HIGH SCHOOL EDITION
Journal of Student Research
Volume 13 Issue 4 (2024)

Should Taiwan Utilize Nuclear Energy?

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ABSTRACT

Regardless of the increase in demand for electricity, Taiwan faces issues in maintaining a stable and environment-friendly way to produce and supply energy. In hopes of decreasing carbon emissions, Taiwan endeavors to substitute electricity generated by fossil fuel power plants with renewable energy. However, the development of renewable energy is limited in Taiwan due to topographical factors. Additionally, research has found that creating excessive amounts of renewable energy infrastructure can damage natural habitats. Despite nuclear energy being a viable solution to Taiwan's energy dilemma, the Taiwanese government has formulated plans to prohibit the operation of nuclear power plants by 2025, regarding concerns of potential hazards and detrimental effects of radiation in the event of nuclear plant accidents.

Moreover, Taiwan also lacks reserved energy that is utilized when electricity interruptions occur. Failure to produce and preserve excessive energy can increase the length of electricity interruptions, which may lead to economic damage to factories that require electricity to operate.

Implementing Smart Grid in Taiwan can maintain stable electricity even when electricity interruptions occur. Investing in small modular reactors (SMR) is also a viable solution to replace fossil fuel power plants due to their low initial investments, greater scalability, and more flexible terrain condition requirements compared to traditional nuclear reactors. This study focuses on the analysis of Taiwan’s electricity issue and searches for possible solutions to decrease carbon emissions and increase the stable supply of electricity.

Introduction

Taiwan's electricity dilemma is not only a matter of supply and demand but also a matter of sustainability and resilience. Taiwan's overreliance on fossil fuels not only increases carbon emissions that contribute to climate change, it increases the vulnerability to supply chain disruptions and geopolitical tensions. As the population in Taiwan progresses in the future, it is predictable that the electricity demand will increase in the future.

Despite the expected increase in electricity demand, Taiwan's government has decided to phase out nuclear power plants by 2025 (呂翔禾) without having a reliable alternative in place, creating an energy gap that needs to be filled urgently. Currently, this gap can only be filled by renewable energy sources such as solar, wind, and hydropower, which have the potential to reduce carbon emissions and increase energy independence. However, increasing renewable energy production requires significant investment and infrastructure development, which the Taiwanese government must prioritize and accelerate.

Another issue that exacerbates Taiwan's power supply problem is the lack of energy efficiency measures and conservation practices. Taiwan's industries and consumers have a high energy consumption rate, which can be reduced by adopting energy-efficient technologies, promoting energy-saving behaviors, and implementing Smart Grid systems. These measures can reduce energy waste and costs and increase the reliability and stability of Taiwan's power grid.

This paper will deeply analyze Taiwan’s issues in maintaining the power demand for both industries and consumers and why power blackouts always cause significant damage to Taiwan’s economy. It will also seek to provide solutions and policies the Taiwanese government could apply to decrease its electricity supply-demand difference and therefore subside the chances of power outages.

Literature Review

Overview of Taiwan's Energy Sources and Production

Unlike other developed countries, Taiwan is not rich in raw materials; coal, lignite, peat, crude oil, and natural gas must be imported from other countries. Over 98% of Taiwan's raw energy resources were imported from different countries and only 2% of the energy produced used raw materials in Taiwan (林德福). Fossil fuel energy is the main method of energy production. Table 1 is the statistical data on the proportion of power generation via various energy sources in Taiwan from 2019 to 2021. We can see that Fossil fuel power plants created 80% of electricity produced for three years straight from 2019 to 2022, and the percentage keeps increasing and won't seem to decrease in the next five years.

Table 1. The proportion of power generation via various energy sources in Taiwan from 2019 to 2021. *Source*: Energy Statistics Information System, R.O.C(Taiwan).

