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February 2022 | MCI (P) 056/03/2022

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ELECTRIC VEHICLES: The energy ecosystem – technologies driving the future of e-mobility

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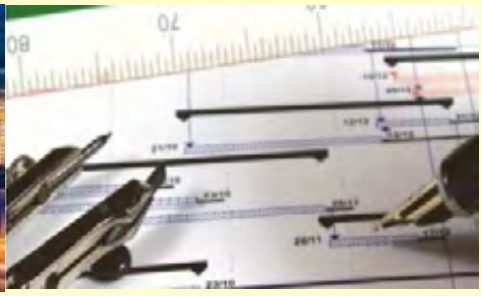

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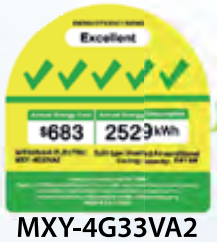

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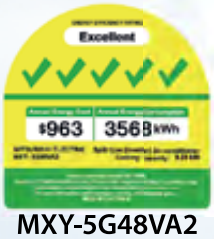

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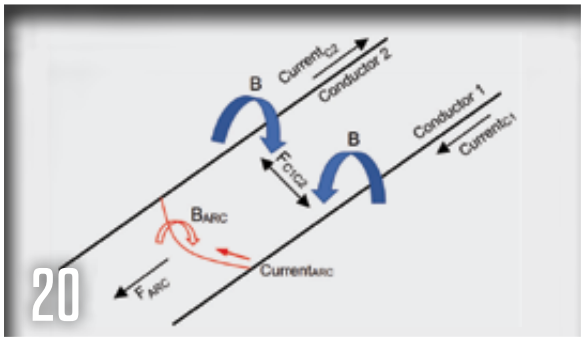

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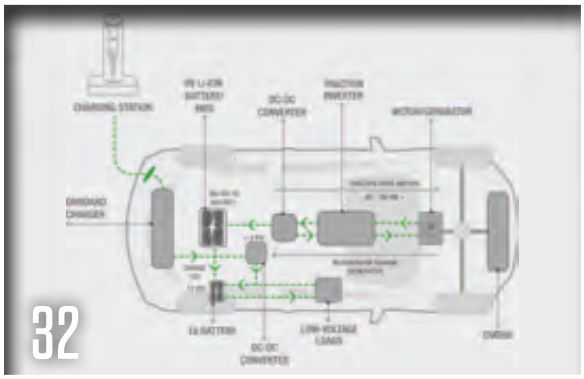
DIGITALISATION

ELECTRIC VEHICLES



PROJECT APPLICATION

REGULAR SECTIONS

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COP26 reaches consensus on key actions to address climate change

Deliberations under COP26, the latest session of the COP (Conference of the Parties), CMP (Meeting of the Parties) and CMA (Meeting of the Parties to the Paris Agreement) came to an end in Glasgow, UK, on 13 November 2021, one day after their scheduled conclusion.

The wide-ranging set of decisions, resolutions and statements that constitute the outcome of COP26 was the fruit of intense negotiations over two weeks, strenuous formal and informal work over many months, and constant engagement both in-person and virtually, for nearly two years.

The package adopted is a global compromise that reflects a delicate balance between the interests and aspirations of nearly all of the 200 Parties to the core instruments on the international regime that governs global efforts against climate change.

Under the UK presidency and with the support of the UNFCCC Secretariat, delegates forged agreements that strengthen ambition in the three pillars of collective climate action – adaptation, finance and mitigation.

Adaptation was the object of particular emphasis during the deliberations. Parties established a work programme to define the global goal on adaptation, which will identify collective needs and solutions to the climate crisis already affecting many countries.

The Santiago Network was further strengthened by elaborating its functions in support of countries to address and manage loss and damage. And the CMA approved the two registries for NDCs (Nationally Determined Contributions) and Adaptation Communications, which serve as channels for information flowing towards the Global Stocktake that is to take place every five years, starting in 2023.

Finance was extensively discussed throughout the session and there was consensus on the need to continue increasing support to developing countries.

The call to at least double finance for adaptation was welcomed by the Parties. The duty to fulfill the pledge of providing 100 billion dollars annually from developed to developing countries was also reaffirmed. And a process to define the new global goal on finance was launched.

On mitigation, the persistent gap in emissions has been clearly identified and Parties collectively agreed to work to reduce that gap and to ensure that the world continues to advance during the present decade, so that the rise in the average temperature is limited to 1.5° C. Parties are encouraged to strengthen their emissions reductions and to align their national climate action pledges with the Paris Agreement.

In addition, a key outcome was the conclusion of the so-called Paris rulebook. An agreement was reached on the fundamental norms related to Article 6 on carbon markets, which will make the Paris Agreement fully operational.

This will give certainty and predictability to both market and non-market approaches in support of mitigation as well as adaptation. And the negotiations on the Enhanced Transparency Framework were also concluded, providing for agreed tables and formats to account and report for targets and emissions.

Ms Patricia Espinosa, Executive Secretary of UN Climate Change said, “I thank the Presidency and all Ministers for their tireless efforts throughout the conference and I congratulate all Parties on finaliaing the rulebook. This is an excellent achievement! It means that the Paris Agreement can now function fully for the benefit of all, now and in the future”.

Mr Alok Sharma, UK President of COP26, said, “We can now say with credibility that we have kept 1.5° alive. But, its pulse is weak and it will only survive if we keep our promises and translate commitments into rapid action. I am grateful to the UNFCCC for working with us to deliver a successful COP26”.

The Heads of State and Government and the delegates who participated in COP26 brought to the conference a keen awareness of the severity of the climate crisis that the world faces and of the need to live up to the historic responsibility of setting the world on the path to address this existential challenge.

They left Glasgow with clarity on the work that needs to be done and the more robust and effective instruments needed to achieve it, and with a heightened commitment to promote climate action – and to do so more quickly – in every area.

UNFCCC

With 197 Parties, the United Nations Framework Convention on Climate Change (UNFCCC) has near universal membership and is the parent treaty of the 2015 Paris Climate Change Agreement. The main aim of the Paris Agreement is to keep a global average temperature rise this century well below 2° C and to drive efforts to limit the temperature increase even further to 1.5° C above pre-industrial levels.

The UNFCCC is also the parent treaty of the 1997 Kyoto Protocol.

The ultimate objective of all agreements under the UNFCCC is to stabilise greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system, in a time-frame which allows ecosystems to adapt naturally and enables sustainable development.

Methane emissions from the energy sector are 70% higher than official figures

Global methane emissions from the energy sector are about 70% greater than the amount national governments have officially reported, according to new analysis released recently by the International Energy Agency (IEA) – underlining the urgent need for enhanced monitoring efforts and stronger policy action to drive down emissions of the potent greenhouse gas.

Methane is responsible for around 30% of the rise in global temperatures since the Industrial Revolution, and quick and sustained emission reductions are key to limiting near-term warming and improving air quality. Methane dissipates faster than carbon dioxide (CO_2) but is a much more powerful greenhouse gas during its short lifespan, meaning that cutting methane emissions would have a rapid effect on limiting global warming.

The energy sector accounts for around 40% of methane emissions from human activity, and this year's expanded edition of the IEA's Global Methane Tracker includes country-by-country emissions from coal mines and bioenergy for the first time, in addition to continued detailed coverage of oil and natural gas operations. Methane emissions from the energy sector grew by just under 5% last year. This did not bring them back to their 2019 levels and slightly lagged the rise in overall energy use, indicating that some efforts to limit emissions may already be paying off.

"At today's elevated natural gas prices, nearly all of the methane emissions from oil and gas operations worldwide could be avoided at no net cost. The International Energy Agency has been a long-standing champion of stronger action to cut methane emissions. A vital part of those efforts is transparency on the size and location of the emissions, which is why the massive underreporting revealed by our Global Methane Tracker is so alarming", said IEA Executive Director, Dr Fatih Birol.

Last year, significant emissions were confirmed in Texas and parts of Central Asia, with Turkmenistan alone responsible for one-third of large emissions events seen by satellites. Relatively few major leaks were detected for the major onshore oil and gas producers in the Middle East.

Satellites have greatly increased the world's knowledge of emission sources, and the IEA Global Methane Tracker incorporates the latest readings from satellites and other science-based measurement campaigns. While measured data continues to improve, the coverage provided by satellites is still far from complete. Existing satellites do not provide measurements over equatorial regions, offshore operations, or northern areas such as the main Russian oil and gas producing areas.

Yet, uncertainty over emissions levels is no reason to delay action on methane. Major reductions can be achieved with known technologies and with tried and tested policies that have been proven to work effectively. The Global Methane Tracker includes a new detailed policy explorer that provides examples of effective implementation and shows where these policies could be most impactful.

If all methane leaks from fossil fuel operations in 2021 had been captured and sold, then natural gas markets would have been supplied with an additional 180 billion m^3 of natural gas. That is equivalent to all the gas used in Europe's power sector and more than enough to ease today's market tightness.

The intensity of methane emissions from fossil fuel operations ranges widely from country to country – the best performing countries and companies are over 100 times better than the worst. Global methane emissions from oil and gas operations would fall by more than 90%, if all producing countries matched Norway's emissions intensity, the lowest worldwide.

The Global Methane Pledge, launched in November 2021, by more than 110 countries at the COP26 Climate Change Conference in Glasgow, marked an important step forward. Led by the European Union and the US, its participants agreed to reduce methane emissions from human activities – including agriculture, the energy sector and other sources – by 30%, by 2030. However, more major emitters need to join. Of the five countries with the largest methane emissions from their energy sectors – China, Russia, the United States, Iran and India – only the US is part of the Pledge, as things stand.

"The Global Methane Pledge must become a landmark moment in the world's efforts to drive down emissions. Cutting global methane emissions from human activities by 30% by the end of this decade would have the same effect on global warming by 2050 as shifting the entire transport sector to net zero CO_2 emissions", said Dr Birol.

European Commission Executive Vice-President Frans Timmermans said, "Methane is the second biggest contributor to global warming. Rapidly cutting methane emissions is therefore a key part of our efforts to tackle the climate crisis".

US Special Presidential Envoy for Climate John Kerry said, "Cutting methane pollution is the fastest way to mitigate climate change, and cutting wasteful venting, leaking, and flaring from oil and gas systems is the fastest way to cut methane. The IEA's new report provides important insight on the scale of this climate action opportunity".

ABB delivers robots to Scania's new battery assembly plant

ABB has entered into an agreement with leading global transport solutions provider, Scania, to provide a comprehensive range of robotic solutions for Scania's new, highly automated battery assembly plant in Sweden. The new facility will be a key milestone in Scania's journey towards the electrification of heavy vehicles. Scania will invest more than SEK 1 billion (USD 108 million) in the facility, over several years, and the new plant is expected to be fully operational by 2023.

"We are delighted to work with one of our longest-standing clients to help deliver their electrification roadmap. The automotive industry has always been at the forefront of automation. But with the shift to electrification, it faces wholesale changes to established manufacturing processes. With our expertise, we will design and help implement the manufacturing flexibility that is vital for market leaders such as Scania in delivering this change", said Mr Joerg Reger, Managing Director of ABB Robotics' automotive business line.

Mr Tony Persson, Head of Scania's battery assembly, said: "The factory is designed in line with Scania's efforts to be at the forefront of industrial digitalisation, automation, and the use of advanced robotic technology to streamline production processes with increased flexibility. That is where the robots and solutions from ABB fit in. For Scania, the factory is also an investment that will further strengthen Sweden's position as a hub for cutting-edge technology in the electrification of heavy vehicles, which is crucial in the transition to sustainable transport".

The advanced 18,000 m² facility will be built next to Scania's chassis assembly plant in Södertälje, Sweden, and will be highly automated, from goods reception through production and to delivery. It will assemble battery modules from cells supplied by Northvolt's battery factory in Skellefteå, with the completed packs delivered directly to the vehicle assembly hall. Multiple ABB robots will be involved in the assembly process, including the IRB 390, IRB 4600 and IRB 6700 models, along with additional solutions to support the production process.

This will mark the first time that ABB's IRB 390 robot will be used in a battery production facility. Originally designed for the packing industry, the robot combines speed with power and can mount contact plates in batteries at a rate of one plate every second, 24 hours a day.

ABB's RobotStudio simulation and programming software will enable full verification of the production line, prior to deployment, which will significantly shorten lead times and support the quality process.

Scania and ABB have worked in partnership for more than four decades and are collaborating on building production infrastructure for electric vehicles. Recently, they joined forces to create charging solutions for heavy goods vehicles that will also be powered by batteries manufactured by Northvolt. The Northvolt facility – Europe's largest lithium-ion battery factory – has also been developed in partnership with ABB.

Scania electric vehicles on the road.

Scania's new battery assembly plant will be built next to the company's chassis assembly plant in Södertälje, Sweden.

Isabel Chong appointed as Siemens ASEAN's Head of Digital Industries

Ms Isabel Chong

Siemens has appointed Ms Isabel Chong as the new Head of Digital Industries for ASEAN, effective 1 February 2022, succeeding Mr Raimund Klein.

A dynamic and seasoned veteran of the power and security industry, Ms Chong has more than 20 years of senior managerial experience. Prior to joining Siemens, she held senior positions and regional roles in various multinational corporations, where she contributed greatly to the growth of their portfolios.

Ms Chong is a strong proponent of diversity and inclusion. She was recognised in the 2021 Singapore 100 Women in Tech list for her contribution to and influence in Singapore's tech industry.

"We are pleased to welcome Isabel on board. She brings with her a wealth of knowledge and understanding of the ASEAN market. As someone coming from outside, she also brings fresh perspectives on how we can grow and transform our business in the region. Isabel's appointment is an important step in strengthening our management team as we gear up for the growing ASEAN economy", said Dr Thai-Lai Pham, CEO of Siemens ASEAN.

In her new role in Siemens, Ms Chong will be leading the Digital Industries business in Southeast Asia. Digital Industries is an innovation leader in industrial automation and digitalisation, and collaborates closely with partners and end-users to drive automation and digital transformation across all industries.

CDL ranked 5th most sustainable corporation in the world and most sustainable real estate company

For its dedication in driving corporate sustainability, City Developments Limited (CDL) has been ranked 5th on the 2022 Global 100 Most Sustainable Corporations in the World and maintains its position as the world's most sustainable real estate management and development company.

This marks the company's best performance to-date, having jumped from 40th position in 2021. Since 2010, CDL has been the first and only Singapore company to be included in the Global 100 for 13 consecutive years. This year, the company has also remained as Singapore's most sustainable company, a position held for the fourth consecutive year. CDL said it will strengthen its emissions pathways and carbon reduction efforts to achieve its net zero target by 2030, and it will also continue to leverage existing and emerging technological innovations to reduce building energy consumption.

Analysed by Corporate Knights, a Toronto-based international media and investment research firm, the Global 100 ranking is recognised as the world's preeminent sustainability equity index and gold standard in corporate sustainability analysis. Companies listed on the 2022 Global 100 ranking were selected after a rigorous assessment of over 6,900 companies with more than USD 1 billion in revenues – each evaluated on a set of up to 24 Environmental, Social and Governance (ESG) indicators relative to their industry peers, using publicly available information.

