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APUEA

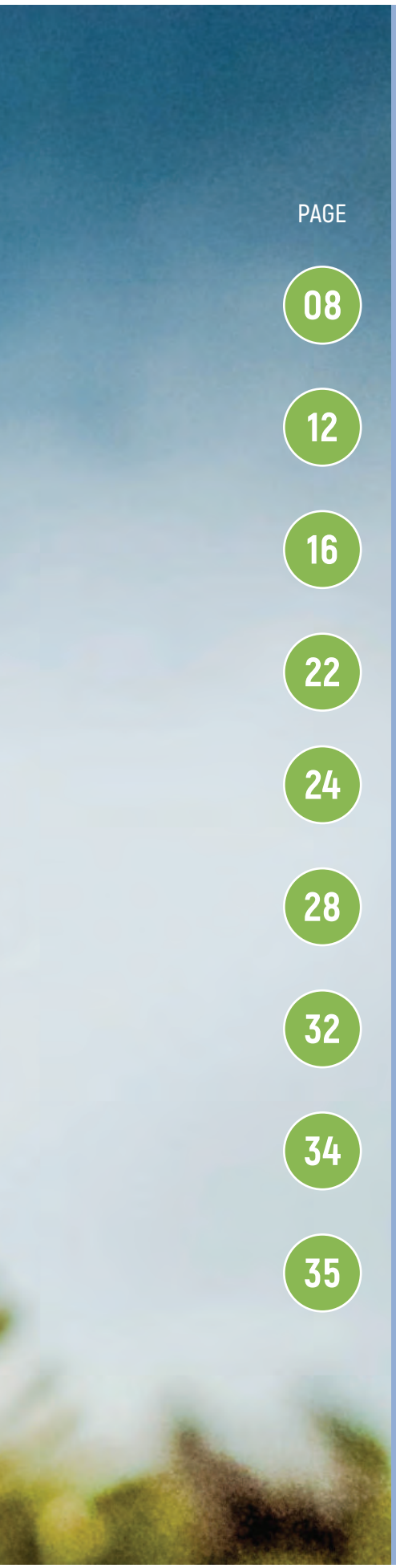
Magazine

LOW CARBON URBAN ENERGY

www.apuea.org

APUEA
Asia Pacific Urban Energy Association

Promoting Sustainable Urban Energy in Asia Pacific



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Editorial

For the first time since the industrial revolution, more coal power plants around the world came offline than were approved. Every two weeks, financial institutions around the world are restricting or divesting from coal. UOB is the third big bank in Singapore to quit coal in 2019, after ICBC and DBS Bank. Asian Development Bank, which has been restricting coal since October 2018, is hosting its annual Asia Clean Energy Forum (ACEF) at the ADB Headquarters in Manila from 17-21 June 2019. The transition towards sustainable cities has begun for real as the world acts on climate change.

In May, EU citizens voted for their candidate to the European Parliament. Despite challenges in recent years, the turnout was the highest since 1994, and global warming was high on the agenda. While "The Greens" increased by over 30%, other parties have also realized that the EU-project is an important platform to jointly address the climate crisis. Climate change has raised on the EU agenda, following trade, peace, and other traditional subjects.

While momentum is built up, APUEA is working hard on supporting cities across the Asia Pacific to take advantage of the movement and learn more how to develop sustainable and resilient cities. We see an increasing number of invitations to support events with a focus on sustainable energy and share our insights from the Asia Pacific markets. This year, we are hosting or supporting one event per month on average, promoting sustainable energy in cities across the Asia Pacific. The events are taking place in China (inc. Hong Kong), France, India, Malaysia, the Philippines, Singapore, Thailand, and the United States.

In the second quarter of 2019, the APUEA secretariat has expanded further to serve our members better and ultimately the cities in the APUEA focus markets: China, Southeast Asia, and India. In China, Ms. Xiawen Fan has been engaged as Marketing Manager, and in India, Mr. Ankit Kamra has been appointed India Representative. Now, APUEA has a local presence in Bangkok, Beijing, and New Delhi, which enables us to further intensify the communication and activities with cities and other relevant stakeholders in our focus markets and across the Asia Pacific.

APUEA will co-host a Deep Dive Workshop on "Integrated solutions for liveable cities in the Asia Pacific: Multi-Energy Systems and Sustainable Buildings" on June 19th during Asia Clean Energy Forum. The Deep Dive Workshop is co-hosted with Asian Development Bank (ADB), United Nations Environment, and the District Energy in Cities initiative (UN DES). Before the Deep Dive Workshop, APUEA will host its Annual General Meeting where all APUEA members are invited. A summary of the previous year's activities will be presented, and the plan for the year to come will be revealed.

In this issue of the APUEA Magazine, you can read about RE and sustainability in Australia, city-level GHG emission frameworks in India, Intelligent Energy Systems utilizing AI and Smart Mobility, and a successful District Energy project in Sidney applying the BOOT business model.

Once again, we would like to express our appreciation to our founding members **ABB**, **Engie**, and **Johnson Controls**, who have committed to developing the association since the establishment of APUEA in 2017. Finally, we would like to thank all our Active, Allied, and Affiliate members for their commitment to supporting cities in the Asia Pacific to develop sustainable urban energy.

Mikael Jakobsson
Executive Director,
Asia Pacific Urban Energy Association (APUEA)

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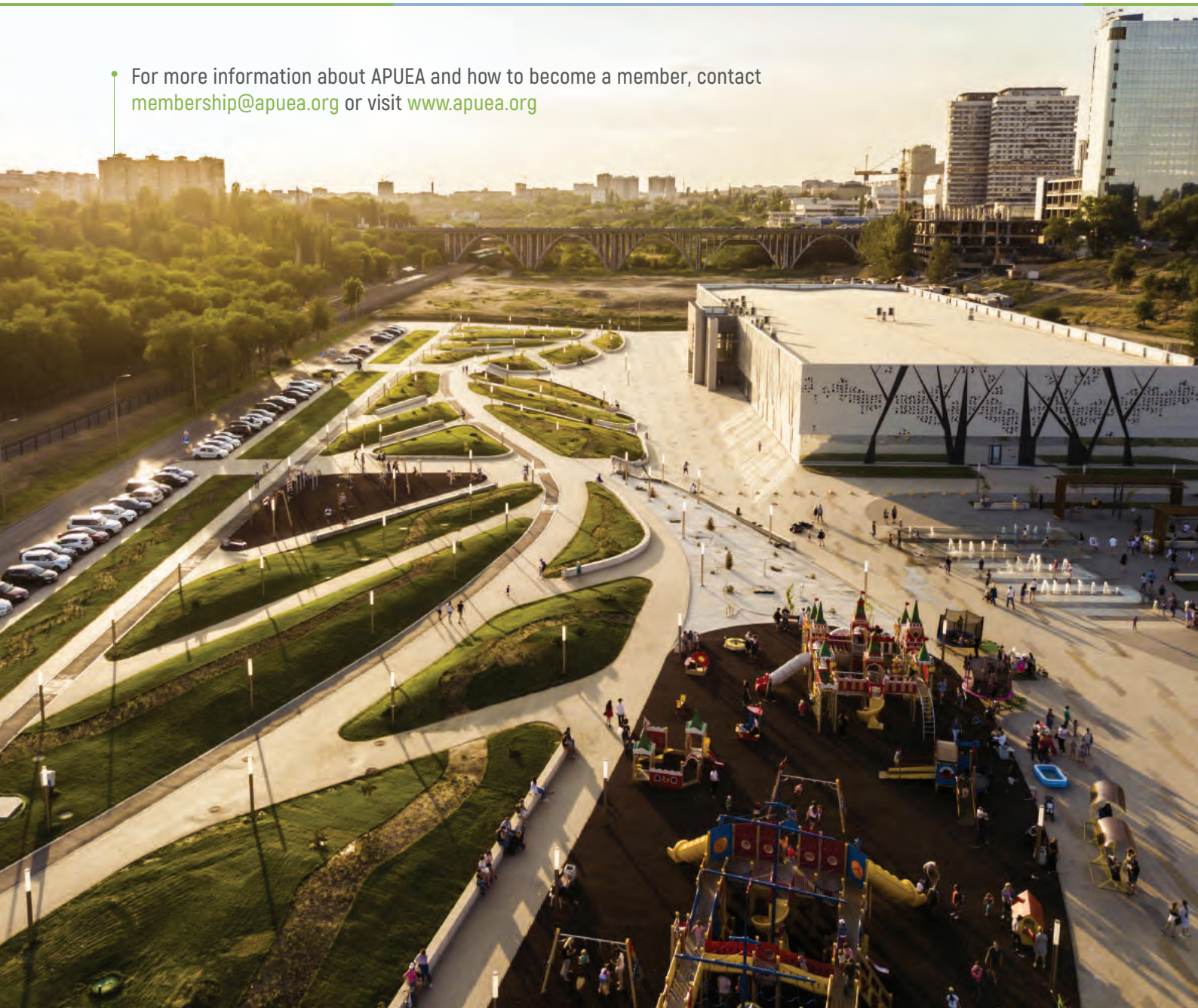
APUEA
Asia Pacific Urban Energy Association

Asia Pacific Urban Energy Association

The APUEA is an initiative of the International Institute for Energy Conservation (IIEC) that promotes the development of sustainable Urban Energy Systems in the Asia Pacific region. The APUEA platform promotes public and private sector collaboration to develop sustainable urban energy systems that support livable cities across the Asia Pacific region. The Association's online portal serves as an information hub to support city policymakers, program managers, and other stakeholders in the design, development, and implementation of sustainable urban energy systems. Through this portal, APUEA events, conferences, and continuous outreach to its members, the Association shares international and regional best practices for planning and implementing sustainable urban energy systems–including policies and regulations, business models, and technologies for implementing district heating and cooling, smart grids, energy efficiency improvements, and renewable energy systems.

