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The Indonesia Htgr Nuclear Safety Management: Peluit 50

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Abstract: The 2017 National Energy Policy states the 2050 national electricity is suggested to be provided by new and renewable energy (NRE) which is clean and competitive. Since nuclear is categorized as one of NREs, Indonesia has truly investigated Nuclear Power Plant (NPP) candidate sites, namely, Ujung Watu Jepara, Central of Java and Bangka island. The National Nuclear Energy Agency (BATAN) and its stakeholders has successfully designed a high temperature and gas cooled reactor not only for producing electricity but also for industry, such called PELUiT 50, an advanced high temperature gas colled reactor (HTGR) type reactor. The International Atomic Energy Agency (IAEA) advises countries being deploy NPPs should consider local content from the beginning till the end of the project. This paper suggests strategies to support a nuclear safety management dealing with the strategic document compilation starting from nuclear design and its standardization, local content concern, public acceptance and new legal aspect for NPP. Therefore, domestic and foreign investors will fully involve in the NPP construction and NPP here will be effective and efficient. The NPP construction will finally give a positive impact on the current national sustainable development. From the overall comprehensive assessment results, a local content HTGR 50/PELUiT 50 nuclear safety management in the country is achievably integrated.

Keywords: Local content, nuclear safety management, HTGR, Indonesia

INTRODUCTION

Almost 17,600 small and big islands spread out all over Indonesia from East to West and North to South [1] and the country also ranks as the biggest four of the world population after the People Republic of China (PRC), India and the United States of America (USA) [2]. Regarding electricity demand till 2050 and based on the national energy policy 2017, Indonesia demands around 346 GWe in 2050 and the electricity need is reinforced from new

and renewable energies (NRE), i.e., biomass, geothermal, wind, solar, micro-hydro, etc. [3, 4].

A nuclear-based electricity may be trusted to be practicable in Indonesia due to its big, highly reliable electricity power and its electricity price lower than other's except coal's. In the South Korea, as one of the Asian developed countries, nuclear energy has been applied not only for households but also for small, medium and heavy industries [5] and nuclear provides around 29% of the whole South Korea electricity. Even, Japan having Fukushima accident on March 11, 2011 is currently planning to reoperate its whole NPPs applying very strict safety rules [6]. Others than the two countries, many developed countries have functioned NPPs since late 1960's and they are forecasted to continue NPP operation as the prime energy to support their electricity for industries till 2050 [7].

Although China commenced to utilize the first NPPs in late 1980s, the country is currently the top one to construct the 30 GWe-total-capacity NPPs till 2050 [8-10]. Meanwhile, some developing countries are currently constructing new NPPs [11-14] and the other has planned to assemble NPPs for the future electricity need by 2040 [15]. Indonesia may be one of the emerging countries to intend to operate the first NPP as soon as 2030 to maximize the use of NREs in the future [7]. This is due to enough human and natural resources, i.e., the success of safe operating 3 nuclear reactors and good enough local content capability for NPP construction including Indonesia's natural resources, i.e., uranium and thorium availability for fuels [16-21].

Based on the Indonesia Nuclear Energy Outlook 2014, it has been anticipated to operate the first NPP (2x1,000 MWe) as soon as 2027 in Java Madura Bali Grid (JAMALI) which has high voltage electricity grids and most industries available in Java [20]. Furthermore, after successfully designing a 10 MW thermal experimental power reactor, called RDE 10 MW, Indonesia through BATAN in corporated with its stakeholders have also developed a 50 MWe HTGR for industries, called PELUiT 50, in 2018. A lot of papers of them have also been scientifically published nationally internationally [22-26]. Lastly, as the 2016 national survey on the application of nuclear science and tehnology (NST) showed 77.58% [27], local content to construct NPP in the country achieved more than 40% [16-17].

The aim of this research activity is to trigger not only domestic investors but also foreign investors to fully participate in the first NPP construction in Indonesia and this is surely appropriate with the government request that the NPP construction is allowed as long as the foreign investor financing applied. To begin with this research, the all-related-to-research available sources and references nationally, internationally were collected, evaluated and assessed, and finally modified, compiled and documented in a very comprehensive nuclear safety management of the Indonesia HTGR 50 (PELUiT 50).