source	2019 (billion kwh)	percentage	2020(billion kwh)	percentage	2021(billion kwh)	percentage
fossil fuel	2232.8	81.50%	2302.2	82.20%	2425.4	83.40%
nuclear energy	323.2	11.80%	314.4	11.20%	277.9	9.60%
wind	18.9	0.70%	23.1	0.80%	22.4	0.80%
solar	40.1	1.50%	60.8	2.20%	79.2	2.70%
hydro	55.4	2.00%	30.2	1.10%	34.7	1.20%
biomass	38	1.40%	37.5	1.30%	37.7	1.30%
pumping hydro	32.1	1.20%	31.6	1.20%	31.8	1.10%
geothermal	0.008	0	0.019	0	0.09	0

total	2740.6	100%	2799.8	100%	2909.2	100%

Analysis of Taiwan's Energy Dilemma

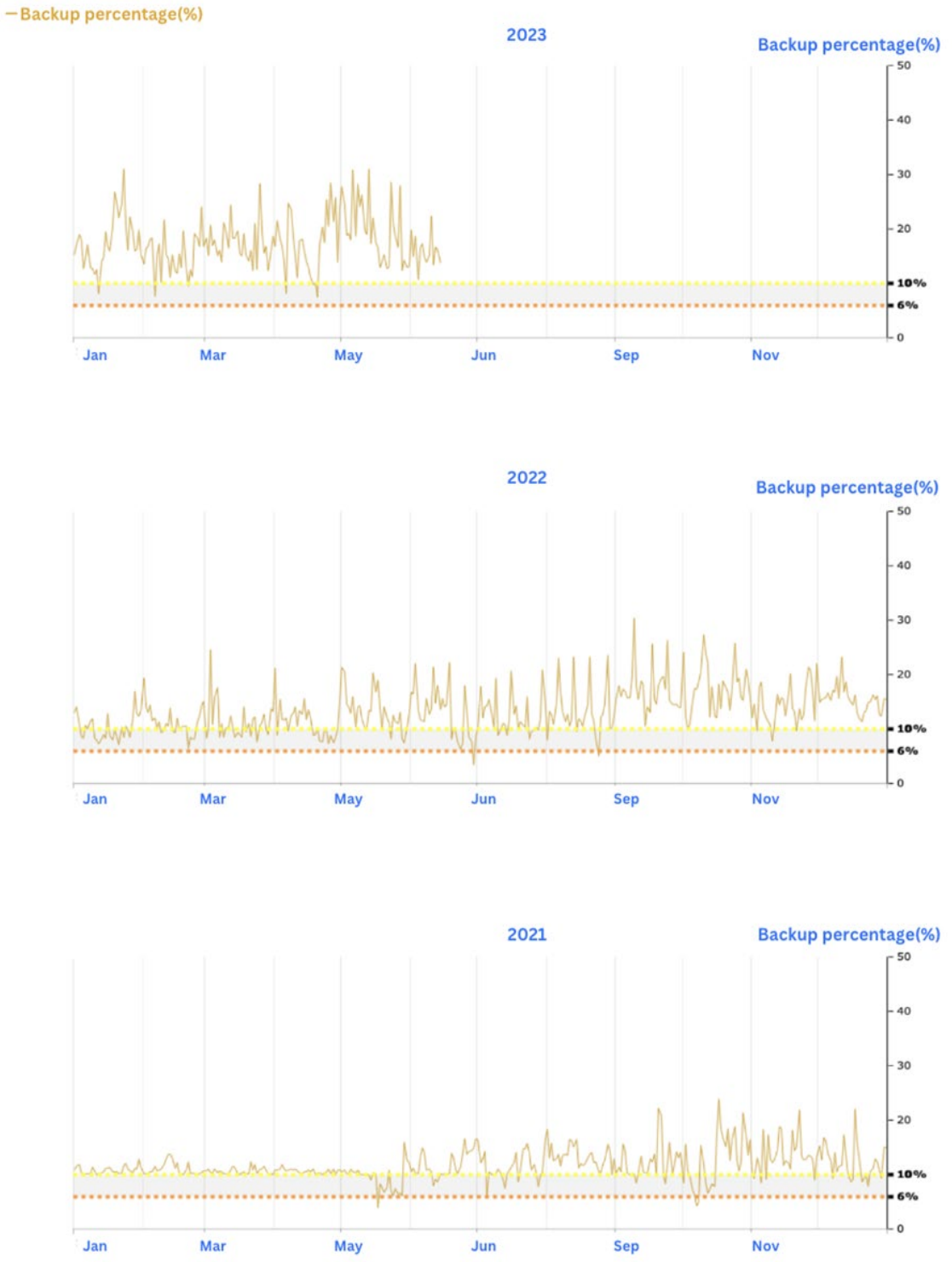

Figure 1. Backup capacity data from 2021 to 2023. Source: Taiwan Power Company, Today's backup capacity rate.

