

MEMORANDUM

JUST ENERGY TRANSITION: TOWARDS MORE ACCESSIBLE, GREENER SOLAR ENERGY

submitted by



Consumers' Association of Penang

To

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Ministry of Natural Resources and Environmental Sustainability (NRES)
Ministry of Economy
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Energy Commission
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MEMORANDUM JUST ENERGY TRANSITION: TOWARDS MORE ACCESSIBLE, GREENER SOLAR ENERGY

1.0 INTRODUCTION

This memorandum provides an analysis of the challenges and benefits of solar energy adoption in Malaysia from the consumers' perspective. It concludes with five key recommendations to address the challenges and optimize the benefits of solar energy adoption in Malaysia.

Solar energy has emerged as a leading contender among renewable energy sources in Malaysia due to the country's high solar energy capacity and strategic geographical location near the Equator.

This memorandum underscores the advantages of solar energy, such as its renewable and sustainable nature, minimal environmental impact compared to fossil fuels, and job creation potential. However, several challenges exist, including space constraints, high initial costs, and environmental concerns related to the manufacturing, disposal, and recycling of solar panels.

To address these challenges and maximize the benefits of solar energy adoption, several recommendations are proposed, as follows:

1. **Investment Incentives:** Provide financial incentives such as tax credits, rebates, subsidies, and low-interest loans to encourage the widespread adoption of solar energy systems.
2. **Establish Clear Policy on Waste Management:** Recycling plants dedicated to safe waste management of solar panels are needed to reduce environmental impacts, and promote circular economy practices. Clear policies and regulations are needed to ensure proper handling and disposal of photovoltaic waste, promoting industry-wide compliance with recycling standards.
3. **One-Stop-Shop Service:** Establish a centralized platform for solar energy services to streamline the entire process from information gathering to installation, maintenance, and waste management, ensuring a seamless experience for consumers.
4. **Information and Awareness Campaigns:** Conduct comprehensive information and awareness campaigns to educate the public about the benefits of solar energy and available incentives, empowering informed decision-making.
5. **Funding In Rural Areas And Urban Poor Communities:** Allocate funds to support solar energy installations in under-served areas, promoting sustainable development in their local communities.

By adopting these recommendations, Malaysia can accelerate its energy transition, create job opportunities, reduce carbon emissions from fossil fuels, and build a sustainable energy future for generations to come. The government must prioritize these initiatives and work collaboratively with stakeholders to achieve a successful and just energy transition in Malaysia.

2.0 CURRENT SCENARIO OF ENERGY TRANSITION IN MALAYSIA

It was estimated that Malaysia produced 291 million tonnes of carbon dioxide (CO₂) in 2022 from three major contributing sources: Oil (37.56%), Gas (32.04%), and Coal (25.52%).¹

In the quest for low-carbon generation of energy, the concept of Just Transition (JT) was developed although the concept has been around since the 1980s.² Just Energy Transition (JET) only gained prominence in recent years, particularly within the context of addressing climate change and ensuring equitable outcomes in the shift toward renewable energy sources.

The JET idea emphasizes that the transition to a low-carbon economy should be just, equitable and orderly for all, and should not leave behind vulnerable communities or workers in industries that may be displaced or affected by the transition. It must ensure inclusiveness and participation; retain culture and tradition; respect and uphold human rights and build on what we need now (energy poverty in the country, especially in Sabah and Sarawak), address and not exacerbate inequalities and inequities.

Since 2000 Malaysia included biomass, biogas, municipal waste, solar, and small hydropower in its Five Fuel Diversification Policy in its energy mix³, diverging from its dependence on fossil fuel, and in mid-2023, the Malaysian government launched the National Energy Transition Roadmap (NETR) Phase 1 to accelerate Malaysia's energy transition.

