SET PLAN CEEC 2017

Conference *report*

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Main *panels*

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OFFICIAL OPENING AND WORLD ENERGY OUTLOOK 2017

Official opening: Martina Lubyová, Rein Oidekivi
Keynote speech: David Turk
Chair of the panel: Ingrid Brocková

SUMMARY

The SET Plan for energy and technology **proposes solutions to many of the world's problems. The EU leads** in setting and achieving **climate goals** and on green technologies. The **Estonian Presidency's priority was digitalization** of the energy sector.

The International Energy Agency's **World Energy Outlook** 2017 observes that there have been four "**large-scale upheavals**". First, the **United States** is becoming the "**undisputed global leader in oil and gas**". Second, **solar photovoltaic energy** is becoming the **cheapest source** of new electricity. Third, **China's new green drive** is recasting its role in the world energy sector. And fourth, **electrification is accelerating** thanks to digitalization and the use of electricity in heating and cooling, and electric vehicles.

OFFICIAL OPENING

Martina Lubyová, Slovak Minister of Education, Sciences, Research and Sport, said the **SET Plan** for energy and technology **proposes solutions to many of the world's problems**. Apart from a low-carbon economy, these are transport, smart systems, renewable energy sources and nuclear safety.

According to **Rein Oidekivi**, Estonian Ambassador to Slovakia, the **EU is the leader in setting and reaching climate goals** and on green technologies. Estonia, currently holder of the EU Council Presidency, has prioritized **decarbonization of the energy sector**; **integration with other sectors** like the automotive industry or housing and organized around **market principles**; **decentralization** of energy production; and **digital** solutions. The Ambassador said the EU had been successful in achieving the Energy Union objectives, but more should be done to **integrate all stakeholders** and academia.

The **Estonian Presidency's priority was digitalization** of the energy sector. This has been thoroughly addressed in the proposed legislation and also aligns well with the SET Plan. He reminded participants that the **E-energy Declaration had been signed in September 2017** in Tallinn. In Estonia, customer complaints have dropped by 50 percent thanks to digitalization. According to Oidekivi, the **market creates the best energy prices and solutions**.

KEYNOTE SPEECH

David Turk, Acting Director for Sustainability, Technology and Outlooks at the International Energy Agency (IEA), presented the IEA's **World Energy Outlook** (WEO) 2017. The WEO is concentrating on **China** on the one hand and **natural gas** on the other.

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is becoming the **cheapest source** of new electricity. Third, **China's new green drive** is recasting its role in the world energy sector. And fourth, **electrification is accelerating** thanks to digitalization and the use of electricity in heating and cooling, and electric vehicles.

The IEA's **Sustainable Development Scenario** (SDS) 2040 is aimed at fulfilling the Paris Agreement and requires, according to Turk, the doubling of **energy efficiency**, 3,250 GW of **solar PV**, an additional 50 BCM demand for **natural gas** and 875 million **e-cars**.

On **digitalization**, Turk said that Internet traffic had tripled in the last three years, while electricity consumption in the digital sector is estimated to have increased by only 3 percent between 2014 and 2030 thanks to **energy efficiency**.

Digitalization is changing business models for **smart buildings, road freight transport, passenger transport, industry, the supply of oil and gas**, and for the **power system as a whole**. Turk envisages **four transformative technologies for the power system**: smart demand response, smart charging of e-vehicles, integration of variable renewable energy sources and solar PV for homes. As Turk noted, there is a parallel need to **build digital resilience and strengthen cybersecurity**.

Asked about nuclear energy by the public, Turk responded "**China is going big on nuclear**". **Central and Eastern Europe**'s specific challenge is **gas security**. Nevertheless, as Turk stressed, **wind** has big potential in Europe. He recommended that **Slovakia should digitalize**, because with its substantial ICT sector, there are "huge market opportunities" for the country.

On the **EU and renewables**, Turk said that Europe had maintained its **leadership in research and development** and expense of member states in this field have even increased. He noted that the importance of this sector is evident in the **SET Plan**.

Carbon capture and storage (CCS) has a "**very important role**" to play in the transition to the 2 degree scenario, said Turk. While energy efficiency and renewables account for one third of decarbonization, the CCS share is 13–14 percent. If the temperature increase is to be limited to 1.5 degrees, the CCS share will increase to 34 percent. **CCS can be cost-effective**. One reason it has not been is that it has been on **too small a scale so far**.

PANEL I: THE ENERGY UNION AS A DRIVER OF THE MODERNISATION OF EU'S ECONOMY

Keynote speech: Dominique Ristori
Chair of the panel: Pavol Demeš
Speakers: Vojtech Ferencz, Rein Oidekivi, Michael Losch, Markku Markkula

SUMMARY

Last year was the first in which **clean energy** attracted the **biggest share of investments** in the energy sector, according to the European Commission. Investments in clean energy including energy efficiency, renewables and smart grids amounted to **43 percent of global investments in the energy sector,** and were worth $1.3 trillion dollars.

The Slovak and Austrian representatives had **diverging opinions on the role of nuclear energy** in European Union's future energy mix. They agreed, however, that Europe has to **invest more in research and innovation** in the energy sector. The representatives from the Committee of Regions and the Estonian Presidency of the EU Council stressed the importance of **digitalization**.

Next year's SET Plan will be held under the auspices of the Austrian Presidency and will focus on "**smart and resistant" cities and buildings, renewables and common projects for reaching the EU's 2030 targets.**

KEYNOTE SPEECH

According to **Dominique Ristori** Director General for Energy at the European Commission, the **EU is already a leader in green energy investments**. It nevertheless needs to **redesign its electricity market**, but this should be achieved through a new regulation currently under discussion.

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Dominique Ristori compared Europe with China and the United states. **China** is also a big investor, but it "has a **different vision**", said Ristori, referring to the different political regime that does not allow free public debate. The **United States** was first to liberalize the energy market, but nonetheless **sought advice from the EU** on market design.

"That makes a big difference between being a leader and a follower," said Ristori, for whom the EU is still a leader.

Ristori listed the **legislative initiatives** which the Commission has produced in recent years. The **proposals to strengthen energy security,** which represent "real solidarity between the West and the East", have already been approved.

This year, the "**Clean Mobility**" legislative package was unveiled.

Ristori highlighted the **role of electromobility**. "We can expect rapid and important progress in electric vehicles." Many European countries will soon introduce support schemes, he said, criticizing opponents of the mandatory installation of charging points in new buildings. "We need to prepare for clean energy **in cities**," stressed Ristori.

One of the objectives of the "**Clean Energy for All Europeans**" package and especially of the regulation on electricity market design is to ensure that the electric grids can cope with **more than a 50 percent share of renewables** by 2030, Ristori said.

The energy system should be **more flexible and digitalized** thanks to improved management of electricity demand, transmission and production. "**Distribution will become more strategic** because of the prosumers," Ristori believes.

He stressed that **the most competitive** countries are those with the **highest investments in research and innovation**. "In the EU, we are very good at important research, but not at applying it to new markets," he added.

Asked by the audience, how he sees **Russia**, Ristori responded that it "is and will remain an **important energy country** (for the EU)", given Russian oil and gas imports in the EU. Both countries must **conduct a dialogue and cooperate** on the clear principles included in the third energy package.

The Director General underlined the **importance of supply diversification**. In a "very short time" the EU has managed to make progress on infrastructure in the Baltic and Northern countries as well as within the CESEC in South-Eastern Europe.

Ristori also pointed out that "**Russia is becoming immobile** and oriented towards the old world, having difficulties accepting the evolution of the world market." One example he gave is the liquefied natural gas market, which has a weak Russian presence.

PANEL DISCUSSION

European Committee of Regions' Vice-President **Markku Markkula** believes the priorities in the energy sector are investments, digitalization and regional and smart specialization.

He argued that **investments should come not only from the EU**, but also from local, regional, government and private investors. The Committee of Regions has created **20 ambassadors for climate and energy** and to work on an action plan. Markkula wants the issue to become part of the future of Europe initiative by European Council President Donald Tusk.

According to Markkula, **smart cities** are a reality. He said his hometown Espoo in Finland wants to become carbon neutral by 2030.

Slovakia's plans for the Energy Union were presented at the conference by the State Secretary at the Ministry of Economy. "**Nuclear energy** is an integral part of it," said **Vojtech Ferencz** reiterating Slovakia's long-term position.

He also listed **energy security and a low-carbon energy system** among Slovak priorities. The "**Clean Energy**" package, considered by Slovakia's members on the Council of Ministers as part of their legislative duties, requires "**a lot of work**", said Ferencz. The most important thing, he suggests, is to balance the principles of **solidarity, subsidiarity and proportionality**.

The State Secretary sees the issue of transferring competences to the EU level as an "extraordinarily dynamizing element" of the debate. He said Slovakia would continue to defend the principles of **technological neutrality** and **freedom of choice of energy mix**.

Regarding **energy security**, Ferencz stressed that "the strength of the chain is determined by its weakest link." He called upon EU member states to behave responsibly, **diversify supplies and remove national market barriers**. Slovakia attempts to adhere to these principles, according to Ferencz, in both electricity and natural gas. Ferencz considers science, **research and innovations** as a means of maintaining the country's **competitiveness**.

According to the Estonian Ambassador to Slovakia, whose country holds the **current EU Council Presidency**, the new legislation must improve the **cost-effectiveness and digitalization** of the energy system. "More market will lead to cheaper prices for consumers," underlined **Rein Oidekivi**. He said "the EU must act as an R&D powerhouse and a test market."

The discussion in the first half of 2018 within the EU Council and with the European Parliament will be led first by the Bulgarian Presidency and then in the second half by the **Austrian Presidency**.

Director General at the Austrian Ministry of Science, Research and the Economy **Michael Losch** said at the conference that Austria's term at the helm of the EU will focus on cooperation with the **Energy Community** linking the South-European countries within and beyond EU's external borders, with the **United Nations Industrial Development Organization** and the UN's **Sustainable Energy for All** (SE4ALL) initiative targeting development countries.

He also believes the **European Fund for Strategic Investments** should be more focused on the energy sector.

For Austria, **nuclear energy is not the future**. Instead, said Losch, the country envisages **10 thematic priorities**: prosumers, smart metering, blockchain, energy storage, flexible energy production on an industrial scale, grid interconnections, electromobility, power-to-gas, the EU's 2030 targets and smart grids.

Next year's SET Plan will be held under the auspices of the Austrian Presidency and will focus, according to Losch, on **"smart and resistant" cities and buildings, renewables and common projects for reaching the EU's 2030 targets.**

PANEL II: THE SET PLAN AS A DRIVER OF THE ENERGY TRANSITION: ACHIEVEMENTS IN ENERGY R&I AND THE WAY FORWARD

Keynote speech: Andris Piebalgs
Chair of the panel: Andris Piebalgs
Speakers: Hans-Guenther Schwarz, Nils A. Røkke, Marko Topič, Pierre Blanc, Lidia Borrel-Damián

SUMMARY

The EU has changed a lot from when industry followed the "the market will decide" principle. But we have all understood that the world is far more complex. Today industry makes use of research potential. But there is room for improvement in creating quality jobs for European people and securing the welfare that Europe needs, Andris Piebalgs, former European Commissioner for Energy said. To achieve this, the discussion participants insisted that enhanced cooperation between different actors, sectors and research fields was essential.

KEYNOTE SPEECH

The SET Plan was launched in 2007. However, in that 10 years the EU has not managed to bring about the **technological revolution**. "We are not there yet," according to **Andris Piebalgs**.