The PELUiT 50 is a newly developed design of advanced HTGR by purely all Indonesia science-engineering groups, so this paper describes NPP safety management dealing with technology safety, technical and non-technical local content, nuclear national standard, public acceptance and legal aspects to support local content NPP safety management of Indonesia HTGR 50 (PELUiT 50). From the overall comprehensive assessment results, a nuclear safety management of Indonesia HTGR 50 or PELUiT 50 is believed to be achieveably integrated.

METHODOLOGY

The IAEA Agency suggested that optimum local content be one of the main parameters to successfully construct the first NPP in a country. To apply the local content for the first NPP construction in Indonesia, public acceptance resulted from national survey on NST should have been implemented. The design of Indonesia HTGR for industry (PELUiT 50) can be a successful local content to be applied for the first NPP construction as soon as

2030. A matter of Indonesia national standard for nuclear is also another local content to be employed for this objective. The more local content we can achieve, the less expensive NPP project will be. Indeed, all collected data and information from various sources have been firstly evaluated and finally, they should be compiled and documented in a very comprehensive nuclear safety management of the Indonesia HTGR 50 (PELUiT 50).

RESULTS AND DISCUSSION

There are at least 5 (five) important outcomes regarding the local content NPP safety management of PELUiT 50. In the following sub-sections, safety design of PELUiT 50, public acceptance of nuclear science and technology (NST), Indonesia national standard of nuclear, technical and non-technical local content for the first PELUiT 50 operation, legal aspects as well as a proposed road map of PELUiT 50 will be elaborated in detail.

Safety Design of PELUiT 50

Prior to design of PELUiT 50, BATAN and all national-related stakeholders have successfully designed a 10-MW-thermal HTGR-type experimental power reactor, called RDE (**R**eaktor **D**aya **E**ksperimen). Some state-owned enterprises have joined to make detail design activities because of their EPC (**E**ngineering, **P**rocurement and **C**onstruction) experiences on a lot of coal plants which have been built in Indonesia. The IAEA Agency has also been appreciative to the RDE developed locally and the Agency has also a regular HTGR meeting among related member states all over the globe as well [28]. The PELUiT 50 was then developed in 2018 due to collaboration between BATAN and INET China. In addition, they have also published the RDE basic design results not only in the international seminars/conferences, but also in national and international journals. The assessment of HTGR fuel plant, NPP waste treatment, uranium resource and its exploration as well as local participation to support NPP construction in Indonesia has been performed [18, 19, 21]. Furthermore, the analysis design of some safety aspects, such as, neutronic, thermal-hydraulic, reactor pressure vessel (RPV), RCCS (reactor cavity cooling system) and coolant design and materials of RDE coolant plant have also been published in some scientific journals [22-34]. China has included the PELUiT 50 program as one of The China International ***OBOR*** (**O**ne **B**elt **O**ne **R**od) programs for BATAN Indonesia. The development of PELUiT 50 may be supported by INET China till its project completion. The PELUiT 50 may be very feasible to be firstly constructed very soon in Indonesia due to strategic, technical and economical consideration. If PELUiT 50 could be assigned as the first NPP program in Indonesia, the budget to support the program would be minimized. For nuclear devices, Indonesia still needs to collaborate with other foreign companies to solve those problems. The PELUiT 50 construction may be very feasible to be operated in East Kalimantan, since the President Joko Widodo already stated the capital of Indonesia would move there. Therefore, the electricity need for East Kalimantan will increase.

Based on the previous mention, the PELUiT 50 can be proposed to be built in that area. East Kalimantan needs additional electricity around 1,713 MWe by 2030 [29] and by assuming the 10%-electricity supported by NRE (nuclear), 3 PELUiT 50 can then be built in that province as soon as 2030.However, since the PELUiT 50 is a new NPP, it will imply to the licensing process of the new NPP which may take time. By law, if the PELUiT 50 taken, the price of the first NPP to be built would be competitive due to much more local participation. Again, to construct the PELUiT 50 in Indonesia, the collaboration to solve the nuclear-island (safety device) construction with foreign companies is still needed.

