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# APUEA

## Magazine

## INTEGRATED URBAN ENERGY

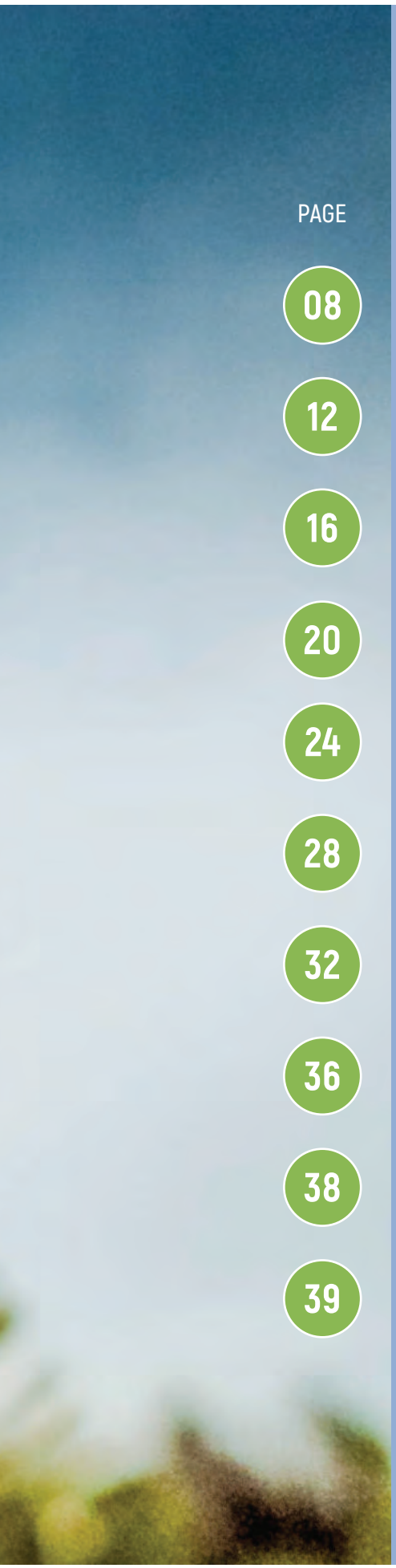
www.apuea.org

APUEA
Asia Pacific Urban Energy Association

Promoting Sustainable Urban Energy in Asia Pacific

photo credit: ABB

# Contents



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# Editorial

This issue of **APUEA Magazine** marks the first anniversary of the Asia-Pacific Urban Energy Association. The APUEA secretariat in Bangkok has now expanded to a team of 6 professionals providing a range of services to APUEA's ever-increasing membership. The team has managed to launch a number of initiatives throughout the year, including newsletters, the online APUEA portal with news and event streams, publications, and APUEA Magazine.

The ongoing energy transition in the Asia-Pacific region highlights the importance of APUEA as a sector association convening cross-sectoral stakeholders with the common goal to create green and sustainable cities. 56 percent of the world's population lives in urban areas by 2020 and 80 percent of the world's energy is consumed here. The urban population in Asia-Pacific will grow by 16 percent between 2020-2030, and by 2050 more than half of the world's urban population will be in the Asia-Pacific region. It is safe to say that the development of sustainable urban energy systems is crucial to combat climate change and help countries in Asia-Pacific to achieve their international climate commitments. APUEA supports cities and regional policymakers to overcome their challenges and develop sustainable and livable urban areas, and for governments to comply with their climate change commitments. APUEA serves as a bridge between members and governments/international agencies helping to accelerate the energy transition and the development of sustainable urban energy systems in the Asia Pacific region.

Over the course of the year, APUEA has participated in several conferences and seminars in the region and around the world, with the aim of highlighting the challenges and opportunities in the Asia Pacific urban energy sector, while also gathering intelligence on international best practices and lessons learned. These events have served as effective platforms for APUEA's mission: "To actively promote the development of sustainable urban energy systems in the Asia Pacific region".

**During the first-year operation, APUEA has participated in the following events;**

- Asia Clean Energy Forum (June 2017, Manila)
- International District Cooling & Heating Conference (October 2017, Doha)
- ASEAN Cooling Summit (January 2018, Bangkok)
- Nordic Clean Energy Week (May 2018, Copenhagen/Malmo)
- Asian Utility Week (June 2018, Bangkok)
- IDEA 2018: 109th Annual Conference and Trade Show (June 2018, Vancouver).

During IDEA 109th Annual Conference and Trade Show in Vancouver, June 2018, APUEA held its first Annual General Meeting. The attendees included members and supporting organizations from Asia, Europe and North America, who provided valuable feedback and advise on the APUEA operation and the Association's future development.

APUEA is now entering a new phase of its operation. During the first-year, efforts were made to establish a solid foundation. In the coming year, we will continue the work to build strong relationships with local governments. In order to maximize the impact of the Association's activities, our special focus will be on China, India and Southeast Asia, where the level of urbanization, GDP (PPP) growth, etc., suggest that significant efforts are required to achieve a sustainable and resilient source of energy supply to cities.

We would once again like to take this opportunity to express our appreciation to our Founding Members ABB, Engie and Johnson Controls, who contributed significantly to the development of the Association over the course of the year.

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

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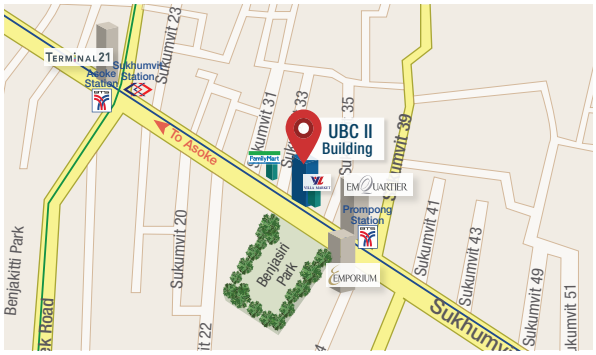

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# ASIA PACIFIC URBAN ENERGY ASSOCIATION MEMBERSHIP

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

# Interview with Michael Schack Engie, Vancouver June 13th, 2018

**Michael Schack**
Director of Decentralized Solutions for Cities and Territories at Engie

During the IDEA2018 Conference in Vancouver, we had the opportunity to sit down and talk with Michael Schack, Director of Decentralized Solutions for Cities and Territories at Engie. We discussed about Engie's strategies, technologies, experience with industry associations and more. Michael is an engineer educated at École Polytechnique in Paris and he also has a PhD in Solid State Physics from the University of Paris. Michael has been with Engie and its predating companies - such as Electrabel France, Lyonnaise des Eaux and Cofely - for more than 25 years working with business development and marketing. He has held management positions in the Water, Services, and Energy Divisions. Today, he is based at the Engie headquarters in Paris

**Q: Can you give us an introduction to Engie?**

"Engie is an old company as parts of Engie have been active for 150 years, but in some aspects Engie is a relatively young company. The last transforming mergers took place in 2008 with Gaz de France and 2010 with International Power. During the past three years, we have been going through our own energy revolution. The strategy and vision of the company today is extremely recent, so we are, in a way, a very young company. Until three years ago our goal was to be the world leading independent power producer helping emerging countries provide electricity which is crucial and necessary for the economic development. We changed this strategy three years ago with the goal to be the world leader of the energy transition focusing on decarbonisation, decentralization and digitalisation. In practice, this means that in the last two years we have sold 15 billion EUR assets including coal-based plants and we are now reinvesting 22 billion EUR in fields related to the energy transition such as renewable energy, infrastructure and energy efficiency. Renewable district heating and district cooling is a part of that and we have invested 3 billion EUR with our partners in the last 16 months moving us from number six to number one in district cooling and preparing us to become a leader in renewable district heating."

**Q: Can you describe your current position and role in Engie?**

"I took my present position nearly three years ago at the headquarters in Paris to help support the worldwide business development of district heating and district cooling networks. Since last month, I am also temporarily in charge of managing sustainable solutions for cities and territories which

include district heating and district cooling, green mobility, decentralised energy production, connectivity and silver economy. We aim to become partners of cities, universities and campuses, military bases, airports and to green them completely. We do this with our know-how, developed over 150 years, with strategic partners worldwide like IBM, Accenture, C3 IOT... and local start-ups and targeted acquisitions and participations such as Siradel (3D modelling and simulation), Tabreed (District Cooling) or Electro Power Systems (smart grids). We don't have only packaged solutions, we co-develop solutions with the local decision makers by integrating know-how from Engie, our partners and local start-ups."

**Q: You are investing 22 billion EUR in the energy transition, what is your geographical focus?**

"In the field I am responsible for, we are a leader in district cooling in the UK, France, Italy, Spain, Portugal and the Netherlands and in the UAE through our partnership with Tabreed. So, we have a regional footprint and our strategy is to move from this regional footprint to a worldwide footprint focusing on North America, South East Asia and the Middle East. We have set up three centres of excellence in these regions. In North America, around the new assets we have acquired like the Ohio State University, the Longwood Energy Centre in Boston serving six hospitals around the Harvard Medical School and we have a large pipeline of projects that I can't yet publicly announce. In South East Asia, we are setting up a Centre of Excellence in Singapore to serve the Philippines, Malaysia, Thailand, Singapore and the South of China. We may look for opportunities in Indonesia as well, which we have not yet done for district heating and district cooling. The third centre of excellence is around Tabreed (UAE) where we made a strategic move to become shareholder and their strategic partner together with Mubadala, the state fund of Abu Dhabi who still is the majority owner. Tabreed will be a developing platform for Engie in e.g. India, Turkey and Egypt. We focus most of our investments and resources in these three regions for the next one or two years, supported by our three centres of excellence. Once we would have started a self-entertained process of organic growth in these regions, we will deploy specific efforts in new regions and countries. It is our strategy to focus on a limited number of countries in the beginning to develop solid partnerships. Soon, we will have a network of operational and expertise centres all around the world in Europe, North America, South East Asia and the Middle East. These four centres will share expertise and know-how and focus on new energy fields with an "ink-dot strategy" to progressively grow and develop our activities."

