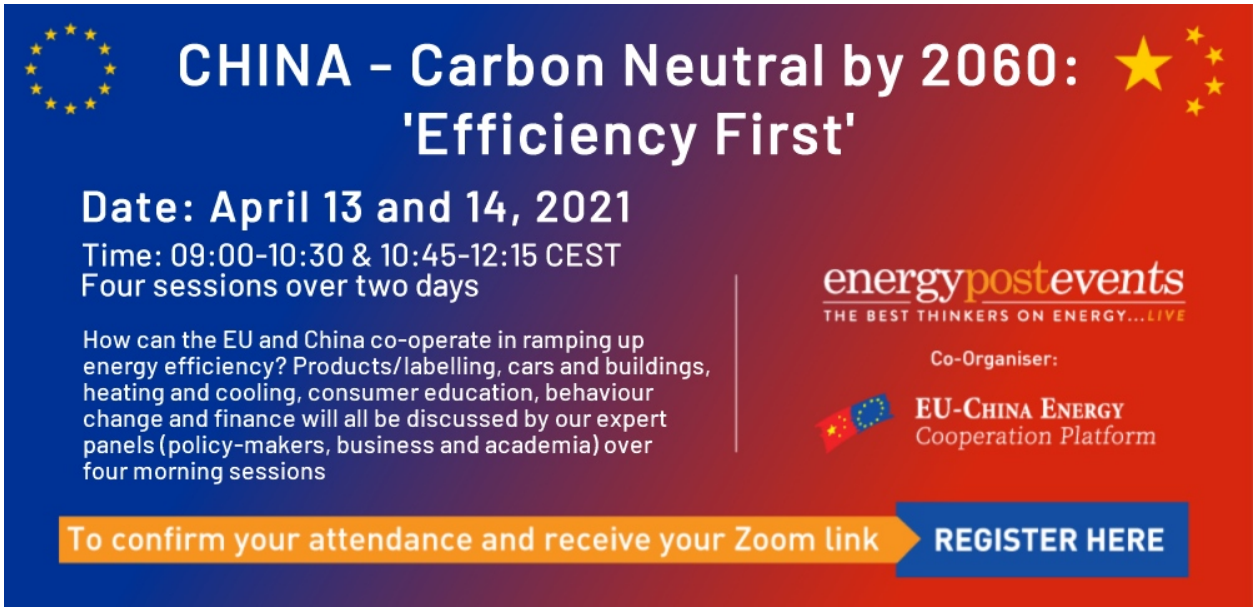
# China – Carbon Neutral by 2060: “Efficiency First”

An online panel event held on 13rd and 14th April 2021




# Session Four: Next Generation System Efficiency

## Participants

**Anna Acanfora - Net-zero cities, WORLD ECONOMIC FORUM**
**Cris Lowery - Analytics Manager, KEARNEY**
**Ahmet Köse - Co-founder and CIO, R8TECH**
**Brittney Elzarei - Policy Manager, EASE (EUROPEAN ASSOCIATION FOR THE STORAGE OF ENERGY)**
**Matthew James (Moderator) - Energy Post**

# Highlights

Energy is transforming from a centralised and mono-directional system - where companies supply power from big power generators to consumers - to a decentralised and bi-directional system that will give consumers the option to generate and store their own energy, inject it into the grid and decide when to use it.

This shift is well underway, but it still requires the uptake of smart technology, including artificial intelligence, and policies, regulations and communications that support its rollout. The necessary technologies such as artificial intelligence, smart meters, electric vehicles and behind-the-meter storage like home batteries already exist.

But consumers in particular need to understand the added value of shifting to, for example, plugging the energy stored in their EV into the grid. Privacy concerns, which have helped slow the smart meter rollout across Europe, need to be addressed.

Energy storage will be crucial in supporting the rise of renewable power generation, to help lessen power curtailment and boost energy efficiency. Until now, however, EU policymakers have often failed to give storage the attention and data collection needed to plan for it.