Malaysia outlines its aspiration to have net-zero greenhouse gas (GHG) emissions as early as 2050 in its 12th Malaysia Plan (2021-2025). To achieve that, the National Energy Policy, 2022-2040 (DTN) was first put into place for the transformation of the energy transition to take place.⁴

In Malaysia's Budget 2024, RM2 billion was allocated for the National Energy Transition Roadmap (NETR), another RM200 million was earmarked for the New Industrial Master Plan (NIMP), and financial institutions will be providing financing funds for another RM200 billion to encourage industries to adopt low-carbon economy.⁵

2.1 Solar Energy

Of the various forms of green energy, the most viable form is solar energy because Malaysia benefits from a high solar energy capacity from its geographical location near the Equator. Other forms of generation of energy such as wind turbines, mega hydroelectric dams, and nuclear energy are not viable in Malaysia.

¹ Our World in Data (June 2020, revised January 2024). *CO₂ Emissions by Fuel or Industry Type*. <https://ourworldindata.org/emissions-by-fuel>

² UNDP (3 November 2022). *What is just transition? And why is it important?* <https://climatepromise.undp.org/news-and-stories/what-just-transition-and-why-it-important>

³ The Star (5 Nov 2023). *Solar Powers Malaysia's Renewable Energy Push*. <https://www.thestar.com.my/news/focus/2023/11/05/solar-powers-malaysias-renewable-energy-push>

⁴ Ministry of Economy. *National Energy Transition Roadmap*. https://www.st.gov.my/en/contents/files/download/188/NETR_S3.pdf

⁵ The Star (31 October 2023). *Budget 2024: The future of ESG in Malaysia*. <https://www.thestar.com.my/news/nation/2023/10/31/budget-2024-the-future-of-esg-in-malaysia>

Solar panels, can be ground-mounted, rooftop-mounted, and floating photovoltaic (PV) systems, have the potential to harvest 269 gigawatts. If we compare, both large and small hydro and bio-energy plants can only contribute about 13.6 gigawatts and 3.6 gigawatts respectively.⁶

The Malaysia Renewable Energy Roadmap (MyRER), which was released in 2021, had a target of achieving 31% installed RE capacity by 2025 and increased to 40% in 2035.⁷ In 2022, there was a slightly revised target set in the National Energy Policy (2022-2040), which aspired to achieve 41% installed RE capacity by 2040. The most recent National Energy Transition Roadmap (NETR) announced by the current government in 2023 saw another new target of achieving 70% RE installed capacity by 2050.⁸

While the NETR's target to achieve 70% installed renewable energy (RE) capacity by 2050 may sound ambitious, the projected total primary energy supply (TPES) in 2050 will see only 17% of the energy sources come from RE, while the majority still comes from natural gas (56%), and crude oil, petroleum products and others (21%).

Subsequently, both domestic consumers and non-domestic users have rushed to take up solar power. The Large Scale Solar (LSS) programme was launched in 2017 to encourage local and international businesses to develop big solar projects which could generate and sell electricity to wholesale buyers.

As of August 2023, a total of 1,492.12MW of installed capacity has been in operation from the four cycles of the LSS programme. Under the programme, an additional 949.09MW of solar PV capacity has been awarded but yet to be operational.⁹ This is based on the fact that there are more than 4.12 million buildings with solar rooftop potential in West Malaysia.¹⁰

3.0 THE PROBLEM WITH SOLAR POWER IN GENERAL

Solar panels, while being a sustainable and renewable source of energy, are dependent on sunlight availability which varies on weather conditions and time of day. Cloudy days and nighttime result in reduced or no energy production, necessitating energy storage solutions or backup power systems.

The production of PV systems has been a contentious issue because of the polymers, metals, metallic compounds, and alloys that are potentially hazardous. Although about 80% of the total weight of a solar panel module is non-hazardous (aluminium and glass), it also comprises materials such as Copper Indium Gallium Diselenide (CIS/CIGS), Cadmium Telluride (CdTe),

⁶ Reuters (20 June 2023). *Malaysia's renewable energy transition*. <https://www.reuters.com/plus/malaysias-renewable-energy-transition>

⁷ SEDA Malaysia (2021). *Malaysia Renewable Energy Roadmap*. https://www.seda.gov.my/reportal/wp-content/uploads/2021/12/MyRER_webVer-1.pdf

⁸ Ministry of Economy (2023). *National Energy Transition Roadmap: Energising the Nation, Powering Our Future*. p. 19. https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf

⁹ The Star (5 November 2023). *Solar powers Malaysia's renewable energy push*.

