"Actions To Achieve Net-Zero Emissions In Hong Kong"

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Introduction

A large contributor to global warming has been the burning of fossil fuel, especially coal for energy use. Therefore, renewable energy has an important role to play in meeting future energy needs and achieving sustainability. The use of renewable energy in Hong Kong is at present very limited, although the city has already made reductions in their use of coal for electricity generation, reducing the use from 48% in 2015 to 24% in 2020 (Environment Bureau, 2021). However, the potential to enhance renewable energy in Hong Kong is believed to be significant. A critical goal for the Paris Agreement in the fight against anthropogenic climate change is to reduce global warming to 1.5°C since pre-industrial levels. In alliance the city of Hong Kong has developed targets to reach net zero coal emissions by 2035. The development of a sustainable energy structure will present both challenges and opportunities for Hong Kong.

The first section of this paper deals with the make-up of energy in Hong Kong (generation and consumption), the challenges that the city faces in terms of switching to renewable energy, and the strengths and weaknesses of these challenges.

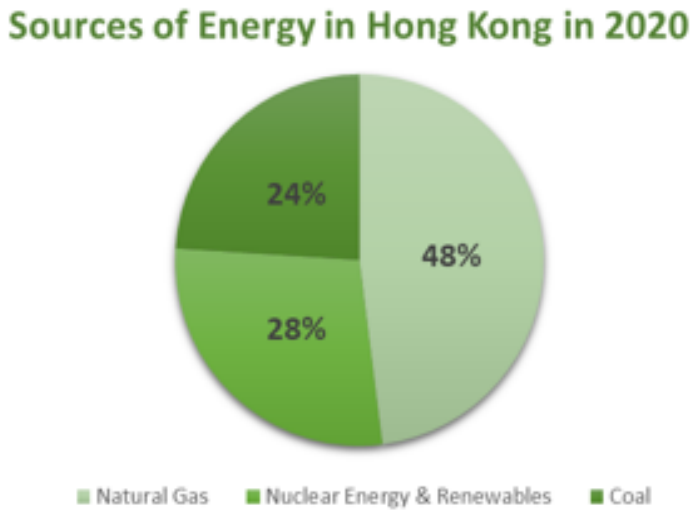
Furthermore, the paper will discuss the feasibility of renewable energy in Hong Kong. Hong Kong is one of the most densely populated areas in the world, and therefore HK's geographical location will be assessed and put into perspective. Also, one of the main focuses of this paper deals with the regulations regarding meeting HK's current electricity consumption with 100% renewable energy. Both aspects will be analyzed and assessed. In this case, several energy generations will be discussed such as nuclear, solar, and wind energy. Later on, recommendations for HK to reach 100% renewable energy will be presented such as further information about the strengths and weaknesses of wind turbines. In addition, this paper includes comparisons on how other countries such as China, United Kingdom, and Germany, are dedicated to reaching net-zero emissions in terms of energy consumption.

Energy Production & Consumption in Hong Kong

Energy Production

The make up of Hong Kong's energy sources consist of coal, renewables, natural gasses, and nuclear energy. Specifically, as shown in figure one, in the year 2020, 24% of Hong Kong's energy was generated from coal, 28% from nuclear energy and renewable sources, and the highest generation of 48% was from natural gas (Environment Bureau, 2022). Hong Kong's electricity is imported from private companies with their main electricity suppliers being CLP Hong Kong Limited and Hong Kong Electric Company Limited (HK Electric) (Environment Bureau, 2022). CLP owns a percentage of the Guangdong Daya Bay Nuclear Power Station located in mainland China, which is where Hong Kong imports nuclear energy from. The CLP power company supplies energy to 2.6 million users within various islands of Hong Kong (CPL, 2020). HK Electric supplies electricity to over 580,000 customers within the Hong Kong region (HK Electric, 2021). Both companies supply electricity to residential properties as well as businesses and other commercial buildings (HK Electric, 2021).

Figure 1 *Sources of energy in Hong Kong 2020*



Note. data retrieved from (Environment Bureau, 2022)

In terms of Hong Kong's renewable energy sources, the country has been generating energy from solar power over the past 20 years (GovHK, 2021). This has been at a small scale with their biggest solar farm large enough to generate 1,100 kW of energy (GovHK, 2021). Despite these efforts, renewable energy made up less than 1% of the country's electricity use in 2018 (GovHK, 2021).

Energy Consumption

Annually, Hong Kong consumes 92TWh of energy (Census & Statistics Department, 2020). This energy is used to power homes, businesses, street lights in the city, transport (including trains, cars and planes), and to fuel infrastructure to provide water (GovHK, 2021). A significant source of electricity in the country is buildings as they use 90% of the total electricity consumption (Environment Bureau, 2021). They also account for 60% of Hong Kong's carbon emissions (Environment Bureau, 2021). Therefore, there is an urgent need to increase the amount of green energy that Hong Kong is using in order to prevent further global warming.

