The Strategies of Indonesia to Operate the First NPP by 2030

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Abstract. Based on the RUEN Law 2017 for the Master Plan for National Energy 2050, the need for future electricity will be provided by new and renewable energy (NRE) which is clean and competitive. To support the previous mentioned matter, Indonesia has deeply investigated on nuclear power plants (NPPs) as part of national energy mixed by affording two nuclear power plant (NPP) candidate sites, such as, Ujung Watu Jepara, Central of Java and Bangka island. There are mainly important reasons up to now, why the first NPP has not yet been constructed in the country. This paper suggests new strategies to support the vision of the first NPP operation in Indonesia by 2030. The strategies consider not only the bureaucracy simplification to speed up the inter-ministerial coordination on developing the new government rules, but also the enhancement of public acceptance from the 2016 national survey of 77.58%. For this matter, the coordinating ministry of maritime and investment should lead to monitor all activities related to the previously mentioned vision In addition, the new strategies of NPP promotion to develop and strengthen the political will of Indonesia government for the first NPP operation are also explained. The all new strategies can be achieved from the survey results on the application of nuclear science and technology (NST) from 2010-2016. Finally, a strategy to maximize the local participation in NPP construction more than to 50% can be achieved by providing regular forum group discussions (FGD) among all national stakeholders. A strategy to speed up the licensing process for the first NPP operation can be gained through involving the Indonesia government or state-owned enterprises in designing, construction, commissioning and operation of the first NPP in the country. From the overall comprehensive assessment results, it is believed that Indonesia has the ability to operate the first NPP by 2030.

Keywords: Indonesia, operate, first NPP, 2030.

1. Introduction

Indonesia owns around 17,504 small and big islands spread out all over the country from East to West [1] and lies on two big continents Australia and Europe. Indonesia also ranks as the biggest four of population after People Republic of China (PRC), India and the United States of America (USA) [2]. Due to National Energy Policy (*Kebijakan Energi Nasional, KEN*) Government Regulation No 22 Year 2017, while the population is predicted to be 335.3 millions in 2050, the country will need 428 GWe derived from coal, oil, gas, new and renewable energy (NRE), such as, solar, micro-hydro, geothermal, wind and others [3-4]. To increase the use of NRE electricity, nuclear-based electricity is trusted to be suitable for Indonesia since nuclear is able to stipulate a big, highly reliable electricity power and also has a bit higher electricity price than coal's. This is because the nuclear energy can be utilized not only for households but also for small, medium and heavy industries. People also do not concern about its technology because the innovative reactor technologies will cover pressurized water reactors (PWRs), high temperature reactors (HTRs), and fast reactors by 2050/2100 [5-6] even small modular reactors (SMRs), especially those belonging to Generation IV in the future [7].

China, French, United Kingdom, Switzerland, India, Russia and USA have operated NPPs and they are predicted to continue NPP operation as the prime energy to support their electricity for industries till 2050 [8-16]. China is very ambitious to construct NPPs having the total capacity of 30 GWe till 2050 [17], although they just commenced to assemble the first NPP around 1985. In addition, Belarus, Turkey, Bangladesh and United Arabic Emirate (UAE) are currently constructing new NPPs [17-22]. Even Saudi Arabia which certainly has a lot of oils is planning to assemble NPPs to anticipate the future electricity need by 2040 [23]. Meanwhile, Indonesia is one of the emerging countries to plan to build the first NPP by 2030, those countries has advanced to operate their NPPs since the end of 1960s. There must be a gap between Indonesia as an emerging NPP

country and those advanced countries operating NPPs, so there must be collaboration between those two, especially for handling the construction of nuclear-island devices for the first NPP in the country. The strategy to handle the previous mentioned matter is described in section 3.3.

Referring to the plan to build the first NPP in Indonesia, the country has actually anticipated the first NPP to be available as soon as 2027 and the country would have 2,000 MWe (2x1,000 MWe) in Java Madura Bali Grid (JAMALI) which has high voltage electricity grid and a lot of industries and people mostly available in Java [24]. Kalimantan and Sumatera may be very suitable for HTRs whose power between 20 MWe to 50 MWe [25-26]. Till to date, to develop such a new NPP in the country seems to be unfortunately possible or goes stagnant although the national commission to assess the possibility to build the first NPP existed in the country in 1972 which means that 37 years have been over, but the first NPP in the country has not yet become in reality.

