continuously on two main issues in the promotion of nuclear power namely public acceptance and financial scheme. Concerning public acceptance, the public worries about the nuclear safety and believe that the Indonesian law and regulations on nuclear energy are not sufficient to ensure the safety of nuclear installations. Despite efforts carried out by BATAN, opposition against

the nuclear project by public remains excessive especially in the area where a power plant was proposed to be erected. Even worse, Islamic scholars and clerics once declared a fatwa that states nuclear power as 'Haram' source of energy (forbidden). This is because they firmly believe that the adverse impacts of nuclear power far outweigh the benefits. Besides the issue of nuclear safety, there is also a concern about public trust that makes nuclear power hard to accept. The public observes the government will be incompetence for handling the high-risk technology like nuclear as they always fail to ensure public safety in other sectors such as public transportation.

## B. Indonesia Public Regulation and Public Perception of Nuclear Energy

The International Atomic Energy Agency (IAEA), as the world's centre for cooperation in the nuclear field, promoting the safe, secure and peaceful use of nuclear technology, has published many guidelines for states that wish to explore their nuclear power potential. [37] In general, IAEA suggests that it is essential for a country developing its nuclear energy potential to have a robust framework for nuclear safety. It is not only useful to gain public confidence in accepting the nuclear power but also ensure its safety when used. [38]

Nationally, BATAN has held extensive discussions on the nuclear technology and its advantages for gaining public acceptance [39] but the efforts do not appear to have been effective. [40] It is believed that the promotion of the benefits of nuclear power has already sufficiently educated Indonesian people especially those whose opposing to any nuclear development to guide them in seeing nuclear energy from a different angle; but still it seems to be not working to 'kick-off' the first commercial use of it. Therefore, the remaining problem is that how to make the public embrace and accept that the nuclear energy as the solution to address the energy crisis and climate change as well as to provide guarantee of safety in the use of such nuclear energy. That said, this paper suggests that the Government should ensure comprehensive laws and regulations are in place as a central way to influence the public to accept the nuclear technology. These laws and promulgations would be expected to fully address reasoned bases of the anti-nuclear movement's hesitation to the use of nuclear energy in Indonesia. However, this paper is not to led to the conclusion that the current promotion of the wider benefits of nuclear power should be stopped. The author is of the view that ensuring a robust legislative framework should be pursued in parallel with an active promotion of broader benefits to nuclear energy.

Indonesia does have a set of regulations governing the use of nuclear energy. Law No. 10/1997 is the legal basis for carrying out nuclear-related activities. The law acknowledges that nuclear energy has many benefits but that its use must be strictly regulated and controlled by the Government because an irresponsible use may cause potential radiation hazard. [41] As such, the law was enacted to balance between the benefits and the risk associated with the use of energy by regulating the utilisation of the nuclear energy as well as ensuring the safety, security, peace, and health of workers, the public and environment. For achieving the above objectives, two governmental bodies was established namely BATAN and the Nuclear



Regulatory Agency (BAPETEN- Badan Pengawas Tenaga Nuklir). Both institutions have separate primary functions. [42] BATAN is an executive and promotional body. It is responsible for conducting the research and development, general survey, explorations and exploitations, manufacturing, and fabrication and waste management. [43] On the other hand, BAPETEN has control over any nuclear activity, which includes issuing regulations and licences and inspecting the compliance of the parties with the law.

In the context of ensuring the safety of installations, the separation of duties between BATAN and BAPETEN is important. The independence of BAPETEN, as the regulatory body, is required to ensure the safety of nuclear use: the decision making of BAPETEN will be expected to be immune to the influence or interests of other parties whose duties are to promote nuclear use. This separation of power is also in line with the Convention on Nuclear Safety ("CNS") [44] and the accepted safety requirements established by the IAEA. [45]

Moreover, the Government and BAPETEN have issued an extensive list of regulations on nuclear safety, either in the forms of government regulations or presidential regulation, BAPETEN Chairman regulations or non-binding guidelines. [46]

#### *1) Adoption of Licensing System to Ensure Nuclear Safety.*

At the outset, Law No 10/1997 and the implementing regulations provide three steps for the Government to secure the safety of the nuclear power use in Indonesia: licensing, inspection, and enforcement. As for the licensing, Article 17(2) of the Law states that: 'the construction and operation of nuclear reactors and other nuclear installations, as well as decommissioning of a nuclear reactor, shall be subjected to licensing'. [47] Article 17(3) of the law further states that 'Government Regulation will set out the requirement and procedures for licensing as referred to in paragraphs (1) and (2)'. The Government has further issued two implementing regulations: (i) Government Regulation No. 54 of 2012 on Safety and Security of Nuclear Installations ("**GR 54/2012**") and (ii) Government Regulation No. 2 of 2014 on Licensing on Nuclear Installation and Nuclear Material Utilization ("**GR 2/2014**"). [48] GR 54/2012 specifies the general provisions on the safety and security requirements of nuclear power plants and the responsibilities of the holder of the licences. GR 2/2014 provides detailed procedures and requirement for applying, reviewing, and assessing the application for obtaining nuclear licenses.