An APUEA membership will provide a unique opportunity to liaise with governmental agencies and important stakeholders and get access to valuable information and intelligence on urban energy developments, business opportunities, trends, and financing in one of the fastest growing energy and infrastructure markets in the world. Membership benefits include a marketing platform, newsletters, APUEA Magazine, Annual Publications, Annual General Meeting including Trade Exhibition and Direct Assistance.

- For more information about APUEA and how to become a member, contact membership@apuea.org or visit www.apuea.org



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ASIA PACIFIC URBAN ENERGY ASSOCIATION MEMBERSHIP

The Asia Pacific Urban Energy Association (APUEA) is a platform to collect and disseminate knowledge, best practices, and tools related to the development of sustainable urban energy systems, and thereby support the development of livable cities in the Asia Pacific region.

APUEA serves a broad range of members including but not limited to utilities, manufacturers, investors, engineering companies, donor agencies and sector associations that are active in the urban energy sector. Members can choose among several membership categories, depending on their sector and level of engagement in APUEA.

APUEA Membership categories are:

ACTIVE MEMBER

Member that benefits from the Association and take an active role in the Association in terms of its governance and operation. An Active Member will be able to influence the scope of APUEA publications and will be recognized in published material from the Association.

ALLIED MEMBER

Member that benefits from the Association and chooses not to take an active role in the Association in terms of its governance and operation.

AFFILIATE MEMBER (Invitation only)

Individual or agency invited by the Association to participate as an individual member; and entities such as regional NGOs, development agencies, and utility organisations. An Affiliate Member benefits from the Association but does not take an active role in the Association in terms of its governance and operation.

The annual membership fee depends on the membership category and organization size:

Member Category	Employees		
	≤ 1,000	1,000 - 10,000	≥ 10,000
Active Member	USD 4,000	USD 5,500	USD 7,000
Allied Member	USD 3,000	USD 4,500	USD 6,000
Affiliate Member	N/A		

BENEFITS

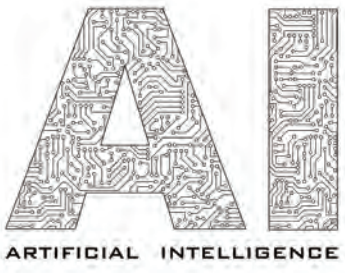
- Online Portal (www.apuea.org)
- Newsletters
- APUEA Magazine
- Publications
- Direct Assistance
- Regional and International Events
- Annual Meeting and Trade Exhibition

AI in Energy: Key Use Cases for an Optimized and Intelligent Energy System

By Yuan-Sheng Yu, Senior Analyst, Lux Research

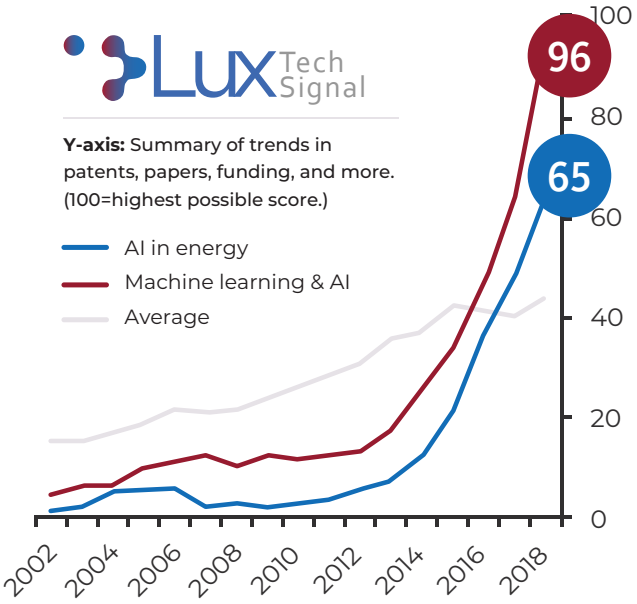
> **THE LUX TECH SIGNAL PROVIDES A HOLISTIC PICTURE OF HOW MUCH INNOVATION IS HAPPENING IN A GIVEN TECHNOLOGY OVER TIME, OBJECTIVELY AND CONSISTENTLY MEASURED BY A COMPOSITE SCORE – INNOVATION INTEREST**

Hype surrounding artificial intelligence (AI) reached new heights last year with more than $25 billion in venture capital funding pouring into AI startups globally and tech companies, small and large, rebranding themselves as AI-first companies. The potential of trained computer programs that can interpret and derive insights from vast amounts of multi-dimensional data has all innovation indicators pointing towards a massive amount of interest in AI technologies.

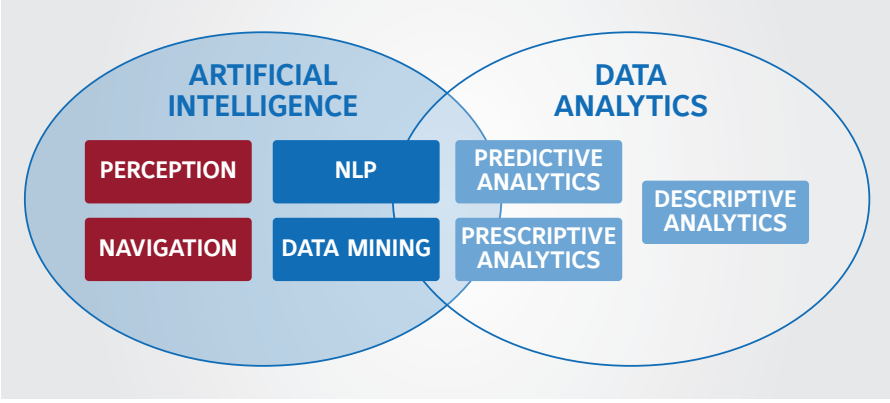


Lux Tech Signal

The Lux Tech Signal (see footnote for methodology) provides a holistic picture of how much innovation is happening in a given technology over time, objectively and consistently measured by a composite score – Innovation Interest. AI ranks as the top emerging technology in 2019; even the specific application of AI in energy is seeing a similarly rapid rise.



Unfortunately, AI is a difficult term to classify. For starters, the term intelligence does not have a universally agreed upon definition, let alone the artificial version. Some use AI to describe artificial general intelligence (AGI), an intelligence capable of completing a wide range of tasks like human intelligence, while others use AI to describe narrow AI, an AI that can perform a single task or a few tasks with high competence. The term AI is incredibly broad and has only grown broader in the past few years with applications of AI increasingly overlapping with the closely related field of data analytics. For this article, we view AI with a wide lens, including abilities from natural language processing (NLP), visual and auditory perception to data mining to predictive analytics and prescriptive analytics.



To illustrate AI's broad potential and diverse use cases, we highlight key use cases for AI in three areas of the energy value chain – planning and design, operations, and customer engagement.

- **Planning and designing the ideal system**. Wind and solar farm layout optimization allow a project developer to determine the optimal arrangement of wind turbines and solar panels to maximize power production and minimize capital costs. This can achieve several-percentage-point improvements in the levelized cost of energy – enough to transform a project that would otherwise be unattractive into a strong opportunity. While a classical optimization problem with factors such as placement, spacing, and height, weather forecasting algorithms powered by AI play a critical role in informing these decisions. Grid planners will also rely heavily on AI to improve forecasts and data mining collected from connected sensors in their network to assess the likelihood and extent of many potential future stressors on the grid. Such as the impact of an increasing renewables capacity as well as future electric vehicles charging.

- **Optimizing and automating operations**. Some utility scale solar PV plants use trackers to angle the panels toward the sun over the course of the day to increase electricity production. Tracking optimization relies heavily on algorithms to determine the best arrangement of panels based on high-resolution weather AI forecasting that continues to improve tracking as well as considering the influence panels have on each other. Predictive maintenance in grid applications will also leverage AI to identify indicators of failure and forecast future equipment lifetime through analyzing operational data, weather and environmental data, and past maintenance data to alert maintenance planners of impending failures in poles, power lines, and substation equipment – reducing downtime. In addition to optimizing, AI will increasingly play a role in active network management by forecasting and adjusting flexible assets, such as generators, batteries, and flexible loads with no operator involvement.