Figure 2 represents the backup electricity percentage from 2020 January to 2023 June. According to the Taiwan Power Company (Taipower), the government rules that the backup electricity percentage should be kept greater

than 15% (Taiwan Power Company), It is obvious that Taiwan's current electricity is sometimes unable to keep up with the policy. Low backup electricity can increase the possibility of economic damage during major electricity blackouts since there wouldn't be enough backup energy to supply high-demand consumers such as businesses and factories, causing the interruption of their operation.

According to the Energy Statistics Information System of the ROC (Taiwan), nuclear energy sites have contributed an average of 9.6% to the annual energy production from 2020 to 2022. After 2025, when the remaining three nuclear power units cease production, Taiwan will need to find a way to compensate for this loss of 9.6% of annual electricity production (Energy Statistics Information System, R.O.C(Taiwan)).

Recently, The second nuclear power plant in New Taipei City was officially shut down on 2023, March 14 (謝佳娟). The percentage of electricity created by nuclear energy has been cut down to roughly 7.48%, leaving the Third Nuclear Power Plant as Taiwan's last operating nuclear power plant (Energy Statistics Information System, R.O.C(Taiwan)). According to Seaver Wang, the Co-Director of the Climate and Energy team from the Breakthrough Institute in California: "Closing down nuclear power plants one by one would not help reduce carbon emissions and could lead to a more unstable energy supply in Taiwan in the short term. Retiring the Guosheng Nuclear Power Plant, for example, would mean a reduction of one-third of Taiwan's clean renewable energy generation" (qtd. in 謝佳娟). Wang suggested that if Nuclear Plants 2 and 3 operate for another decade and allow coal-fired power plants with the same capacity to retire, the carbon reduction effect could be equivalent to Kenya's annual fossil fuel emissions. Despite Taiwan's efforts to build renewable energy sources such as wind and solar power in the past ten years, it has not achieved its goal of reducing its carbon footprint. Almost 90% of the population still relies on electricity generated by fossil fuels (謝佳娟).

The conflict over nuclear energy in Taiwan centers around concerns over safety and environmental risks. While some argue that nuclear power is necessary for the country's energy needs, others believe that renewable energy sources like wind and solar are safer and more sustainable options.

Previous Research and Studies on Taiwan's Energy Issues

Based on the contents of the "Energy Transition in Taiwan's Coastal Areas: The Investigation of Environmental Justice", written by Kate Huang, Wind power facilities and solar energy panels would also damage coastal areas and ultimately destroy ecosystems (Huang). "While the Changbin Lunwei solar power plant provides 181MW of energy, it damages the habitat for the organisms living there…The solar panels cover a large area of intertidal zones that possess an abundance of biodiversity such as oysters, crabs, and mudskippers. Environmental unions argue that during low tide, the compact overlapping of solar panels with natural habitats will lead to the destruction of ecosystems by occupying organism habitats and blocking sunlight to reach the land and carry out photosynthesis."(qtd. in Huang, 2022).

Taiwan has no relevant power storage equipment to conserve the extra electricity produced, which could only result in building more fossil fuel power plants to cover the energy demand. Based on the *Awakening News Network* article about Taiwan's energy dilemma: "Ming Ru Lin, vice chairman of the Federation of Industry and Commerce, pointed out that the development of renewable energy faces various limitations. One such limitation is the saturation of onshore wind power, indicating that further expansion in this sector is not feasible. Moreover, the uncertainty surrounding the potential installation of offshore wind power poses another challenge. Additionally, solar energy can only be harnessed during daylight hours, restricting its availability, while offshore wind power predominantly thrives in autumn and winter. Furthermore, the absence of suitable power storage equipment in Taiwan exacerbates these constraints"(qtd. in 呂翔禾).