Through the licensing system, the Government aims to verify and control the nuclear installations safety: such verification and monitoring encompasses not only activities related to the operation of the nuclear reactors, but also covers the entire life cycle of the project starting from the site selection, design preparation, manufacturing, construction, maintenance and, finally, decommissioning. [49] Furthermore, under GR 2/2014, an applicant must follow the procedures and comply with the requirements to obtain the license – either for construction, commissioning, or decommissioning – from BAPETEN. An applicant for a license in every life cycle – construction, commissioning, or decommissioning – of a nuclear reactor must submit several

documents that should satisfy certain administrative, technical, and financial requirements. [50]

Upon the receipt of the documents, depending on the types of the licenses, BAPETEN will conduct a series of assessments within a given period. The proposed site selection, power plant design, construction and safety procedures, plants' commissioning as well as the decommission plans will be reviewed by BAPETEN. [51] Furthermore, on the issue of Indonesia's geography condition, GR 54/2012 and GR 2/2014 require BAPETEN to conduct a physical site evaluation. [52] The assessment comprises analysis on the impacts of erecting nuclear installations on the environment and evaluation of natural aspects upon the installations such as geological, seismological, and meteorological aspects of the site and demography. [53]

All the above legal requirements align with the CNS and IAEA's safety standards. Article 7 of the CNS requires each contracting party to establish a legislative and regulatory framework that provides for a licensing system and prohibits the operation of nuclear power plants without a license. Furthermore, IAEA's safety standards require that a regulatory body should have the ability to require the operators to provide relevant information on the nuclear installations. In Indonesia, GR 2/2014 satisfies this requirement. [54]

#### *2) Inspection by BAPETEN*

BAPETEN has the authority to carry out inspections of installations using ionising radiation either under construction or already operating. Article 20 of Law 10/1997 stipulates that the inspections will be conducted periodically or at any time to ensure that the nuclear energy utilisation is according to the legal provisions. [55] The inspectors are authorised to (i) enter the installation's site and examine nuclear facilities at any time during the nuclear reactor life cycle and (ii) oversee the level of radiation inside and outside the nuclear installations. If the inspectors find irregularities or any situation in the installations that may danger the safety of the workers, surrounding people, plants, and environment, BAPETEN can instruct the cease of the construction, operation and decommission of the installations. [56]

The above procedures and requirements are again in line with the provisions of the CNS and IAEA's safety standards. Article 7 of CNS provides that:

*'a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licenses' must be set out in the contracting party's legislative and regulatory framework'. [57]*

Commensurate to the provisions under the CNS, IAEA's safety standards suggest the regulator conducts a review and assessment of the facility. [58] The review and assessment should also be considered in making decisions on the granting of licenses to the operators such as licenses for modification, renewal, or revocation of the installations. In light of this, if BAPETEN finds that the operator fails to comply with the safety requirements, BAPETEN may revoke the operating license granted to the operator or suspend its renewal until the operator satisfy its obligations. [59]

### 3) Law Enforcement on Safety Requirements

Law enforcement is guaranteed under law and regulations on nuclear energy: For instance, Article 94 of GR 54/2012 states that BAPETEN can impose an administrative sanction(s) on the holders of nuclear licenses if BAPETEN found a violation of any provisions of the law on nuclear safety. The sanction may be in the forms of written warning, suspension, up to the revocation of license. [60] Criminal penalties may also be imposed on the operators if, for example, a person or a company is engaged in nuclear power activities without a license. In this particular case, however, law enforcement will be undertaken by the police of the Republic of Indonesia following a violation report submitted by public or BAPETEN. Until recently, the most common enforcement measure that has been taken by BAPETEN was up until the issuance of warning letters to the operators. The operators are required to respond or do certain actions to rectify the violation pointed out by BAPETEN. Submission of a work plan and report on the progress of rectifying any incompliance are also required by BAPETEN depending on the types of violations. Failure to appropriately respond to the letters, the license can be revoked, and the operators are no longer allowed to continue any business activities. In the case of revocation, the operator is still fully responsible for the management of nuclear installations including the nuclear materials and radioactive waste. [61]

CNS does require certain provision of enforcement mechanisms to be within regulations by each contracting party. Its implementation in Indonesia is visible through Article 94 of GR 54/2012 as elaborated before above.

However, nuclear law is not static. [62] The coverage of the nuclear law has also broadened due to the enhancement of new nuclear technology and the lessons learned from nuclear accidents. [63] In the context of Indonesia, Law 10/1997 has been 20 years without any substantive changes whilst the technology surrounding nuclear safety has improved in the intervening time period to the present day. Therefore, it may well be said that the law is outdated. This is demonstrated by the following examples.

First, Law 10/1997 defines the terms of radioactive material as ‘any material that has been contaminated only by the operation of nuclear installations’. The wastes generated from non-nuclear installations are therefore not covered under this definition thus leaving a legal vacuum in the controlling of nuclear safety. [64]

Second, SMR(s) (Small and Medium Reactors) designs have recently been introduced as an alternative to the large nuclear power plants. The existing regulations only acknowledge land-based nuclear reactors models, and thus the adoption of new technology, such as floating nuclear power plants, may not be covered by the current legal framework.

Given the above, although there is – in fact – a sufficient legal framework available in Indonesia for governing nuclear safety, the existing laws and regulations cannot be regarded as up-to-date. As briefly explained above, the definition of certain new nuclear technology is yet to be covered under the law and thus given the authority of BAPETEN to supervise relies on the provisions of the law, BAPETEN may also have an issue in overseeing the construction and operation of the power plants through the

licensing mechanism if the operator is using advanced technology.