Mr Sherman Kwek, CDL Group Chief Executive Officer, said, "It is very encouraging to see companies around the world taking decisive climate action and CDL is deeply honoured to be ranked 5th on the 2022 Global 100 Most Sustainable Corporations. Our unwavering commitment continuously spurs us to set new benchmarks, such as including embodied carbon in our net

CDL project: 80 Anson Road (former Fuji Xerox Towers) is one of the first few projects to be accorded the BCA Green Mark Platinum Super Low Energy certification. The building will feature an energy-efficient glazing on the façade along with shading devices, which help to reduce heat absorption into the building.

zero targets. As we join the global momentum towards net zero and do our part in decarbonising the environment, we hope to see more companies join the collective effort. Only by working with our partners and stakeholders can we positively impact our value chain. Together, we can build a more resilient and sustainable future".

Mr Toby Heaps, Corporate Knights Chief Executive Officer, said, "We are pleased to see long-term Global 100 company, CDL, break into the top five this year, as part of a growing contingent from the Asia-Pacific region, and remain the top-ranked real estate and leasing company. With more than 80% of its revenue coming from clean and energy-efficient building construction and management, CDL is showing global leadership in addressing the major carbon impact of our built environment".

The Global 100 rankings were announced virtually in January this year, at a launch event which included a leaders' roundtable discussion focusing on the imperative for businesses and governments to commit and take affirmative action to achieve climate targets.

CDL was the only Singapore company represented at this roundtable leadership panel, with its Chief Sustainability Officer, Ms Esther An, participating alongside other senior executives from global MNCs.

In 2021, CDL aligned itself with more ambitious carbon emissions reduction targets and commitments. This includes targets validated by the Science Based Targets initiative (SBTi), under which, CDL will reduce its Scope 1 and Scope 2 Green House Gas (GHG) emissions by 63% per square metre leased area, by 2030, from a 2016 base year. The company will also reduce its Scope 3 GHG emissions from purchased goods and services by 41% per square metre Gross Floor Area (GFA), by 2030, from 2016. Lastly, it will reduce absolute Scope 3 GHG emissions from investments by 58.8%, by 2030, from 2016, including hotels managed by CDL's wholly-owned hotel subsidiary, Millennium & Copthorne Hotels Limited.

CDL project: Since its completion in 1996, Republic Plaza has continuously undergone several enhancements, including major retrofitting of chiller plants and installation of energy-efficient lighting with motion sensors, to improve the building's energy efficiency. In 2019, Republic Plaza further enhanced its features, such as modernising its lifts and introducing the latest destination control system – both of which are estimated to reduce energy consumption by 18% and increase lift operation efficiency, when upgrading works are completed.

CDL project: The Singapore Sustainability Academy (SSA) has a solar PV panel footprint of 3,200 ft², extensively covering 4,300 ft² of the building. The PV panels are estimated to generate an annual energy yield of over 60,000 kWh, exceeding the building's annual energy consumption, thus enabling the academy to be self-sufficient. Certified as a BCA Green Mark Platinum building, this zero-energy facility has been recognised for its energy-efficient design and features.

In addition, as the first real estate conglomerate in Southeast Asia to sign on to the WorldGBC Net Zero Carbon Buildings Commitment, CDL has also extended its pledge towards a net zero whole life carbon-built environment. Through this expanded commitment, CDL's new and existing wholly-owned assets under its direct management and operational control will operate at net zero carbon and achieve maximum embodied carbon reduction in new developments, compensating for any remaining residual operational and upfront embodied emissions, by 2030.

In November last year, CDL was awarded the inaugural 2021 Terra Carta Seal by His Royal Highness (HRH) The Prince of Wales, through his Sustainable Markets Initiative – the only Singapore company to be awarded the Seal. The Seal recognises global companies driving innovation and demonstrating commitment and efforts towards creating genuinely sustainable markets.

CDL's robust ESG integration and disclosures are widely recognised by 12 other prominent global ratings, rankings and indexes. These include receiving double 'A's in the 2021 CDP Global A List for corporate climate action and water security.

Singtel unveils orchestration platform for 5G edge computing and cloud services

Singtel recently launched Paragon, a platform that enables enterprises to tap into Singtel's 5G network to activate network slices on demand, deploy mission-critical applications on Singtel MEC (multi-access edge compute) as well as access a robust eco-system of partner applications.

The platform also empowers enterprises to securely deploy applications in a hybrid fashion, across the edge, at Singtel MEC and on a public cloud of their choice.

Developed in-house, Paragon is said to be the industry's first all-in-one orchestration platform for 5G edge computing and cloud services. It reduces the complexity and time needed to adopt 5G MEC and low latency applications and services – lowering the barriers to entry for enterprises and enabling faster deployment of use cases while removing considerable operational and cost overheads.

"Many enterprises are undergoing rapid digitalisation, while exploring and developing tailored 5G solutions for deployment in their industries. We understand the challenges and complexities that they face in managing the various networks, edge cloud applications and services, with the required cybersecurity, resiliency and demanding service assurances required, cost-effectively. Paragon was conceived, developed and delivered to help enterprises meet these needs through a single platform", said Mr Bill Chang, Chief Executive Officer, Group Enterprise, Singtel.

"We are pleased to already witness exciting and successful trials being conducted on Paragon, and invite partners in 5G-related fields, from chipset manufacturers, Internet-of-Things devices manufacturers, apps and software developers, content producers, systems integrators and solution providers, to join us, as we scale this platform regionally and globally, with other telecommunication leaders, to benefit customers in a 5G world", he added.

Digital acceleration platform

Without an all-in-one solution, enterprises have to juggle multiple tools to manage their network connectivity, cloud and application lifecycle at the edge. Paragon empowers enterprises to interact with the 5G network and deploy their edge computing applications and services on Singtel's infrastructure independently, securely and within minutes. This shortens their innovation curve and improves time-to-market as well as reduces costs. Enterprises can also access a wide range of solutions from Singtel's partners to deliver their 5G use cases.

Compared to the current 4G and public cloud-enabled edge computing solutions, Paragon provides improved latency with much higher bandwidth throughput from Singtel's 5G network. This means better performance and faster decision-making at the edge where the data resides, critical for autonomous systems like robotics; drones and unmanned vehicles; immersive, video-rich experiences; and powerful, real-time, edge AI use cases.

Other unique 5G features like network slicing – which usually requires weeks to acquire and set-up – can be done almost instantly, autonomously and as many times as needed. Enterprises can also optimise cost by utilising a network slice only when there is a need and for the intended duration.

Building a strong 5G MEC eco-system

Singtel's 5G eco-system partners play a key role in delivering the overall solution built on the Paragon platform. Through the Paragon

Mr Bill Chang, Chief Executive Officer, Group Enterprise, Singtel, delivering his opening address at the launch of Paragon.

Marketplace, which operates like an app store, partners can integrate their offerings through robust, industry-standard application programming interfaces (APIs) to rapidly build and deploy their solutions on Paragon. Some of these solutions already available include real-time fleet management, mixed reality and metaverse-based simulations, smart warehouse management, among others.

As Singtel scales Paragon across the region with a number of telecommunication leaders, partners in its 5G eco-system will have access to multiple markets based on the solutions they have built on the Paragon platform. The company remains committed to helping partners, through the Singtel Partner Programme, to develop solutions needed by customers across industries.

Singtel

Singtel is Asia's leading communications technology group, providing a portfolio of services from next-generation communication, and 5G and technology services, to infotainment, to both consumers and businesses. The group has presence in Asia, Australia and Africa, and reaches over 740 million mobile customers in 21 countries. Its infrastructure and technology services

for businesses span 21 countries, with more than 428 direct points of presence in 362 cities.

For consumers, Singtel delivers a complete and integrated suite of services, including mobile, broadband and TV. For businesses, Singtel offers a complementary array of workforce mobility solutions, data hosting, and cloud, network infrastructure, analytics and cybersecurity capabilities.

All images by Singtel

Demonstration of Singtel's fleet management and tracking systems with Solace, to show the speed and agility of Paragon's 5G and MEC capabilities.

A live demonstration of how Paragon brings together IoT devices and 5G MEC to support logistics and supply chain management, lag-free and seamlessly.

Demonstration of zero-latency augmented reality applications for e-training and e-learning, made possible with Paragon's 5G and MEC capabilities.

Siemens fast AC electric vehicle charger to be deployed in Singapore

Siemens VersiCharge, an electric vehicle charger that is compliant with the TR25:2016 Standard, has obtained the Letter of No Objection (LNO) from the Energy Market Authority-Land Transport Authority Interim Joint Panel (EMA-LTA IJP), paving the way for it to be sold and installed in Singapore.

VersiCharge is a sleek and compact electric vehicle alternating current (AC) smart charger capable of delivering up to 22 kW of power, through a Type 2 plug or socket. It allows EVs to be charged quickly, safely and cost-effectively, and can be installed in any parking lot and in public housing, private homes and commercial and industrial locations.

It is compliant with IEC and UL standards and meets a protection class of IP56 and IK10, making it weatherproof for outdoor use and capable of lasting for a long time.

“Singapore is a key market in our eMobility strategy. With the government's Singapore Green Plan 2030, the EV market is expected to grow exponentially in the coming years. Siemens is poised to partner with Singapore in its plan to deploy 60,000 EV charging points across the island by 2030, by providing quality charging infrastructure, solutions and technology”, said Mr Arjun Raju, Head of eMobility for Asia Pacific, Siemens.

The VersiCharge seamlessly ties into many network topologies; comes equipped with GSM/4G/LTE, Wifi, Ethernet and Modbus; and is compatible with OCPP 1.6 back-end protocol. With simple touch buttons and LED indicators for key functions, the unit is intuitive and simple to operate.

The Siemens VersiCharge Mobile App (available on Google Play Store and Apple iTunes) further increases the usability and configurability of the charger, when connected. It allows users to schedule charging time, view energy consumption, check charge status and more.

The ability to pre-set the start time of the charging process, in two-hour intervals, between two to eight hours, enables users to take advantage of economical electricity rates outside of peak periods and to significantly lower electricity costs. In addition, Siemens provides cloud-based remote diagnostics and over-the-air updates to future-proof the smart charger.

The VersiCharge is available in both single-phase (7.4 kW) and three-phase (22 kW) versions for rated current up to 32 amps. For an average passenger car, the charging time for 22 kW power charging is between 2.5 hours and 4 hours.

The VersiCharge electric vehicle charger, from Siemens, has obtained the Letter of No Objection from the relevant authorities, paving the way for it to be sold and installed in Singapore.

Sandvik Coromant appoints new digital machining expert for Asia Pacific

Mr Albert Waloni

Sandvik Coromant, a leader in metal cutting, has appointed Mr Albert Waloni as its Digital Machining Sales Manager for Sales Area South and East Asia (SASEA). As the current Digital Machining Manager for Southeast Asia and Oceania (SEAO), Mr Waloni's role will expand further afield as customers across India and Japan seek more support for integrating digital services into their metal cutting activities.

By 2025, the digital transformation market in Asia Pacific (APAC) is expected to grow by 20% - the highest rate compared to any other region. To support the uptake in the adoption of Industrial Internet of Things (IIoT) technologies, Mr Waloni's current role will expand to meet the requirements of several markets in the APAC region.

Mr Waloni, who has worked as the Digital Machining Manager of the company for the SEAO region, since January 2021, is the first employee at Sandvik Coromant to be appointed to this role. His mechanical engineering experience, combined with his time working in the Machining Solutions division at Sandvik Group, has equipped him with the expertise to manage this growing business area across the rest of Asia.

"Sandvik Coromant has been on a journey from initially providing metal cutting tools, to now providing complete, integrated, digital solutions. We have seen how our knowledge in metal cutting can combine with digital technologies such as IIoT sensors, cloud computing and digital planning software to help our customers maximise on productivity and efficiency", said Mr Waloni.

"To succeed in this journey, we are developing some of the technologies on our own, but we are also continually acquiring other technologies to build our portfolio. As digitalisation accelerates across APAC, this is the ideal opportunity to position Sandvik Coromant as an expert in digital machining solutions", he added.

"I see that manufacturing companies are really considering digital technologies and strategies right now. This includes the IIoT, data-driven manufacturing, predictive manufacturing and smart factories. To support this shift in focus, Sandvik Coromant solutions can be implemented in design and planning, tool preparation, machining and even in post-machining", Mr Waloni continued.

ISOTeam introduces pesticide made fully from plants

ISOTeam Green Solutions Pte Ltd (IGS), a wholly-owned subsidiary of SGX-ST Catalist-listed ISOTeam Ltd (ISOTeam or together with its subsidiaries, the 'Group'), has launched CnO Remover, a chemical-free plant-based pesticide.

Developed by a partner of ISOTeam, the CnO Remover is suitable for closed bin-chute systems and targets cockroach infestations while, at the same time, neutralising unpleasant odours by reducing methane accumulation. The product has fulfilled the National Environment Agency's (NEA) stringent criteria. After more than two years of testing under both physical and laboratory conditions, the CnO Remover has received the green light for commercial use and sale.

Made mainly from edible plant oils, the non-toxic and environment-friendly product has shown positive results in the four-week field trial conducted in early 2021 at a Housing & Development Board (HDB) block in Tanjong Pagar Town Council. Results from the trial showed that within the first week of treatment, the CnO Remover significantly reduced active cockroach infestations at the block, by more than 75%, and demonstrated residual efficacy, with infestations over the subsequent three weeks kept at four-times lower than without the treatment. Overall, more than 80% reduction in cockroach infestation was observed by the end of trial period, when compared with the infestation level prior to conducting the study.

The CnO Remover does not cause a flushing effect as a result of which cockroaches are expelled from hiding en masse into homes. It has 90% ready biodegradability at 28 days and can be naturally broken down by environmental bacteria.

ISOTeam estimates that there are about 100,000 bin chute systems, bin centres and transit centres in HDB estates. The Group plans to target these HDB estates and also NEA markets and food centres, islandwide.

Tanjong Pagar Town Council Deputy General Manager, Mr Chandra Mohan, said: "The field trial of CnO Remover at Tanjong Pagar Town Council produced good results and highlighted the product's effectiveness in reducing active cockroach infestations and its strong residual effect compared to a synthetic pesticide. As it is water-based, it is also easy to apply".

ASHRAE wraps up first hybrid Winter Conference and a successful AHR Expo in Las Vegas

More than 2,800 HVACR industry professionals, building systems engineers, architects, contractors and students, gathered in Las Vegas, USA, and virtually, from 29 January to 2 February for the 2022 ASHRAE Winter Conference. Registered conference attendees were provided entry to the co-sponsored AHR Expo, held from 31 January to 2 February, at the Las Vegas Convention Center.

"This year's conference and expo marked the first time that the society has been together for our Winter Conference, in two years, and the return to the AHR Expo after last year's cancellation", said 2021-22 ASHRAE President, Mr Mick Schwedler.