On one hand, the high percentage of fossil fuel power plants increases carbon emissions, and building more green energy facilities could damage the environment; on the other, the risk of power outages increases since Taiwan does not have enough backup electricity. When errors are made in operations or damages are done to the power units, cities could suffer from hours of power outages and potential economic losses. The

Taiwanese government requires a comprehensive strategy to solve its energy dilemma. The most significant challenge Taiwan has to deal with is the lack of energy storage equipment to conserve extra-produced electricity. Taiwan's energy infrastructure is unable to keep up with the amplifying demand for energy, particularly during peak hours, and building more fossil fuel power plants to cover the demand increases the carbon dioxide emissions that are known to have catastrophic impacts on both the environment and human health. As previously mentioned, constructing more green energy infrastructures could also pose a threat to the environment as well. Moreover, if Taiwan chooses to rely on traditional power plants. The risk of power outages occurring significantly increases when errors are made in operations or damages are done to the old power units, the cities could suffer from hours of power outages and potential economic losses. This affects not only households but also businesses that depend on a stable and reliable power supply such as semiconductor factories. This puts Taiwan in an energy dilemma where no solution is perfectly viable to back up its decision to go Nuclear energy-free in 2025.

Lack of Energy Efficiency Measures and Conservation Practices

The lack of energy efficiency measures and conservation practices in Taiwan is a critical concern that requires immediate attention. It should be reasonable for Taiwan to have plenty of energy-conserving technologies and facilities due to the high energy consumption in Taiwan. Not to mention that the lack of energy-saving facilities increases the damages of power outages.

Implications for Energy Security, Climate Change, And Economic Development

The implications of Taiwan's energy issues extend way beyond the environment, as these issues also have significant impacts on the country's economy, energy security, and social well-being. The dependence on imported energy increases its vulnerability to supply disruptions. Which can negatively affect economic growth and national security.

According to the "Residential electricity demand in Taiwan", co-written by Pernille Holtedahland and Frederick Joutz from The George Washington University, Department of Economics, studies show that Taiwan's residential electricity consumption per capita correlates to the real disposable income per capita. Figure 2 and Figure 3 are graphs that represent the residential electricity consumption and real disposable income in Taiwan (Energy Statistics Information System, R.O.C. (Taiwan)). There is evidence that electricity consumption correlates with disposable income. As previously mentioned, the population of Taiwan is increasing, which would lead to an increase in electricity demand. Therefore, if Taiwan fails to increase its energy output as well as its backup energy reserves, it will also affect the economy (Holtedahl and Joutz 201-224).

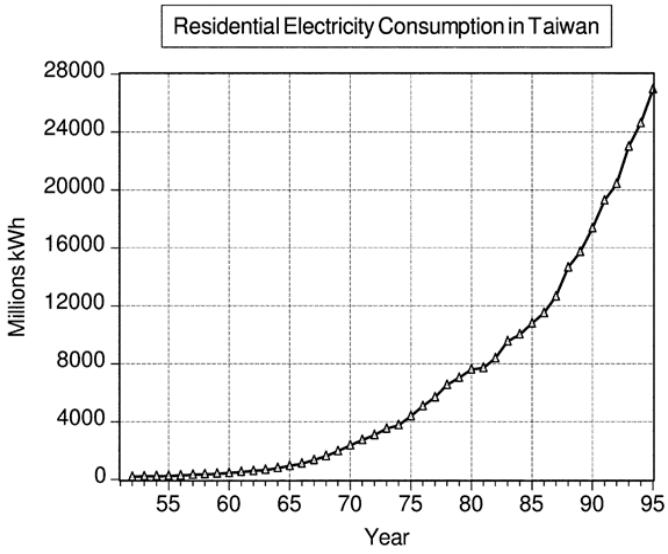

Figure 2. Residential Electricity Consumption in Taiwan. Source: Residential electricity demand in Taiwan.

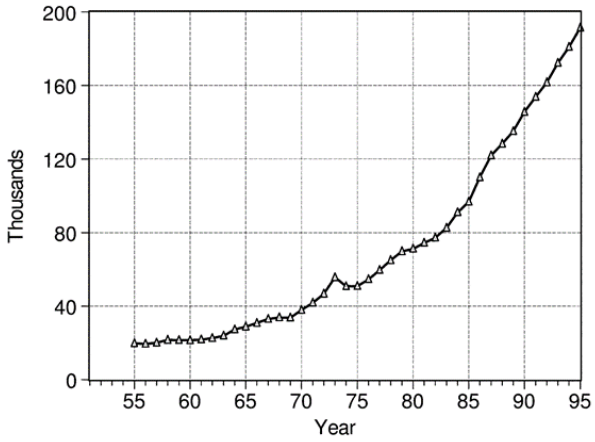

Figure 3. Real Disposable Income Per Capita in Taiwan. Source: Residential electricity demand in Taiwan

As previously mentioned, renewable energy is determined to be an incomplete solution for replacing partial percentages of electricity produced via fossil fuel power plants since appropriate locations for building additional renewable energy infrastructures are limited. It is also found that building renewable energy infrastructures can also possibly damage natural habitats.