The above analysis allows the conclusion that the claim of anti-nuclear groups [65] that Indonesian authorities are incapable of handling such high risks are, to a certain extent, reasonable due to the lack of knowledge and legal vacuum. However, this problem may be rectified through the cooperation between the government and international community that will allow Indonesia to gain insights and experiences and to enhance the effectiveness of the national nuclear safety. Indonesia has ratified several international conventions on nuclear safety and has signed cooperation agreements with countries that are developing nuclear power plants for example a cooperation agreement on nuclear safety between Indonesian and United States. [66] Therefore, the next chapter will discuss whether the participation of Indonesia in these arrangements could address the issue of the outdated laws and the criticism of incompetency of the authorities responsible for nuclear energy.

### III. INTERNATIONAL LAW ON NUCLEAR SAFETY

Nuclear safety is not solely the concern of the states where the nuclear installations are constructed and operated: it is also a concern at an international level. [67] As discussed above, the damages caused by a single but catastrophic nuclear accident does not recognise boundaries. Therefore, the international involvement is desired not only to ensure the high level of nuclear safety but also to prevent and mitigate the transboundary damages caused by any nuclear accident. International laws and regulations on nuclear safety are also important as a platform for “nuclear states” to share as much knowledge as possible in order to assist the rest of the international community to set acceptable nuclear safety standards. Technology for the efficient use of nuclear power continually improves. Therefore, ensuring nuclear safety does not appear to be possible without a corresponding improvement in the relevant standards. [68] Such improvement would be best achieved through supervision by international institutions and cooperation with the international community. [69] Furthermore, international participation is also justified in the context of public international law since every state is generally obliged to prevent and mitigate any harmful consequence that may occur from its own high-risk activities, such as the use nuclear energy.

CNS is the primary international treaty that regulates nuclear safety. It is the legal product of a compromise to balance two relevant interests on nuclear energy use: (1) the growing concern about safety and (2) the impacts of international standards on the sovereignty of states in governing the use of nuclear energy. [70] Regarding the latter, note that for some states, nuclear energy plays a major role in its energy policy, therefore, the external influence in the control of their use was simply not acceptable. As a result, CNS does not look at the satisfactory nuclear safety of individual power plant of the contracting states by imposing sanctions for non-compliance. Instead it focuses on compelling signatory states to ensure the safety of nuclear use through meeting the obligations thereunder and to continuously improve the international safety standards by making a periodic report and evaluating it through the ‘peer review’ mechanism. [71]

Indonesia, as a party to CNS, could continually gain benefits from this 'peer review' mechanism. According to the guidelines on the review process, a group of contracting states meets and critically discusses the national report submitted by each state for review. [72] Through this system, BAPETEN could learn from the other members of CNS in order to improve the nuclear safety provisions in Indonesia. However, the incentive nature of the CNS may also be viewed as too weak: there is no formal mechanism where Indonesia could be faced with disciplinary actions if it fails to follow up the comments provided. [73] The preamble of the CNS reaffirms that 'nuclear safety rests with the State having jurisdiction over nuclear installations'. Thus, it is for Indonesia to determine the appropriate steps and actions required for ensuring their compliance with the Convention. Given this, BAPETEN must present a realistic picture of the conditions of the nuclear safety development in Indonesia in its report in order to receive meaningful inputs from other contracting states. [74]

Apart from CNS, IAEA plays the central role in the establishing and adopting nuclear safety standards. [75] In collaboration with international organisations – such as the World Health Organisation (WHO), Food and Agriculture Organisation (FAO), International Labour Organisation (ILO), and the Organisation for Economic Co-operation and Development (OECD) – IAEA's standards gain international recognition to guide established or emerging nuclear states to develop a comprehensive national regulatory regime. [76] IAEA also offers nuclear safety services along with a voluntary review that can assist the states to obtain valuable information and experience on ensuring the safety of nuclear power plants: for example, the Operational Safety Assessment Review Team (OSART) programme allows states to request that the agency reviews the operation of a nuclear installation and provide recommendations regarding the installation's safety. [77]

Furthermore, IAEA continually publishes updated technical guidelines on the nuclear safety such as safety fundamentals, safety requirements and safety guides. [78] It also maintains databases of safety recommendations that can be used by Indonesia in improving its nuclear safety provisions. [79] Given this, the gap between the Indonesian authorities' knowledge and the evolving nuclear technology the public is concerned about can be alleviated with the assistance of IAEA through – among other things – submitting a request to IAEA or adopting the technical guidance that openly available to all member states. [80] However, the recommendations and standards are not binding. Tromans notes that unless states enter into a separate agreement with IAEA that will allow it to inspect upon the compliance of the states, IAEA does not have any power to force the state to follow its recommendations, do complete inspections or, however unsafe, instruct and enforce the closure of the power plant in question. [81]

This paper would suggest that the Indonesian government commits to implementing – in the most practical way possible – a binding requirement for Indonesian authorities to comply with IAEA recommendations and standards from time to time in domestic legislation or via BAPETEN regulations to make them enforceable, whether or not that is directly or indirectly.

