



EENP AWARDS 2023

AWARD
RECIPIENTS



EENP AWARDS 2023 RECIPIENTS

Excellence in Energy, Greenhouse Gas Management

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Abbott is a global healthcare leader, dedicated to helping people live more fully with their life-changing technologies and products, including diagnostics, medical devices, nutritional products and branded generic medicines. For over 50 years, more than 1,100 employees in Singapore are helping people to live better and healthier, every day.

Abbott believes that a sustainable future starts with good health. Abbott's 2030 sustainability plan focuses on designing access and affordability into its life-changing technologies and products – with the goal to improve the lives of 3 billion people every year by decade's end. In order to innovate for greater access in health, Abbott believes in building a stronger, more sustainable company, in everything they do.

30per cent ↓  from 2018 baseline by the end of 2030

Abbott's 2030 sustainability plan targets includes actions to protect a healthy environment. It outlines the company's goal to reduce absolute Scope 1 and 2 carbon emissions by 30 per cent from 2018 baseline by the end of 2030. Aligned with this target, Abbott's nutrition facility in Singapore is committed to managing energy resources in a climate responsible manner consistent with Abbott's policies.

The Utilities Excellence (UEX) team in the nutrition facility in Singapore comprises a dedicated group of professionals who governs the plant's Energy Management System. To develop their competency in energy management, several full-time employees have participated in Singapore Certified Energy Manager trainings. In addition, a designated full-time staff member is certified as an Energy Efficiency Opportunities Assessor (EEO Assessor) by The Institute of Engineers, Singapore. The plant's commitment to optimising energy consumption and decarbonisation efforts is championed at all levels, from leadership to the shop floor. Energy performance is monitored at various levels, including daily monitoring on the shop floor and monthly and annual reviews with the site leadership team.



ACHIEVEMENTS

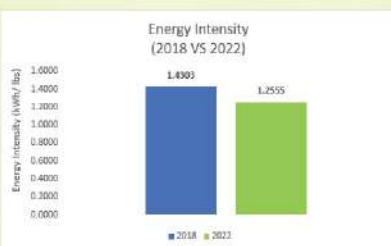


Diagram shows energy intensity reduction in Singapore Nutrition Facility over the 5 years (2018 vs 2022) by 12.2%.

Every year, Abbott's nutrition facility in Singapore establishes and advances projects to reduce environmental impact. Since 2018, Abbott's nutrition facility in Singapore has invested in eight significant projects aimed at increasing energy efficiency. Overall, the Abbott facility achieved 12 per cent reduction in energy intensity from 1.43 kWh/lbs to 1.26 kWh/lbs – in line with their goal to reach 30 per cent by the end of 2030.

Major projects contributing to these results include:



Photo of new air compressor with variable speed drive functionality

- Installation of a new air compressor with variable speed drive functionality.
- Improvements to the heating, ventilation and air conditioning (HVAC) chiller plant efficiency by optimising return air temperature set points and chiller cut-in and out programming.



Alcon is a global leader in eye care, with a heritage spanning over 75 years. Alcon Singapore Manufacturing delivers safe and quality aseptic ophthalmology products, enabled by innovative technologies.

Alcon's leaders are essential in promoting innovation and setting the tone for the organisation. The company is dedicated to improving energy consumption efficiency, reducing operation cost, optimising capital investment for energy efficiency, reducing greenhouse gas emissions, and conserving natural resources through its robust energy management

framework. Alcon aims to reduce total energy consumption by 15 per cent (based on the year 2021) over the next 5 years.

Dedicated to:



Improving Energy consumption efficiency



Reducing operation cost, optimizing capital investment for energy efficiency



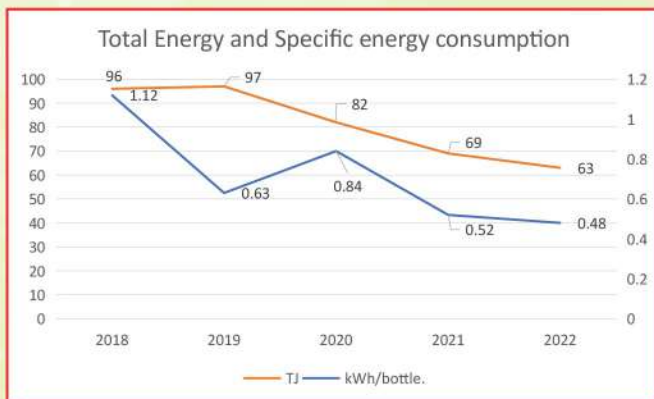
Reducing greenhouse gas emissions, and conserving natural resources

The energy management team comprising members from all departments regularly discusses energy-related data obtained through the Energy Management System and presents it for management to review the company's energy performance. To further enhance staff awareness and knowledge on energy efficiency, Alcon also recognises employees who have contributed to energy-saving ideas, and sends operational staff to process-related training.



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Alcon's constant follow-ups and monitoring have reduced the company's total energy consumption, including natural gas and electricity, by 29 per cent in 2021 compared to 2019. Alcon aims to reduce energy consumption further by 10 per cent by 2023. Carbon emissions also decreased by 740 Mt in 2021, and is expected to reduce by 801 Mt in 2023, compared to 2019. Furthermore, Alcon's specific energy consumption decreased by 17 per cent in 2021 compared to 2019.



The following projects have helped to reduce the energy consumption over the years.

- Increase in chilled water temperature and reduction in pumps speed.
- Replacement of LED light.
- Change in the limit of Relative Humidity percentage for cleanrooms.
- Lower boiler feed water capacity.
- Flash steam recovery.
- Installation of small-size compressor.
- Reduction of air change rate and optimisation of operations in the lab.