## The transformation

- The system is shifting from centralised and mono-directional to decentralised power production, more interaction between different stakeholders and a bi-directional energy flow.
- Demand centres will be consuming energy, producing energy and eventually storing energy.
- There are a lot of solutions out there that are already reliable and viable.
- We have the twin challenge of addressing an increasing need for electricity while reducing emission - in the order of $20 trillion.
- You need integration and planning. For this to be a success, you need it to be autonomous and personalised - AI can do that.
- As EV ownership rises you need more demand-side response. You need the financial incentives and the AI to do it.
- There needs to be cooperation between the energy provider, the DSO and TSO to ensure that solutions are deployed in a way that serves the whole system.
- Smart meter deployments are far from complete, and a lot of the challenge for suppliers is that consumers are not always willing to adopt it.

## Cities

- When it comes to where to deploy these business models, it's fundamental to start from cities.
- They are responsible for over 70% of carbon emissions and cities host almost all of our buildings, which account for over 40% of carbon emissions.
- 20% of the EU's commercial buildings are ready for smart solutions.
- Cities need to think about how to deploy an efficient building, and understand how that asset is an energy asset that is playing a role in the urban energy system.
- We can plan infrastructure to spread transportation and mobility needs throughout the day, around shop openings, school times, etc.

## Policy and regulation

- Policy and the regulation should keep energy access as a primary and fundamental right for the wider community.
- The variety of energy storage options available makes policymaking challenging because it's very complex.
- Policymakers increasingly recognise the role and value of energy storage but they don't always consider storage across all different policies.
- Data on storage is lacking. The European Commission's modelling for 2030 and 2050 does not consider behind-the-meter storage.
- Already now almost half of the storage deployed in the EU is behind the meter, so we're seeing this huge potential for storage that is not being considered.
- The EU is underestimating the flexibility needs of the future. It may need a target for storage for 2030 or 2050.
- Governments that have been proactive in incentivising renewables deployment have been behind in terms of taking the whole system into perspective.
- The revision of the Renewable Energy Directive to increase the target could and should put more focus on the whole integration of renewables, including storage.
- Smart meters are the backbone for advanced energy offerings, so at the beginning it will be a mix of push-and-pull.

## Consumers

- We are seeing a different role for energy consumers, moving from purely consumers of the energy commodity to also consumers that can make specific choices.
- Energy companies need to work on their communications with customers and leverage digital solutions to exchange information.
- The consumer is becoming more active, and this is important for combining renewables and storage, and in providing flexibility to the system - if the consumer is incentivised to do so.
- If it's too much hard work people are not going to get involved.
- According to the Clean Energy Package, all consumers should have the right to store electricity and to feed it back into the grid.
- Consumers need to understand the added value of smart meters.
- In the future people will have an energy performance certificate and a smart readiness certificate that explains the advantages of smart technologies and suggest ways to improve it.

## Storage

- Storage can balance power grids, integrate variable renewables and reduce curtailment. It can save surplus energy at different levels of the system.
- About 10% of the future storage deployments will be built to support the role of charging infrastructure.

- Behind the meter, there is the possibility for smart charging and vehicle-to-grid solutions, providing flexibility so consumers don't necessarily need to have stationary storage.
- The business case for behind-the-meter storage is questionable. For example, why use a home battery when you could use an EV?

# Session Four Summary

This is a summary, not a verbatim transcript, of the key points made during the online panel event.

**Matthew James (Moderator)**
**Energy Post**

One thing that has come up time and time again over these two days is that the technologies needed to deliver efficiencies are ready. Funding is an area of concern, the money seems to be there and green and efficiency investments have a lot of support, but the challenge is a question of adoption and getting consumers and stakeholders involved. Anna, can you give us your opening presentation.