The World Energy Outlook for 2017 outlines four large shifts in the energy system. Basically, **technology is moving faster** than expected, which has significant positive consequences for the energy transition at the global level. Renewable energy is being deployed and costs are going down. For instance, the International Energy Agency predicted that the price of **wind energy** would **fall** to 5 eurocents per kilowatt hour by 2040. But that occurred in 2016 instead. Since 2010 the cost of wind energy has come down by 25 percent and the cost of photovoltaic (PV) energy by 70 percent.

Second, the level of **electrification** is also rapidly expanding, which is a major, albeit less pronounced development. Third, **China**'s pattern of economic growth is extending more into services, with cleaner energy production and consumption. Four, **shale gas and tight** oil production have proved to be resilient to low oil prices.

But paradoxically, the two revolutions are taking place simultaneously and balancing each other out. On the one hand, a **renewable energy breakthrough** can clearly be seen, but

on the other the **fossil fuel industry** is resisting the change, bringing an expanding resource basis and decent prices. Together this creates a rather 'unencouraging' perspective for 2040, in which 75 percent of fossil fuels will still be used, instead of the 61 percent in the sustainable development scenario.

Despite having the technology, **more R&D is needed**, for instance on safety limits on injections in the **gas grid**, on **CCS** and **CNG vehicles**, **LNG fueled ships** and the requisite charging infrastructure. **Industry** now believes that Europe will move sustainably towards decarbonization and no longer questions the need for this shift. We need to get them on board.

More investment is always the right **solution** – this is the wisdom that has been lacking for a long time. That's why recent developments are so significant – the **Juncker plan** assigned a lot more financial resources to R&D in renewable energies and the development of new technologies, and the European Investment Bank is involved. Still, not enough is being done, and if we follow this business as usual pattern GHG emissions will not have fallen 40 percent by 2030, never mind 85 percent by 2050.

We need a substantial shift to get **different communities to work together**. For that, a compromise has to be achieved between **ambition and realism**. Realism is about people who need first to be persuaded to take the ambitious path, since action is no longer being initiated by governments but by market actors.

We also need **strengthened regional cooperation** on R&D and common visions on the direction in which this research should go. It will be difficult for the whole EU, as Latvia and Portugal probably do not face similar challenges, but Latvia and Sweden are already much closer. We can learn from the Nordic example as regards regional research programmed and funding but also common PhD programs in energy and common green solutions for export strategy.

Assuming that the future can be extrapolated from the past is the wrong attitude. It is crucial the **future is viewed as being built on unexpected discoveries** and research, giving us a chance to evolve. Therefore, the SET Plan should not allow

us to forget that there are also research fields not directly connected to energy that may still produce unexpected breakthroughs.

PANEL DISCUSSION

Hans-Guenther Schwarz, a member of the SET Plan Steering Group, recounted that it took six years to bring all the countries together and get them to agree on how to move the SET Plan forward. This shows how difficult it is to get different actors to collaborate. However, collaboration is key. Therefore, research founders, industry, civil society players like cities should communicate. Shared **program management structures** can facilitate dialogue and serve as black boxes enabling lessons to be drawn from the past to provide future initiatives a basis on which to move forward. Hence, they are an essential solution for the SET Plan temporary working groups.

Programmed Management within the SET Plan will require action on three levels for all 14 implementation plans to proceed effectively. First, the engagement of **national public actors** is essential. They will gather the financial resources for the development of new technologies. Second, **"glue money" from European Commission** – like Horizon 2020 – will be required to overcome collective weaknesses related to political cycles at the national level. Third, policy incentives at the EU and national levels will be required to make the research funding attractive to **industry**. Since the benefits are not necessarily financial – when the market is not there yet (the so called valley of death situation) – businesses need policy commitments.

What are the **barriers** hindering effective multi-layered cooperation? The main one is **narrow-mindedness and short-sightedness**, where national lobbying concentrates on "money from Brussels" at the expense of excellence and innovation. **Europe requires the removal of barriers hampering collaboration between national stakeholders** and the best of those involved in Europe, networking power, and national R&I actors and industries to be embedded. The second barrier is the perception that our national markets are our home markets, which ignores the fact that national R&I actors and industries are part of a much larger value chain. Real success will come out of the awareness that **our home market is Europe** and that only by synchronizing efforts across the continent can we become global innovation leaders. Excellency is achieved through collaboration and relevance. Hans-Guenther Schwarz concluded by saying "let's invest."

Nils A. Røkke, Chair of the European Energy Research Alliance (EERA), stated that the SET Plan had been successful in assembling the world's largest research alliance on energy – the EERA. However, research in Europe faces a major **funding** problem, with just **7–8 percent guaranteed by the EU** and the rest coming from member states. Additionally, just **1.8 percent of R&D public spending** goes **on clean energy** – a tiny amount given its aim to tackle the world's most imminent problem – climate change. In 2015 22 EU countries decided to double this and Mission Innovation is now ongoing. Achieving a low carbon Europe requires ambition and greater collaboration in other R&I spheres as well. Nils A. Røkke said "We are delivering at different levels in Europe, in the Member States (MS) and the Associated Countries, in the international space and by leveraging SET Plan country efforts at the European scale. Still **we need to do more and in a more concerted way.**"

Marko Topič, Chair of the PhotoVoltaic European Technology & Innovation Platform, recounted that in 2006 the total global PV capacity was 6 GW, yet by 2016 this had been increased to 303 GW. Just within the last year a further 75 GW had been added, and another 90 GW is estimated for this year. Growth is continuing at speed – today solar PV is entering into a new era, which is a TW skill to be achieved around 2020-2022.

Europe is making progress in PV R&D but is lagging behind on deployment. To tackle this, last year European stakeholders joined forces and formulated the SET Plan Declaration of Intent to safeguard the essential role of PV in the future European energy mix that will ensure the global competitiveness of Europe's PV industry sector. The overarching goals include pursuing high-performance PV technologies and their integration into the EU energy system, rapidly and sustainably reducing the cost of electricity from

PV and to allow competition in electricity markets all over Europe. To achieve these goals requires major advances in the efficiency of established technologies (silicon and thin film) and new concepts – which must be designed to reduce the cost of key technologies, further **enhance PV lifetime**, to ensure quality and sustainability, and the mass realization of Zero Energy Buildings through **Building-Integrated PV** (BIPV) – and in manufacturing and installation.

The PV era is just getting started – PV can be used across the spectrum (an innovation from Europe!) in smart cities, buildings, integrated infrastructures and transport – on land, sea and in the air, helping the environment and society. Europe should get more out of it.

Pierre Blanc, a Chief Technology Officer at the Temporary Working Group on Batteries for E-Mobility & Stationary Storage at Leclanché, affirms that the **battery industry** is a key enabler in the further development of clean energy and transport. However, although there is a lot of R&I in Europe in the battery field, **a key component is missing – manufacturing capability**. Consequently R&I is not being crossing over into industry. So, **Europe has to rely greatly on Asia for battery storage,** despite being a leader in development. The situation is not going to change in the near future, as the production capacity forecast for 2020 indicates that EV Battery production will be concentrated in China, on 62 percent (108GWh); the US, on 22 percent (38GWh); South Korea, on 13 percent (23 GWh); and Poland on 3 percent (5GWh). However, the manufacturing facilities in Poland and Hungary have been built by the South Koreans, and only assembly work, not high-end jobs, is performed there. The automotive industry will need cell capacity of at least 200 GWh per year by 2025 for Europe alone. **Battery storage** systems could therefore become **strategic to European competitiveness**. Clean energy and mobility remain target. Yet if you buy a battery to put in an electric vehicle in China, the car will need to do approximately 30,000 km before it becomes carbon neutral. Therefore, it is important that Europe **controls the entire value chain** and does not just do the assembly work. Finally, the cost of a battery is 70 percent of the material cost. **The scarcity of materials is driving the cost up**. R&I should make sure that we can either use advanced materials that are less scarce or improve recycling, or even enable second use. Nonetheless, R&D is essential but not sufficient. The SET Plan must translate this into industrial reality.

Klaus Willnow, Head of Innovation & Future Technologies at Siemens Gamesa asserts that, from the company perspective, **R&D** is treated **as an investment in the future, ensuring competitiveness and securing jobs**. Despite renewables having led to a tremendous drop in prices, driven by RD&I, competition and economy of scale, we need to drive costs further down for customers as well to safeguard the market pool. Therefore, we need **innovations at all stages of the value chain**, since – for instance – a wind turbine comes in at less than 30 percent of the total cost, while over 70 percent goes on the foundations, operating costs, logistics and grid connection.

Global cooperation is central to RD&I. But we need to **think global and act local** – specifically on renewables, where all technologies – and challenges – are site-specific. The support of public authorities is greatly needed as this can accelerate the innovation process. Especially if we are to take anti-climate change goals seriously.

Lidia Borrel-Damián, Director for Research and Innovation at the European University Association, reported on a project designed to **marry the skills provided through higher education with those needed by the industry** to better answer the needs of the **labor market**. Moreover, it is important that higher education has the cooperation and support of **business** and **policymakers**.

Lidia Borrel-Damián thinks Europe is good at generating knowledge from **basic research** but finds **translating it into innovation more problematic**. Thus, more **investment** is needed, but not at the expense of basic research, which is key to a future breakthrough.

There are national and European programs targeting education, research and innovation. However, it is necessary to realize that the latter rely on education as well. So, **quality higher education** is of the utmost importance to a successful energy transition. Hence, we need to appreciate the importance of **multidisciplinarity** and bring people together from different sectors and backgrounds **to tackle challenges holistically**.

PANEL III: GLOBAL DIMENSION OF THE ENERGY R&I

Keynote speech: Patrick Child
Chair of the panel: Laura Diaz Anadon
Speakers: Florence Lambert, David Turk, Dolf Gielen

SUMMARY

In meeting its ambitious climate and clean energy targets **Europe needs more regional and international collaboration to mobilize research efforts and avoid duplication**. Such global cooperation is **very hard but worthwhile,** especially in the context of **China's beefing up its research investment and the deployment of innovative technologies. Plus, according to the IEA, "achieving carbon neutrality by 2060 requires unprecedented technology innovation and investments."**

KEYNOTE SPEECH

Patrick Child, Deputy Director General, DG RTD at the European Commission, admitted that **Europe is not really on track to meet the ambitious goals of the Paris Agreement, thus there is an urgent need to accelerate innovations in low carbon technologies**. As our societies and economies are becoming more and more interdependent, **international cooperation** – through joint actions and genuinely common programs – can make a very important contribution to accelerating the energy transition by **mobilizing the research effort**.

How can we most effectively fast-track the green transition? First, we need greater effort to ensure the **rapid deployment of existing viable technologies**. This requires a **strong policy lead from public authorities**, **sustained large scale investment** and a **favorable regulatory framework**. Secondly, we need **more investment in research** – both public and private – to speed up innovation and support next generation development and economically viable clean technologies. Thirdly, we need **new ways of getting different actors working together** towards these common goals.

Joint international cooperation aimed at truly rapid progress must include the sharing of **information, experience and best practice**, sometimes called "**soft cooperation.**" If this works then countries can define their own research priorities to **mobilize synergies**, whilst **avoiding the duplication** of effort.

The EU has over 20 bilateral science and technology agreements in which energy issues figure prominently. However, given the scale of the climate challenges including **air pollution, energy poverty and energy security**, we need to go beyond multi- and bilateral collaborations and take up more ambitious approaches.

At the European level **SET Plan** and **Mission Innovation** both open up new frontiers globally for clean energy cooperation and showcase how excellency in research can be maximized via mobilizing research efforts and public and private funding – through high-level institutional collaboration, soft cooperation and hard collaboration on specific research programs. This approach could be a real game changer.

