Singapore Aerospace Industry Solar Adoption Report

2021

Table of Contents

01	02	03
Foreword	Introduction - Why Solar	Report Methodology
04	07	11
Key Findings	Qualitative Insights	JTC's Push for Solar Adoption
12	12	
Conclusion	References	

Foreword



In 2017, our association reviewed its purpose and developed a new collective vision of "an innovative Aerospace community for a sustainable future". Our initial focus was on economic sustainability, to secure the competitiveness of the aerospace industry in Singapore for the long term.

It later became evident, through our consultations with members, that there was a strong, developing interest in the environmental and social dimensions of sustainability, beyond the economic. Since then, we have been gearing up and taking incremental steps towards collective action.

Even as the global pandemic continues to create uncertainties, aviation has been plotting its green recovery. The local aerospace industry has continued to pursue sustainability and decarbonisation goals. Companies such as the SIA Group and Rolls-Royce Singapore have recently iterated their progressive commitment towards net zero carbon emissions.

Our inaugural Singapore Aerospace Industry Solar Adoption report presents a consolidated view of progress made by the aerospace industry in Singapore towards implementing solar energy as part of Singapore's national target of 2GWp by 2030. It represents the association's effort and commitment to work with aerospace companies to meet their sustainability goals. We hope this provides more impetus for companies to understand the benefits and possibilities of solarisation, and helps them embark on the path to a greener future.

The Intergovernmental Panel on Climate Change (IPCC) recently issued a report that provided a stark warning about how the human impact on climate change can lead to catastrophic effects for the global population. It is a strong call to action. As an Association, we will continue to galvanise the aerospace community's efforts to create a better tomorrow for all.



Introduction

This is the inaugural report on solar energy adoption by the aerospace industry in Singapore. The report is a collaborative effort between the Association of Aerospace Industries (Singapore) (AAIS) and JTC Corporation (JTC). The objectives are to communicate the industry's sustainability efforts to a wider audience, engage current and prospective parties, and share about the benefits in implementing solar energy. This way, companies from all industries can learn and be ready in greening their energy use.

Why Solar?

Dealing with climate change is a matter of survival for Singapore. As an island nation, we will be threatened by rising seas and temperatures in the years ahead. We have to decarbonise the economy and reduce emissions so as to do our part under the 2015 Paris Climate Agreement and keep within the safe global warming pathways. With the launch of the Singapore Green Plan 2030 in February 2021, there are plans to take action across all sectors to enable the low-carbon transition.

Switching to clean energy is critical, given that power generation accounts for 38.9% of Singapore's emissions profile [1]. Solar is by far the most practical and promising clean energy in Singapore's context. We get ample sunshine and solar photovoltaic (PV) panels can be deployed on roof-tops, open fields and even in our reservoirs.

A December 2017 study published in Nature Energy journal compared the projected lifecycle greenhouse gas emissions – i.e. from resource extraction, construction, operations, decommissioning and waste management – between fossil fuel and non-fossil fuel power technologies. The emission footprint for solar energy was 6 gCO2e/kWh, significantly lower than the 78-109 gCO2e/kWh range for fossil fuels such as coal and natural gas. Importantly, solar energy's emissions are below the global average target of 15 gCO2e/kWh necessary for the world to keep within the safe 2C warming threshold.

02

Solar energy is not only good for the environment, it is cost-effective. According to an April 2020 press release by the Solar Energy Research Institute of Singapore (SERIS), solar energy's levelised cost of electricity (LCOE) – which measures the lifetime cost of generating power – varies between SGD 0.065/kWh and SGD 0.097/kWh. This compares favourably to the wholesale electricity price of SGD 0.08/kWh, which reflects Singapore's national average cost of generating and delivering electricity.

The Singapore government has set a goal of installing at least 2 Gigawatt-peak (GWp) of solar PV power by 2030, five times the current installed capacity, which will power more than 350,000 households annually.

Report Methodology

The aerospace industry in Singapore is involved in maintenance, repair and overhaul (MRO) services, manufacturing, aftermarket services, as well as research and development (R&D) activities for aircraft and spacecraft. The industry has more than 130 aerospace players with Singapore being Asia's leading one-stop MRO solutions provider, contributing 10% to global MRO output.