Up to now, there has not yet been a comprehensive assessment that Indonesia is able to operate the first NPP by 2030, so this paper recommends the new strategies to achieve the vision of the first NPP operation by 2030. The strategies deal with the coordinating ministry of maritime and investment to establish the bureaucracy simplification to speed up the inter-ministerial coordination on developing the new government rules [27-29]. The strategy to enhance public acceptance from the 2016 national survey of 77.58% and to establish the NPP promotion to strengthen the political will of Indonesia government was made based on the summary of survey results for the application of NST from 2010-2016 [30-36]. Finally, the strategies to increase the local participation in NPP construction from 41% to more than 50% [37-41] and to speed up the licensing process for the first NPP to become around 7 years instead of 9½ years are also explored [42-44]. From the overall comprehensive assessment results, it is believed that Indonesia has the ability to build and operate the first NPP by 2030.

2. Methodology

As explained in section 1, the objective of this research paper is to comprehensively assess the chance of Indonesia to operate the first NPPs by 2030. To achieve the previously mentioned objective, the following strategic methodologies were applied. **First**, to investigate the strengths, opportunities, weaknesses and threats (SWOT analysis) to achieve the first NPP operation by 2030 was utilized [45-48]. Authors believe that while strengths and opportunities will push and speed up every program declared, weaknesses and threats may make the program go improperly or stagnant. However, this paper suggests some new strategies decrease or minimize weaknesses and threats which may happen during the program going on. **Second**, the political will of the Indonesia government is the utmost of the whole target previously mentioned, so the 77.58% public acceptance to accept NPPs in the country is one of the main spirits to propose the first NPP operation to the government [30-36]. It is believed that by improving the strategy of public acceptance through public information and education to all levels of people as well as all stakeholders involvements, the national survey on the use of nuclear science and technology (NST) will increase and hence the political will of the Indonesia government on the first NPP operation by 2030 will fully support and become in reality and on time.

Third, due to the national participation in operating the first NPP as high as 41%, its enhancement should be promptly engaged to make the first NPP more effective and efficient, but still safe [37-41]. One of the strategy to be applied is to ask all related state-owned enterprises involve in all activities related to the application of NST for daily lives and hence they finally believe that NST is able to improve their live qualities. **Fourth**, the bureaucracy simplification among the ministries, agencies and others should be promptly established [27-29]. The authors request Mr. President Joko Widodo to assign the Coodinating Maritime Minister to lead and coordinate all national and international activities to continuously support the vision of the first NPP operation by 2030. **Fifth**, to speed up the licensing process of the first NPP to become 7½ years is a must, so that the price of electricity nuclear-based will be very competitive [42-44]. By providing the active collaboration between BATAN and all related stakeholders to support the previous mentioned vision, the 7 ½-year licensing process for the first NPP operation by 2030 will become in reality and on time. Indeed, the summary of the paper can be seen in the section of conclusion.

3. The strategies to operate the first NPP in Indonesia by 2030

3.1. SWOT Analysis to Focuse on The New Strategies to Operate The First NPP by 2030

Analysis of **s**trengths, **w**eaknesses, **o**pportunities and **t**hreats (SWOT) is believed to be able to succeed a certain national program to become in reality. The program called *to operate the first NPP in the country by 2030* requires a lot of human resources, time and budget due to other countries' experiences. Indonesia is also a developing country which is trusted to own a lot of ethnics and cultures, so that the role of social engineering in operating the first NPP can not be neglected. The country has also established the National Nuclear Energy Agency (BATAN) since 1958 and the Agency has had a lot of collaboration not only with domestic universities, ministries and agencies, but also with foreign universities and institutions. The SWOT analysis to operate the first NPP in Indonesia by 2030 can be seen in table 1.

TABLE 1. SWOT analysis to operate the first NPP in Indonesia by 2030.