Renewable Energy Challenges in Hong Kong

Limited Land Space

There are various challenges that Hong Kong faces with trying to achieve net zero coal by 2030 in terms of energy generation. These challenges arise from the geography of the city, as well as the costs of renewable energy. Naturally, Hong Kong consists of a steep mountainous environment (Country Reports, 2022) with a limited land space of 1,106 square km (Climate Ready, 2017). The city is densely populated therefore much of the land is taken up as it has been urbanized. This is a challenge as there is a significantly limited amount of land to build and develop infrastructure to support renewable energy generation. For example, renewable sources such as wind and solar farms. Generally, to generate one megawatt of energy through solar panels, five to ten acres of land is required (SEIA, 2022). These factors are significant to the

success of renewable energy in Hong Kong as they cannot be changed. Therefore, renewable infrastructure may have to be built off-shore where Hong Kong would then have to import energy from.

Expense

Another challenge of switching to renewable energy generation in Hong Kong is the cost of it all. The initial installation of the infrastructure to create clean energy generation (such as solar panels and wind turbines) is expensive. In detail, wind farms can cost US$1500 per kW to install (Ministry of Business, Innovation & Employment, 2020). Additional costs include maintenance and storage. Overall, the main expense is in the installation as the energy resources themselves (sun, wind, etc.) are free.

Climate impacts

Climate impacts such as extreme weather events and sea level rise are also a challenge when it comes to Hong Kong generating renewable energy. For example, as climate change exacerbates, extreme weather events are likely to become more severe and more frequent. Hong Kong's existing vulnerability to typhoons will therefore worsen as they occur more often. This impacts the development of renewable energy in this city as infrastructure becomes at threat of cyclone-induced damage. In addition, sea levels will continue to rise as they have already risen an average of 31 mm each decade during 1954-2020 in Victoria Harbour (Environment Bureau, 2021). Sea level rise will cause more damage as it increases the power of storm surges - creating larger, more destructive waves. It is especially a cause for concern in Hong Kong as it is a coastal city.

Strengths & Weaknesses of These Challenges

The limited land space that Hong Kong has to offer is a weakness in itself in relation to reaching net zero coal by 2035. The reason being is that this is something that is not able to be changed. The issue can be worked around by the placement of solar panels on roof tops for example, however, the scale of this development is limited. This means that Hong Kong would have to

develop renewable energy off-shore in order to generate a suitable amount to provide for its population of 7.39 million.

Although Hong Kong will be unable to develop renewable energy on-shore at a large scale, developing infrastructure off-shore could deepen relationships with other countries and therefore improve trade. This would be a strength for the city as there is a heavy reliance on trade for their economy. Additionally, Hong Kong developing renewable energy could lead other countries in this same direction, therefore having a large impact on reducing further global warming.

Despite having its challenges, as mentioned, the development of renewable energy could also strengthen the city by creating employment in various areas such as research, business, technology development and engineering (Environment Bureau, 2021). This is a positive opportunity as the future is headed in the direction of clean, green energy. Therefore, having people ready with the skill sets to support this will be extremely beneficial.

Renewable Solutions

Renewable Electricity Feasibility

Hong Kong's (HK) main limiting factor to producing 100% renewable electricity (RE) is its small land area (1106 square kilometers) in proportion to its large population (7.6 million) who consumes annually 44 Twh (Census & Statistics Department, 2021, p. 6) of electricity. This makes HK one of the most densely populated areas in the world with roughly 6 800 people per square kilometer with a high demand for electricity - mainly air conditioning (Electrical & Mechanical Services Department, 2021, p. 26).

On top of this, HK is very mountainous and consists of many small islands. This factor alone makes renewable electricity generation difficult, despite having such limited space to deploy the technology.

This means, in order to effectively provide Hong Kong with a reliable supply of renewable energy, either a large deployment of low intensity RE production (e.g. solar and wind, including offshore), or a smaller establishment of high density RE production (e.g. nuclear), would need to be built. Ideally, though, a consort of these technologies would be deployed simultaneously to meet varying electricity needs at different times with different intensity demands.