<https://www.thestar.com.my/news/focus/2023/11/05/solar-powers-malaysias-renewable-energy-push>

¹⁰ *Ibid.*

Amorphous Silicon (a-Si), Cadmium Telluride, Hexafluoroethane, Lead, and Polyvinyl Fluoride which can have serious health and environmental concern.¹¹

Germany has one of the most robust policy frameworks mandating recycling of photovoltaic (PV) panels. Germany implemented the Waste Electrical and Electronic Equipment (WEEE) directive which requires the recycling of solar panels once they reach the end of their life cycle. This directive ensures that manufacturers are responsible for taking back and recycling their products. Additionally, Germany has a well-established recycling infrastructure and a commitment to sustainability, contributing to its leadership in PV recycling policies.¹² However, it's worth noting that other countries, such as France, Japan, and Italy also have strong regulations and initiatives in place for PV recycling.¹³

Malaysia lacks specific laws governing the recycling of PV products and the handling of lithium-ion batteries at waste and recycling facilities. Without clear policies and legal mandates in place to regulate the recycling of PV products, their disposal at the end of their lifespan will likely pose a serious environmental problem in the future. There have been 390 reports of lithium-ion batteries causing fires at waste and recycling facilities in the US and Canada in 2022.¹⁴ The 2021 US Environmental Protection Report stated that “in the past seven years, 78% of MRFs (materials recovery facilities) have had to call emergency responders at least once, as opposed to 40% of landfills”.¹⁵

Large-scale PV installations require significant land area or roof space which might not always be readily available in densely populated areas. There is also the cost of maintenance to consider. However, governments are working with financial institutions and private partners to come out with subsidies and innovative packages to attract property owners.

The question of the integrity of a roof structure of a landed building also determines the suitability to install a PV system because each standard residential solar panel of about 1.6 square metres may weigh about 18kg.¹⁶ It is thus recommended to ensure that any repair patches, repairs, or replacements be done before the installation of the PV system as roof works will be trickier after the installation.¹⁷ This would mean an additional expenditure pertaining to roof inspection and repair by a roofer prior to the PV system installation.

¹¹ Iowa Solar (7 March 2022). *The Truth About Dangerous Chemicals In Solar Panels*.
<https://iowasolar.com/dangerous-chemicals-in-solar-panels/>

¹² Umwelt Bundesamt (7 April 2017). Electrical and Electronic Equipment Act.
<https://www.umweltbundesamt.de/en/topics/waste-resources/product-stewardship-waste-management/electrical-electronic-waste/electrical-electronic-equipment-act#:~:text=The%20German%20Act%20governing%20the%20Sale%2C%20Return%20and,for%20the%20end%20of%20life%20of%20their%20products.>

¹³ IEA PVPS Task 12 PV Sustainability Status of PV Module Recycling in Selected IEA PVPS Task 12 Countries (July 2022). https://iea-pvps.org/wp-content/uploads/2022/09/Report-IEA-PVPS-T12-24_2022_Status-of-PV-Module-Recycling.pdf

¹⁴ Waste Dive (22 March 2023). High number of facility fires in 2022 prompts renewed look at battery recycling efforts. <https://www.wastedive.com/news/high-number-of-facility-fires-in-2022-prompts-renewed-look-at-battery-recyc/645682/>

¹⁵ EPA (July 2021). *An Analysis of Lithium-ion Battery Fires in Waste Management and Recycling*, p. 1.
https://www.epa.gov/system/files/documents/2021-08/lithium-ion-battery-report-update-7.01_508.pdf

¹⁶ Forbes Home (7 March 2024). *Solar Panel Size and Weight: A Comprehensive Guide*.
<https://www.forbes.com/home-improvement/solar/solar-panel-size-weight-guide/>

¹⁷ *Ibid.*

The high initial cost of purchasing and installing PV systems deter many people even though the cost has been decreasing over time due to technological advancements and government incentives. Solar panels require minimal maintenance but there may be a need to replace components such as inverters over time, incurring additional costs.