**Anna Acanfora**
**Net-zero cities, WORLD ECONOMIC FORUM**

We know that the energy system is going through a major transformation, from a centralised, mono-directional system to a system that includes more decentralised power production, more interaction between different stakeholders and a bi-directional energy flow between different elements of the system.

## Increasing efficiency in the energy system

Supply › Transport and distribution ‹› Demand ‹

I would like to focus on efficiency on the demand side. Whether it's a small demand centre or large, it will no longer be the ultimate destination of unidirectional energy flows. They will be consuming energy, producing energy and eventually storing energy. This means they will be more and more integrated into a more interconnected system, and that their role will be crucial to enable the advanced efficiency level we want to reach.

This new setting of the energy system of course enables many technology solutions and consequently new business solutions.

## Enabling efficiency in the new energy market

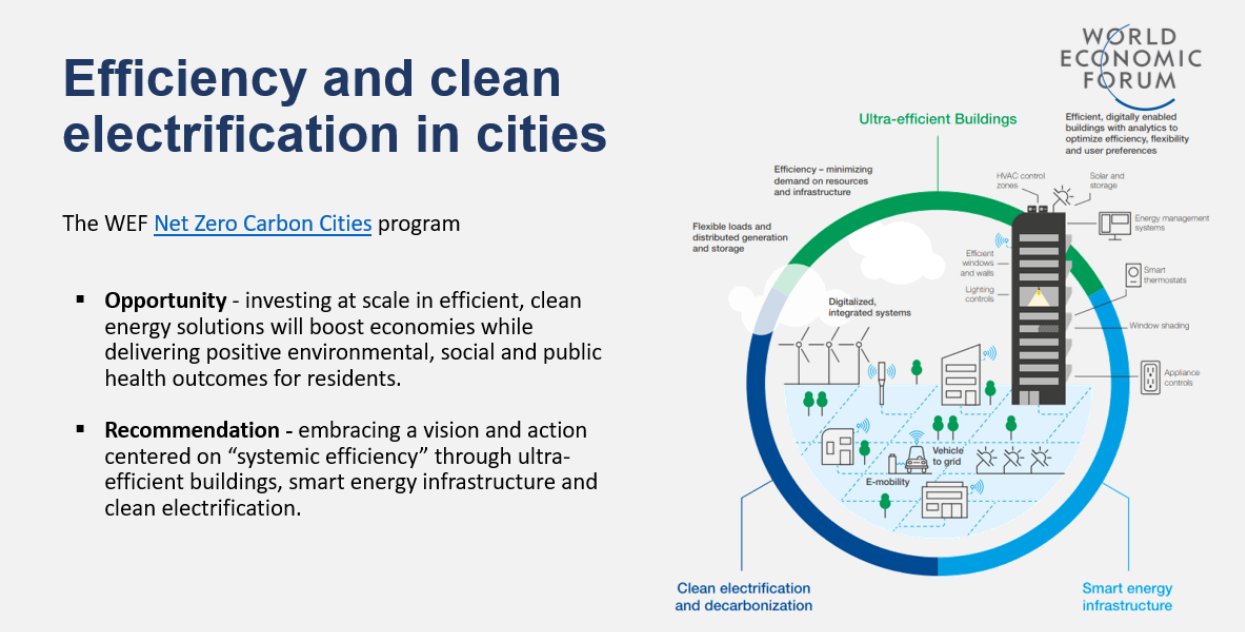
**Systemic Efficiency** → a delivery mechanism that encompasses clean electrification, smart digital technology, and efficient buildings and infrastructure, along with a circular economy approach to water, waste and materials.

**Policies and Regulation** → to enable stakeholder collaboration through an integrated policy framework

The question we have today is how to bring efficiency to the next level in this new energy market. From a technology point of view, there is a fundamental to improve a systemic efficiency approach.

