ERASMUS energy FORUM 2017

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Erasmus Energy Forum 2017 report

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It is a conference for discussion between business, science and policymakers. In 2017 the sixth edition focused on accelerating the energy transition and the path to zero carbon energy. Science Day was on Wednesday 28 June, and Business Day on Thursday 29 June. www.erasmusenergyforum.com

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Accelerating the energy transition – paths to zero carbon energy

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An opening address from Pex Langenberg, deputy mayor for the City of Rotterdam and responsible for mobility, sustainability and culture, opened the 2017 Erasmus Energy Forum Business Day on 29 June. He described how progress in Rotterdam and the Port of Rotterdam fitted the theme of the Forum, *Accelerating the energy transition – paths to zero carbon energy*.

A hard habit to break

Alderman Langenberg said carbon emissions were a hard habit to break but his participation in the Paris Climate Agreement in 2015 and the Rotterdam Climate Initiative in 2016 inspired him to bring the energy transition to Rotterdam, where he dreams of clean transport and a clean port; an enormous challenge that requires changes to be made now, but the city is on the right track to the transition to renewable sources of energy, he said. Rotterdam has three ambitions for sustainability:

1) A clean, healthy and future-proof city with pedestrian-friendly streets and more parking for bikes, improved public transport, green roofs and more city parks.
2) Cleaner and cheaper energy, saving city households 40 per cent in energy costs – around € 600 per household per year; enough wind energy for a third of city households by 2025; to make use of the flat roofs of Rotterdam for solar panels; and to further experiment with floating solar panels in the port.

3) A strong and innovative economy that includes co-operations with waste chemical initiatives to make fossil fuels redundant.

Langenberg referred to American economist Jeremy Rifkin, co-founder of the 'roadmap' for the next economy. For the urban Rotterdam-Den Haag region this aims to attract millions of euros in investments and make the region ready for the future. Existing initiatives and partnerships for the region include the RUGGEDISED project, Erasmus Centre for Entrepreneurship, the Cambridge Innovation Centre, and RDM Rotterdam.

Making a sustainable future requires new ways of thinking, and connecting with people and authorities on a local and EU level, but also with corporates and the academic world. The key is to work together. "If you want a sustainable future for your city, you need the people to think along. Encourage them, and if people come up with an idea, you need to listen and help them out.

"Our journey is a step to clean energy and sustainability. We need to shape the future together."

Clean energy for all Europeans – unlocking Europe's growth potential

Dolf Gielen, Director IRENA Innovation and Technology Centre (IITC), International Renewable Energy Agency (IRENA).

The first energy transition from wind and horse-power to coal happened 250 years ago, and a transition to natural gas was 50 years ago. It's now time for another energy transition that's not opportunity-driven, but needs-driven by climate change, said **Dolf Gielen**. Internationally, the drivers vary. Gielen says in Europe it's about climate change and rapidly growing energy demand, but is also seen as a way to create economic opportunities. It first requires an enabling policy framework that includes energy efficiency and energy coalitions between governments – between China and Germany for example – although cities also play an important role. The USA has more commitment for this at state level than federal level.

Europe can't do it on its own

The proportion of renewable energy sources is growing faster in Europe than globally, so Europe will reach the global average before 2020 and will continue to grow faster than the rest of the world. But Gielen warned that Europe can't do it on its own. "It must be a global energy transition, so we must get others on board."

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Innovation plays an important role and has already resulted in spectacular cost reductions from offshore wind, electric vehicles (EVs) and solar power – which have also resulted in changes to markets and new business models. “The combination of ICT and energy transition is interesting with many developments,” he said.

But energy transition won’t happen overnight, and fossil fuels will continue to play an important role. The prevalent focus on transitioning from coal to natural gas is not enough to get a virtually decarbonised energy sector by 2050.

Hydrogen as a zero-emission fuel was in the news 10 years ago, but nothing more was heard of it until recently. “Now I’m getting questions about it again. Something has changed and it would be interesting to get views on how hydrogen plays a role in this transition.”

