Third Mission Innovation Ministerial Meeting (MI-3)

Public-Private Cooperation on Clean Energy Innovation: Deals for Decarbonisation

Malmö, 23/05/2018

Summary of the breakout session discussions

Introduction

The Third Mission Innovation Ministerial (MI-3) included a session entitled "Public-Private Cooperation on Clean Energy Innovation: Deals for Decarbonisation" and involved five breakout discussions focused on concrete means to accelerate action around specific technologies. The discussions were held under Chatham House rules and involved Ministers and Heads of Delegation (HoD) from MI countries as well as CEOs and top-level managers from selected public and private organizations and enterprises from MI Countries. This report summarises the key outcomes and topics raised during the sessions.

Table 1: Smart Grids

1. Headline

Ministers and CEOs agreed to work on Smart Grids deployment and initiatives with latest advancements in technology, innovation priorities, business opportunities and potential areas of innovation

2. Key Messages

- Smart Grids are among the most cost-effective solutions to mitigate the effects on power system reliability and resilience related to the intermittency of variable renewable resources such as wind and solar.
- The adoption of smart grids technologies and solutions enable adequate observability and control of the network behaviour to ensure a reliable operation of the network
- The smart grid will allow utilities to move electricity around the system as efficiently and economically as possible.
- The prioritized joint research and development activities to address the issues of smart grid and to propose methodologies and solutions to be picked up by interested industrial players.

3. Challenges and opportunities

- Several challenges must be met to reach a substantial decarbonization of the energy sector and to provide accessible, affordable and sustainable energy services to the users.
- Power Grid is the central element that enables the energy system transformation, integration of distributed generation and digital cities while ensuring resilience.
- Smart Grids are among the most cost-effective solutions to significantly mitigate the effects on power system reliability and resilience related to the intermittency of variable renewable resources such as wind and solar.

- The smart grid innovation must focus on technologies like smart metering and Distribution Automation with the application of industry 4.0 technology, cloud computing and AI concept.
- A novel approach for smart grid activities is to create a unified open innovation program, which is open to all external partners like start-ups, labs, universities, technology firms, etc. with sustainability.
- China and India together have a share of 55% of the total world population, cheap and effective technologies of the smart grid must be produced to reach-out the public.
- To create a cross-national “Smart Grid Innovation Accelerator” with public and private stakeholders that bring together the public sector, utilities, financial companies, start-ups /R&D tech firms and international organizations (such as World Economic Forum) with the involvement of MI partnered countries altogether.
- The upgrade of the existing grid must follow the way of digitization. Installing sensors in the grid makes the system into the whole new level of control and optimization, where the grid must work even there is no availability of mobile or Wi-Fi signal.
- Encourage the energy regulator to create sandboxes for innovation where new ideas can be tested.
- Create an overarching strategy under the clean growth plan which lays out a medium-term strategy for decarbonization.
- Creating central funding and innovations grants by allowing regulated grid operators to have a pre-determined innovation funding.
- Government and Private companies should join as a team to design competitions that encourage and inspire start-ups to deliver solutions to solve common challenges by promoting global competitions.

4. Conclusions

The breakout session envisioned the strategy, vision and approach for various funding opportunities to implement smart grid integration in the existing network. This will lay the foundation to create a unified open innovation program to motivate the start-ups and technology firms in the Smartgrid field. This will let governments invest in design and development of economic and feasible technologies of Smartgrid.

5. Next Steps

Working with participating organizations from the breakout session, Innovation Challenge 1 will develop a plan of how to practically implement effective smart grid technologies to address the common challenges and which will then be shared with member countries to explore implementation.

Table 2: "Empowering Sustainable Batteries"[1]

1. Headline

Ministers and CEOs at MI-3 agreed that batteries play a crucial role for the energy transition, which led to a declaration to promote sustainable battery value chains.

2. Background

Environmental awareness is increasing as regards the batteries currently offered on the market, in particular in the sphere of e-mobility. Indeed, e-mobility brings real environmental benefit only when electricity in the grid is green and when batteries are sustainably produced. The demand for raw materials that constitute electric batteries, such as lithium, nickel and cobalt is rapidly rising. Eco-designing cells for ease of disassembly, second-life and recyclability will be key. Challenges in recycling include reversed logistics, battery dismantling, and improved chemical processes for metal recovery. The main challenge for second-life is the provision of a 'guarantee of performance' through an intelligent life-long Battery Management System. These issues call for action on research and innovation, regulations, codes and standards.

3. Key Messages

In the global drive to accommodate more and more electric vehicles in the transport sector[2] and to integrate growing volumes of variable renewables in the energy sector (up to 100%), batteries are becoming the key enabling technology to ensure flexibility.