Systemic efficiency is a delivery mechanism that optimises the use of resource and infrastructure. It means optimising the integration and interaction between smart energy infrastructure and clean electrification. When we talk about technology, it's not necessarily technology innovation. There are a lot of solutions out there that are already reliable and viable.

We need to have good policy and good regulation that enables the deployment of these solutions. We need to ensure that the policy and the regulation environment keeps energy access as a primary and fundamental right for the wider community. We want this energy transition to be inclusive and equitable for all.




This is a unique opportunity to tackle two challenges at the same time: environmental and socio-economical. The latter challenge has been worsened worldwide by the health crisis, which puts further pressure on systems and governments.

When it comes to where to deploy these business models, it's fundamental to start from cities. They are responsible for over 70% of carbon emissions and host all of our buildings, which account for over 40% of carbon emissions. We have a huge opportunity to increase efficiency.

We think of Europe as a playground where you can test different solutions and see how different elements can interact in the energy system. That's why it's important to have an integrated system. We are seeing a different role for energy consumers, because they are moving from being purely consumers of the energy commodity to often customers that can make specific choices. The key question is how to engage customers.

In order to harvest the full potential of efficiency for customers, energy companies need to work on their communications with customers and leverage digital solutions to exchange information with customers and ensure a seamless customer experience.

**Brittney Elzarei**
**Policy Manager, EASE (EUROPEAN ASSOCIATION FOR THE STORAGE OF ENERGY)**

Our members cover all types of storage. There are batteries and hydrogen, but also mechanical storage technology, thermal storage - there's a big toolbox, from large-scale to small behind-the-meter. It can play an important role at all levels of the system. It also makes policymaking challenging because it's very complex.

Storage can do a lot from the energy efficiency side, it can balance power grids, integrate variable renewables and reduce curtailment. It can save surplus energy at different levels of the system. The consumer is becoming more active, and this is important with combining renewables and storage, and in providing flexibility to the system - if the consumer is incentivised to do so.

The business case for storage is not well understood. Policymakers increasingly recognise the role and value of energy storage but they don't always consider storage across all different policies. It should be considered in energy efficiency policy and in renovation. There is a lot of funding that could be made available. We want storage to be a key technology for energy efficiency.

The final goal should be to have more flexibility at all levels - the consumers, the commercial industrial players and the grid scale.

**Ahmet Köse**
**Co-founder and CIO, R8TECH**

Buildings account for 40% of emissions and commercial buildings account for 18% more or less. We are developing a software solution that aims to increase energy efficiency in commercial buildings by around 20%. We want to reduce energy consumption or CO2 emissions globally by 1%.

The technology is there. 20% of the EU's commercial buildings are ready for our solutions. In 20 or 30 years, most of the buildings in Europe will be higher efficiency and we will be able to apply our software. We have a goal for the indoor climate too, which draws more attention than efficiency, especially in office buildings. So we want to ensure there is no disruption of the indoor climate.

We need to scale up with solutions. In the next generation, building energy or indoor climate management will go through the data, the building ecosystem, along with energy prices, weather forecast and tenants' needs.

**Cris Lowery**
**Analytics Manager, KEARNEY**

We have the twin challenge of addressing an increasing need for electricity while reducing emissions. This challenge is of the order of $20 trillion. Governments now are thinking about how to reignite their economies after Covid, and that includes the energy transition. Through technology we can lower that cost of $20 trillion and hit our emissions targets in a simpler way.

AI and technology has to span the three energy uses - heat, transport and electricity. The reality is that while EV technology, for example, will address transport, it's not independent of the energy system. Unification is key. You need integration and planning. And for this to be a success, you need it to be autonomous and personalised. There are a lot of optimisations to be had, you can change when you use your electricity, but to do that you need to predict when that user will be home. It has to be autonomous, otherwise it won't happen. And it has to be personalised - you can't charge EVs at the exact same time or in the same way. AI is there to do that.