- **Personalizing customer engagement.** Home energy monitoring tools tracking energy consumption over a period of time often provide data per appliance via load disaggregation to the homeowner. Load disaggregation requires AI to identify individual appliances from the signal commonly sensed from the main electrical panel. This application of asset monitoring is not only about providing personalized information accessible, but also about uncovering invisible insights. To further personalization, AI enables user preference matching in peer-to-peer energy trading. Many implementations allow for users to specific the source of its energy all in the spirit of providing personalization to best satisfy consumers.

Despite the flood of venture capital investments and AI initiatives popping up left and right, many are still rushing to developing AI solutions for the sake of developing an AI project. Unfortunately, this is unlikely to change as AI hype remains strong with AI becoming even more accessible to everyone. Taking a technology-first approach will lead to many glorious failures in the coming years. To reduce the

likelihood of an AI failure, start with the end in mind by determining the problem and outcome to solve for and instead focus on the return and value that the solution provides as we gradually progress towards an optimized and intelligent energy system.

The Lux Tech Signal is based on analysis of innovation data including patents, academic papers, venture capital funding, government funding, and Lux Research proprietary data. The Innovation Interest score is calculated by analyzing multiple, diverse datasets weighted based on our evaluation of the role innovation sources play in each stage of commercial technology development; empirically tested and validated against real-world historical data. The maximum possible score is 100, indicating the highest observed rate of research, patenting, funding, news, and more.

Lux Research

Lux Research is a leading provider of tech-enabled research and advisory solutions, helping clients drive growth through technology innovation. A pioneer in the research industry, Lux uniquely combines technical expertise and business insights with a proprietary intelligence platform, using advanced analytics and data science to surface true leading indicators. With quality data derived from primary research, fact-based analysis, and opinions that challenge traditional thinking, Lux clients are empowered to make more informed decisions today to ensure future success.

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At the current rate of fossil fuel usage will soon lead to an energy crisis. The necessity of both the government and the private sector to plan, move forward, energy to a sustainable future. Under Thailand Power Development Plan: PDP 2018-2037, the PDP sets a goal of new power capacity of 56,431 MW, of which renewable energy projects are planned to account for 20,766 MW, or about 37 percent by 2037.

The PDP also allows solar panels to be installed on private property and surplus power to be sold to Electricity Generating Authority of Thailand (EGAT). EGAT will purchase at least 100MW of solar power a year in the next 10 years After the new PDP is enacted, four other plans will soon be drawn up and implemented: oil management, natural gas supply, alternative energy development, and energy savings & efficiency. All plans will be integrated in the energy blueprint under the country's energy reform plan.

Source: Bangkokpost.com

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ABB puts the charge into world's first 12-metre fully electric autonomous bus

By ABB

ABB OFFERS THE FULL RANGE OF CHARGING SOLUTIONS FOR ELECTRIC CARS, ELECTRIC AND HYBRID BUSES AS WELL AS ELECTRIFICATION SOLUTIONS FOR SHIPS AND RAILWAYS

Launch of trailblazing electric bus project in Singapore

The world's first 12-metre fully electric, autonomous 40-seater bus was unveiled today at Nanyang Technological University (NTU) in Singapore where two of ABB's Heavy Vehicle Chargers (HVC) have been delivered to make this vision a reality.

The project is part of an ongoing collaboration between NTU, the Land Transport Authority (LTA) and Volvo Buses to develop autonomous bus technologies. This phase, which includes self-driving bus trials, demonstrates the ability to provide fixed route and scheduled services similar to existing public bus services in Singapore. ABB is a key industry partner of the project, helping Singapore to make another major step towards sustainable mobility.

ABB's HVC 300P fast charging system delivers 300 kW DC power and will recharge a battery in three to six minutes. It is based on OppCharge, an open interface for DC electric bus charging, which is now being used in Singapore and across Asia Pacific. Using a pantograph mounted on the charging infrastructure for end-point charging, set up at a bus stop or depot, it allows buses to be charged at the end of the line, without impacting the normal operation of the route.

Tarak Mehta, President of Electrification Products division said: "ABB is at the forefront of developing smart and sustainable transportation solutions. We have pioneered the creation of flexible and high quality electric charging systems that enable the development of cleaner, more efficient and cost effecitve solutions.

"We are delighted to be involved in this landmark project in Singapore and hope this will mark a positive step toward greater electrification of public transport solutions across the region, where traffic emissions have been identified as a major concern in fast-developing cities."

One of the autonomous electric buses will be used at the Centre of Excellence for Testing and Research of Autonomous Vehicles (CETRAN) – Singapore's advanced new test facility at the NTU campus – where researchers will test new functions and study how the bus interacts with other road-users. The second bus will be used for tests in a bus depot, in partnership with SMRT.

ABB: powering firsts for electric mobility

Firsts are deeply etched in ABB's DNA, with an R&D culture that is continually advancing pioneering technologies. This is particularly evident in the field of electric mobility. ABB was one of the founders of both the CHAdeMO and CCS alliance charging standards, launched the first DC fast charger in 2010, the first nationwide DC charging networks in 2012 and the first eBus charging networks in Europe in 2016. Today, ABB's is the world leader in electric vehicle infrastructure.

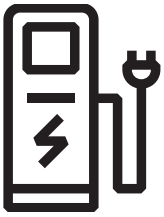
ABB offers the full range of charging solutions for electric cars, electric and hybrid buses as well as electrification solutions for ships and railways. ABB entered the EV-charging market back in 2010, and today has an ever-growing global installed base of 10,500 ABB DC fast chargers installed across 73 countries, more fast chargers than any other manufacturer. ABB's installed base includes its Terra high power chargers, capable of adding 200km of range to an electric vehicle in just 8 minutes.

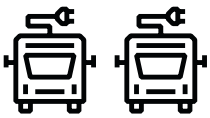
Fortune Magazine recently ranked ABB #8 on its list of companies that are "changing the world" for the advances it has made in e-mobility and electric vehicle charging. In its role as title partner of the ABB FIA Formula E championship and as Official Charging Partner for the new Jaguar I-PACE eTROPHY series, ABB extends its commitment to support and expand the future of smart and sustainable transport.

ABB (ABBN: SIX Swiss Ex) is a pioneering technology leader in electrification products, robotics and motion, industrial automation and power grids, serving customers in utilities, industry and transport & infrastructure globally. Continuing a history of innovation spanning more than 130 years, ABB today is writing the future of industrial digitalization with two clear value propositions: bringing electricity from any power plant to any plug and automating industries from natural resources to finished products. As title partner of Formula E, the fully electric international FIA motorsport class, ABB is pushing the boundaries of e-mobility to contribute to a sustainable future. ABB operates in more than 100 countries with about 147,000 employees.

ABB puts the charge into world's first autonomous electric passenger bus

The world's first electric, fully-autonomous 40-seater bus has been unveiled at Nanyang Technological University (NTU) in Singapore where two of ABB's Heavy Vehicle Chargers (HVC) have been delivered to make this vision a reality.





The system will charge **two all-electric 12-meter Volvo 7900 Electric buses**

300 kW DC power

ABB's **HVC 300P** fast charging system delivers 300 kW DC power and **is based on OppCharge**, an open interface for DC electric bus charging, which is now being used in Singapore and across Asia Pacific.

3-6 minutes

Using a pantograph mounted on the infrastructure for end-point charging, set up at a bus stop or depot, **it allows buses to be charged in three to six minutes at the end of the line, without impacting the normal operation of the route.**

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The second bus will be used for tests in a bus depot in partnership with SMRT, **the public transport provider in Singapore.**

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Focused on digital transformation upgrades and customer engagement	Focused on optimising power plants and large scale renewable power programs	Focused on implementing smart grids with a focus on grid edge integration	Focused on promoting deep solar power penetration within Malaysian and ASEAN	Focused on financing the energy transition

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Accelerating Low-Carbon Development in Cities – Methods and Measures

By International Institute for Energy Conservation (IIEC)

> **LOW CARBON DEVELOPMENT IS FUNDAMENTAL TO DESIGNING SMART CITY FRAMEWORKS AND ONE OF THE MOST SIGNIFICANT DRIVES OF THE INDIAN GOVERNMENT**

Cities around the globe are rapidly growing due to increasing population resulting in escalation of energy consumption and sources of global greenhouse gas (GHG) emissions. Increasing pressure on fuels, resultant GHG emissions and its adverse impacts on environment have prompted cities around the globe to take proactive steps like identifying and accounting of GHG emissions and subsequently creating an action plan for reducing GHG emissions.