Strengths	**Opportunities**
1. High public acceptance for NPP availability	1. NPP clean and support from *RUEN* 2017 on NRE in 2050
2. Indonesia Parliament support	2. Small and big NPPs
3. Capability on non-nuclear devices	3. Good geopolitics
4. HTGR program supported by International Belt and Road program	4. Enhancement of qualified human resource/local participation
	5. Countries operated and planned NPPs till 2050
Weaknesses	**Threats**
1. Safety class devices below 50%	Dependence on NPP fuels and nuclear devices
2. Investor doubt on political will for the first NPP	
3. Improvement on applicable rules for NPP	

From table 1, it is very evident there are fortunately more strengths and opportunities compared to weaknesses and threats, so that there should be having more confidence to achieve the vision of operating the first NPP by 2030. In the following sub-sections, the new strategies to maintain even increase the strengths and opportunities to support the operation of the first NPP by 2030 will be explained in detail. Finally, the strategies to deeply minimize the weaknesses and threats in achieving the previously mentioned vision will be comprehensively elaborated.

3.2. Inter-ministerial coordination to establish new government rules for supporting the first NPP in Indonesia

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]. In the plenary of the National Energy Chamber (*Dewan Energi Nasional, DEN*), the President as the Chairman's ordered the Chamber to prepare a roadmap for nuclear power development in the country. The utilization of NRE clearly goes up from 23% in 2025 and even to 31% in 2050 as seen in figure 1. 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.

Based on the previous description, it is suggested some new strategies to be developed and even impplemented very soon. The vision to apply NRE for electricity till 2050 should be followed by important actions to be implemented by all related ministries, agencies, institutions and others to support a vision of the first NPP operation in Indonesia by 2030. Since the vision is one of the national significant programs, the vision should be firstly stated by the President of Republic of Indonesia. The new strategies to be developed and implemented are then suggested the followings. **First**, the Maritime Coordinating Minister should lead a regular national coordinating meeting to make sure that all activities are to support the vision and hence the vision becomes in reality and on time, such as, bimonthly meeting and an immediate meeting once a very urgent matter to be soon decided. **Second**, the Agency for National Planning and Development/BAPPENAS should develop a national program to implement all national activities to support the vision of the first NPP operation by 2030. The BAPPENAS can then clearly divide all tasks to all related ministries, institutions, agencies and a certain provincial governments in the country. The Minister of Home Affairs is responsible to cope with the provincial government in which the first NPP will be built in their province.

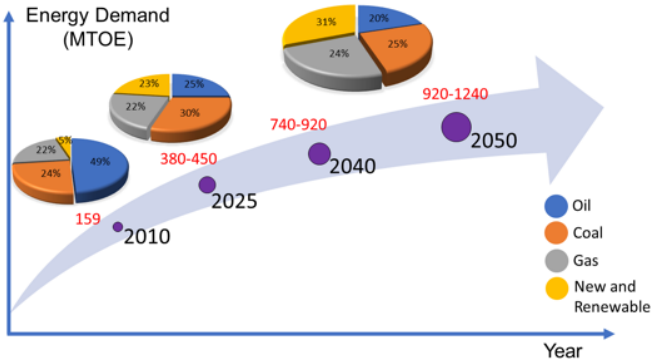

FIGURE 1. Energy demand till 2050 based on the national energy policy 2014.

Third, the Ministry of Law and Human Rights should lead to firstly develop a president decree to support the vision previously mentioned. Due to the applied law, the decree can be updated annually and the first decree would start at the beginning of 2020. This is due to hoping the first stone laying ceremony for the first NPP construction to be inaugurated by Mr. President Joko Widodo. In addition, the Ministry of Finance has a task to provide a national budget for every related ministries, agencies and institutions decided by the BAPPENAS.

Fourth, while the Ministry of Energy and Mineral Resources has a plan to build small and medium power plants for the Eastern part of Indonesia, the Ministry of Industry should lead on that by national law assurance, the local participation should be maximized for the construction of the first NPP in Indonesia. Furthermore, the Ministry of Foreign Affairs has a task to keep geopolitical lobbying among the regional and global nations work properly and hence there would not be any objection from other countries due to this national program implementation. The Ministry also promotes the first NPP construction mostly financed by foreign engineering or financing companies. The Indonesia government then only supports NPP licensing, site and law gurantees for the first NPP construction.