**Q: What is your investment strategy when you go into new countries and regions?**

"We have a deliberate strategy for cities and territories. We believe in public-private partnership (PPP) because when well-managed, and if the government applies the appropriate policies and regulations, these partnerships create a lot of values for all the stakeholders. PPP is not a form of privatisation it means that the public hand, a municipality, local government or the state can keep ownership of infrastructure and a lot of technical and operational know-how to be able to control the public partner. In infrastructure projects, we accept to be a minority partner like with Malaysia's Megajana for district cooling operations in Cyberjaya, a city close to Kuala Lumpur. In this project we partnered with the Ministry of Finance of Malaysia which owns 51 percent. We own 49 percent and we do the operation and maintenance. In Tabreed we have a similar approach where the Mubadala state fund of Abu Dhabi owns 42 percent and we hold 40 percent of the shares. In this partnership we provide the operation and maintenance manager and business development manager. This is how we create value to the partnership by sharing best practises, digital tools and procurement on a world-wide level. Such partnership with a public stakeholder will be sustainable if it creates concrete value. It is important to be transparent, this is absolutely crucial in these long-term partnerships to preserve the license to operate. In order to do that, in addition to be transparent and create value, you must also be a "loyal good citizen" which means that you pay taxes, hire local people and work with local companies and start-ups. You have to be embedded in the socio-economic relationship and we have learnt from our 150 years of existence some lessons that we want to apply to district heating and district cooling in cities. We will be ethical, transparent and a good local citizen. This is really our core strategy."

**Q: It is a high degree of localization?**

"Yes. Decentralization means decentralized energy assets, but it also means empowering the local activities. We rely on our business units which are close and know well the geography they are in charge of, they have the PNL and the final decision. This model has both advantages and disadvantages, but we believe it creates long-term value for all the stakeholders."

**Q: What are the key technologies in the Energy Transition?**

"The technologies exist, of course. There are some technologies like photovoltaics or hydrogen that are complete game changers. But in the field of district heating and district cooling, I think it is more a matter of regulatory issues and the mind-set of the decision makers. As mentioned earlier, the goal of my department is to green cities and campus entities and to do this we have the technologies today. While often cities and university campuses tend to focus on each verticals like energy efficiency in buildings, public lighting, district heating, supply of electricity, supply of gas, independently, we advise them instead to adopt an holistic view and we propose them integrated solutions where they could create 10 to 30 percent more value. For instance, the fourth generation of district heating and cooling, a combination of thermal and electrical smart grids using co-generation and tri-generation, can supply heating, cooling and electricity with twice the energy efficiency compared to district heating with conventional boilers. Then you can store energy with cooling and heating storage which is much cheaper than electricity storage. You can indeed use the thermal mass of the networks and buildings and for instance cold water or ice storage to store energy very efficiently and in a much cheaper way than with batteries. We think that

renewable district heating and highly efficient district cooling is the backbone of sustainable cities. We also believe that intelligent public lighting combined with connectivity and video surveillance as "neurons" of better Cities can contribute to more harmonious Cities with a better quality of life. So, combining existing technologies to make todays sustainable cities is a way to dramatically reduce carbon footprint and increase energy efficiency, to increase the quality of life, for example by addressing the heat island effect, and reduce pollution."

**Q: So, energy efficiency plays a key role in creating sustainable energy in cities?**

"Yes, that is right. In the merit order, energy efficiency is number one and is then the priority. The cheapest energy is the one you don't use. Number two is waste heat. If you could collect all waste heat in Europe, you could provide heating to the 500 million Europeans. Waste heat from the US power plants could provide heating to all of the world outside of China, Russia and the US! Then you have to go for local renewable energy like geothermal, thermal solar and local biomass. So you have to set up a merit order: energy efficiency, waste heat, renewable local resources and then global resources. This has been understood by the French government who has put up regulation along these lines."

**Q: You are working together with partners like APUEA and the UN District Energy in Cities Initiative, can you describe how you cooperate with associations?**

"We think that the International Energy Agency (IEA) in the developed world and the United Nations Environment Programme in emerging countries have a crucial role because they are the most credible to convince governments and to adapt strategies that will allow us to respect the Montreal protocol and the Paris agreement and, in a nutshell, to save the world. Financial institutions like the World Bank and the Asian Development Bank can also play a role. The second layer consists of sector associations like Euroheat & Power (EHP), International District Energy Association (IDEA) and Asia Pacific Urban Energy Association (APUEA) because you are closer to the industry. Associations have much more credibility towards governments than private companies. We really count on associations like APUEA to help convince national governments, local governments and cities with putting the legal and regulatory framework in place. Associations have a crucial role to open up markets. Then private companies bring innovations and resources, answer to tenders in the framework of PPP to help in practice and to deliver what is promised. I think it is at least a three-layer strategy, United Nations and IEA globally, industry associations like APUEA and then private partners. We all share the same goals to have a sustainable planet with green sustainable cities and to have a quality of life that is sustainable for the next generation."

> **WE REALLY COUNT ON ASSOCIATIONS LIKE APUEA TO HELP CONVINCE GOVERNMENTS, LOCAL GOVERNMENTS AND CITIES WITH PUTTING THE LEGAL AND REGULATORY FRAMEWORK IN PLACE. ASSOCIATIONS HAVE A CRUCIAL ROLE TO OPEN UP MARKETS. THEN PRIVATE COMPANIES BRING INNOVATIONS AND RESOURCES, ANSWER TO TENDERS IN THE FRAMEWORK OF PPP TO HELP IN PRACTICE AND TO DELIVER WHAT IS PROMISED.**

**Q: What is your take on different sustainable concepts, such as Smart Cities, Eco Cities, and Future Cities?**

"When we think about the smart city we don't only address the dashboard, IT and connectivity layers. What we try to do is to identify what is really the dominant issue of the local government. We have done interviews with cities all over the world. To our surprise, it appears that there are often a similar limited number of categories that local governments want to address all over the world. Air pollution is a major issue that many cities want to address. For instance, in Beijing we worked on coal-to-gas conversion with the local government and provided them with liquefied natural gas. We have also worked with Beijing Gas on the energy efficiency of heating networks. Another example of public stakeholder discovering solutions for their city is given by the Ministry of Environment in Chile, for which we organized technical visits in Paris to show them how the city incinerates waste to feed the district heating networks. This was an eye opener for them as they are facing problems with their waste management and massive air pollution from burning bad quality biomass in houses. Using waste as an energy resource for district heating would solve pollution issues in the cities in the south of Chile at an acceptable cost for the population if the government provide appropriate policies. So they seem to go that way based also on the fantastic and amazing work that the UN District Energy in Cities Initiative has done.

Michael during a panel discussion at the IDEA 2018 conference

We have identified ten big issues that cities and mayors face all over the world such as air pollution, economic development, security, resilience, and climate change. For each of these issues, we have references of concrete achievements we did with cities. Once again, it is not really a technology issue, it is not science fiction, it is not ground breaking new technologies, it is the way to assemble existing technologies we have in-house or together with our partners."

**Q: Gas is still a major part of Engie, how do you see the future of Gas in terms of decarbonisation?**

"Gas is an important part of the necessary energy package and we think it is a crucial asset in the mix to decarbonize as much as possible the cities and the world. We have quit coal but stay in gas because it is indispensable in combination with intermittent renewable energies. In the really long term, for instance in France where we are a transmission and distribution operator of gas, we have set ourselves a goal by 2050 to have reduced or gone out of fossil gas by substituting fossil gas with biomethane or renewable hydrogen. For the time being we are progressively injecting a few percent of biomethane in the gas network and we are one of the leaders in the private sector to develop renewable hydrogen technology and infrastructure. We are one of the very active companies in the renewable hydrogen field because we think it is a way to utilize intermittent renewable electricity production from, for example, wind power and solar-PV systems. There will be moments of electricity oversupply from wind and solar and one way to deal with this is to produce green hydrogen by hydrolysis and inject it in the gas network. We can inject up to ten percent of renewable hydrogen in the gas network without any modification for end customers. This would provide a huge capacity to store and use renewable hydrogen. This is another way to mobilize renewable energy sources when it cannot be used other ways and use gas infrastructure as a renewable infrastructure."

**Q: Do you also invest in gasification technologies?**

"Yes, we have a research program and we have worked on gasification. We have a big pilot plant in Lyon called the Gaya project where we have invested tens of million EUR. Gasification is a potentially interesting technology which will help us move to bio methane and can play a role in the future of gas. So we hedge our bets, we go for hydrogen and possibly methanation, as well as first and second generations of biomethane. We try to cover all these technologies because we need all sources of green gases in the long run. We are technology agnostics and we want to propose the best solution for the community."

**Q: How do you see competition in the market from Engie's point of view?**

"We like the competition because there is so much to do. If we want cities and territories to become green, we need a huge collective effort from the UN, IEA, the associations, ADB and the World Bank and we need other companies to go the same way we are going. Obviously, we cannot do it alone. We would love if other companies have the same strategies and philosophy as us. We are running out of time because of climate change so there is a real urgency. Unfortunately, there is a limited number of companies that go the same way as us. Today, in the district and cooling field, the most aggressive competitors are not utilities or service providers, it is pension funds and infrastructure funds."

**Q: Is this because energy services are not valued enough?**

"It is because when you go for long term infrastructure investments, 30-50 years, the financing aspect becomes very crucial and no utility can compete with infrastructure funds on financial return expectations of the shareholders. Instead of competing, we decided to ally with them. For instance, in the last large deal in the US, that we closed one month ago, we allied with a Canadian firm called Axium to invest in a microgrid and district energy system to supply energy to the Harvard Medical School and six Harvard-affiliated medical institutions in Boston. This is a strategy that we will continue with in the future. As a utility we have limited Capex while the infrastructure funds have greater resources at limited costs. The good news for the industry and the world is that there seem to be quite unlimited funds available and that to date we don't seem to be restricted by Capex to deliver the energy revolution and to decarbonise cities and campuses. It seems more to be a matter of political and regulatory will and vision!"