Public Acceptance of Nuclear Science and Technology (NST)

Up to the end of July 2019, there are 445 NPPs operable all over Europe, North and South Americas and Asia and Pacific countries and these are less compared to 449 NPPs operable in 2017 due to 8 NPPs shutdown and 4 NPPs connected to electicity grid [30]. Meanwhile, China, French, India, Japan, Korea, Russia, Switzerland, Russia and USA have operated NPPs since 1960's and most of them are projected to persist NPP operation to mainly support their electricity for industries till 2050. Moreover, Belarus, Bangladesh, Turkey and United Arabic Emirate (UAE) are currently constructing new NPPs. Moreover, Saudi Arabia specifically having a lot of oils is planning to assemble NPPs to expect the future electricity demand by 2040 [11-15]. For the first NPP in Indonesia, it is suggested the country be better to operate HTGRs in the Eastern part of the country, such as, PELUiT 50 whose power between 20 MWe and 50 MWe [7, 16]. The Eastern parts of Indonesia do not request more electricity compared to those in the Indonesia Western parts. Furthermore, since PELUiT 50 has been designed by Indonesians, its high-tech local content will be optimum and hence the PELUiT 50 will become effective and efficient.

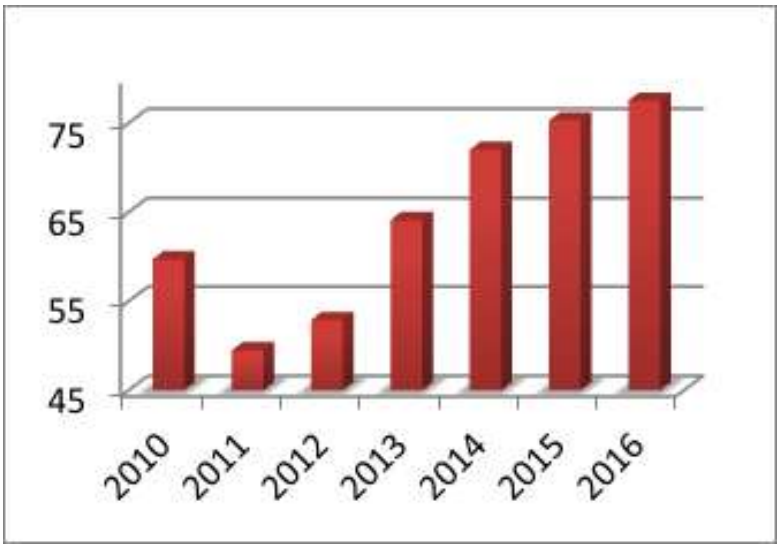

Figure 1. National Polling on NST from 2010 to 2016 [27, 32-36].

In terms of NPP construction, public acceptance is one of the main keys to successfully operate the PELUiT 50 as soon as 2030 in Indonesia. Therefore, the countries which have operated NPPs are of very good partners to join NPP promotion due to their successful operating NPPs. BATAN and its independent stakeholders have implemented the 2010-2016 national survey on the use of nuclear science and technology (NST) in which 3,000-4,000 various people had involved [27, 31-36]. From Figure 1, only in the 2011 national survey, the survey results showed less than 50% Indonesians agreed with NPPs to be available in the country and this is due to the Fukushima accident taking place on March 11, 2011. In the 2016 national survey, there are more than 75% people agreed with NPP available in the country. From the public acceptance point of view, Indonesians principally agreed with the availability of NPP here meaning that NST promotion through seminars, conferences, TV talk shows, meetings with public figures, debates, forum group discussions (FGDs) and others has been successfully implemented.

Furthermore, the national survey of NST should be kept stable even enhanced, so the strategy to make more people agree with NPP should be broadened using IT-based promotion. The strategic promotion to enhance the national public acceptance is that NST

promotion should contain on-line and off-line matters, so the NST material is suggested to become one of the curricula for education from primary to senior high schools even in universities. The NST would then be very familiar since they are young. Smartphones as IT-based promotion can be applied provide such short interesting and inspiring films or advertisement related to the NST.

In 2019, almost 182 millions (68%) of productive Indonesian inhabitants are very dominant in the country [1], so the NST promotion through smartphones would be very worthwhile. The NST promotion should take care of not only NPP matters, but also health, food and industries. This promotion style will make them acknowledge how NST is very valuable in their daily lives. Moreover, the FGD dealing with the NST advantages to support the efficiency of NRE should be regularly instigated and shadowed by all NST stakeholders containing youths, economists, engineers, state-owned enterprises, private companies and others. FGDs should be apprehended not only in formal-state buildings but also in schools, plazas, shopping malls, and of course in NPP candidate sites as well. People are strongly aware of the philosophy of **N**ot **I**n **M**y **B**ack **Y**ard (NIMBY) for NPP site, so the government and NPP owner should then disseminate that all residents living in the areas near the NPP plant will earn a certain discount for their electricity bills in the future.