PANEL DISCUSSION

According to **Laura Diaz Anadon**, Professor of Climate Change Policy at the University of Cambridge, to meet the goals of the Paris Agreement and address other energy challenges we need to answer three key questions: **how much money, on what, and how**? All analysts agree that the first question is the easiest, as **more investment is always beneficial**, e.g. for security, environment and competitiveness. To answer "on what" we need to observe where the **competition** lies and

analyze the development stories of new energy industries. In answering "how," there is **a lot of experimentation and innovation is already in place** on the design of public institutions promoting energy innovation – this is a good opportunity to learn from those developments.

Looking at the global landscape today, the **average EU28 R&D input amounts to just under 2 percent and was surpassed by China's in around 2011**. There's a high level of investment in the US at 2.8 percent, and in Germany at 2.9 percent, while the UK has just announced its goal to move from a relatively low 1.7 percent today to 2.4 percent in 2027. China, Korea and other OECD states are trying to do more.

China is also flexing its muscles in term of **output, e.g. publications**. In 1981, it had just 0.3 percent of the global share of publications and had extended this to 10.3 percent by 2011, while the **US** has gone into reverse, from 40.6 percent in 1981 to just 20.4 percent in 2011.

OECD countries are **investing much more in public ERD&D than 10 years ago** – spending $16.6b (PPP) in 2016 compared with about $10b in 2000. Yet **China invests more** in terms of PPP **than all the OECD countries combined**. In addition to increasing funding, China is improving the management of its national labs, state labs and institutes (over 1,000, about 16 percent of which deal with energy).

Additionally, despite the 2015 decision by 22 countries to double energy RD&D investments from $14b to $30b in 2022, according to the latest **Trump administration announcement, the US, instead of doubling of its research spending as pledged, it will actually reduce it**. This – if enacted – will make the overall goal of Mission Innovation much more difficult to achieve.

Wind and solar PV industries have taken root in industrialized countries, while today China is the largest manufacturer and market for these technologies. China's success on the wind market is down to central government policies throughout the innovation life-cycle starting in the 1990s. Solar PV is a different story – the domestic manufacture of solar panels in China went from negligible to 50 percent of global production in five years. This time there was very little central government intervention – it was very much a global intervention story in which transnational entrepreneurs mobilized global resources to build the manufacturing industry in China. China has also dominated the **lithium-ion battery** market, and is developing it quickly.

Depending on the circumstances, **international cooperation** can **accelerate innovation beyond the capabilities of a single nation** and can **facilitate access to markets**. **Pooling costs enables** projects of **greater scale** and **lessens duplication**.

Florence Lambert, Director, Commissariat à l'Énergie Atomique et Énergies Alternatives (CEA-Liten) and CEO at Institut National de l'Énergie Solaire (INES) said we are experiencing an **energy revolution in the high level of penetration of renewable energy resources**. The rapid **development of PV** technology **will also drive other renewable technologies**, especially storage.

There are four different **musts if we are to accelerate clean**

energy solutions in Europe and succeed against the "valley of death" challenge: 1) we must **concentrate and coordinate research** within countries and across Europe, and across different industries and research fields, 2) we must **address different domains and vectors** (electricity, heat and gas) as the energy optimum will be obtained by bringing together different visions, 3) we must have **early demonstrations of technologies** so new usages and possible business models can be identified, and 4) we must **address the European clean energy challenge at the European level** with the engagement of all the key players, since most of the technologies require the whole European market to achieve mass market status.

David Turk, Acting Director for Sustainability, Technology and Outlooks at the International Energy Agency (IEA) brought good news on energy-related CO2 emissions, as according to the IEA, **global CO2 emissions are flattening off for the third year in a row**, despite simultaneous healthy global GDP growth.

Given today's reference technology scenario, **we are barely on track to achieve the 2 degrees scenario** (2DS). To change this pessimistic outlook in a cost-optimized way, different technologies should contribute to global cumulative CO2 reductions – in 2DS, efficiency would mean a 40 percent share, with renewables on 35 percent, fuel switching on 5 percent, nuclear on 6 percent and CCS on 14 percent. However, there's also a "**below the 2 degrees scenario**" (B2DS), which would involve **further contributions** – efficiency at the level of 34 percent, renewables at 15 percent, fuel switching at 18 percent, nuclear at 1 percent, and CCS at 32 percent.

We face the challenge of **difficult emissions** especially in industry and transport. A lot of these **can be picked up and**

taken out of the system using CCS. And there might be additional innovative technologies, beyond CCS, for achieving this – that's the challenge ahead of us in tackling the climate situation.

The IEA monitors clean energy progress, measuring whether 27 energy technologies are on track towards their share in the 2DS. We consider **PV, onshore wind, energy storage and EV to be on track**. The bad news is that **24 of the 27 are not on track** and still need a strong push to achieve their full potential and deliver a sustainable energy future (e.g. CCS).

In real terms, public RD&D spending in IEA countries has bounced back since a low in 2000, attaining growth mostly in clean energy technologies. In 2015, all 22 Mission Innovation countries declared they want to be **innovators in a clean energy space,** not wanting to lose out on competition. In Asia Korea was one of the first countries to join the effort, which put pressure on Japan, which put pressure on China – and this positive domino effect spread further globally. The **focus of public RD&D** has changed, however, as much more spending now goes on **efficiency especially** and less on nuclear and basic energy research.

There are **a lot of regional and global programs** like Mission Innovation, SET Plan or IEA, and we should try to **link at least some of these together**, building on different technology collaborations from the past.

Dolf Gielen, Director at the IRENA Innovation and Technology Centre in Bonn, said that according to IRENA research, **achieving the B2DS requires 90 percent efficiency in renewables** (IEA 75 percent) **by 2050**. The implication is that the **share of renewables needs to rise from 15-16 percent of primary energy to 65 percent** of primary energy by 2050.

We've made great progress, visible especially in the cost announcements, but that's not enough. The **share of renewables** has been rising by 0.2 percent a year but what we need is a **6 fold increase to 1.2 percent per year**. The European Commission tabled the objective of achieving at least a 27 percent share of *renewable* energy consumption by 2030, while IRENA's analysis shows that 34 percent would be technically feasible and cost neutral. If we compare that with the reference scenario of around 24 percent that means a 1.2 percent rise on an annual basis, exactly in line with global growth needs.

The prospect of decarbonization by 2050 puts particular pressure on the initial years in terms of R&D. We see **challenges** in two fields in particular – one is **heavy industry** and the second is the **transport** sectors of road freight, aviation and shipping. The challenge here is the difficulty of regulating them (e.g. heavy industry has concerns relating to competitiveness or carbon leakage). Therefore **what is lacking is the political will**, which is something that needs reversing, and R&D, since there are no economically viable options for decarbonization of around one third of the energy-related emissions in the Reference Case for 2050.

To achieve innovation in renewable energy technologies we need to think beyond R&D – we need a **holistic, systemic innovation** for the energy transition that combines various policy instruments across the **whole technology lifecycle, from R&D to market development including creating standards and quality infrastructure**. But policy must be combined with **technical, business model and regulatory considerations**. And that requires dialogue on how to couple new technologies with new frameworks.

PANEL IV: INNOVATIVE LOW-CARBON TECHNOLOGIES AND EUROPEAN COMPETITIVENESS: FINANCIAL TOOLS

Chair of the panel: Charlina Vitcheva
Speakers: Pilar Solano, Sonja Chirico Indrebø, Diego Pavía, Stefaan Vergote, Mark van Stiphout

SUMMARY

The EU has **two instruments for investing** in R&I. The first is **Horizon 2020**, under which €2 billion grants are invested in four energy areas: buildings, renewables, storage and alternative fuels. The second financial instrument is **InnovFin** loans aimed at smart specialization.

Horizon 2020 requires **more flexibility**. **Energy efficiency** is an "administratively very complicated market," since procedures differ in the household and industry sectors. In any case, there is an "oversubscription" of projects and it is good that the EU has InnovFin as well.

The European Investment Bank's **InnovFin** has projects worth €600 million in the pipeline in areas as diverse as geothermal energy, stationary biofuels and ocean energy. The **eligibility criteria** include SET Plan priorities, Horizon 2020 geographical coverage, innovation, scaled demonstration and commitment from sponsors.

A **new EU objective** is to launch the **innovation fund** financed by the EU Emissions Trading System. Yearly, the fund will receive €450 million and will focus on **first-of-a-kind demonstration of large-scale industrial projects**.

The EU must **make three structural improvements to its energy market**. First, it has to shift from supply-side to demand-side measures. Second, the EU must homogenize regulation across the continent. Third, the EU would better off completing the supply-side by raising private funds so it can act as leading investor.

Statoil presented its Project of Common Interest based on carbon capture and storage (CCS). It does not concern CCS for coal, but **for industrial emissions.** The company wants to have a **complete CO2 value chain**. Another Statoil project for the future is a **floating offshore wind park** for countries with a seabed deeper than 50 meters.

PANEL DISCUSSION

Charlina Vitcheva, Deputy Director-General of the Joint Research Centre at the European Commission, said that **5 percent of EU's investment goes into research and innovation**. The target areas comprise fields with lower technology levels, where the risk of failure is higher, and demos of first-of-a-kind technologies.

The EU has **two instruments for R&I investments**. The First is **Horizon 2020**, under which €2 billion grants are invested in four energy areas: buildings, renewables, storage and alternative fuels. The second financial instrument is **InnovFin** loans for smart specialization.

EU investment has to be able to cope with **two issues: flexibility and predictability**. One solution is the **10 year climate and energy plans member states** have to present in 2018.

Pilar Solano is the Head of Division on Infrastructure, New Products and Special Transactions at the Directorate for Operations at the European Investment Bank (EIB). She is also in charge of **InnovFin**. She described project **eligibility criteria**. First, the project has to reflect at **least one of the SET Plan priorities,** except for energy efficiency, which has other financial instruments open to it, and nuclear energy. Second, it has to include at least **one Horizon 2020 country**. Third, it has to **be innovative**. Fourth, the project has to be ready for **scaled demonstration**, because the EIB wants to encourage the leap into commercialization at scale. Fifth, the project must have **plausible bankability prospects**. And sixth, it has to have **commitments from sponsors**. Solano stressed that the EIB does not award grants.

Examples of EIB funded projects include **offshore wind in Portugal** and biomass **gasification for electricity production in France**. The bank has projects worth €600 million in its pipeline in areas as diverse as geothermal energy, stationary biofuels and ocean energy.

Solano explained that projects sometimes collapse mid-way. She said that innovative energy is also about being **a business leader and good manager**, because projects take a long time to mature.

Stefaan Vergote, Adviser to the Director for Climate Strategy at the European Commission's DG CLIMA, said that **10 years**

of EU funded research had made a difference. The cost of renewables has decreased, and the industry has gone global.

The objective now is to **create a virtuous circle** via the agreed reform of the **EU Emission Trading System**. Part of the income from the sale of emission allowances goes to the **innovation fund**. Yearly, the fund will receive **€450 million**. Its scope comprises renewables, carbon capture, utilization and storage (CCUS), low-carbon technologies in the industry as well as energy storage technologies. The **eligibility criteria** reflect the geographically balanced distribution of projects, small and large. One of the most important criteria is the **possibilities of dissemination, wider application and cost-reduction**. The fund can cover up to 60 percent of the project costs.

Vergote stressed that the innovation fund will be focused on **first-of-a-kind demonstration of large-scale industrial projects**. The fund will provide opportunities to share risks and combine expertise across sectors.