# Promoting Sustainable Urban Energy in Asia Pacific

Asia Pacific Urban Energy Association (APUEA)

image credit: Ciel&Terre International

# Renewable Energy Intermittency: Realistic Solutions for Asia

By Yvan Paquot, Manager for Renewable Energy Projects at Pöyry Energy, Bangkok

*Author's Note*

Some hybrid solar-hydro plants currently in development in Asia have capacity in the order of 50 MW.

**Most countries across Southeast Asia have embarked upon developing large scale wind and solar power plants. Thailand has pioneered the movement and has so far installed about 3.5 GW of generation capacity from these sources. Past the initial enthusiasm sparked by the dramatic decrease in cost of renewable technologies, concerns are now rising from the power network operators that the unpredictable intermittency of solar and wind resources could destabilize the grids and increase stress on the existing power plants.**

## What are the practical solutions to mitigate intermittency?

Grid power experts around the world advocate a global "smart grid," where electricity demand of industry, transports, new energy storage plants and residential buildings would be automatically dispatched according to the energy instantaneously available. Cross-border transmission lines would also allow for rebalancing production and consumption at the level of the continent, as it is done in Europe for instance. Although the concept is indeed promising, there is a long way to go in a region where power systems haven't been designed for it and national grids are hardly connected.

Fortunately, there are also easier means of re-balancing power networks in a preliminary stage. Pöyry, as a global consultant in the energy sector, is involved in multiple renewable energy projects across Asia and has a good vision on **current and emerging technical solutions to mitigate intermittency**. We interact with the main stakeholders (developers, lenders, authorities, suppliers, contractors) and advise on the following trending schemes.

## Hybrid Power Plants and Dispatch

The simplest and least expensive strategy to partially mitigate generation fluctuations by renewable power plants is to associate assets of different natures in a smart way, based on their statistical production patterns. One of the major costs of a large scale "smart grid" is the electrical transmission network. By grouping strategic assets, the grid requirements are much lower and the total cost of development strongly reduced.

A particularly interesting scheme of such synergy is the rising trend of **floating solar PV plants** on hydropower reservoirs. Pöyry has the chance to be involved in four large scale projects using this emerging technology. Instead of occupying precious land, solar panels are mounted on plastic floats assembled into a large pontoon that can withstand water level fluctuations of up to 40 meters. The system can be connected onto the same electrical lines as the hydro turbines, with limited additional cost.

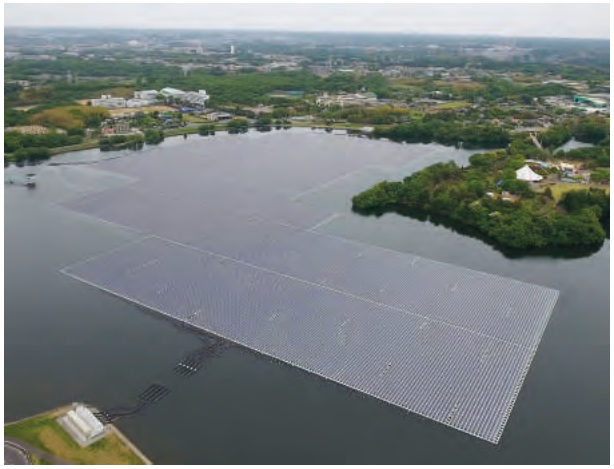


Figure 1: 13.7 MW floating solar power plant on Yamakura Dam reservoir, Japan (image credit: Ciel&Terre International)

Hydropower stations are known to be excellent at regulating production: when there's a peak of power demand, turbines are activated and when energy is less needed, the gates are closed for later use of water. This can compensate for the drop of solar output due to a cloud or the night time. Moreover, there is an interesting seasonal complementarity between the high solar production during dry season, when hydropower is at its lowest, and vice-versa.

Given the large number of hydropower reservoirs across Asia, the region has a hybridization potential of multiple gigawatts, although contractual arrangements of existing systems may constitute a barrier to development in some cases.

Since 2017, the Ministry of Energy of Thailand has also opened bidding for hybrid power purchase agreements essentially oriented towards biomass and solar PV or wind to incentivize the deployment of regulated renewables. Even if other combinations are also welcome, the scheme is initially thought to use a biomass or biogas plant as regulating base to guarantee a firm generation during peak hours, eventually in association with other renewable sources. Some developers have proposed using battery storage to regulate the plant.

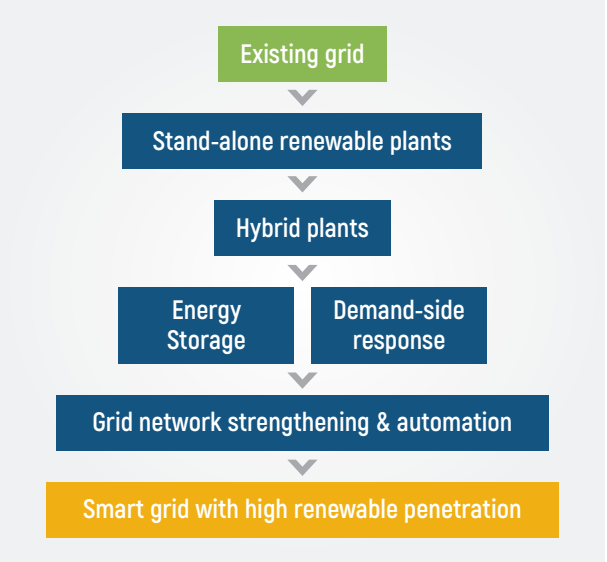
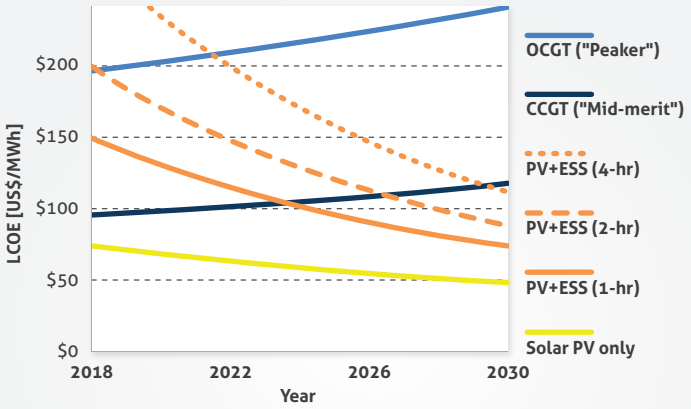



Figure 2: Expected intermediate steps towards a high renewable penetration

## Energy Storage

This brings us to one of the hot topics of the moment: **energy storage**. In spite of the profusion of new experimental methods, only two main technologies offer a credible business model at the time being: pumped hydropower and batteries.




- The blue curves show the expected levelized cost of electricity (LCOE) evolution for traditional gas plants for slow response (dark blue) and fast reaction to peak demand (light blue).
- The yellow curve shows a typical cost of unregulated solar energy.
- Orange curves describe the price of energy from solar plants with various capacities of battery storage (1, 2 and 4h duration), which could offer flexibility comparable to peaking gas plants.

Figure 3: Solar+storage is expected to become competitive with gas fired power plants

**Pumped hydropower storage plants** or **"PSP"** used to be the only relevant large scale model for over a century and still represents more than 95% of the total worldwide installed grid storage capacity. Excess electricity is used to pump water–for example from a river–to an artificial lake at a higher altitude. In mountainous countries like Laos, Vietnam and many others in Asia, the natural relief is very well suited and offers a rich potential for PSP. Pöyry has been involved in 35 PSP projects worldwide in the last 10 years only, including a number of schemes in Asia, and expects to see more opportunities arising in the region, to enable intermittent solar and wind plants developments.

**Batteries** have come to the headlines recently thanks to the fast drop in price. However, they apply to a different market segment than PSP. Their cost still remains too high to compete for storage longer than a few hours, but their unique feature is a tremendously fast reaction time. While hydropower generation can start to full capacity in a matter of minutes, Lithium batteries latency comes down to seconds or milliseconds! This agility, along with fast construction process and low requirements regarding the location, make it an increasingly attractive solution to complement solar plants by shifting the generation peak by a couple of hours, while stabilizing the entire power grid against second-scale fluctuations. We could then see "solar + battery" plants competing with gas peaking plants in the coming years for these applications, as indicates a recent research by Pöyry featured in Figure 3. More information on the study can be found in our publication **"Utility Scale Solar + Storage in Southeast Asia"** (http://www.poyry.com/news/articles/utlity-scale-solarstorage-southeast-asia)

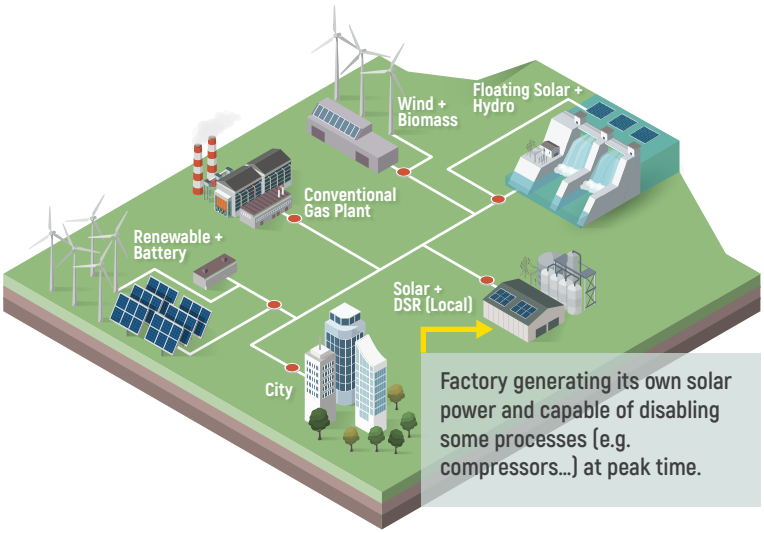



Figure 4: Vision of a preliminary step towards a "smarter grid": instead of being densely interconnected and centrally controlled, assets are aggregated in small clusters based on their natural generation and consumption patterns to reduce grid development requirements.