Solar storage solutions, typically using batteries or other energy storage systems, can be expensive and have limited capacity. Another serious setback is the environmentally unfriendly production of such energy storage systems, particularly when mining and processing of lithium, cobalt, and other minerals used.

While PV systems' efficiency has improved significantly in recent years, it remains relatively low compared to some other forms of energy generation. This means that a large surface area of panels may be required to generate a significant amount of electricity.

To address these challenges it often involves technological innovations, supportive policies, and continued research and development in the field of solar energy.

4.0 ADVANTAGES OF SOLAR ENERGY

4.1 Renewable and Sustainable

One of the main advantages of solar energy is its renewable and sustainable nature. Any energy source that can be naturally renewed at a rate comparable to or faster than the energy consumption rate of that resource, is considered a renewable energy source.¹⁸ Solar energy is abundant and inexhaustible, unlike the finite stocks of fossil fuels, which makes it a dependable long-term energy source. The sun's energy is anticipated to be accessible for billions of years, offering a steady and reliable power source.¹⁹ Electromagnetic radiation that results from the nuclear fusion of the Sun is the energy that is emitted into space. The total energy that reaches Earth's surface is 1.5×10^9 TWh. 70% of the energy is absorbed on the surface of the Earth (1.05×10^9 TWh), with the remaining 30% being redirected into space. This quantity is more than the combined reserves of coal and oil.²⁰

Malaysia is located in the equatorial region where the land is exposed to high levels of heat and solar radiation. Due to Malaysia's strategic geographical position, we have a daily average of 4 to 8 hours of sunshine and daily solar radiation as high as 4500 kWh/m² throughout the year.²¹ According to the United States Department of Energy, the sunlight that reaches the Earth's surface in just 90 minutes provides sufficient energy to fulfill the global energy demand for an

¹⁸ Maradin, D. (2021). Advantages and Disadvantages of Renewable Energy Sources Utilization. *International Journal of Energy Economics and Policy*, 11(3), 176–183. <https://doi.org/10.32479/ijeep.11027>

¹⁹ Investopedia. (2024). Solar Energy: Benefits and Drawbacks. <https://www.investopedia.com/articles/investing/053015/pros-and-cons-solar-energy.asp>

²⁰ Simo Stevanović, Snežana Stevanović, & Radovan Živković. (2022). Advantages and Disadvantages of Solar Production and Use. *Journal of Agricultural, Food and Environmental Sciences, JAFES*, 76(4), 65–70. <https://journals.ukim.mk/index.php/jafes/article/view/1884>

²¹ Buysolar. (2018). Is Going Solar a Good Idea in Malaysia? <https://www.buysolar.my/resources/articles/is-going-solar-a-good-idea-in-malaysia#:~:text=Well%E2%80%A6E2%80%A6,sun%20due%20to%20its%20location.>

entire year.²² As long as the sun continues to shine, we will have access to solar energy, making it a reliable and sustainable source of power in Malaysia.

4.2 Environmentally friendly compared to fossil fuel-based power

Solar energy is considered environmentally friendly for several reasons, primarily due to its minimal impact on the environment compared to conventional fossil fuel-based power generation. Fossil fuel combustion releases large amounts of greenhouse gases into the air, accelerating climate change. On the other hand, there is no fuel combustion involved in solar panel technology, its greenhouse gas emissions are negligible, which can help in mitigating air pollution and combating climate change.

For the first few years of operation, solar panels release about 50g of CO₂ for every kWh generated. Most solar panels achieve carbon neutrality by the third year of installation. Even so, this still produces around 20 times less carbon dioxide than electricity generated by coal.²³ Installing solar panels is a highly efficient method to reduce the carbon footprint. Although there are carbon emissions associated with manufacturing solar panels, these are quickly offset once they are installed and operational.²⁴

Moreover, solar panels do not generate noise or chemical pollutants during use.²⁵ This environmentally friendly attribute makes solar energy a crucial component of efforts to transition towards a low-carbon economy and achieve sustainability goals.