"While the numbers are expectedly lower than past conferences, in-person attendance still exceeded our expectations and our virtual attendees added a welcomed dynamic to our sessions. We are grateful to everyone involved in establishing a comprehensive health and safety plan for our attendees, which included guidance provided by the ASHRAE Epidemic Task Force", he added.

The Winter Conference featured over 50 technical sessions, updates from society leaders, tours, social events and live-streamed sessions for virtual attendees. Top sessions included Introduction of Building Decarbonization; HVAC Design, Control and Operation of Hospitals After COVID-19 Fiasco; and CPS 21: Refining ASHRAE COVID Guidelines and Standard 100.

The AHR Expo featured a total of 1,573 exhibitors, including 281 international exhibitors, and covered 443,769 ft² of exhibit space in the Las Vegas Convention Center. More than 43,000 people pre-registered to attend the show.

At the Winter Conference, Mr Schwedler provided updates related to the society's current theme, 'Personal Growth. Global Impact. Feed the Roots'. He focused on personal development and how the society's extraordinary global growth and impact to the built environment has nourished the roots of the global HVACR industry.

"When we concentrate on our mission and vision and talk about our impacts – we make the world more sustainable and resilient to future changes. We reduce both energy utilisation intensity and environmental emissions. We helped mitigate a global pandemic by keeping vaccines cold and their efficacy high. Forty percent of the world's food spoils between the field and consumption. We reduce that. And most importantly, we keep students and staff in schools, and occupants of the built environment safe and healthy", said Mr Schwedler.

During the plenary session, Mr Jeff Littleton, ASHRAE Executive Vice President and Secretary, reported on the society's current initiatives, as well as the dedication of ASHRAE volunteers during the pandemic.

"A Diversity, Equity and Inclusion Board subcommittee is focused on proactively driving diversity, equity and inclusion at all levels of the society. Task groups have been formed to drive society strategies on decarbonisation and on international standards. We have released 14 new and 24 revised publications and standards. Examples of new publications include the ASHRAE Design Guide for Natural Ventilation and the ASHRAE Guide for HVAC in Hazardous Spaces. We have even released the Children's book, Lucy's Engineering Adventure. The commitment of ASHRAE's entire global membership to the society's work has never wavered during the pandemic. I find that truly remarkable. When so much of our professional and personal lives has been disrupted, some 7,000 ASHRAE volunteers at the society, regional and chapter levels continue to drive ASHRAE forward", said Mr Littleton.

Experienced and emerging leaders in the industry were recognised during an honours and awards ceremony. Record-breaking polar explorer, Ann Daniels, closed the plenary session with an inspiring presentation on good leadership, teamwork and self-belief.

ASHRAE Learning Institute (ALI) offered 17 courses. New courses were as follows: Advanced High-Performance Building Designs: Key Concepts for Lifelong Building Sustainability; V in HVAC – What, Why, Where, How, and How Much (includes Basic Requirements of Standard 62.1-2019); Best Practices for Installing DDC Systems; Save 40% by Complying with Standard 90.1-2019; Principles of Building Commissioning: ASHRAE Guideline 0 and Standard 202; Guideline 36: Best in Class HVAC Control Sequences; Changing Environments and Loads for Data Centers (High Density, Liquid Cooling), Edge Computing and Health Impacts of Indoor Air Extraction, Ventilation, and Filtration – Same or Different.

The 2022 ASHRAE Annual Conference will take place from 25 June to 29 June in Toronto, Ontario, Canada. The 2023 Winter Conference will take place from 4 to 8 February and the AHR Expo, from 6 to 8 February, in Atlanta.

ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating ventilation, air conditioning, refrigeration and their allied fields.

Future Mobility Asia 2022 to jumpstart the electric vehicle value chain in Asia

Hosted by the Ministry of Energy, Thailand, Future Mobility Asia (FMA) 2022 will be held at the Bangkok International Trade and Exhibition Centre (BITEC), from 20 to 22 July 2022.

Presented as an integrated global exhibition and conference conclave for all stakeholders in the area of mobility, FMA 2022 will feature an extensive display of clean mobility technologies and innovations.

The event is expected to attract more than 10,000 visitors, comprising government leaders and officials, trade professionals, global technology experts, transport fleet owners, and others. More than 100 brands will be showcasing their latest innovations that will enable transformation towards clean and autonomous mobility in Asia.

Exhibits to be presented indoors and outdoors

The exhibits will occupy a total of 15,000 m² of space, including 3,000 m² of outdoor area. At the event, attendees can expect to see, first-hand, electric and autonomous vehicle demonstrations that will help bring about accelerated commercial adoption, as well as the launch of autonomous passenger and commercial vehicles. There will also be announcements on new technologies, products and innovations.

In addition, there will be a line-up of engaging activities, ranging from on-floor lighthouse projects, case-studies, start-up showcases and pitching for venture capital, to hackathons.

FMA 2022 will be a platform for business leaders to meet and connect with prospective partners and keep abreast of dynamic developments in future mobility.

Exhibitors at this global event include manufacturers of autonomous vehicles, passenger and commercial vehicles; original equipment manufacturers (OEMs); battery energy, storage and charging infrastructure providers; aftermarket suppliers; future mobility start-ups; enabling technology providers; and others.

"FMA 2022 promises to be the transformative launchpad for future mobility stakeholders to explore new market opportunities and seal deals with decision-makers, participate in the regenerative global effort to green mobility and beyond, and inspire and persuade participants to work closely together for meaningful, collegial, and profitable outcomes", said Mr Mel Lanvers-Shah, Vice President Asia of dmg events, organisers of the event.

Three-day conference

FMA 2022 will also play host to keynotes from energy ministers and global CEO dialogues, and will enable direct access to mobility start-ups, scale-ups, investors, and multinational corporations spanning the world.

Concurrently, a three-day conference, with a slate of 100 speakers and over 1,000 global delegates, will facilitate the sharing of strategic knowledge and technology insights as well as global learning, networking and business development, across the Asia-Pacific region.

Ministers, policy makers, OEMs, CEOs, Industry CVOs, innovators, and leading research development institutes are expected to attend the conference.

Insight series

A fortnightly insight series, leading up to the physical event in July 2022, will be hosted by FMA 2022, consisting of 1-to-1 interviews and online discussion panels with government ministers, mobility thought leaders, opinion leaders, and delegates. Additionally, FMA 2022 will feature sneak previews of exclusive clean mobility projects and research work, on its website, prior to the actual event.

Crafted by leaders for leaders

FMA 2022 was co-developed with the assistance of an advisory committee comprising mobility leaders and industry practitioners. The committee contributes to efforts propelling national and regional EV ambitions and roll-outs, by helping to attract investments into the entire EV value chain and generating awareness amongst industry players and international media.

dmg events

A wholly-owned subsidiary of the Daily Mail and General Trust Inc (DMGT), dmg events is an international exhibition and publishing company, with a portfolio of 84 exhibitions held each year, that attract around 425,000 visitors.

Headquartered in Dubai, UAE, since 1989, the company has operations in Saudi Arabia, Egypt, the UK, South Africa, Canada, and Singapore. The 300-strong company nurtures professional communities for diverse industries including construction, energy, coatings, transportation, hospitality and interiors.

Sustainability Experience Centre set up to introduce green solutions at workplaces

The centre will help local companies implement energy-efficient initiatives and reduce overhead costs.

Nanyang Polytechnic (NYP) and Schneider Electric have launched a one-stop Sustainability Experience Centre to help Singapore's small and medium-sized enterprises (SMEs) implement green technologies at the workplace. This can help Singapore achieve its goal of having at least 80% of buildings to be green by 2030.

A key showcase at the centre focuses on sustainable facilities management. Augmented Reality is tapped for instant diagnosis, and when coupled with contactless and predictive maintenance, the overall power efficiency of a venue is significantly improved. This helps SMEs operate more sustainably and enhances the productivity of maintenance crew, as repairs and rectifications can be reliably predicted, and preventive maintenance carried out.

At the centre, students from NYP's School of Engineering will be able to gain valuable hands-on experience in cutting-edge solutions used by the industry to meet sustainability goals.

For example, students from NYP's Diploma in Electronic & Computer Engineering course will learn how to integrate multiple systems and devices to collect and analyse relevant data. The first-hand experience would provide gainful insights to these students, thereby preparing a steady pipeline of talents to meet the demands for sustainability solutions in future industries.

Ms Jeanne Liew, Principal & Chief Executive Officer, NYP, said, "We are excited to partner Schneider Electric, one of the world's leaders in energy solutions, to launch NYP's Sustainability Experience Centre. With NYP's expertise in engineering systems and data analytics, alongside Schneider Electric's technology and solutions, SMEs will now have easy access to kickstart their green journey. This is also a great opportunity to strengthen and inculcate a sustainability-conscious mindset among our youth and empower them to play a role in bringing about a greener future".

Dr Kan Ee May, Specialist (Sustainability Engineering) and Lecturer, School of Engineering, Nanyang Polytechnic (far right), and Mr Jackson Seng, Sustainability Business Development Director, Schneider Electric (second from left), at the launch of Nanyang Polytechnic's Sustainability Experience Centre. Image: Nanyang Polytechnic.

Demonstrating the use of Augmented Reality. Image: Nanyang Polytechnic.

Another key showcase at the centre helps SMEs identify solutions to optimise power usage and reduce energy consumption. With deft application of automation and sensors, lights would be activated only in areas where needed, and data usage patterns can also be analysed in real-time.

Schneider Electric's EcoStruxure Building Operation 3.0 makes this possible by pulling in data from a wide range of sensors, running an analysis, and providing users with

suggestions to maximise energy use and reduce overall cost. Lighting and temperature can also be adjusted, on the fly. According to Singapore's Energy Efficiency Programme Office (E2PO), occupancy sensors for lighting controls can result in at least 50% energy savings after implementation at workplaces. Implementing such energy-efficient measures helps SMEs reduce operating costs and become more competitive.

Schneider Electric and NYP are also co-training a pipeline of future-ready workers to meet the increasing demands and help companies implement a sustainable transport solution – through electric fleets.

To-date, staff from more than 20 SMEs have been trained on the key skills of managing Electric Vehicles (EVs), including setting up charging systems and processes for these EVs. To ensure buildings have enough electric supply capacity for EV charging stations, Schneider Electric also developed an EVlink Wallbox, to integrate with a load management system and regulate the amount of electricity allocated for EV charging in real-time. This allows building owners to deploy such sustainable solutions with minimal infrastructure cost, while ensuring that critical functions are prioritised to prevent electrical overload.

Mr Yoon Young Kim, Cluster President, Singapore, Malaysia & Brunei, Schneider Electric, said, "Our commitment to fostering the next generation of engineers and dedication to sustainability are core identities of Schneider Electric. This opportunity to work with NYP is a perfect match with our DNA. We have always been advocates of using cutting-edge technology to help the industry meet critical sustainability goals, and our own regional headquarters at Kallang is a testament to that belief. The Sustainability Experience Centre is a fantastic, two-pronged approach where we can showcase our technology to the industry, while training the next generation who can help implement these solutions".

Demonstrating the use of the EV charging system. Image: Schneider Electric.

Showcasing the EVlink Wallbox. Image: Nanyang Polytechnic.

The centre was built with a strong sustainability focus, with most materials being highly rated products under the Singapore Green Building Product (SGBP) certification scheme administered by Singapore Green Building Council (SGBC).

Ar. Tang Kok Thye, President, SGBC, said, "Going green is not just the work of the building and construction industry. Everyone is a stakeholder and beneficiary of a greener, healthier built environment. By putting together such a showcase of proven sustainability solutions for students and industry to learn from, we will be able to move the needle towards greater adoption, and advance the environment that we live, work and learn in, to one that is better for not just ourselves but for the next generation and beyond".

Unilogic Technologies Pte Ltd and Ichi Seiki Pte Ltd are among companies who have visited the centre to learn more about the solutions they can readily adopt.

Ms Jiehui Kia, Business Development Manager, Ichi Seiki Pte Ltd, said, "Global and national climate targets have been set, so we expect that sustainability will be a key priority for manufacturers in Singapore. The launch of the Sustainability Experience Centre at NYP is timely, as it brings together multiple solutions and integration possibilities and demonstrate how these could work in one single location. This gives SMEs a good starting point to learn about the solutions that may be relevant to us".

IES-INCA SUPPORTS ENGINEERS IN SCALING UP THEIR TECH VENTURES

IES-INCA (IES Incubator & Accelerator) was set up in July 2019 to support engineering and enterprising leaders and scale up deep tech ventures. It is currently supporting 19 companies in business planning development, mentoring and fundraising activities.

These deep tech companies are in the areas of Infrastructure Technology, IOT, Robotics/ Automation and Cleantech/ Sustainability, which are key growth sectors for technology commercialisation. IES members can participate in IES-INCA's activities by becoming an incubatee, mentor or investor.

As an incubatee, company founders can be supported by IES-INCA's pool of business, technology, finance or market mentors according to their most pressing needs. Guided by these mentors, incubatees will work with IES-INCA to develop their businesses, acquire key skills and address their fundraising needs.

Meanwhile, mentors can leverage their experience and business networks, to help transfer knowledge and bring incubatee companies further and faster, reducing their business risks.

IES members can join the IES-INCA and ISCA (Institute of Singapore Chartered Accountants) Investor Network to invest in selected incubatees and give them the necessary resources and strategic connections to scale up their business ventures.

IES-INCA Incubatees at the Investor Pitching Event on 14 December 2021

IES-INCA is also an accredited mentor partner with Enterprise Singapore's Startup SG Founder programme, which enables first-time entrepreneur teams of at least 3 members to get a 1:5 matching grant to support their new ventures. Through it, IES-INCA has supported 3 teams and looks forward to help more engineers keen on this grant.

Furthermore, to assist engineering and tech SMEs, IES-INCA has setup the Dare To Transform (D2T) programme to provide access its panel of consultants who can help IES members and engineering leaders to adapt to the dynamic business climate with new ideas, technologies and innovative business models.

For this year, IES-INCA plans to hold more international activities to bring its incubatees, IES members and their technology products and services to the ASEAN and global market.

To be incubated, mentor or invest in incubatees, or participate in our IES-INCA programmes, visit https://ies-inca.com/ or email incubate@ies-inca.com for more information.

IES INCA

The IES-INCA logo is represented by a hub with various spokes. Each spoke inherits the red, blue and yellow colours from the IES logo, and represents the key components of IES-INCA: The incubatees, the mentors, and investor community. Through this programme, IES aims to support engineering and enterprising leaders and scale up deep tech ventures to market.

MEET OUR INCUBATEES

Joseph Lew, Founder, Aison (left) and Kek Hean Hooi, Co-Founder and CEO, Antbuildz.com

Q: Please introduce yourself.

Joseph Lew (JL): I'm Joseph Lew, I was a software engineer and project manager. I have an executive MBA from Insead and worked in A*STAR for five years before founding Aison.

Kek Hean Hooi (Kek): I'm Kek, the co-founder & CEO of Antbuildz.com. I graduated from Civil Engineering, and I have been involved in the construction industry and project management for close to ten years.

Q: What are the key products/services of your company?