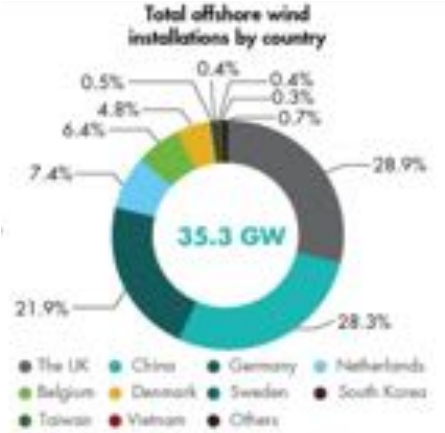
As well as this, HK consumes ~92Twh of energy annually (Census & Statistics Department, 2021, p. 6), of which 44Twh of electricity is included in this figure. Most of this shortfall is accounted for when considering oil and gas use (for mainly transport, hot water and cooking (Electrical & Mechanical Services Department, 2021, p. 27)). Because most cars will need to be powered by either battery, green hydrogen or another renewable source, and other fossil fuels like liquefied natural gas (LNG) will need to be eventually phased out, renewable electricity will be needed to close that gap and replace both oil and natural gas. Therefore, renewable electricity will need to cover practically all of HK's energy needs (i.e. ~92Twh). By this consideration alone, paired with global ambitions of reaching net-zero emissions by 2050 and to achieve Hong Kong's goal of reaching zero electricity generation from coal by 2035, a wartime-like industrial deployment of renewable energy is urgently required.

However, interim goals need to be set in the meantime. So the focus of the recommendations set out in this report are centered around meeting HK's current electricity consumption (44Twh) with 100% renewable sources. Current renewable sources of energy, including nearly solely nuclear, account for 28% (i.e. 12.32Twh). There is therefore a gap of roughly 32Twh that needs to be filled by newly built renewable electricity generation.

Wind Power

Wind power is an increasingly popular renewable energy source. China, the United Kingdom, and Germany are all prominent leaders in installing and developing wind energy (*World*, 2021).

Figure 2 *The percentage of offshore wind installations by country.*

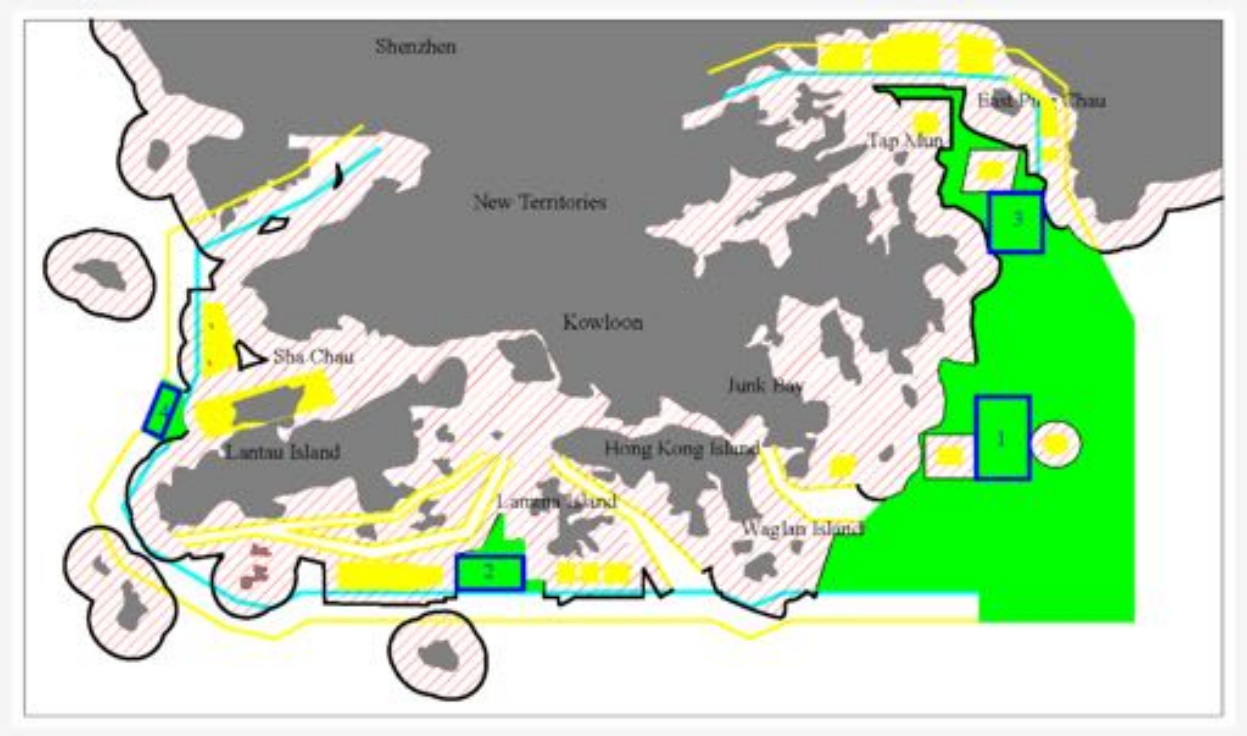


Note. Data received from (*World*, 2021).