CHEVRON ORONITE PTE LTD

Chevron Oronite is a leading developer, manufacturer and marketer of fuel and lubricant additives, helping provide solutions to customers globally. Chevron Oronite’s lubricant additives manufacturing facility in Singapore is its largest in the Asia Pacific region. These additives are shipped across the region to distribution points worldwide, leveraging Singapore’s highly reliable and efficient logistics capabilities.

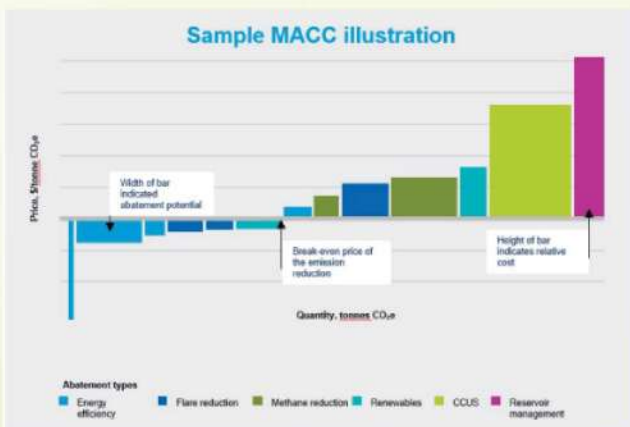
Lowering the carbon intensity of operations and energy management are key focus areas for Chevron. As a company in the Chevron group, Chevron Oronite Pte Ltd (COPL) seeks to achieve this through a comprehensive energy management system (ISO 50001 certified). Firstly, the efficiency performances of the significant energy users (SEUs) are monitored routinely via a digital dashboard to ensure that any deviations are identified and resolved. The team then provides quarterly updates to the management team and to key personnel from Operations, Technical, and Maintenance departments on SEUs’ performance.

OPERATIONS ○
 TECHNICAL ○
 MAINTENANCE ○



ACHIEVEMENTS

In order to identify lower carbon opportunities and create a culture of energy efficiency, COPL adopted the following approaches:



- A marginal abatement cost curve (MACC) study was conducted which allowed a visualisation of abatement opportunities, showing their relative cost and abatement potential on a similar basis for comparison.
- Regular participation in brainstorming sessions by process engineering team to identify and implement energy efficiency improvement projects.
- Contribution of energy savings ideas by operation shifts team.
- Deployment of computer-based training module on “Energy and Greenhouse Gas (GHG) Awareness” for new hires.
- Sponsoring its engineers for Singapore Certified Energy Manager (SCEM) training to become certified, with 4 personnel being certified in the past 4 years.

COPL completed about 30 energy improvement and lower carbon projects from 2019 to 2022.¹ These projects achieved cumulative energy savings of about 4.5 per cent of COPL’s annual energy usage and a carbon abatement of 3,700 tCO₂e.

One of the notable energy savings projects was to optimise the solvent charge to the batch reactors through a series of plant trials, which resulted in a reduction of steam consumption required to distil the excess solvent. This has led to an estimated annual energy savings of 10 TJ.³

Another energy savings project implemented was to reduce the soot blowing frequency at two of the Waste Heat Boilers to be performance-based rather than time-based. The soot blowing process utilises steam, which resulted in an estimated annual energy savings of 6.9 TJ.⁴ COPL also utilised the rooftop spaces above buildings to install about 275 solar panels which generated 170,000 kWh of electrical energy annually and resulted in 70 tCO₂e of carbon abatement annually.



¹ Source: COPL Annual Energy Use Report Submission to NEA for Reporting Year 2019-2022
² Source: COPL Annual Energy Use Report Submission to NEA for Reporting Year 2019-2022
³ Source: COPL Annual Energy Use Report Submission to NEA for Reporting Year 2019
⁴ Source: COPL Annual Energy Use Report Submission to NEA for Reporting Year 2021

Mead Johnson Nutrition (Asia Pacific) Pte Ltd is a wholly owned subsidiary of Reckitt. The company started its powder-based infant milk manufacturing operations in 2013.

Reckitt is committed to being a regenerative business that adds value to both society and the environment. Reckitt recognises its responsibility to combat climate change in all aspects of its operations. To minimise their environmental impact, Reckitt strives to make its operations and entire value chain more sustainable, while also focusing on resilience and adaptation.

The company's goals include:

- 50 per cent reduction in Reckitt's products' carbon footprint by 2030.
- 69 per cent reduction in greenhouse gas (GHG) emission in its operations by 2030.
- 25 per cent reduction in energy use by 2025 vs 2015 baseline.



ACHIEVEMENTS

To achieve these goals, the Energy Management Team brings together relevant expertise to guide, develop and implement projects aimed at optimising energy consumption. The team reports the plants' energy consumption data on a regular basis.

In addition, Reckitt rolled out training, awareness, and capability building programs to create a culture of energy savings and continuous improvement among its human resources. Some initiatives implemented include awareness sessions, external trainings, conferences and seminars, sustainability campaigns, employee monthly spot award program and quarterly regional innovator award.