4.3 Job Creation

One of the significant advantages of solar energy is its potential to create jobs. As the solar industry continues to expand, there is a growing demand for skilled workers in various sectors, including sales, manufacturing, installation, maintenance, research and development, and support. There are even jobs in education for people pursuing solar energy jobs.²⁶

The installation of solar panels requires trained professionals to handle tasks such as site assessment, system design, and electrical work, leading to job opportunities for electricians, engineers, and technicians. As one of the world's largest manufacturers of solar PV, Malaysia holds a significant position in the solar energy industry. With a module production capacity of

²² National Oceanic and Atmospheric Administration. (2024). How Do Clouds Affect Solar Energy? <https://scijinks.gov/solar-energy-and-clouds/>

²³ Solaris Renewables. (2022, April 25). What Is the Carbon Footprint of Solar Panel Manufacturing? <https://solarisrenewables.com/blog/what-is-the-carbon-footprint-of-solar-panel-manufacturing/#:~:text=Solar%20panels%20emit%20around%2050g,of%20coal%2Dpowered%20electricity%20sources.>

²⁴ Wigness, S. (2023, January 9). What is the Carbon Footprint of Solar Panels? <https://www.solar.com/learn/what-is-the-carbon-footprint-of-solar-panels/>

²⁵ Investopedia. (2024). Solar Energy: Benefits and Drawbacks. <https://www.investopedia.com/articles/investing/053015/pros-and-cons-solar-energy.asp>

²⁶ Pahang Skills Development Centre. (2023, March 10). 5 Reasons to Consider a Career in the Solar Industry - Pahang Skills Development Centre. <https://www.pahangskills.gov.my/5-reasons-to-consider-a-career-in-the-solar-industry/>

approximately 8.9 gigawatts (GW) in 2019, Malaysia reported 16,150 direct PV jobs during that year, a number that could potentially double when indirect employment is taken into account.²⁷ With module capacity expanding to around 14 GW by 2022, Malaysia is expected to see a rise in employment opportunities within the solar PV sector.²⁸ By investing in solar energy, governments and businesses can reduce carbon emissions and promote environmental sustainability, besides creating new employment opportunities and driving economic growth.

5.0 DISADVANTAGES OF SOLAR ENERGY

5.1 High Initial Cost

One of the significant drawbacks of adopting solar energy is the high initial cost associated with installing solar panels, inverters, and battery storage systems. The upfront investment required for purchasing and installing solar equipment can be a barrier for many homeowners and businesses. The size and type of the solar panel, type of house, location, and roof size are some of the factors that can affect the actual cost of installation.

In Malaysia, the price range for a standard household solar system is between RM25,000 and RM45,000.²⁹ Similar to conventional housing loans, solar panel installation financing usually has a 25 to 35-year payback period. Homeowners should consider how extra loan repayments may affect their monthly budget and overall financial commitments. It is essential to assess whether the long-term energy savings from solar panels outweigh the added loan obligations.

To protect their investment, homeowners might also need to purchase insurance coverage against potential damages to their solar panels, such as landslides or floods. Additionally, regular maintenance is essential to ensure optimal performance and longevity of the solar panel system. Annual maintenance costs typically range from RM200 to RM800 per visit, with an average cost of RM320.³⁰

Another thing we need to invest in is batteries. Although we are in a tropical region, solar energy may also face some specific disadvantages related to weather dependence and daily fluctuations, which can affect its reliability and efficiency. Thus, a solar battery is an essential component of a home reliant entirely on solar power. The battery functions to store power

²⁷ International Renewable Energy Agency. (2023, August 23). In Rural Malaysia, Local Communities Are Empowered to Develop and Maintain Renewable Power. <https://www.irena.org/News/articles/2023/Aug/In-Rural-Malaysia-Local-Communities-Are-Empowered-to-Develop-and-Maintain-Renewable-Power#:~:text=With%20a%20module%20production%20capacity,increase%20in%20solar%20PV%20employment.>

