PROGRAMME

13.00–14.15 **RECEPTION & VISIT TO 3 DEMO AREAS CONTAINING BREAKTHROUGH TECHNOLOGIES**

14.10–14.20 **OPENING – SETTING THE SCENE**

Chair: Dr. ir. Machteld de Kroon, Managing Director at TNO Buildings, Infrastructure & Maritime

Experienced in co-creation and mission driven collaborations in research

We need new technology at an affordable cost and it must be deployed worldwide to address our climate challenge. What do we know about the challenge itself? What kind of solutions could contribute the most? Which technological possibilities exist? How do we transform those solutions in industrial business and how will our industries look in the near future?

14.20–14.40 **(20 MIN) ENERGY PERSPECTIVE**

MSc Jasper van de Staaij, Associate Partner and Senior Solution Leader at McKinsey Energy Insights

Leads McKinsey's Global Energy Perspective team, which models energy demand across all sectors, fuels and countries until 2050

Energy systems around the world are going through rapid transitions that will bring important changes to the way we fuel our cars, heat our homes, and power our industries. These trends will have widespread implications for businesses, governments, and individuals in the coming decades. Based on their global energy demand models, McKinsey indicates that—with continued technological development, existing legislation, and financial optimization—we will see a ~20% reduction in human-induced greenhouse gases from energy by 2050. This is insufficient to reach the IPCC pathway of max 1.5 degrees of global warming by 2100. To get to a 1.5-degree scenario, far-reaching decarbonization or demand reduction is needed across all sectors.

14.40–15.00 **(20 MIN) WITHOUT A SINGLE SILVER BULLET, WE NEED A MASTER PLAN**

Professor Dr. André Faaij, Director of Science at ECN part of TNO, distinguished professor Energy System Analysis – RUG

The current plans are not enough to realise a climate-neutral industry, and the challenge to do so is immense. The solution lies in the combined deployment of many different mitigation options: new, inherently more efficient processes, renewable feedstocks, renewable energy carriers, CCS, increased circularity and new value chains. But to find optimal, smart and competitive transition pathways, we need an integral and long-term perspective. Promising perspectives on competitive industry can be envisioned that may even partly generate negative emissions. But what should an approach look like and what is needed in terms of research, technology development and cooperation?

15.00–15.20 **(20 MIN) CLIMATE PICTURE**

Professor Dr. Pieternel Levelt – KNMI and Delft University of Technology
Scientific lead of major international earth observation missions under which TROPOMI
Today's models and plans to lower greenhouse gases need to be aligned with measurements. We can calculate emissions from human activities in various ways. How do these methods compare? And how easy is it to disentangle emissions from human activities and natural sources? We must continuously monitor the emission of greenhouse gases worldwide. Today, KNMI uses TNO-developed satellite instruments, which allow for much more detailed views than ever before. But more is needed, more gases, more accuracy and more detail, preferably to the level of point sources. State-of-the-art plans are presented by KNMI and University of Technology Delft.

15.20–15.45 **(25 MIN) STORAGE CHALLENGE: TECHNOLOGY BREAKTHROUGHS FOR STORING ELECTRICITY**

Ir. Menno Kleingeld MBA, Managing Director at VDL Enabling Transport Solutions
Making Electric Public Transport a reality by roll out of Public Electric Bus Systems

Dr. Eric Meulenkamp, Program Director at TNO-Holst Centre
How to realise next-generation solid-state battery technology
Solar and wind energy are key renewable energy sources, but fluctuate. Large scale energy storage is becoming the critical factor for further growth. In the coming decade, the demand for battery storage will explode. VDL ETS demonstrates that a rapid switch to electrical mobility using batteries is possible and does lead to new business. However, the price/performance curve for batteries does not evolve as fast as Moore's law for Si circuits. Still, progress is being made and new battery technologies are emerging. The Holst Centre is developing new, better and intrinsically safe battery technologies. The challenge is to industrialise these technologies and to create the necessary high-tech manufacturing equipment to produce them. The market is there.