## Demand-Side Response (DSR)

Following the adage "the cheapest electricity is the electricity we don't have to produce", the same is true with energy storage: an important part of the mismatch between production and consumption can be avoided by simply deferring by a few hours the use of some appliances such as water heating, electrical vehicles charging, and some specific industries (large compressors, treatment plants,...) that are not strict on the timing of their operation. As reward for such flexibility, the users can benefit from more advantageous tariffs.

A pilot project of the scheme has been initiated in Vietnam with Ho Chi Minh City Power Company and results will be awaited to define the next implementation stages. Although differential tariffs are already in use in most countries, with fixed peak and off-peak prices for energy, a more advanced DSR system would ideally enable a dynamic reaction of the demand to a given event (for instance a cloudy afternoon or a power plant failure).

More information on the topic can be found in our publication "Demand Side Response – the myths and realities" (http://www.poyry.com/news/poyry-demand-side-response-the-myths-and-realities-).

## Conclusion

The three classes of intermittency mitigation measures discussed in this article – hybridization, energy storage and local DSR – present practical, readily available solutions by order of cost and complexity of implementation. The typical roadmap featured in Figure 2 is a simplified vision of the successive stages leading to a power grid with a high integration of renewable energy sources. The current "opportunistic" development of renewable projects, based only on solar or wind resource availability, is currently possible thanks to the relatively low share they have in the energy mix. However, with the rise in renewable installed capacity, grids will be increasingly in need of regulation. Authorities are already starting to implement hybrid development plans, energy storage is in the air too and it is a safe bet that demand side response will be part of future developments.

PÖYRY

Pöyry is an international consulting and engineering company. We serve clients across power generation, transmission & distribution, forest industry, biorefining & chemicals, mining & metals, infrastructure and water & environment. Together, we deliver smart solutions and work with the latest digital innovations. Pöyry's net sales in 2017 were EUR 522 million. It approximately has 5500 experts, present across 40 countries and 115 offices.

Pöyry has been powering Southeast Asia in the last 50 years. The company currently has over 300 experts in the region who specialise in thermal, hydropower & renewable energy.

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

# DistrictCooling2018

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**Cities across the globe are turning to district cooling to achieve community-scale efficiency and environmental targets. Dubai, UAE is clearly a world leader in deployment of district cooling infrastructure to support rapid economic growth while conserving vital resources. After unprecedented growth in the last decade, the Dubai Supreme Energy Council seeks to double investment in district cooling by 2030.**

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UH Maui College will generate 100 percent of its energy from on-site solar coupled with battery distributed energy storage. Photo by University of Hawai'i

# University of Hawai'i Campus Can Go 100% Renewable with Johnson Controls Distributed Energy Storage

By Jeremy Niederjohn, Johnson Controls

> **WHEN ITS NEW SOLAR + STORAGE SYSTEM IS OPERATIONAL IN 2019, UH MAUI COLLEGE WILL BE CAPABLE OF ELIMINATING THE CAMPUS' FOSSIL FUEL-BASED ENERGY USE–16 YEARS AHEAD OF SCHEDULE.**

Johnson Controls is helping the University of Hawai'i Maui College move toward being one of the first U.S. campuses to generate 100 percent renewable energy on site, from solar + distributed energy battery storage. Four more UH community college campuses on O'ahu will also significantly reduce fossil fuel consumption.

More than $79 million in savings will be generated across all campuses over 20 years, guaranteed. Energy efficiency upgrades will also reduce the deferred maintenance backlog at these campuses by approximately $20 million.

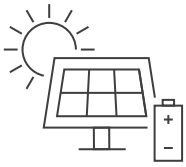
The photovoltaic solar + storage systems will be developed by Johnson Controls and owned by Hawai'i -based Pacific Current.

Distributed energy storage from Johnson Controls brings together the company's expertise in batteries and buildings to create advanced energy storage solutions, using lithium-ion batteries in modular systems for easy scaling. These systems support multiple applications, are driven by intelligent and adaptive controls, and easily integrate with existing building automation systems for holistic, efficient energy management.

In 2015, Hawai'i became the first U.S. state to commit to achieving 100 percent renewable energy by 2045. The state legislature and UH together set a goal for the university system to be "net-zero" by January 1, 2035, meaning the system would produce as much renewable energy as it consumes across its campuses.

When its new solar + storage system is operational in 2019, UH Maui College will be capable of eliminating the campus' fossil fuel-based energy use–16 years ahead of schedule. On O'ahu, through a combination of solar shade canopies, distributed energy storage and energy efficiency measures, Leeward Community College, Honolulu Community College, Kapi'olani Community College and Windward Community College will reduce their use of fossil fuel for energy by 98 percent, 97 percent, 74 percent and 70 percent, respectively.

The project will have the following solar PV and distributed energy storage capacity:

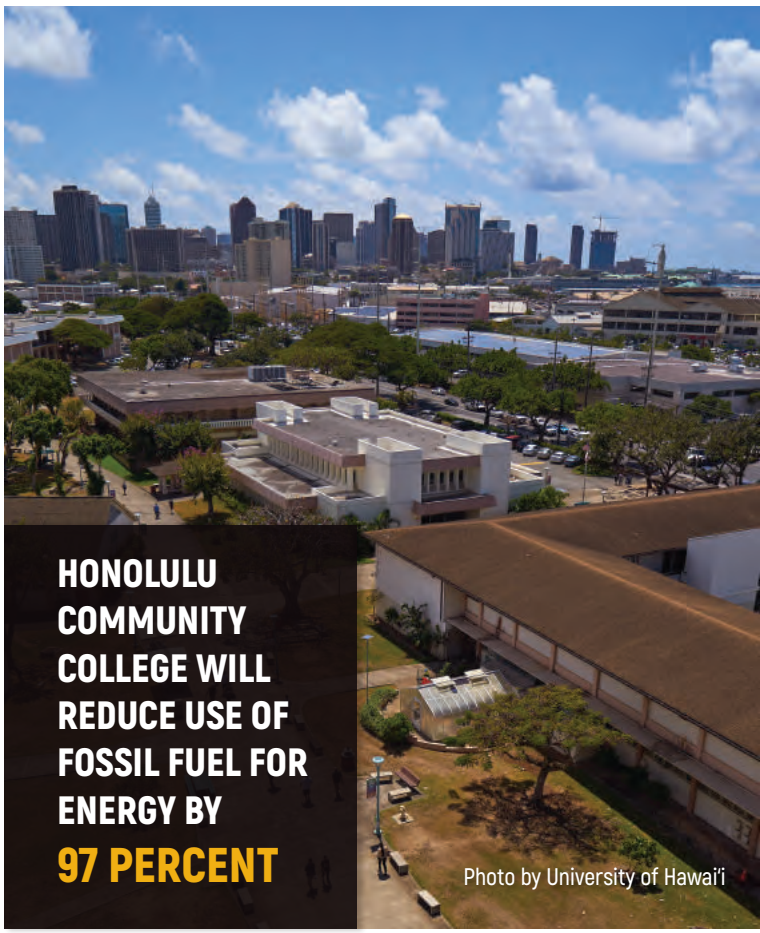


### SOLAR PV (10.5 MW)

**Total on-site capacity**
**Maui:** 2.8 MW of solar PV
**O'ahu:** 7.7 MW of solar PV

### DISTRIBUTED ENERGY STORAGE (41.8 MWH)

**Total on-site capacity**
**Maui:** 13.2 MWh of battery distributed energy storage
**O'ahu:** 28.6 MWh of battery distributed energy storage




Since 2010, Johnson Controls has worked with the university system to increase energy efficiency and sustainability through performance contracting. The partnership between UH, Johnson Controls and Pacific Current is the second phase of this project, which also includes educational programs for faculty and students.

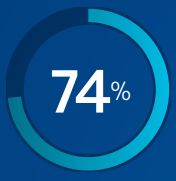
## Advancing toward 100 percent renewable energy

By 2019, the University of Hawai'i (UH) Maui College will be capable of producing as much energy as it consumes. A total of five UH Community College campuses will cut their fossil fuel energy consumption by the following:


MAUI CAMPUS


LEEWARD CAMPUS


HONOLULU CAMPUS




KAPI'OLANI CAMPUS


WINDWARD CAMPUS

Photo by University of Hawai'i

## KAPI'OLANI COMMUNITY COLLEGE WILL REDUCE USE OF FOSSIL FUEL FOR ENERGY BY 74 PERCENT

Johnson Controls

Johnson Controls is a global diversified technology and multi-industrial leader serving a wide range of customers in more than 150 countries. It has more than 120,000 employees creating intelligent buildings, efficient energy solutions, integrated infrastructure and next generation transportation systems that work seamlessly together to deliver on the promise of smart cities and communities. Johnson Controls' commitment to sustainability dates back to its roots in 1885, with the invention of the first electric room thermostat. The company is committed to helping its customers win and to creating greater value for all of its stakeholders through a strategic focus on buildings and energy growth platforms.

Photo by Ron McClenny on Unsplash

# The Art of Renewable Energy Forecasting

By Mikkel Westenholz, Managing Director, ENFOR

## Benefits

- **Support the transition to renewables and reduce $CO_2$ emissions**
- **Enable the ability to manage large amounts of renewable energy**
- **Lowers the cost of balancing renewable energy (reducing cost of standby capacity)**
- **Increase the security of supply**

## Why Forecast Renewables?

In order to reduce $CO_2$ emissions, the share of renewable power production (especially wind and solar power) increase in many countries around the world. As renewable power production increase, the electricity systems face a new challenge due to the fluctuating and intermittent nature of renewable power production. As wind, solar, wave and hydro power all are highly depending on weather conditions, the ability to forecast the weather and accurately transform it to a power forecast, becomes as key competence. For countries like Denmark, where wind power alone makes up for more than 40% of the annual power consumption and where renewable power can make up for more than 100% of consumption in individual hours, accurate renewable power forecasting becomes system critical. The forecasting solutions provided by ENFOR has been operational since 1994 and have supported the transition of the electricity system both in Denmark and many other countries.