JL: Aison is an artificial intelligence (AI) design company specialising in cutting-edge AI solutions for facility management, geriatric care and the medical sector. We use cameras to detect anomalies and security breaches. Unlike conventional video analytics, our AI system self-learns and grows through daily use. Aison also provides bespoke AI solution development services to help companies gain productivity and increase their bottom line.

Kek: With Antbuildz, customers will be able to browse, search, compare and rent construction equipment with a few clicks. Not only do you enjoy the best rate, the rented equipment is also covered with insurance. Through our platforms, Antbuildz connects the best equipment suppliers to users in the market.

In the beginning, we were focused on the rental of construction equipment like excavators, boom lifts, and forklifts. Now, we have expanded our offerings and added noise and vibration monitoring systems, and are moving on to other spaces in the logistics and warehousing sectors. Antbuildz currently offers the broadest range of equipment rental in the market.

Q: Are you fundraising? How much, and why?

JL: Yes, we are fundraising and looking for like-minded investors. We are looking for S$2 million pre-series A to acquire more customers, increase market penetration and the reliability of our services.

Kek: Yes, definitely. Since we started one and a half years ago, we have achieved good traction. The online rental volume has been growing on our platform. We are looking for S$1 million funding to scale up our business and also to expand to overseas markets. We will also use the funds to further improve our platform to accommodate a greater variety of rentals to allow Antbuildz to be even more valuable in the B2B rental space.

Q: How can IES members support your company?

JL: We are looking for members with commercial buildings, residential or industrial premises that we could apply our facility management AI to help to reduce operating cost. If you have premises like these, please contact us and we will love to help you.

Kek: Many IES members come from the construction, shipyard, marine and other engineering industries and may require the rental of equipment at some point. Antbuildz is here to help! Users will be able to view online catalogs and print quotations instantly, saving a tremendous amount of time and paperwork, thus helping to contribute to environmental sustainability. A single online rental process can easily save up to seven pieces of paper! Do visit antbuildz.com and explore what we have to offer. ■

Arc flash analysis and ensuring safety

by Er. Simon Lee, IES Council Member, IES M&E TC Chair, MSc, PEng (22 kV Switching), Bescon Consulting Engineers Pte

A practising engineer discusses electrical faults on switchgear panels, the risks posed to working personnel, and safe working procedures.

INTRODUCTION

It is imperative that operators, electrical engineers and workers are fully aware of the risks of working near 'live' electrical equipment, in particular, high voltage switchgear. This article addresses the general causes of an arc flash and its impact on working personnel. Estimations of arc flash energies and risk assessment to mitigate the arc flash are also presented.

ARC FLASH AND ARC BLAST

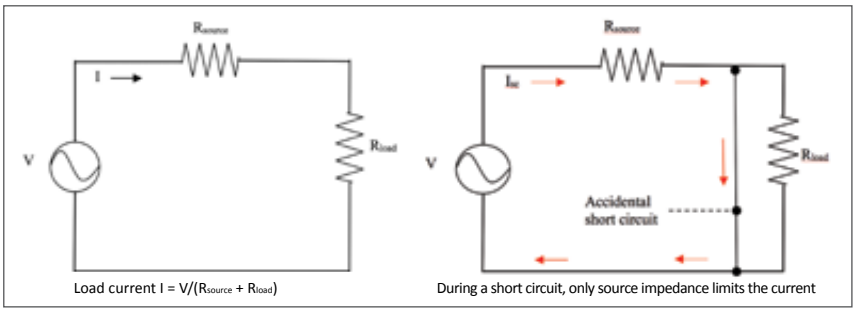
An arc flash is a dangerous electrical discharge that occurs when the electrical field between two conductors exceeds the breakdown strength of the air. In accordance with Townsend's equation, a sufficient number of air molecules will be ionised, between the conductors, to form a conductive path resulting in an arc flash. Due to the instantaneous and tremendous amount of energy released, an arc-flash is an electrical explosion with effects similar to an explosion produced by TNT.

Normally, the electricity flow from the point of generation to the point of usage, through insulated cables, switchgear and transformers, is in accordance with Ohm's law:

Voltage (V) = Current (I) x Resistance (R)

In the event of a short circuit, the fault current is limited only by source impedance R_{source}. Mathematically, the short circuit current approaches infinity, as source resistance approaches zero. The energy released is a function of system voltage, fault current magnitude and fault duration. A high short circuit current implies that the arc flash energy will be tremendous. An arc flash within enclosures, such as a Motor Control Centre (MCC) or switchgear, magnifies the blast and the energy transmitted, as the blast is forced towards the open side of the enclosure and towards the worker adjacent to the panel.

A short circuit can be caused by insulation failure, flash over air gaps, incidental human contact on a live conductor or dropping of tools across live conductors. The high short circuit current will generate massive heat, intense light energy and radiation, instantaneously. The temperatures at the arc terminals can reach up to 20,000° C or four times the surface temperature of the sun. Due to the extremely high temperature of the arc, the live conductors' copper surface will be vaporised to form toxic copper oxide with a volume 67,000 times that of solid copper. The air and gases surrounding the arc expand rapidly, resulting in a shock wave called an arc blast. The sound energy from blasts and pressure waves can reach 160 dB, exceeding the sound of an airplane taking off. The arc blast will propel shrapnel and molten metal, causing serious injury to nearby workers. Blast pressures may exceed 10,000 kg/m^2 which can throw workers off ladders and cause workers' lungs to collapse. An arc blast occurs with a speed exceeding 1000 km/hour, making it impossible for workers to get out in time.



Electricity flow from point of generation to point of usage.

Workers, directly exposed to arc flash and arc blast events, are subject to third degree burns, possible blindness, shock, blast effects and hearing loss. The high temperatures of the arc will ignite any flammable materials, causing fire and property damage. Electricity distribution and associated operations will be disrupted, resulting in high indirect costs. Investigation, legal and medical expenses will further escalate the damages.

The factors affecting the severity of an arc flash are:

- Electrode configuration
- Magnitude of short circuit current
- Arc duration

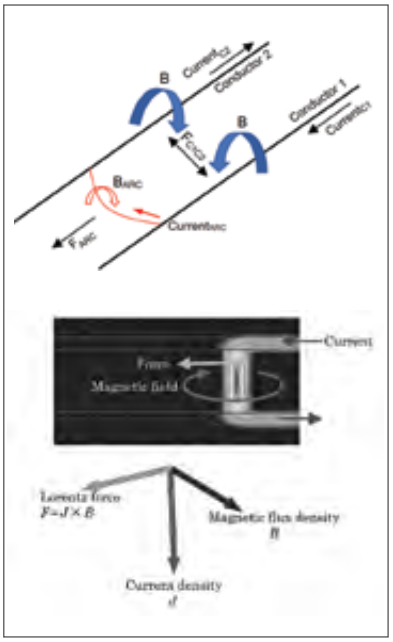
Electrode configuration

An arc flash migrates away from the source, due to the Lorentz Force, calculated as the cross product of the charge velocity vector and magnetic field:

$$F = qv \times B$$

As current flows through two fixed, parallel conductors, a circulating magnetic field is established perpendicular to the axis of the conductors, according to the right-

hand rule. Since the conductors are fixed, the Lorentz Force cannot push them apart. When an arc occurs between the two conductors, the arc current produces a separate magnetic field. As an arc consisting of a conductive air channel is moveable, the Lorentz Force will push the arc in the direction of current flow in Conductor 1 and away from the source, as follows:



Arc migration due to the Lorentz Force.

This behaviour drives an arc flash towards and off the ends of bus bars and electrodes. For vertical electrodes during an arc flash, heat and plasma will bounce around the enclosure and will be expelled out via radiation and pressure. For horizontal electrodes, the Lorentz Force will propel arc plasma from the end of the electrodes towards workers. This explains why horizontal electrodes are more deadly than vertical electrodes.

Magnitude of a short circuit current

The arc flash severity is proportional to the energy release I^2t. The magnitude of the short circuit current is proportional to the number of parallel sources and generators connected. Consider the following short circuit due to a single transformer:

$I_{sc\ pu} = 1 / X_{Tpu}$

For 2 transformers in parallel:

$I'_{sc\ pu} = 1 / (X_{Tpu} /2) = 2 \times I_{sc\ pu}$

Arc energy = $(2 \times I_{sc\ pu})^2 t = 4 \times I_{sc\ pu}$

The arc energy of parallel transformers is approximately 4 times that of the single transformer. To reduce the risk of an arc flash significantly, during work on the electrical panel, parallel configuration of sources should be avoided or minimised.

Arc duration

The incident energy increases with arcing time and fault current. Hence, to reduce the severity of the arc flash, it is necessary to reduce the arc duration. The measures for reducing arc duration are described in the section 'MITIGATION OF ARC FLASH EFFECTS', later in this article.

IEEE STANDARD 1584 & NFPA 70E

To understand the thermal energy of the arc flash, we can refer to IEEE Standard 1584-2002 and the NFPA 70E-2000 Edition. The terminologies used are:

- Working distance – Distance from the worker to the arc flash location. The working distance of 18 inches or 457.2 mm is used because it is the typical distance a worker's face or upper body may be away from an arc.
- Incident energy – Heat energy incident on the worker. The unit is cal/cm² or Joules/cm² (1 cal/cm² = 4.1868 J/cm²).
- Bolted fault current – The current that would flow through a short circuit with two conductors bolted together. It is the maximum fault current and is used to calculate the arc fault current.
- Arc fault current – Due to the arc resistance, the arc fault current is less than the bolted fault current.
- Arc flash boundary – Distance where the incident energy is 1.2 cal/cm².

The working distance is used to determine the degree of risk and the type of Personal Protection Equipment (PPE) necessary to protect against arc hazards. Tests have shown that an incident energy of only 1.2 cal/cm² will cause second-degree burns to unprotected skin. Usually, second-degree burns are curable and will not result in death.

The effects of incident energy are, typically, as follows:

Incident Energy (cal/cm²)	Effects
0.0033	Amount of energy the sun produces in 0.1 sec on the ground's surface at the equator
1	Equivalent to a finger tip exposed to a cigarette lighter flame for 1 sec
1.2	Amount of energy that will instantly cause 2nd degree burns to bare skin
4	Amount of energy that will instantly ignite a cotton shirt
8	Amount of energy that will instantly cause incurable 3rd degree burns to bare skin

Table 1: The effects of incident energy.

NFPA 70E, the Standard for Electrical Safety in the Workplace, classifies arc flash hazards into five Hazard Risk Categories (HRC 0 through 4).

Category	Energy Level (cal/cm²)
0	<2
1	5
2	8
3	25
4	40

Table 2: Hazard Risk classification as per NFPA 70E.

ARC FLASH CALCULATION

The arc flash can be calculated using procedures in accordance with IEEE 1584-2002 and NFPA 70E.

Parameter	Range
Frequencies (Hz)	50 or 60 Hz
System Voltage (kV)	0.208 to 15
Gap between electrodes (mm)	13 to 152 mm
Bolted fault current (kA)	0.7 to 106 kA
Grounding type	Ungrounded, grounded, high resistance grounded
Phase	3 phase faults
Equipment enclosure type	Open air, box, MCC, panel, switchgear, cables

Table 3: Conditions under which IEEE 1584 formulas are valid.

Step 1: Calculate bolted fault MVA

Assume, transformer capacity S_T and source impedance Z_T,

Bolted fault $MVA_f = S_T / Z_T$

Step 2: Determination of arc current

For low voltage electrical systems ≤1 kV, the arc current is determined using formula (1):

$$I_a = 10^{\{K + 0.662*\log(Ibf) + 0.0966*V + 0.000526*G + 0.5588*V*\log(Ibf) - 0.00304*G*\log(Ibf)\}} \quad (1)$$

where

I_a = arcing current (kA)

K = -0.153 open configuration (no enclosure)

-0.097 box configuration (enclosed equipment)

I_{bf} = bolted fault current for three phase faults (symmetrical RMS) (kA)

V = system voltage (kV)

G = gap between conductors (mm)

For a medium voltage electrical system 1 to 15 kV, the arc current is determined using formula (2):

$$Ia = 10^{\{0.00402 + 0.983*\log(Ibf)\}} \quad (2)$$

The typical gap between conductors of electrical equipment is shown in Table 4.

Step 3: Determining normalised incident energy

The normalised incident energy, which is derived from 0.2 second arc duration and 610 mm arc distance, is determined using formula (3)

$$En = 10^{\{K1 + K2 + 1.081*\log(Ia) + 0.0011*G\}} \quad (3)$$

where

En = Incident energy normalised for time and distance (J/cm²)

K_1 = -0.792 open configuration (no enclosure)

-0.555 box configuration (enclosed equipment)

K_2 = 0 ungrounded and high resistance grounded systems

-0.113 grounded systems

G = gap between conductors as per Table 3 (mm)

= 153 mm (typical gap for MV conductors)

Step 4: Evaluation of incident energy

The normalised incident energy is used to calculate the incident energy at the specific working distance and the devices clearing time using formula (4):

$$E = 4.184*C_f * E_n * (t/0.2) * (610/D)^x \quad (4)$$

where

E = incident energy (J/cm²), (1 J/cm² = 0.24 cal/cm²)

C_f = calculation factor
= 1.0 (Voltage >1kV)
= 1.5 (voltage <1kV)

t = arcing time (seconds)

D = working distance from arc (mm)

X = distance factor as per Table 4

Step 5: Flash protection boundary (NFPA 70E ARTICLE 130.2A)

The flash protection boundary is the distance within which workers without personal protective equipment (PPE) may suffer second-degree injuries that can be treated and cured. It is computed with formula (5).

$$D_B = 610 * [4.18 * C_f * E_n * (t/0.2) * (1/E_B)]^{1/x} \quad (5)$$

where

D_B = distance of the boundary from the arcing point (mm)

System Voltage (kV)	Equipment Type	Typical gap between conductors (mm)	Distance X Factor
0.208 to 1	Open Air	10 – 40	2.000
	Switchgear	32	1.473
	MCC and panels	25	1.641
	Cable	13	2.000
>1 to 5	Open Air	102	2.000
	Switchgear	13-102	0.973
	Cable	13	2.000
>5 to 15	Open Air	13-153	2.000
	Switchgear	153	0.973
	Cable	13	2.000

Table 4: Typical gaps and Distance X factors for various equipment and voltage class categories.

C_f = calculation factor
= 1.0 (Voltage >1kV)
= 1.5 (voltage <1kV)

E_n = normalised incident energy (J/cm²)

E_B = incident energy at the boundary distance (J/cm²)

T = arcing time (seconds)

X = distance factor as per Table 4

I_{bf} = bolted fault current (kA)

Step 6: Arc blast pressure

The blast energy or pressure can be computed using formula (6).

$$\text{Pressure} = 11.58 * I_{arc} / (D/304.8)^{0.9} \quad (6)$$

where

Pressure = pounds per square foot

D = distance from arc in mm

I_{arc} = arc current in kA

Typical operating times of the overcurrent protective device are given in Table 5.