15.45–16.15 **(30 MIN) VISIT TO 3 DEMO SETUPS DURING THE BREAK**

– Earth observation for climate monitoring
– Energy storage (Electricity and Heat)
– CO_2 reduction for the chemical industry

16.15–16.40 **(25 MIN) STORAGE CHALLENGE: TECHNOLOGY BREAKTHROUGHS FOR STORING HEAT**

Henry van der Meer, Caldic Nederland b.v. Product / Accountmanager
The most promising thermal chemical material at this moment

Professor Dr. ir. Olaf Adan, TNO – TU/e
A heat battery: key to boost energy transition in the built environment
In moderate and cold climate zones, low caloric heat is a significant part of energy use. The large-scale use of electric heat pumps during cold periods introduces an extreme peak load in electricity consumption, which is even more demanding when wind and solar energy supplies are low or non-existent. A new heat storage solution based on salt hydrates delivers a breakthrough for domestic and community use, allowing for peak shaving in combination with heat pumps or district heating grids.
We will demonstrate what has recently been achieved, stressing the compact and loss-free features needed to bridge periods of days to periods of months. This will lead to a complete changeover from better known durable energy storage systems like EV batteries, water and hydrogen.

16.40–17.25 **(45 MIN) THE CHALLENGE FOR THE CHEMICAL INDUSTRY: THE FUTURE OF INDUSTRIAL PRODUCTION OF MATERIALS AND FUELS**

Ir. Robert Claasen, Executive Director Chemelot

Climate Neutral Chemistry, a necessity, challenge as well as chance!

Chemelot has the ambition to become CO_2 neutral in 2050. What does this imply for a transition in the next 10 years and the next 30 years? How can we replace fossil resources for feedstock and fuel with bio- or recycled polymers using pyrolysis and similar technologies (using gases) at short notice? What about switching to the electrically-heated cracker by 2040? At Chemelot, a long list of different options is being considered. We are looking to this challenge from the perspective of the 5 I's; innovation, infrastructure, instrumentation, involvement and international. We will explain clearly the 5 I's, the importance of cooperation and why these play an important role to achieve the goals as agreed in the climate agreement.

Ir. Martijn de Graaff, Program Director Voltachem, electrification of process industry

The opportunities and challenges of using renewable energy in industry

The materials and fuels that society needs are currently being produced from fossil energy and feedstock. Using renewable energy to power these conversions, centrally and locally, will provide a huge business and climate opportunity. Technically this is possible, but industrial mindsets will have to change. In this presentation we will sketch a roadmap for the current industry to change its energy source to renewable energy. Also we will show the technical possibilities of directly converting CO_2 to chemicals and fuels using this energy, which will open a whole range of possibilities for the industry and supplying equipment sector.

Professor Dr. Pascal Buskens, Principle Scientist Colloids & Interfaces

Directly using sunlight to produce methane and other important chemicals

Reducing CO_2 back to a simple hydrocarbon (C1) requires a lot of energy. One method is to deploy new electrolysers (electrons to C1). To enable the sunlight-fueled reaction of CO_2 and hydrogen to methane, we developed a new concept based on plasmon catalysis. This concept enables efficient harvesting of the entire solar spectrum, resulting in unprecedented high photon-to-methane efficiencies of up to 55%. Both electrochemical and photochemical processes are promising technologies to facilitate the transition towards a climate neutral chemical industry.

17.25–17.45 **(20 MIN) SHAPING THE FUTURE: THE NEXT BUSINESS WAVE**

Arnold Stokking, Managing Director TNO Unit Industry

Passionated about innovation, focussed on realisation through Industrial adoption

Technology is needed to accelerate, industrialise and deploy solutions for power generation, storage, transport, balancing and so on. Reduction of emissions need to turn into business opportunities of sustainable and circular products. This industry transition will create innovations, new products and systems for a decarbonised society. TNO is showing an insight for what these opportunities could look like during the conference. The industry sectors high-tech systems and materials & sustainable chemical technologies will be key enablers of the energy transition.
The modus operandi of this research is shifting to creating innovation and industrial ecosystems in which intensive interactions between all parties result in the faster ideation of new ideas/technologies into solutions, user feedback on prototypes and demonstration setups, industrial upgrading and commercially successful deployments. Private enterprises, TNO, universities and other RTO's, work together with support of the government on a portfolio of innovations.
Having concluded all of the above, we call for action, as only the mass industrialisation of new technologies will have an impact on climate change and generate the next economic wave.

17.45–18.00 **(10 MIN) CLOSING REMARKS**

Professor Dr. Emmo Meijer

Thought Leader for the Sustainable Transformation of Process Industry

"Circular economy is the mother of all transitions towards sustainability"