Reckitt reduced approximately 12 per cent of total energy consumed and carbon emission from 2019 to 2022 by implementing the following energy savings projects:

Project	Annual Energy Saving Achieved	Annual GHG Reduction
Boiler optimization project	7 GWh	1.4 kt
LED projects (The plant is now a 100 per cent LED site)	1.95 GWh	0.8 kt
Chiller optimisation project	1 GWh	0.408 kt
Compressor pressure optimisation project	0.183 GWh	0.07 kt
Air Handling Unit's (AHU) Electronically Commutated (EC) fan retrofitting project	0.69 GWh	0.28 kt

As part of Reckitt's commitment to further reduce carbon emission, the company has several projects in the pipeline for evaluation:

- AHU's EC fan retrofitting project phase 2 – Estimated energy saving of about 0.43 GWh/year saving and GHG reduction of about 0.18 ktpa.
- Solar heater for canteen – Estimated energy saving of about 0.36 GWh/year and GHG reduction of about 0.07 ktpa.
- IE5 motor retrofitting in chill water plant – Estimated energy saving of about 0.21 GWh/year and GHG reduction of about 0.08 ktpa.
- Installation of solar PV cells on site – Estimated electricity generation about 3.8 GWh/year about, resulting GHG reduction of about 1.59 ktpa.
- Installation of biomass boiler – estimated 19 GWh/year of renewable energy with a GHG reduction of 3.5 ktpa.



SHELL SINGAPORE PTE. LTD.



Pulau Bukom along with its sister site in Jurong island, is Shell's only energy-and-chemicals park in Asia. Once an oil storage installation and later Singapore's first refinery in 1961, Bukom consists of Refinery and Ethylene cracker. Bukom now focuses on producing low-carbon energy products and incorporate circularity.

Bukom (Site) is committed to protecting the environment and operating its assets efficiently, in accordance with Shell's Health, Safety, Security and Environment & Social Performance policy. Shell aims to play a leading role in promoting best practices in the industry and achieving continuous performance improvement.

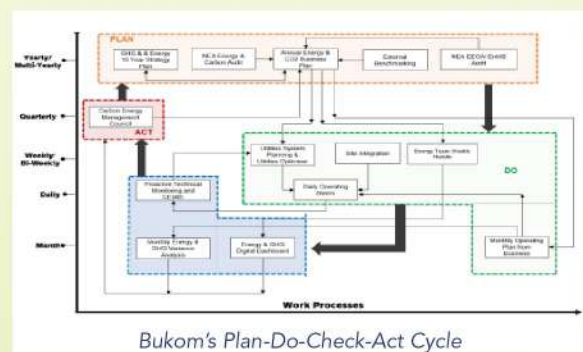
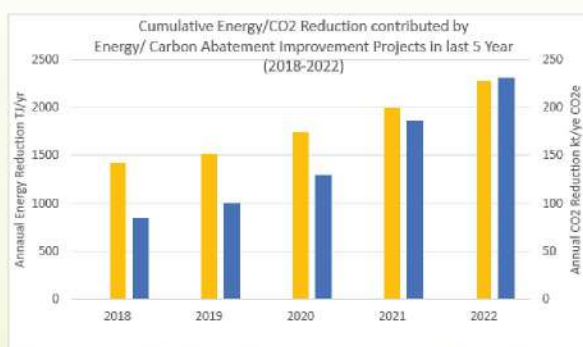
ACHIEVEMENTS

To achieve these goals, Bukom has established targets for reducing its Refinery Energy Intensity Index (EII), utilising Global Benchmarks and Energy/GHG Improvement plans as reference points. The organisation has already made progress towards this goal, having achieved a 5 per cent reduction in Refinery EII performance compared to 2018 baseline, resulting in a cumulative total energy reduction of 2,300 TJ and a cumulative CO₂e reduction of 200 kt.

Shell has implemented a mix of online and face-to-face training programs to build energy efficiency and greenhouse gas abatement skills among staff. These skills are also embedded as part of the job competency for relevant staff, ensuring that energy management practices are integrated into everyday organisational and operational practices.

The Plan-Do-Check-Act (PDCA) cycle is the operating principle of the Energy/GHG Management System at Bukom. The goal is to embed energy and GHG management into everyday practices, ensuring that energy efficiency and carbon abatement are prioritised at all levels of the organisation.

To further improve energy efficiency, Shell leverages state-of-the-art digital tools for energy optimisation and has dedicated campaigns such as the Ultimate Potential Journey-Energy Workstream and Energy Maintenance Program. The energy efficiency improvement and carbon abatement plan of Bukom comprises Operational Excellence initiatives (with no or low capital investment) and Minor/Major Energy Efficiency Improvement Projects (with capital investment). By implementing these initiatives and programs, Bukom is making significant progress towards its energy efficiency and carbon abatement targets. Details of Shell Singapore's top 3 energy efficiency projects, from 2018 to 2023, and operation excellence tactics implemented are listed below:



Energy Reduction of Top 3 Energy Efficiency Projects, 2018 – 2023:

Selected Energy Efficiency Improvement Projects	Energy Reduction TJ/yr	Year Completed
Installation of High Efficiency Cogeneration Plant	849	2018 (Stable Operation)
Improvement of Let-Down Stations and Elimination of Valve Erosion	188.2	2021
Optimisation post Refinery Asset Reconfiguration	370	2022

Energy Reduction of Top 3 Energy Efficiency Operation-Excellence Tactics, 2018 – 2023:

Selected Energy Efficiency Improvement Projects	Energy Reduction TJ/yr	Year Completed
Optimisation of site BFW Network	89.5	2020
Optimisation of Site Power Generation	122	2021
Changing of SPMG (Surplus Platformer Make Gas) to Hydrocracker (HCU) within Hydrogen Manufacturing (HMU)	122	2021

ST ENGINEERING (COMMERCIAL AND DEFENCE AEROSPACE BUSINESS)



ST Engineering is a global technology, defence and engineering group with a diverse portfolio of businesses across the aerospace, smart city, defence and public security segments. Its Commercial Aerospace business is a world-class original equipment manufacturer and maintenance, repair, and operations solutions provider, while its Defence Aerospace business provides a comprehensive suite of maintenance solutions for global military customers.