In 1H 2021, we conducted a survey of 28 Singapore-based aerospace companies that have deployed, are deploying or plan to deploy solar systems in their buildings and facilities situated at the Seletar Aerospace Park and other locations. The survey excludes companies directly involved in aviation services, such as the airlines. We asked for information pertaining to locations deployed (e.g. building and car park roofs), installed capacity and annual electricity generated. This helps us build the baseline inventory for the industry. We also asked for qualitative feedback on the solar transition process. Our intention is to publish a follow up report in 1-2 years' time to understand the progress of solar adoption for the industry.



Key Findings

Total deployed solar capacity by the aerospace industry (as of June 2021)





A total of 14 solar projects were implemented in the period 2013 to 2020. The implementation peak was in 2015 with 6 projects generating a total of 6.63 MWp capacity. 1 Megawatt-peak (MWp) is the nominal power rating achieved under ideal solar irradiance conditions, and is equivalent to the maximum power generated by 3,333 solar panels each with a rating of 300W.

04

Annual average growth rate of solar capacity (from 2013 to 2020)

B33.69/0 The industry's solar adoption looks set to grow incrementally. From the survey feedback, there are 3 projects scheduled to be operational in 2021 and a potential pipeline of 12 additional projects. Number of solar panels installed within aerospace facilities in SG

65,000

This is an approximation, assuming that an average power rating of 300W is generated by a commercial solar panel (96 cell) measuring 1m x 1.9m.

The installed capacity of 19.65 MWp accounts for 4.4% of Singapore's total solar capacity of 443.60 MWp [2]. If we are looking at just the non-residential private sector installations in Singapore as the base, the aerospace industry's installed capacity would account for 8.3%. This is a noteworthy sectoral achievement, bearing in mind that the aerospace industry accounts for a proportionately smaller 1% of Singapore's Gross Domestic Product (GDP) [3].

Solar energy as share of respondents' overall energy consumption

10.7%

The contribution varies from 4% to 95% across the companies that have deployed solar energy, in view of the amount of rooftop space available and the nature of their operations. The 10.7% is a weighted average. Amount of building, hangar and car park roof space used

123,053 SQM This is the amount of space equivalent to 17 soccer fields - that has been repurposed for economic and

environmental benefits.

Singapore Aerospace Industry Solar Adoption Report 2021 05

Total electricity produced annually

21.18 million kWh



This amount of electricity is sufficient to power

4-room public housing apartments in Singapore annually [4].

As solar panels are emission-free when generating electricity, this amounts to an estimated avoidance in annual carbon emissions [5] of

8.65 million kgCO₂



The emissions avoided are equivalent to the CO₂ absorbed by



mature trees [6].

Qualitative Insights

Motivations for Deploying Solar



We recognise the importance of sustainability and the need for us to drive positive changes for the environment and community. SIAEC started our sustainability journey a few years ago and we have since installed solar panels across all our hangars to generate renewable energy. The adoption of solar energy reduces our exposure to volatility in electricity pricing. Today, we are seeing energy cost savings of 18%, thanks to solar power alone."

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- Mr Foo Kean Shuh, Senior Vice President Corporate Planning, Fleet Management & Commercial, SIA Engineering Company -

Solar Leasing: A preferred approach

The most common deployment approach is via solar leasing, whereby the company leases its space to a solar vendor that will install, own and operate the solar panels. The company can choose to buy all or part of the solar energy generated.

13 of the 14 companies that have deployed solar in our survey are using solar leasing. The contract duration for solar leasing varies between

10 - 25 years

Advantages of Solar Leasing

The advantages of a solar leasing model are that there are no upfront capital costs for the company, the cost of electricity is lower than buying from the electricity retailers, energy pricing can be negotiated and fixed over the long term with the solar vendor, the vendor takes on the operating costs and risks for the solar PV systems, and this can enhance the value of the facilities. The process for solar leasing, which could take about 2 years between agreement and actual implementation, is fairly seamless post-contractual negotiations as the installation and other works are done by the appointed vendor.