Given the above, while the IAEA's review missions and guidance could certainly assist Indonesia improve its safety

provisions and enhancing their authorities' knowledge on nuclear technology and safety, they are still unable to address public distrust of the government authorities. Public transparency could be the answer to this problem. However, it would still be useless if, in the end, the government does not implement the regulatory regime and takes all the appropriate action to guarantee the nuclear safety in Indonesia. As the academic community notes: 'the promulgation of international safety standards cannot restore public confidence if the public suspects that the standards are not being followed or applied'. It is clear that a multifaceted approach is required, of which robust and up-to-date regulation is a key element..

#### IV. THE APPLICATION OF PRIVATE REGULATORY MECHANISMS IN INDONESIA

A private regulation is principally a set of rules designed by a group of business actors (or sometimes in collaboration with others) by which they agree to abide. [82] Theoretically, the application of private regulation in governing certain risky activities is more superior than public regulations if: (i) the private parties have more information about the regulated activities than the public authorities, (ii) the regulated activities involve technology which is continuously evolving and thus require a nimble regulation to control and regulate [83], (iii) if public regulations are not effectively followed and enforced due to, for example, corruption practices committed by public authorities [84], and (iv) the Government has a limited resources to monitor the compliance of the public laws and has only limited budget in drafting or updating the laws to keep up to date. [85]

The integration of the existing regulations and the private regulation would be the best approach for Indonesia in governing the nuclear safety and gaining public acceptance. As discussed above, Indonesia has not yet use nuclear power commercially. Thus, BAPETEN has a lack of knowledge on this matter. Even if Indonesian government can request the assistance of IAEA to provide training or performing review services, this will require certain expenses to bear i.e. for doing some preparatory works. [86] Technology transfer of nuclear technology from developed countries is also not cheap to be made.

Furthermore, nuclear safety is developing very quickly because of technological enhancements learning, among others, from several nuclear accidents like Chernobyl and Fukushima. The Indonesian government has poor records in responding to such rapid technology development. As in 2015, the Government acknowledged that it failed to foresee the impact of rapid technological in transportation sectors. Riots took place in Jakarta among conventional taxi drivers and application based ones like Go-Jek (motorcycle-taxi) and Uber. At that time, the main issue was that Indonesia did not have any specific regulation that governs on the online-based transportation and thus it caused unfairness upon the public transportation companies as the app-based drivers could provide their services to customers without needing any specific licenses to operate and they were also not subject to any tariff regulations. Besides that, the regulations in Indonesia are typically very rigid and as discussed above, amending laws and regulations require an extended period to complete.



Government authorities are also vulnerable to corruption practices. According to the International corruption index, Indonesia's corruption rank is not impressive, more to be horrifying. As Amir correctly pointed out, corruption in Indonesia is endemic since the corruption practices involve not only at the higher level of the government but also infecting every segment in various sectors. [87] Especially in the nuclear industry, BAPETEN officers and a parliament member in charge of energy sector were accused of bribery and corruption. This case signifies a clear picture that the Indonesian authorities are not yet bullet proof to corruption temptation and therefore this raises doubts upon the effectiveness of regulatory enforcement. Lastly, BAPETEN's staffing is limited. As such, monitoring the compliance through licensing and inspections would be problematic. This is also worsened by the fact that only a few nuclear professional and experts exist in Indonesia and therefore make it more difficult for the Government to ensure the full compliance of the regulatory regime. It is also not to mention that many of them are already at their retirement age. Indonesia also has an issue on budgeting because most of the money goes to subsidising the purchase of electricity for low-income people and the remaining devoted to keeping sustainable oil production.

Given the above, the application of private regulation will have potential benefits in co-governing nuclear safety. [88] While asymmetry information on nuclear technology can be addressed by holding training workshops or requesting assistance from IAEA, the information can also be collected from the private parties engaged in nuclear industry. The information can be gathered by, for example, requiring a financial audit and technical review over the project. The government can also save transaction costs and valuable time in passing or amending laws and regulations. Note that for enacting such laws, complete information on subject matters is also needed and therefore requires participations or inputs from researchers, institutions, and all related parties. Therefore, through the private regulatory framework, the authorities could minimise the costs for drafting the required standards as well as the enforcement costs as those actions will be borne optimally by the industry or the tax payers by having a more advanced information on the nuclear technology. [89] Regarding enforcement, maintaining insurance policy can be one way to motivate the operator not only to ensure the safety of its nuclear power plant operator but also to gain financial incentives. The latter can be obtained through an arrangement made between insurer and operator in which lower premium would be given with the condition that the operators perform full safety practices during the nuclear life cycle. [90]

Moreover, the standards set by the industry will be easier to modify in correspond to safety innovation such as the development of Gen IV nuclear system. Once the public regulation is enacted, it will be sticky as the regulators tend to avoid spending more budgets and going through a whole due process again. Also, note that public regulation relating to the use of energy in Indonesia is centralised and it would also not be easy to set a standard and to implement it throughout the territory of Indonesia given the various geographical conditions. The private regulation would be more flexible and thus avoid complicated bureaucracy process. A concern for corrupted authorities can also be answered through private regulation. The industry will have the same goals and incentives i.e. optimising their profits

while at the same time managing their risks of loss. Therefore, they will not be attracted toward other goals and solve the public distrust of the authorities. This would be very different if the authorities are doing the monitoring and enforcement because self-enrichment may deviate the public authorities' goals in ensuring the safety of nuclear power plant.