So far, **eight workshops have been organized** with the industry. Next up is a **stakeholder consultation**. The objective is to have the fund **up and running in 2020**.

Mark van Stiphout, Deputy Head of the "New Energy Technologies, Innovation and Clean Coal" Unit of the DG Energy at the European Commission, discussed the future of Horizon 2020 and the **next Framework Program**. The priority is to **simplify the application process**.

There is **no shortage of money**, it's about finding the right instruments for specific projects, stressed van Stiphout. The Framework Program **needs more flexibility**. For example, **energy efficiency** is "administratively a very complicated market," given the different procedures in the household and industry sectors.

The Commission official concluded by saying that there is **"oversubscription" of projects** and it is good that the EU has InnovFin as well. "We organize a kind of Tour de France and not everyone can win it," added van Stiphout.

Sonja Chirico Indrebø, Vice President for Strategy and Innovation at Statoil's New Energy Solutions, described a **CCS project** her company has been working on. Statoil has been building its competence in CCS since 1996, she explained. **It's not about CCS for coal, but about the capture and storage of industrial emissions** in the cement and waste sectors. Statoil intends to transport CO2 from the United Kingdom and the Netherlands to Norway and inject it into the country's seabed. The company wants to have a **complete CO2 value chain**.

Statoil is pleased to be **on the third list of Projects of Common Interest**, which will help scale up the project. Another of Statoil's projects for the future is a **floating offshore wind park** aimed at countries with a seabed deeper than 50 meters. The first commercial project consists of five turbines with a 6MW capacity off the coast of **Scotland**. The project has received **subsidies**, but has already managed to **decrease cost** per MWh by 60 to 70 percent compared with the prototype off Norway's coast. A further cost decrease is expected. According to Chirico Indrebø, floating offshore wind can be **appropriate for islands and is exportable beyond Europe**.

Finally, according to **Diego Pavía**, Chief Executive Officer at KIC InnoEnergy, the **EU's advantage** – in comparison to the US or China – is that it **applies a systemic and holistic** (cross-sectoral) **approach**. The priority is to bring successful research projects to maturity.

Pavía said the EU must **make three structural improvements to its energy market**. First, it has to **shift from supply-side to demand-side** measures. Second, the EU **must homogenize regulation** across the continent. Third, the EU would better off completing the supply-side by **raising private funds** so it can act as leading investor.

PANEL V: DECARBONISATION: INDUSTRY AND TRANSPORT FUELS

Chair of the panel: Piotr Szymanski
Speakers: Adwin Martens, Walburga Hemetsberger, Daniel Gauthier, John Scowcroft, Franz Hörzenberger, Fabrice Stassin

SUMMARY

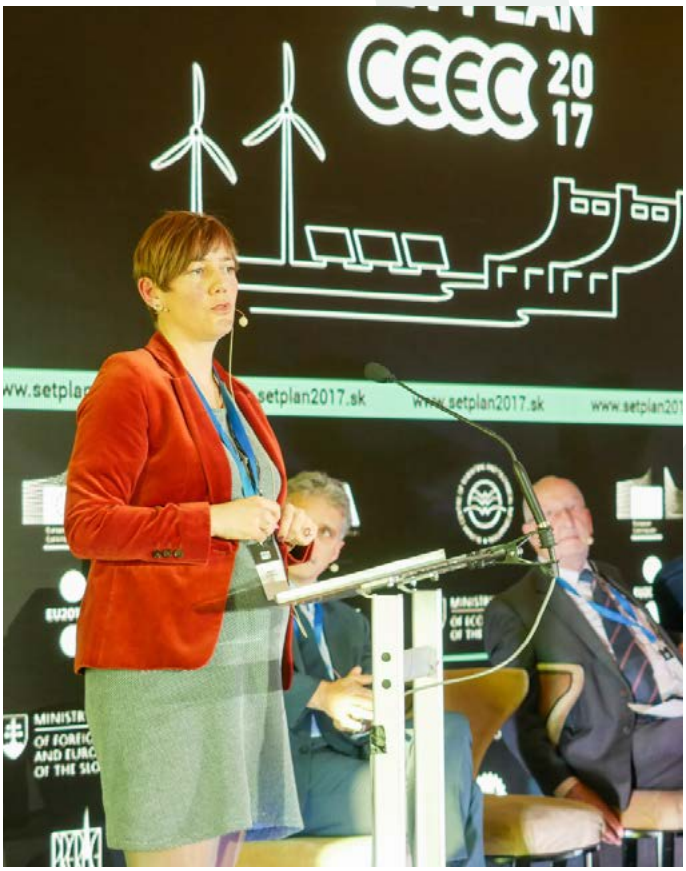
Hydrogen can be used in **power, heating, transport and industry**. In the energy sector, it will allow for the large-scale **integration of renewables**.

Carbon capture and storage (CCS) is a **crucial** element in the portfolio of low-carbon technologies. This is even truer of carbon capture, **utilization** and storage (CCUS). While CCS is linear and CO2 is no longer used, CCUS allows for **process optimization**.

By 2060, **one fourth of CCS** will have to be provided by **OECD countries**. **Cost-wise**, CCS is best used for **processing natural gas and for biomass-to-ethanol** technologies.

There is **great potential for CC(U)S** in the **steel** industry, the top-emitter. The issue is **public acceptability**.

In **transport**, however, the focus should be on **standard battery manufacturing**. European authorities need to dedicate **more resources**, align their choices better with **industry funding** and apply improved research and **innovation tools and methodologies**. Electric vehicles will be cost competitive by 2030 at the latest, which is—technologically speaking—tomorrow.



PANEL DISCUSSION

According to Director of WaterstofNet **Adwin Martens**, **hydrogen can be used in power, heating, transport and industry**. Until now, use has been mainly limited to transport, but new projects are being developed in the natural gas and chemical sectors.

In 2010 Waterstofnet opened a 1MW fuel cell plant near Antwerp that uses only European technologies. The hydrogen is a **by-product of chemical production**. Every hour, one ton of hydrogen is produced, equivalent to fueling 25 buses or 200 cars. Another project involves two electrolysers connected to wind and solar plants.

"You need **committed end-users**," said Martens. These projects are being developed further, and the latter one will result in a publicly accessible hydrogen-fueling station.

Walburga Hemetsberger, Head of the EU Representation Office of Verbund and Member of the Hydrogen Europe Board, spoke on behalf of Verbund, Austria's largest electricity provider. Renewable sources account for 96 percent of the electricity produced by Verbund. She defended the idea of using **hydrogen** to enable the energy transition. Hydrogen will enable **large-scale renewable integration** and power generation as well as **industry and transport decarbonization**.

She believes **battery and hydrogen technologies are compatible**. In the future, hydrogen batteries could be used for medium- to long-range cars, buses and fleets in general in the Alpine Valley.

According to **John Scowcroft**, Executive Adviser for Europe at the Global CCS Institute, carbon capture and storage (**CCS**) is a **crucial element in the portfolio of low-carbon technologies**. In the 2 degree scenario (Paris Agreement), CSS will contribute to 14 percent of the cumulative CO2 reductions from 2015 to 2060. Energy efficiency will contribute 47 percent, renewables 35 percent, nuclear energy 6 percent and fuel switching 5 percent. **One fourth of CCS will have to be provided by OECD countries**. He added that in the future, CCS could be used to absorb the CO2 already emitted into the atmosphere.

Cost-wise, CCS is best used for **processing natural gas and for biomass-to-ethanol** technologies.

Daniel Gauthier, President of A.SPIRE Heidelberg Cement, explained how his organization focuses on the decarbonization of the chemical, steel and construction industries. Gauthier agreed that the industry needs CCS, in addition to **carbon capture, utilization and storage** (CCUS), where development is slower. While **CCS is linear** and CO2 is no longer used, **CCUS allows for process optimization**.

Head of European Affairs at ArcelorMittal Global R&D, Franz Hörzenberger explained that every day one kilogram of steel is produced per every person globally. **Europe** produces 165 million tons (Mt) of **steel per year**, of which **100 Mt is primary steel and 65 Mt recycled** steel. The steel industry is responsible for 5 percent of global emissions. In terms of **emissions reduction**, the EU has to do in the next ten years what it took the last 20 years to do, said Hörzenberger.

The steel industry can apply **several solutions**. One is **process intensification**, but **CC(U)S has much greater potential**. The issue is **public acceptability**. Another solution is **direct carbon avoidance** (CDA), but major potential for a leap forward lies in **C-lean steel making**.

Fabrice Stassin, Managing Director of the Energy Materials Industrial Research Initiative (EMIRI), **suggests there are three specific requirements for battery manufacturing** to develop in Europe.

First, **more resources** have to be allocated to clean energy and clean mobility. Stassin recommends that Horizon2020 should have €400 million for funding battery research and innovation compared to the €243 million in FP7. Second, according to Stassin, public authorities need to make **better choices that are aligned with industry funding**. He recommends an implementation plan based on the SET Plan. The third element is the need for the promotion of **better research and innovation tools and methodologies**. Here, Stassin recommends improvements in research and innovation coordination.

He believes that **electric vehicles will be cost competitive by 2030 at the latest**, which is – technologically speaking – tomorrow.

The audience raised the question of carbon storage. **Scowcroft** thinks there are possibilities in **Austria**, for example, which **has suitable geology**. **Public acceptance of CCS** is different from that on renewables: In principle, everyone supports renewables, but no one wants to have them in their backyard. Scowcroft is convinced that **counties reliant on carbon-intensive industries will accept** CCS to protect jobs.

Gauthier said that **the production of hydrogen requires several times the energy needed to produce** standard electricity for vehicles. Hemetsberger agreed that this applies to clean hydrogen, but thinks the **focus is on hydrogen produced from CCUS**. She thinks public **acceptability** is a question of **getting used to it**.

Asked about **biofuels**, Scowcroft responded that **policymakers are bad at picking market winners**, and should only create the conditions for a fair race. He stressed that the **total cost of running an energy system** must always be taken into consideration.

PANEL VI: SOLUTIONS FOR SMARTER ENERGY SYSTEMS AT THE LOCAL LEVEL

Chair of the panel: Mechthild Wörsdörfer
Speakers: Bernd Vogl, Pirita Lindholm, Rastislav Lauko, Panagiotis Ktenidis, Vincent Berrutto

SUMMARY

The concept of smart cities should be based on a **beyond-sector and multi-actor approach**. Experience gained through successful projects should be replicated in other places, and smaller cities and towns should be coached so they can benefit from this experience. The concept should also extend to the countryside, and whole **smart regions** should be developed.

A smart city is not only about technology but also about **social innovation**. **Citizens** should be involved in the projects and participate in the development of solutions.

Buildings and **transport** play a significant role in the smart city concept.

Existing buildings have the largest potential for energy savings. It is important to focus on the deep renovation of existing buildings and on the **heating & cooling** sources in them. There is good potential for waste heat to be used for H&C in cities, and this is being explored.

One of the main challenges concerning energy efficiency in buildings is to **attract private capital** that can be invested in energy efficiency projects.

Another area of innovation is the development of **smart technologies** which enable the use of renewable energy and respond to demand.

Electromobility is an important facilitator of smart city development. It is important to have e-cars that represent good value for money and the appropriate infrastructure.

It is also important that the development of electromobility goes hand in hand with the development of the **new electricity market design**.

PANEL DISCUSSION

Bernd Vogl, Head of the Energy Planning Department at the City Government of Vienna, Austria, gave a presentation

on Green Energy Lab, an innovation project involving four Austrian states and targeting a million energy users. The aim of the project is to explore opportunities for the **use of renewable energy in cities**.