Similarly, it is also found in studies that Nuclear power plants are responsible for coral bleaching near their infrastructures. As explained by Science Monthly: "According to the second law of thermodynamics, complete energy conversion is impossible, resulting in the release of energy in the form of heat that cannot be utilized. In the case of nuclear power generation, a substantial amount of water is employed to cool the power plant and prevent overheating-induced malfunctions. Consequently, a significant quantity of warm water is generated as a byproduct of this cooling process." (王立雪). Coral bleaching continues to be a concerning issue for Taiwan's marine habitat. If nuclear power plants fail to find a solution to cool down the warm water released by nuclear power plants, it will continue to cause chaotic damage to Taiwan's coral reef in the long run.

Figure 4. "Coral Bleaching found near Maanshan Nuclear power plant(3rd nuclear power plant). 20 October 2010." (蔡宗憲).

Case Study: Ryugasaki Substation Outage

Table 2 is an analysis report for all the major blackout events in Taiwan. Most of the reasons for significant blackout events often have the keyword "major insufficient amount of spare electricity" appearing in the sentence. This indicates that spare electricity is a major part of Taiwan's energy stability.

Table 2. "The list of major blackouts in Taiwan since 1988." ("Lists of Major Blackouts In Taiwan."). *Source*: 台灣大停電列表，維基百科

Date	Reason for Blackout	Time span of blackout(days)	Spare capacity ratio on the night before blackout(%)	Affected households
1988	insufficient amount of spare electricity	2	21.7	
1989	insufficient amount of spare electricity	8	14	
1990	major insufficient amount of spare electricity	3	7.4	
1991	major insufficient amount of spare electricity	14	4.8	
1992	major insufficient amount of spare electricity	2	6	
1993	major insufficient amount of spare electricity	4	4.2	
1994	major insufficient amount of spare electricity	16	4.8	
1995	major insufficient amount of spare electricity	3	4.7	
1996	major insufficient amount of spare electricity	1	5.6	
1999	insufficient amount of spare electricity, 921 earthquake. electricity tower collapsed	21	12.5	

2002	insufficient amount of spare electricity, spare natural gas inefficient, electricity rationed to industrial users	1	16	
2017/8/15	major insufficient amount of spare electricity, six units of Datan Power Plant tripped	1	3.17	5.92 million
2021/5/13	major insufficient amount of spare electricity, 4 units of Xingda Power Plant tripped	1	10.01	4.62 million
2021/5/17	major insufficient amount of spare electricity	1	4	1 million
2022/03/03	major insufficient amount of spare electricity	1	<10	5.48 million

According to the Chinese Institute of Engineers, Taipower (Taiwan Power Company), the state-owned electric utility company responsible for generating, transmitting, distributing, and selling electricity across the entire country and its outlying islands, obligates itself to have at least 15% of backup electricity. As you can see in Figure 6, other than in 1988's case, all of the significant blackout cases in Taiwan had a spare capacity ratio of less than 13% the night before, implying Taiwan's insufficient backup power issue.

Power outages not only cause inconvenience for civilians but also damages the economy. One example of electricity outages causing economic damage would be the 2022 Xingda power outage in Taiwan, also known as the 303 power outage. On March 3rd, 2022, a significant power outage struck Taiwan. The outage was caused by a technical failure at the Xingda power plant operated by Taiwan Power Company (Taipower). Xingda power plant is one of the largest natural gas-fired power plants in Taiwan.

Background and Context of the Outage

Taipower claimed that the transmission and distribution line failure at the Longqi ultra-high voltage substation caused the northern and central power grids to disconnect from the southern power grids, resulting in a large-scale power outage across the island (陳怡君).

b. Analysis of the impact on industries and the economy

The 303 power outage was one of the biggest electricity failures in Taiwan's history. Due to the instant loss of 10.5 million kilowatts of electricity, which is about 30% of Taiwan's total electricity (李蘇竣), blackouts occurred in central and northern regions. About 5.48 million households were affected, and power was not fully restored until 9:30 pm. The total outage lasted 12 hours, the longest in recent years.