In Indian context, there is an incessant impetus on climate change mitigation and adaptation as India is highly susceptible to the adverse impacts of climate change considering its vast population, rapid urbanization, agrarian economy, expansive coastal areas, the Himalayan region and islands. As per UN World Urbanization Prospects the urban population in India in 2011 was 377 million which is expected to reach 609 million by 2030. As a result of increasing urbanization and rapid economic growth, the cities in India are growing a parallel increase in demand for energy and infrastructure, for instance, according to India's INDC, energy demand in India was 776 TWh in 2012 and it is expected to rise to 2499 TWh by 2030.

Low carbon development is fundamental to designing smart city frameworks – one of the most significant drives of the Indian government is to pursue low carbon development. In order to assess the significance of a particular low carbon measure, it is important to develop a robust baseline of greenhouse gas (GHG) emissions (i.e. the GHG inventory) at the city level so that contribution of each

low carbon initiative can be measured in a rational manner compared to the baseline. From a nation point view, this will play an important role while reporting the progress against India's Intended Nationally Determined Contribution (INDC). An inventory would allow better understanding of GHG intensive sectors and GHG reduction potential. Subsequently, an effective and actionable low carbon plan can be devised to make the city livable and sustainable.

For example, in the transport sector, one way of assessing the baseline GHG emissions is to collect total fuel consumption data over a span of time and multiply the same with appropriate emission factor. However, if it is calculated based on fuel consumption, it would be difficult to estimate the GHG emission reductions from individual initiatives such as carpooling, use of fuel efficient cars, change in mode of transport (e.g. bicycling) as the baseline inventory will not have the details of kilometers travelled by and fuel efficiency of each type of vehicle to be compared with the project scenario i.e. post implementation of a low carbon initiative. Hence, for decision making on the low carbon options and monitoring performance of low carbon initiatives, the first step is to develop a baseline GHG inventory based on a detailed approach so that all comparable parameters are available both in baseline and project scenarios.

The most reliable methodological framework for city level GHG emissions is the **Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC)** that provides a robust methodology to establish a credible baseline GHG inventory, based on which GHG mitigation goals and targets can be set and progress can be tracked over time based on measurable indicators. This methodology has been applied globally (e.g. Rio de Janeiro, Johannesburg) and nationally (e.g. Rajkot, Thane). Further, this methodology allows the inventories to be comparable to other cities in India and other countries.

GPC covers the following sectors, clearly defines **scope 1, 2, 3** emissions for each sector and stipulates the activity level data that are required for estimation of GHG emissions from each sector:

SECTOR	SCOPE	DATA REQUIREMENT
Stationary Energy	Scope 1: Emissions from fuel combustion and fugitive emissions in the city Scope 2: Emissions from the consumption of grid-supplied electricity/steam/heating and cooling in the city Scope3: Distribution losses from grid-supplied electricity/ steam/heating and cooling in the city	• Quantities of fuel (e.g. coal, diesel oil etc.) and electricity consumed for all residential/domestic, commercial and industrial activities within the city • Emission factor of fuel, electricity • Emissions from transportation of fuel to its final point of use
Transportation	Scope 1: Emissions from transportation occurring in the city Scope 2: Emissions from grid-supplied electricity used in the city for transportation Scope 3: Emissions from the portion of trans boundary journeys occurring outside the city, and transmission and distribution losses from grid-supplied energy from electric vehicle use; Transportation modes are rail, on-road, off-road, water and aviation	• Total quantity of fuel sold to vehicles (road, rail, water, aviation) within the city /departing from/arriving at the city • Total vehicle km travelled by each type of vehicle • Fuel intensity /mileage of vehicle • Emission factor of the fuel used
Waste	Scope 1: Emissions from waste treated inside the city Scope 2: Not applicable Scope 3: Emissions from waste generated by the city but treated outside the city	• Quantities of waste generated and disposed (of various types municipal solid waste, hazardous waste, industrial waste, biomedical waste) • Emission factor , oxidation factor and other conversion factors of relevant GHGs that are emitted during landfill, treatment, and incineration of wastes (e.g. CH_4, N_2O)
Industrial Process and Product Use (IPPU)	Scope 1: Emissions from industrial processes (mineral, metal, chemicals) and product uses (HFCs as refrigerants, lubricants etc.) occurring within the city Scope 2: Not applicable Scope 3: Other out-of-boundary emissions	• Number of mineral/metal/chemical production units within the city • Annual production of mineral/metal/chemical from the units • Default emission factors per tone of production
Agriculture, Forestry and Other Land Use (AFOLU)	Scope 1: In-boundary emissions from agricultural activity, land use and land use change within the city boundary (livestock, manure management, biomass burning, use of limestone, fertilizers for soil management, land use change etc.) Scope 2: Not applicable Scope 3: Other out-of-boundary emissions	• Livestock category and number • Types of land use and changes in land use • Quantity of biomass/dead wood etc. • Default conversion factors, emission factors

GPC provides flexibility in terms of choosing the level of GHG inventory as **Simple (BASIC)** or **Complex (BASIC+)**, methodology for apportionment and scalability as per the extent of data available. BASIC and BASIC+ decide on the scopes of emissions to be covered for various sectors.

In case of BASIC, inclusions are all Scope 1 emissions from stationary energy, transportation and waste, scope 2 emissions from stationary energy and scope 3 emissions from treatment of exported waste.

BASIC+ additionally includes scope 1 emissions from IPPU and AFOLU and scope 3 emissions from stationary energy.

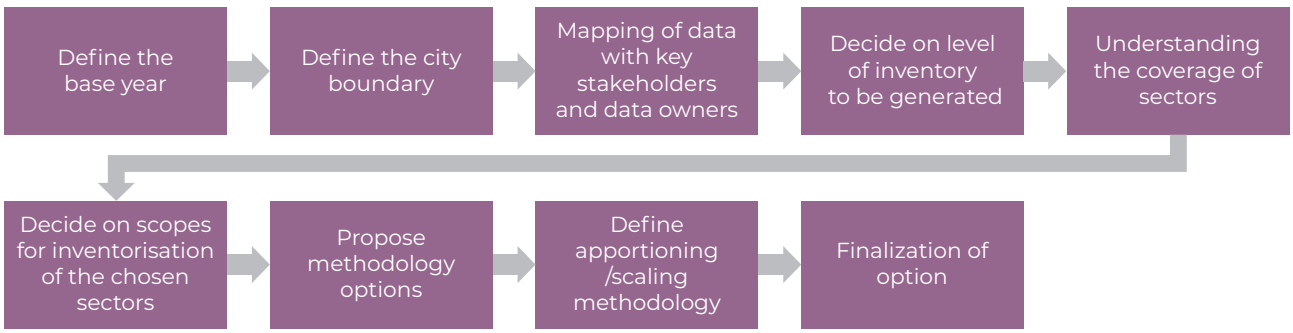
Based on the extent of data available, a judicious approach needs to be taken while deciding on the level of GHG inventory to be developed. In terms of extent of data availability, options for apportioning/scaling need to be decided as suggested in GPC.

SCENARIO	METHODOLOGY FOR APPORTIONING/SCALING
When total fuel consumption data from stationary combustion is known but sector wise data are not available	Apportion using the total built space of each sub-sector
When partial fuel consumption data from a few utilities/fuel suppliers is known	Scale up the data by population served by the available data and the total population of the city
When no fuel consumption data is available	Use of energy intensity figure
Where transport data on number of vehicle, kilometer travelled, mode share are not available	Use fuel sales method and calculate emissions based on fuel sold multiplied by emission factor
If regional fuel sales data is available but not within city level for transportation	Scale down the data by apportioning as per numbers of vehicles owned within the city or as appropriate
If waste generation data are not available for a city but available at the district/state level	Apportion by using population data of the city and the state/district

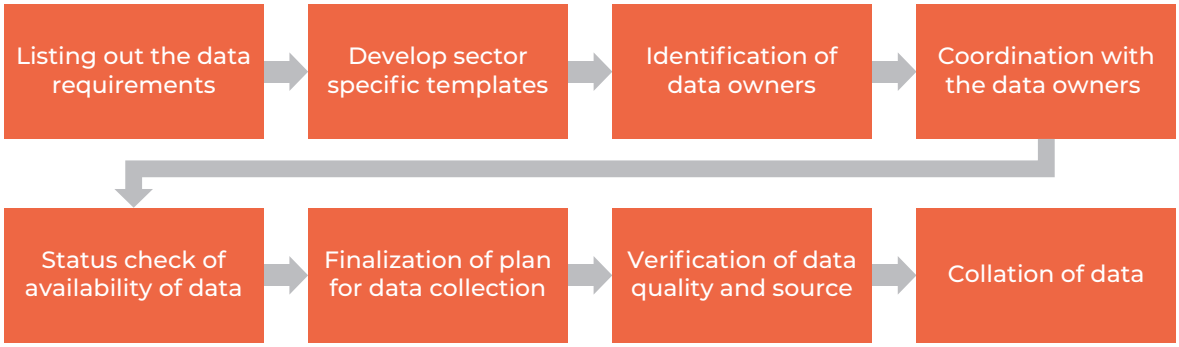
Approach

The approach is developed based on our understanding of the use of GPC in different sectors, sub-sectors and scenarios of data availability.

