



**The 2023 Euro-CASE Annual Conference**  
**“Energy challenges in Europe. The role of Engineering**  
**in securing supplies and technologies”**

**Real Academia de Ingeniería, Madrid Spain, 25 September 2023**

**CONFERENCE HIGHLIGHTS**

**Opening session**

The opening session highlighted the importance of addressing energy challenges in Europe, especially European energy sovereignty, power systems for the security and reliability of clean energy, and the security of mineral supply.

The CEO of the Euro-CASE conference reiterated that the conference aims to address issues related to European competitiveness from the engineering perspective, as engineers are those who “get things done”.

**Keynote speeches**

The European Commissioner emphasized the critical importance of energy in Europe's strategic autonomy and also the need to transition away from fossil fuels toward clean technologies to achieve Europe's goal of becoming a climate-neutral continent by 2050 while doubling Europe's electricity generation capacity. The speech highlights the belief in Europe's technological capabilities to shape a more sustainable future and the need to turn this technological advantage into commercial leadership. The role of engineers as solution finders and technology and industrial policy makers is highlighted in achieving these ambitions. A keynote speaker mentioned that social acceptance is often forgotten in discussions about energy. Thus, the successful implementation of sustainable energy shall be performed at the same pace in all sectors of the economy.

**Introductory address from the European Commission**

Highlighting the first challenge related to energy and fossil fuels, i.e. that energy production is responsible for over two-thirds of greenhouse gas emissions, the need for a rapid and comprehensive shift to renewable energy sources was stressed, with its own set of challenges, including intermittency, decentralization, and the importance of digitalization and cybersecurity.

Other challenges are related to the scarcity of resources like minerals and water. Moreover, to ensure that technological innovations are accessible to all citizens and do not create societal divisions.

The concept of "circularity by design" and the importance of engineers and researchers in achieving progress in this area were discussed. Europe must lead the way in sustainable development through research and innovation.

**Key points from the sessions**

- Europe's existing energy landscape was outlined, stressing the dominance of fossil fuels alongside the use of nuclear energy and the slow rise in renewables. This context is pivotal for understanding the challenges in transitioning to cleaner energy sources.
- Challenges and Opportunities were discussed. Speakers highlighted both the opportunities, such as the growth in electricity demand and the shift towards renewables, and challenges, including ensuring system stability, supporting vulnerable customers, and managing uncertainty for investors.
- Strategies for integrating technologies like hydrogen production, smart EV charging, and grid storage were discussed extensively. The idea of inter-seasonal energy

storage with sustainable hydrogen production was brought up. The presentations emphasised the significance of a diversified energy mix and efficient integration across sectors to maximise renewable energy utilisation.