Fifth, BATAN, BPPT (The Agency for the Assessment and Development of Technology) and BSN (The Agency for National Standard) have tasks the assurances of nuclear/safety and non-nuclear technologies and national standards 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 task to ensure the social engineering around the NPP site and hence the public acceptance for the construction of the first NPP will go properly and high. Finally, the availability of the new NPP would be safe and the first NPP construction would finally become in reality and on time.

Lastly, the Ministry of Communication and Information has a task to promote and disseminate the national vision to operate the first NPP operation by 2030 to public 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. 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 vision to operate the first NPP by 2030 would become in reality and on time. It is, therefore, Go Nulcear statement from Mr. President Joko Widodo is still needed and should be promptly stated.

3.3. To increase local participation in constructing the first NPP in Indonesia by 2030

Since 1965, BATAN has operated safely the 3 nuclear research reactors, such as, 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 opeated other nuclear installations, such as, experimental power fuels, nuclear waste treatment, nuclear engineering facilities, radioisotope and radiopharmaceutical and others. From 1982 to 1987, the construction of a nuclear research reactor called RSG-GAS reactor having the power of 30 MW and its supporting facilities in Puspiptek area, Serpong had made some state-owned enterprises to have significant experiences on the construction of high-tech buildings and nuclear facilities. For example, the RSG-GAS reactor was constructed by WK (*Wijaya Karya*) and HK (*Hutama Karya*), two of the biggest state-owned enterprises in Indonesia and they are currently becoming superior companies in terms of engineering, procurement and construction (EPC). Those two companies were supervised by the RSG-GAS vendor (Interatom GmbH, West Germany). Therefore, regarding the national capabilities to support NPP construction, the survey showed that the readiness of local companies to contribute to the NPP construction is around 41% [25-26]. To maximize local participation implemented by local engineering companies in supporting the first NPP operation by 2030, some following new strategies should be developed and implemented.

First, as previously mentioned, the first NPP operation by 2030 should be established as one the national priority programs to be implemented till 2030 and this shoud be followed by establishing the President Decree to support the program. Once the priority program declared by the President, all activities are surely to be supported not only by all related ministries, institutions and agencies, but also by private engineering companies. This is believed to be able to increase local participation in constructing the first NPP in the country.

Second, FGDs on NPP construction should be regularly held by involving all related stakeholders, such as, 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. For the construction of nuclear-island devices, they can collaborate with foreign state-owned companies and private companies from US, Russia, Japan, Republic of Korea (RoK), China etc. After local companies frequently participate in NPP construction, especially in nuclear devices, the collaboration with foreign companies would then be decreased.

Third, BATAN and all related stakeholders are currently designing RDE (experimental power reactor) and the RDE detail design is expected to be completed in 2020. Some state-owned companies have joined to participate in detail design activities due to their EPC experiences on coal plants which have been built in Indonesia. **Fourth**, to firstly operate NPP by 2030 is one of the national priority programs and the program will be fully supported by the government, its stakeholders including bankers, so that they will be able to have opportunities to visit NPPs abroad, such as, NPP 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.

Fifth, the International Atomic Energy Agency (IAEA) has been appreciative to RDE developed locally and the Agency has a regular meeting among related member states all over the globe [49]. The conceptual (pre-basic) design was completed at the end of December 2015 and the design was evaluated the IAEA experts in 2017 and 2018. Therefore, BATAN and its stakeholders should regularly deliver the joint success of RDE design in Annual General Conference in Vienna. In addition, they have also conveyed 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 done [50-53]. Furthermore, the analysis design of some safety aspects, such as, reactor pressure vessel (RPV), coolant design and materials of RDE coolant plant have also been delivered in some scientific journals [54-61]. It is also noted, BATAN and INET China have successfully developed a HTGR-type 150 MWth called PELUiT 50 MWe for electrical power and industry. China has included the PELUiT 50 program as one of The China International OBOR (*One Belt One Rod*) programs for BATAN Indonesia. The program may seem a guarantee to be fully supported by the PRC government through the collaboration between INET China and BATAN Indonesia. The development of PELUiT 50 may be fully maintained by China till its project completion. Therefore, the PELUiT 50 could be

very feasible to be firstly constructed by 2030 in Indonesia due to strategic, technical and economical consideration.