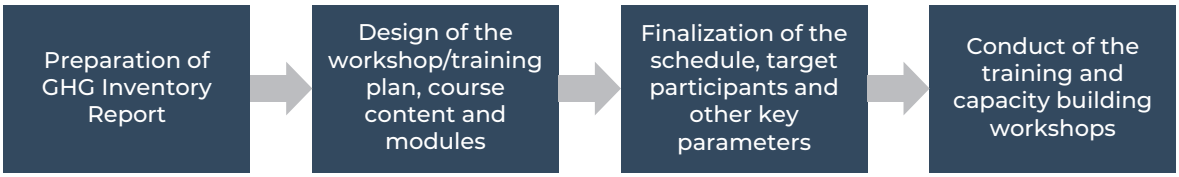
Step 1: Develop City Level GHG Emissions Calculation Approach



Step 2: Collection of Data



Step 3: Prepare inventory report & build capacity of local institutions



The Project Context

International Institute for Energy Conservation (IIEC) conducted the GHG accounting of 5-cities in India in 2017-18 with funding support from United Nations Industrial Development Organization (UNIDO) under a GEF-6 funded project on sustainable cities. IIEC developed the methodology to map, track and monitor the GHG emissions within the identified boundaries of the cities and helped them in preparation of low carbon action plans. The assistance provided to the cities included:

- Clearly measuring and showcasing the ground level scenario
- Identifying and tackling the critical issues
- Extensive stakeholder engagement - paved way for participation of citizens, other cities and national governments
- Enabling cities to take effective climate change mitigation action

Overall, this exercise enabled the cities to address the challenge of GHG mitigation in a new and innovative manner while promoting a sustainable, inclusive and climate resilient growth.

The following tasks were performed for the accounting of GHG emissions in the cities:

- Formulated a methodological approach for GHG accounting for the five shortlisted cities
- Identified and worked with appropriate local partner institutions, both for facilitating appropriate data collation as well as building local capacity for updating and reporting on the GHG emissions inventory
- Developed a city level inventory report, based on an agreed methodology
- Conducted training and capacity building workshop for five cities on the methodology used and the results achieved

IIEC project team carefully analyzed the activities and formulated the work plan, considering the synergies and sequences. For instance, the project initially focused on building a robust up-to-date context of the study and collated all the information available through secondary research and literature review. This created a strong foundation for primary data collection from the city authorities as well as for analysis of GHG emissions.

A review of methodologies for calculation of emissions of Indian cities revealed that, till date around 40 Indian cities have undertaken city level GHG accounting. Most of these cities have undertaken the accounting exercise based on 1996/2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines), with some cities such as Ahmedabad, Bangalore, Bhubaneswar, Coimbatore, Cochin, Hyderabad, Gwalior, Jaipur, Kota, Dehradun, Pune, Rajkot, Shimla and Thane used GPC Beta version.

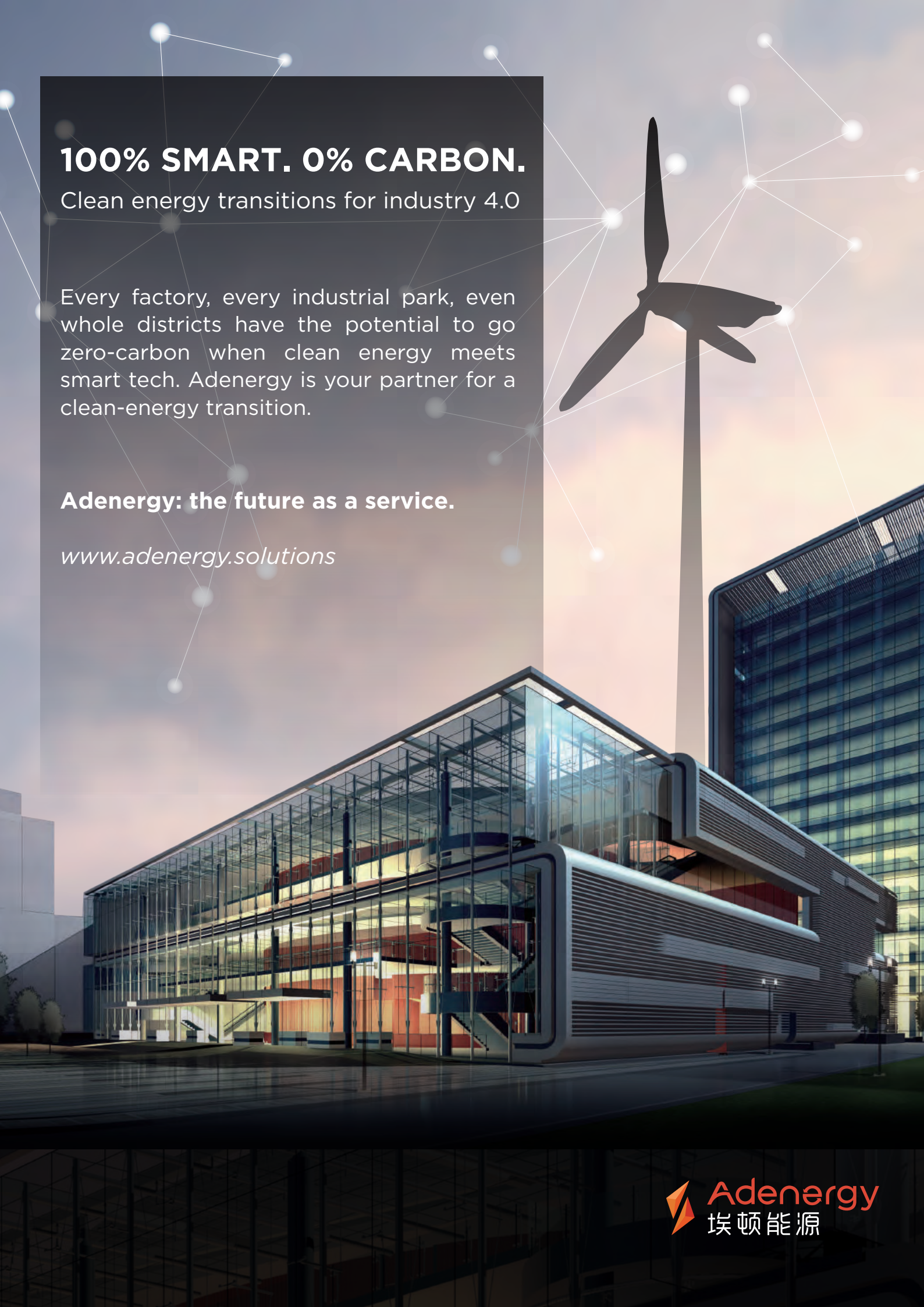
Before finalizing the protocol, a comparative review of some of the most commonly used GHG standards and protocols were undertaken. Table below provides an illustrative comparative overview of different GHG standards.

Standards Name	Target Audience	Consistency with major IPCC emission sources categories	Adoption of in-boundary /out of boundary framework	In boundary emissions	Out of boundary emissions	Gases	Detailed guidance on Calculation methodolo-gies	Guidance setting Reduction targets
Global Protocol for Community-Scale GHG Emissions Inventories (GPC), C40 ICLEI WRI (2014)								
1996/2006 IPCC Guidelines for National Greenhouse Gas Inventories								
International Local Government GHG Emissions Analysis Protocol (Version 1.0), ICLEI (2009)								
International Standard for Determining Greenhouse Gas Emissions for Cities (Version 2.1), UNEP UN-HABITAT World Bank (2010)								
Baseline Emissions Inventory/ Monitoring Emissions Inventory Methodology The Covenant of Mayors Initiative (2010)								
U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Version 1.0) ICLEI USA (2012)								
PAS 2070: Specification for the assessment of greenhouse gas emissions of a city, BSI (2013)								