## How to Forecast Renewables

Operational power forecasting typically has a time horizon of a few minutes ahead and up to approx. 2 weeks, which can thereby be used for short to medium term planning of power production. Such power forecasts are based on weather input from global and regional weather models. The weather forecasts are then combined with local measurements from the renewable power assets.

Accurate forecasts can be achieved by feeding off-line production data on a regular basis (once a month or similar) such that machine learning algorithms can automatically adapt to the data and

thereby continuously tune the models for optimal performance even as the assets wear and tear. For increased short term performance the access to online/real-time data from the assets are critical as huge improvements can be achieved on the 3-4 hour time horizon. It is also possible to combine off-line and on-line assets using upscaling techniques. In such a setup, the online data from some assets will benefit the forecasts of assets where only off-line data is available.

With the development of the internet and cloud computing, the concept of "forecast as a service" has emerged and are becoming more and more popular due to its simplicity and effectiveness. Even though it is indeed still possible to setup a local installation in the clients IT-environment, there are a number of benefits from letting the forecasting provider handle the installation. In such a setup the client just transfer measurement from the assets (e.g. production, availability and weather) to the forecast provider, who then produce the power forecasts and transfer them back. The provider will take of model updates, weather forecasts, server hosting (and redundancy), which often yields a more reliable service.

ENFOR has developed a long range of special forecasting techniques which have been imbedded into dedicated modules, which can handle special situations. Probabilistic forecasting techniques (describing the uncertainty of the forecast), can be used for optimizing trading strategies and can also be used to provide the probability of ramping events, for improved risk management.

Other modules have been driving by specific customer requirements as the Australian Energy Marked Operator (AEMO), for whom ENFOR, and its partner Overspeed, developed an ultra-reliant wind and solar power forecasting system with 100% uptime. The system has never had downtime during the 8 years of operation.

For Hydro-Quebec in Canada, who has a large wind power portfolio in mountainous and icy conditions, ENFOR developed special techniques for forecasting of wind power in complex terrain as well as forecasting icing events and the decay of such ice on the turbines.

More widely used, is the combined forecasting module, which can take multiple weather forecast providers as input and then automatically and dynamically select the best combination of weather forecast providers for the individual renewable power assets. By applying such techniques, it is often possible to further improve forecast accuracy by 5-10%.

## Renewable energy forecasting and data requirements

Data is of uttermost importance, but there is a trade-off between the cost of implementing vast amounts of data processing and the value of the resulting accuracy improvements. For smaller portfolios, the cost/benefit ratio of an advanced setup might not be high enough, and it might be advisable to go for a simpler, but still fairly accuracy configuration. For large GW portfolios it is almost always worth the extra effort of including as much data as possible, since small improvements in forecast accuracy often have high economic benefits. The ENFOR solutions a flexible and built such that they can provide reliable forecasts even with very limited data.

### Benefits

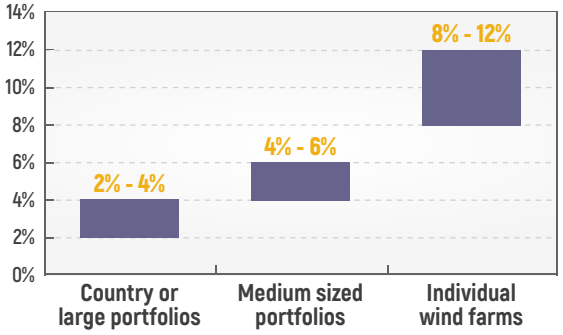
Accurate renewable energy forecast provides following benefits for the electricity system:

- **Support the transition to renewables and reduce $CO_2$ emissions**
- **Enable the ability to manage large amounts of renewable energy**
- **Lowers the cost of balancing renewable energy (reducing cost of standby capacity)**
- **Increase the security of supply**

Online production measurements can have a huge impact on intra-day forecast accuracy. Schedules (e.g. outages and maintenance information) is another important, but often overlooked piece of information. The omission of schedule information will not only impact the specific event, but also cause noise in the models and reduce the general forecast accuracy. For optimal performance the forecast provider should not only automatically receive information about schedules, but ideally also receive online data about turbine availability (turbines ready to produce) and set-point (e.g. curtailments).

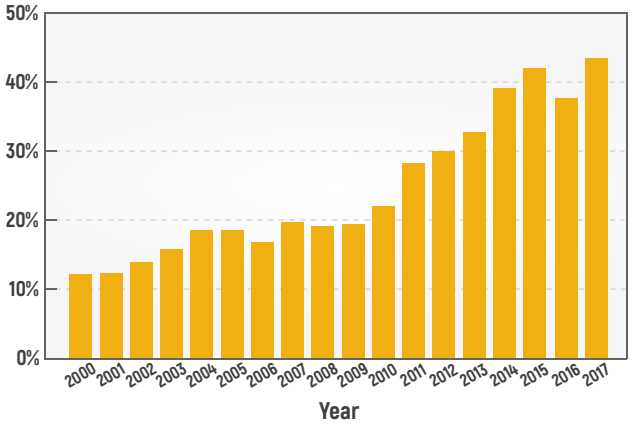
Forecasting of new wind and solar farms is an exercise which requires particular attention as there is no historical data. Ideally the design of the wind or solar farm also resulted in a power curve describing the expected production as a function of the most important weather parameters. Such, a power curve is then used to initialize the forecast engine, which should then quickly and fully automatically adapt the power curve as real measurements are recorded. Alternatively, a default power curve based on turbine type and other relevant static information can be used to initialize the forecast process.

### Expected forecast error for day-head forecasting of wind power




The numbers are provided as Normalized Mean Absolute Error (NMAE)

**The share of wind power in Danish electricity consumption (%)**




## Selecting Forecast Provider

When selected forecast provider there is a number of items to consider, of which forecast accuracy, system reliability and price are probably the most important factors.

Even if it might seem simple, forecast accuracy is actually a complicated subject, since it can be defined in so many ways. In order to best compare between forecast providers, the performance metrics should be precisely defined and match the economics of the specific electricity market in question. Normalized Mean Absolute Error (NMAE) is one of the classic performance metrics used. In markets where large errors have a disproportional cost compared to small errors, it is better to use Normalized Root Mean Square Error (NRMSE), as this metric penalize large errors more than small errors. In addition, it is important to define the exact forecast horizon to be used (e.g. day-ahead or hour-ahead) as the forecast horizon should match the decision processes within the company and the regulatory framework in the country. Accuracy can only be compared if measured during the same period (and minimum 3-4 months) as there will be variations from months to months. Other factors have huge influence on the performance such as the capacity factor of the farms, geographic location and the aggregation level used for calculating performance.

Forecast accuracy for a specific portfolio, can be measured through a real-time/online trial or through an off-line simulation based on historical data. Off-line simulations have the benefits that they are fairly quick and cost-effective for both parties. The big drawback is, that it is easy to tamper with the simulations and improve forecasts when both the actual production and actual weather is known. Therefore, simulations should only be used as benchmark when engaging with well-established forecast provider, where there has already been established a high level of trust. Real-time/online trials have the benefit that they give an indication of real performance, but they take time (at least 3-4months), are costly for both parties (in the long run customers will have to pay the costs of running trials even they might not face any direct costs when carrying out a trial).

Since more complicated setups and special configurations can rarely be modelled during a real-time trial or off-line simulation, these benchmarks will only give an indication of the performance one can expect. Therefore, it is also important to check the experience, track record of the forecast provider and ideally receive references from customers.

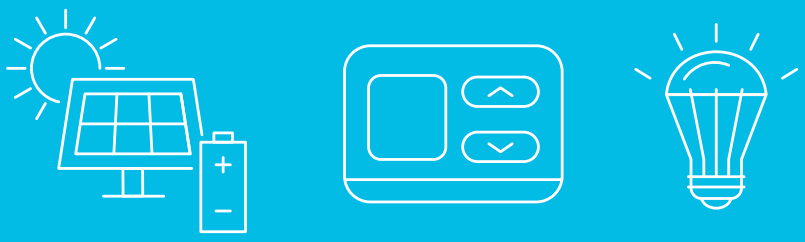
The experience of the forecast provider to handle various special configurations, will in the end also have an influence on the outcome and forecast accuracy. In addition, the experience of the forecast provider will most likely also have a significant impact on the reliability of the forecast service and if they consistently will deliver forecast even when parts of the input data might be missing or contain errors. The ability to handle erroneous data and consistently deliver forecasts in such situations, comes with years of experience. Reliability should also be an evaluation criterion during a real-time trial, but most likely the best way to assess this factor, is to check references and the reputation of the forecast provider since trial often only run for (relatively) short periods of time.

Price will also be an important criterion for selecting the forecasting service. If at all possible the evaluation should be based on an assessment of the value of accurate forecasts. Depending on the market and regulatory framework, this could be measured against imbalance penalties from market mechanisms, regulatory performance requirements (penalties) or the cost of handling/correcting imbalances (securing and activating standby capacity). Well-established forecast providers should have differentiated services, such that the customer can get the service matching their specific needs and yield the optimal cost/performance ratio. Such optimal cost/performance ratio should be based on the mentioned economic assessment and then obviously take the size of the customer portfolio into consideration. Achieving a 1% performance improvement has a significantly higher value on a 4GW portfolio than for a 50MW farm.

ENFOR

"**ENFOR** provides forecasting and optimization solutions for the energy sector. Utilities, energy traders, transmission and distribution system operators use ENFOR solutions for forecasting of wind power, solar power, hydro power, electricity and heat demand as well as optimization of district heating systems. Based in Denmark, and established in 2006 as a spin-off from the Technical University of Denmark, the company has a solid operational track record and successfully serve customers all over the world."

Author's note: "ENFOR is supported by the Danish EUDP project Wind Task 36 Forecasting Danish Consortium under the contract no. 2015-II-499149"



# Increase efficiency with DES – every building, every day


**Distributed energy storage** from Johnson Controls helps building operators make better use of renewable resources:

- Intelligent, adaptive software controls
- Scalable lithium-ion battery modules
- Easy integration with building automation systems
- Outstanding reliability and service, built on 130 years of innovation

DES empowers you to increase energy efficiency and reduce operating costs. Let us show you how to capture the greatest value.