The TV talk shows should be intensively sustained and tailed by resource people from politicians, engineers, religion leaders, academicians, environmentalists, public figures, and others and one of the talk-show topics should cover advantages and disadvantages of NPPs. The application of social engineering in every region of the NPP developed by making a few-people group to be skilled by BATAN and its related shareholders. Every group really have a certain responsibility to convey the NST research results for health, agriculture, energy, industry and others. Finally, lobbying to Yudicatives, Executives and Parliaments are also of the main keys to be employed and hence the NST would be more familiar to all of them. It needs to be anticipated as well that NST can be a crucial topic to be discussed during the regular cabinet meeting between the President and all related ministers. Indeed, all NST promotion should always be on and off lines for NST public information (PI) and public education (PE), FGDs as well as TV talk shows and those are to be necessarily and regularly seized.

Indonesia National Standard of Nuclear

Indonesia has Badan Standardisasi Nasional (The National Standardization Body, BSN). The development of BSN has originally started from the development and application of standards began from the Dutch and Japanese colonial times since 1928. During the Japanese occupation 1942-1945, the formal standardization activities in the country were halted [37]. After Indonesia's independence on August 17, 1945 and till 1951, the Indonesian Normalization Fund Foundation (YDNI) was formed. In 1955, YDNI was represented as a member of the international standards organization (ISO). The YDNI then successfully represented Indonesia as a member of the International Electrotechnical Commission (IEC) in 1966.

After Law No. 10 of 1961 was available in the country, standardization activities were still sectoral at that time and carried out by various departments or ministries. Following the National System Development for Standardization program developed in 1973 and National Standardization Board (DSN) existed in 1984, the Indonesia Government finally dissolved the DSN which subsequently changed to the National Standardization Body (BSN), a Non-Ministry Government Institution (LPNK). The Body has tasks to foster and coordinate all standardization and conformity assessment activities in the country. Since 2018, BSN has been very powerful to handle all matters of Indonesian National Standar (SNI) and has actively participated in such globe activities held by various International Organizations, such as, ISO, IEC, APEC etc. The Body is

also as the secretariat of the National Accreditation Committee (KAN) which continues to develop accreditation and certification schemes and fight for international mutual recognition. The following paragraph describes in detail the main system and components in the HTGR 50/PELUiT 50.

In general, the whole nuclear reactor system mainly contains two devices, i.e., safety and non-safety devices. Those two devices are categorized into systems and components of the reactor. Regarding HTGR 50/PELUiT 50 systems and components, Figure 2 shows the main system available in the HTGR 50/PELUiT 50. Principally, like other nuclear facilities, system and components of the PELUiT 50 should meet with the applied BAPETEN (Indonesia Nuclear Regulatory Body) regulation. All systems and components attached to and integrated with the reactor core are categorized as safety class devices meaning that those system should stand to earthquake with the magnitude of minimum 7 Richter scale and hence these system components are classified to the industry-class plus. Meanwhile, other system components out of the reactor core are generally considered industry classes as mostly applied in coal plants in the country. Remember, while instrumentation and controls (I&C) are considered safety class devices, monitoring instrumentation only deals with industry class. Till to date, although local engineering companies actively participated in constructing RSG-GAS nucear reactor and other supporting nuclear facilities in 1980s till 1990s in Serpong, the companies which intend to participate in the NPP construction in the future should still collaborate with foreign nuclear engineering companies to gain their experiences on manufacturing nuclear-safety devices of the NPP plant [7]. From those countries experiences on NPP construction, it is concluded that after constructing some NPPs, the countries are able to enhance their local contents in constructing their NPP plants. If Indonesia government lets then local engineering companies actively participate in NPP construction here, the local content capabilities on the previous mentioned matter will be improved significantly.