**MJ:** The products are there. So how do we get stakeholders at different levels to start introducing these opportunities, products, solutions? Anna, talk about that engagement side again, what are the key factors when you're talking to stakeholders about net-zero cities?

**AA:** Energy is a complex market, so to allow the customer to choose the energy service and product we need to prepare the framework behind it. In the creation of this framework, particularly in Europe, we foresee a very high level of collaboration and alignment between a very diverse set of stakeholders.

This is the biggest effort, and the biggest challenge, but at the same time opportunity - to have different stakeholders in the energy sector, governments and municipalities - not forgetting that we're talking about energy infrastructure. While there is a large consensus around making sure there is good planning, what's not always straightforward is the collaboration in turning those plans into actual solutions.

Demand loads are changing and they can be different in different cities in the same country. You need to create the same language between different stakeholders too.

**MJ:** Could you highlight the different levels - cities, energy companies - what are the differences you're looking to stimulate, say in terms of where energy is sourced and how it's delivered?

**AA:** Integrated policies and integrated planning. When you talk about developing new construction and retrofitting, cities need to think about how to deploy an efficient building, and understand how that asset is an energy asset that is playing a role in the urban energy system. It's an interactive play that needs to be very well planned.

**MJ:** Brittney, could you talk about storage on the other side of the meter? The uptake of EVs we're going to see over the next 15 years, that will be a trigger on the domestic level for great opportunities for people being able to install storage and start these bi-directional flows.

**BE:** We see a very strong link between energy storage technologies and EVs. About 10% of the future storage deployments will be built to support the role of charging infrastructure.

Especially for very fast charging there could be demand for stationary storage. We've already seen pilot projects where stationary storage is put in a gas station for EV charging infrastructure. Behind the meter, we see the possibility for smart charging and vehicle-to-grid solutions, providing flexibility so consumers don't necessarily need to have stationary storage. It will depend on the location.

It would be interesting to see if a consumer has an option to have solar PV or solar thermal, a thermal storage behind the meter, a battery behind the meter and an electric vehicle. It will be important to make sure all these different pieces are integrated and interoperable.

**MJ:** Ahmet, what type of connections will your customers have with the grid?

**AK:** We are mainly operating in commercial buildings - shopping malls, hotels and office buildings, where tenants are playing a crucial role. If you are going to make a change to the temperature, the demand-response communication with the grid does not make sense.

**MJ:** Will AI make a difference in terms of making sure this happens? What is the difference to us as end-users and us as society?

**CL:** If it's too much hard work people are not going to get involved. Whilst a lot of the bits are there we still have problems to solve. It's clear that the infrastructure for electric vehicles in the UK needs to be changed significantly. Teslas on the road are seeing problems, and reinforcing the grid is not the way forward, it's incredibly expensive. You can do it through hardware, but the reality is the solutions need to be smart, data driven and use artificial intelligence.

If everyone plugs in at 5 or 6pm when they come home, you're going to have a massive peak. As EVs pick up you need more demand-side response. You need the financial incentives and the AI to do it.

**MJ:** Brittney, this is very relevant to your organisation. Energy stored locally through distributed generation, for example on your EV battery, could be shared with your neighbour. Will people understand it quickly enough? What are the opportunities? Should we be worried our car battery will be emptied?

**BE:** According to the Clean Energy Package, all consumers should have the right to store electricity and to feed it back into the grid. There is some language on double taxation and there are a lot of interesting options, including neighbourhood battery projects, cloud battery storage where consumers have a 'virtual' meter.

There are several projects underway, especially behind-the-meter projects in Germany, and EU members are quickly deploying the regulatory framework and the incentives for consumers. With that, installations can happen very quickly.

A lot more needs to be done to explain the different options to consumers. There needs to be work between the energy provider, the DSO and TSO to ensure that solutions are deployed in a way that serves the whole system. For heating and cooling there's a lot of focus on battery storage and less on heat storage behind the meter. The question is, will the policy speed up enough to make it happen, and will we have the interoperability and collaboration to make it happen?