**See case studies at www.johnsoncontrols.com/des**

Johnson Controls

# Getting the EV Show on the Road

By Kumail Rashid, Sales Manager – Asia Pacific, EV Charging Infrastructure, ABB

**MOST EXPERTS AGREE THAT THE WIDESPREAD ADOPTION OF ELECTRIC VEHICLES IS A GOOD THING, BUT THERE IS ALSO A REALIZATION THAT IT WILL ONLY HAPPEN IF NETWORKS OF FAST-CHARGERS ARE BUILT UP QUICKLY, SO THAT CHARGING IS AS EASY AS FILLING A PETROL TANK.**

**Today, transportation contributes nearly one quarter of global $CO_2$ emissions. Governments are increasingly recognizing this rising challenge and taking some encouraging measures to make transportation greener, driven by global agreements and treaties and tightened emissions standards. But if public transportation is ever to achieve zero local emissions, full electrification of the system is needed.**

## In a flash

The city of Geneva, Switzerland, has taken a key step towards full electrification of its public transportation network. The "TOSA" bus line is fully electric despite not featuring overhead lines. Instead, ABB's "Flash" or opportunity charging tops up the batteries at intermediate points on the route in as little as 15–20 seconds, during which time the bus has stopped to allow passengers to embark and disembark. This also means that the dead weight of large batteries is reduced, saving both space and weight. Also, as the battery remains partially charged, charging time is reduced at the ends of the route, which is especially important during time-constrained rush-hour operations.

The absence of overhead lines is not only less visually disruptive, but also saves on installation costs by avoiding extensive construction work for the overhead line and allows for more flexible bus operations during road works. It also saves on maintenance, which accounts for a significant portion of the costs of traditional bus operation using overhead line infrastructure.

## A City Takes Charge

In Singapore, a new autonomous electric bus project is being developed by Volvo Buses and Nanyang Technological University (NTU). ABB will provide its state-of-the-art Heavy Vehicle Chargers (HVC) 300P fast charging system, delivering 300 kW DC power and recharging a battery in three to six minutes, without impacting the normal operation of the route.

Nanyang Technological University estimates that electric vehicles could make up as much as 50 percent of Singapore's motor population by 2050.

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 – 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 the bus depot. The aim of the project is to enable tomorrow's buses to charge their batteries, drive to the vehicle wash and park – entirely autonomously.

## From A to B with ABB

Think of any kind of transportation and you will find proof that it is becoming "smart" and connected. That starts with walking and the use of personal fitness trackers, and also includes bike-sharing services or electric buses in major cities. This phenomenon has led to the concept of the "intelligent transportation system" (ITS), which is about connecting the dots to move people and freight around more efficiently, safely and at lower cost. It involves the use of sensors to collect data, communication technology to enable remote control and analytics to continuously improve the system.

At the same time, electric cars are at a tipping point. Several countries have announced bans or limits to the use of the internal combustion engine within the next couple of decades, and major manufacturers are responding with an increased range of electric models that are more affordable than ever.

It is no surprise that the ABB FIA Formula E Championship, a fully electric street-racing series, which demonstrates the cutting edge of electric vehicle technology, is capturing the imagination of motor-racing fans around the world.

Most experts agree that the widespread adoption of electric vehicles is a good thing, but there is also a realization that it will only happen if networks of fast-chargers are built up quickly, so that charging is as easy as filling a petrol tank. Digital connectivity has an important role to play in ensuring the reliability of supply. ABB is a global leader in electric vehicle charging, with a range of DC fast-chargers for cars and e-buses. These chargers are connected using the digital ABB Ability™ platform solution to remotely monitor each charger, and can be found in fast-forward countries such as The Netherlands and Bulgaria and cities like St. Petersburg, Russia and Trondelag in Norway.

In the Philippines, ABB chargers will soon be the backbone of QEV Philippines' ambition to bring more electric vehicles to the Philippines. In 2018, the venture will seek government assistance to convert 10,000 jeepneys to e-jeepneys every year. These vehicles are the most popular means of public transportation in the Philippines. As its technology partner, ABB will support QEV Philippines' mission with its fast charging technology for all current and next-generation vehicles.

ABB will supply 200 Terra 53 chargers, as part of a broader cloud-enabled network over the next three years. Part of the ABB Ability™ portfolio of connected solutions, the network will enable them to "look inside" chargers hundreds of miles from their control center, predict when maintenance is needed and deal with problems without having to send an engineer. This will help reduce costs and make money, while providing a reliable service to passengers.

The future of transportation will take connectivity to an ever greater level. Automated driving technologies promise improved safety and convenience. Proponents even describe a vision of a connected system of driverless cars, buses and bikes, all easily accessible via a single app. In this future, each automated car can produce an estimated 4,000 GB of data every day, digital services such as ABB Ability solutions are key, to ensure that energy is directed to where it is needed, including the option for cars to supply excess energy back into the grid and help to keep the system running smoothly.

Technological advances have given this historic opportunity to run the world without consuming the earth. The key is for all of us work together to combine electric vehicles with renewable power generation, connecting them with a smart grid. As the environmental and public health concerns of our longstanding reliance on fossil fuels have grown, it is clear just how much we stand to gain by embracing new and improved ways to travel. The faster we can make this happen, and rid our cities of air pollution and our atmosphere of greenhouse gas emissions, the better.

Let the future of sustainable transport begin.

**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.

# Smarter Mobility
## For transport of the future, today

In 2017 there were more than 2 million electric vehicles worldwide and the market is growing, with electric car stock set to range between 9–20 million and 50% of new buses in Europe to be electric from 2020 onwards. Electric vehicles require power, and ABB offers a total solution, from reliable DC fast charging stations for cars to innovative on-demand electric bus charging systems.

### Market leading position

**No. 1**
in connected EV charging infrastructure

**>6,000**
chargers installed **worldwide**

**100%**
**connectivity: ABB Ability™** cloud-based technology and real time data for remote and proactive control

### EV charger benefits

ABB chargers provide
**99%** **uptime**

**3–6 minutes**
re-charging time for buses

**10–12**
**minutes** charging time for 300 extra kilometers

**2.6 million**
tons less $CO_2$ per year, equivalent to about 10 million cars

# Sino-Asia Pacific Urban Energy Conference 2018

## Regional and International District Energy Experiences

## Fengxi New City, Xian, P.R. China
## 12-13 September 2018

As the urbanization continues, city governments are facing challenges to cope with the increased energy demand while maintaining economical growth, sustainable local environments and reliable energy services. There is a great need for innovative urban energy solutions that can cope with the future demands in terms of flexibility, reliability and efficiency while being competitive with conventional solutions.

Xian, the Capital of Shaanxi province, has high expectations from the central government being the Pivot of the Silk Road Economic Belt, the Hub of China's Opening to the West strategy and the Engine of China's Western Development. Xian government has ambitious targets developing sustainable urban energy schemes, and great attention is put on reducing emissions and particles in order to improve the local environment.

Fengxi Energy Company, Xian District Heating Company and Asia Pacific Urban Association (APUEA), are hosting the first Sino-Asia Pacific Urban Energy Conference in Xian during 12-13 September 2018.

During the conference international and national experiences within district energy, distributed energy and other sustainable energy schemes will be shared. Special attention will be given to smart district energy, heat recovery, efficient and integrated utilization of gas and renewable energies, modernization of existing district energy systems, among other topics.

This conference will feature international and national sector experts, sharing experiences from real-world cases, enabling a great opportunity to share ideas, aquire intelligence and discuss relevant topics and business opportunities.

The expected audience will include government officials, planning agencies, utility executives, financial and legal experts, planners, developers, design institutes, companies with interests in district heating and district cooling, academia and domestic and international sector associations.

For speaker slots, sponsorship and registration please contact **Peter Lundberg** at **plundberg@apuea.org**.


A Scania Hybrid Electric Truck on an E-Highway in Sweden

# Electrification – Securing the Path to a Fossil-Free Future for Transportation?

By Alexander Mastrovito, Head of Sustainable Transport Solutions, Scania Asia & Oceania

**OUR OWN RESEARCH SHOWS THAT ELECTRIFICATION OF COMMERCIAL VEHICLES IS THE MOST COST EFFICIENT OF ALL PATHWAYS TO A FOSSIL-FREE TRANSPORT SYSTEM.**

**"Demand for a proper automobile battery is so crying that it soon must result in the appearance of the desired battery. Everywhere in the history of industrial progress, invention has followed close in the wake of necessity"**

The assumption that innovation always follows need is a popular idea, and if the preceding quote was written just some 10-20 years ago it might provide the foundation for quite a rosy outlook for the current development of electric vehicles. But, that quote was made in 1901 – 117 years ago.

Electrification of vehicles is not a new phenomenon. What is it then that makes them the talk of the town right now? Technology-wise we have come some way since the early 1900s, lithium-ion batteries have doubled their capacity since they first became commercially available in the 1990s; but lead-acid batteries have not progressed much since their inception in 1859. Having been around for so long, how come the electric vehicle never took off? Well in certain applications it did admittedly take off, electric trolley buses have been a mainstay of many cities' mass transport systems for a long time. But in the end, for most on-road transport applications electrification could never compete with the cost, practicality, and energy density of the combustion engine powered by petroleum based fuels. Even when gasoline and diesel have reached record high prices, the take-off of alternative fuels and electrification has been only temporary. But, in spite of the historical irony that might make you question this next statement - perhaps we're actually closing in on a paradigm shift in transportation propulsion right now.

Two things in our environment have changed since we entered into the 21st century. The first thing that became painfully clear was that we have already, or would very soon, reach the peak of our oil production. Public debate has disagreed on when, but there is little to no debate on if. The second major mind-set shift that has happened is the almost universal adoption of the reality that we have now moved from a Holocene (i.e. the last geological period that controlled our climate through natural processes) to the Anthropocene – where human activity has beyond doubt become the main influence on climate patterns by exponentially increasing the saturation of $CO_2$ in the atmosphere.