ILLUSTRATIVE

IIEC International Institute for Energy Conservation 35 ANNIVERSARY EST. 1984

The International Institute for Energy Conservation (IIEC) was founded in 1984 to dramatically increase the use of energy efficiency as an important clean energy approach in developing countries. We believe local presence is the best way to bring about results, and through our regional offices all over the world, we have been effective in bringing about progress in energy efficiency policy and implementation that has both reduced energy consumption by thousands of MWs and fostered economic development in the countries we serve. The IIEC works with stakeholders across all sectors to connect international best practice with the unique needs of the communities in which we operate, combining sound energy efficiency, Demand-side management (DSM) and renewable energy policy with hands-on implementation in order to reduce greenhouse gas emissions and encourage sustainable development.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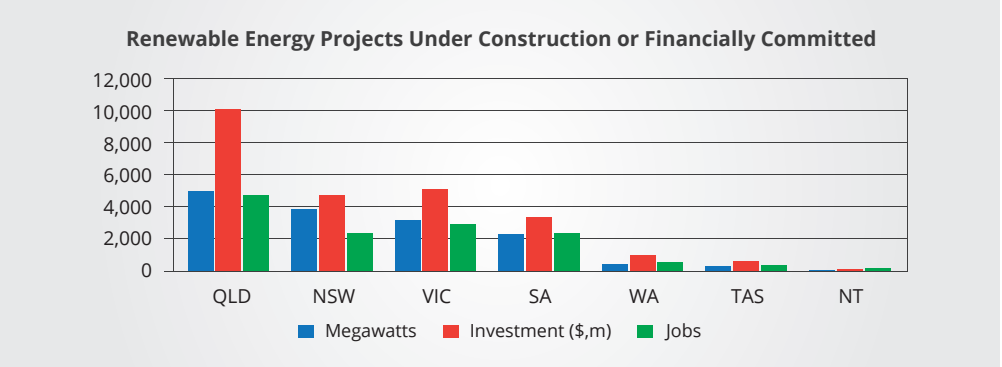
An Outlook on the Australian Energy Market in Regard to Renewable Energy and Sustainability

By Muhammad Ali, Direct Energy Australia and APUEA Advisor

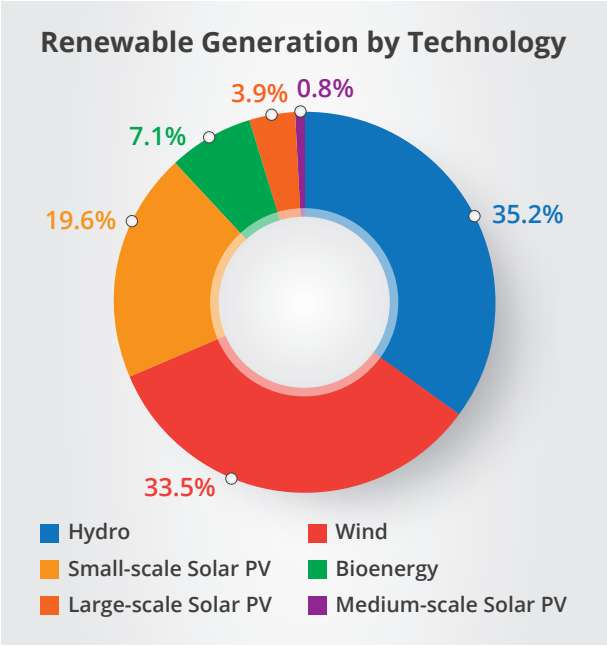
> **IF THE CURRENT RATE OF RENEWABLE ENERGY INSTALLATION CONTINUES, AUSTRALIA IS PROJECTED TO ACHIEVE 50% RENEWABLES BY 2025**

Australia is experiencing a construction boom in large-scale renewable energy projects. Clean Energy Council Australia has recently published [1] details on under-construction or financially committed projects that total a production of 14.841 Gigawatts, AUD 24.5 billion of investment, and 13,233 jobs. The report presents state-wide statistics on renewable energy, as shown in the graph below



Although each state has its own electricity demands and ways of generating it, Tasmania is leading with the largest renewable energy penetration of 95.9%, followed by South Australia with 53.0%, Victoria with 20.6%, Western Australia with 16.2%, New South Wales with 15.0%, and Queensland with 9.5%.

Renewable technologies are being deployed widely throughout Australia and include large-scale and residential solar PV, concentrated solar power, battery storage technology, wind, hydro, biomass, wave, and geothermal energy sources. Hydropower plays a major role, with 35.2% renewable energy generation contributed by hydroelectric power plants, followed by wind at 33.5%, small-scale solar PV at 19.6%, bioenergy at 7.1%, large-scale solar PV at 3.9%, and medium-scale solar PV at 0.8%. The overall contribution of solar technologies is 24.3%. The national average solar system size has increased from 1.97 kW in 2010 to 7.13 kW in 2018. Solar power experiences a great penetration in projects of all scales and in residential and commercial applications, and prospects are bright. Geothermal-based heating and cooling are getting traction, and district-based pilot projects are taking shape in different states. Renewable energy-based HVACR systems are expected to contribute substantially in the coming years to achieve national sustainability targets.



Renewable sources accounted for 21% of annual electricity generation in 2018, whereas fossil fuels meet 79% of the demand. If the rate of installing more than 10 Gigawatts of new renewable projects in 2018 and 2019 is maintained, Australia will reach 50% renewables in 2025 [2] and close to 80% by 2030 [3].

21%

Annual Electricity Generation from Renewable Sources in 2018

The Australian government is investing in clean energy technology, such as concentrated solar thermal and battery storage, to provide additional backup in times of peak demand. The government has committed over AUD 220 million to support energy storage technologies since 2013. The Australian Renewable Energy Agency (ARENA), the Australian Research Council, and the CSIRO are the main bodies providing research and development grants in the renewable energy sector. The Clean Energy Innovation Fund is providing financing for emerging technologies in Australia. Projects near commercial deployment can access debt and equity from the Clean Energy Finance Corporation (CEFC), which has AUD 10 billion in capital to provide debt and equity financing to promote investment in clean energy technologies [4].

The Australian government supports several measures [4] for renewable energy targets, funding, and investment. The Renewable Energy Target (RET) scheme encourages the new generation of electricity from renewable and sustainable sources. The Australian households have installed more than 2.1 million solar PV systems and 1.17 million solar water heaters and air source heat pumps as of 30 April 2019 with the help of RET. The Solar Communities program is another interesting program that provides AUD 5 million in funding to install rooftop solar panels, solar water heaters, and solar-connected battery systems.

Sustainability is a key component in Australia for reducing the environmental impact of buildings. There is a wide range of rating schemes and assessment tools in practice that measure different aspects of building sustainability. These include:

- National Construction Code (NCC) Energy Efficiency Requirements
- Commercial Building Disclosure (CBD)
- National Australia Built Environment Rating System (NABERS)
- Green Star Environmental Rating System

The National Construction Code is published by the Australian Building Codes Board (ABCB). NCC assists are improving the environmental performance of homes and other buildings through the implementation of rating tools. NCC now widely requires a minimum energy rating of 6 stars for new single dwellings, as assessed by the Nationwide House Energy Rating Scheme (NatHERS). This has elevated the average performance of homes built prior to the regulation [5].

Australia is on the path of achieving higher penetration of renewable energy in the coming years. If the current rate of renewable energy installation continues, Australia is projected to achieve 50% renewables by 2025. The growing trends in the sustainable urban energy system are opening new opportunities for enhanced energy storage, microgrids, and renewable energy-based district energy systems for existing and new projects. This is creating more jobs and investment opportunities in renewables and urban energy sectors.

References:
[1] As at 15 March 2019, cleanenergycouncil.org.au/cleanenergyaustralia
[2] theconversation.com/at-its-current-rate-australia-is-on-track-for-50-renewable-electricity-in-2050-102903
[3] https://www.energymatters.com.au/renewable-news/renewable-energy-growth-2030-gem/
[4] https://www.energy.gov.au/government-priorities/energy-supply/renewable-energy-and-technology
[5] https://www.absa.net.au/about-building-sustainability/what-is-building-sustainability/

Case Study on Energy Efficiency in Buildings – Introducing the Build, Own, Operate and Transfer (BOOT) scheme at the Four Seasons Hotel in Sydney, Australia

By ENGIE

> **WITH ENGIE'S DIGITAL SOLUTIONS, THE FOUR SEASONS PROJECT IS A PRIME EXAMPLE OF DEVELOPING AN ENGINEERING SOLUTION FOR OLDER BUILDINGS THAT NEED MORE EFFICIENT COOLING SYSTEMS**

Project background

In 2017 the Four Seasons Hotel in Sydney, Australia, was facing challenges with maintaining an outdated and inefficient chiller system dating back to when the hotel was built in the early 1980s. It was clear that the chiller system had to be replaced, but convincing the building owners to invest more than $AUD2 million on new plant was difficult and a major obstacle for the project. After all, comfortable beds, a great restaurant and modern fittings – the things guests pay for – generally take precedence over a room full of pipes, chillers and boilers when it comes to capital allocation.

Introducing the BOOT scheme

The solution came in the form of a Build, Own, Operate and Transfer (BOOT) scheme that included purpose-built energy efficient equipment and operating systems. Jack Siwek, the Chiller Team Manager from multi-technical services business ENGIE Services Australia & New Zealand, said his company devised a solution to design, fund, build, own and operate the facility for 12 years and then transfer the assets to Four Seasons at no cost. Once the system optimization is complete, the team expects annual energy savings of 26 per cent on electricity and 16 per cent on gas. To deliver such a result, ENGIE

collaborated with Quantum design engineers in Germany to develop new generation, high-efficiency compact chillers tailored for the retrofit market, in particular where crane expenses normally add significant costs to a project.