ARC FLASH RISK ASSESSMENT

Both OSHA and NFPA 70E require an electrical hazard analysis prior to beginning work on or near electrical conductors that are, or may become, energised. The analysis must include all electrical hazards – shock, arc flash, arc blast, and burns. NFPA 70E Article 110.8(B) (1) specifically requires electrical hazard analysis within all areas of the electrical system, that operate at 50 volts or greater. The results of the electrical hazard analysis will determine the work practices, protection boundaries, personal protective equipment, and other procedures required to protect employees from arc flash or contact with energised conductors.

NFPA 70E Articles 110.8(B) (1) and 130.2(A) require a shock hazard analysis. The shock hazard analysis determines the system voltage to which personnel can be exposed, the protection boundary requirements, as established in NFPA 70E Table 130.2(C), and identifies personal protective equipment (PPE) required to minimise shock hazards.

NFPA 70E has established three shock protection boundaries:

- Limited Approach Boundary
- Restricted Approach Boundary
- Prohibited Approach Boundary

Limited Approach Boundary

The Limited Approach Boundary is an approach boundary that has been defined to protect personnel from shock. A boundary distance is

Overcurrent protective device	Typical opening time at 8 x rating (second)	Typical opening time at 20 x rating
Current limiting fuse / Current limiting circuit breaker	0.1 to 1	<1/2 cycle or 8.3 msec
MCCB without adjustable trip	5 to 8	1.5 cycles or 25 msec
MCCB with adjustable trip	1 to 20	1.5 cycles or 25 msec
ACB	5 to 20	3 cycles or 50 msec
Medium Voltage circuit breakers	5 to 20	5 to 6 cycles or 100 msec

Table 5: Typical operating times of the overcurrent protective device.

Incident Energy From (cal/cm2)	Incident Energy To (cal/cm2)	IE Low Marginal (cal/cm^2)	IE High Marginal (cal/cm^2)	Hazard Risk Category	Clothing Description	Hand & Arm Protection	Foot Protection	PPE Others
0	1.2	0	1.19	0	Nonmelting, Flammable Materials	Leather Gloves	N/A	Safety glasses
1.2	4	1.21	3.9	1	Arc-rated FR Shirt & Pants	Leather Gloves	Leather work shoes	Safety glasses, electrically rated hard hat with hood and face shield.
4	8	4.1	7.8	2	Arc-rated FR Shirt & Pants	Leather Gloves	Leather work shoes	Safety glasses, electrically rated hard hat with hood and face shield. Hearing protection.
8	25	8.2	24	3	Arc-rated FR Shirt & Pants & Arc Flash Suit	Arc-rated Gloves	Leather work shoes	Safety glasses, electrically rated hard hat with hood and face shield. Hearing protection.
25	40	26	38	4	Arc-rated FR Shirt & Pants & Arc Flash Suit	Arc-rated Gloves	Leather work shoes	Safety glasses, electrically rated hard hat with hood and face shield. Hearing protection.
40	999	41	998	Dangerous!	No FR Category Found	Do not work on live!	Do not work on live!	No FR Category Found

Table 6: Arc flash category and required PPE as per IEEE 1584.

established from an energised part, based on system voltage. To work within this boundary, unqualified persons must be accompanied by a qualified person and they must use PPE.

Restricted Approach Boundary

The Restricted Approach Boundary is an approach boundary that has been defined to protect personnel from shock. A boundary distance is established from an energised part, based on system voltage. Only qualified persons are allowed within this boundary and they must use PPE.

Prohibited Approach Boundary

The Prohibited Approach Boundary is an approach boundary that has been defined to protect personnel from shock. Working within this boundary is considered the same as making direct contact with an energised part. Only qualified persons are allowed to work within this boundary and they must use PPE.

Shock protection boundaries are based on system voltage and on whether the exposed energised components are fixed or moveable. NFPA 70E Table 130.2(C) defines these boundary distances for nominal phase-to-phase system voltages, from 50 V to 800 kV. Approach boundary distances may range from an inch to several feet. NFPA 70E Table 130.2(C) provides more information.

In summary, a Shock Hazard Analysis is performed to reduce the potential for direct shock. It will establish shock protection boundaries and determine the PPE required for protecting workers against shock hazards.

MITIGATION OF ARC FLASH EFFECTS

Singapore electricity regulations stipulate that before commencement of work on electrical equipment, the equipment must be de-energised. This eliminates the arc flash hazard but is sometimes difficult to apply. To minimise arc flash effects, it is necessary to limit the energy released so that personnel are not incidentally subjected to dangerous arc flashes. This can be achieved through the adoption of passive and active measures.

Passive measures can be the use of barriers or procedures such as:

- Arc-proof switchgear – designed to direct the arc energy to vent out from the top of the switchgear, and limit the energy directed to the front.
- Remote control operation of protection and switching devices – keeping personnel at a safe distance from the equipment.
- Closed door racking-in/out of the withdrawable circuit breakers – breakers allow closed door operations and have their primary connections isolated by shutters.
- Remote or longer operating mechanisms so that racking-in/out operations can be carried out at a safe distance.
- Barriers between personnel and equipment during racking-in/out or opening/closing operations.
- Reduction of the short-circuit current by disconnection of unnecessary power supply sources – for example, disconnecting parallel transformers/generators and opening bus ties.
- Remote control devices for racking-in/out of the circuit breaker at a safe distance.
- Arc flash risk assessment.
- Providing warning labels to indicate HRC category and requirement of PPE.

For installation with high short circuit current, it is necessary to limit the arc duration and corresponding energy release. The active measures to do that are as follows:

- Installing circuit breakers with fast tripping times – improving protective device coordination study to balance reliability and reduce the arc flash hazard.
- Zone selectivity or bus differential protection – this allows the setting of a fast trip time for selective zones.
- Providing fast tripping times during maintenance – many breaker manufacturers have a 'dual setting' function which allows the setting of fast tripping times during maintenance operations.
- Optical sensors to trip the breaker in the event of an arc flash.
- Using current-limiting fuses. At high fault current, fuses clear the fault much faster than breakers and hence reduce the incident energy significantly.

CONCLUSIONS

The most common cause of an arc flash and other electrical accidents is carelessness. No matter how well a person may be trained, distractions, weariness, pressure to restore power, and over-confidence, can cause an electrical worker to bypass safety procedures, work unprotected, drop a tool, or facilitate contact between energised conductors. Faulty electrical equipment can also cause such hazards, while being operated.

The severity and causes of an arc flash are varied. The best protection is to de-energise the equipment before working on it. No one has ever been killed or injured from an arc flash while working on de-energised equipment. If equipment cannot be de-energised, electrical workers must be qualified, trained, wear appropriate personal protective equipment (PPE), and follow all applicable OSHA and NFPA standards, as currently there is no Singapore Standard for arc flashes and arc blasts.

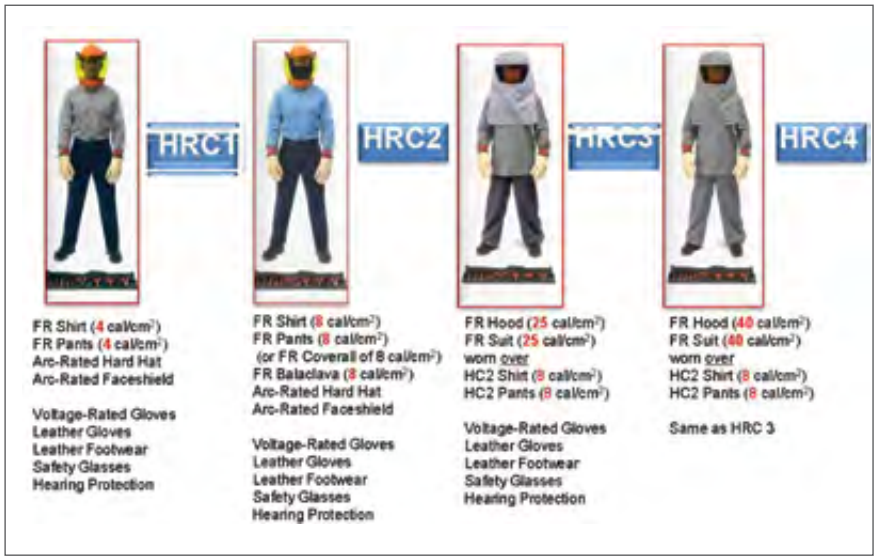
Examples of arc flash calculations

The arc flash has been calculated, in accordance with IEEE 1584-2018 for system voltages >5 kV to 15 kV, for a 6.6 kV MSB supply from 22 kV/6.6 kV 18 MVA 12% YNd5 & 6.6 kV 32 MVA genset (Xd=20%) with the following configurations:

- Single transformer.
- 1 transformer and genset operating in parallel.
- 2 transformers and genset operating in parallel.

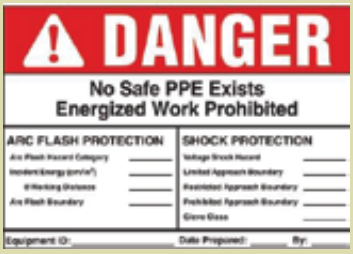
s/n	Item (User Input in Yellow)	Symbol	Unit	(a)	(b)	(c)
1	Fault Current	I_{bf}	kA	13.1	27.1	40.2
2	System Voltage	V	kV	6.6	6.6	6.6
3	K: - Open Air : -0.153 - Enclosed: -0.097	K		-0.097	-0.097	-0.097
4	Conductors Gap: - Open Air : 13 mm - 153mm - Switchgear : 153mm - MCC : 153mm - Cable : 13mm	G	mm	153	153	153
5	K_1 - Open Air : -0.792 - Enclosed : -0.555	K_1		-0.555	-0.555	-0.555
6	K_2 - Ungrounded & high res ground : 0 - Grounded : -0.113	K_2		0	0	0
7	Arc Duration: - VCB : 5-6 cycles/0.1 - 0.12s	t	sec	0.12	0.12	0.12
8	Working Distance: - MV switchgear : 36 inch/910mm	D	mm	910	910	910
9	Distance Factor - Open air and cable : 2 - Switchgear: 0.973	X		0.973	0.973	0.973
10	Arc Current	I_a	kA	12.68	25.88	38.14
11	Normalised Incident Energy	E_n	J/cm2	6.39	13.83	21.03
12	Incident Energy	E	Cal/cm2	**2.60**	**5.62**	**8.55**
13	Incident Energy	E	J/cm2	10.87	23.52	35.77
14	Incident Energy at boundary distance	E_B	J/cm2	5.00	5.00	5.00
15	Flash Protection Boundary	D_B	mm	2022	4468	6875
16	Flash Protection Boundary	D_B	feet	6.9	9.9	12.1
17		D_B	mm	2105	3026	3686
18	Pressure	P	pound/ft2	54.84	111.98	165.04
19		P	kg/m2	267.77	546.72	805.79
20		P	kPA	2.63	5.36	7.90
	ARC FLASH CATEGORY AND REQUIRE PPE AS PER IEEE1584					
21	Hazard Risk Category (0 to 4)			**1**	**2**	**3**
22	Clothing Description			**Arc-rated FR Shirt & Pants**	**Arc-rated FR Shirt &Pants**	**Arc-rated FR Shirt & Pants & Arc Flash Suit**
23	Hand & Arm Protection			**Leather Gloves**	**Leather Gloves**	**Arc-rated Gloves**
24	Foot Protection			**Leather work shoes**	**Leather work shoes**	**Leather work shoes**
25	Other PPE			**Safety glasses, electrically rated hard hat with hood and face shield**	**Safety glasses, electrically hard hat with hood and face shield, hearing protection**	**Safety glasses, electrically rated hard hat with hood and face shield, hearing protection**

Table 7: Arc flash calculation as well as the incident energy and PPE required.



Details of PPE required.

Sample Labeling



Arc flash hazard warning lahels.

References

IEEE 1584:2002 – Guide for performing arc-flash hazard calculation.

NFPA 70E:2015 – Standard for electrical safety requirements for Employee Workplaces (defines arc flash approach boundaries and PPE selection).

LittleFuse Electrical Safety Hazard Handbook.

ABB Arc Flash Hazards.

NFPA 2014.

New technology to boost energy efficiency of district cooling systems

Its application, following a successful trial, will improve sustainability and reliability.

A new invention, the Thermal Energy Storage (TES) technology solution, could improve the energy-carrying capacity of district cooling systems (DCS), by up to three times as compared to a conventional chilled water storage system, and yield more than 10% in cost savings, annually. A trial was successfully completed, in August 2021, at one of Keppel Infrastructure's (KI) district cooling plants in Singapore, located at Changi Business Park.

The TES technology solution uses a new Phase-Change Material (PCM) that can store and release cold energy as it changes between liquid and solid states. The stored cold energy is gradually released in a district cooling plant to mitigate cooling peak loads in commercial buildings.

This solution was jointly designed and developed by the National University of Singapore (NUS) and Keppel DHCS Pte Ltd (KDHCS), a wholly-owned subsidiary of KI. The project was funded by the Energy Market Authority under its Energy Resilience Grant Call in 2018.

The NUS research team has also developed a lab-based cold energy recovery system that harnesses cold energy which is released as a by-product when liquefied natural gas is converted back into its gaseous state for electricity generation. Cold energy recovered can be stored and released, similar to an energy storage system, to balance energy demand and supply, when needed. An example is the balancing of intermittent output from renewable energy sources like solar, so as to maintain the reliability and resilience of Singapore's power grid.