²⁸ International Renewable Energy Agency. (2023, August 23). In Rural Malaysia, Local Communities Are Empowered to Develop and Maintain Renewable Power. <https://www.irena.org/News/articles/2023/Aug/In-Rural-Malaysia-Local-Communities-Are-Empowered-to-Develop-and-Maintain-Renewable-Power#:~:text=With%20a%20module%20production%20capacity,increase%20in%20solar%20PV%20employment.>

²⁹ Buysolar. (2024). The Average Cost for Residential Solar Installation. <https://www.buysolar.my/resources/articles/the-average-cost-for-residential-solar-installation>

³⁰ GetSolar. (2022, April 26). Solar Panel Malaysia: Price of Installation. <https://getsolar.ai/blog/solar-panel-price-malaysia/#g7e1ab5d28701>

during the day, so it can be used at night to run the lights continuously. Solar batteries typically have a lifespan of 10 years, after which they may require replacement.³¹

For many homeowners, the high cost of solar panel installations continues to be a major obstacle. Some individuals may prefer to rely on electricity supplied by utility companies rather than investing in solar panels. This preference may stem from the belief that they can control their electricity consumption to reduce their bills. From the perspective of the homeowner, it would be less of a financial burden to pay to the electricity utility company particularly if their electricity bill is not excessive than to commit to a financial institution for the installed solar panels. Moreover, electricity consumption can be controlled by the users to keep their bills within their affordable limits.

5.2 Geographic And Space Limitations

Installing solar panels and the associated wiring requires a lot of space, which could be an issue for homes with small roofs or in less-spacious residential areas. Despite having much sunshine, there is limited land area in Malaysia, particularly in densely populated areas. Areas with trees or other structures blocking the solar panel will also result in less efficient electricity generation as it diminishes the sunlight that reaches these residences.

To generate increased electricity output, a larger number of solar panels and additional space are required to optimize sunlight collection.³² Solar panels can sometimes be prominently placed in locations where they are easily visible to both owners and neighbours. Regrettably, some individuals may find the appearance of solar panels unappealing or worry that they could detract from the visual harmony of buildings or landscapes.³³

5.3 Toxic E-waste During Manufacturing And Disposal

The manufacturing process of solar technology comes with environmental drawbacks, as it involves the mining of materials and the production of solar panels, which results in a significant emission of greenhouse gases. Solar technology contains some of the same environmentally harmful substances in many consumer and industrial electronics, so proper disposal is critical. At present, recycling options for solar panels remain limited.³⁴

Production of solar panels consists of toxic materials such as Copper Indium Gallium Diselenide (CIS/CIGS), Cadmium Telluride (CdTe), Amorphous Silicon (a-Si), Cadmium Telluride (CdTe), and Cadmium Telluride (CdTe).

³¹ Crail, C. (2023, December 27). Everything You Need To Know About Solar Batteries.

<https://www.forbes.com/home-improvement/solar/what-is-a-solar-battery/#:~:text=A%20solar%20battery%20is%20an,emergency%20backup%20during%20power%20outages>.

³² GreenMatch. (2024, January 26). Pros & Cons of Solar Panels (Watch this video before you invest). <https://www.greenmatch.co.uk/blog/2014/08/5-advantages-and-5-disadvantages-of-solar-energy>

³³ Exeo Energy. (2024). Solar Panel Aesthetics. <https://www.exeoenergy.co.uk/solar-panels/solar-panel-aesthetics#:~:text=The%20aesthetics%20of%20solar%20panels,as%20possible%20can%20be%20crucial>.