Industries such as semiconductors, optoelectronics, Apple supply chains, petrochemicals, and steel have been severely damaged. An official from the Ministry of Economic Affairs stated that the preliminary inventory of industrial areas has lost more than 5 billion NTD (163 million USD), which the petrochemical industry has suffered the most. The amount of damage to manufacturers in the science and technology industrial park is around 600 to 700 million NTD (20-23 million USD) (陳怡君). From the perspective of a high school student, I faced issues when blackouts like this happened. Power outages can disrupt learning, especially when my school relies on technology or the internet to deliver lessons. I lost hours to work on given assessments which later disrupted my routine for the whole day.

Figure 5. "Xingda power plant malfunction, causing a massive blackout in Taiwan. 4 March 2022." (黃國甦 et al.)

Discussion of the Causes and Lessons Learned

The 303 power outage highlights the vulnerability of power grids and the need for a robust infrastructure to prevent blackouts from occurring. It also illustrates the importance of having enough backup electricity and diversifying energy generation. The damages were large because the Xingda power plant generates a great ratio of electricity for Taiwan. If energy generation were diversified, the overall effect of the outage wouldn't be as big. But most importantly, Taiwan must figure out how to solve its backup energy ratio firsthand to prevent future outages.

Potential Solutions and Policy Recommendations

Overview of Potential Solutions to Taiwan's Energy Issues

Nuclear energy currently generates 7.48% of the electricity created in Taiwan. The recent shutdown of the second nuclear energy power plant would bring more burden for each energy power plant, including fossil fuel power plants, which would put more pressure on Taiwan's carbon emission policy as well.

In the previous paragraphs, I mentioned that increasing renewable energy output is not a viable solution to decrease the electricity produced by fossil fuel power plants since it can also be harmful to the environment, and the appropriate locations for renewable energy infrastructures are limited. Therefore, we would have to come up with a different approach.

Potential Solutions and Policy Recommendations

Define Nuclear Energy as Green Energy

Labeling nuclear energy as green energy can be a possible solution for decreasing the percentage of electricity produced by fossil fuel power plants. It would increase the public's acceptance if perceptions of safety and sustainability were shifted.

The EU has recently labeled nuclear energy as green energy in 2022. European Commission chief Ursula von der Leyen described the European Green Deal as "Europe's man on the moon moment." She has called climate neutrality "our European destiny". She also claimed that Europe will become the first continent with net-zero energy. Countries in the EU such as France, Poland, Hungary, the Czech Republic, Bulgaria, Slovakia, and Finland have all supported the pro-nuclear policy (Strauss).

SMR (Small Modular Reactors)

Additionally, France, which derives about 70 percent of its electricity from nuclear plants, is considering investing in new nuclear power plants called small modular reactors, or so-called SMRS ((Deutsche Welle). The strategy allocates 1 billion pounds for the SMRs. French President Emanuel Macron declared the SMRs to be "Goal number one" in their energy policy. The SMRs in France have a capacity of 50 megawatts and up to 500 megawatts, which is roughly 3/10 times of a regular nuclear power plant in France (Deutsche Welle).

According to the U.S. Department of Energy, SMRs require lower initial capital investment, offer greater scalability, and have more flexibility for locations that are unable to accommodate more traditional reactors that are larger. SMRs also held the potential for enhanced safety and security compared to larger Nuclear power plants. Taiwan is a small island that has fewer areas to fit in traditional nuclear reactors. SMRs can be a great investment for Taiwan's carbon emission issue (U.S. Department of Energy).

Smart Grid

Smart Grid is an electric network grid of transmission lines, substations, transformers, and the delivery of electricity from the power to homes, factories, or businesses. Smart Grid provides more efficient transmission of electricity by having quicker restoration of electricity after blackouts, it also reduces power usage during peak demand hours. Moreover, the Smart Grid increases the integration of renewable energy by increasing the level of communication and information between suppliers and customers (U.S. Department of Energy).