- The European Commissioner for Internal Market stressed Europe's energy autonomy, warning against energy dependencies and advocating for a shift to clean technologies for climate neutrality by 2050. Emphasising the need to double electricity capacity and generate clean hydrogen, the commissioner highlights the crucial role of engineering in achieving very ambitious goals at present and in the future.
- The concept of "net load" was introduced, depicting the residual electricity demand after deducting inputs from non-dispatchable sources such as wind and solar. Employing a techno-economic model, a speaker showcased the potential of various flexibility measures—like hydropower, batteries, hydrogen production, and electrified heat production—to diminish the net load to zero, guaranteeing a consistent power supply. It is emphasised that this model's efficacy hinges on the specific system characteristics.
- The European renewable energy landscape was discussed, emphasising its rapid growth, for example, reaching a renewable electricity mix of 74% in Spain in 2030 (50% in 2023). The actual plan states 74% for 2030 and the government is proposing 81%. A speaker emphasised the importance of real-time monitoring, controllability, and grid stability measures like CECRE forecasts to maintain reliability.
- Nuclear power's contributions to global and EU electricity production were pointed, stressing their attributes like high-capacity factors, low emissions, and grid stability. The potential of small modular reactors (SMRs) and microreactors was discussed in the context of future electricity mix. Challenges include cost competitiveness, public acceptance, and licensing for advanced reactors.
- Speakers engaged in discussion about European electricity balancing methods, addressing challenges without thermal generation and ensuring compliance with EU regulations. A conference member encouraged young engineers to engage in nuclear engineering, highlighting its interdisciplinary nature. The EU's classification of nuclear power plants as non-renewable was acknowledged.
- Energy transition implies an increasing demand for minerals and metals. It was stressed that it is necessary to avoid new dependencies. For instance, the challenge is now being addressed with new regulations at the European level. Besides monitoring and managing risks along the supply chain, producing domestic minerals in Europe is the best way to avoid dependencies from third countries and effectively contribute to European sovereignty.
- Without increased mining, the demand for battery input materials will not be met, so while recycling processes are important, developing resilient supply chains for lithium-ion batteries will be essential.
- Battery technologies that may replace lithium-ion batteries do not have the same supply chain risks as lithium-ion batteries. There is a need for a shift from traditional resource dynamics characterised by "take, make, dispose" towards a more sustainable approach of "produce, reuse and recycle", with avoidance of wastage wherever possible.
- Engineers will play a pivotal role in facilitating this shift. Their ethical and environmental responsibility is not a choice but a duty and should not just be limited to those working in the industry that are seen as more closely linked to the environment and the energy transition.
- New technologies to render aluminium and steel production more sustainable were discussed, as well as the need to do so on key materials production in the industry rapidly. Securing more financial support going towards new technologies is vital. This approach was prioritised in China, and it is imperative that European governments should adapt.
- Europe's journey toward sustainable electricity is pivotal for achieving independence and fulfilling climate objectives. This transformation demands cohesive EU regulations and innovative technologies like small modular nuclear reactors, a diversified energy

portfolio encompassing fossil fuels, and surplus electricity converted into hydrogen. This surplus hydrogen can be reconverted into power via turbines when necessary or harnessed as an industrial power source, marking a crucial step in the continent's energy evolution, addressed in the following section.

- The role of engineering in transforming the oil and gas sectors was discussed. Available solutions for the oil and gas industry to make their operations more sustainable include renewable electricity, low-carbon molecules, and carbon capture and storage (CCS). It was stated that the industry is well-equipped to integrate these solutions into its operations.
- It was shown that oil companies anticipate 25% of their energy production and sales to still be oil, LNG and natural gas by 2050. This reliance will need to be compensated by carbon capture and storage to address the associated emissions.
- Producing e-fuels and biofuels at large industrial scales will be challenging, with the production and logistics of e-fuels requiring substantial changes to existing assets.
- Europe will have to reduce the amount of resources consumed through increases in efficiency, reuse, and recycling. The complexity of replacing fossil fuels with alternative feedstocks such as waste, biomass, and alternative sources of CO<sub>2</sub> needs to be resolved.
- The potential for hydrogen was said (when produced from renewable electrolysis or through other low-carbon processes) to play a fundamental role as a feedstock for sustainable fuels in the future energy system, as long as generation of H<sub>2</sub> will be done at scale, which is still far away. Thus, engineering is paramount in addressing all these challenges, with a vital role in developing, scaling and delivering the right solutions that address barriers within the industry.
- The role of carbon dioxide capture, utilisation and storage (CCUS) in the oil and gas industry was also discussed. Europe's prioritisation of CCUS can help achieve its 2030 and 2050 climate targets. CCUS can be a key solution for hard-to-abate industries and oil and gas businesses, such as cement, steel, pulp and paper, and refineries, with permanent storage of CO<sub>2</sub> underground addressing emissions that cannot be removed through other approaches. This induces a need for substantial engineering challenges to be effectively addressed in CCUS.
- Engineering is pivotal in advancing sustainable practices like efficient metal recycling for lithium-ion batteries, mitigating dependencies on critical minerals driven by digitalisation's material demand, and fostering European mineral production for increased sovereignty and independence.
- The importance of multidisciplinary and multiscale approaches in energy was also highlighted to facilitate sustainability, with early integration of theory, simulations and experiments critical to decreasing costs, reducing risks and uncertainty, and providing a comprehensive evaluation of deployment trajectories and their impacts.