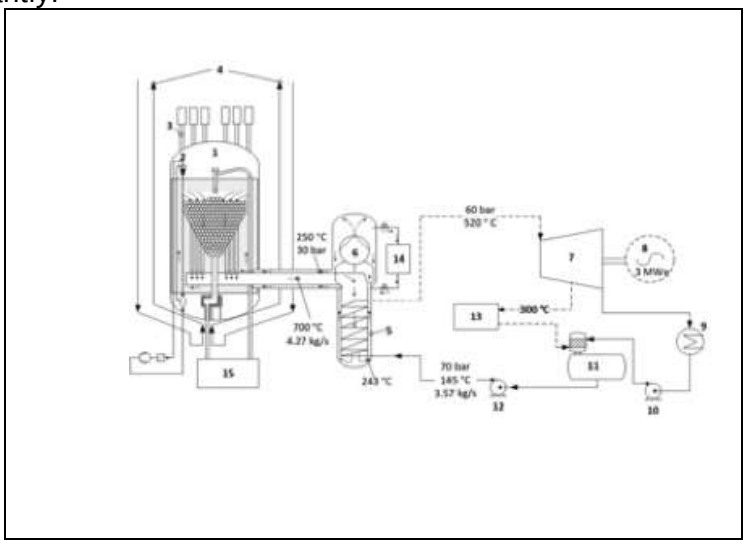

Figure 2. Thermal Diagram and Main Parameters of the RDE at 100% Power. 1-Reactor; 2-Small Ball Absorber Shutdown System (SAS); 3-Control Rod Drive Mechanism (CRDMs); 4-Reactor Cavity Cooling System (RCCS); 5-Steam Generator (SG); 6-Primary Gas Blower (PGB); 7-Steam Turbine; 8-Generator; 9-Condenser; 10-Condensate Pump; 11-Deaerator; 12-Feed Water Pump; 13-Process Heat Application Unit; 14-Helium Purification System (HPS); 15-Fuel Handling System [22].

Local Content of HTGR 50/PELUiT 50 Operation

Indonesia has successfully operated the 3 nuclear research reactors, i.e., Triga Mark 2000 since 1965 in Bandung, Reaktor Kartini 250 kW since 1979 in Yogyakarta and RSG-GAS reactor since 1987 in Serpong. BATAN has also operated experimental power fuels, nuclear waste treatment, nuclear engineering facilities, radioisotope and radiopharmaceutical and others in Serpong since 1987. It is the facts that local engineering companies have fully involved in the construction of high-tech buildings and nuclear facilities whilst constructing RSG-GAS and its other nuclear facilities. At that time, WK (Wijaya Karya) and HK (Hutama Karya), the two local biggest state-owned enterprises, fully participated in the reactor construction in which they collaborated with the reactor vendor, Interatom GmbH, West Germany. Regarding the national capabilities to support NPP construction, the survey showed around 41% [7, 16]. The successful key to firstly operate an NPP operation is that the NPP program should be established as one of the national priority programs to be implemented by 2030. Therefore, the President Decree to support the program should be firsly established. If the priority program declared by the President, all activities will be supported not only by all related ministries, institutions and agencies, but also by private engineering companies.

Furthermore, FGDs on NPP construction should be regularly held by involving all related stakeholders, i.e., state-owned enterprises, national and private universities as well as private companies. Site visits to state-owned enterprises as the potential local vendors should be increased and hence they can fully take a main role to participate in constructing activities mainly in non-nuclear devices. It is noted that to firstly construct even operate NPP as soon as 2030, the NPP program should be one of the national priority programs, so the program will be fully supported by the government, its stakeholders including bankers. They should also have opportunities to visit NPPs abroad, i.e., visit to Japan, RoK, Russia, US, China and others. This is such a very important program that most local companies would then believe that to construct an NPP is a promising business.

Since the PELUiT 50 is a new NPP, it will imply to the licensing process for the new NPP which may be slower. By law, the nuclear licensing process is much simpler, if a licensed-new NPP has been given in the country NPP producer. However, if the PELUiT 50 taken, the price of the first NPP to be built would be also more competitive due to much more expected local content [38, 39]. Indeed, either the foreign new-NPP or the PELUiT 50 chosen, the collaboration to handle the nuclear-island (safety devices) construction with foreign companies should still be employed.

Legal Aspects of PELUiT 50

The Government Regulation Number 22-year 2017 states to focuse on using mainly NRE for energy needs till 2050. The energy or electricity demand is based on the electrification ratio 88.30% in 2015, COP 21 (The 21st Conference of Paris 2015), fossil fuel limitations and electricity consumption 910 kWh per capita in 2015 [3]. President as the Chairman of DEN (National Energy Chamber) ordered the Chamber to prepare a roadmap for nuclear power development in the country. As seen in Figure 3, the utilization of NRE clearly rises from 23% in 2025 and even to 31% in 2050. The Commission of Indonesia Parliament dealing with environment, higher education and energy has recently demanded the Minister of Energy and Mineral Resources to utilize NPPs in the years of 2019-2038 due to NPPs providing a big, sustainable, effective electricity power and hence they will support sustainable electricity for small, medium and heavy industries in Indonesia.