There are many benefits to wind power, including that it is a zero-carbon energy, which means carbon emissions are not generated during usage (*Hong Kong's*, 2021).

Wind power can be onshore or offshore, and there are advantages and disadvantages to both (*The pros,* 2021). Hong Kong, as mentioned, is a small area but highly populated, which means there is limited space onshore. An advantage of offshore wind turbines is that they do not impact land usage (*The pros,* 2021). However, to meet the goal of NetZero coal, Hong Kong needs to invest in smart ways for both onshore and offshore solutions. Luckily, Hong Kong has good geographical conditions to create effective wind power (Gao et al., 2019).

Figure 3 *Wind resources in Hong Kong Territorial Waters. Green highlights good wind areas and the blue boxes show potential wind farm sites.*



Note. Data received from (*Gao et al.*, 2019).

Offshore wind speeds can be more stable and faster than onshore turbines leading to more energy creation (*The pros,* 2021). However, offshore wind turbines can be expensive, maintenance can be complex, and there is not enough understanding of marine and bird life impacts (*What are the*, n.d.). Regardless, China is tackling these challenges. China has focused on researching how to incorporate fish farms with offshore wind farms to support the development of sustainability and develop fisheries while effectively using sea space (Baiyu, 2021).

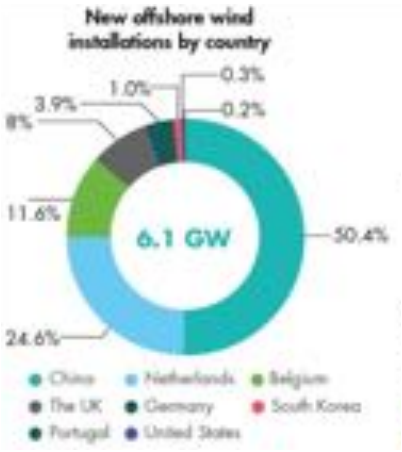
Figure 4 *The operational, planned, and under construction offshore wind and marine ranching projects in China.*

Note. Data received from (Baiyu, 2021).

Public attitudes towards renewable energy can involve knowing that the technologies will create renewable energy while also being conflicted about the potential negative impacts on the local landscape (Gao et al., 2019). Research to develop wind turbines that also benefit the natural world, such as wind turbines combined with marine ranching, help to show the public the additional benefits of integrating renewable technologies into everyday life.

Within the last few years, China has invested a lot in offshore winds and in 2020 6.1GW of offshore wind was installed, and China was the leader (*World*, 2021). .

Figure 5 *The percentage of new offshore wind installations by country in 2020.*



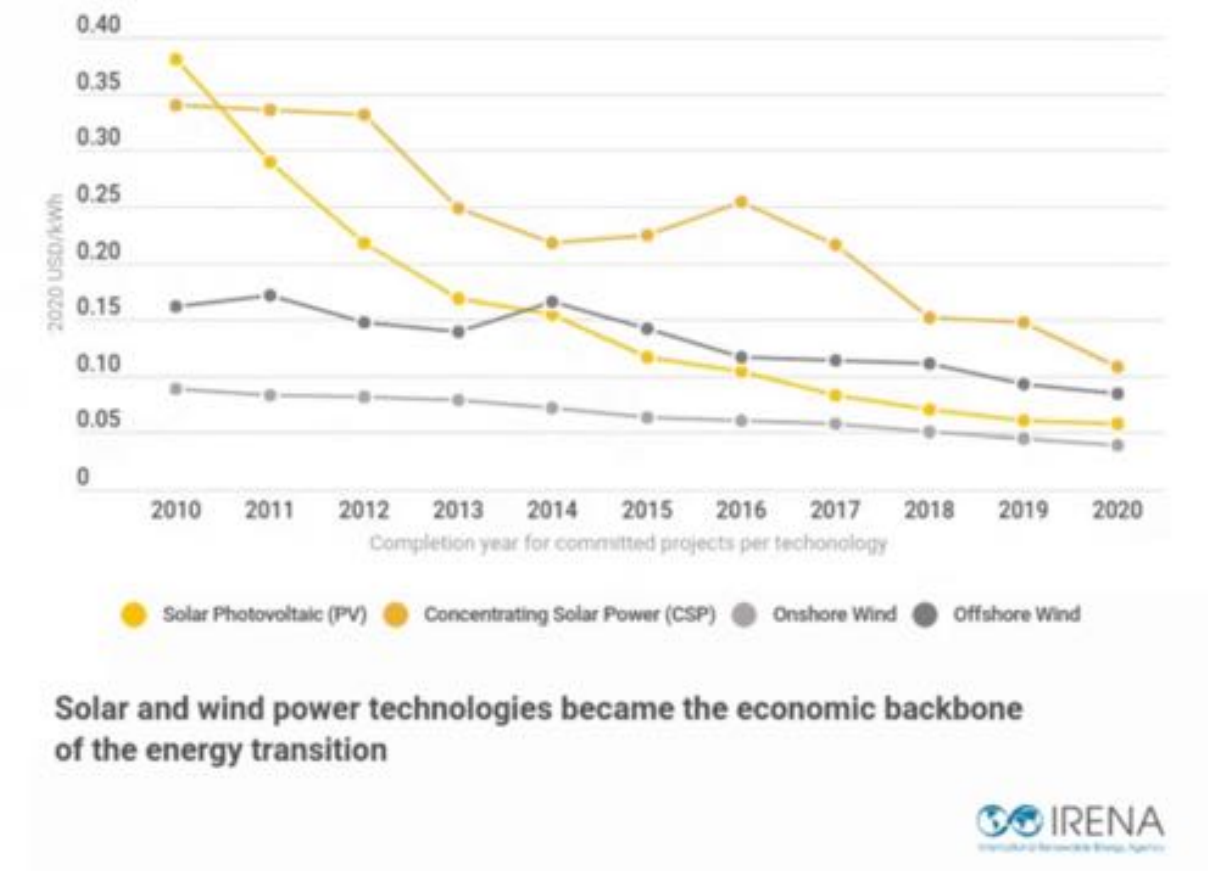
Note. Data received from (*World*, 2021).