When the electricity supply is interrupted, Smart Grids decreases the possible economic loss as much as possible by ensuring the supply of high-value energy services. Typically, gas turbine power plants are capable of rapidly adjusting their generation of electricity when interruptions occur; however, Smart Grid offers cost-effective options to minimize possible losses due to interruption. According to Abhishek Shivakumar, an energy consultant from the United Nations, "Smart Grids may minimize the cost of interruptions by ensuring near-perfect reliability and quality of supply for high-priority demand types while reducing the requirements for demand types which are less sensitive to these needs. Loads may be prioritized according to demand types such as emergency services, financial institutions, industries, and consumers. Such a prioritization may not be limited to consumer groups, but may also apply to demand types within one consumer group. For example, approximately half of the private household demand does not need to be met instantly and can be shifted flexibly. Examples include dishwashing, washing of clothes, air conditioning, and heating. In the transport sector, electric vehicles may provide this flexibility. In industry, related examples include electric boilers or process heat requirements. So instead of cutting off several consumer groups completely, with Smart Grids specific demands may be interrupted, thus ensuring the supply to more high-value energy services and reducing the cost of interruption."(qtd. in Shivakumar, 2014).

Figure 7 is a supply analysis of the appropriate periods for Smart Grid to supply higher demand types by extracting electricity from lower demand types from the Rapid Response Energy Brief of 2014.

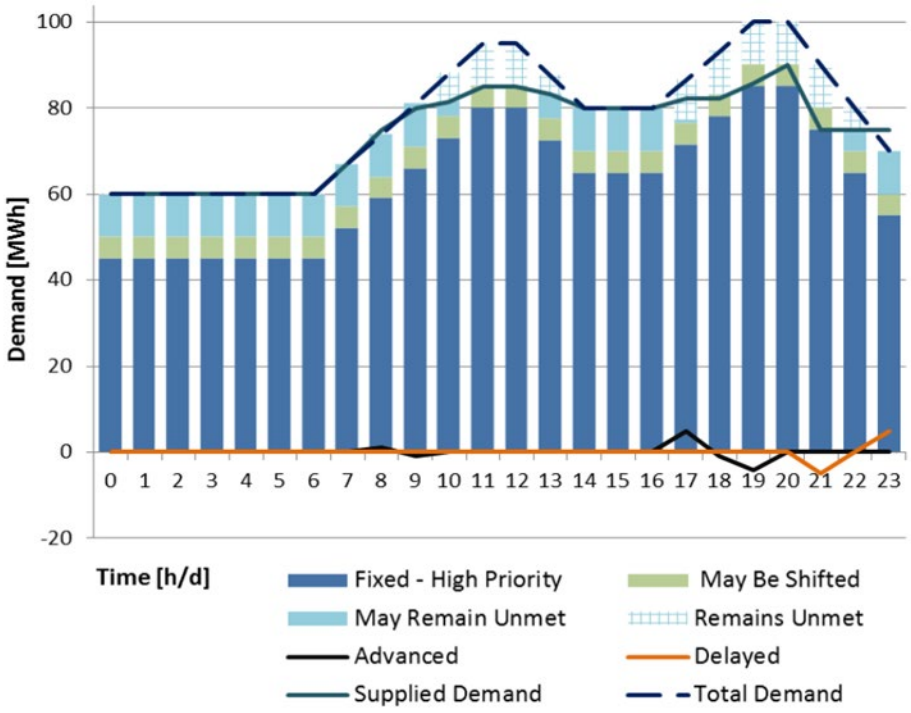

Figure 6. Supply analysis to meet demand types with different prioritisations and flexibilities. Source: Rapid Response Energy Brief November 2022.

Singapore is the first Asian country to implement a Smart Grid into its electricity supply. They have issued a US$7.4 million deal with 3M on grid sensing and data analytics. General Electric (GE) has also partnered with Singapore to digitalize its substations. Countries such as Vietnam, Thailand, Indonesia, the Philippines, and Brunei have all started to implement Smart Grids as well (Gnanasagaran). Introducing Smart Grid to Taiwan is one of the solutions to minimize the losses of interruption. Though it takes time and money to complete the entire grid for the country, Smart Grid has a tremendous amount of potential to solve Taiwan's electricity dilemma.