ST Engineering recognises that energy efficiency is key to sustainable growth of its business. Its energy policy outlines its commitment to achieving high standards in energy performance through the establishment of an Energy Management System (EnMS) based on key principles such as compliance, energy efficiency, communication, and continuous improvement. As a group, ST Engineering is on track to reduce its absolute GHG emissions by 50 per cent by 2030 using 2010 as its baseline.



ACHIEVEMENTS



ST Engineering has introduced a mandatory e-learning module on sustainability for all new and existing staff to raise awareness of the company's decarbonisation journey and emphasise the importance of each staff member's contribution. A new sustainability steering committee was also established in January 2021 and meets regularly to update management on the setting of reduction targets and progress of ongoing and new initiatives.

Since 1 January 2011, ST Engineering's Commercial and Defence Aerospace Business has implemented a series of energy and GHG reduction initiatives, with some ongoing. These initiatives include the implementation of solar PV at all three major sites (Changi, Paya Lebar, Seletar), process enhancements in engine test cells activities to reduce jet fuel consumption, plant chiller upgrades, trial usage of electric ground power units instead of conventional diesel types, installation of electric vehicle (EV) charging points, and exploring trial usage of sustainable aviation fuels.



Implementation of Solar PV

The most significant initiative is the solar PV deployment, where the usage of solar energy now constitutes 30 per cent of its aerospace business's total electricity consumption in FY 2022. This helps to offset up to 4500 tCO₂e annually.

Onn Wah is a locally-owned precision engineering company established in 1961. It specialises in manufacturing precision metal components utilising high-energy usage Computer Numerical Control (CNC) machines.

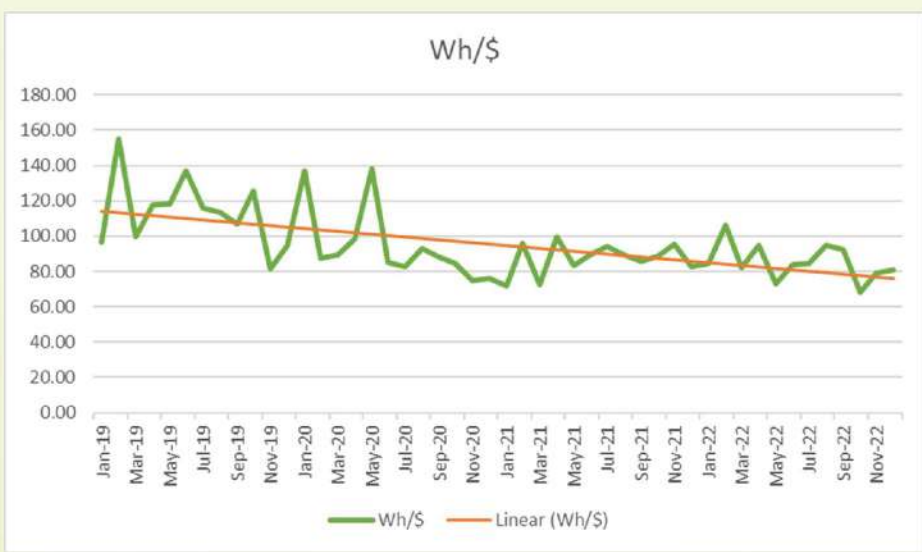
ACHIEVEMENTS

In line with Singapore's plan to decarbonise, Onn Wah embarked on its sustainability journey despite its resource constraints as an SME. Onn Wah started off by conducting an energy assessment with the Energy Efficiency Technology Centre (EETC) in August 2021. Following EETC's recommendation, Onn Wah replaced all lights with LED lights, added motion sensors to the lights in the stairwells, and rectified leaks in its compressed air system.

To understand its energy usage pattern, Onn Wah installed an Energy Monitoring Information System (EMIS) with 102 sensors on its distribution boards. To further reduce energy usage, Onn Wah also installed 133 blackout and 84 heat rejection solar films on its windows. Going beyond energy efficiency, Onn Wah installed a 263 kilowatts peak (kWp) solar panel system with more than 700 panels on its rooftop.



As the company is still in growth stage, Onn Wah tracks its energy improvement in energy use per revenue dollar (Wh/\$). Onn Wah's energy usage per revenue dollar decreased from 110 Wh/\$ in 2019 to 84 Wh/\$ in 2022. This represents a 23.8 per cent reduction in energy usage per revenue dollar.



Onn Wah's Energy Usage per revenue (2019 - 2022)

On top of implementing energy efficiency solutions, Onn Wah has also enrolled its employees in sustainability courses which cover topics such as carbon reporting and circular economy design.

PLC INDUSTRIES PTE LTD

Established in 1995, PLC Industries Pte Ltd is a precision engineering company with high precision machining capabilities, serving local and global clients in the photonics and optics, imaging and laser industries.

PLC is tapping on Schneider Electric's SME Kickstarter Decarbonisation Programme, which is supported by EnterpriseSG's Enterprise Sustainability Programme, to measure and monitor its emissions, as well as to develop its decarbonisation roadmap. PLC has set a goal to reduce 40 per cent of its electrical consumption by 2030.