Furthermore, China used to import offshore wind turbines from Europe where the seabed and conditions are different, leading to increased engineering costs to fix these issues (Baiyu, 2020). Through innovation and development, China has since increased the amount of energy from offshore wind turbines while decreasing costs (Baiyu, 2020). It is incredibly beneficial to Hong Kong that China invests, research, and develops wind turbines because it allows Hong Kong to utilize these advancements.

One of the main proposed projects for offshore wind farms is from HongKong Electric Company Limited at Southwest Lamma Waters. However, this project has been delayed due to criticism from the public and capital-intensive deliberations (Gao et al., 2019).

In previous years public attitude in Hong Kong around wind power has been negative (Gao et al., 2019). According to Gao et al. (2019), in 2018 each unit of wind power would cost HKD 1.8-2.3, whereas the electricity price at the time was HKD 1/kWh. However, year-by-year renewable energy is seeing increasing drops in price (*Majority*, 2021). The International Renewable Energy Agency has estimated that electricity created from renewable energies will be cheaper than that made from the newest, most inexpensive coal plants (*Majority*, 2021).

Figure 6 *The unit price (USD/kWh) of renewable energies from 2010 to 2020.*



Note. Data received from (*Majority*, 2021).

The continued decrease in manufacturing price and the decline in unit price creates a huge opportunity for Hong Kong. Hong Kong can use China's expertise and research to have more effective and more affordable wind farms while keeping costs down for the public.

According to Gao et al. (2019), there are three potential ways that Hong Kong could use wind for electricity. Firstly, the completion of the project by HongKong Electric Company Limited at Southwest Lamma Waters, which has the potential to create 14.5TWh/yr. Secondly, it is mentioned that onshore wind farms could be placed in rural mountainous areas in Hong Kong that are 65m or higher and the resource estimated potential is roughly 2.6TWh/yr. Lastly, Gao et al. (2019), mention the capability to place small wind turbines on top of 65m or higher

buildings. With the assumption that 30,000 buildings in Hong Kong meet this criteria, there are no installation constraints, and one turbine per building would create 2 to 3 TWh/yr.

The offshore wind farm, the rural onshore wind farms, and the small wind turbines on high urban buildings would create 19.1-20.1 TWh/yr, covering 43-46% of Hong Kong electricity consumption per year.

Solar

Considering HK's lack of space, it is not economical to build solar farms on land. However, many rooftops have the capacity for rooftop solar. A study done by Professor Hongxing concluded that a combination of rooftop solar as well as photovoltaics (PV) integrated into the facade of many buildings including residential, commercial, industrial, schools, government buildings and public housing, could generate up to 11.6Twh of electricity (Hongxing, 2014, p. 55). This doesn't account for sharp development of solar panels in the last 8 years and could be an understatement. This finding is substantial and could if PV were produced at such a scale, the electricity generation would account for 26% of HK's current electricity consumption.