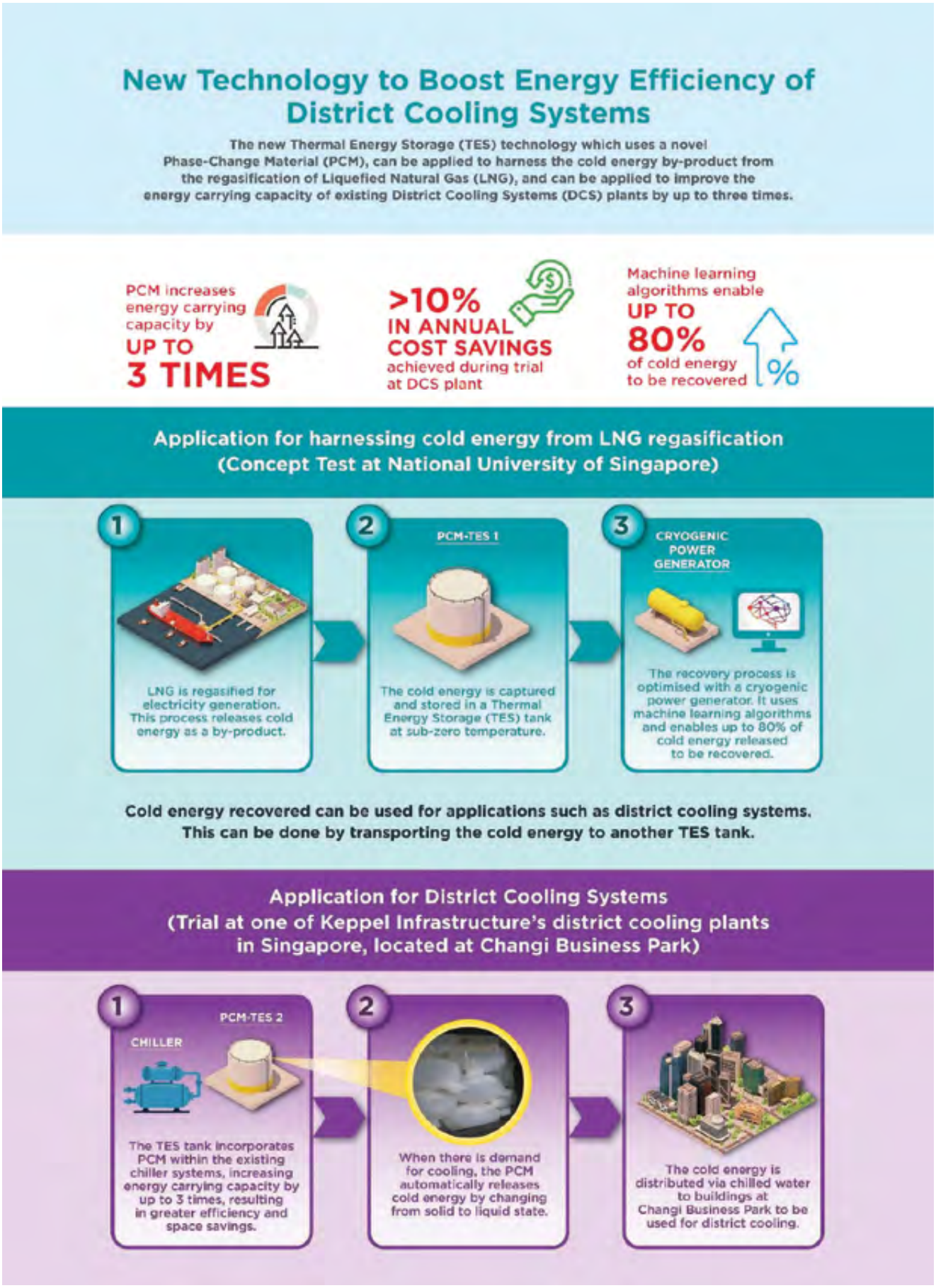
Mr Ralph Foong, Deputy Chief Executive of the Energy Planning and Development Division at EMA, said, "The close collaboration between industry, the research community and the Government has enabled the development of this innovative solution to enhance the efficiency and resilience of our energy sector. EMA is pleased to have supported this project which provides a more energy-efficient solution to meet the substantial amount of energy use for cooling in Singapore's warm tropical climate".

"TES technology can be likened to a battery that can store thermal energy and release it at the desired time. Our new TES system is specifically designed and engineered to bridge the gap between local cold energy supply and energy demand. It enables the redistribution of cold energy such that peak load demands can be met in an energy-efficient manner", said the project's Principal Investigator, Associate Professor Ernest Chua from the NUS Department of Mechanical Engineering.

Mr Chua Yong Hwee, Executive Director of New Energy at Keppel Infrastructure, said, "We are pleased to have partnered with NUS and EMA in successfully developing this new technology. This is in line with Keppel's Vision 2030 which places sustainability firmly at the core of the company's strategy".

The Phase-Change Material thermal energy storage tank. Image: Keppel DHCS.

The Phase-Change Material thermal energy storage system installed at Keppel DHCS' Changi Business Park district cooling plant. Image: Keppel DHCS.



Visual summary of the new technology. Infographic: Keppel DHCS.

Ensuring efficient use of energy and water

Mr Eric Lai

Mr Eric Lai, Regional Managing Director, Industry – APAC & Country Director for Singapore at Grundfos, a global leader in advanced pump solutions and water technology, explains how some of the major industrial challenges can be addressed, in this interview with 'The Singapore Engineer'.

The Singapore Engineer (TSE): What are the challenges and barriers faced by Singapore's industries, particularly the SMEs, in their efforts to achieve sustainable operations?

Mr Eric Lai (EL): Businesses are increasingly realising the importance of transitioning into the digital era, especially as operating sustainably is demanded by everyone, from governments to consumers. However, when it comes to embracing sustainability across their operations, one of the key barriers, especially for SMEs, is cost. To move Singapore's industries towards 'Factories of the Future' – where new digital technology and innovations in operations are incorporated to improve cost efficiency, energy and water efficiency, productivity, and quality – businesses need to reassess their processes and identify and implement these new technologies and innovations, which require a commitment of resources and investment.

While the initial cost can be seen as a barrier for some, the long-term benefits that come with embracing digitalisation goes beyond just achieving sustainability goals. Intelligent technology has the capability of aligning productivity with sustainability for industries. Automation and data exchange help to create productivity gains for the manufacturing sector, across the value chain, while saving resources by limiting material wastage and overproduction. This is in line with the circular economy model that encourages using less, more wisely.

This, in turn, drives greater cost savings across operations, substantiating the investment in the long-term. Also, as adoption of such intelligent technology becomes more widespread, we can expect the cost associated to continue to decline and the technology to become more accessible.

TSE: What are some opportunities for solution providers in the increasingly digitalised and disruptive manufacturing environment?

EL: As we see the manufacturing environment shift considerably towards digitalisation, the goal for solution providers, like Grundfos, is to help businesses effectively adopt sustainable solutions and develop tailored solutions that can create real value. How can the water industry create solutions that not only benefit businesses, customers, and the environment, but also achieve optimum management and bolster resilience for water systems in the region?

As discussed above, sustainability will continue to drive more energy-efficient solutions that tap into new and innovative technology. However, digitalisation does not stop at the product level. An efficient water system goes beyond individual components working in silos, and so solution providers need to deliver solutions that consider the entire system and how it can work together cohesively to ensure the optimisation of resources.

With increased digitalisation, solution providers will also have the opportunity to meet customer needs for prompt, efficient service, as it will minimise downtime and keep any negative impact to business continuity to a minimum. This means finding new ways to connect with customers effectively and efficiently. For example, through the Grundfos Smart Serv app, customers can locate the nearest service provider and raise a request easily through filling an online form and including a picture of the pump or system.

Lastly, we will see greater demand for pre-emptive and predictive maintenance in water infrastructure, saving precious time, energy, and costs. Through the Internet of Things, advanced real-time data collection and sensors, water networks can access information that allows them to operate in a more predictive manner, reducing downtime and avoiding serious business and environmental consequences.

TSE: What are among the technologies and solutions that Grundfos offers, that could contribute towards achieving sustainability in manufacturing?

EL: Sustainability is a very important part of Grundfos' DNA. We do business in an environmentally sustainable way and create sustainable solutions, embracing the UN Sustainable Development Goal 6 on Clean Water and Sanitation and Sustainable Development Goal 13 on Climate action.

We aim to create cleaner technologies and solutions which limit water consumption, improve efficiency, enable consumers to reduce their water and energy consumption, and increase the reuse of resources.

One of the key offerings that focuses on developing innovative and smart solutions is Grundfos' iSOLUTIONS range of products, which leverage intelligent technology to deliver optimal performance, greater energy efficiency and reliability.

iSOLUTIONS utilises intelligent pumps, cloud connectivity and digital services that can enable real-time monitoring, remote control, fault prediction and system optimisation, that help solution providers reach a new level of performance. The ability to monitor and control the system also ensures that operators can plan maintenance and avoid costly, unplanned breakdowns, thereby reducing the total service cost.

In 2020, Grundfos opened its first iSOLUTIONS lab in the region, in Singapore, to encourage the adoption of these digital solutions among our customers, ranging from utilities to building services providers and industries.

TSE: Could you elaborate on the MoU between Grundfos and Singapore Polytechnic?

EL: As part of Grundfos' efforts in supporting industries in their efforts to be sustainable, this partnership with Singapore Polytechnic will seek to co-develop water- and energy-efficient smart solutions through collaboration, talent development, and sustainability education.

The three-year partnership will focus on sustainability education and talent development in three main areas:

- A comprehensive range of solution packages, projects, events, courses, and training programmes will be rolled out to proactively promote sustainability and smart sustainability to the industry – including webinars, sharing sessions, seminars and conferences.
- Mentorship programmes, book prizes, student projects, internships, and other various programmes will be implemented between both parties to build talent pipelines and foster talent development.
- A pilot project at Grundfos' facility in Singapore will include feasibility studies followed by implementation of a rainwater harvesting system, the use of solar power as alternative power source at the facility, and the application of digital solutions in the production building. The final outcome of this pilot project will help Grundfos further reduce the water and carbon footprint of the building.

Institutes of Higher Learning (IHL) such as Singapore Polytechnic are best placed to take the lead in driving sustainability innovations, as youths have shown a growing passion for sustainability issues, as well as new and exciting ways of thinking. With this partnership, we want to be able to foster growth and development among our younger generations and spur innovative thinking that has the potential to advance Singapore's sustainability trajectory.

TSE: Which industrial sectors would the MoU address?

EL: The innovative, sustainable solutions from this partnership will be implemented across a variety of industries – from semiconductor manufacturing to food & beverage processing. Currently, these industrial processes account for 19% of worldwide water consumption.

We hope that the solutions that result from this partnership, focused on digitalisation and intelligent technology, will be capable of aligning productivity with sustainability for industries. By utilising smart technology, we can ensure industrial processes use water and energy intuitively, on-demand, and in a more efficient manner.

TSE: In his Budget 2022 speech, Finance Minister, Mr Lawrence Wong touched on the need to join the global effort in tackling climate change. What are your comments on the importance of sustainable development, moving forward?

EL: Green measures in the budget – raising the national carbon tax, issuing green bonds, incentivising electric vehicle adoption – will certainly strengthen the foundation for the country's green transition. As Finance Minister, Mr Lawrence Wong, noted, investing to achieve net-zero emissions is a cost that cannot be skimped on, given the rising risks of extreme flooding and weather events for an island state like Singapore. Digitalisation and intelligent technologies can play a key role here, and are critical for Singapore's vision of becoming a smart city state.

As Singapore looks to bring forward its net-zero emissions ambition, it is crucial to recognise that industries can play a big role in impacting the nation's carbon footprint, as the most energy-intensive sector in Singapore to-date. With these resource-reliant industries slated to grow by 50%, over the next 10 years, it is even more imperative that they operate more sustainably, by adopting new technologies to align with the national agenda on sustainable development.

To address these challenges, leveraging local talent is key, and public-private partnerships can be a tool to cultivate the next generation of innovators. Grundfos' recent partnership with Singapore Polytechnic, which I have elaborated on, earlier, is one such example. We look forward to seeing this partnership work hand-in-hand with Singapore's ongoing efforts towards achieving sustainability.

TSE: Any other information that you would like to provide?

EL: At Grundfos, we strongly believe in the power of partnership. Through working with industry partners, NGOs, governments, businesses, and academic institutions, we have expanded our technological expertise and experience throughout the years. And through collaboration, we have discovered new ideas that are ultimately turned into innovative solutions that benefit both customers and communities around the globe.

Strategic partnerships will always play a key role in accelerating our sustainability efforts, sharing, and building on each other's industry knowledge and expertise to move the industry forward.

Grundfos leverages collaboration to advance the global sustainability trajectory, and as a global water solutions leader, we will continue to actively pursue collaborations with other educational institutions, moving into the future.

Engineering the plant of the future

by Amish Sabharwal, Executive Vice President, Engineering Business Unit, AVEVA

Mr Amish Sabharwal

Digital twins are integral to the creation and operation of sustainable, efficient and future-proof industrial facilities, as they help to connect data, people and processes.

Industrial organisations across sectors, as varied as energy, power, marine, chemical, and mining, are accelerating their digital transformation projects to drive efficiency, in order to stay profitable and competitive amidst complex challenges and eroded margins.

Not only are they having to manage growing regulatory requirements and shifting market demands, priorities around energy transition and net-zero goals are also mounting, as the world responds to the challenge of climate change.

These challenges reflect an increasing need for efficient, data-driven, green facilities, which is adding pressure on industrial businesses to transform how they engineer, build and operate new and existing plants.

Industry's role in supporting a more sustainable future

This year, sustainability and the environment are at the forefront of minds more than ever before, following the United Nations Climate Change Conference (COP 26). With a reduction in the severity of the pandemic, industrial leaders have also recognised the prime opportunity to build back greener.

To navigate the necessary transition to a more sustainable future, the industrial sector must take a multi-faceted approach, from driving a circular economy through the value chain to electrification on existing plants, and growing capital investment in the areas of renewable energy, net zero technologies and carbon capture facilities.

This shift to greener plants is not just essential for a company's reputation, it has also become a prerequisite for gaining regulatory approval and securing funding, as governments put new laws in place to support more sustainable practices. It is understandable then, that the naturally cautious industrial sector has become more open to change.

According to McKinsey, digital adoption in the industrial sector grew six- to ten-fold in 2020. It cannot be denied that this was, in part, due to the pandemic which pushed many organisations to speed up their digitalisation efforts to support project stops and starts, remote work, and more agile plant operations. This acceleration also enabled them to see the many benefits digital transformation could offer in today's rapidly shifting business landscape and the opportunities to improve in the future.

Digital twins are paramount to the plant of the future

To meet the needs of the future, Owner Operators, and Engineering, Procurement and Construction companies (EPCs) need to build clear strategies that empower connected workers to drive sustainable outcomes and increase engineering efficiency and operational agility, now. One way to do this is by connecting engineering, operations and maintenance data; the people that generate and consume this data; and all related processes. When this is all done on a common platform, ideally on the cloud, organisations will realise seamless and secure data-sharing in real-time, and the ability to extract insights that can save time and money, improve safety, reduce emissions and enhance productivity for many years to come.

Valued at USD 5.04 billion in 2020, the global digital twin market is expected to expand at a compound annual growth rate of 42.7%, from 2021 to 2028, as a growing number of businesses implement them to provide actionable insights. In fact, one of AVEVA's global energy customers estimates that there are over 150 use cases for its digital twin strategy today, and the company is just getting started.

Data-centric engineering enables organisations to dramatically reduce engineering hours.

While each plant and project is different, the journey to the plant of the future will be underpinned by data-driven insights enabled by the digital twin.

Greenfield projects, primarily driven by the United Nation's push towards Net Zero 2050, will be engineered and executed using digital workflows from the start, compiling trusted engineering and asset data as the project progresses, ultimately creating the core of the digital twin. When developed early, digital twins have many uses across both the project and plant lifecycles, from providing performance insights that can only be achieved with verified, data-centric engineering data, to enhancing efficiency and project transparency across all stakeholders, on the cloud.

Meanwhile, the same data can be utilised for tracking sustainability progress, with a focus on lowering the carbon impact and reducing wasted time, costs and materials, on both capital projects and operational plants. At the end of the project, the digital twin can be seamlessly handed over and evolved to incorporate operational efficiency programmes that incorporate Artificial Intelligence (AI) and Machine Learning (ML) to extend the benefits throughout the entire life of the operational plant.