Lastly, the RDE program could be assigned as the program to be firstly operated by 2030, so that the budget to support the program can be minimized. However, for nuclear devices, it is still needed to collaborate with other foreign companies. In addition, due to the President statement recently, the capital of Indonesia will be moved to East Kalimantan, so the need for electricity for East Kalimantan will increase. An extension power of RDE from 10 MWth to 150 MWth (PELUiT 50) as the first choice can be proposed to be built in that area. By assuming East Kalimantan needs the electricity at least 151 MWe by 2030 as seen in table 2, 3 PELUiT can be be built in that province by 2030. However, it is noted that the PELUiT 50 is a new NPP, so it will imply to licensing process for the new NPP which may be slower, but there are strategies to speed up the PELUiT 50 licensing process which can be seen in the following section. By law, the licensing process from the Nuclear Regulatory Body (BAPETEN) is much simpler if a licensed-new NPP as the second choice has been given in the country NPP producer. However, if the second choice taken, the price of the first NPP to be built would be more expensive due to much less local participation, but faster in the licensing processes to earn site, construction, commissioning and operation permits. **Indeed**, either the first or the second choice taken, the collaboration to handle the nuclear-island construction with foreign companies should be implemented.

TABLE 2. Proposed PELUiT 50 for provincial energy in 2024/2030.

No	Province	2024/2030	
		Additional power estimation **(MWe)**	Potential of PELUiT utilization **(50 MWe)**
01	West Kalimantan	137/239	2/4
02	Central Kalimantan	130/125	2/2
03	South Kalimantan	142/216	2/4
04	East and North Kalimantan	122/151	2/3

3.4. To speed up the licensing process for the first NPP in Indonesia

To build a new nuclear reactor and facility in Indonesia should be referred to licensing process allowed by the Government Regulation Number 02 Year 2014 [62]. BAPETEN, Indonesia nuclear regulatory body, issued an RDE site permit in January 2016 and BATAN has then proposed an RDE design approval in November 2018. Based on the regulation, licensing of RDE deployment is proposed to bear permits of site, construction, commissioning and operation as seen in figure 2. some following strategies are suggested to be implemented, so that the first NPP operation by 2030 can be achieved. The proposed strategies are then the followings:

First, the licensee should propose the road map as seen in figure 2 to earn all permits required from site to operation. The RDE licensing can be taken as an example, all detail design activities should have been completed at the end of 2021. The site preparation would then start following the construction permit which had been given. The construction would then start at the beginning of 2023. By assuming the construction time is 6-7 years, the commissioning would start at the end of 2028. The operation of the first NPP would be at the end of 2029 by considering one year for RDE commissioning in 2029.

Second, the total time estimation may take as soon as 9.5 years and the detail time for whole RDE licensing can be seen in table 3. However, there may be a strategy to shorten the licensing time by frequently coordinating between the regulatory body and the applicant during the licensing process. The involvement of Indonesia government, in this case the Maritime Coordinating Minister, is therefore needed to speed up the licensing process and hence all national stakeholders will simultaneously, fully support the program without breaking the all applied rules.

Third, for the PELUiT 50, the time estimation of the PELUiT 50 licensing may be shortened from 9.5 years to 7 years and 2 months as proposed in table 3. RDE has been in the process of design approval since November 2018 and the coordinating meeting between BATAN and BAPETEN to discuss all related matters for the site

permit has been going on. BAPETEN is expected to issue the RDE construction permit at the beginning of 2023, so that the plant construction will start in 2023/2024 and complete in 2028. The commissioning and operation process will then follow. The licensing process of the plant commissioning and operation is expected to start at the beginning of 2028. By considering the commissioning process may take 1.5 to 2 years, the plant operation will start in the middle of 2029 or at the end of 2029 at the latest.

Lastly, if the light water reactor (PWR) would be proposed for the first NPP to be operated by 2030, the process of licensing could be simplified. This is due any type of PWR which has been licensed in its vendor country, but as earlier mentioned, the budget for the project would be more expensive due to much less local participation. It is finally depending on the government policy, whether to support the local technology, such as, PELUiT 50 or to let another country technology's NPP come in to Indonesia.

