“The role of green ammonia in a future carbon-free energy landscape.”

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When Fritz Haber and Carl Bosch developed the artificial nitrogen fixation process (the so-called Haber-Bosch process), they put ammonia in the centre of the first chemical global revolution, enabling the expansion of the population with its use as fertilisers. This seminar will focus on the technological challenges to enable a second ammonia revolution as a portable long-term (days to months) energy storage vector versus the short-term storage (seconds to hours) offered by electrochemical storage (i.e. batteries). Green ammonia offers unique opportunities due its high hydrogen content, known handling and existing transport infrastructure. As such, it can reshape the current energy landscape by directly replacing fossil fuels in transportation, heating, electricity, etc. In addition, new economic opportunities will arise as many countries will inevitably become net-energy importers/exporters with the outlook of a renewable energy market similar to the current one based on fossil fuels.

The future of a carbon-free society, and indeed the electrification of the chemical industry, relies on the use of intermittent and variable renewable energy supply (solar, wind, hydro) to power chemical processes such ammonia synthesis. Combining catalysis and material development with reactor, we present a novel integrated single-vessel green ammonia production process in an attempt to re-defined the conventional, high capital, steady-state Haber-Bosch process. In addition, our techno-economic analysis highlights the paramount importance of the flexible and fast ramping capabilities of the green ammonia synthesis as well as the need for tailored approaches and efficient strategies for dynamic operation.