Waste-To-Energy

HK produces ~11 000 tonnes of Municipal Solid Waste (MSW) (Environmental Protection Department, 2020, p. 1) each day. The HK government is currently building a waste-to-energy facility (I-Park or the Integrated Waste Management Facility (IWMF)) which will process up to 3 000 tonnes of waste per day to produce 0.48Twh/year (Environmental Protection Department, para. 18) which is 1.1% of HK electricity consumption. This facility costs HKD$31B (Waste Management World, 2018, para. 1) . So, to process all of HK's MSW, a total of four of these facilities would need to be built to produce 1.92Twh of energy which is 4.4% of HK electricity consumption at a cost of HKD$124B.

Figure 7 Artist Impression of the IWMF

Note: Image retrieved from (Environmental Protection Department, 2021).

Addressing concerns of potentially more greenhouse gasses (GHG) being emitted, overall, from the incineration process of MSW, by replacing fossil fuel combustion with MSW combustion and a reduction in volume of MSW in landfill "it is estimated that about 440,000 tonnes of greenhouse gas emission per year can be curtailed" (Environmental Protection Department, 2021, para. 19).

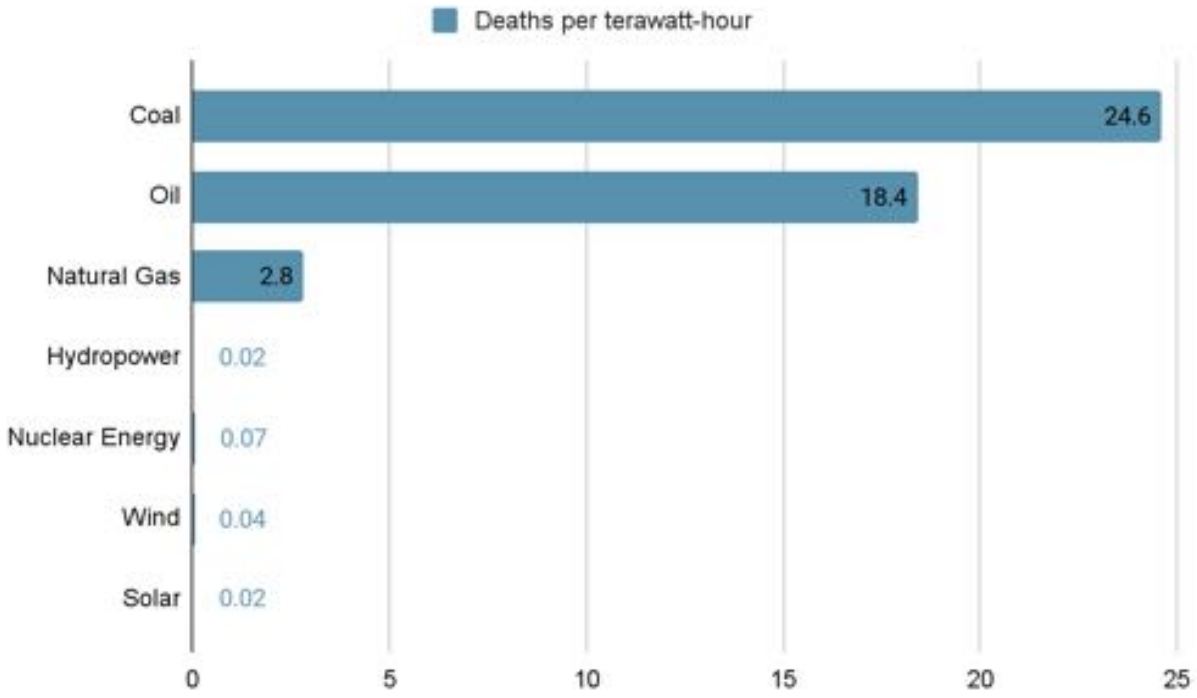
Nuclear Energy

Although there are negative perceptions of nuclear energy globally and indeed in Hong Kong surrounding the risks and costs involved in using nuclear energy, in the long term, it is an economically sound investment, becoming very profitable after at least 16 years from the point of investment (Real Engineering, 2020, min. 9:20). Although this is a long time politically and

indeed economically, the massive amounts of zero-emission energy production from nuclear power is extremely lucrative when tackling HK's net-zero emissions goal by 2050.

In terms of safety, nuclear power is extremely safe. The death rate for nuclear energy is "350 times lower than coal" (Our World In Data, 2017, para 28). Per Twh, nuclear energy production results in 0.07 deaths, 0.02 from solar and 0.04 from wind (Our World In Data, 2017, figure_). However, the death rate for nuclear energy also accounts for the deaths from Chernobyl and Fukushima disasters, including just one from Fukushima.

Figure 8 Death Rate From Accidents & Pollution



Note. Data retrieved from (Ritchie, H, 2020).