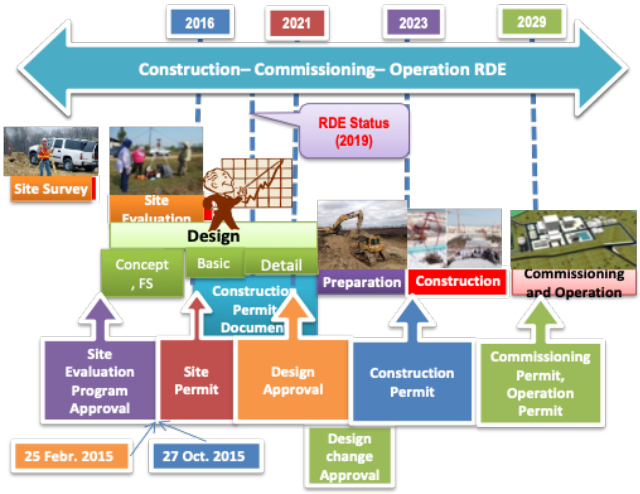

FIGURE 2. Proposed road map of RDE licensing process.

TABLE 3. Proposed time estimation of NPP licensing process. [Modified from Ref. 62].

No	Licensing stages	BAPETEN review	Revision by applicant	Proposed time estimation
1	Site evaluation approval	<= 6 m	<= 6 m	<= 4 m
2	Site permit	<= 2 y	<= 3 y	<= 2.5 y
3	Design approval	<= 1 y	<= 6 m	<= 4 m
4	Construction permit	<= 2 y	<= 2 y	<= 1.5 y
5	Design change approval	<= 6 m	<= 6 m	<= 4 m
6	Commissioning permit	<= 1 y	<= 6 m	<= 4 m
7	Modification approval	<= 6 m	<= 6 m	<= 4 m
8	Operation permit	<= 2 y	<= 2 y	<= 1.5 y
	Total of time	**9.5 y**	**9.5 y**	**7 y 2 m**

Note: Assuming document completeness less than 30 days.

3.5. To Develop The New-Strategy-Nuclear-Based Promotion to Increase The Public Acceptance for The First NPP Operation in Indonesia

Up to 2017, there are 448 NPPs available all over Europe, North and South Americas and Asia and Pacific countries [63]. As previously mentioned, China, French, India, Japan, Korea, Russia, Switzerland, Russia and USA have operated NPPs before 2000 and most of them are predicted to continue NPP operation as the prime energy to support their electricity for industries till 2050. Even China is very ambitious to operate NPPs for the total of 30 GWe till 2050. Furthermore, Belarus, Turkey, Bangladesh and United Arabic Emirate (UAE) are currently constructing new NPPs and specifically for Saudi Arabia certainly having a lot of oils is planning to assemble NPPs to anticipate the future electricity need by 2040. Indonesia has actually anticipated the first NPP to be available as soon as 2027 and the country would have 2x1,000 MWe in Java Madura Bali (JAMALI) and even Eastren part of Indonesia may be very suitable for HTRs, such as, PELUiT 50 whose power between 20 MWe and 50 MWe [24]. It is a big hope those countries which have operated and planned NPPs now and future would inspire and hence push the Indonesia government to speed up the first NPP construction in the country.

All previously mentioned countries are of very good partners to join NPP promotion due to their successfull constructing NPPs. BATAN and its stakeholders has implemented public survey on the use of nuclear science and technology (NST) from 2010 to 2016. figure 3 summarizes the national polling implemented during the years previously mentioned. Only in the 2011, the survey showed less than 50% Indonesians agreed with NPPs to be available in the country due to the Fukushima accident taking place on March 11, 2011. The NST promotion has dealt with seminars, conferences, TV talk shows, meetings with public figures, debates and others.