ACHIEVEMENTS

PLC identifies and implements energy projects based on the suitability of solutions to reduce energy consumption and to provide insights into its energy consumption and energy profile. Completed projects include:

- Energy assessment with Energy Efficiency Technology Centre (EETC) to determine the company's energy profile before implementing energy efficiency solutions.
- Replacement of 81 light bulbs with LED bulbs which saved 119.8 kWh or 0.5 tCO₂e in 2021.
- Installation of a 104 kWp solar panel system with 234 solar panels, generating 117,510 kWh of electricity in 2021.
- Installation of 14 energy sensors to monitor energy usage of 12 CNC machines and 2 compressors.
- Installation of variable speed model compressor.



To improve its energy and carbon abatement performance further, PLC is looking into replacing its current split unit air conditioners with 4- and 5-ticks' models, and installing more solar panels



Implementation & Installation of PLC's Solar Panels

Aside from implementing energy efficiency projects, PLC engages its staff on energy efficiency and carbon abatement matters by monitoring energy consumption monthly and conducting reviews when required. PLC also reskilled its facilities managers by enrolling them in the Professional Conversion Program (PCP) for Clean and Renewable Energy.



PROGRESS GALVANIZING PTE LTD

Progress Galvanizing was established in 1986 with a 34,000 sqm factory and office building. It invested in a fully automated galvanizing plant in 2017, which is the first in South-East Asia, serving industries such as Construction, Offshore & Marine, Manufacturing and Hardware suppliers. Progress Galvanizing is a one-stop solutions provider for hot dipped galvanizing and was certified to ISO 50001:2018 in 2022.

Progress Galvanizing focused its improvement actions on energy performance and energy management system (EnMS) in 3 areas:

1. Competency development, awareness and commitment - Progress Galvanizing engaged an EnMS Consultant to develop the EnMS (including energy policy, targets and energy review). The EnMS Consultant and equipment/metering vendors were also engaged to provide training to supervisory staff, who in turn trained their respective staff in a train-the-trainer scheme.
2. Data collection and analysis via networked meters - Progress Galvanizing transitioned from estimated energy data to measured energy data, which allowed for more accurate analysis for energy review, monitoring and control.
3. Addressing hidden energy losses - Progress Galvanizing reviewed its energy performance issues in the significant energy uses (SEUs) to identify energy improvement projects.



ACHIEVEMENTS

By utilising metered data to analyse compressor energy performance and loading, Progress Galvanizing has been able to better manage compressor usage and identify opportunities to upgrade or phase out poor performing compressors. Additionally, by reviewing production planning to improve equipment loading, Progress Galvanizing achieved a 10 per cent improvement in specific energy consumption (SEC) for natural gas (NG) (i.e. NG consumed/Total Production Output). Overall, the implementation of the EnMS resulted in energy savings of 3.56 TJ in 2022, equivalent to a carbon emission reduction of 195.6 tCO₂e.

Progress Galvanizing has also been measuring and computing energy losses, such as thermal energy losses or compressed air leakage, and taking action to minimise these losses. This resulted in the identification of a key project, Hot Water Recovery from Quenching Tank for Process Heating, which led to energy savings of 5.53 TJ/yr or 298.6 tCO₂e reduction.



Key staff training staff involved in EnMs after being trained by external expert



Quenching Water Tank Return Pipe Outlet in Operation



MR NARASIMHAN JEYAKUMAR



With 24 years of experience in SPH Print Centre, Mr Narasimhan Jeyakumar played a key role in SPH's Print Centre's energy management. He formed the Energy Management Team, comprising staff from all departments, to reduce energy consumption and improve energy performance by a minimum of 2 per cent from base line (3 years moving average). He spearheaded monthly meetings to review Significant Energy Use (SEUs) and promoted energy saving awareness with the SPH Print Centre's staff through bi-annual Meet the People Sessions.

Jeyakumar has also taken on a mentoring role, guiding and inspiring young executives in energy management. He has enrolled staff in courses such as ISO 50001 Energy Management System and Singapore Certified Energy Manager (SCEM) and provided exposure to recent and ongoing energy improvement projects.

MENTORING



ACHIEVEMENTS

Committed to SPH Print Centre's energy policy and goals, Jeyakumar initiated and led a number of projects:

- Progressive reduction of Maximum Demand from 8.9 MW in 2019 to 6.38 MW in 2021, amounting to \$407,232 energy cost savings per year based on current contracted capacity charged \$13.44 \$/kW/month.
- Replacement of all lighting units to energy efficient LED lightings, including induction high bay lights to LED high bay lights. The total estimated energy savings for LED high bay lights being was 95.48 MWh per year, excluding others.
- Implementation of energy efficiency improvement works for AHU unit with the installation of Variable Speed Drive (VSD), with a total of 39 VSD installed, and optimisation of AHU unit. The total actual energy savings of was 540.8 MWh per year.
- Implementing Chiller Systems Upgrading and Optimisation Project to improve energy efficiency of the chiller system which includes equipment upgrading and operation optimisation, and retrofitting cooling tower to prolong the lifespan and increase the energy efficiency of the cooling towers. The energy monitoring system (EMS) was also upgraded to expand the energy monitoring at a sub-metering level.

With these energy initiatives and projects implemented, Jeyakumar has demonstrated SPH Print Centre's dedication to sustainability and energy goals over his 10 years as SPH Print Centre's Energy Manager, achieving an Energy Efficiency improvement rate of 2.27 per cent and total energy savings of 3.73 GWh based on the 2019 baseline.