Nevertheless, it is important to note that private regulation is outside the hierarchy of law in Indonesia. Therefore, a legal framework remains necessary to: (i) ensure that the standards are binding and no free riders benefiting from those deliberately complying or implementing the standards, (ii) monitor the private parties so that the standards will not, in any way, hinder a new player to enter the industry, (iii) to avoid a conflict of law between the public regulations and private regulation. Furthermore, the Government should also ensure that the private parties do enforce the implementation of the standards that they agreed to be set. The private regulations can be applied along with the licensing system as discussed in the previous chapter of this paper. Certification can also be utilised as part of implementing the standards. This certification process works in the construction sector in Indonesia where a contractor must obtain certification from an independent body (so called Lembaga Pengembangan Jasa Konstruksi (LPJK)) before engaging in construction works and as a prerequisite for obtaining a construction license from public authorities.

## V. CONCLUSION

The conclusion that this article reaches is that the decision of the Indonesian government – implemented by GR 79/2014 – for nuclear energy to be the last option in the state's energy strategy is unjustifiable. From the above, Indonesia does have the potential to undertake commercial nuclear energy production: this potential could be utilised for both meeting electricity demand and lowering Indonesia's greenhouse gas emission levels.

Public concerns about the risks of nuclear production and use are understandable. However, technology, regulation and collaboration on nuclear safety are continually evolving and progressing. A more suitable compromise may be to consider the introduction of small-scale nuclear power plants to gain incremental experience in generating electric power using nuclear energy.

The assumption that the Government does not have the ability to control and supervise nuclear use is not fully justifiable. Although Indonesia's current regulations are still outdated to regulate nuclear use and to keep up with the development of nuclear safety technology, the licensing system is sufficient to control and monitor the use of nuclear energy in Indonesia. Furthermore, by applying international cooperation and complying with international obligations, Indonesia can gain valuable knowledge and, thus – through adoption of recommendations and standards within domestic regulation – exploit the potential of nuclear power without neglecting the safety aspects of that energy source.

The private regulatory mechanism can also help Indonesia in responding to the public's lack of confidence in the government resulting from severe corruption. Information can also be gathered and utilised by the government in formulating more comprehensive laws in regulating the safety of nuclear use in Indonesia. Together

with public regulations, private regulation is expected to guarantee the safety of nuclear projects.

Finally, political supports are essential if Indonesia wants to use nuclear power. How great the regulation and safety arrangements are in Indonesia but without the will of political elites, the nuclear project in Indonesia is only budget-wasting and a fairy-tale

#### ACKNOWLEDGMENT

I would like to express my sincere gratitude to Chevening for funding master degree without which I cannot produce this paper. Sincere thanks to both my parent who always support me to finish my master study which resulted in the main idea of this paper. I also owe a debt of gratitude to Aberdeen lecturers who provided me with their legal insights and shared their valuable experiences in energy sectors; special thanks to Dr. Roy Partain of the University of Aberdeen. Lastly, I humbly extend my thanks to everyone that always support me and those who involved directly or indirectly in doing and completing this paper.

This paper is the product of the author's researches for his postgraduate dissertation.