³⁴ Crail, C. (2024, February 6). Solar Energy Pros And Cons: What Are The Advantages And Disadvantages? Forbes. https://www.forbes.com/home-improvement/solar/solar-energy-pros-and-cons/#disadvantages_of_solar_energy_section

Selenide, Hexafluoroethane, Lead and Polyvinyl Fluoride. These hazardous chemicals are introduced into the environment at two stages of a solar panel's lifecycle: during production and disposal. Throughout production, these chemicals undergo various processes such as collection, manipulation, heating, cooling, and numerous other steps involving human intervention at each stage.³⁵

Concerning the manufacturing and disposal of PV systems, it is pertinent for the Malaysian government to regulate the industry, including the recycling of PV systems when they have reached their end-of-life of about 35 years. It is projected that approximately 80 million tonnes of solar panels will reach the end of their lifespan by 2050.³⁶ Without effective recycling and disposal methods in place for solar panels, there is a risk of environmental harm and the unnecessary depletion of natural resources.³⁷ Therefore, there is a need for stringent regulations because failure to do so can result in pollution and ecological damage. The government has to start planning and consider bringing in stakeholders who are interested in venturing into recycling the materials safely.

5.4 Fire Hazard And Leaching From Landfill

Lithium solar batteries present a potential fire hazard that warrants careful consideration. Fires in landfills or battery-recycling facilities have been attributed to inappropriate disposal of lithium-ion batteries. Lithium-ion batteries have a high potential to catch fire when exposed to heat and moisture, or crushed – common conditions in garbage trucks and household waste facilities.³⁸

Li-ion batteries are susceptible to catching fire or exploding as they are structured to fulfill the three fundamental requirements for a fire: oxygen, fuel, and heat. The organic solvents present in the electrolyte serve as combustible material, exacerbating the potential for fire incidents.³⁹ Moreover, the toxic materials in solar panels can leach out as they break down, and landfilling also creates new environmental hazards. This will lead to water and soil contaminations as they leach out of landfills.

³⁵ Iowa Solar. (2022, March 7). The Truth about Dangerous Chemicals in Solar Panels. <https://iowasolar.com/dangerous-chemicals-in-solar-panels/>

³⁶ Energy Watch. (2023, November 2). Getting Ahead of Solar's Emerging Concern. <https://www.energywatch.com.my/blog/2023/11/02/getting-ahead-of-solars-emerging-concern/#:~:text=In%20other%20news%2C%20First%20Solar,solar%20panels%20and%20other%20products>

³⁷ Energy Watch. (2023, November 2). Getting Ahead of Solar's Emerging Concern. <https://www.energywatch.com.my/blog/2023/11/02/getting-ahead-of-solars-emerging-concern/#:~:text=In%20other%20news%2C%20First%20Solar,solar%20panels%20and%20other%20products>

³⁸ Australian Competition and Consumer Commission. (2023, October 4). Consumers urged to use and store lithium-ion batteries safely to prevent deadly fires. <https://www.accc.gov.au/media-release/consumers-urged-to-use-and-store-lithium-ion-batteries-safely-to-prevent-deadly-fires#:~:text=As%20an%20increasing%20number%20of,trucks%20and%20household%20waste%20facilities>

³⁹ Scutum. (2021, November 9). Why do Lithium Ion Batteries Catch Fire and Explode? <https://www.scutumsoutheast.co.uk/help-advice/why-do-lithium-ion-batteries-catch-fire-and-explode/#:~:text=However%2C%20it%20also%20creates%20the,as%20fuel%20for%20a%20fire>

6.0 RECOMMENDATIONS

To utilize solar energy efficiently, the Malaysian government can deploy a range of strategies to foster widespread adoption while optimising its benefits and mitigating adverse effects.

6.1 Investment Incentives

The government can encourage people to participate in solar energy systems by providing financial incentives including tax credits, rebates, subsidies, and low-interest loans. With the initial expenses of solar installations partially covered by these incentives, a larger spectrum of stakeholders may afford and utilize solar installations. The government may lessen dependency on fossil fuels and hasten the switch to clean energy by providing incentives for using solar power, thereby reducing the negative effects on the environment.