A need for clear signals

But there are many aspects of the energy transition that need clearer and more credible signals. He stressed the importance of a CO_2 price higher than five euros per tonne. Freight, aviation and shipping have not made such significant progress – they operate internationally so are subject to policies and international competitiveness. This is where a global sectoral approach and global processes are needed.

The downward trend in costs for photo voltaic (solar panels) makes it increasingly competitive, and reflects the increasing deployment of renewable sources of energy. An ‘uptick of progress’ can be seen in heat pumps, EVs, home storage batteries. “Plus, ICT and the energy sector are getting much closer – we’ll see a lot of talk about these today,” he commented.

The conclusion of talks with the International Energy Agency was that the energy transition is technically and economically feasible, “but you really need an energy transition and you need to speed it up. In our view, improving efficiency and using renewables are the bulk of the effort and the power sector needs to play a key role. And if you do it right, then renewables can become the dominant source of energy supply over the next half century or so, but it won’t happen by itself.”

So what about the role of consumers? According to Gielen, Germany has 1.7 million electricity producers; they include solar panels on roofs of dwellings. And he said the number of corporates sourcing renewable energy is growing.

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An audience member asked about nuclear energy options. Gielen answered that nuclear is a carbon-free energy source so in that sense it contributes and fits, but there's an issue with the economics because China and Russia are the main suppliers, but other nations are withdrawing from nuclear power. "Japan has a real problem with accepting the starting up existing plants.

"Nuclear power will probably contribute, but I'm not expecting a nuclear renaissance on a global scale."

Global outlook of renewable energy

Maria van der Hoeven, Senior Associate Fellow of the Clingendael International Energy Programme.

Politics and politicians have a role to play in the global outlook for renewable sources of energy, just as much as technologists, researchers or scientists, said **Maria van der Hoeven**, Senior Associate Fellow of the Clingendael International Energy Programme. After 20 years as a politician she has observed the changing energy markets, and the increasing need for energy. "The energy landscape is changing – but not as fast as some think – on three fronts; climate change, secure energy supply, and economic development," she said.

Mitigation of climate change depends on reducing energy use, and decarbonising energy. The demand for energy is expected to grow in developing countries, where the mix of technologies providing energy is undergoing change, broadly according to four interdependent trends:

1. Decentralisation and consumer empowerment
2. Digitisation
3. Greater integration and service orientation from industrial sectors, processes, new jobs and skills
4. Decarbonisation.

Sector distinctions may fade

Energy consumers will play a more important role, she said, but several important challenges remain, including creating stability in the grid.

New technologies will bring new solutions, but changes will not take place at the same pace in all countries. The distinctions between sectors of the energy industry may fade as changes take place, and with a new mix of incumbents and new arrivals. New renewables still play a quite small role in absolute terms, but the landscape is still dominated by fossil fuels.

In most economies, decarbonisation is accelerating, but in developing economies, renewables are expected to meet only a proportion of energy needs.

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Maria van der Hoeven's recommendations are:

1. Support innovation in market integration
2. Create stable and sustainable policy frameworks
3. Reduce the cost of financing and improve its risk profile

New realities

Seeing that solar and wind power are growing fast worldwide, and that increasing capacity leads to new realities in the scale of costs – and costs are coming down – means that solar and wind are now priced competitively against fossil fuel electricity in many countries. "So further sustained deployment of these energies will mean economies of scale and further cost reductions, she said, and referred to Bloomberg New Energy Finance's 2017 report.

Investors need a strong financial case – in addition to the environmental case – because many large-scale infrastructure projects are characterised by long lifetimes and a requirement for large finance deals, so changes to the structure of the industry are needed now. In order to capitalise on the wins and gains available, Maria van der Hoeven described what's needed in the future; a taxonomy (scheme of classification) of policy support and public funding, as well as changes in human behaviour, societal innovation and technological innovation. All of industry has a part to play, she said.