#### REFERENCES

- [1] Sylvie Comot-Gandolphe, 'Indonesia's Electricity Demand and the Coal Sector: Export or meet domestic demand?' (Oxford Institute for Energy Studies, March 2017), 4 <<https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/03/Indonesias-Electricity-Demand-and-the-Coal-Sector-Export-or-meet-domestic-demand-CL-5.pdf>> accessed 19 January 2018.
- [2] PWC, 'Power In Indonesia' (Investment and Taxation Guide November 2017 – 5th Edition) <<https://www.pwc.com/id/en/energy-utilities-mining/assets/power/power-guide-2017.pdf>> accessed by 28 February 2018.
- [3] Lukas Joko Dwiatmanto, 'Penantian Pembangunan Pembangkit Listrik Tenaga Nuklir Indonesia': The Waiting of the Development of Nuclear Power Plant in Indonesia (Orbith 2016) 60; Ditjen Minyak dan Gas Bumi, 'Statistik Minyak dan Gas Bumi 2015': Oil and Gas Statistic 2015 (Kementerian Energi dan Sumber Daya Mineral, 2015) <<http://www.migas.esdm.go.id>> accessed 25 July 2017.
- [4] Peraturan Pemerintah No. 79 Tahun 2014 tentang Kebijakan Energi Nasional: Government Regulation No. 79 of 2014 on Energy Policy (GR 79/2014), Art 9 <<http://peraturan.go.id/perpres/nomor-79-tahun-2014-11e44c503a840e40a801313232363539.html>> accessed 23 July 2017.
- [5] *ibid* Art 10.
- [6] *ibid* Art 9.
- [7] *ibid*.
- [8] *ibid*.
- [9] GR 79/2014 (n 8) Art 9, Art 11(3).
- [10] Alan Marshall, 'The case against nuclear power development in Indonesia', (2012) 5(1) *Journal of Geography and Regional Planning* 1, pp.5.
- [11] Fedina S. Sundaryani, 'PLN to go nuclear if renewable energy goal flops' (Jakarta Post, 25 April 2017) <<http://www.thejakartapost.com/news/2017/04/25/pln-to-go-nuclear-if-renewable-energy-goal-flops.html>> accessed 12 January 2018.
- [12] Jim Schiller, Anton Lucas and Priyambudi Sulistiyanto, 'Learning from the East Java Mudflow: Disaster Politics in Indonesia' (2008) 85(1) *Indonesia*, pp 51.
- [13] Greenpeace, 'A Reasonable Fatwa – Nuclear power is haram (forbidden)' (Greenpeace, 13 September 2007) <<http://www.greenpeace.org/international/en/news/features/fatwa-nuclear-power-haram/>> accessed 19 January 2018.
- [14] Sulfikar Amir, 'Challenging Nuclear: Antinuclear Movements in Post Authoritarian Indonesia' (2009) 3(2-3) *East Asian Science, Technology, and Society*, pp 343, 347.
- [15] *ibid* 348.
- [16] Susetyo Hario Putero, Haryono Budi Santosa, Widya Rosita and Anung Muharini, 'Challenge in the Public Acceptance and Cooperation on the Verge of Building the First Nuclear Power Plant in Indonesia' (ASME Power Conference 2012) (ResearchGate, July 2013) <<https://www.researchgate.net/publication/267581395>> accessed 19 January 2018, pp 2.
- [17] Dwiatmanto (n 3) pp 59.
- [18] Mario Einaudi Center for International Studies, 'Debate: Is Nuclear Power the Answer to Climate Change?' (Cornell University, 19 May 2016) <<http://www.cornell.edu/video/debate-nuclear-power-climate-change>> accessed by 19 January 2018.
- [19] Benjamin Sovacool and Christopher Cooper, Nuclear Nonsense: 'Why Nuclear Power is No Answer to Climate Change and the World's Post Kyoto Energy Challenges' (2008) 33(1) *William and Mary Environmental Law and Policy Review* 1, pp 16.
- [20] GR 79/2014 (n 4) art 11(3).
- [21] Peter D. Cameron, 'The revival of Nuclear Power: An analysis of the Legal Implications' (2007) 19:17 *JEL*, pp 74.
- [22] Phil Smith, 'A Comparison of the Merits of Nuclear and Geothermal Energy in Indonesia' (Quality in Research 2013), pp 162.
- [23] Amir (n14), pp269.
- [24] Dewa Wiguna, 'Batan: Potensi Uranium Indonesia 78 ribu ton: Batan: Indonesia Uranium Potential 78 thousand tonnes' (Antaranews.com 2016) <<http://www.antaranews.com/berita/582705/batan-potensi-uranium-indonesia-78-ribu-ton>>.
- [25] Bambang Setiabudi, 'Dampak Pembangunan PLTN Terhadap Perubahan Tata Ruang Kabupaten Jepara' (2010) 1 *Gema Teknologi*, pp 11.
- [26] I.R. Subki, Adiwardojo, M.s. Kasim, A. Iskandar, Mulyanto, 'Prospect and Potential of Nuclear Power in Indonesia' (IAEA 1997) 25 <[http://www.iaea.org/inis/collection/NCLCollectionStore/\\_Public/28/031/28031002.pdf](http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/28/031/28031002.pdf)> accessed 25-07-2017.
- [27] Benjamin K. Sovacool and Christopher Cooper, Nuclear Nonsense: 'Why Nuclear Power is No Answer to Climate Change and the World's Post Kyoto Energy Challenges' [2008] 33(1) *Wm. & Mary Env'tl. & Pol'y Rev* 16, pp 18. See also the Paris Convention Article 4 <[http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php)>.
- [28] Olivia Wooley, 'Developing Countries Under the International Climate Change Regime: How Does the Paris Agreement Change Their Position?' (Springer International Publishing AG 2017), pp 186.
- [29] Amir (n14), pp256.
- [30] Helen Cook, 'The Law of Nuclear Energy' (Sweet and Maxwell 2013), pp 64.
- [31] Ioannis N. Kessides, 'The future of nuclear industry reconsidered: Risks, uncertainties, and continued promise' (2012) 48 *Elsevier Energy Policy*, pp 193.
- [32] *Ibid*. pp 199.
- [33] Putero et al (n16), pp 3.
- [34] Adiwardojo et al (n26), pp 25.
- [35] *Ibid*.
- [36] Soedyartomo Soentono, 'Nuclear Power Development in Indonesia', (IAEA 1997) 58 <[http://waste.nuc.berkeley.edu/asia/1997/97ILP\\_Soentono.pdf](http://waste.nuc.berkeley.edu/asia/1997/97ILP_Soentono.pdf)> accessed 25-07-2017.
- [37] IAEA, Consideration to Launch a Nuclear Power Program (IAEA, 2007) <<https://www.iaea.org/OurWork/ST/NE/Downloads/files/Consideration.pdf>> accessed 19 January 2018; IAEA, 'Milestone in the development of national infrastructure for nuclear power' (IAEA, 2007) <[http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1305\\_web.pdf](http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1305_web.pdf)> accessed 19 January 2018; IAEA, 'Basic Infrastructure for a nuclear power project' (International Framework For Nuclear Energy Cooperation, June 2006) <[https://www.ifnec.org/ifnec/upload/docs/application/pdf/2016-02/basic\\_infrastructure\\_for\\_a\\_nuclear\\_power\\_project.pdf](https://www.ifnec.org/ifnec/upload/docs/application/pdf/2016-02/basic_infrastructure_for_a_nuclear_power_project.pdf)> accessed 19 January 2018; IAEA, 'Evaluation of the status of National Nuclear