The European market for batteries can be estimated at 250B€/year from 2025 (ie. roughly the size of the DK economy). There is place for everybody in a market of this size, but there is urgency for the European industry and there is a need for the synchronisation of the timelines within the battery value chain.

Important investments are needed, including R&I on the next generation battery cells. However, investments in production lines are of a totally different order of magnitude when compared to R&I investments. It was estimated that more than 100M€ needs to be invested to produce one GWh of batteries.

At the same time, growing concerns over the environmental footprint of batteries puts the sustainability of the entire battery supply chain in the spotlight. Improving the sustainability of the entire batteries value chain requires overcoming both technical and non-technical obstacles.

Starting with raw materials, accessibility and transport are the main issues to be addressed, in particular for cobalt, which is a critical raw material. Several ideas were discussed, from the creation of a certification of mining conditions up to adapting Europe's foreign policy with regard to Africa. R&I is also needed for the substitution of

[1] This breakout discussion was organised in collaboration with the World Economic Forum

[2] For example, more and more mayors of important European cities have banned the circulation of diesel cars and this is changing the minds of car manufacturers, that are accelerating the design and production of electric cars.

raw materials used in battery production. During the discussion it was further mentioned that recycling norms should be tightened since recycling has a dual role to play in the protection of the environment but also in diminishing the dependency with regard to raw materials; if all batteries of the mobile phones were recycled, this would represent in Europe the equivalent to the production of two cobalt mines per year.

The participants agreed that decarbonisation is not displacement of CO2 emissions, just as sustainability is not only about decarbonisation, but also about environmental stewardship and protection of human health and safety.

The round table concluded that battery cells are not a commodity and that there is a very high number of challenges to be addressed in sustainable battery cell production, but together (industry and policy makers) it is feasible. These challenges cover the whole value chain, from raw materials, production, fair market conditions based on reciprocity of treatment, second-life and recycling. The table also concluded that there is urgency in the action and that synchronisation of the timelines of the different actors of the value chain is needed.

Another issue discussed was the lack of battery production skills in Europe. The table concluded that there is an urgent need of academia and industry to collaborate on the definition of the profiles - and elaboration of training programmes - that will be needed in the future.

4. Conclusions

The outcome of the round table was a policy declaration (below) to which all the participants have agreed.

Policy Declaration on Empowering Sustainable Batteries

Third Mission Innovation Ministerial (MI-3),

23 May 2018 – Malmö, Sweden

In the global drive to accommodate more and more electric vehicles in the transport sector and to integrate growing volumes of variable renewables in the energy sector, batteries are becoming the key technology to enable both these objectives. At the same time, growing concerns over the environmental footprint of batteries put the sustainability of the entire battery supply chain in the spotlight.

Sustainability must be considered in its broadest sense, encompassing substitution of critical raw materials; environmentally sustainable and responsible extraction and processing of raw materials; battery second-life; and recycling at the tail end of the battery value chain. Energy use, carbon footprint, environmental, health, safety and human rights issues are equally important dimensions, from mining to manufacturing, use and dismantling.

We, national and European decision makers, met today to discuss how we can improve the sustainability of the entire batteries value chain by overcoming both technical and non-technical obstacles. Collectively, with strong global commitments and supportive government policies, we have the opportunity to accelerate the development and deployment of sustainable batteries for the decarbonisation of the energy and transport sectors. As a baseline, we agree in unison that decarbonisation does not equal displacement of CO2 emissions, just as sustainability is not only about decarbonisation, but also about environmental stewardship and protection of human health and safety.

We agree that the following key actions are needed to deploy this important global technology.

1. We will promote the use of sustainable and responsible mining techniques and practices as well as processing of raw materials, with minimum CO2 footprint and environmental damage and high protection of (workers) health, labour and human rights.
2. We will work on improving material efficiency and production processes, while reducing CO2 footprint and health and safety impact of the battery cell production process.
3. We will work towards extending the maximum lifetime of batteries (including second life), optimising recyclability and maximising recycling.
4. We will reinforce Research and Innovation in battery technologies that are less dependent on critical materials.
5. We will provide appropriate information to citizens/consumers to be able to make informed choices and drive the market and R&I towards cleaner solutions.
6. We will increase global shared learnings on sustainable battery supply chains by disseminating best practices and lessons learned.

This policy declaration is open so that MI countries and/or industries not participating to the breakout discussion can adhere to it at a later date.

Table 3: Heating & Cooling of Buildings

This session focused on how to address the large amount of energy wasted globally by poorly performing heating and cooling systems in buildings.