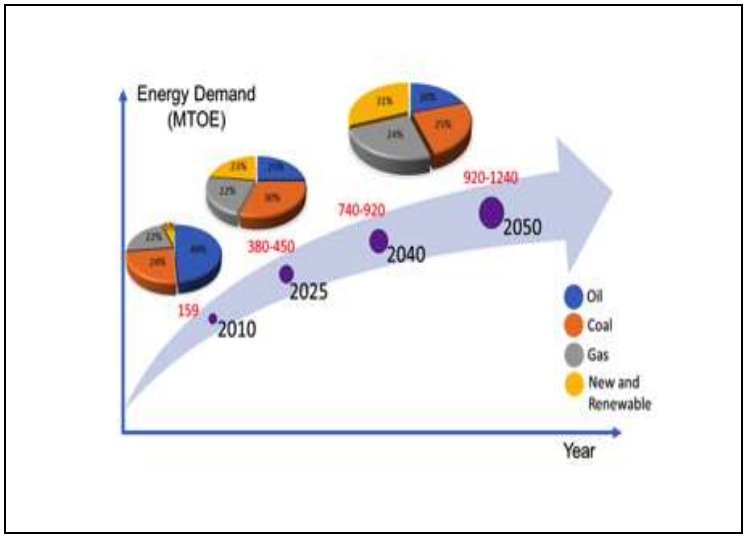

Figure 3. Energy demand till 2050 based on the national energy policy 2014 [3, 29].

The vision to apply NRE for electricity till 2050 should then be followed by important actions to be implemented by all related ministries, agencies, institutions and others to support the PELUiT 50 operation in Indonesia as soon as 2030. To support the previous mention, it is suggested The Maritime and Investment Coordinating Minister lead a regular national coordinating meeting to make sure that all activities are dedicated to support a vision of NPP operation and hence the vision becomes in reality and on time. The BAPPENAS should develop national priority programs and one of them is the program to firstly operate PELUiT 50. The BAPPENAS can then clearly divide all tasks to all related ministries, institutions, agencies and a certain provincial governments in the country. Furthermore, due to covid 19 matter, the BAPPENAS should also try to earn soft loan from foreign countries. Meanwhile, the Ministry of Home Affairs is responsible to cope with the provincial government in which the PELUiT 50 will be constructed in its province.

The Ministry of Law and Human Rights should lead to firstly establish a president decree to support the priority program previously mentioned. By law, the decree is able to be updated annually depending the progress of the project and the first decree would start at the latest of 2020 or the beginning of 2021 due to Covid 19 pandemic all over the globe. Therefore, it is a big hope the first stone laying ceremony for the first NPP construction to be inaugurated by Mr. President Joko Widodo at the beginning of 2021. Due to the covid 19 matter, the Ministry of Finance has still a task to provide a minimum national budget at least to provide NPP sites land and nuclear licensing.

While the Ministry of Energy and Mineral Resources has a plan to build small and medium power plants in the Eastern part of Indonesia, the Ministry of Industry should lead on that by national law assurance that the local participation should be maximized for the construction of the first NPP in Indonesia [38, 39]. The Ministry of Foreign Affairs principally has a task to keep geopolitical lobbying among the regional ASEAN, Asian and global countries work properly and hence there would not be any objection from other countries due to this national priority program implementation. The Ministry is also able to promote the first NPP construction mostly financed by foreign engineering companies. The government then only supports NPP licensing, site and law gurantees for the PELUiT 50 construction.

BATAN, BPPT (The Agency for the Assessment and Development of Technology) have tasks the assurances of nuclear/safety and non-nuclear technologies to be applied for whole activities to support the vision and hence the first NPP is guaranteed to be safe and secure

operable. Meanwhile, LIPI (The Agency for National Sciences) has a responsibility to assure the social engineering around the NPP site working properly and hence the surrounding-site public acceptance for the PELUiT 50 construction is also increased. Finally, the availability of the new NPP would be safe and the first NPP construction in Indonesia would finally available as soon as 2030.

The Ministry of Communication and Information has a task to promote and disseminate the national priority program to operate the PELUiT 50 operation as soon as 2030 to public. The programs can be made through regular talk-show in radios and televisions, forum group discussion (FGD), seminars, conferences, smart phones and others. Meanwhile, the State-owned Enterprises Ministry has a task to ensure the optimum local participation during the whole construction of the first NPP [38, 39]. Therefore, the ministries are regularly offered to actively participate in NPP's FGD provided by BATAN and other related national and international stakeholders. Indeed, if all activities coordinated and monitored regularly, it is believed that the PELUiT 50 operation as soon as 2030 would become in reality and on time. Indeed, the Go Nulcear statement from Mr. President Joko Widodo is still needed and this should be promptly stated at the end of 2020 or at the beginning of 2021 at the latest.