The intermittency of solar and wind power is an extra challenge, as is the current structure of electricity markets. How can increased flexibility – facilitated by digitalisation – be rewarded? A holistic approach is needed for generation and storage, for example from electric vehicles (EVs) connected to a smart grid that can be used to store electricity from renewable sources, or using clean molecules such as hydrogen. These are new business models and new rules and regulations in which digitalisation is paramount.

Consistent and stable policy

In conclusion, consistent and stable policy is crucial, said Marian van der Hoeven. The differences in established and emerging economies are huge and need to be balanced; innovation research is crucial for bringing costs down and discovering new technologies. And a meaningful price for CO_2 and further standards on efficiency and emissions are needed.

"The future is in our hands, you have to start work today. Taking the future seriously means there is no room for business as usual," she said.

Answering questions from the audience, Maria van der Hoeven said: "I didn't like it at all that biggest economy in the world stepped out of the Paris climate agreement but she also pointed out that the USA cannot withdraw immediately, and she hopes that the large amount of countervailing opinion in the USA would have an effect.

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Business model and market perspective on zero carbon energy

Wolf Ketter, Professor of Next Generation Information Systems, Scientific Director Erasmus Centre for Future Energy Business at RSM

People working for a future using sustainable energy should be fearless, despite recent fear-inducing headlines that manipulate feelings, said Wolf Ketter, Professor of Next Generation Information Systems and Scientific Director Erasmus Centre for Future Energy Business at RSM. But there's also a feeling of hope, of moving forward, he said, agreeing with the previous speaker, Maria van der Hoeven, of the disappointment of the US president's decision to withdraw from the Paris Climate Agreement, but pointing out that there were 'pockets' in the USA at a state level that still wanted to go ahead with the Agreement and push for the energy transition.

Dramatic change

Prof. Ketter gave a recap of the state of evolution of energy landscape; markets are complex, there are wicked problems to solve and data can help. The energy industry of the past was a well-managed vertical arrangement; energy companies at the top generated and distributed electricity to passive customers at the bottom. "That's going to change dramatically," he said. Complexity has been added to the landscape and it's now highly decentralised. Those people who used to be passive end customers are now prosumers who both produce and consume electricity.

Behind the scenes, there's an impetus for pushing the use of renewable sources of energy up to 100 per cent, "But I don't know when that will be," said Ketter. Academics working in the field are engaged in a tough debate over whether or not we can reach the energy transition by 2050. Prof. Ketter said even he is not sure of the date. "It could be possible to have 80 per cent renewables by 2050, or 100 per cent renewables by 2080. What's certain is that we need 100 per sent sustainable energy," he said.

A dance between supply and demand

Ketter described his research to model the effects on the market of more renewable energy, using animated slides to demonstrate price drops that can be expected from forward markets when renewables are added to the mix, and real-time or 'spot' markets that deal with commodities for immediate delivery. "Market volatility is a dance between weather-dependent supply and demand. But fossil fuels suppliers are reliable producing a constant energy output."

Wolf explained how prices might sometimes benefit the fossil fuel suppliers – 'but we are smarter than that' he said. "We need to add renewables in a sustainable manner so that markets don't crash," and described the transition as not 'a big bang effect' but an evolving piece which included elements such as storage, ramping-up and ramping-down supply, quickly adding energy to the market or removing it, incentivising customers, demand-side management, smart metering, market redesigns and designs for new markets.

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Connecting the pieces

It boils down to the value of flexibility, he said. Flexibility can be reached from different angles but interdisciplinary dialogue is essential – thus the existence of the Erasmus Energy Forum, bringing together politics, academia and business.

One idea to connect the pieces is the Power TAC competition, a market-modelling competition. The competition has been running for a few years but a recent new idea 'captured a big part of the market' explained the professor. A team from the University of Augsburg are 'the new kid on the block'. "That just goes to show that there's a lot of room for new innovations that can be tested in this environment," said Ketter.

Big steps, bright outlook

His mantra – and he acknowledges wishful thinking – is to get to 100 per cent renewable energy. "I believe that we must do that, no matter what some people in some countries say. With what we already have we can already make big steps to realising that vision."