In another project – Smarter Together – the City of Vienna is concentrating on **reducing energy consumption** and expanding **smart technologies** in **existing buildings**. According to Vogl, the **refurbishment** of existing buildings is one of the most complex issues in the energy transition. One of the aims of the project is to find ways in which **waste heat** can be put to proper use in the city.

Aspern Smart City Research is a project testing how **buildings can be connected** to the electricity system and how to get the widest range of **energy sources on site**. One solution already on the market is to use the soil beneath buildings and concrete foundations for **heat storage**.

Vogl believes that it would be useful for new research projects to focus on ways of connecting different types of buildings in **low temperature networks** that use waste heat and ambient heat on site. It is also important to explore ways of connecting buildings to the electricity market.

In existing buildings, the focus should be on **efficient building envelopes**, the use of **heat pumps**, the **decarbonization** of district heating and gas, hydrogen or renewable electricity based heating.

According to **Pirita Lindholm**, Director of the European Regions Research and Innovation Network (ERRIN), it is important that the concept of smart cities adopts a **beyond-sector approach** to identify innovative solutions, and a **multi-actor approach** that would enable city administrations to work together with research institutions and the private sector.

Both technological solutions and the human aspect are important, and smart cities should focus on **social innovation** as well. Some cities have adopted a "citizen's city" approach and are developing solutions working together with the inhabitants.

Lindholm also noted that it is also useful to think in terms of **smart regions** which go beyond smart cities to include both cities and the countryside. One recommendation was to communicate with smaller cities and towns to help them replicate the experiences of bigger ones.

Rastislav Lauko, Executive Director of GreenWay Infrastructure, stated that **electromobility** is an important facilitator of smart city development.

An electric car is not just a vehicle, but it also **stores energy** and encourages the **acceptance of new technologies**. Electromobility also helps to improve **air quality,** which has an important impact on the **quality of life** in cities.

The further development of electromobility requires **e-cars that represent good value for money** and the **appropriate infrastructure**. Buildings and cities should be equipped with charging infrastructure, and it is important that whole regions and countries are well served by the infrastructure.

There is a need for **all types of charging**, from slow charging at home and slow and quick public charging to fast charging on highways and in transport hubs and ultra-fast charging where the car can be charged up in a matter of minutes.

It is important that the development of electromobility goes hand in hand with the development of an electricity market which can send **price signals** and enable **demand-side response**, with **special electricity tariffs**.

Lauko also believes it is important to focus on the implementation of **vehicle-to-home** and **vehicle-to-grid** systems, on cooperation between **charging point operators** and **distribution system operators** and on **battery second life** for electric vehicle.

Panagiotis Ktenidis, Senior Researcher at the Piraeus University of Applied Science, presented **TILOS, a project** from the Greek island of Tilos on ways of supplying energy in **remote areas**.

There are more than 2,200 **inhabited islands** in the EU. Despite having access to renewable sources of energy, such as wind and wave energy, many of them depend on expensive fossil fuel imports for energy supplies.

The TILOS project consists of a **smart microgrid** and a **hybrid power station** consisting of a single wind turbine with an output of 800 kW and solar panels with an output of 160 kW. There is a prototype **battery storage system** for storing excess energy. Smart meters and demand-side management devices enable energy management in local homes and centralized loads such as pumping stations. The operation of the entire TILOS system is coordinated by an Energy Management System (EMS).

Ktenidis stressed that for the successful implementation of the project, it was very important to **involve local citizens** in the whole process from the beginning.

Vincent Berrutto, Head of the "H2020 Energy" Unit at the Executive Agency for Small and Medium-sized Enterprises (EASME), explained that as part of H2020 finance for **energy efficiency in buildings**, the European Commission has been focusing on three types of technological innovation: integrated approaches for the **deep renovation** of existing buildings, the development of technologies in new **almost zero-energy buildings** and **demand response**.

In projects targeting efficiency in **district heating & cooling systems**, the focus has been on tools to map the demand for and supply of H&C in order to find the ideal match, tools for monitoring and optimization of district H&C and new H&C recovery systems using **low-grade heat sources**, such as waste heat.

Berrutto also mentioned the challenges the innovations face on their way to market, like the need for **proper business plans** and **skilled workers**.

One of the biggest challenges is to **attract private capital** for investments in buildings and cities. Berrutto said the Commission envisaged three ways of doing that: funding projects to **de-risk** the investment, **aggregating projects** into larger units and using public money to **leverage private capital**.

PANEL VII: THE EU AS THE LEADER IN RENEWABLE ENERGY TECHNOLOGIES

Chair of the panel: Piotr Tulej
Speakers: Christoph Hünnekes, Rémi Gruet, Philippe Dumas

SUMMARY

Europe has **a problem bringing existing technologies to the market**. We need to get from the prototype stage to the commercial or pre-commercial stage.

Manufacturing capacity is currently located outside Europe. Manufacturing and a market presence not only mean jobs, competitiveness and financial profit, but are also a **huge benefit to consumers** who can rely on quality systems and a low carbon footprint.

The public sector has a role to play in financing risky projects and the SET Plan is a strategic collaboration to mobilize European efforts that will facilitate the clean energy transition.

PANEL DISCUSSION

Jean-Claude Juncker said he wants to make the **EU a global leader in renewables** – and this has become a motto for the European Commission, member states and the research community. This is even more the case as **decarbonizing the European economy by 85 percent by 2050** would be **impossible without major development in the renewables' sphere**, as **Piotr Tulej**, Head of Unit, Renewable Energy Sources, DG RTD at the European Commission, admitted. **Renewable** energy will **supply electricity, heat and power for transport**.

What we need now is the **technology**, as it is **key to unlocking the potential** in the EU and to the EU being a global leader. Let's face it, compared to **China,** the EU cannot become a major competitor in generating capacity but the **EU has the know-how**, the **technology** and it **can create industries** that will benefit from the huge market potential.

So, research in innovation is where the SET Plan comes into the bigger picture. It was thought up as a collaborative effort between the EC, the research community, industry and the member states as a way of aligning research and innovation policies and actions so we can achieve the targets we set for ourselves.

Christoph Hünnekes, Head of Photovoltaics at Project Management in Jülich, said that making Europe number one in renewable energy is a challenging task and two actions have been determined to accomplish it – achieving sustainable technology leadership by **developing highly performative renewable technologies**, **integration into the EU energy system**, and **reducing costs**.

The cost of solar PV has already reached a low level but it is still set to go down if we manage to **translate research into industry**. To reduce costs, we should also embrace **system quality** to ensure **security of the renewable energy supply** – if the plan is to build huge renewable capacities, then they must be reliable.

Another problem is that of the **oversupply** that arises when we build huge renewable capacity on the basis of favorable conditions like high velocities or high solar insulation and as a result the value of this power in euros per MW goes down. Thus, we need to address how we can **combine local production with consumption, storage and flexible load management**.

The third challenge is that the revenues we generate from renewables in Europe, especially in PV, are under threat from the competition from **cheap manufacturing in the far East**.

The **system integration** of the PV sector must closely reflect other activities listed in the SET Plan – Smart Resilience and Secure Energy Systems, Energy Security in Buildings and Batteries for Immobility at Stationary Storages.

When looking at the **major innovations** that have led to today's high performance PV cells, modules and systems, like new preservation layers, use of laser technologies or chemical processes, we see that most of them **were developed in Europe** and are now sold as key elements of very successful European mechanical and engineering industries. Of course, there are important innovations from Japan and the US, but **Europe has the technological leadership in PV,** and the SET Plan implementation plan sets out practical actions to maintain this position. New ideas about the new materials and processes are now needed for the future technology generations.

Despite the existence of important joint public programs, we require **additional collaborative efforts** from both private and public actors. So, while competition is one of the main pillars of success for private companies, confronted with the growing competition from outside Europe, industry could discuss **closer collaboration in the pre-competitive sector** that would be beneficial for the whole European business.

Rémi Gruet, CEO at the Ocean Energy Europe, talked about five resources that are considered represent five opportunities and which use five different technologies. The technologies are **tidal stream, wave, ocean thermal energy conversion, salinity gradient and tidal range**. The first two are the most developed.

"**Ocean energy** has a big role to play in our clean energy package. It **can meet up to 10 percent of the EU's power demand by 2050**, equivalent of cutting 276 million tons of CO2 every year", said Karmenu Vella, Commissioner for the environment and maritime affairs. We envisage attaining 100GW by 2050 which will represent 10 percent of EU power consumption and be equivalent to 400,000 locally-based jobs. Within the last 10 years the private sector has invested a billion euros in ocean energy development.

Europe possesses the **technological advantage** in this sector – **66 percent of tidal and 44 percent of wave patents globally belong to European companies** that are already **exporting European technology** to Japan, Indonesia, Canada, Australia and Philippines, etc. These also provide the EU with security of supply, as this is an **indigenous and secure source of energy** that **diversifies the energy mix**.

The path to **cost reduction** leads via **R&I, demonstration projects, and across the "Valley of Death," through economy of scale, and above all through reducing the cost of capital**. To address the challenges facing the tidal sectors (e.g. access to finance and the cost of finance) and wave (technological validation of devices) we will need **public support,** as these technologies can provide significant **added value for Europe**, and create **jobs** – especially in the maritime areas of Europe.

Philippe Dumas, Secretariat, ETIP Deep Geothermal, EGEC, recounted that **geothermal energy** was used in Europe during antiquity, by the Greeks and Romans for bathing. Also, geothermal electricity was first produced in Europe over 100 years ago. So, it is an old technology which in the last 3-4 years has undergone a **technological breakthrough**. **The price of geothermal energy dropped by 20 percent** over that time simply because of the **market conditions** (especially in oil and gas) that are key to this sector.

Geothermal energy may have lower potential than other renewables, but it has key characteristics – it is a **baseload energy** and it is **flexible** – and we are now working on developing its capacity to produce high temperatures for industry.

As regards Europe's **industrial competitiveness**, we currently have 2.5 GW out of the 15 GW installed globally. But we can develop more. **Europe is the world leader in GSHP capacity on the shallow geothermal market**. It also leads in geothermal technology innovations, e.g. **underground thermal energy storage** (UTES). The main competition in **heat pump manufacturers** comes from China and the US, but Europe can maintain its lead. Europe has been overtaken by China on **geothermal DH systems** due to the large demand there; nonetheless, 500,000 Parisians use this heating system. Global competition exists mainly in heat exchangers and pipes, but innovation has also led us to develop **smart thermal grids**. Europe has also started **supplying geothermal energy to industry**, mainly for the agri-food industry. The next generation of technologies – **EGS plants** – is only in use in Europe so far.

The main **potential** of geothermal is in **supplying geothermal heating and cooling for cities and in the smart geothermal grid being developed**, as well as in **geothermal storage**, with a lot of R&D already in place in the Netherlands. In the long run, geothermal energy will play a role in the **decarbonization of industry**, by providing competitive solutions for **process heat**.

However, to unlock geothermal power, the cost must first go down and performance has to increase, and this is only possible with improvements to capabilities, adaptability, reliability and durability. It will be worthwhile because to achieve the decarbonized economy we need to combine different sources, technologies and approaches, and there is no single ultimate solution.

PANEL VIII: NUCLEAR SAFETY AND ENERGY SECURITY

Chair of the panel: Michael Huebel
Speakers: Daniel Iracane, Hamid Aït Abderrahim, Peter Líška, Radek Škoda

SUMMARY

The experts agreed that nuclear is a **low-carbon, secure-supply and guaranteed-price** source of energy. If the world wants to achieve the 2 degree objective, **nuclear capacity has to increase**. To facilitate this, **regulatory convergence** across the EU is needed.