Conclusion

Summary of Taiwan's Energy Issues

On behalf of Taiwan's lack of natural resources, Taiwan's excessive reliance on imported fossil fuel energy conflicts with the government's carbon emission policy. It is crucial for Taiwan to urgently address the shortfall in electricity generation resulting from the nuclear plant's shutdown and replace a portion of the power generated by fossil fuel plants to follow its government's emission policies. Failure to do so could cause energy blackouts and significant economic damages. As the demand for energy increases with the economy and the population, finding a suitable solution is crucial to ensure a reliable energy supply and a stable economy.

Summary of Potential Solutions and Policies

Labeling nuclear energy as green energy can increase the public's acceptance if perceptions of safety and sustainability are shifted, therefore the government can build more nuclear power plants to replace the electricity contribution made by fossil fuel power plants.

SMRs require lower initial capital investment, offer greater scalability, and have more flexibility for locations that are unable to accommodate more traditional reactors that are larger. For a smaller island like Taiwan with fewer areas to fit in traditional nuclear reactors, SMRs can be a great investment for Taiwan's carbon emission issue.

Smart Grid can minimize economic by supplying electricity extracted from low-electricity-demand residents to high-demand businesses when electricity interruptions occur. Though it would take some time and investment to complete the entire grid for the country, it has a tremendous amount of potential to solve Taiwan's electricity dilemma.

Final Thoughts and Recommendations

Overall, Taiwan faces an electricity dilemma beyond supply and demand. Its heavy reliance on fossil fuels leads to increased carbon emissions and climate change impacts, which repels its geopolitical policies. Old fossil fuel power plants can easily be damaged and cause power blackouts and financial damage to industries that need electricity to operate. Nuclear energy is a clean and sufficient way to replace fossil fuel power plants but Taiwan plans to phase out nuclear energy by 2025. Though renewable energy might also seem a viable way to solve Taiwan's energy issue, some researches show renewable energy such as solar power panels and wind power can damage natural habitats.

As the economy of Taiwan improves in the future, the electricity demand is predicted to increase. Taiwan must implement stable and safe energy to control its carbon emissions and prevent economic damage caused by energy blackouts.

Labeling nuclear energy as green energy can enhance public support if opinions of safety and sustainability change, allowing the government to build additional nuclear power plants to replace the electrical contribution made by fossil fuel power plants. Investing in SMRs and Smart Grid electricity systems can benefit Taiwan by replacing the electricity percentage produced by fossil fuel power plants and also prevent economic damage when blackouts happen. While Taiwan focuses on lowering carbon emissions and decreasing the use of nuclear energy, it is also important to consider other factors such as having a stable electricity supply to secure its economy.

Limitations

While the solutions of my study are possible ways to solve Taiwan's energy issue, it is important to understand not every solution is achievable since the ultimate decisions for Taiwan's electricity dilemma are made by the government.

Public perception of nuclear energy today generates worries about safety and sustainability. Even if public opinion changes in the future, it will take time to gain popular support and overcome these objections. Furthermore, the building of further nuclear power facilities would necessitate substantial investment and could meet opposition from environmental groups and local people.

Furthermore, though investing in Small Modular Reactors (SMRs) and Smart Grid electricity systems shows promise in replacing fossil fuel power plants and avoiding economic losses during blackouts, implementation of these technologies may face technical challenges and necessitate significant financial resources.

Moreover, the Taiwanese government may have a lack of financial power to largely invest in these structures and systems, before any investments are made, Taiwan still needs to carefully examine the liability of each proposal.

During this research project, I encountered various obstacles that posed challenges to its successful execution. At the beginning of the project, I lacked the knowledge of how to locate reliable data to present as evidence or as graphic information. There were also times when I found credible resources but inaccessible due to copyright restrictions. Numerous essays and research materials available online were exclusively obtainable through purchase. I was not able to afford them because I'm still a student. Moreover, language translation presented another predicament. Given that Taiwan often presents data and titles in Chinese, I often have to translate quotes from essays word-by-word into English to ensure comprehensibility for my target audience.

There are several areas in which this essay could be improved. For instance, incorporating additional data infographics would enhance the visualization of numerical information for my audience. I use more information and data published by the Taiwan government or the Taiwan Power Company(Taipower) to increase the accuracy and credibility of my evidence. If I attain financial independence, I would also consider purchasing research essays and reports authored by professionals to study and reference to strengthen the quality of my research.

Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

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