6.2 Establish Clear Policy on Waste Management

Clear policies and regulations are needed to ensure proper handling and disposal of photovoltaic waste, promoting industry-wide compliance with recycling standards. The government can allocate funds towards the establishment of recycling plants specifically dedicated to safe recycling and waste management of solar panels. A suitable recycling infrastructure is necessary to manage electronic waste and reduce the environmental impact of the anticipated rise in solar panels that are reaching the end of their useful lives. Solar panel recycling facilities guarantee the recovery and reuse of important materials, hence decreasing the need for virgin resources and limiting waste sent for disposal. In addition, clear policies and regulations must be established to ensure the proper handling and disposal of PV waste, promote industry-wide compliance with recycling standards, and foster the development of a sustainable recycling ecosystem. In Malaysia, the infrastructure for solar panel recycling remains limited, with only one operational facility currently in place.⁴⁰ First Solar, a leading provider of photovoltaic solar solutions, recently began operating a solar e-waste recycling facility in Malaysia. This facility can reclaim more than 90% of glass and semiconductor materials from discarded solar panels, subsequently repurposing them for the production of new solar panels and various other items.⁴¹

6.3 One-Stop-Shop Service

Establishing a One-Stop-Shop for solar energy services significantly benefits consumers in Malaysia seeking to adopt solar technology. This centralized platform streamlines the entire process, from initial information gathering and supplier selection to the purchase, installation, upkeep, and disposal of solar panels. In Malaysia, companies such as Buysolar, Brilliant Solar, Verdant Solar, Samaiden, and ERS Energy already offer comprehensive one-stop-shop services for solar energy, providing end-to-end support to consumers. By leveraging these

⁴⁰ Yeo, B.Y. (2024, January 20) First solar panel recycling facility in next 10 years. <http://energy.bernama.com/news.php?id=1808038>

⁴¹ Energy Watch. (2023, November 2). Getting Ahead of Solar's Emerging Concern. <https://www.energywatch.com.my/blog/2023/11/02/getting-ahead-of-solars-emerging-concern/>

existing service providers, the government can further facilitate consumer adoption of solar energy while reducing administrative burdens and boosting consumer trust. Promoting reputable companies and encouraging collaboration with them ensures that consumers have access to reliable and convenient solutions for their solar energy needs.

6.4 Information and Awareness Campaigns

The government can educate the public about the advantages of solar energy and the various incentives by establishing comprehensive information and awareness campaigns. These initiatives emphasize the social, economic, and environmental benefits of adopting solar energy through workshops, seminars, public events, and digital media platforms. By providing accurate information and resources, the government can empower individuals and businesses to make informed decisions about solar energy investment, contributing to widespread adoption and positive environmental outcomes.

6.5 Funding In Rural Areas And Urban Poor Communities

Considering the financial constraints in rural areas and urban poor communities, the government should provide funding for the installation and management of solar energy in these areas. This could involve grants for the initial expenses of installing solar panels, increasing the affordability and accessibility of solar energy in these under-served areas. Through the allocation of funding to support such initiatives, the government can empower rural areas and urban poor communities to switch to renewable solar energy thus promoting sustainable development in their local communities.

7.0 CONCLUSION

In conclusion, it is imperative for the government to carefully weigh the advantages and disadvantages outlined in this memorandum regarding the adoption of solar energy. While solar energy presents significant benefits in terms of environmental sustainability, environmental friendliness, and job creation, it is essential to acknowledge and address potential challenges such as geographic and space limitations, high initial costs, and negative environmental impacts.

To mitigate these challenges and maximize the benefits of solar energy adoption, the Consumers' Association of Penang (CAP) strongly urges the government to consider the key recommendations as stated above. These include providing investment incentives, investment in solar panel recycling plants, the establishment of a One-Stop-Shop for solar energy services, promotion of public awareness and education through campaigns, and implementation of clear and consistent policies. By taking decisive action and implementing these recommendations, the government can pave the way for a transition to a cleaner, more sustainable energy future while minimizing the negative impacts associated with solar energy adoption.

Therefore, CAP calls upon the government to carefully consider all aspects of solar energy adoption and make informed decisions that prioritize the long-term sustainability, prosperity, and well-being of our nation and its citizens. By embracing solar energy and implementing the necessary measures to support its deployment, we can build a brighter and more resilient future for generations to come.