- Infrastructure Development' (IAEA, 2016) <[http://www-pub.iaea.org/MTCD/Publications/PDF/PUB1737\\_web.pdf](http://www-pub.iaea.org/MTCD/Publications/PDF/PUB1737_web.pdf)> accessed 19 January 2018.
- [38] IAEA, 'Milestones in the Development of National Infrastructure for Nuclear Power' (IAEA Nuclear Energy Series 2015) <[https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1704\\_web.pdf](https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1704_web.pdf)> accessed by 28 February 2018. See also Helen Cook, *The Law of Nuclear Energy* (Sweet and Maxwell 2013) 3.
- [39] Putero et al (n 16), pp 3.
- [40] Amir (n 14) pp 23.
- [41] Bagian Menimbang Undang-Undang No. 10 Tahun 1997 tentang Ketenaganukliran: Preamble of Law No. 10 of 1997 on Nuclear Power  
[https://portal.mahkamahkonstitusi.go.id/eLaw/mg58ufsc89hrsg/UU\\_10\\_1997\\_ok.pdf](https://portal.mahkamahkonstitusi.go.id/eLaw/mg58ufsc89hrsg/UU_10_1997_ok.pdf).
- [42] Contrast Law No. 10/1997 (n ), art 3 with art 4. See also Amil Mardha, 'The renewal of licensing system for nuclear reactors in Indonesia' (2008) 2(1) *Int'l Journal of Nuclear Law* 67.
- [43] Law No. 10/1997 (n 56), art 3.
- [44] The International Convention on Nuclear Safety (CNS) (adopted on 17 June 1994, entered into force 24 October 1996), art 8 <<http://www-ns.iaea.org/conventions/nuclear-safety.asp>> accessed 5 August 2017.
- [45] IAEA, 'IAEA Safety Standards: Governmental, Legal and Regulatory Framework for Safety' (IAEA, 2016) <<http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1713web-70795870.pdf>> 6.
- [46] BAPETEN, 'Jaringan Dokumentasi dan Informasi Hukum - Badan Pengawas Tenaga - Nuklir': Documentation and Legal Information Network  
[http://jdih.bapeten.go.id/index.php/site/doklist/thnsk/kat\\_id4/cr\\_kat\\_id/cari/page/3](http://jdih.bapeten.go.id/index.php/site/doklist/thnsk/kat_id4/cr_kat_id/cari/page/3).
- [47] Law No. 10 of 1997, art 17(2).
- [48] Peraturan Pemerintah No. 2 Tahun 2014 tentang Perizinan Instalasi Nuklir dan Pemanfaatan Bahan Nuklir: Government Regulation No. 2 of 2014 on Licensing on Nuclear Installation and Nuclear Material Utilization <<http://peraturan.go.id/pp/homor-2-tahun-2014-11e44c4fed61a670bd6f313232343439.html>> accessed 23 July 2017.
- [49] Mardha (n 42), pp 68.
- [50] GR 2/2014 (n 67) arts. 7-13. Administrative documents are those such as the applicant's deed of establishment and operating business licenses. Technical documents include site evaluation report, technical data of nuclear reactors, information on the proposed design of reactors, and quality assurance program. Financial documents, evidence the financial arrangement between the operator and financial institutions that guarantee the completion of every stage of nuclear installations. See further: The Asia Institute, 'A Survey of the Nuclear Safety Infrastructure in Southeast Asia and Prospects for the Future' (The Asia Institute, 1 May 2010) <<http://www.asia-institute.org/wp-content/uploads/2012/09/2010-05-01-A-Survey-of-the-Nuclear-Safety-Infrastructure-in-Southeast-Asia-and-Prospects-for-the-Future1.pdf>> accessed 19 January 2018.
- [51] Peraturan Pemerintah No. 54 Tahun 2012 tentang Keselamatan dan Keamanan Instalasi Nuklir, Pasal 87: Government Regulation No. 54 of 2012 on Safety and Security of Nuclear Installations, Art 87 <[https://jdih.bapeten.go.id/files/\\_000274\\_1.pdf](https://jdih.bapeten.go.id/files/_000274_1.pdf)> accessed 28 February 2018.
- [52] Peraturan Pemerintah No. 2 Tahun 2014 mengenai Perizinan Instalasi Nuklir dan Pemanfaatan Bahan Nuklir, Pasal 17: Government Regulation No. 2 of 2014 on Licensing on Nuclear Installation and Nuclear Material Utilization, Art 17 <<http://www.hukumonline.com/pusatdata/download/lt52fb3b1a954b7/node/lt52fb3a3e3f7a9>> accessed 28 February 2018.
- [53] BAPETEN Chairman Regulation (BCR) No. 5 of 2015 on the Site Evaluation in the Volcanology Aspect of Nuclear Installation / Peraturan Kepala Badan Pengawas Tenaga Nuklir Nomor 5 Tahun 2015 tentang Evaluasi Tapak Instalasi Nuklir untuk Aspek Kegunungpian (BAPETEN, Unknown Date) <<http://jdih.bapeten.go.id/index.php/site/dokview/id/425>> accessed 19 January 2018.