Proposed Road Map of PELUiT 50

The road map for PELUiT 50 construction and operation is very important to be established and Figure 4 shows the proposed road map of PELUiT 50 which commences from basic detail design till the reactor operation. For the time being, PELUiT 50 is in a basic design period and to make it detail, BATAN should collaborate with local engineering companies, then called the collaborated company to solve non-safety devices matter. On the other hand, to solve safety devices of the PELUiT 50, the collaborated company is suggested to cooperate with one or a couple of foreign nuclear engineering companies to solve safety device matter of the reactor. Based on the government laws [40] which is also conformed with the International law [41-42], the licensing should begin with the site evaluation and site program regarding all administrative matters related to the main reasons why the PELUiT 50 should be constructed in this country and what most it is used for. Principally, the availability of the PELUiT 50 should be assessed from all aspects, i.e., safety, social, economy, environment and others.

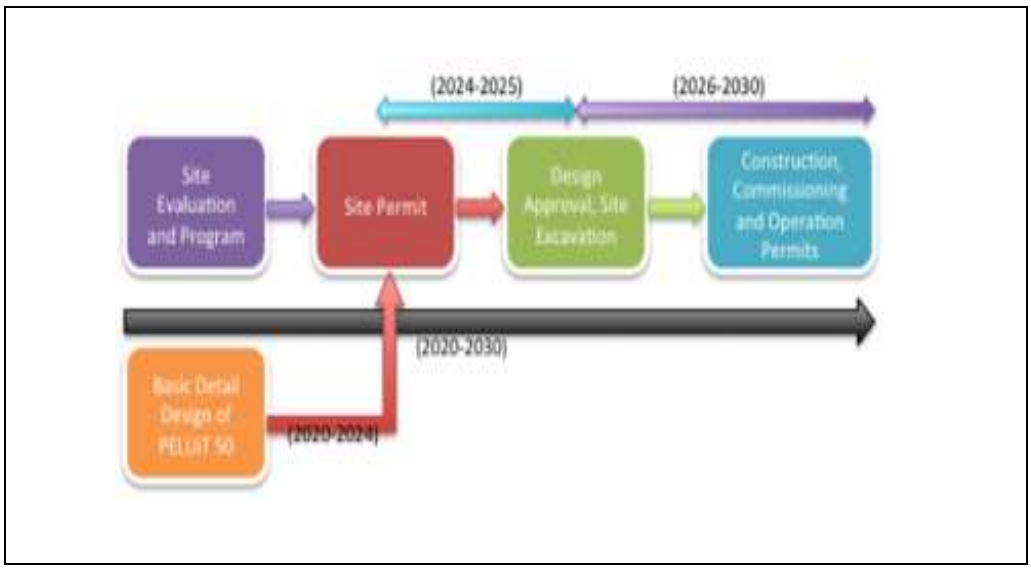

Figure 4. Proposed Road Map of PELUiT 50 [Mod. Ref. 40].

Once the site evaluation and program met with the applied law, the licensee which is also the owner of PELUiT 50 is able to propose the site permit to the national nuclear regulatory body (BAPETEN). The regulatory body surely requests PELUiT 50 detail design not only for site permit, but also for design approval. The design approval of it is expected to be agreed by 2025 at the latest, and hence the PELUiT 50 construction will be released by 2025 as shown in the above Figure. To come along with the reactor construction which normally lasts 4 to 5 years, the commissioning and operation reactor permits can be simultaneously proposed by the licensee to the regulatory body. Finally, once the commissioning permit released in 2029 at the latest, the final operation of PELUiT 50 is considered to take place in 2030 at the latest due to normally one year for reactor commissioning.

Indonesia HTGR Nuclear Safety Management: PELUiT 50

Indonesia HTGR nuclear safety management of PELUiT 50 is principally as shown in Figure 5. The nuclear safety management of PELUiT 50 commences from design user requirements (DUR) of PELUiT 50 itself. First, there some main keys in DUR of PELUiT 50, i.e., what is the reactor used for and when it will be operated; how megawatts the reactor could achieve; where the location of the reactor could be; how the life cycle of the reactor should be; what the criteria for the reactor vendor could be; how many percentage of local content can be, etc.