When transforming brownfield projects and existing plants into connected, digital facilities, a digital representation of the as-is facility is needed. Through laser scanning and intelligent information management, even the oldest plants can be futureproofed and optimised to run safely and efficiently, for many years to come. The resulting digital twin provides the same valuable performance insights and decision support as on net-new plants. It can be used to train workers remotely and simulate design scenarios before they are implemented. It also enables agile plant re-modernisation to keep up with future requirements.

The tangible benefits of digital transformation

By creating a data-driven culture that connects workers and information in the cloud, EPCs and Owner Operators can obtain detailed, end-to-end insights required to quickly identify opportunities to gain efficiencies and improve sustainability.

Deloitte reports that digital transformation can lead to a 5% to 10% reduction in plant build costs and a 10% to 20% reduction in operational costs – something that is backed-up by Promon Engenharia, an energy plant solutions provider in Brazil. This company was able to reduce engineering hours by 15% and implement projects 60% faster, by using digital twin and simulation tools.

Shell aggregated its engineering data on six plants, thus far, to create a common digital thread and securely deliver contextual information from a single source to decision-makers across its engineering and operations functions. This has helped the organisation drive asset reliability, enhance efficiency and reduce unplanned downtime.

Empowering businesses in new and exciting ways

Ultimately, whether built new or being given an upgrade, industrial plants of the future need to be smart, automated, efficient and connected.

Operations, maintenance, engineering and capital project stakeholders will be connected to a single, trusted hub of data – the digital twin which will break down silos, enable collaboration and facilitate smarter, faster decisions.

In the end, all this information will become the digital thread businesses use to empower operations and maintenance for many years to come – in ways we have highlighted here and in ways not yet imagined.

A data-driven culture connects workers across the enterprise with the information they need to improve sustainability and operational agility.

The energy ecosystem - technologies driving the future of e-mobility

Ms Hwee Yng Yeo

by Hwee Yng Yeo, Industry Solutions Manager, Automotive and Energy, Keysight Technologies

Recent innovations in design and test methods are presented.

Climate concerns and evolving consumer preferences are driving technology innovations for electric vehicles (EVs), as a means towards a greener transportation future.

Innovations for this expanding e-mobility market range from smart inverters that can help integrate solar energy and other distributed energy resources into the electric grid, to ultra-fast charging EV supply equipment (EVSE), and increasingly potent battery cells. These technologies help to provide range assurance and drive the adoption of EVs.

EV sales surged by 160% in the first half of 2021, from a year earlier, to 2.6 million units globally, despite the global pandemic.

Technological innovations, including better design and test methods across the electronic microcosms of power devices, converters, batteries and chargers, are just some of the developments helping to fuel the overall growth of the e-mobility ecosystem.

Let us explore some recent automotive innovations and test methods that are enabling the rolling chassis.

Double pulse test for Silicon Carbide and Gallium Nitride power devices

Within the EV power ecosystem are power semiconductors. These tiny chips help to convert power within the different systems, such as the power steering and braking, infotainment system, lighting, air-conditioning and, of course, the electric powertrain.

Increasingly, designers are switching to new wide bandgap (WBG) Silicon Carbide (SiC) and Gallium Nitride (GaN) power devices to leverage faster switching frequencies, as well as higher voltage and thermal operation ranges (Figure 1).

While WBGs improve functional efficiency and help reduce both design size and cost, they also suffer from higher switching losses due to the extremely fast oscillations, resulting in reduced efficiency of the power converter.

Power converter designers are turning to a relatively new method called the double pulse test (DPT) technique to make repeatable and reliable measurements for determining these switching losses.

Double pulse tests can help designers ensure their end products conform to industry standards, such as those set by JEDEC, a global leader in developing open standards and publications for the microelectronics industry.

Testing and saving with regenerative power

Power conversion occurs throughout the EV (Figure 2).

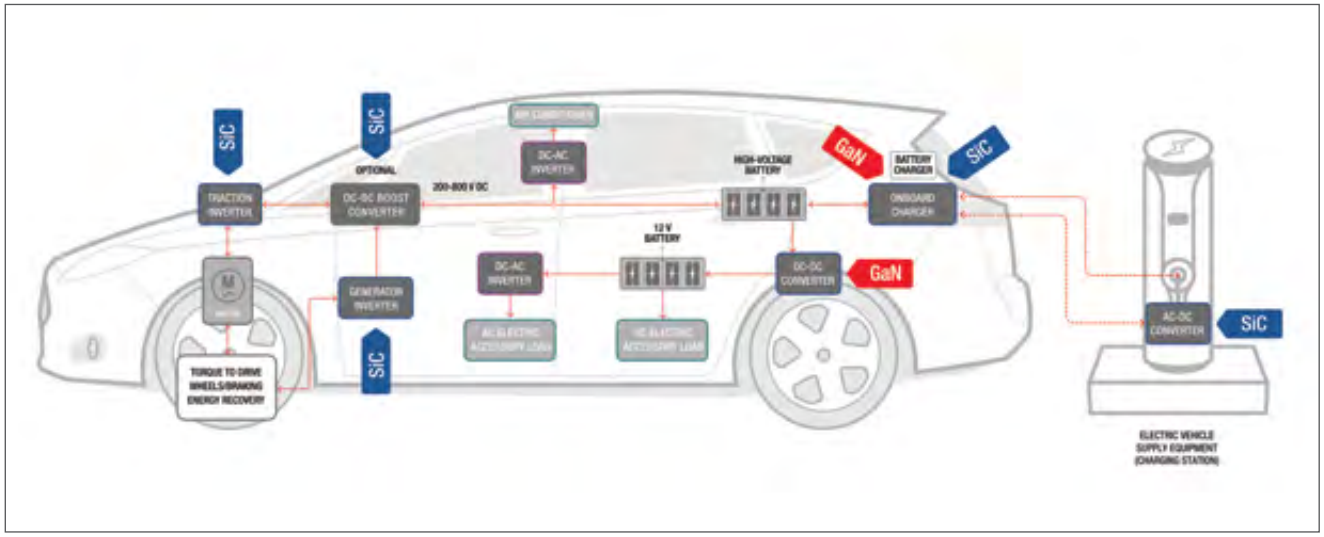


Figure 1: Silicon Carbide (SiC) and Gallium Nitride (GaN) applications in the modern EV. Image: Keysight Automotive Power Electronics Test.

Power levels in the electrified vehicle range from ~50 kW up to and over 180 kW. Most of the components in the EV support bidirectional power flow. Besides the humble 12 V battery that powers the vehicle windows and lights, today's EVs sport batteries from 280 V to 800 V.

Testing at high-power is not a simple extension of the low power testing carried out for conventional combustion engine cars.

Working with hundreds of volts, the automaker must prioritise the safety of both human and devices under test. High-power testing also generates tremendous amounts of heat, which add to air-conditioning costs.

An increasingly popular cost-down solution is to use commercially available regenerative power systems which provide bi-directional, regenerative DC or AC power. The regenerative capabilities of these power supplies allow the energy consumed to be put back onto the grid cleanly, instead of being dissipated as heat, hence saving costs of energy consumption and cooling.

Understanding cell self-discharge to make longer-lasting batteries

EV batteries have improved vastly since the early 2010s, where they supplied only 50 to 60 miles per full charge. These days, the average EV battery offers 250 miles per full charge, enough to assuage the range anxiety of most drivers.

Creating better batteries starts from an understanding of cell chemistry. A pet peeve of cell designers is the phenomenon of abnormally fast self-discharge in Lithium ion cells.

Cell self-discharge is the reduction of the stored charge of the battery even when it is not connected to any device. Self-discharge decreases the shelf life of Li-ion cells and causes them to initially have less than a full charge when used.

To detect abnormal self-discharge in Li-ion cells, developers and manufacturers have traditionally relied on measuring the drop of a cell's open-circuit voltage (OCV) over a period of several weeks or even months to get good validation results.

Having to wait this long during development results in lost opportunities, by being late to the market with new designs. This is further compounded if self-discharge testing must be repeated.

In manufacturing, storing large quantities of cells for a long time

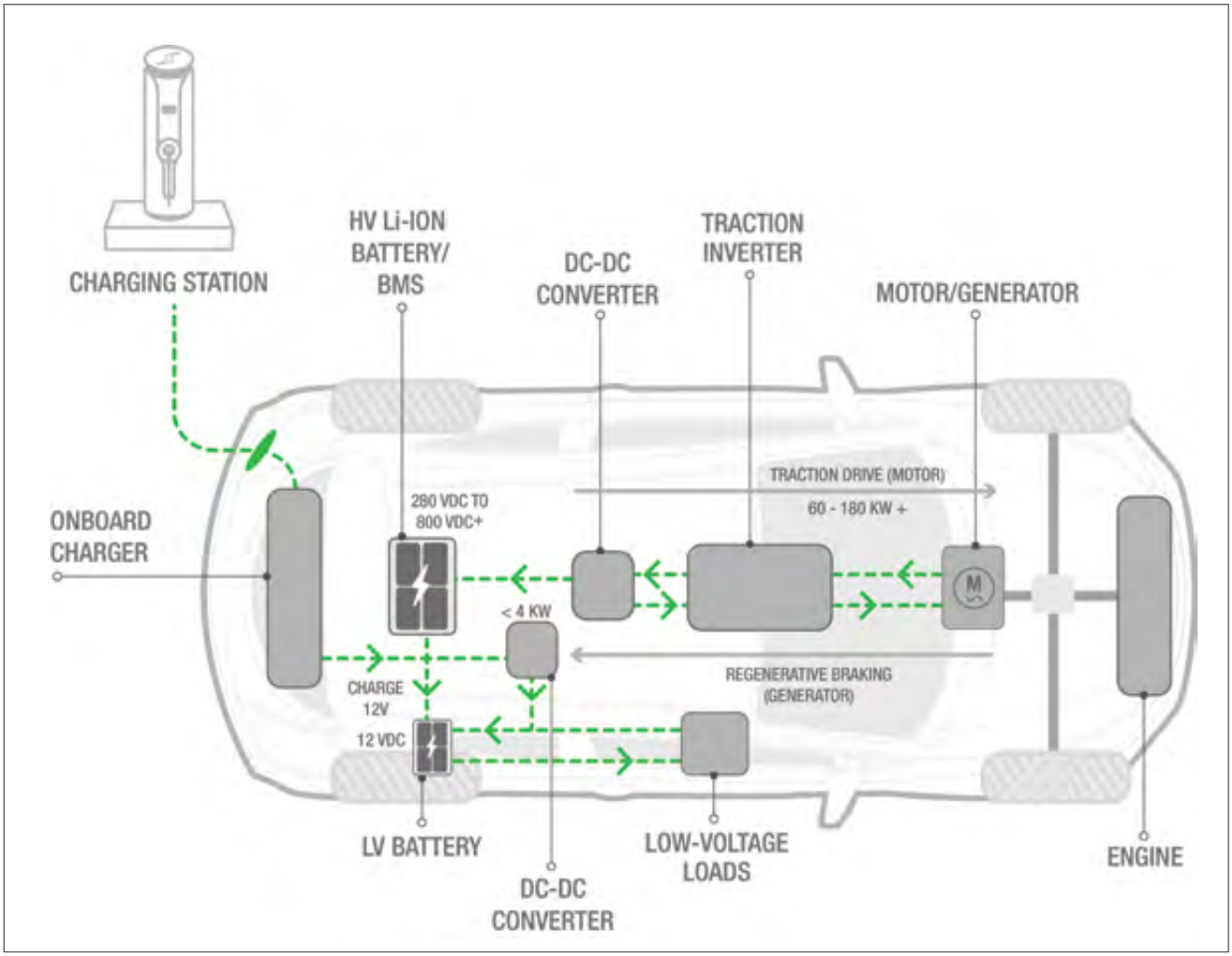


Figure 2: Simplified block diagram of power conversion in an EV. Image: Keysight E-Mobility Design and Test Technologies.

to screen them for self-discharge, presents major expenditure, logistics, and safety problems.

To address these challenges, Keysight created a 'potentiostatic' self-discharge measurement technique (Figure 3) that slashes the time required to measure cell self-discharge currents.

For smaller cells, like cylindrical 18650 or 21700 cells, developers can now measure the stable self-discharge current in as little as 30 minutes to 2 hours, depending on the cell characteristics.

For larger capacity pouch cells (e.g. 10-60 Ah), this takes as little as 1 to 4 hours. This shaves off a huge amount of test time and reduces the cost of the product development cycle, contributing to cheaper EV batteries.

Ensuring interoperability

The EV is connected to the grid via an increasingly sophisticated network of EVSE.

According to a Reuters report, there are more than 300 EV charging companies globally. Combining that with over 500 EV models, different charging modes and charging standards, around the globe, we can see why charging EVs at different charging stations is not as simple as filling up the gas tank.

To address this interoperability challenge and accelerate time-to-market, many EV and EVSE manufacturers are investing in simulation solutions that can save them time and money.

These design verifications use machines that can simulate both electric vehicles and charging stations, solving the challenges of uniquely testing a new product with different EV or EVSE models.

Creating a sustainable energy ecosystem

The automotive industry will face evolving consumer demands, such as for products to meet environment, social, and governance goals.

New test technology will need to evolve in tandem, to help develop better electronic microcosms such as power devices, converters, cells, batteries and drivetrains.

At the macrocosm level, we will see smarter grids harnessing renewable energy to power the growing fleets of EVs, and meet our ESG goals as a civilisation.

Figure 3: Results from a 4 hour test of 18650 cells using a high-performance potentiostatic analyser. Image: Keysight Li-Ion Self-Discharge Measurement Solutions.

Keysight introduces automotive software applications

Keysight Technologies Inc recently announced new automotive serialiser/deserialiser (SerDes) transmit and channel test applications, as well as an automotive adapter portfolio to verify mobile industry processor interface (MIPI) A-PHY and Automotive SerDes Alliance (ASA) standards. These solutions were developed in collaboration with Sony Semiconductor Solutions Corporation and Rosenberger.

High-speed automotive SerDes interfaces enable transport data streams to make in-vehicle video, audio and communication possible. High bandwidth, reliability and performance of SerDes serial links are key requirements in automotive applications, which enable advanced infotainment and driver-assistance systems (ADAS) in modern vehicles.

As automotive in-vehicle technologies increase in speed and bandwidth, test equipment vendors must adapt to changing standards. Tests performed by Keysight's AE2010T automotive SerDes transmitter test application enable customers to automatically configure each result utilising a Keysight Infiniium UXR-series oscilloscope. Tests performed by Keysight's AE2010L automotive SerDes channel test application enable customers to automate network analyser tests. Together, these applications provide critical information to maintain data integrity and low loss networks, while meeting current automotive SerDes specifications.

Keysight has also partnered with Rosenberger to offer customers industry-accepted adapters for automotive SerDes and high-speed data links.

Opening doors with mobile phones

Europe's newest multipurpose arena, Nokia Arena in Tampere, Finland, incorporates advanced access management.

A new era began in the heart of Tampere, Finland, when Nokia Arena opened its doors in December2021. The arena, designed by the internationally renowned architect, Daniel Libeskind, and built above the main line railway, will host large events, including the 2022 Men's Ice Hockey World Championships.