The challenges for the **nuclear industry** are to make nuclear energy **safe, cheap and innovative**. Safety is a key element, but it can never be perfect.

A specific issue was the **lack of technicians** in nuclear power plants and companies. The Slovak speaker stated they had been replaced by managers, which may negatively impact on safety. The case of **fake safety documentation at Dukovany** nuclear power plant was also discussed. Again, the problem was the **wrong safety culture**.

Safety, costs and innovations have to be improved with **transparency** being the highest priority, and this may help increase **public support** for nuclear energy.

PANEL DISCUSSION

The panel discussion was commenced by **Daniel Iracane**, Deputy Director-General and Chief Nuclear Officer of the Nuclear Energy Agency (NEA) at the OECD. Iracane said **nobody does nuclear energy "for pleasure"** – there are a lot of "doubts and buts." He added that nuclear energy is a matter of confidence, in which **safety is the key element**. Safety can never be perfect. Iracane reported that the **Fukushima accident had been "a great lesson"** and that expert exchanges between countries had increased tremendously. Countries had improved and updated safety.

On the regulatory environment, Iracane noted that single technologies such as the French European Pressurized Reactor do not receive the same regulatory treatment. **Regulatory convergence is needed**, the NEA official stressed. If the world wants to achieve the **2 degree objective, nuclear capacity has to increase 2.5 times**. Iracane believes carbon capture and storage is not a mature enough technology. Nuclear is the solution if we want not **only low CO2 emissions**, but also **economic growth and a secure baseload**, he said.

The challenges for the **nuclear industry** are to make nuclear energy **safe, cheap and flexible**. Only then can it be synergic with the growing share of renewables. Nuclear energy has to get **back to innovating**, Iracane told the public.

Hamid Aït Abderrahim, Chairman of the Governing Board at the Sustainable Nuclear Energy Technology Platform (SNETP), described the basic advantages of nuclear energy. These are that it is a **low-carbon, secure-supply and guaranteed-price energy source**.

SNETP's **research** mission is to have **new generations** of nuclear reactors, beyond-electricity solutions such as **hydrogen** and **fast-neutron reactors**. Abderrahim also called for **EU-wide safety standards** across the reactor generations.

In the EU, the SNETP Chairman reported, there are **129 reactors with a turnover of €70 billion per year**. They provide jobs for 800,000 people and are the largest source of carbon-free electricity production. In the future, Abderrahim believes **nuclear will play an important role in the world energy mix and will co-exist with renewables**. Post-Fukushima research and development will continue and depends on the EU's financial instruments.

The **challenges** facing the nuclear energy include **high-level waste management, limited uranium reserves and the cost-**

efficiency of nuclear energy. Solutions to these will be based on the public acceptance of nuclear energy, fast-neutron reactors and small modular reactors, respectively. The overarching challenge is **how to apply these solutions without jeopardizing nuclear safety**, the SNETP Chairman noted.

Peter Líška, Vice Chairman of the Board of Directors at VÚJE, complained that **there are fewer and fewer technicians in nuclear power plants and companies**. They have been replaced by managers, which is detrimental to nuclear safety. Moreover, from their positions, they may negatively influence the remaining technicians.

Safety can quickly be improved, with correct the attitude, Líška believes. In contrast, **correcting the failures of top-level management takes a very long time**.

VÚJE Vice Chairman also criticized **nuclear research in Slovakia** for **not being properly organized**. Whether funded by the EU or the Slovak nuclear regulatory, "most projects consist of meetings," said Líška.

The **priorities** of Slovak research are **energy security improvements, fourth-generation reactors and nuclear safety**. Upcoming tasks include exploiting the potential of Bohunice V1 reactor for research in decommissioning, the modernization of safety systems, storing and handling of spent fuel and small modular reactors.

Assistant Professor at the Czech Technical University Radek Škoda analyzed the recent scandal of **fake safety documentation at the Dukovany nuclear power plant**. All the documents relating to each reactor had to be rechecked and 20 percent were found to be incorrect. In addition, not all the necessary checks had been completed. The reason for the scandal was the **wrong safety culture**. At the beginning of the process, there was the decision to increase electricity production at Dukovany by **reducing outages**. Under the pressure, the inspectors **simplified the checks**. Škoda saw a **larger, HR related reason** behind the scandal: the top decision-makers were not nuclear technicians and the checks had been subcontracted out, yet there were corporate links between the various companies involved.

During the **discussion**, **Líška** stated that **Slovakia** had considered several locations for the underground storage of **spent fuel**, but had no intention of starting building one in the near future. **Instead**, it was working on **fourth-generation reactors**, which will be able to use spent fuel produced much earlier. Líška said that once the **Mochovce** reactors are finished, Slovakia will produce 65 percent of its power from nuclear energy.

Regarding **public acceptance of nuclear energy**, **Iracane** said citizens need to see **more transparency** in the nuclear industry. On the technical aspects of the future energy system, he said that 100 percent renewable use was not possible and that battery storage was too complicated and expensive. Nuclear would be necessary.

PANEL IX: MARKET INTEGRATION I. CENTRAL EUROPEAN NATURAL GAS MARKET

Chair of the panel: Maciej Jakubik
Speakers: Milan Sedláček, Florijana Đedović, Sergiy Makogon, Michal Slabý, Jan Osička

SUMMARY

The development of **gas hubs** is improving in some Central European countries, such as the Czech Republic and Slovakia.

Transmission system operators (TSOs) in Central European countries stress that **diversification of routes and sources** remains an important issue for the region.

The common denominator of all the projects in Central Europe is the **North–South dimension**.

Liquefied natural gas (LNG) will have an increasing influence on the Central European market.

A study showed that market interconnection is often confused with **market integration**.

The future of Central European gas market is linked to the future of **Ukrainian transit**. Both would be significantly influenced by the construction of **Nord Stream II**.

The pace of the **gas market reforms in Ukraine** has slowed.

PANEL DISCUSSION

Florijana Đedović, Head of Strategic Development and EU Funds Business Unit at Plinarco, stated that Croatia is looking at developments on the natural gas market as a country that is in both Central and South Eastern Europe.

Croatia is a small market. Its domestic production is in decline, while consumption is on the rise. The country has **interconnections** with Slovenia and Hungary only. Therefore, Plinacro is focusing on developing interconnections with other neighbors.

The company is also working on the development of several **strategic projects**: the **LNG terminal** on the island of Krk, the **Ionian-Adriatic Pipeline** (IAP), the **Baltic-Adriatic**

Gas Corridor and compressor stations within the Croatian transmission system.

The LNG project and the IAP will have a major impact on Croatia and the region. The Baltic–Adriatic Gas Corridor will link the LNG terminal in Krk and the LNG terminal in Świnoujście, and help to integrate the whole Central European region into the European gas market. **LNG** will have an increasing influence on the Central European market, Đedović said.

Which projects will be implemented in Europe will depend on the market. Đedović believes that the European Commission can provide help to Central European countries in the form of a regulatory system that will allow the flow of gas from one country to another. While the market in this part of Europe is **not mature** yet, the Commission should offer flexibility in terms of regulation.

Milan Sedláček, Head of EU Affairs and Strategy at Eustream, noted that in the past, the Slovak transit system had mainly been used for the flow of Russian gas from East to West, but after 2009, a **bi-directional system** was implemented and the transit became **highly flexible**.

Central Europe has made significant progress from being dependent on Russian gas and having no access to LNG or non-liquid fragmented markets.

Gas hubs are developing quite well in some CEE countries. Between 2015 and 2016, the Czech Republic moved away from being an "emerging" to becoming an "advanced" hub, while Slovakia improved its status from "illiquid" to "emerging" hub.

However, the need for **diversification** of **import routes** and **sources** remains an important issue. The common denominator of all projects in Central Europe is the **North–South dimension**.

The future of the Central European gas market is linked to the future of **Ukrainian transit**. Both would be significantly

influenced by the construction of **Nord Stream II**, Sedláček said.

He stressed that **Ukraine** should focus on the inevitable **gas sector reforms** and should execute TSO unbundling, solve the problem of household subsidies and adopt further steps to demonopolize the market.

Michal Slabý, Senior Manager at NET4GAS, was also grateful that the **development of gas hubs** in the Czech Republic and Slovakia had improved between 2015 and 2016.

The wholesale markets are developing well in the EU, but the **price of household gas** differs in each member state, Slabý stressed. For example, in some countries it is largely dependent on taxation or distribution fees.

The new EU regulation on **security of gas supply** guarantees security in theory. Slabý, however, believes that in practice it will be guaranteed through the **diversification** of routes and sources and the **dismantling of capacity bottlenecks**.

Slabý also mentioned the **Trading Region Upgrade (TRU)**, a hub-to-hub service which should facilitate market integration and connect the **Austrian and Czech gas markets**. The service will be set up using the existing gas infrastructure of GCA the Austrian TSO, N4G in the Czech Republic and Eustream in Slovakia.

Sergiy Makogon, Executive Director and Head of Strategy and Business Development at PJSC Ukrtransgaz, shared the views of the **Ukrainian** TSO.

Thanks to the "small reverse" **Vojany pipeline** between Slovakia and Ukraine and new interconnections with Poland and Hungary, the country is able to **import gas from the EU** and has not bought gas from Russia for almost two years.

However, due to **legacy agreements with Gazprom**, the Ukrainian TSO is not able to utilize the previous infrastructure for the same purpose.

Makogon also said that in terms of the respective costs, transmitting gas through Ukraine could be the most cost-effective routing alternative for supplies of gas to Southern Eastern Europe, comparing this option with the planned **Eastring** or Bulgaria–Romania–Hungary–Austria (**BRUA**) pipelines.

The EU should wisely consider all new projects and invest more in software development, which means legislating to ensure the **free flow of gas** between countries.

Makogon also stressed that the **Southern Gas Corridor** and **LNG** supplies are far more reasonable routes and sources of diversification than the Russia-backed pipelines designed to bypass Ukraine, such as **Nord Stream II**.

Jan Osička, Assistant Professor at the Center for Energy Studies, Masaryk University, presented a study undertaken by Masaryk University in Brno, which explores **market integration** at the EU level and its relevance vis-à-vis regional projects such as the **V4** one. It also considers V4 energy cooperation and the importance of gas market integration within that. The study also maps stakeholder positions on the process.

One finding is that the defining feature of V4 natural gas market integration is the **lack of a shared understanding** on what the term actually means.

Also, **market integration** is often confused with **market interconnection**. For many stakeholders, infrastructure automatically means security of supply.

Some stakeholders tend to question the benefits of market integration. Integration is widely seen as a "**political assignment**" which consumes stakeholders' resources.

PANEL X: MARKET INTEGRATION II. MARKET COUPLING IN ELECTRICITY

Chair of the panel: Zoltan Gyulay
Speakers: Jiří Strnad, Nikolay Iliev, Vsevolod Kovalchuk, John Lowry

SUMMARY

Despite **Bulgaria** having **all the prerequisites for market coupling** on its borders, its **neighbors** are **not interested**. But political authorities not only ensure a level playing field for market coupling, but also take the final decision. It is a **political process**. For **other countries**, the **priority** is capacity allocation and congestion management (**CACM**). Market coupling and CACM are difficult to **manage in parallel**, some say, while others disagree. The Bulgarian expert went as far as to say that one coupling can be an obstacle to another coupling. **In the further integration of day ahead markets**, the market regional coupling of Central Europe with Western Europe was also stopped – by **Germany and Austria**. Both countries want to focus on core regional market coupling and relations between the German and Austrian markets.