- [54] GR 2/2014 (n 48) art 20.
- [55] Law No. 10 of 1997 (n 56) elucidation of article 14.
- [56] BCR No. 1 of 2017 on the Implementation of Inspections in the Supervision of Nuclear Energy Utilization / Peraturan Kepala Badan Pengawas Tenaga Nuklir No. 1 tahun 2017 tentang Pelaksanaan Inspeksi dalam Pengawasan Pemanfaatan Tenaga Nuklir (BAPETEN, Unknown Date) <<http://jdih.bapeten.go.id/index.php/site/dokview/id/481>> accessed 19 January 2018, art 20.
- [57] CNS article 7.
- [58] IAEA (n 45) 6.
- [59] GR 2/2014 (n 48) art. 126.
- [60] GR 54/2012 art 94.
- [61] GR 54/2012 art 120.
- [62] Cook (n 30), pp 3.
- [63] Ibid. 4.
- [64] D. S. Wisnubroto, 'Analysis of the Institutional Framework for Radioactive Waste Management in Indonesia' (2009) 35(2) *Atom Indonesia*, pp 75.
- [65] Amir (n 14), pp 300.
- [66] Bapeten, 'RI-AS Tandatangani Kerjasama Keselamatan Nuklir', (Perpustakaan Badan Pengawas Tenaga Nuklir 2016): 'RI-AS Signed Cooperation In Nuclear Safety' <<https://perpustakaan.bapeten.go.id/ri-as-tandatangani-kerja-sama-keselamatan-nuklir/>> accessed 28 February 2018.
- [67] Norbert Pelzer, 'Learning the Hard Way: Did the Lessons Taught by the Chernobyl Nuclear Accident Contribute to Improving Nuclear Law?' (OECD 2006), pp 78.
- [68] Rosa Ptasekaite, 'Continuous Improvement of Nuclear Safety', in Christian Raetzke (ed) "Nuclear Law in the EU and Beyond" (Nomos 2014), pp 75.
- [69] Norbert Pelzer, 'Safer nuclear energy through a higher degree of internationalization? International involvement versus national sovereignty' (2013) 91 *Nuclear Law Bulletin* 43, pp 82.
- [70] Norbert Pelzer, 'Learning the Hard Way: Did the Lessons Taught by the Chernobyl Nuclear Accident Contribute to Improving Nuclear Law?' (Nuclear Energy Agency, 2006) <<http://www.ha.nea.fr/law/chernobyl/PELZER.pdf>> accessed 19 January 2018, pp 93.
- [71] CNS art 20.
- [72] Pelzer (n 67) 93.
- [73] Menno Kamminga, *The IAEA Convention on Nuclear Safety* (Cambridge University Press 1995), pp 882.
- [74] Monica, pp 460.
- [75] Article III(6) of the IAEA's Statute of IAEA (adopted on 23 October 1956, entered into force on 29 July 1957) <<https://www.iaea.org/sites/default/files/statute.pdf>> accessed 28 February 2018.
- [76] Patricia Birnie, Alan Boyle and Catherine Redgwell, 'Nuclear Energy and the Environment' in Patricia Birnie., Alan Boyle and Catherine Redgwell (eds), *International Law and the Environment* (3rd ed, OUP 2009) 496.
- [77] IAEA, 'Operational Safety Review Team' (IAEA, Unknown Date) <<https://www.iaea.org/services/review-missions/operational-safety-review-team-osart>> accessed 19 January 2018.
- [78] World Nuclear News, 'IAEA updates regulatory self-assessment tool' (WNN 2017) <<http://www.world-nuclear-news.org/RS-IAEA-updates-regulatory-self-assessment-tool-0505174.html>> accessed 28 February 2018.
- [79] See IAEA, 'Nuclear Security Series' (IAEA, Unknown Date) <[http://www-ns.iaea.org/security/nuclear\\_security\\_series.asp](http://www-ns.iaea.org/security/nuclear_security_series.asp)> accessed 19 January 2018.
- [80] Morris Rosen, 'Nuclear in Developing Countries: The Transfer of Regulatory Capability' (1979) 21(2-3) *IAEA Bulletin* 1, pp 2.
- [81] Stephen Tromans QC, *Nuclear Law: The Law Applying to Nuclear Installations and Radioactive Substances in its Historic Context* (Hart Publishing 2010) pp 45.
- [82] Martijn Scheltema, 'Balancing Public and Private Regulation', [2016] 12:1 *Utrecht Law Review* 16.
- [83] Faure et al, pp 140.
- [84] Ibid. 141.
- [85] Ibid. 140.
- [86] Monica, pp 450.

- [87] Sulfikar Amir, "the State and the Reactor: Nuclear Politic in Post-Suharto Indonesia" (NTU 2010), pp 132.
- [88] Angela J. Campbell, 'Self-Regulation and the Media', (1999) 51(3) Federal Communications Law Journal, 715 <SSRN: <https://ssrn.com/abstract=184279>>.
- [89] Partain, pp 118.
- [90] Faure, pp 141.