Answering questions from the audience, the professor said the energy outlook is very bright with many innovations for storage, distribution and generation.

Policy as an enabler – panel discussion

Moderated by **Volker Beckers,** Chairman of the ECFEB Advisory Board, former Group CEO of RWE Npower

Participants

Dolf Gielen, Director of IRENA's Innovation and Technology Centre

Maria van der Hoeven, Senior Associate Fellow, Clingendael International Energy Programme

Eric van Heck, Professor of Information Management and Markets, RSM

Sharon Dijksma, Dutch Minister for the Environment, NL

Policymakers could be the enabling missing piece in Prof. Ketter's jigsaw, said Volker Beckers, noting that there are world leaders who neglect climate change. "Massive investments are needed across the globe. For the UK these costs are estimated to be the same – billions of pounds – as the 2012 Olympics in London. How can politicians be an enabler for these transitions?"

Sharon Dijksma, Dutch minister for the environment, said a report by McKinsey estimated € 200 billion will be needed for the transition in the Netherlands by 2060. "With political courage and goodwill we'll have that money available," she said. An example of that courage was the announcement, the previous day, by Dutch minister of economics affairs of a subsidy-free wind farm. "You can only do this with clear vision and

landmarks you can fill. We need politicians to take leadership and a clear agenda of what's been promised," she said.

Volker Beckers said investments in energy are for at least 10 years, "So we need long-term sustainable frameworks. What is the Netherlands doing differently to the other 27 EU member states?"

Dijksma said many politicians look only to the next election, while the Netherlands' energy agreement until 2023 is a perfect example of co-operation with governments and other partners, while it tries to lead at putting a price on carbon within Europe. It's failing at the moment with too many rights still in the system, but it's not easy because the Netherlands' friends have other political interests."

This isn't only about future generations, Dijksma said. There are droughts due to climate change in Bangladesh right now, but many politicians are not taking responsibility, and it takes courage to really make a difference. "It's not easy, you get a lot of opposition but there are many allies too."

The minister said the government needs to get back to business by investing heavily to deliver growth and job opportunities in the sector.

Prof. Eric van Heck said all stakeholders need good research and prototypes. He referred to RSM's 7,000 business students, all keen to work on issues such as sustainability, cradle-to-cradle and energy concepts with companies, to be influenced by new ideas and to learn from each other.

Technology alone won't cut it

Business needs to collaborate with academia, said Prof. Van Heck, to create solutions such as Uber's ride sharing and using waste heat from computer servers. "We also need new behaviour. Technology alone won't cut it."

Maria van der Hoeven: To proceed and implement all the innovation taking place in science and industry requires policy makers to create the right standards. Sometimes policies can hinder innovation. We need to make sure this doesn't happen."

"It's a mix of government intervention, getting prices up and changing behaviour sector-by-sector," said Dolf Gielen. "A CO_2 price for coal plants is effective, but for households it probably won't work. Market mechanisms might be combined with a CO_2 floor price. What's a reasonable floor price? It's hard to determine what this should be."

Minister Dijksma: "You need a stronger Emission Trading Scheme (EU ETS), and a Plan B – it could be a minimum price linked with Western European industries. We're putting our cards first and firmly to improve the current system. Because if we have a worldwide price for carbon, then we would have a

problem. In China, California and Canada they're all working towards a system like this. You need your own system."

Dijksma added long-term policies are needed, as well as short-term results, 'otherwise people get frustrated and don't have faith in the policy'.

Van der Hoeven talked more about the combined approach. "There's a competitive phase of co-operation. You need money to do that, which must come from governments and the public sector. You keep things in your hand, but then let it go and put money in another place. You start with one and grow into each other. You need industry and competition."

"I hope leaders will stick to the Paris agreement, in words and action," said Minister Dijksma. Van der Hoeven said she hoped governments would report on their progress towards the Paris agreement in two years' time.