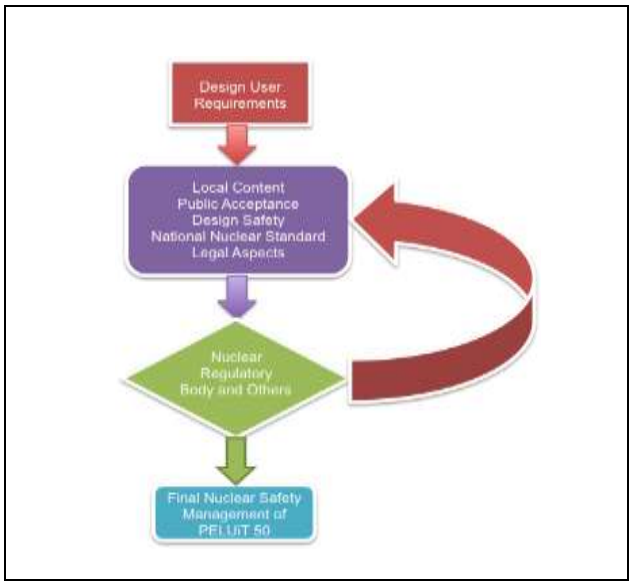

Figure 5. Nuclear Safety Management of PELUiT 50

The second point is then from all DURs given and there are main keys which can be decided, such as, during the reactor construction, it can be determined how many percentage we can achieve each for non-safety and safety devices. Third, for public acceptance, based on the 2016 national survey on NST, there are almost 78% Indonesians agreed with the NPP to be available in the country. From this point of view, to improve public acceptance on NPP, it can then be decided what kind of promotion and public information and public education (PI/PE) should be developed and hence Indonesians realized that NST is not only to support the electricity needs for the country prosperity, but also to prolong the whole national development goals till 2050 even 2100. Fourth, design safety of PELUiT 50 is a must, so that the PELUiT 50 safety should be focused on the nuclear safety of advanced

HTGR in the future or GEN-IV nuclear safety

Fifth, local content of PELUiT 50 is one of the government goals in terms of national vision to be gained, namely, prosperity, self reliance and sovereignty. Therefore, the PELUiT 50 operation should be decided as one of the national programs to be soon implemented. Based on the government regulation [38-39], the more local content of the PELUiT 50 can be achieved, the less expensive of the PELUiT 50 project will be. At last, legal aspects of PELUiT 50 as well as the road map of PELUiT 50 are very important to be taken care of. The President decree should deal with the PELUiT 50 or the vision to operate PELUiT 50 as the first NPP in Indonesia as soon as 2030. The President decree should also cover all activities to support the national vision previously mentioned and divide all tasks and authorities to all related ministries, agencies, state-owned enterprises, private companies etc. After all aspects integrated in nuclear safety management of PELUiT 50 and delivered to the national nuclear regulatory body (BAPETEN) and the related ministries for nuclear and non-nuclear licensings, the regulatory body and the related ministries will then evaluate all matters for licensings of site, design, construction, commissioning and operation. The overall licensing processes will take time, since the regulatory body and the other related ministries should briefly review all nuclear reactor proposals delivered by nuclear reactor licensee either BATAN or the collaborated companies including foreign engineering companies. The final review which has been implemented by all of them will establish the Final Nuclear Safety Management of PELUiT 50 as shown in the previous Figure.

CONCLUSION

An assessment to develop nuclear safety management of PELUiT 50 has been done. The development of NPP in Indonesia is still relevant due to the globe trend to assemble certain NPPs till 2050 even 2100. Local participation for NPP construction should be considered and to maximize the local content, the government should fully involve in designing, standardization, licensing, construction and operation of PELUiT 50 and hence the PELUiT 50 project would be effective, efficient and available as soon as 2030. The political will from the Indonesia government would be increased due to the new strategies to promote NST to public using on and off lines and IT-based information and education. The NPP legal aspect is also one of the main stages to be solved, so the role of the Coordinating Ministry of Maritime and Investment is mandatory to promptly solve any problem risen during the implementation of the whole project. Indeed, from all implemented assessment, due to technically, strategically support from Indonesia government, it is believed that Indonesia is able to develop such a nuclear safety management of PELUiT 50 dealing with maximum local capabilities.

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