The chiller components were designed to fit the hotel's goods lift size and weight limitations, saving more than $AUD150,000 a day in crane costs that would have been required using a traditional replacement program. The innovative chiller design also allows the evaporator and condenser vessels to be transported in the lift, without the need for split vessels, removing the risk of costly repairs for leaking gaskets during the life of the chillers. Following the factory acceptance tests, the chillers were delivered to ENGIE Services' Sydney workshop where they were disassembled by ENGIE Services' in-house, Original Equipment Manufacturer-trained chiller team. The components were then delivered to site and transported to the Level 35 plant room using the goods lift, reassembled and commissioned.

The plant is remotely monitored and ENGIE Services staff have 24/7 access to the system to ensure efficient and reliable operation. ENGIE Services is also trialing Internet of Things (IoT) vibration analysis sensors on the chillers to improve remote monitoring, alarming and plant reliability. Following the upgrade of the central plant, an UltraHD 3D model of the plantrooms was developed, with links to operations and maintenance and real-time data from the Building Management System (BMS) to allow state-of-the-art operation of the plant. The chillers also have a direct connection to the manufacturer in Germany. This provides the Four Seasons with remote diagnostics, troubleshooting and automatic software and firmware upgrades.

According to ENGIE Services' Head of Services Development, Michael Sue, the BOOT scheme delivered by ENGIE Services was a unique approach for this type of project. **"It allowed us to deliver energy savings to our customer from installing new equipment and systems without them having to make a big capital investment upfront."** he said.

"The Four Seasons project is a prime example of developing an engineering solution for older buildings that need more efficient heating and cooling systems. There's growing demand and indeed expectation among owners, managers and even users for smarter buildings that provide a more comfortable environment for the user, while also delivering better financial outcomes for owners and operators."

"Under our model, the client transfers project risk to ENGIE Services. They pay fixed maintenance fees with guarantees for equipment reliability and efficiency over the length of the BOOT scheme. At the end of the term, the client obtains ownership of a well-maintained, optimized plant room."

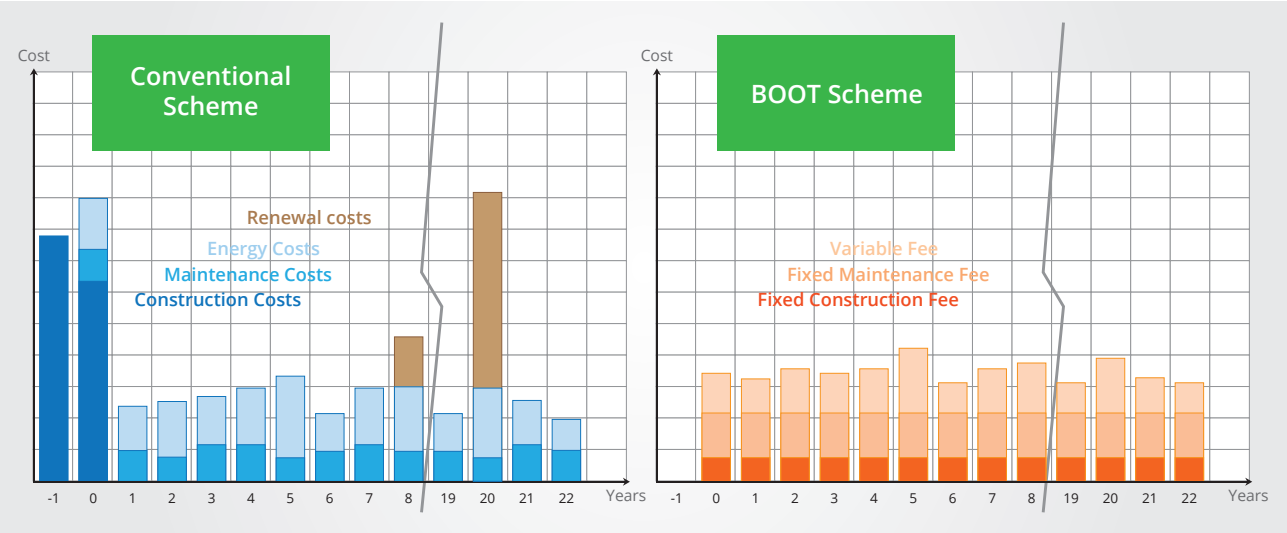
The BOOT benefits

- Long-term or even lifecycle commitments on the performance of plant
- Upfront capital expenditure avoided
- Risk transferred to/shared with solution provider
- Increased availability and reliability of the plant
- Comprehensive warranty for the contract term
- Predictable cost profile for annual budgeting purposes
- Reduced overall lifecycle costs
- Well-maintained and optimized system at ownership transfer

Project key points

- Two x 900kW Quantum Chillers utilising magnetic bearing, oil-free Turbocor compressors
- Heat recovery from the chillers via a condenser water loop, used to preheat feedwater to the domestic hot water system – this reduces the gas consumption of the boilers, as well as electricity consumption of the cooling tower fans
- Two x Rendamax fully condensing boilers for heating hot water and domestic hot water – the two systems are controlled at independent temperature set points for maximum efficiency
- Kamstrup ultrasonic thermal energy meters are used to monitor, control and measure secondary energy demand and consumption of the hotel's chilled water, heating hot water, domestic hot water and heat recovery
- Existing fiberglass cooling towers were refurbished with all new fill and fans
- Side stream filtration was installed on the condenser water system to minimise the amount of chemicals required
- The entire building BMS is being upgraded including central plant optimisation and energy management system

Cost comparisons



Energy savings

Energy Savings	Guaranteed*	Current**	Projected
Gas savings (GJ p.a.)	860 (6%)	1768 (12%)	2309 (16%)+
Electricity savings (MWh p.a.)	92 (8%)	254 (23%)	287 (26%)+
$AUD savings p.a.* **	$38k	$85k	$107k
CO_2 savings (t p.a.)	139	347	412

* Only efficiency and coefficient of performance are guaranteed. Consumption may vary.
** First two months of operation. System optimisation incomplete.
*** Savings above guaranteed level are shared.

Heat recovery: How it works

- Heat is recovered from the chillers via the condenser water loop to pre-heat incoming cold mains water to 32 degrees before it enters the domestic hot water heaters
- Reduces gas consumption for hot water production
- Reduces cooling tower fan energy consumption
- Reduces cooling tower water consumption
- Reduces water treatment chemicals

"ENGIE Asia Pacific is a leading energy and services company focused on three core activities: low-carbon power generation, global networks and client solutions. We operate low-carbon power plants that focus on natural gas and renewable energy across Asia Pacific. Apart from our suite of renewable technologies including wind, solar, and hydro plants, our retail arm is based mainly in Singapore and Australia.
With our regional headquarters in Singapore, we are also growing our services business, largely in Singapore, Philippines, Malaysia and Australia. With the energy mix and fast-growing demand for power in Asia-Pacific providing significant opportunities for growth, we are striving towards our zero-carbon ambitions."

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Recent APUEA Activities

By Asia Pacific Urban Energy Association (APUEA)

> **TO PREPARE FOR OUR CONTINUED ACTIVITIES IN OUR FOCUS MARKETS AND TO BETTER SERVE OUR MEMBERS AND CITIES, THE APUEA SECRETARIAT HAS BEEN EXPANDED. APUEA NOW HAS A LOCAL PRESENCE IN BANGKOK, BEIJING AND NEW DELHI.**

APUEA has aimed to increase its activities in 2019 to promote sustainable urban energy. Our focus markets for 2019 is China, India, and Southeast Asia, and so far, we have attended events in New Delhi, Shanghai, and Hong Kong. To prepare for our continued activities in our focus markets and to better serve our members and cities, the APUEA secretariat has been expanded. We are glad to introduce, Mr. Ankit Kamra, our new India representative and Ms. Xiawen Fan, our new Marketing Manager for the Chinese Market. After this expansion, APUEA now has a local presence in Bangkok, Beijing and New Delhi.

Ankit Kamra
India Representative

Xiawen Fan
Marketing Manager

INDIA

12 - 16 March 2019
New Delhi, India

From March 12 to March 16, APUEA participated as a supporting partner during **India Smart Utility Week** hosted by the **India Smart Grid Forum** in New Delhi. The conference attracted over 1,800 energy professionals from around the world who could choose from among 377 presentations /speeches given by 288 experts from 41 countries. The event offered an excellent platform for utility leaders, regulators, government officials, and technology providers for networking and experience sharing with their peers from around the globe. This was APUEA's first activity in India and the starting point for future activities in the country. The conference provided us with important insights into the energy market in India as well as contacts for future activities.