Companies on a solar leasing model can choose between paying a cost-effective fixed tariff or a floating tariff pegged at a discount against the prevailing national regulated rate. In this way, companies are assured of reaping savings throughout the contractual term. The absolute savings would depend on the contribution of solar to the company's overall energy consumption, commercial terms agreed with the solar vendor, as well as the prevailing market tariff rates. One company reported that it saw 20% savings in its energy expenditure.



Overcoming Implementation Challenges

An implementation challenge highlighted by companies was the need for additional upfront investment and space requirements if batteries were to be installed to store electricity for on-site usage during evening hours. This applies to both companyowned and solar leasing models. Without battery storage, surplus solar energy generated in the daytime can instead be sold to the grid.

> Another highlighted issue was that tests had to be done to ensure rooftop solar panels did not interfere with radar and navigation systems or cause reflective glare for pilots. The context of this safety concern was that many of the aerospace companies were located near the airports.

JTC's Push for Solar Adoption

JTC currently has two solar initiatives – SolarLand and SolarRoof – that generate renewable energy via the installation of solar panels on vacant land and on unutilised rooftops of JTC's buildings respectively.

The SolarRoof programme was launched in 2016 to make solar adoption easy for the 14,000 businesses housed in JTC's estates. It exports solar energy generated on the rooftops of JTC's buildings directly to the national power grid. The programme was first deployed at 24 JTC-owned buildings across Singapore and was well-received by businesses. The solar deployment is being extended to an additional 40 JTC-owned buildings with an estimated additional solar capacity of 17.4 MWp, slated to be operational by 2022.

By working with partners and businesses, JTC plans to optimise the use of over 740,000 sqm of industrial land and roof space, so as to eventually reduce 55,000 tonnes of carbon emissions and contribute 100 MWp of solar energy to the Energy Market Authority's national 2030 target.

Readers interested to check out JTC's Solar Deployment Infokit can <u>click here</u> or scan the QR code below.



Conclusion

Addressing climate change, reducing energy costs and supporting a national goal are all compelling reasons for the aerospace sector to harness solar energy. An added bonus is that the solar marketplace has matured, hence companies interested to deploy solar energy in their facilities need not buy the panels and incur a substantial expenditure upfront. Instead, they can get started by tapping on solar leasing and other innovative programmes offered by a range of service providers.

References

- 1. National Climate Change Secretariat, Singapore's Emissions Profile 2018. (https://www.nccs.gov.sg/singapores-climate-action/singapore-emissions-profile/)
- Installed capacity of grid-connected solar PV systems in Singapore as of Q1 2021, based on statistics published by the Energy Market Authority (EMA). (https://www.ema.gov.sg/cmsmedia/47RSU_Q1_2021.pdf)
- 3. Source: https://www.businesstimes.com.sg/government-economy/singaporesaerospace-sector-gets-training-support-from-the-government
- 4. A 4-room Housing and Development Board (HDB) apartment consumes a monthly average of 359.1 KWh of power in 2019.
 - (https://www.ema.gov.sg/cmsmedia/8RSU.pdf)
- 5. This is using the grid system-wide emission factor of 0.4085 kgCO2 per kWh for 2019. (https://www.ema.gov.sg/cmsmedia/18RSU.pdf)
- 6. This is based on an estimate of 22 kg of CO2 absorbed by a mature tree annually, published by the European Environment Agency in 2012. (https://www.eea.europa.eu/articles/forests-health-and-climate-change/key-facts/trees-help-tackle-climate-change)

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The Association of Aerospace Industries (Singapore) or AAIS, is a not-for-profit organisation established in 2003 to promote the development of Singapore as a leading aerospace hub. Its vision is "An Innovative Aerospace Community for a Sustainable Future."

For more information, visit www.aais.org.sg.



JTC is the government agency championing sustainable industrial development. Together with our partners, we masterplan clean, green and smart estates as attractive destinations for talent and the community. We also drive innovation in the Building and Infrastructure sector.

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