The central location of the venue in the city centre and its opening hours, round-the-clock, highlight the importance of access management. For example, it must be possible to separate semi-public, open areas from premises accessible only to employees or hotel guests. Security solutions as well as access management and control systems for the arena have been implemented by Abloy.

Nokia Arena highlights the latest security trends, with access rights becoming digital and door environments touchless. In this development, various human resource, space and access management systems, for example, are integrated. They share information to improve operational efficiency and security.

Mobile devices and wristbands as keys

In the arena, the doors are opened with access rights on mobile devices and wristbands. Electromechanical keys are also used.

A wide range of keys has been introduced. Access permits can be sent to smart devices, in which case, the door opens with the help of a mobile phone or smartwatch, immediately. In this way, for example, an ice hockey team training in the rink does not have to worry about losing the keys or returning them to the right place when the access rights expire at the end of the game. When granting access, it is also possible to determine which premises can and cannot be accessed.

Nokia Arena is designed by the internationally renowned architect, Daniel Libeskind. Image: SRV/ Libeskind/Tomorrow.

The locks are also integrated into the work shift system of the arena's restaurants. For example, when a waiter arrives at the beginning of his or her shift, the access rights granted to the person immediately take effect in the necessary premises.

Push bars for speedy emergency exit

Directing an audience of 15,000 to safety, in case of emergencies, is essential for an event centre like Nokia Arena. Accordingly, the locks on the arena doors are integrated with the fire safety system. Smooth evacuation is also ensured by ABLOY push bars. All doors and exit routes in the customer premises are equipped with push bars, also called panic bars or crash bars, so that the doors open quickly and easily when needed.

Simulations during the construction phase showed that 4,500 people can be guided away from the main floor of the arena in less than eight minutes. The entire arena can be emptied in about 15 to 20 minutes, in an optimal situation. This would not be possible without effective opening mechanisms on the exit routes.

Doors are opened with access rights on mobile devices and wristbands.

In the event of an emergency, smooth evacuation is facilitated by push bars.

"Nokia Arena is an important project for us, where together we have been able to develop completely new, technology-enabled ways of using locking solutions. We have good experiences securing similar large arenas, such as the Helsinki Olympic Stadium in Finland and the Warsaw National Stadium in Poland", said Mr Jari Perälä, Vice President, Domestic Sales and Marketing, Abloy Oy.

Automated post-processing of 3D printed metal and plastic components

Companies across many industries have come to the conclusion that additive manufacturing will make them less dependent on traditional supply chains. However, an essential pre-condition for this approach is that the post processing operations must comply with the requirements for volume production.

For over 80 years, the privately owned German company, Rösler Oberflächentechnik GmbH (Rösler), has been actively engaged in the field of surface preparation and surface finishing. The company offers a range of equipment, consumables and services, relating to mass finishing and shot blasting technologies, for a wide spectrum of different industries.

Under the brand name AM Solutions, Rösler offers numerous equipment solutions and services in the area of additive manufacturing/3D printing.

'AM Solutions – 3D post processing technology', a division of the Rösler group, and which specialises in the automated post processing of 3D printed components produced in large volumes, offers new solutions for the automated post processing and refinement of 3D printed metal and plastic components. In parallel, the division 'AM Solutions – Manufacturing service partner' supports the development and production of AM components with comprehensive services.

Additive manufacturing offers companies the potential to become less dependent on traditional supply chains and, at the same time, make their production operations more flexible and faster. However, the post-processing of 3D printed components is frequently a stumbling block against achieving these goals. On the one hand, many post processing steps still require costly manual work and, on the other hand, the post-processing operations are limited to handling single components or extremely small production lots. This does not allow compliance with the established standards for volume production, namely consistent and repeatable product quality, process control, cost-efficiency and sustainability. AM Solutions now offers new equipment that allows a way out of this dilemma.

Safe and stable post-processing of plastic components

With the new S2 system, AM Solutions – 3D post processing technology offers a continuous flow shot blast machine for post processing of 3D printed plastic components produced with powder-bed printing systems. The ATEX-compliant plug-and-play machine was designed for round-the-clock, three-shift operation, and is equipped with interfaces allowing its integration into interlinked manufacturing lines.

The work pieces are loaded into the machine as complete print jobs. The loading takes place either by hand or automatically. Once in the machine, the plastic components gently pass through a special feed loop belt, in single piece flow. The tumbling action of the components ensures that they are equally blasted from all sides so that any residual powder is consistently and completely removed from the component surface. Depending on the utilised blast media, the work piece surface can also be homogenised and/or peened. The machine can be equipped with up to four blast nozzles. The number of blast nozzles, the blast pressure and the transport speed, can be individually adapted to the respective work pieces. These process parameters can then be stored in the control panel as individual processing recipes. On average, a print job requires cycle times of 15 minutes to 20 minutes. Depending on the condition of the raw work pieces, the Ra surface roughness readings can be reduced by up to 13 µm.

To ensure that the blast media remains at a consistently high quality, the compact shot blast machine is equipped with an effective blast media cleaning and recycling system. This, in combination with the integrated electronic reporting tool, guarantees repeatability of the blasting results, complete process control and a high cost-efficiency of the post processing operation. A patent application covering the machine and the process is pending.

Eco-friendly chemical surface smoothing and application of a colour dye

The C2, presented as a concept solution, illustrates that AM Solutions - 3D post processing technology has its origins in the development and production of machinery and consumables for volume production. This patent-pending innovation enables fully automatic chemical surface smoothing of 3D printed components made of common polymers and elastomers (including TPU) in series. Thus, the costly single piece handling of the work pieces is eliminated for this post-processing operation. The bounding box allows the processing of work pieces with dimensions ranging from 10 mm x 10 mm x 10 mm to 300 mm x 300 mm x 300 mm and a wall thickness of at least 2 mm.

In addition, the process includes a newly developed, non-hazardous processing media that was specially developed by AM Solutions – 3D post processing technology. This ensures that the surface smoothing operation is eco-friendly and that the subsequent waste disposal is not subject to any environmental restrictions and is cost-effective.

The C2 chemical surface smoothing system, for which a patent application is pending, can be

retrofitted for applying a colour dye on plastic components. The C2 is expected to be commercially available in the first quarter of 2022.

Specially developed wet blast system for 3D printed components

Wet blasting has been a well-established and efficient surface refinement process for metal or plastic components produced in large volumes. With the S1 Wet system, AM Solutions – 3D post processing technology has adapted the benefits of this surface treatment method to the specific requirements of additive manufacturing. The flexible S1 blast system can be used for cleaning as well as surface homogenisation and smoothing of a wide array of work pieces.

A key feature of this technology is that the blast media and process water are mixed together to create a slurry. Depending on the initial surface roughness of the work pieces, their Ra readings can be significantly reduced. To a certain extent, this is even possible on internal surface passages and cavities. Since the water in the slurry creates a protective layer on the components, the process is gentle. It also prevents media particles from penetrating the surface of components made from plastic and soft metals. Another advantage of the wet process is that it maintains the dimensional integrity and prevents the warping of delicate work pieces with complex shapes and thin walls. Wet blasting also prevents the creation of dust and, therefore, requires no protective ATEX accessories.

Another feature of the compact, plug-and-play S1 Wet system is its small footprint. On a space of only 2.6 m², it offers everything that is required for an efficient and sustainable operation. Integrated into the machine is not only the control panel but also the monitoring of the blasting system (to ensure a repeatable process) as well as the air filter unit and the waste water management system. The discharged wastewater flows into a settle tank to collect most of the sludge. This sludge-type material can be further de-watered by an optional process water cleaning and recycling system integrated into the S1 machine. This reduces the water consumption and waste disposal costs significantly.

The S2 is a continuous flow shot blast machine for the post processing of 3D printed plastic components produced with powder-bed printing systems. It allows the simultaneous cleaning and surface finishing of the work pieces in a continuous flow operation.

The C2 system facilitates fully automatic chemical surface smoothing of plastic components printed from standard polymers and elastomers (including TPU) in series.

Additional equipment options, adapted to the respective processing tasks, allow the use of the S1 Wet, in applications ranging from the manual treatment of single components to the fully automatic processing of complete work piece batches.

The wet blast system, S1 Wet, permits not only the removal of residual powder but also the surface finishing of 3D printed metal components.

AM Solutions – Manufacturing service partner

AM Solutions – Manufacturing service partner specialises particularly in services related to additive manufacturing. The range of services covers the entire AM process chain and is also designed to meet the requirements of series production. To this end, the Italian-based company covers all phases of the product creation process, from the basic conception and testing of the product idea, through technical and economic feasibility studies, product development and the creation of prototypes, to large-scale production, including post-processing.

The aim is to exploit the advantages of additive manufacturing in a component-specific manner, through the optimal use of advanced technologies and comprehensive know-how, so that innovative parts are created in significantly shorter development and time-to-market periods.

All images by AM Solutions – Rösler Oberflächentechnik GmbH

Aerotech introduces two-axis laser scan head

Aerotech Inc, a global leader in precision motion control and automation, has released the AGV-XPO, a high-dynamic, two-axis, laser scan head that combines low-inertia, high-efficiency motors with ultra-high resolution position feedback and optimised structural dynamics, to deliver rapid acceleration profiles and good part-profile tracking with minimal following error.

The AGV-XPO is ideal for high-throughput applications that require superior dynamic precision, minimal following error and rapid move-and-settle performance, including display processing and manufacturing; high-speed drilling and cutting; electronics manufacturing; large-field and long focal length scanning; and femtosecond laser processing.

Key features include:

- Increased process throughput with dynamically optimised design.
- Superior dynamic accuracy and improved process yield with high resolution feedback.
- Enhanced thermal stability with optional air- and water-cooling.
- System design flexibility with a range of optical configurations.
- Easy synchronisation with other motion axes for seamless integration and ease of use.

The AGV-XPO is a high-dynamic, two-axis, laser scan head.

High-precision uniform material coating of bore holes and internal threads

Combined with different ViscoTec dispensers for material feeding, the Rotorspray vipro-SPIN enables volume-dispensed application of adhesives or viscous greases in bore holes or internal threads. The desired amount of material to be dispensed is applied in precisely defined quantities and with repeatable accuracy all round. The internal contours are wetted evenly and over a wide area. This is a non-contact application. Due to the conical inner geometry of the spinner head, it is possible to use the Rotorspray in both vertical and horizontal orientations.

The vipro-SPIN is suitable, for example, for low to high viscosity lubricants, greases and anaerobic or other adhesives. A total of four different spin heads are available for flexible coating of interior cylindrical surfaces with diameters of approximately 16 mm to 50 mm. A plug-in cable, available in different lengths, allows the Rotorspray to be easily integrated into various control unit systems.

The vipro-SPIN can be used when adhesives or other viscous materials are introduced into bore holes, internal threads, or ball bearings. Another possible application is in making a shaft-hub connection. This is of particular interest, for example, in automotive engineering, engine construction, or other industries such as vacuum cleaner manufacturing.

Continuous spray pattern

A volume-dispensed application is possible with the Rotorspray. This means that the volume can be precisely defined via the dispenser, and the layer thickness of the material application is continuously uniform. Over- or under-dispensing is avoided by using a volumetric dispensing system instead of a time-pressure system.

The ability to set and spray different volumes on one component offers a further advantage.

Additional features

The Rotorspray can be used to spray two-component materials, if required, in addition to single-component materials. The adhesive system or other two-component materials are mixed and fed to the vipro-SPIN and applied by it to the component. Simple and fast disassembly of the spinner head or the dispenser itself allows uncomplicated cleaning of the components.

Rotorspray with RD dispenser during a spray test in the ViscoTec technical centre.

Intelligent signal technology from WERMA

WERMA is a leading international company producing optical and audible signal devices and process optimisation systems. The signal devices warn, guide and protect people around the world. The company's solutions make working environments safe, processes more efficient and protect people working with machines, at manual workstations, in factory halls or in buildings.

According to the company, its modular signal tower has been the industry standard for almost 30 years and the company has now developed networked, intelligent system solutions for process optimisation.

eSIGN

The new eSIGN signal tower is described as a breakthrough and is the result of WERMA's continual technological progress. This signal tower sets high standards in terms of individuality and flexibility, with its full-surface signalling, industrial design and features.

The eSIGN is a signal tower with visibly improved performance – more colours, more effects and more individuality.

Thanks to the modularity of its electrical components, combined with the latest LED technology, different signalling modes can be produced using multiple colours, brightness levels and light effects – from the classic traffic light display to fully customised options. Variable fill-level displays or full-surface signals can also be generated, using this signal tower.

WERMA process optimisation systems

WERMA offers solutions that make Industry 4.0, digitisation and networking tangible, accessible and ready for practical implementation.

The company's wireless process optimisation systems for industry, production and shipping logistics link machines and workstations via radio communication. They are simple, retrofittable and ready-made solutions for reducing downtime and controlling automatic material replenishment.

Included are the following:

- SmartMONITOR – A smart alternative to machine data acquisition systems for manufacturing companies.
- AndonSPEED – An Andon system for optimising processes in shipping businesses.
- AndonWIRELESS – Freely configurable, professional call-for-action system for optimising processes in production, logistics and manual workplaces.

WERMA signalling devices make working environments safe and processes more efficient.

EXPLORING THE FUTURE OF ENGINEERING – INDUSTRIAL REVOLUTION 4.0

The seventh webinar in the Young Engineers Career series, titled "Future of Engineering – Industrial Revolution 4.0", took place on 17 January 2022. Dr Bicky Bhangu, President for South-East Asia, Pacific, and South Korea at Rolls-Royce, was the main speaker for the event.

Dr Bhangu began by introducing Rolls-Royce's operations across the world, which are organised into three key businesses: Civil Aerospace, Defence and Power Systems. While pivoting away from fossil fuels, the company is opening up new growth opportunities and markets, in order to achieve its goal of becoming a carbon-neutral business by 2050.

Technology is an important enabler for the transition to a low carbon economy, he said. For example, data analytics and AI are being used to build smarter, more efficient jet engines. This is supported by data collected from digitalisation processes, which also can help improve customer care, improve operational efficiency, and upskill the workforce.

Advances in sensors, machine learning, AI, Robotics and 3D printing are some of the technologies that are coming together to create new insights, processes and opportunities.

He further elaborated on Rolls-Royce's three pillars for achieving net zero in the civil aerospace business. These are: Improving system efficiencies, accelerating the use of sustainable aviation fuels, utilising alternative technologies such as electricity and hydrogen to power next-generation aircraft.

During the Q&A, many questions were raised regarding the issue of technology replacing human jobs. To that end, Dr Bhangu felt that instead of complete replacement, it was more of an evolution of their roles. He mentioned that at Rolls-Royce, the company invests in their engineering staff at all levels to help them adapt to the world of Industry 4.0 across the entire value chain of activities.

On the future of manufacturing, Dr Bhangu noted that companies needed to plan ahead and have a holistic adoption strategy across their products and services, while staff will need to be equipped with digital skillsets. Lastly, an awareness of how the evolution of the supply chain can impact business would also be useful to the company.

With more than 360 registrants from 14 countries, both practicing engineers and students, this webinar is the most popular to date for this series.

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