1. Headline

Ministers and CEOs at MI-3 agreed to work on sharing building performance data to reduce the enormous amount of energy lost by poorly performing heating and cooling systems

2. Key Messages

- Heating and cooling accounts for over 40% of global energy use and carbon emissions.
- Heating and cooling plant in buildings is often poorly commissioned, operated and maintained offering energy saving opportunities of typically 5-30%.
- Data is key to managing building energy performance; while such data is generated by the systems in most modern buildings accessing this data can be extremely challenging.
- An open source repository of standardised building energy performance data would enable innovators to develop new ways to drive up efficiency and drive down costs.
- Governments could lead uptake by mandating data on buildings they occupy are stored.
- There is an appetite in governments, cities, and industry to tackle this challenge.

3. Challenges and opportunities

- Heating and cooling is often forgotten when we discuss decarbonising energy and too often we focus only on electricity. However, worldwide, heating and cooling accounts for over 40% of global energy use and its share of renewables for heating is low.
- Solutions to providing heating and cooling vary dramatically around the world driven by climate, culture and wealth, but in all regions, there are significant opportunities to reduce waste and improve efficiency.
- Modern buildings generate huge amounts of data on all aspects of their performance and use. Typically, this data is spread across multiple sources and has multiple owners, it is non-standardised and often in propriety formats. So, it is very difficult to bring all the data together to equip ourselves to address this challenge.
- In older buildings and homes availability of data is much more limited, often only annual consumption data; although this is beginning to change with national smart meter initiatives and the development of low cost easy to deploy monitoring devices.
- Data comprises both static and dynamic data. Static data is useful for benchmarks and statistics, and as a precursor of outcome based codes; however, it is the richness of dynamic data that could provide actionable information with which to optimise performance.

- Some organisations at the top of their sector (e.g. major shopping centres) recognise the value of such data and use it to create business advantage so the opportunity is real.
- Potential for savings is vast (5-30% for most large buildings) even in countries that believe they have addressed all efficiency problems already.
- There are already some initiatives to improve access to data at a city, regional and national level, however, these are currently limited in scale, provide static data, and limit any opportunity for global innovation in analytical platforms to optimise performance.
- If you share data more widely it gets used in ways that were never imagined and provide unexpected new benefits. Data on buildings is a rich, untapped seam of opportunities.
- Data security, privacy, permissions and ownership remain big issues that need to be addressed; indeed data ownership may be key to getting buy-in, but people and companies have already demonstrated a willingness to trade data for reduced risk or other real benefits, provided their commercial interests are protected.
- Vested interests remain a barrier, e.g. business models for many facilities management companies are based around maintenance call-outs, so strong leadership to insist on change will be essential.
- There is a clear role for government to encourage and break down barriers and drive change not just as a legislator but also as a major property occupier. This could involve ensuring that data on their buildings is sent to the data store and potentially demanding a defined level of benchmarking before leasing buildings. Cities can also play an important part given their role in planning consent and their ability to mandate data disclosure.
- There are also technical challenges that need to be overcome: what data is really necessary; how is it anonymised; how to simplify and standardise data collection? These seem soluble given the right programme framework.
- Industry already has a huge capability in data extraction, storage and analysis and a global data repository, tailored to geographic needs, would be technically achievable. It is less clear however, how such a programme might be initiated in practice.

4. Conclusions

The breakout session envisioned a world with an open-source repository of anonymised, standardised and dynamic data on building performance. This would let innovators develop new algorithms to improve the performance of existing buildings. It would let operators benchmark their energy performance against best practice. It would let regional authorities manage their cities more effectively. And it would let government understand where best to target policy interventions.

5. Next Steps

Working with participating organisations from the breakout session, Innovation Challenge 7 on Affordable Heating & Cooling of Buildings will develop a plan for how to realise this vision which will then be shared with member countries to explore implementation.

Table 4: "CCUS"[3]

1. Headline

At MI-3, governments and industry discussed how to work together to coordinate CCUS R&D achieving lower costs and more efficient CCUS technologies.

2. Key messages

Leading countries at the table: Saudi Arabia and US

US and Saudi Arabia have led this challenge

- Co-hosted the CCUS Expert Workshop in Houston, Texas, in September of 2017
- Convene the world's experts in CCUS to focus on key R&D challenges
- Report from the workshop including key findings was released today (May 23rd), and will guide global research

Mexico and the United Kingdom are stepping up to co-lead this challenge alongside Saudi Arabia.

CCUS is an exciting technology – commercializing CCUS is a key challenge.

Some Countries such as the US are focused on reducing the costs for carbon capture – which is the largest cost component of an overall CCUS project.

Many regions and countries can offset capture costs through enhance oil recover.