**MJ:** 50% of our emissions reductions need to come from a reduction of energy use. The common issue when you talk about efficiency is ownership, because efficiency is spread across the system, and there seems to be a lack of coordination on efficiency. Anna, do stakeholders feel the networks are ready for the solutions we've talked about?

**AA:** The short answer is that it's chicken and egg. It also starts from commitment - even if it's a chicken-and-egg situation we need to start, and enabling a collaborative environment is a good place to start. We know that today we have technologies - such as smart charging - that can overcome the problem of investing in new grids and networks.

We can probably think about how we reorganise our structure - our lives and work - to make sure we do not create and plan infrastructure to accommodate the peaks of urban flows, but instead we spread transportation and mobility needs throughout the day. We can play around with the opening times of shops, schools, offices, etc.

**BE:** There is very poor data collection on storage compared to other facilities in the energy system. The European Commission's modelling for 2030 and 2050, for example, does not consider behind-the-meter storage. Already now almost half of the storage deployed in the EU is behind the meter, so we're seeing this huge potential for storage that is not being considered.

**MJ:** Why do you think that is?

**BE:** I assume it's because it's hard to collect data from behind the meter. If you don't have this basic information about how much storage is being deployed behind the meter, and where and by whom and what type, then you're missing out on necessary planning information.

**MJ:** Which dossier would it sit in?

**BE:** The EU should include storage in one of its ongoing energy projects. It should be considered part of the system, integrated. It's underestimating the flexibility needs of the future. We're working now to define whether we need a target for storage for 2030 or 2050 and what kind of modelling is needed for behind-the-meter storage.

**MJ:** Chris, how smart are our systems?

**CL:** When I've seen behind-the-meter it's because the company is building a business case to do that. There are two challenges. A lot of firms do not believe behind-the-meter is the way forward because they don't believe the business case is there. For example, if you're building a battery to put in someone's home you could instead be putting it in a car. There is enough storage in EVs that there is not a case to put it in your home unless it's a repurposed battery.

How smart are these things today? We're not quite there. Smart meter deployments are far from complete. We're still struggling to roll them out and a lot of the challenge for suppliers is that consumers are not willing to do it, for example for privacy concerns.

**BE:** I'm not saying storage behind the meter is always the best solution, but if people have an EV, are they going to park it at home between 12 and 3pm in order to store the electricity at that time? Or would they rather have a storage system to time shift that and charge their EV when they get home?

**MJ:** Storage in whatever form is seen as a key part to stop curtailment of renewable energy. So this is a huge opportunity for efficiency. Is one holding the other back? There's an explosion of renewables but with the risk of curtailment.

**BE:** Governments that have been proactive in incentivising renewables deployment have been behind in terms of taking the whole system into perspective. In the future if you have more storage you might always have some percentage of electricity that's curtailed because it's the most cost-effective option, but you need a really good assessment.

We're not focusing enough on longer duration storage, such as power-to-gas and thermal storage. There has been more focus on deploying renewables, and now there is a lot of catching up to do.

There is a revision of the Renewable Energy Directive to increase the target, and I'm hoping to see there more focus on the whole integration of renewables. For example, storage should be included in offshore wind projects.

**MJ:** Chris, are you involved in developing AI to help the network adapt to production and demand?

**CL:** There's a range of solutions to create efficiencies. For example, on the distribution side, Habitat Energy and Pivot Power are building loads of 50MW batteries that are local hubs, and they could have a petrol station, a supermarket and EV charging. The idea is that they combine the heating, the charging, electricity, etc., all into one, and use AI tools to optimise it so that it's as efficient and cheap as possible.

Companies are also moving their fleets to electric. To do that you need a smart selection of which vehicles to transition to electric, and then decide where to set up charging infrastructure, rotas for employees, etc.