Ukraine, too, plans market integration with the EU. It can **offer** the European market **balancing provisions** as well as effective **use of generation capacities** (peak shift effect). The integration should happen in **two stages**: first, Burshtyn Island will connect in 2018-2019; second, Ukraine's remaining power system will follow in 2022.

The Irish expert stressed that the challenges facing electricity system operations cannot be discussed without mentioning the **challenges facing the industry**. He insisted that "we are facing a much **more complex environment than ever before**." **Ireland** had to find solutions to integrate **significant amounts of wind** into the system in line with its renewable energy targets. But the challenge is **cross-sectoral and cross-border**. The central element in delivering on the renewable target of 70 percent of variable energy sources in the power system by 2030 is the **auxiliary services market**. EirGrid is coordinator of the **EU SysFlex project co-funded by Horizon2020**. Its objective is to contribute to market design and the regulatory framework to foster innovative flexible approaches and solutions to **address the technical shortfalls** within the pan-European system in an environment where there is **high penetration of renewable energy sources**.

PANEL DISCUSSION

Nikolay Iliev, Deputy Director of the Bulgarian Electricity System Operator EAD, said **Bulgaria has all the prerequisites for market coupling on its borders**. Nevertheless, he complained that none of its neighbors want to do market coupling.

Officially, the country belongs to the same region as Romania and Greece. Market coupling requires the coordination of transmission system operators, nominated electricity market operators and regulators. However, **Bulgaria is unattractive** because it has the lowest electricity prices. We are aware our prices have to rise, Iliev said, but added that the country is also

plagued by energy poverty.

Currently, market regional coupling (MRC) covers 19 countries, representing over 85 percent of the EU's electricity consumption. The EU has a roadmap for extending MRC by 2020. A Memorandum of Understanding on MRC and capacity allocation and congestion management (CACM) was signed in April 2016.

Vsevolod Kovalchuk, CEO of NPC Ukrenergo, reported that in April 2017 the **Ukrainian parliament had adopted a new energy market law**. The new market design will apply as of July 2019. In June 2017, however, the **EU and Ukraine had reached an agreement on interconnections**.

According to Kovalchuk, Ukraine's power sector is highly monopolized, and this should change thanks to the new market design and integration with ENTSO-E. The estimated **cost for Ukraine is €365 million**.

Ukraine can offer the European market **balancing provisions** as well as effective **use of generation capacities** (peak shift effect). The integration should happen in two stages: first, Burshtyn Island will connect in 2018-2019; second, Ukraine's remaining power system will follow in 2022.

In the next discussion, two transmission system operators (TSO) represented by **John Lowry**, Project Director at EirGrid, and **Jiří Strnad**, Executive Director of Energy Markets Development and Operation at SEPS, agreed that **a level-playing field should be ensured in market coupling**. The expert from the Slovak TSO pointed out, however, that **this is a political decision,** since prices are regulated. Guidelines from policy-makers will always help. **Kovalchuk** even thinks that in market coupling the "political aspect is most important." Ukraine has huge physical interconnections with Russia, but the two markets have always been separate. It is easy to forecast that prices will become similar on national markets after coupling; the issue is political.

Iliev said that Bulgaria was asked a couple of years ago to **fulfil certain criteria before market coupling**, but **ENTSO-E had since changed its approach**. Different Balkan countries, he claimed were allowed to couple together, before coupling with the EU. "This is for me very strange," concluded Iliev. **Zoltan Gyulay**, Market Manager of ENTSO-E, reacted by saying that

the organization had "**never told anyone they should not couple between themselves**".

Iliev again reminded the audience that **Bulgaria is ready to couple**, in contrast to its European neighbors. But **Strnad** responded that **the priority lies with CACM**, whose deadlines are "quite ambitious." One condition in market coupling is that **interest must be expressed**. Serbia and Croatia expressed an interest. The second condition is the **approval of all regulators**, since prices are regulated. However, one regulator did not

agree with coupling with Serbia. This was not a precedent. The **region Slovakia is part of turned down its wish to couple with Germany and Austria's regions** because these countries had other priorities. We don't have the political support, summarized Strnad. From this **Iliev** concluded that **one coupling can be an obstacle to another coupling**. "When we couple with someone, we create obstacles for someone else," he said. According to **Gyulay**, there are **constraints in terms of human resources** to running various coupling processes in parallel. **Iliev** thinks this is about having the **appropriate software**. He added that he doesn't understand **why a country has to apply for MRC**, if the rules are clearly given. Strnad stressed that regional market coupling is a "**voluntary project.**"

In his presentation, **Strnad** described the process whereby a **Single Allocation Platform** was created in 2015 to support market coupling activities and organize long-term auctions. SEPS's other initiative is the **4M MC Region** project which is about coupling four markets. These are the Czech and Slovak Republics, followed by Hungary and Romania. Poland is an observer.

Further integration of day ahead markets is challenging. SEPS **first option was to integrate with Germany and Austria**, but the project was stopped because they wanted to focus on core regional market coupling and relations between the German and Austrian markets. "It is not a good solution," said Strnad, adding that Slovakia was promised market coupling several years ago. The **second option was market coupling with Croatia**. Through Croatia, the countries would have access to MRC. But the volume of coupling would be too low. **The third option was to integrate with Serbia**, but that was stopped by the Czech regulator. **The last option is to do nothing**, which is a pragmatic choice – focusing on the core region. **TSOs have not yet found a common position** on flow-based market coupling.

John Lowry started his presentation by saying that the challenges facing electricity system operations cannot be discussed without mentioning the **challenges facing the industry**. "We are facing a much **more complex environment than ever before**," Lowry stressed. Operators are striving towards renewables integration, but also the electrification of heat and transport, diversification, decentralization and consumer engagement. The Internet of things allows for the management of much bigger volumes of much more complex information than before. It opens up possibilities for a much more integrated **pan-European electricity system**.

Ireland had to find solutions to integrate **significant amounts of wind** into the system in line with its renewable energy targets. But the challenge is **cross-sectoral and cross-border**, Lowry pointed out. Ireland is delivering on innovations in wind, not only volume-wise, but also in terms of operation. "We are capable of operating the system with **wind at 60 percent at any given time**," said Lowry. EirGrid deals with the constraints using the DS3 program, where S3 stands for system tools, system performance and system policies. The central element in delivering on the renewable target of 70 percent of variable energy sources in the power system by 2030 is the **auxiliary services market**. The market design has to move away from energy and capacity payments towards system services.

The pan-European system faces the challenges of market and regulatory change, data management and exchange, operational change, plant capability and ability to develop assets. "We need to be in a situation where we can **maximize the potential of assets** we have on a pan-European basis," underlined Lowry.

EirGrid is the coordinator of the **EU SysFlex project co-funded from Horizon2020**. Its objective is to contribute to the market design and the regulatory framework to foster innovative flexible approaches and solutions to **address the technical shortfalls** within the pan-European system in an environment of **high penetration of renewable energy sources**. "Innovation will cover the technical capability for delivery of the right **flexibility and system services** and the ability of TSOs to integrate," said Lowry. EU-SysFlex is a multidimensional project bringing together knowledge from various parts of the continent on technical shortfalls, developing **market and regulatory solutions** and eventually drafting a **roadmap for Europe**. The participants are TSOs, distribution system operators (DSOs), technology providers, universities and technology institutes. The consortium covers **15 countries** and includes **6 demonstration projects**. Lowry believes the project will make a "**major contribution**" to Europe's meeting the **renewable energy targets in 2030 and beyond**, to developing tools for TSOs and DSOs and to their cooperation across borders and sectors.

Evening *sessions*

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ES I: SMART SPECIALIZATION PLATFORMS AND THE TRANSITION TO A LOW CARBON ECONOMY FOR COAL-INTENSIVE REGIONS

Chair of the panel: Anna Colucci
Speakers: Guy Vekemans, Evangelos Tzimas, Eduard Hulík, Bert de Wel, Lev Pidlisetskyy

SUMMARY

On 11 December, the European Commission **launched its Platform for Coal Regions** in Transition.

Experts shared their experiences of smart specialization and the coal transition ahead of the announcement. They agreed it is imperative to **involve all relevant stakeholders,** create **sustainable jobs in the long term** and base the new regional economic model on **local potential**.

PANEL DISCUSSION

There is no doubt the **coal regions will be affected** by the energy transition and will present a social and economic challenge, said **Evangelos Tzimas**, Deputy Head of the Knowledge for Energy Union Unit at the Joint Research Centre (JRC) attached to the European Commission. The question is **who will be affected and how and what instruments will the regions be able to choose** and use.

"**The problem is European, the solutions are local**," pointed out Tzimas.

Tzimas noted that there are **207 coal power stations with a total capacity of 150 GW in 21 member states**. In addition, there are 157 coal mines in 12 member states. These provide 55,000 jobs in the power sector and 185,000 in mining. In total there are **240,000 direct jobs**, and a further **215,000 indirect jobs**.

Tzimas believes regions should seek **alternative business opportunities** for employment and economic growth "based on **regional potential**".

JRC is currently mapping out how best practices can be shared with stakeholders across Europe. "All stakeholders should be included; only the region knows the best," underlined Tzimas.

Eduard Hulík, advisor to the State Secretary at the Ministry of Education, described the **situation in Slovakia**. **Coal is mainly mined in the Upper Nitra** region and represent most of the supply to the local Nováky power plant.

Mining is promoted as providing **energy security**; coal is extracted as a domestic source of energy and burnt to stabilize the electricity flow.

Hulík pointed out that although Hornonitrianske bane Prievidza mining company is a major employer in Upper Nitra, the miners have a **below-average life expectancy** and face an **above-average risk of workplace accidents**.

He stated that **Nováky power plant** has three generators with a total capacity of 266 MW and is run by Slovenské elektrárne. It provides a regulation source with semi-peak operation and supplies steam for the district heating system and industry.

The direct cost of sustaining the coal industry falls in part on electricity consumers who contribute **€100 million per year**. "That's one fourth of the support (in subsidies) for renewable energy sources," calculated Hulík. There are also other costs, such as the higher incidence of respiratory diseases in Upper Nitra.

If the power plant were to close, which the advisor to the State Secretary admitted would be a departure from the long-term government position, "**there is no need to replace the electricity source in Nováky** (as) there are other power plants in the system."

However, "**there is an urgent need to replace heat sources** for central heating and for industrial companies" hinting at the possibility of biomass or geothermal resources.

According to Hulík, there is "**a need to eliminate the environmental damage** caused by coal mining and to **retrain the miners for other industries**."

Bert de Wel, Senior Advisor at the Just Transition Centre, Oslo, mentioned some good examples of **transition in Canada and Australia**. Canada **involved the trade unions** in the coal transition in the power sector. While in Austria the power station **workers themselves defended the plan to build a thermal solar plant** before the authorities did. Another positive case is the Netherlands, which had a society-wide "agreement on energy transition".

"There is no win-win solution and someone has to pay, but it is important to **involve all stakeholders**," said de Wel.

EnergyVille is a **research institute located in Genk**, Belgium, but it has links with two other coal-mining countries, the Netherlands and Germany. The last mine in our region closed in 1987, said **Guy Vekemans**, Energy Ville Strategy Developer at VITO, one of the research centers behind Energy Ville.

Vekemans explained that in the past people thought the **car industry** would drive the regional economy. However, the **local Ford factory closed down in 2014**. The question again arose as to how **sustainable jobs** could be provided. VITO teamed up with universities and the energy industry to launch EnergyVille.

The key to success, stressed Vekemans, was using historically accumulated knowledge on the subterranean world. EnergyVille's focus is on **developing deep geothermal energy**. Existing maps are being digitalized to decrease the risks associated with this form of energy.