In addition, nuclear energy provides a critical advantage that wind and solar cannot provide - base load power. Unless solar and wind farms are complemented by a large installation of battery storage, when the sun doesn't shine and the wind doesn't blow, these renewable

energy sources become stranded assets. This is a crucial element in any electricity grid and vital for an active international financial hub such as HK. For this reason as well as HK's limited land availability and that battery storage is still relatively expensive, nuclear energy is the most effective solution to achieve 100% renewable electricity for HK by 2035.

Hydrogen & Battery Storage

Once there is enough reliable renewable electricity generation to meet HK final consumption demands, the introduction or compliment of batteries and even green hydrogen can begin, which will eventually be a major component in the replacement of oil.

Green hydrogen or battery storage, however, can only be produced using renewable electricity when there is excess of it in the grid. This production of green hydrogen or batteries would then only be truly effective once HK reaches 100% renewable electricity production and consumption. For this reason, to eventually rule out the use of oil for mainly transport, the investment in renewable energy needs to be achieved on a war-like industrial scale of immense proportions.

Recommendations

1. Install PV panels on every feasible roof and facade surface in HK generating potentially 11.6Twh of electricity annually.
2. Erect as much offshore wind in HK territorial waters as possible, including placing turbines on mountain ridges and smaller turbines on top of many high rise buildings - this can potentially amount to roughly 20Twh of electricity production annually.
3. Develop another three IWMF's which will not only process all of HK's current MSW but can provide 4.4% of HK's current electricity consumption (1.92Twh). This will not only reduce emissions from current landfills but will also reduce landfill land use which will free up more of HK's most scarce resource - space - for potential renewable energy generation (e.g. a new nuclear energy plant) which is HK's most scarce resource.

4. The construction of a 2000MW Nuclear Power plant which could generate upwards of 15Twh of electricity annually for HK. Of course to implement this solution, the City will require Mainland China's help, due lack of space.

The environmental risks in taking half measures and only building what is 'profitable' is ill-advised and even detrimental to the future stability and security of HK which is a coastal city that will be severely impacted by rising sea-levels.

Any investment in renewable energy is encouraged. But an intense and radical approach to ramp up renewable energy production is encouraged even more so.

Conclusion

In conclusion, this paper deals with how Hong Kong is able to reach net-zero coal emissions and therefore move to a sustainable future, meeting the critical goals of the Paris Agreement to reduce global warming to 1.5 degrees pre-industrial levels.

To achieve these targets, in the first section of this paper a clear analysis of Hong Kong's energy consumption and generation was discussed such as the challenges the city faces with renewable energy generation. Various challenges such as limited land space, expenses and climate impacts have been analyzed and categorized into strengths and weaknesses.

In addition, the second section of the paper is built around the feasibility of renewable energy. Therefore, Hong Kong's geographical location has exposed several weaknesses, such as the disproportionate land-population distribution. Also, HK's mountainous land mass consists of small islands, which aggravates the development of renewable energy technologies. However, this paper presents the urgent requirement of renewable energy in order to reach net-zero coal emissions by 2035. Therefore, the focus needs to be centered around meeting HK's current electricity consumption with 100% renewable energy. Thus, various renewable energy generations have been presented. Currently, the main source of renewable electricity is generation from nuclear sources. In this case, the profitability and safety of nuclear energy has been discussed. However, this paper presents further recommendations for HK to reach 100% renewable energy that include installing PV panels on all feasible roofs and facades to avoid problems regarding the limited space. Lastly, this section proposes that once there is enough reliable energy generation to meet HK energy consumption, further renewable energy sources such as green hydrogen or battery storage can be introduced.

The paper also presents the strengths and weaknesses of wind turbines. Wind turbines are increasingly popular in countries such as China, the United Kingdom, and Germany. Benefits regarding wind turbines are that it is a zero-carbon energy, and therefore no carbon emissions

are generated during the process. This section deals with HK's feasibility of introducing wind turbines off and onshore. Furthermore, the paper submits that placing wind turbines offshore can generate several environmental threats. However, China has set a blueprint on how to install and create wind turbines offshore that are environmentally and economically friendly. Therefore, the paper highlights three potential solutions on how wind energy can be beneficial for the city of Hong Kong to reach net-zero coal emissions by 2035.