These two external challenges have contributed significantly to incremental improvements and increased investments in electrification technologies – like the aforementioned recent developments of the lithium-ion battery, along with many other electrochemical combinations that either provide an improvement in some metric or struggle to find stability. Other advancements come in related areas like aerodynamics, rolling resistance, and battery management software. Another recent change is the emergence of China as an automotive powerhouse. Struggling to find a competitive edge on the incumbents of the automotive industry, they have turned to electrification as a strategic industrial bet. And they've done so with great impact; unfettered by a legacy of production of the combustion engine there hasn't been much resistance internally to build up production capacity that already today produces around half of the world's EVs. Furthermore more than 90% of the world's electric bus fleet exist in China and the theoretical production capacity amounts to several times the current yearly output of some 350 000 EVs.

Altogether all these developments – peak oil, climate change, technological advancements and China's emergence onto the global automotive scene – have created an environment which may, for the first time since the electric vehicle's introduction in the 19th century, actually displace the internal combustion engine. And it has to.

Achieving a fossil-free commercial transport system in the time-frame of the Paris Agreement target is not only possible, but also financially attractive from a societal point of view. It won't be easy, nor will it have unanimous support. But similar challenges on a global scale have been solved before. Both ozone depleting substances (CFCs) and leaded gasoline were eliminated in the span of just two decades in most of the world through concerted action by the international community. Today there are two camps, one calling for urgent immediate action whatever the cost. The other calling for systematic analysis, thought-through decisions, incremental actions, and careful evaluation. The most likely truth is perhaps that both camps are important parts of the solution to climate change – one driving momentum and a sense of urgency, the other making sure that the right things are done in the right way.

Case in point, there is already today a huge momentum for electrification of on-road vehicles of all types. At the helm many cities around the world have called for bans on diesel vehicles within the coming decades and closely following these developments many manufacturers are vying for a leadership position with bold statements of going electric in the near future.

Our own research shows that electrification of commercial vehicles is the most cost efficient of all pathways to a fossil-free transport system. The available technologies today for $CO_2$ emissions elimination are biofuels and electrification. There exists a plethora of biofuel options on the global market, and they can be situationally beneficial and offer high $CO_2$ reduction numbers. But if biofuels alone were to power to whole world's transportation needs there just wouldn't be enough – and the depletion of top-soil and devastation of marine ecologies that would follow in its wake would render any achievement a Pyrrhic victory.

Thus electrification stands alone as the solution to a majority of the emissions emanating from transportation. However as opposed to passenger vehicles, where range and weight requirements are less crucial, commercial vehicles have several challenges ahead of them. While 2-300 km might be an acceptable daily range for a passenger car and city distribution vehicle, most commercial vehicles travel at least twice that in a day, and in some operations and markets even more than that. In addition goods vehicles, and to a certain extent buses, are heavily dependent on the amount of load they can carry. For hybrid vehicles that have a battery pack of sometimes up to a tonne, there can be concessions to carry an additional tonne of payload. But in regards to fully electric goods vehicles, battery packs would be in significant excess of a tonne – and even if concessions were made, eventually the load bearing capability of our roads would be the limitation. Equally challenging for all vehicles however is the lack of charging infrastructure which suffer from a textbook chicken and egg problem – if there are no vehicles on the road, then there's no business case for installing charging points; if there are no charging points around, there's no demand for electric vehicles. Finally the last challenge is the so often touted question, **but why electrify if the power we charge with isn't fossil-free?**

**The Range Challenge** – When a truck or bus has operational requirements beyond the capabilities of a battery's on-board storage a few options exist. Either the energy is supplied along the route while the vehicle is moving, or it is stored on the vehicle as hydrogen. An on-route charging solution is for example opportunity charging which is suitable for city buses, and catenary e-trucks (or E-Highways) as have been tested in both the EU and US. The main drawback of on-route charging is that it is very expensive and also severely limits the flexibility of a vehicle owner, locking them in to the currently very spotty coverage of charging. And while hydrogen has an advantage in range and thus can be a solution for certain operation types, the key reason why it won't be a silver bullet for trucks is the complicated and costly distribution of the fuel itself. Hydrogen can't be pipelined so it's bound to be trucked to filling stations around the world – and when you calculate the energy efficiency of that supply chain it casts doubt on the Energy Return On Investment (EROI).


Figure 1: An Opportunity Charged Fully Electric Scania Bus and Pantograph

**The Payload Challenge** – The aforementioned solutions of on-route charged trucks and hydrogen will be important to deal with the payload challenge as well. But for operation types which opt to carry a heavy load of batteries – for example urban distribution trucks - weight concessions will need to be made by legislators already in the start-up phase. The form of the concession can be made in many ways, not just by allowing more weight. It could be made as a zero-emission zone, a low-noise zone, or just a complete ban on alternatives – the point is simply: levelling the playing field for electric. Eventually when the technology becomes ubiquitous a **new normal** would eliminate these worries to a certain extent, but the risk is that it wouldn't take care of actually providing society with the level of cost-efficient goods transportation that it has gotten used to.

**The Charging Challenge** – The best example of a successful transition to an electric only transportation system is what has been achieved in Shenzhen, in China's Guangdong Province. At the end of 2017 all of the city's 16000 buses were converted to fully electric, and battery swap stations and charging in depots were fully deployed. The key success factor in this case was a complete and relentless focus from authorities in Shenzhen, with the support of the central government, to make it happen. A strong and motivated local industry played its part as well. Since there isn't yet a level playing field for electric vehicles compared to diesel this shows that focused and long-term support is required to change the status-quo. Another example of how to transition is a kind of **Trojan Horse** methodology, where series-hybrid vehicles with diesel generators are used to replace existing vehicles. When a critical mass to run a profitable charging scheme is reached, the engines are disassembled and sold.

**The Green Grid Fallacy** – An idea that a cynical person might suggest was promulgated by, and found traction with people and organizations that were the most unwilling to change. And it makes sense, if you look at the math, today. But if we consider the bigger picture, we won't make a dent in global $CO_2$ emissions if not all major emitters become carbon neutral together, and as fast as possible. And since transport has magnitudes more individual emitting units than power generation – and is more decentralized and thus less controllable by policy - we should logically not delay the transformation of the global vehicle fleet a single second.

So how can we get to the future that electrification seems to promise? The drivers are in place and when we scenario-plan we see three distinct scenarios emerging as a possibility. The first and fastest scenario relies on the Paris Agreement and strong policy to drive a transformation of the transport system. In the event that the Agreement is followed and adhered to strictly we would see a shift to 50% of the global volume of commercial vehicles sold in around 10 years. Based on the actual current trajectory with developments in price parity of batteries but with less ambitious $CO_2$ reduction targets the 50%-point can be reached in some 15 years. And in an as-is scenario where we rely solely on market mechanisms the turning point in sales volume is expected to happen in some 15-20 years' time. What all scenarios have in common though is that they expect batteries and other solutions to start becoming competitive on Total Cost of Operation in just a few years – which will spark a change in consumer behaviour.

And even though the point where the majority of vehicles sold are electric seems more than a decade away, the starting point of sales for electrified commercial vehicles therefore logically must come before that. For city buses this has been no secret, almost 400,000 exist in the world today. And for goods vehicles we see those first steps being taken already today. City distribution vehicles are on the markets, albeit with low actual availability, and more than a few long-haulage concepts have been announced. However most concepts today lack in both performance and affordability. But, some up-and-coming manufacturers have made bold promises, which if true, could really start to shift the momentum early in favour of electrified trucking.

So it seems today that we actually do have a different environment around us that can ignite a new paradigm in transportation propulsion. Because ultimately, electrification was never really a problem of technological innovation - but one of economics and the state of the world around us.

SCANIA

Scania is a world leading provider of transport solutions. Together with its partners and customers Scania aims to drive the shift towards a sustainable transport system. In 2017, Scania delivered 82,472 trucks, 8,305 buses as well as 8,521 industrial and marine engines. Founded in 1891, Scania operates in more than 100 countries and employs around 49,300 people. Research and development are concentrated in Sweden, with branches in Brazil and India. Production takes place in Europe, Latin America and Asia, with regional production centres in Africa, Asia and Eurasia. Scania is part of Volkswagen Truck & Bus GmbH.

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**21 November 2018 | Four Seasons Hotel, Hong Kong**

The Financial Times is delighted to announce the inaugural **FT Climate Finance Asia Summit** taking place on 21 November at the Four Seasons Hotel Hong Kong.

This one-day summit brings together leading Asia companies, investors and financiers to explore the developing trends and emerging opportunities in Asia's low-carbon transition - from the rise of sustainable investment in Asia to challenges of translating Nationally Determined Commitments (NDCs) into projects and the growth of green bonds as an important new source of finance for companies across the region.

**APUEA members are entitled to a 20% off the ticket, using the discount code APUEA.**

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# Recent APUEA Activities

By Asia Pacific Urban Energy Association (APUEA)

**"MORE THAN 100 EXPERTS FROM 65 COMPANIES, UNIVERSITIES AND ORGANIZATIONS IN THE ENERGY FIELD INCLUDING EXECUTIVES, TECHNICAL MANAGERS, SALES AND MARKETING MANAGERS, BUSINESS AND PROJECT DEVELOPERS WAS REGISTERED TO THE WORKSHOP. THE GOOD TURNOUT IS A TESTAMENT TO THE INCREASED INTEREST IN THE GROWING MARKET FOR DISTRICT ENERGY IN THE ASIA-PACIFIC REGION."**

## IDEA2018 – Local solutions, Global impact

APUEA attended IDEA2018, the 109th annual conference and tradeshow of the International District Energy Association (IDEA) during June 11-14 in Vancouver, Canada. The event attracted 800 attendees from 22 countries all over the world. As a collaborating partner of IDEA, APUEA co-hosted several events during IDEA2018, including a workshop, networking reception, and the APUEA annual general meeting.

### Workshop on "District Energy for Warmer Climates"

District energy is playing an increasing role in warmer climates, to help meet growing energy demand and increase system resiliency and energy efficiency, while also reducing greenhouse gas emissions in cities, communities and campuses. The District Energy for Warmer Climates workshop was co-hosted by IDEA, APUEA and UN Environment's District Energy in Cities initiative. The workshop highlighted topics such as district cooling, combined heat and power (CHP), and microgrids.