Geothermal energy is currently used to produce electricity and heat. According to Vekemans, the project has **replication potential across Europe**.

EnergyVille's other projects include **photovoltaic panel production** and the aim is to relocate this back to Europe. But the institute does not shy away from the sensitive issue of future jobs for former coal industry workers. The 'T2 campus' being developed will be devoted to **retraining and requalification**.

Lev Pidlisetskyy, Member of the Ukrainian Parliament, drafted the country's new electricity strategy. The **main issues to be tackled in the energy sector** are supply **monopolies**, lack of competition, the high **debt** in the energy sector, the "manual mode" of **setting electricity prices**, **cross-subsidizing and energy dependence** and non-fulfilment of export-import potential.

It is expected that within the next 20 years, **Ukraine's energy mix will change significantly**. For example, in 2015 coal provided 27 MTOE of the total primary energy supply, but this is expected to drop to 12 MTOE by 2035. On the other hand, the renewable share will increase from 2.2 to 21 MTOE.

ES II: SMART GRIDS, SMART HOMES, STORAGE AND E-MOBILITY

Chair of the panel: Tudor Constantinescu
Speakers: Konstantin Staschus, Richard Pieger, Vladimír Mistrík, Bart Biebuyck, Patrick Clerens

SUMMARY

With the increasing role of **renewable energy sources**, the growing number of **prosumers** and the development of **electro mobility**, **energy storage** technologies are becoming more and more important.

Hydrogen and **fuel cells** may play an important role in the future alongside the various types of **battery storage**. Innovative solutions may bring **new technologies** onto the market.

There is, therefore, a need for coordinated action in **R&I**, and for a **market design** that will allow for the expansion of energy storage.

Social transformation is another challenge associated with the new trends in energy, and there is an increasing need to ensure **cybersecurity** and **personal data protection**.

PANEL DISCUSSION

Patrick Clerens, Secretary General of EASE, believes that without **energy storage**, the EU will not be able to meet its climate and energy policy targets, decarbonize its transport sector and achieve the electrification of the heating & cooling sector.

Energy storage provides services for energy producers, transmission and distribution systems operators as well as customers.

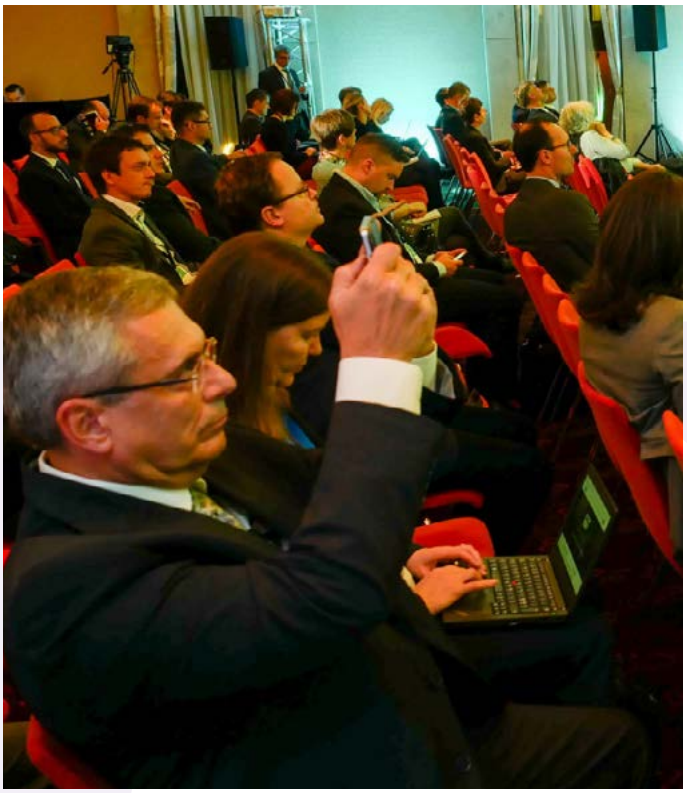
New technologies are still being developed, which means that the regulatory framework must be **adaptable to the future**. There will be a need for solutions at many different levels and facilities that provide storage capacity for **various periods of time**.

Clerens stated that EU policy on energy storage should be **technology-neutral**. There is a need for a **new market design** that will not contain limitations and constraining definitions which would have a negative impact on new technologies coming onto the market. In developing energy storage it is important that electricity **prices reflect scarcity** and congestion in the system.

According to Clerens, there is a need for a single **strategic plan** in energy storage **R&I** containing all the different technologies and focusing on research into the ideal market design.

Konstantin Staschus, Director of Ecofys – a Navigant company, was grateful that data on the development of smart metering in the EU are available because several member states are in the middle of **smart meter roll-out**. There are already households in the EU whose energy bills reflect wholesale prices.

He expects that **customers** will become more interested



in smart solutions, now that e-mobility, smart homes and electricity-based heating & cooling technologies are improving. Customers will be able to see the benefits of adopting an active approach to energy issues.

Staschus presented the main points of the **Implementation Plan (IP) 2017-2020,** prepared by the European Technology and Innovation Platform Smart Networks for Energy Transition (**ETIP SNET**), which should enable the transition towards a reliable and sustainable European electricity system with a high share of renewables.

The IP should serve as a reference for funding organizations interested in **short-term R&I priorities** for all system and market aspects of the energy transition enabled by smart networks and sector coupling.

Vladimír Mistrík, Project Manager at NIORE, explained the principle behind **NIORE energy storage technology**. It consists of a floatable flywheel which is able to store energy in the form of water, thanks to the utilization of centrifugal force.

Richard Pieger's presentation focused on the **future of mobility**, especially in the car segment.

While vehicle ownership is currently perceived as a necessity or a question of prestige, and it is normal for a car to contain just the driver, in the future it will be common for **vehicles to be shared** by more people. Drivers will also be able to hire vehicles for special purposes, unlike today, when a single car is used for multiple purposes.

Pieger stated that future vehicles will be propelled by **renewable sources of energy** and thanks to smart technologies, there will be **less congestion** and transport will be considerably safer than today.

This transformation of the transport sector will be accompanied by a **social transformation** in which citizens will be able to adapt to the new technologies and create, use or share data with others. Pieger stressed that **data security** will need to be ensured throughout the whole system in order for this transformation to happen.

Bart Biebuyck, Executive Director at the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH2JU), underlined the role of **hydrogen and fuel cells** in **energy storage** and **sector coupling**.

Since hydrogen can be produced by **water electrolysis**, we will be able to introduce more renewable sources into the system. When in gas form, energy can be stored **in large quantities for a long time**.

Hydrogen can be used in **transport**, including cars, as well as trucks and buses. There is also significant potential for the use of hydrogen and fuel cells in **rail**, as in the EU 42% of this sector is still not electrified. Biebuyck also discussed the first demonstration projects in the **maritime and aviation sectors**.

Green hydrogen produced from renewable electricity also has enormous potential for use as an **industrial process gas**, said Biebuyck.

He gave an example of a project being implemented at Voestalpine steel in Linz. This will be the site of one of the world's largest electrolysis plants for producing green hydrogen, constructed by the H2FUTURE project consortium. The green hydrogen will be fed into the internal gas network, allowing the testing of hydrogen use at various stages of **steel production**.

ES III: ADDRESSING ENERGY POVERTY

Chair of the panel: Andreea Strachinescu
Speakers: Lidija Živčić, Maria Jeliazkova, Panagiotis Ktenidis

SUMMARY

Energy poverty concerns **millions of Europeans**, but because there is no official **definition or measure**, addressing it can be difficult. In 2016 the Commission created the European Energy Poverty Observatory (EPOV) to **study energy poverty** and to convey **best practices** from member states. However, this is just a short-term solution (40 months). It is important to monitor policies and their impact on energy poverty. **Innovation and technology** can help to address energy poverty, but people need to be a part of the solution. That's why **cross-sectional dialogue** is crucial – the solutions have to be both **technical and social.**

PANEL DISCUSSION

Andreea Strachinescu, Head of the "New Energy Technologies, Innovation and Clean Coal" Unit at DG Energy, European Commission, opened the session by stressing that energy poverty is a **reality in the EU**. The Clean Energy for All Europeans legislative **package** deals with **energy poverty** in part. There is a link between energy poverty and energy efficiency. In 2016 the Commission created the **European Energy Poverty Observatory** (EPOV) to study energy poverty and to convey best practices from member states.

Lidija Živčić, Senior Fellow at the Focus Association for Sustainable Development in Ljubljana, introduced REACH, an energy poverty project in South-East Europe. She stated that one of the biggest challenges is the lack of a **governmental or legislative definition** of energy poverty. Where there is support, it often comes in the form of **subsidies for coal** or other polluting fuels. This issue is not just about **pollution**, but also about people's **health** (affected by breathing fumes).

Project REACH was about empowering energy poor households **to reduce their energy use and bills** and to highlight the fact that energy poverty is an issue requiring **tailor made structural solutions**. They attempted to motivate local actors into helping and trained 202 students and 42 teachers in vocational schools to be **energy advisors**. Through these energy advisors they distributed tailor made packages containing energy saving tools. The **average saving** was **70-80 euros** per household per year – quite a lot over the long term.

REACH also made **policy recommendations** for national governments and the EU on definitions, analyses, data collection and energy efficiency measures (for example, interest-free loans for the renovation or replacement of old appliances). They found that **cross sectional dialogue** is crucial – social actors say it's a technical, environmental and infrastructural problem, while those engaged in these fields say it is a social problem.

Maria Jeliazkova, Vice President of the European Anti-Poverty Network in Brussels, agreed that dialogue between all those involved is very important as is the need for a definition. EAPN hopes to link up **social and energy stakeholders.** In the EAPN

they think the problem is **how energy poverty is targeted** – the idea that **energy savings** are of primary importance. Energy saving behavior is for the better off; those living in extreme poverty need **different actions.** The EAPN believes the right to energy is a **basic right** and if we look at it from this point of view coming up with a definition should not be a problem. The definition will have to reflect the **link between income and prices**.

It is important to **monitor policies** and their impact on energy poverty. The SET plan actions are neutral; they could increase or decrease energy poverty. **Deliberate efforts to connect** with social stakeholders are key. We need to have a **precautionary principle** and **consult with committees**. We need participatory solutions and to ensure adequate incomes – **EU frameworks on minimal income and minimum wage**. An **integrated approach** (income, energy efficiency) has to be adopted in **national action plans**. We can take examples from the **Scandinavian countries** where energy poverty is at its lowest. **The EP Observatory is very important**, but it is a short-term project – it should be made into a strategic plan – we need long-term actors in the field.

Panagiotis Ktenidis, Senior Researcher, Piraeus University of Applied Science, spoke about how **innovation and technology** can help to address energy poverty. Building **wind turbines and solar collectors** on islands has given rural people **autonomy**. The people were **part of the solution**. In Greece energy poverty is a big problem. It is estimated that 30 percent of people living in the Athens area are energy poor. Giving them money is not of long-term benefit to them; it is a **complex cycle**. You have to go to their homes and **combine energy and social solutions.**

The participants discussed **smart metering** – this could be used to identify energy poor households. Ktenidis mentioned the UK, where people rejected smart metering – they have to be **engaged from the beginning**.

According to Živčić, **economy transformation** is needed because energy poverty is an undesired **side effect of the current system**

Jeliazkova suggested that **the use of EU funds for energy efficiency should be monitored**. Structural fund use complies with the financial rules, but there is insufficient monitoring of their impact.

It would be great to include **actions to eliminate energy poverty in the SET plan.**

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