WORKSHOPS & ROUND TABLE SESSIONS

At this point in the Energy Forum, members of the audience joined one of five simultaneous workshops, each led by an expert. Discussions followed an introduction to the subject and brief examples. A pattern emerged identifying a need for collaboration, but varying motivations to do so.
Read reports from the workshop sessions here.

Business vision on zero carbon energy

Felix Zhang – Group executive director, Envision Energy

"The future of the energy industry is zero carbon," said Felix Zhang, group executive director at Envision Energy, a smart energy management company. He said the existing energy industry is mostly based on fossil fuel, and the new energy system focuses on wind and solar, but it's still young – 'a teenager', he said. Innovation is required to address issues and challenges.

The 'levelised cost of electricity' (LCOE) is key for utility-scale power, said Zhang, and commented: "If we get rid of subsidies, then wind and solar are cheapest by far."

Zhang said two issues need to be addressed: the cost of energy, and the cost of synergy, and gave a recent example: when Australian power back-up systems didn't kick in, wind farms were blamed. "Now, the Australian government is

putting an auction on energy saving solutions. But how are we combining intermittent wind and solar generation in smart grids, e-vehicles and many other things to come?"

The zero carbon energy system exists but the cost of synergy is key. He said big data, robotics and communication – and the Internet of Things – are evolving very fast. What's needed is 'smooth trading action'.

Trading needs a connector

Zhang told the audience about Envision in Shanghai. "The massive transformation in trading of energy commodities needs a connector. We need a platform – he introduced Envision's new Energy Internet, and the importance of secure technology in a trading platform. "We need to focus on being an open, cloud-based system, and we need deep insights to deal with politician and policy makers."

Zhang said it's important to be at the forefront of ecosystems, innovations and start-ups – Envision produces wind turbines and solar panels as well as applications, and is a global investor. He gave the example of sonnenBatterie energy storage, which has developed a new business model to engage consumers. "Energy is no longer going to be a commodity, it will be free. It will be integrated in energy contracts," he commented.

"When you talk to financial investors and tell them the energy is free they freak out." The value is in the back end, in the transaction, but the product is free at the front end.

How can we accelerate the energy transition?

Jan Rotmans, Professor of Transitions and Transition Management, Erasmus University Rotterdam

Jan Rotmans, Professor of Transitions and Transition Management at Erasmus University Rotterdam has spent 25 years dealing with the energy transition and is still optimistic, he told the audience. "The transition is more than energy."

He said the energy transition is more than just using wind and solar power, it's about building an entirely different energy system. And "It will become free but we need to invest massively in the new system," he explained.

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The biggest barrier is between our ears

Taking the Netherlands as an example, the 'massive investment' is needed over the next couple of decades, as well as a change in behaviour, said the professor. "After 25 years of observing the energy transition, the biggest barrier is between our ears."

Differences between China, the USA, Germany and the Netherlands are not based on technology, but on vision, and on pressure from society. This takes decades to change, said Rotmans.

He described how the tipping point of the energy transition had been reached, from its origins in the 1970s with discussions in the global think tank the Club of Rome and its 1987 report called *Our Common Future* – also known as the Brundtland Report from the United Nations World Commission on Environment and Development; the UN's Rio Earth Summit in 1992, the Kyoto Protocol in 1997; and the Fukushima Accident in 2011, which had huge impact on attitudes to nuclear energy.

The transition is more than a battle of technology, it's a shift in thinking, he said. He predicted a disempowerment of the current regime followed by the development of new niches. He identified indicators such as the phasing out of coal-fired power plants worldwide; the decoupling of economic growth and $C0_2$ emissions, the drop in value of electricity companies; a decrease in oil price; and the fact that solar photovoltaic energy is now about 80 per cent cheaper than it was seven years ago. Grid parity has existed in many regions since 2013 – that's the point at which solar power and wind power can compete with power from fossil fuels.