## Conclusions

**Antonio Colino Martínez**, President of the RAI.

The president highlighted the pivotal role of engineering in addressing the complex challenges of the ongoing energy transition. He emphasized that while technology and engineering have been instrumental in shaping the world, integrating culture, science, and research is essential for successful progress. He referred to the profound impact of historical industrial revolutions and acknowledged the ongoing fourth industrial revolution.

**Tuula Teeri**, President of Euro-CASE

Tuula reflected on the significance of engineers in addressing the challenges posed by energy security and the ongoing energy transition. She stressed that the decisions made now have far-reaching economic, societal, and political consequences, particularly in the context of climate change mitigation. While acknowledging the complexities and conflicts of interest that come with these solutions, Tuula emphasized the need for industry and society to embrace

change. She underscored the importance of conveying certainty and making effective, translatable communication a priority.

*Euro-CASE 2023 Annual Conference Minutes*

*Prepared by Luke Hatton & Jakub Zemek*

*Eloy Alvarez Pelegry, Fellow of RAI and Chair of the Programme Committee*

*Patrick Maestro, Secretary General of Euro-CASE*

*Nadia Pipunic, Euro-CASE*

# The 2023 Euro-CASE Annual Conference

## “Energy challenges in Europe. The role of Engineering in securing supplies and technologies”

### PROGRAMME

#### Opening session

Antonio Colino Martinez, President of the Royal Academy of Engineering of Spain.

Tuula Teeri, President of Euro-CASE

#### Keynote speeches

Thierry Breton (FR), European Commissioner for Internal Market

Loreto Ordóñez (ES), Chief Executive Officer, Engie Spain

#### Introductory address from the European Commission

Helene Chraye (FR), Deputy Director for RTD C “Clean Planet” and Head of Unit of C1 Clean energy transition

#### First session: Electricity mix and power systems for reliable supplies

Ignacio Perez Arriaga, Fellow RAI

Daniel Iracane (FR), NATF

Filip Johnsson (SE), Department of Energy and Environment, Energy Technology, Chalmers University of Technology, Göteborg

Dirk Uwe Sauer (DE), RWTH Aachen, E.ON Energy Research Centers

Tomás José Domínguez Aufran (ES), Director of Operation, Red Eléctrica de España

Francisco Suarez Ortiz (ES), Vice-Chair of the European Nuclear Society Young Generation Network (ENS-YNG), Tecnatom\*

#### Second session: Energy transition and Digitalization: the challenge of minerals for a strategic sovereignty

Eloy Alvarez Pelegrý, Fellow of the RAI and Professor Ad honorem at Superior Technical School of Mining and Energy in Madrid

Stephane Bourg (FR), BRGM, Director of the French Observatory of Mineral Resources (OFREMI)

Susanne Norgren (SE), Group Expert Materials Design, Department of Mechanical Engineering, Division of Production and Materials Engineering, Lund University

Egbert Lox (BE), Former Senior Vice President Government Affairs Umicore and Honorary Professor at Karlsruhe Institute of Technology

Robert Dominko (SI), National Institute of Chemistry and associate professor at University of Ljubljana

Migle Laukyte (LT), Member of the European Group on Ethics in Science and New Technologies (EGE)

Mark Jolly (UK), Professor and Director of Manufacturing Academic & Business Support, Cranfield University

#### Third session: The role of Engineering in the transformation of the oil and gas sectors

Luis Cabra Dueñas, EMD Energy Transition, Technology, Institutional Affairs, & Deputy CEO, Repsol

Nicolas Aimard (FR), SVP of TotalEnergies OneTech

Andrea Ramirez Ramirez (NL), Faculty of Technology, Policy and Management, Technical University of Delft

Joachim Meister (UK), Senior Vice President Global Power & New Energy, Worley

Francesca Zarrì (IT) ENI's CTO

Marie Bysveen (NO), Chief Market Developer at SINTEF Energy for CCUS and Smart Sustainable Cities

Vicente Cortés Galeano (ES), President INERCO

**Closing of the Conference**

Antonio Colino Martinez, President of the Royal Academy of Engineering of Spain.

Tuula Teeri, President of Euro-CASE

Miklos Bendzsel, President of the Hungarian Academy of Engineering, hosting the 2024 Annual Conference