Now, the target of NPP promotion consists of public acceptance, stakeholder involvement and decision makers and there are three main strategies implemented to achieve the target, such as, public information and public education and utilization of NST results. The national polling of NST should be maintained even enhanced, so that the strategy to keep more people agree with NPP should be broadened using digital promotion. The comprehensive actions to achieve the targets are as the followings:

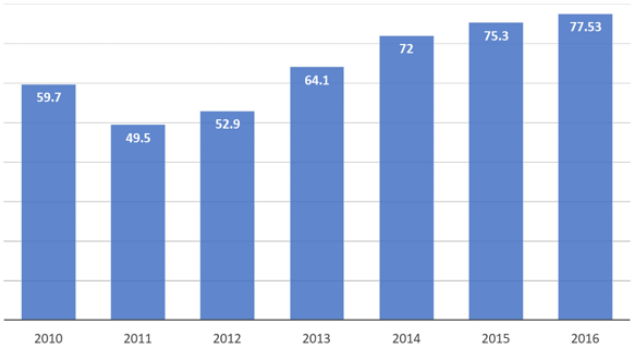

FIGURE 3. Summary of NPP polling in Indonesia from 2010 to 2016.

First, NST promotion should consist of online and offline, so that the NST material is suggested to become one of the curricula for education in primary, junior, senior high schools and hence NST would be very familiar since they are young. For online promotion, smartphones can be used to provide such short interesting/inspiring films/advertisement related to NST. **Second**, young Indonesians accumulated to 110 millions in 2018 are very dominant in the country, so that the NST promotion through smartphones would be very worthwhile. The NST promotion should deal with not only NPP matters, but also health, food and industries. This promotion style would make them acknowledge how NST is very important in their daily lives.

Third, the FGD dealing with the NST advantages to support the efficiency of NRE should be regularly implemented and followed by all NST stakeholders consisting of youths, economists, engineers, state-owned enterprises, private companies and others. FGDs can be held not only in formal-state buildings but also in schools, plazas, shopping malls, and of course in NPP candidate sites as well. To avoid the philosophy of **NIMBY** (**N**ot **I**n **M**y **B**ack **Y**ard) for NPP site, the government and NPP owner should promote that all residents living in areas near the NPP plant would have a certain percentage discount for their electricity bills. **Fourth**, the TV talk shows should be intensively held and followed by resource people from politicians, academicians,

engineers, religion leaders, public figures, environmentalists and others and one of the topics would cover advantages and disadvantages of NPPs.

Fifth, social engineering in every region in the NPP candidate site should be established by making a 4-6 people group to be trained by BATAN and its stakeholders. Each group has a task to deliver the utilization of NST research results for health, agriculture, energy and industry. Finally, lobbying to Executives and Parliaments are two of the main keys to be implemented and hence NST would be more familiar for all of them. It is also expected that NST can be a crucial topic to be discussed during the meeting between the President and related ministers as well as chairmen of the Indonesia Parliament.

As summary, all promotion of NST should always be on and off line for public information and public education and FGDs of NST as well as TV talk shows to be necessarily and regularly held. To maximize local participation during the first NPP construction, it suggested that either RDE or PELUiT 50 can be chosen as the first project to be implemented to achieve the vision of the first NPP operation by 2030. The advantages will then be earned not only our pride to use most local high-tech design for the first NPP, but also the project would be more effective and efficient due to mostly use local-based devices. Furthermore, the NPP licensing process is 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. Finally, if all new previously mentioned programs simultaneously implemented, it is believed that not only the survey of NST application would be stable or even increased, but also the Decision/Statement of **Go Nuclear** from Mr. President Joko Widodo would be coming soon and hence the vision to achieve the first NPP operation by 2030 would become on time and real.

4. Conclusions

An assessment to operate and maintain the first NPP by 2030 has been done and the globe trend to assemble certain NPPs till 2100 is one of the important opportunities to make collaboration in terms of solving nuclear island devices during the first NPP construction. Local participation for NPP construction should be considered and to maximize the local participation, the government should fully involve in designing, licensing, construction and operation of the first NPP and PELUiT 50 as local high-tech design can be chosen as the first NPP to be constructed in the country due to mostly use local-based devices. 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 licensing process is 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, it is believed that Indonesia is able to operate the first NPP (RDE or PELUiT 50) by 2030 considering the strong support, sustainable commitment and political will from the Indonesia government.

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