The workshop was opened Mr Rob Thornton (President of IDEA) and Mr Mikael Jakobsson (Executive Director of APUEA), who introduced district energy concepts, presented global trends and technologies, and described key opportunities and challenges, both globally and in the Asia-Pacific region. Governments in the Asia-Pacific region face major challenges, including fast-growing populations, high rates of urbanization, and increased expectations about liveable cities. To a great extent, these challenges can be tackled by taking advantage of the decades of experience of developing sustainable district energy schemes in North America and Europe.

Mr. Teruhisa Oi (Asian Development Bank) during a panel discussion

The International Energy Agency (IEA) predicts that half of the cooling demand growth in the world by 2050 will come from three countries; India, China and Indonesia. This projection highlights the need for sustainable and efficient cooling systems, including district cooling, co- and tri- generation systems, as well as the massive market opportunity opening up in the region. Other speakers included Celia Martinez Juez from the District Energy in Cities Initiative, who presented best practices in accelerating deployment of District Energy in the Asia-Pacific region and Derek Supple from Johnson Controls, who talked about global experience with thermal microgrids.

The workshop included a number of panel discussions, which covered topics such as "Perspectives from Expanding Markets", "Understanding Key Success Factors", "Looking to the Future" and "Finance, Governance and Operations". Panelists included Teruhisa Oi (Asian Development Bank), Michael Schack (Engie), Jimmy Khoo (Singapore District Cooling) and Chris Lyons (Solar Turbines), and others.

More than 100 experts from 65 companies, universities and organizations in the energy field including executives, technical managers, sales and marketing managers, business and project developers was registered to the workshop. The good turnout is a testament to the increased interest in the growing market for district energy in the Asia-Pacific region.


## APUEA Networking Reception

The APUEA networking reception was held in the main exhibit hall in connection with the signing ceremony for the collaboration between IDEA and KDHC (Korea District Heating Corporation). After a short introduction by Mikael Jakobsson, the conference audience had the chance to mingle with representatives from APUEA and other APUEA members to learn more about the Association and the ongoing and upcoming activities in the Asia Pacific region.

## APUEA Annual General Meeting

The first APUEA Annual General Meeting (AGM) was held during IDEA2018 and gathered APUEA members and collaborating partners as well as conference participants who wanted to learn more and contribute to the development of the Association. The meeting was opened by APUEA's Executive Director Mr Mikael Jakobsson, who presented the associations activities since the launch in July 2017. The main achievements for the first year included the establishment of a fully operational secretariat in Bangkok, the launch of the APUEA

Group photo of participants at the APUEA Annual General Meeting

Mr. Samuel Chatterton, Johnson Controls speaking at the APUEA Annual General Meeting

portal, and regular publications including newsletters and the quarterly APUEA Magazine. For the coming year, more effort will be put into establishing solid relationships with local governments in the region and continue to recruit new members who have an interest in in the development of sustainable urban energy in the Asia Pacific energy markets.

Following Mr Jakobsson's introduction, Mr Teruhisa Oi from Asian Development Bank (ADB), who has been one of the initial supporting forces behind APUEA, explained the importance of establishing the Association and how timely the initiative is for regional developments toward sustainable energy and climate action. Mr Oi stressed that APUEA is filling an important role that historically has been missing in the Asia Pacific region–namely, to support international financial institutions and government agencies through their member base to develop bankable and feasible district energy projects.

Mr Michael Schack from Engie and Mr Samuel Chatterton from Johnson Controls explained how they as founding members have supported the establishment of APUEA and how they see the role and future development of the Association.

Ms. Tanya Kozel from International District Energy Association (IDEA) explained the important role that IDEA has played not only in the North American energy sector, but also internationally, as an organization that is similar to APUEA. The collaboration between IDEA and APUEA will support both associations in their common goal of serving the members' interests and accelerating the development of sustainable energy systems around the world. Statements were also made by Mr Guan Xin from Capital Heat (China), who explained how they as members of APEUA have used the Association to find suitable technology partners; Mr Birger Lauersen from Euroheat & Power and the Danish District Heating Association, who presented information on District Energy trends in Europe and Denmark; and Mr Pär Dalin from Devcco who also representats the District Cooling Working Group of Euroheat and Power, elaborated on the importance of having such a sector association in the Asia Pacific region.

# Asian Utility Week in Bangkok, Thailand

**APUEA attended the 19th edition of Asian Utility Week in Bangkok during June 27-28, as a supporting partner. This year, Asian Utility Week attracted 2,000 participants, including regional and international utilities, energy companies, regulators, academics, and research institutions.**

The conference, hosted by Clarion Events, had a thematic focus on Digital Transformation and Customer Experience, and covered a range of topics including Smart Grids, Electrical Vehicles, Commercial and Industrial (C&I) Energy Savings, and Prosumers to name a few. As a supporting partner, APUEA was represented by Mr Mikael Jakobsson (Executive Director) and Peter Lundberg (Head of Operations). APUEA participated in the panel discussion **"Managing the Rise of Urban Prosumers and the Evolving Role of AMI-IoT networks"** as well as in a focus group on "C&I Energy Procurement". The expert presentations and exchanges at the conference provided participants with great insights into the trend toward digitalisation in the utility sector and the range of new technologies and solutions being deployed. The conference provided APUEA with the opportunity to communicate with professionals and future collaborating partners in Asia-Pacific energy sector.

# #ENGIE Harmony Project

A series of collaborative projects
to contribute to more harmonious progress

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**Energy Observer / Niteroi / PowerCorner**
**Queen Elizabeth Olympic Park...**

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ENGIE

# Event Calendar

**12 SEP 2018**

**12 - 13 September 2018**

Xian, P.R. China

### Sino-Asia Pacific Urban Energy Conference

**APUEA Activity:** Co-hosting the conference togehter with Xian District Heating Company and Fengxi Energy

**01 NOV 2018**

**1 November 2018**

Singapore

### Innovations in Digital Energy Asia

**APUEA Activity:** Co-hosting the conference with Clarion Events

**05 NOV 2018**

**5 - 10 November 2018**

Shanghai, P.R. China

### Sino-Europe Clean Heating Conference/Sino-Denmark Clean Heating Forum

**APUEA Activity:** Supporting organization

**28 NOV 2018**

**28 November 2018**

Hong Kong

### Financial Times Climate Finance Asia Summit

**APUEA Activity:** Supporting organization

**DEC 2018**

**December 2018**

Qingdao, P.R. China

### Smart District Energy Seminar

**APUEA Activity:** Co-hosting the conference togehter with Qingdao Energy Group and Asian Devlopment Bank (ADB)

**09 DEC 2018**

**9 - 11 December 2018**

Dubai, UAE

### District Cooling 2018 - Efficient Energy for Smarter Cities

**APUEA Activity:** Participating

# Member Directory

## Founding Members

ABB

Engie

Johnson Controls

## Members

International District Energy Association (IDEA)

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)

District Energy in Cities Initiative

International Partnership for Energy Efficiency Cooperation (IPEEC)

DEVCCO

Xian District Heating Company

Thai ESCO Association

## 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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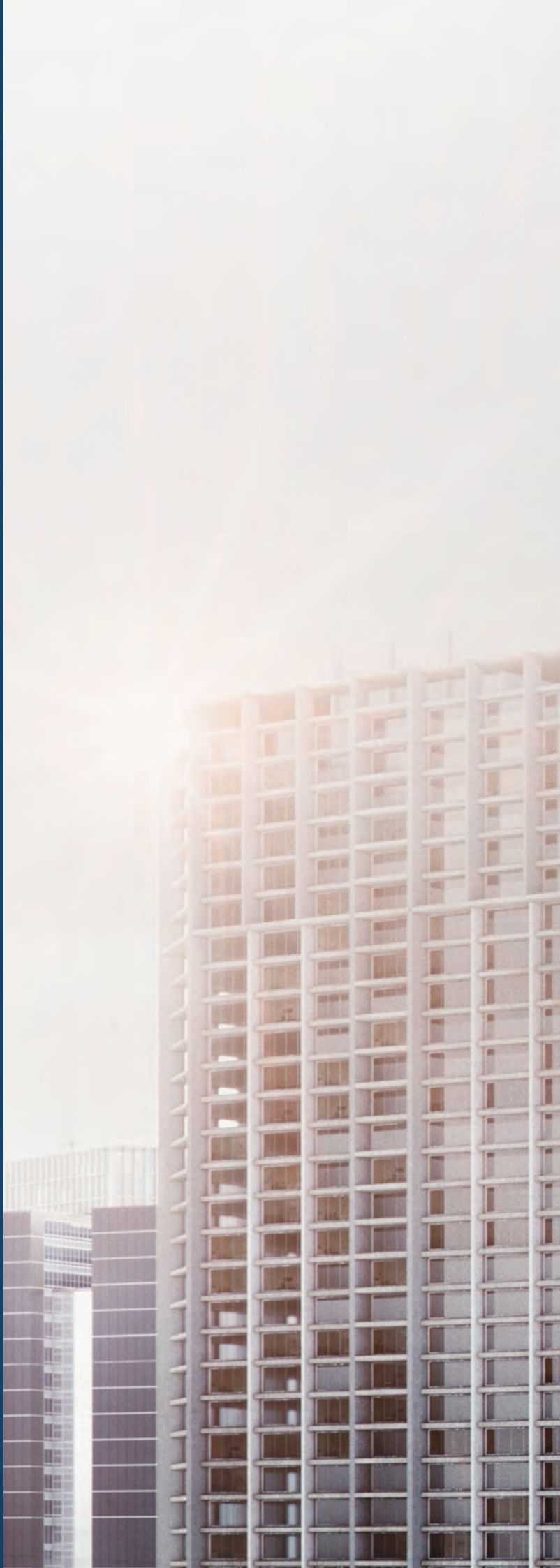
Asia Pacific Urban Energy Association



# APUEA Magazine

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