**MJ:** Ahmet, is this high up on your customers' list of priorities?

**AK:** The most important factor is the business model, the second is motivation. Typically, technical managers are more conservative with solutions, mainly because they will be out of their comfort zones - it's something new. They also want to know what the technical benefits of batteries, EVs, etc., will be. We are trying to be innovative as a company, but make sure that we are filling an actual gap.

**MJ:** There seems to have been a slowdown in smart meters, is that right Brittney? Is this a key tool?

**BE:** Smart meters are really key and I'm hoping that the renovation wave and other initiatives, including with finance, will accelerate the rollout.

**AK:** Brittney, how do you convince end-users about smart meters? We face difficulties in convincing people to use them.

**BE:** The communication of the benefits to the consumer - they need to understand the added value for them.

The smart readiness indicator could be interesting because in the future people will have an energy performance certificate and also a smart readiness certificate that explains the advantages of these smart technologies for consumers and suggest ways to improve it. That means of course, compared to now, they need to be exposed to more dynamic pricing, or have the option to be remunerated if they can give flexibility service to the grid.

**MJ:** Anna, does the fact that the EU has member states make it difficult to rollout smart meters across the Union?

**AA:** It depends on the regulation level of the overall energy market and the degree to which independent countries can offer and change meters.

But we go back to the willingness and clear commitments of deploying basic solutions - it's a matter of putting out a plan and making sure it happens. Smart meters are the backbone for advanced energy offerings, so at the beginning it will be a mix of push-and-pull.

With policy and regulation we need to increase the minimum level of performances and standards, which includes the rollout of the smart meters. This way we create an increasingly better set of standards.

# Q&A

**Xioai Wen asks:** Is there any platform where stakeholders can cooperate?

**AA:** The World Economic Forum is developing a digital platform that will enable cities and different stakeholders to understand the most suitable efficiency and decarbonising solutions for different city archetypes. This digital solution will be launched in August.

**CL:** When you build a smart local city you need the data, and there will be different standards. There are quite a few companies working on that, but it's not totally solved. Those standards have been around for five to 10 years and are constantly improving. When you get it right on the small scale you can always scale it up, so it might be worth talking to some of the hardware players.

**Yong Chen asks:** Regarding power-to-heat, or thermostorage: is there any experience in Europe in harmonising the tariff system? There are two different commodities and the tariff structure in most countries is different.

**BE:** There was a huge deployment of hot water tanks in Europe the 1970s and 1980s to provide balancing for the excess nuclear power at night, in France and Belgium, for example.

The flexibility resource is quite cost-effective. It's not the most attractive in terms of being technologically advanced, but works well. There is a lot of discussion now on thermostorage technology and larger scale storage for district heating and cooling and there are issues in terms of tariff structures and taxes and fees with technologies crossing from electricity to gas in the heating sector. The sector integration strategy is under discussion.

**Ari-Pekka Karppo asks/comments:** We developed our platform starting with optimising buildings, and soon realised the advantages for heating and cooling. Now we're working from the plans to the space. We now have a platform energy companies can use.

**MJ:** Do you believe this platform, this network of customers coming together, would be of interest internationally? Could we take it to China?

**…Ari-Pekka Karppo:** Absolutely. It's a problem for district heating and that's where everything should start. We know that this kind of complete platform with a complete roadmap towards less burning and using the local possibilities with heat pumps and so on will be the future of district heating and cooling.

**MJ:** Final thoughts.

**BE:** We all agree we need better system planning at all levels and involving all the stakeholders. We need to have a balanced approach to behind-the-meter solutions and demand-response to understand where it's appropriate and how to integrate it.

**CL:** I agree.

**AK:** More connections, more communications, and more supply to customers will bring us higher efficiency.

**AA:** It's exciting to see how much interest this topic is gaining. We have a unique opportunity to make the best of this opportunity.

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*Summary compiled by Sara Stefanini*
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