We need to stand up projects and drive down costs for CCUS through learning by doing.

Mexico is rapidly advancing their CCUS efforts, projects, and programs including CCUS on natural gas.

CO2 should be thought of as a commodity – as we develop processes and technologies and business models that help drive costs down and accelerate commercialization.

Public-private collaboration is absolutely essential to accelerate CCUS development and deployment.

We discussed CCUS as a value proposition not just as an added costs.

CCUS projects will always operate under regulatory frameworks – such frameworks need to be stable and support this value proposition for CCUS.

Policies also need to support the business case and enable investment in CCUS technologies and projects.

Norway detailed how they are developing the entire value chain for CCUS – focused on industrial capture, Hubs, and infrastructure to support CCUS projects.

We briefly discussed policies such as 45Q Tax Credits in the United States.

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[3] This breakout discussion was organised in collaboration with the World Economic Forum

And we discussed sticky issues such as long-term liability.

On liability, we have some great examples to draw from:

- Test centers like Mongstad and the National Carbon Capture Center
- About 20 large scale projects, proving CCUS works, and where we can continue to push R&D advances
- OGCI and the oil & gas sector stepping up
- Opportunities to increase public-private partnerships around promising R&D and technologies

One group detailed how CCUS may progress at the European level, and also the interplay between Hydrogen and CCUS

> *Note that a new Hydrogen challenge has been added to Mission Innovation, and appears to have strong synergies with the Carbon Capture Challenge.

For CCUS technologies, there exists a long supply chain, which has opportunity for increasing the overall efficiency, and can be supported through additional business opportunities.

Much R&D is going on globally at the low-TRL stage (I.e., early stage)

We need to accelerate mid-TRL level efforts to commercial deployment, but Mission Innovation is best positioned to focus on early stage research to drive down costs.

MI should coordinate with CEM and other efforts overall, with MI focused on aggressively driving down costs and improving the value for CCUS

Industry should remain involved in early stage efforts to help guide research, ensure relevance, and at the same time gain experience with new and emerging technologies.

Government, Industry, and Financial roadmaps can help inform this development.

3. Conclusions and Next Steps

- Look at Best Practices and replicate those that have been successful
- Increase participation by developing countries
- Develop supporting policies

Table 5: "Hydrogen"[4]

1. Headline

Industry and governments agreed to work together to develop the hydrogen supply chain at MI-3. There was lots of enthusiasm for the new hydrogen innovation challenge.

2. Key Messages

Vice-Minister Ogushi of Japan and Deputy Secretary Jo Evans of Australia welcomed participants to the Roundtable. Vice Minister Ogushi provided an overview of the advantages of hydrogen and Japan's Basic Hydrogen Strategy, and asked participants to consider what the key technical challenges were along the hydrogen supply chain, emphasising the need for global public-private collaboration.

Participants provided an overview of their individual interests in hydrogen, which ranged from decarbonising natural gas, providing energy storage, light and heavy transport, large-scale production as a chemical input, and production through a variety of technologies.

In a lively dialogue with a range of sometimes competing views, participants emphasised the need to think of hydrogen as a market rather than a technology, and noted that there was an imperative to scale up volumes quickly. Some thought that greater demand would drive scaling-up; others stated that accelerating innovation would also be essential, in production, logistics and end-use. Some considered that hydrogen at scale would replace or disrupt existing markets - for example, natural gas - other thought it would also be seeking new markets, such as energy storage. There was consensus around the principle that the market needs to drive the innovation and that this meant driving down costs. There was also consensus of the value of achieving a Hydrogen supply project at scale (as a means to drive down costs) and agreement that international collaboration would be important to delivering this result.

The need for partnership between public and private sectors, and between governments was noted, reflecting that hydrogen can potentially be traded across borders and long distances. One also noted the need to engage countries outside of Mission Innovation, recognising that the biggest source of future energy growth is likely to be in south-east Asia.

3. Conclusions and Next Steps

In general, participants concluded that end-use subsidies were not necessarily to best way to achieve scale, and that governments should focus on encouraging innovation, bringing groups together to build scale, and making resilient policy that could respond flexibly to a market that is likely to develop quickly. There would be a need for both public and private sectors to take a share of risk, given the likely scale of projects, and the potential for hydrogen to disrupt existing technologies, commodities and business

[4] This breakout discussion was organised in collaboration with the World Economic Forum

models. Areas where Mission Innovation could focus activity included improving electrolysis to allow greater production from renewable energy, end-use technology for heavy transport, and improving platforms for data on demand, to allow the supply chain to develop between countries. Some participants also noted it would be important for industry and governments to continue discussions around actions beyond technology that will be needed to pull through a large scale hydrogen project.