MR SEAH XIAN MING



SRC's energy manager, Mr Seah Xian Ming's portfolio covers three distinct categories: governance, technical expertise, and workforce engagement. On the governance front, Mr Seah has worked closely with the SRC leadership team and relevant stakeholders to refine the Energy Policy, ensuring its relevancy. In addition, Mr Seah has enhanced the SRC Energy Management System, establishing a robust workflow process that evaluates and monitors key energy performance indicators.

On the technical front, Mr Seah provides technical solutions to drive continuous improvement in refinery energy optimisation and lower carbon solutions. Mr Seah crafted a roadmap for energy efficiency and carbon reduction solutions. This roadmap encompasses projects which are developed in collaboration with multiple stakeholders, including the Operations team, Maintenance team, and various external consultants.

ACHIEVEMENTS

Among the projects, three noteworthy energy projects were successfully commissioned:

- Conversion of a recycle gas compressor's condensing turbine to a backpressure turbine;
- Conversion of a low efficiency furnace into a high-pressure steam exchanger; and
- Installation of flare gas recovery compressors.

As a result of these initiatives, substantial annual carbon abatement of 8 ktCO₂e, 5 ktCO₂e, and 6 ktCO₂e were achieved respectively while other energy projects are in the development pipeline.



On the workforce engagement front, Xian Ming recognized that energy conservation initiatives are greatly enhanced from having a workforce committed to saving energy, with a focus on excellence in safety and operations. Mr Seah organised a 12-week-long "Energy Blitz Campaign" aimed at inculcating an energy-saving culture and consolidating energy-saving ideas among SRC employees. This Campaign served as a platform for SRC to explore novel approaches to energy conservation and executed through numerous physical and virtual engagements, the Campaign featured friendly competitions among operational shift teams, brainstorming sessions, recognitions, and awards to energy culture champions who were voted by their peers. The campaign outcome was a success with an 80 per cent engagement rate among the workforce and about 100 unique ideas were generated. Implemented projects from the campaign resulted in an annual energy savings of over 1 million dollars.



1. SRC Energy Champion Award
2. SRC Energy Blitz Campaign people engagement

MR STEVEN TOH

As an energy manager in 3M Innovation, Tuas Plant, Mr Steven Toh's role is to drive energy efficiency, analyse energy usage, and develop compelling energy proposals to support 3M's sustainability goals.

To further strengthen energy management practices, 3M obtained ISO 50001 certification and developed a 5-year sustainability roadmap. These initiatives not only demonstrates 3M's commitment to continuous improvement but also provide a structured framework for enhancing energy management processes. Transparent communication plays a vital role in 3M's strategy, and it utilises weekly energy reporting meetings to keep management and cross-functional teams informed. Additionally, energy awareness posters strategically placed throughout 3M Singapore manufacturing facilities serve as constant reminders to employees about on the importance of energy conservation. Engaging employees through organisation-wide energy efficiency competition initiatives such as the Energy Kaizen competition further encourages their staffs' active involvement in finding developing innovative energy-saving solutions.

3M is actively working towards its carbon neutrality goal by 2050. 3M Tuas Plant is currently developing a proposal for combined cooling, heating, and power (CCHP), which is a crucial strategy in its sustainability journey. Additionally, 3M Tuas Plant is exploring opportunities to optimise the central chiller using digital twin technology and machine learning. 3M Tuas Plant also has several pipeline projects underway, such as the implementation of IoT sensors, demand flow control, plug load control, and smart lighting control. These initiatives will help 3M Tuas Plant drive additional energy efficiency, further reduce its carbon footprint, and continue to promote sustainable practices to achieve its long-term sustainability objectives.

ACHIEVEMENTS

3M has achieved significant milestones in improving energy efficiency, which include implementation of the 2,179 KW solar roof farm in, retrofitting initiatives for the central chiller plant in 2019, and the central air compressors system in 2021. These projects have been successful in optimising energy usage and contributed to reducing the company's energy consumption by 24 per cent, with a base line of 2015, and reducing the plant's carbon footprint.

Headquartered in Singapore with subsidiaries in Southeast Asia countries, G-Energy Global Pte Ltd proposes sustainable solutions most suited to clients' project's needs.

One of G-Energy's key highlights is SamWoh Smart Hub, which is the first privately-owned positive energy building. At SamWoh Hub, innovative solutions such as Solar-Driven Digitally Controlled Chiller and Smart Fan Coil Units (FCU) were installed.



SamWoh Smart Hub Building

At SamWoh Hub, Solar PV power is fed directly and utilised by the Solar-Driven Digitally Controlled Chiller. In the event when there is an excess of solar PV power after utilisation by the chiller, this remain power is converted to AC and channelled to the building electricity grid. This technology helps to reduce energy loss (4 to 5 percent) from DC to AC conversion and AC to DC conversion on Solar energy that is utilised for the chillers. It also reduces initial investment on both solar inverters, circuit breakers and cables that channel the solar PV power to the building electricity grid.

The Smart FCU operates at a high chilled water temperature of about 12°C without adversely affecting the relative humidity in the space while achieving good total system performance. The operating fan speed can be varied from 30 to 100 per cent, as controlled by built-in smart controller.

ACHIEVEMENTS

At SamWoh Hub, the design and installation of these energy efficient equipment resulted in an estimated total amount of energy saved to be 1,152 MWh (47.55 per cent). The carbon abatement is estimated to be approximately 467.5 tCO₂ annually.

The installation of the Solar-Driven Digitally Controlled Chiller and Smart FCU has contributed to total savings from the Chiller Plant and Airside of about 258MWh (13.95 per cent) which translates to the carbon abatement of approximately 104.7 tCO₂ annually.