No one person can stop this

"No one person can stop this transition anymore," said Rotmans. "The forces affecting the energy transition now are societal pressure, geopolitics, technology, climate, business and finance. The Paris Agreement in 2016 was a historical landmark, and if Trump wants to go back to coal – well, do you really think he can make money by going back to the past?" he asked the audience.

He called President Trump's decision 'annoying and significant' but "it is merely noise compared to what is happening globally. I say it again, no single man can stop this happening." Professor Rotmans explained that the countervailing response is happening all over the world because of Trump. "Others are going even faster – he has motivated them," he observed, and referred to the 'Divest' protest which originated in a demonstration by students at Swarthmore College who objected to their college's investment in fossil fuels. The protest has spread to colleges across the USA.

The major players in the transition are Russia, China and Europe and the competition will escalate, he said; complicating factors are the Ukraine crisis affecting the competition for gas between Russia and Europe; the competition between China and Europe – and between the USA and China – over solar panels; and competition between Germany and other European countries.

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There is no recipe for accelerating the energy transition, he said, but there are four key impulses: financial, judicial, institutional and mental.

There are still legal barriers

To decentralise and digitise the Netherlands' energy systems would need a massive investment over the next decade, to be paid by business, industry and the population. "So we have to pay a lot to get that 'almost free' energy," said Rotmans. Both hardware and software are important for preparing the population for the next economy, which he predicted would create 250,000 Dutch jobs in the long term. But that number excludes jobs lost from the old economy when coal and gas plants close. "There are also 20 legal barriers in to the energy transition in the Netherlands; for example you cannot re-use waste, as a result of a ruling from Brussels, he said. "But if you can't re-use waste, how can you stimulate a circular economy?"

Connecting the old and the new

We need more connectors to connect the old economy and the new, and to get central governments on board, giving a direction and providing space, facilitating and connecting people and cities.

Preparing young people and preparing a strategy for zero carbon, circularity and for becoming more bio-based is the vision for 2050, he said. Examples of enablers generating action on transition pathways already include truck platooning to increase the capacity of roads, 'waste2chemicals' to recover biochemicals from waste streams, geothermal energy, a CO_2 grid, and campuses with field laboratories.

There are already business cases about regional investment platforms, and city neighbourhoods are earmarked for 'smart' and energy neutral transformation. "This is among the greatest challenges we have seen in modern history. We have people, a knowledge network and institutions, but we hardly profit from it. We need to collaborate more, and with courage and leadership."

Responding to questions from the audience, the professor predicted a battle for resources because China produces 95 per cent of the rare earth metals that are scarce in Europe but are essential for the energy transition. Asked by a member of the audience if there is a role for energy tax, the professor replied that while CO_2 doesn't have 'a real price' there will be no progress. "It's absurd that it's so low. I already predicted 15 years ago that the EU's Emissions Trading Systems (ETS) would not work. We need to give CO_2 a price, and there's no other way other than to tax it," he said.

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Business in the lead – panel discussion

A panel discussion debated how business can take the lead in the energy transition and tried to identify the new business models and strategies for 100% renewable energy supplies.

Felix Zhang, Group Executive Director, Envision Energy

Ab van der Touw, CEO, Siemens, representing the Transition Coalition

Christopher McLachlan, Co-Founder, pear.ai and Innogy, an accelerator program for start-ups in Silicon Valley, USA

Wolf Ketter, Professor Next Generation Information Systems, Scientific Director ECFEB at RSM

The audience were asked for their opinions before the panel discussed the issues: what will the European energy mix look like in 2030? A majority of the audience thought it would feature mostly wind and sun energy. Asked when Europe would be using only sustainable energy, most members of the audience thought it would happen in around 2060.

Moderator Dorothy Grandia from RSM asked if this 43-year time frame is realistic; what's the timeline for the transition?

"People underestimate progress of technology," said Ab van der Touw, CEO of Siemens. "In 1972 the front cover of *Time* magazine predicted home computers. People also overestimate. The only realists are the engineers; you need a realistic approach."