References

Baiyu, G. (2021). *Chinese companies explore joint wind and fish farms. China Dialogue Ocean.* https://chinadialogueocean.net/20062-chinese-companies-explore-joint-wind-and-fish-farms/#:~:text=Projects%20are%20being%20built%20in,and%20support%20more%20sustainable%20development

Baiyu, G. (2020). *Offshore wind takes off in China*. China Dialogue. https://chinadialogue.net/en/energy/china-offshore-wind-power-growth/

Census & Statistics Department. (2021). *Hong Kong Energy Statistics. Annual Report 2020.* https://www.censtatd.gov.hk/en/data/stat_report/product/B1100002/att/B11000022020AN20B0100.pdf

Country Reports. (2022). *Hong Kong Geography.* https://www.countryreports.org/country/HongKong/geography.htm

CLP. (2020). *Our Regional Presence.* https://www.clpgroup.com/en/about/our-business/our-regional-presence.html#hk

Climate Ready. (2017, January). *Hong Kong's Climate Action Plan 2030+.* https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf

Environment Bureau. (2021). *Hong Kong's Climate Action Plan 2050*. https://www.enb.gov.hk/sites/default/files/pdf/cap_2050_en.pdf

Environment Bureau. (2022, January 22). *Energy Supplies.* https://www.enb.gov.hk/en/about_us/policy_responsibilities/energy.html

Environmental Protection Department. (2020). *Monitoring of Solid waste in Hong Kong - Waste Statistics for 2019 https://www.wastereduction.gov.hk/sites/default/files/msw2019.pdf*

Environmental Protection Department. (2021). *Problems & Solutions - Integrated Waste Management Facilities https://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/WFdev_IWMF.html*

Electrical & Mechanical Services Department. (2021). *Hong Kong Energy End-Use Data 2021.* https://www.emsd.gov.hk/filemanager/en/content_762/HKEEUD2021.pdf

Gao, X., Xia, L., Lu, L., & Li, Y. (2019). *Analysis of Hong Kong's Wind Energy: Power Potential, Development Constraints, and Experiences from Other Countries for Local Wind Energy Promotion Strategies*. https://doi.org/10.3390/su11030924

GovHK. (2021). *Energy & Our Environment.* https://www.gov.hk/en/residents/environment/energy/energyandenv.htm

GovHK. (2021). *Key Government Renewable Energy Projects.* https://www.gov.hk/en/residents/environment/renewable/projects.htm

Hong Kong's Climate Action Plan 2050. (2021). https://www.climateready.gov.hk/files/pdf/CAP2050_booklet_en.pdf

Hongxing, Y, The Hong Kong Polytechnic University. (2014). *Solar Energy - New Development & Future Trend.* http://www.energyinst.org.hk/Activity/ICE2014/2.2%20Prof%20Hongxing%20YANG.pdf

HK Electric. (2021, July 28). *The Power behind Hong Kong.* https://www.hkelectric.com/en/about-us

Majority of New Renewables Undercut Cheapest Fossil Fuel on Cost. (2021). International Renewable Energy Agency. https://www.irena.org/newsroom/pressreleases/2021/Jun/Majority-of-New-Renewables-Undercut-Cheapest-Fossil-Fuel-on-Cost

Ministry of Business, Innovaion & Employment. (2020, June 30). *Wind Generation Stack Update.* https://www.mbie.govt.nz/assets/wind-generation-stack-update.pdf

Real Engineering. (2020). *The Economics of Nuclear Energy.* *https://www.youtube.com/watch?v=UC_BCz0pzMw*

Ritchie. H. Our World In Data. (2020). *What Are The Safest & Cleanest Sources of Energy?* https://ourworldindata.org/safest-sources-of-energy

SEIA. (2022). *Sitting, Permitting & Land Use for Utility-Scale Solar.* https://www.seia.org/initiatives/siting-permitting-land-use-utility-scale-solar#:~:text=De

pending%20on%20the%20specific%20technology,(MW)%20of%20generating%20capacity.

The pros and cons of onshore & offshore wind. (2021). Brunel. https://www.brunel.net/en/blog/renewable-energy/onshore-offshore-wind#:~:text=Offshore%20wind%20speeds%20are%20typically,energy%20as%20an%20onshore%20turbine.

Waste Management World. (2018). *US$4bn Waste to Energy Deal for Keppel Seghers in Hong Kong.* *https://waste-management-world.com/artikel/us-4bn-waste-to-energy-deal-for-keppel-seghers-in-hong-kong/*

What are the advantages and disadvantages of offshore wind farms?. (n.d.). American Geosciences Institute. https://www.americangeosciences.org/critical-issues/faq/what-are-advantages-and-disadvantages-offshore-wind-farms#:~:text=Offshore%20wind%20farms%20have%20many,environmental%20pollutants%20or%20greenhouse%20gases

World installs 6.1GW of Offshore Wind in 2020, led by China. (2021). Global Wind Energy Council. https://gwec.net/world-installs-6-1gw-of-offshore-wind-in-2020-led-by-china/