Rooftop Solar Panels

Perfluorocarbons (PFC) Gas Abatement in Semiconductor Manufacturing Plant

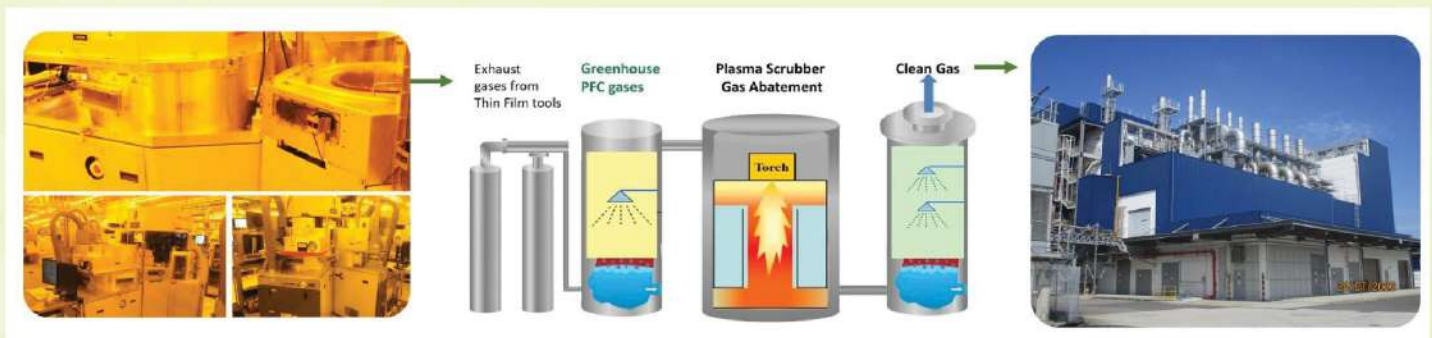
Systems on Silicon Manufacturing Company Pte Ltd (SSMC) is a manufacturer of semiconductor wafers. With over 20 years of experience, SSMC has a growing portfolio of processes specialised in producing wafers for Automotive, Internet of Things, Secured Connectivity, Portable & Wearable applications.

SSMC pioneered a large-scale installation of Plasma Gas Abatement technology in Singapore. The project significantly reduces the release of high "Global Warming Potential" (GWP) air contaminant Perfluorocarbons (PFC) into the atmosphere by up to 95 through a high temperature Plasma scrubber technology.

RESULTS

SSMC project is unique on the following fronts:

- Being the first in Singapore to install plasma scrubber in a semiconductor manufacturing plant in large-scale quantity.
- Pioneering the installation of plasma scrubber in Singapore that treat a "high powder deposition" waste gas from "Thin-Film" process. In the initial stage of this project, the "high powder deposition" waste gas frequently choked the waste gas pipeline and reactor chamber causing low equipment uptime. SSMC and the scrubber supplier team collaborated to improve the scrubber system design and successfully obtained a stable process that maintains high equipment uptime and gas destruction efficiency.
- With the new plasma scrubber system, SSMC achieved approximately 87,000 tonnes of CO₂ abatement per year.



SSMC believes in continuous reduction of carbon footprint. Moving forward, SSMC is embarking on a roadmap to achieve net-zero carbon emission by 2035.

Energy Saving through Axial Fan Implementation

Alcon is a global leader in eye care, with a heritage spanning over 75 years. Alcon Singapore Manufacturing delivers safe and quality aseptic ophthalmology products, enabled by innovative technologies.

Most of the older design of mechanical ventilation system uses centrifugal fans for Air Handling Units (AHU). While the fans were satisfactory in terms of performance, the increasing focus on energy efficiency prompted Alcon's management to study the performance of axial fans which were more energy efficient while giving the same level of performance. Alcon initiated a proof-of-concept project to physically change two centrifugal fans to axial fans and studied the performance before embarking on the critical area AHU.

RESULTS

The trial project yielded energy saving opportunities, which led to the replacement of 14 AHU units with axial fans. Besides energy savings, these fans reduced maintenance costs as the direct drive mechanism of axial fans reduced the need for preventive maintenance.



From this completed project, Alcon's energy consumption reduced by 780 MWh, with the energy saved on a system level being 16 per cent, and the indirect CO₂e abatement was 317 Mt annually.


CO₂
↓ 780 MWh
and 317
MtCO₂e per
annum

Singapore Chemical Plant (Olefins) Turbine Extraction Optimisation Project

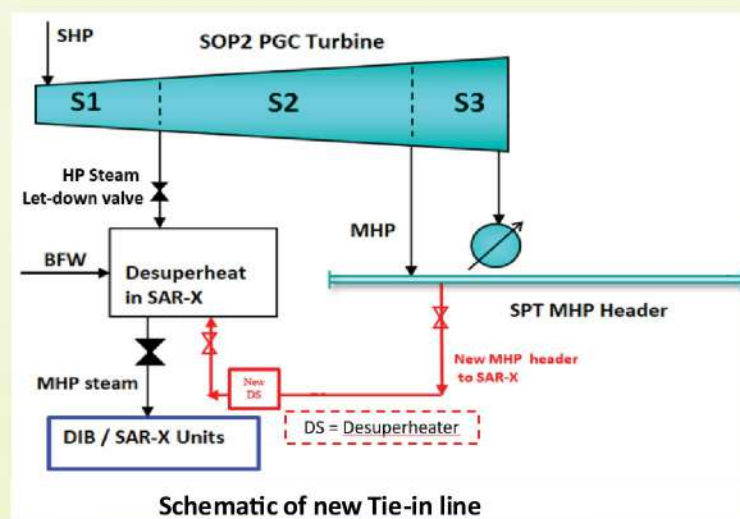
ExxonMobil is one of Singapore's largest foreign manufacturing investors with over S\$25 billion in fixed asset investments and over 3,500 employees. Their Singapore affiliate, ExxonMobil Asia Pacific Pte Ltd (EMAPPL), has manufacturing facilities which include an integrated world-scale refining and petrochemical complex in Jurong and Jurong Island.