Christopher McLachlan, co-founder of pear.ai, a Silicon Valley start-up and runner-up in the Erasmus Energy Awards 2017, said the finance industry should look at energy from a different perspective. "Until the 70s this was bold industry that was testing new things. In the 70s and 80s it was a super reliable investment industry. It now needs to get back into the equation." McLachlan said his start-up's slogan was 'let's make energy fun again'. "Coming from a utility start-up, and providing an app and transmitting energy data with moving animals, it puts a smile on people's faces. You just need to dare to do this."

Ab van der Touw: "I agree with Rotmans that it's not about energy in the first place. You need to take people along so they don't lose their jobs. We need social innovation and reorganisation of the labour force. You should reckon with that." He said you must present new perspectives in a way that people understand. "I welcome conferences like this one, they play a major part in that."

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Prof. Wolf Ketter said US President Donald Trump tries to infiltrate his fear and yet the renewable energy industry is providing many more jobs. It's RSM's duty as a business school to come up with new programmes for the future and to be optimistic about it. It's about hope instead of fear.

Moderator Dorothy Grandia suggested that inclusiveness might be a way 'to get the mojo going again'. The more conservative the business model, the less diversity in the mental framework, she said.

A majority of the audience (80 per cent) agreed that technology and social innovation are equally important for accelerating the energy transition. Ab van der Touw said there's a big division between the two sides of the Atlantic Ocean. "You need time to re-educate; social innovation is a prerequisite. There's no other way than taking your time with social innovation."

There's been a debate about developers in Silicon Valley, said McLachlan. "They will be laid off because computers are programming themselves," he said, and mentioned the idea of a basic income because humans will still excel in the creative part and working with people, which is what many start-ups focus on, so how can this be leveraged? This is not only an energy problem, it's in all industries."

Prof. Ketter supported the idea of a basic income. There are so many different developments and experiments in automation and artificial intelligence, he said. We really have to re-educate all that labour force.

The workforce is ageing in Europe and China, said Van der Touw. Zhang agreed: "A small percentage of people create a lot of value. Social innovation is far more important than technological innovation, no matter what country or society."

Asked if the energy transition is a burden or a beckoning perspective that will bring rewards, most of the audience agreed with the latter – that it's a beckoning perspective. Members of the panel continued to debate the question: "There's a vision but we need a common path," said van der Touw. "We might run into huge havoc if there's a breakthrough technology that's not wind. You need to experiment in many fields."

McLachlan: "We've been missing a dot on the horizon. People can't engage with these types of ideas. There's a lot of disruption, especially in Silicon Valley. It's easier for people to engage when you show dots on the horizon."

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The Stedin Erasmus Energy Awards

Towards the end of the afternoon, the Forum audience was invited to help pick the winner of the Stedin Erasmus Energy Award. Three shortlisted finalists were invited to make one of the shortest elevator pitches ever – just 60 seconds each to explain their innovative and sustainable energy concepts on stage. A jury of energy experts had already made their choice, and the combined results from the jury and the audience voting decided the winner.

Jury members were Rick Heerink, Change and Innovation Manager at Stedin, and Volker Beckers, Chairman of the ECFEB Advisory Board and former Group CEO of RWE Npower. The three finalists operate in different parts of the value chain and are complementary parts of the value chain, commented Rick Heerink.

- Rob den Exter of **Stored Energy** presented the company's approach for initiating and realising energy storage projects
- Francesco Maaza of **Solarus** presented third generation hybrid power collectors that produce heat and electricity for heating or cooling
- **Pear.ai** presented 'Sam', a virtual energy assistant for businesses to get to grips with their energy data and expenses without expensive software tools or consulting services.

After the audience vote, the winner of the Stedin Erasmus Energy Award was Solarus. Read more about the winner's and runners-ups' concepts here.

Keep the conversation going

Concluding the Erasmus Energy Forum, Professor Wolf Ketter said: "We need these fora continuously. I like to keep the conversation going – and I like the word conversation, because it is a conversation."

The conference concluded with a networking reception in the Energy Expo.