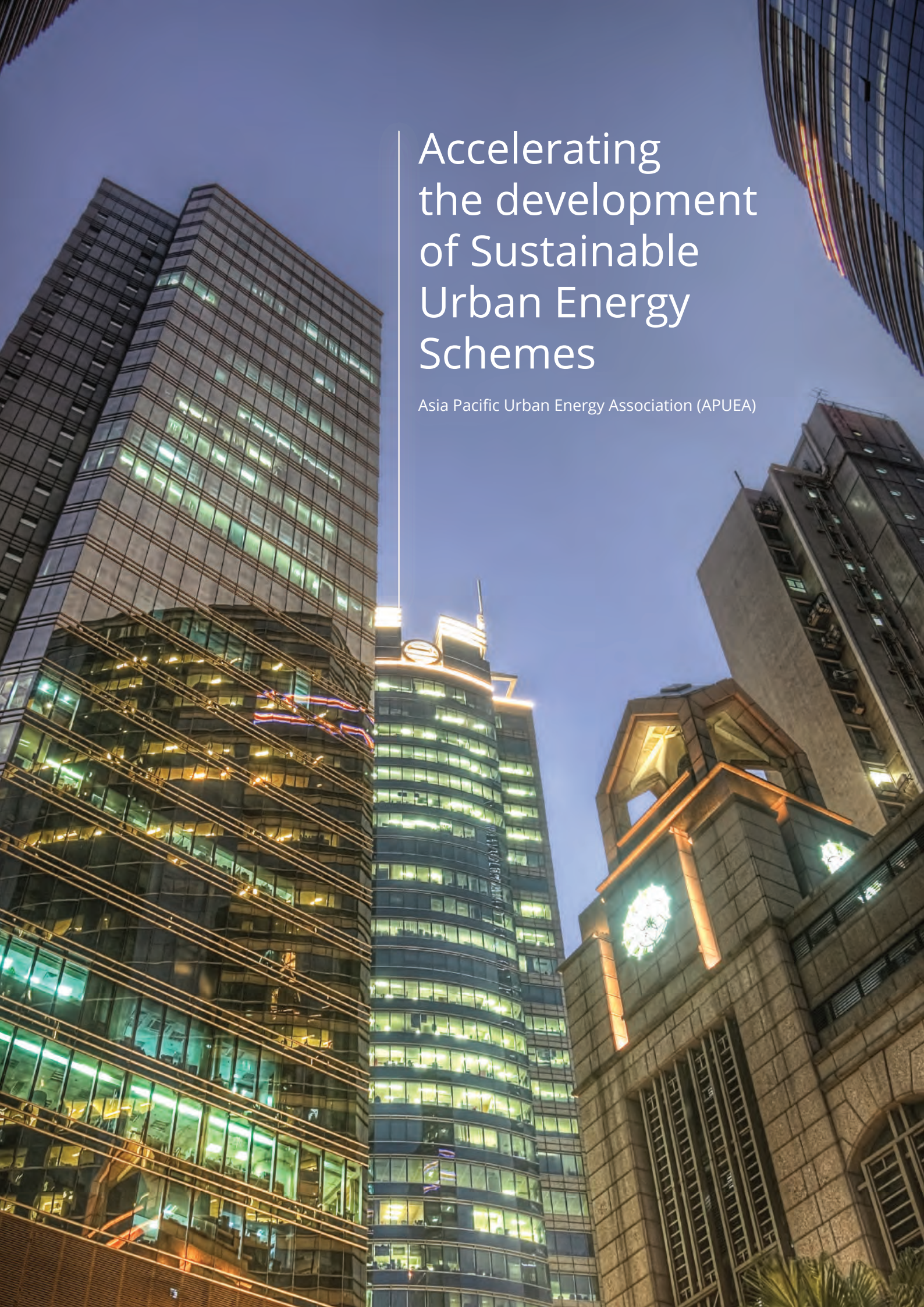
CHINA

27 March 2019
Shanghai, P.R. China

As one of our focus areas, APUEA continues to have a strong presence in China and on March 27th, APUEA's Executive Director, Mikael Jakobsson, presented the topic "**Unlocking the Potential of District Energy**" at the Future Energy & Tech Investment Forum in Shanghai. The presentation raised the importance of district energy as a natural component to integrate into Multi Energy Systems (MES), while addressing the growing energy demands in cities across the Asia Pacific. The forum gathered more than 150 energy experts to learn more about future technology and innovation in the energy industry.

9 May 2019
Hong Kong

On May 9th, APUEA's Head of Operations, Peter Lundberg, was invited by the Green Council in Hong Kong to speak at the seminar on "**Energy for Our Future Generations**". The presentation was titled "Multi-Energy Systems for Sustainable Cities in the Asia Pacific" and focused on the importance of district energy systems in sustainable cities. The event attracted more than 100 energy professionals and provided many valuable insights about the energy system in Hong Kong as well as pointing out the challenges faced by the city to become more sustainable.



Accelerating the development of Sustainable Urban Energy Schemes

Asia Pacific Urban Energy Association (APUEA)

Smarter Mobility

Holistic charging infrastructure solutions

They say that EV charging infrastructures are the ‘fuel station of the future’. With its future-proof charging technology and unrivalled connectivity, ABB wants to ensure that the affordable, long-range electric vehicles of tomorrow are fully supported by reliable infrastructures today. ABB charging points and fast-charging stations will be the fuel of electric cars, electric buses and other passenger service vehicles.

Event Calendar

17 JUN 2019

17 - 21 June 2019
Manila, Philippines
Asia Clean Energy Forum & APUEA2019 AGM
APUEA Activity: Hosting Organization

24 JUN 2019

24 - 27 June 2019
Pittsburgh, USA
IDEA2019 Annual Conference and Trade Show
APUEA Activity: Supporting Organization

3 SEP 2019

3 - 4 September 2019
Kuala Lumpur, Malaysia
Asian Utility Week 2019
APUEA Activity: Hosting Organization

TBD 16 SEP 2019

TBD 16 - 20 September 2019
Hunan Province (Changsha/Xiangtan), P.R. China
District Energy and Distributed Energy Conference
APUEA Activity: Hosting Organization

TBD OCT 2019

TBD October 2019
TBD Bangalore, India
Asia Pacific Cooling Summit
APUEA Activity: Hosting Organization

29 OCT 2019

29 October - 1 November 2019
Singapore
Singapore International Energy Week (SIEW)
APUEA Activity: Supporting Organization

TBD DEC 2019

TBD December 2019
Guangzhou and Shenzhen, P.R. China
District Cooling Conference
APUEA Activity: Hosting Organization

Member Directory

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Euroheat & Power (EHP)

Alliance to Save Energy

Capital Heat

Qatar Cool

Tianjin Euro Energy Technologies Co., Ltd. (TEET)

China District Heating Association (CDHA)

Danish Board of District Heating (DBDH)

International Institute for Energy Conservation (IIEC)

Northeast Clean Energy Council (NECEC)

International Partnership for Energy Efficiency Cooperation (IPEEC)

District Energy in Cities Initiative

DEVCCO

Xian District Heating Company

Thai ESCO Association

Overseas Environmental Cooperation Center (OECC)

SPX FLOW

Solar Turbines

Chongqing Renewable Energy Socitey

Lux Research

Aden

Partners and Supporting Organizations

- Sustainable Energy for All (SEforALL)
- Asian Development Bank (ADB)
- International Energy Agency (IEA)
- UN Environment

You can print out your registration and entry form below.

APUEA Registration Form - Membership

We, the under-mentioned organisation / company, hereby apply to become a member of APUEA:

1 ORGANIZATION / COMPANY DETAILS:

Organization name .....

Marketing name and/or Abbreviation .....

Street .....

Postal code ..... City ..... Country .....

General Phone ..... General Fax .....

General E-mail ..... Web .....

Primary Contact: First name ..... Surname .....

Position ..... Direct Phone ..... E-mail .....

2 ORGANISATION CATEGORY (please check as appropriate below):

- ◯ Association / Federation
- ◯ NGO
- ◯ Academic
- ◯ Advisor - Financial / Legal / Banking
- ◯ Consultancy - Engineering / Design / Technical
- ◯ Manufacturer / Equipment Supply
- ◯ Utility / Operator
- ◯ Media company - Press / Journalist / Advertisement
- ◯ Building Sector
- ◯ Other

Specify: .....

3 BILLING INFORMATION (if defferent from above):

Billing Address: .....

.....

.....

4 MEMBERSHIP CATEGORY (please check as appropriate below):

		Employees		
Member Category		**≤ 1,000**	**1,000 - 10,000**	**≥ 10,000**
Active Member		◯	◯	◯
Allied Member		◯	◯	◯
Affiliate Member	◯			

5 PAYMENT METHOD:

◯ Bank Transfer ◯ Credit Card ◯ Paypal

Please indicate preferred payment method. Payment instructions will be provided following confirmation of membership.

Please complete the form, and send a scanned version to membership@apuea.org

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APUEA
Asia Pacific Urban Energy Association

APUEA Magazine

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