ExxonMobil actively identify opportunities to improve energy efficiency, as part of their Global Energy Management System. One example is the turbine extraction optimisation project which improved the energy efficiency of supplying medium-high pressure (MHP) steam to di-iso butylene and aromatics expansion units.

RESULTS

Based on the original line up, the MHP steam was supplied to both units by letting down high pressure (HP) steam to MHP steam. This method of producing MHP steam is less energy efficient when compared to extracting it through the process gas compressor (PGC) turbine from the olefins plant – the latter being the new methodology.

It was observed that the PGC had margin to extract more MHP steam. Hence, a new tie-in line was constructed to connect the MHP steam header that carried MHP steam extracted through PGC turbine to the two units.



This allowed the MHP steam extracted from the PGC to be supplied directly to the units, which resulted in less super high pressure (SHP) steam being required by the PGC turbine when compared with the original configuration.



253 TJ and 14.21 ktCO₂e
per annum

This project resulted in a reduction of 253.24 TJ per annum savings, which is equivalent to 14.21 ktCO₂e per annum.

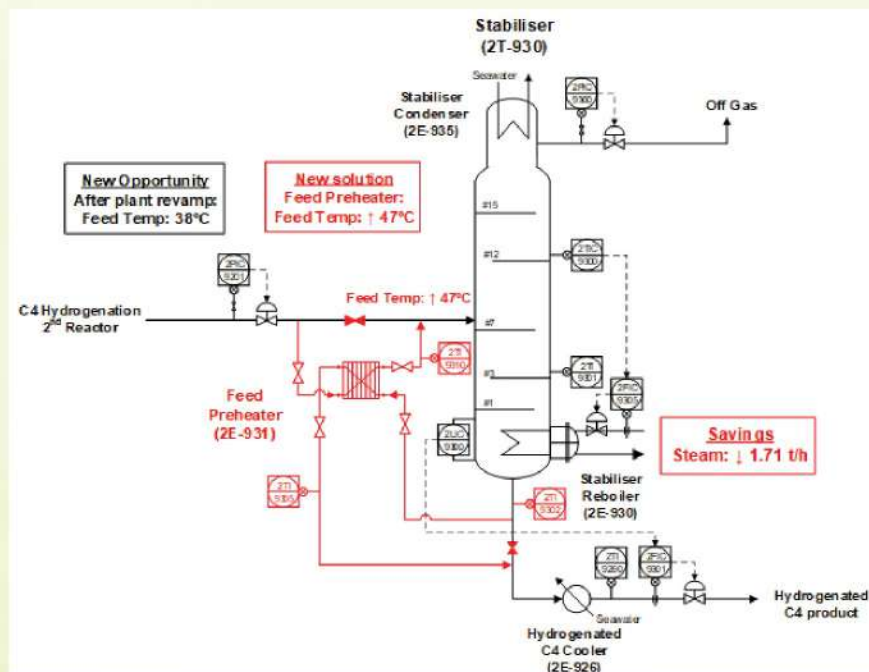
Innovative Approach of Stabiliser Feed Preheater Installation for Carbon Abatement

During the C4 Hydrogenation plant revamp, the preheater feed was changed from Crude C4 feed (high Butadiene content, ≥ 40 mol per cent) to C4 Raffinate-2 feed (low Butadiene content, ≤ 0.05 mol per cent). This resulted in the reactor effluent having a lower temperature to the stabiliser.

A new energy improvement opportunity was identified by installing a feed preheater to recover waste heat from the stabiliser's bottom hot effluent to preheat the incoming stabiliser feed. For existing brown field plants, limited space availability is a key constraint. This was overcome by implementing a compact welded plate heat exchanger for feed preheater.

RESULTS

Feed preheating by waste heat reduced steam demand by the stabiliser reboiler which in turn reduced steam generation requirement. This led to savings from reduced fuel oil consumption in boilers and reduction in PCS' carbon tax payable.



Installation of Stabiliser Feed Preheater



The successful implementation of the project achieved an annual energy savings of 33.2 TJ, and 2.6 ktCO₂e emission reduction. This translated to an annual energy savings of 63.8 per cent for the system.



Flaring Reduction Program at Shell Energy & Chemicals Park Singapore, Bukom

Pulau Bukom, along with its sister site in Jurong island, is Shell's only energy-and-chemicals park in Asia. Bukom focuses on producing low-carbon energy products, incorporating circularity, and providing renewable energy.



Bukom Flare Reduction Program

Since 2018-2019, the site embarked on a flaring reduction program. With a long-term end goal, the site stretched its flaring reduction targets as it simultaneously worked on process improvements.

RESULTS

The flaring reduction program is a combination of small initiatives and major projects. With focus on operational discipline, reliability, and process stability the site identified, developed, and implemented improvements to achieve over 50 per cent flaring reduction in 2022 compared to that in 2017.

Key improvements of the flaring reduction programme include:

1. Proactive base load flaring reduction such as optimising sweep gases and arresting leakage from passing valves.
2. Improving reliability and availability of existing flare gas recovery system.
3. Projects for additional flare gas recovery.
4. Flare-system upgraded to have better combustion efficiency and reduction in purge gas.



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