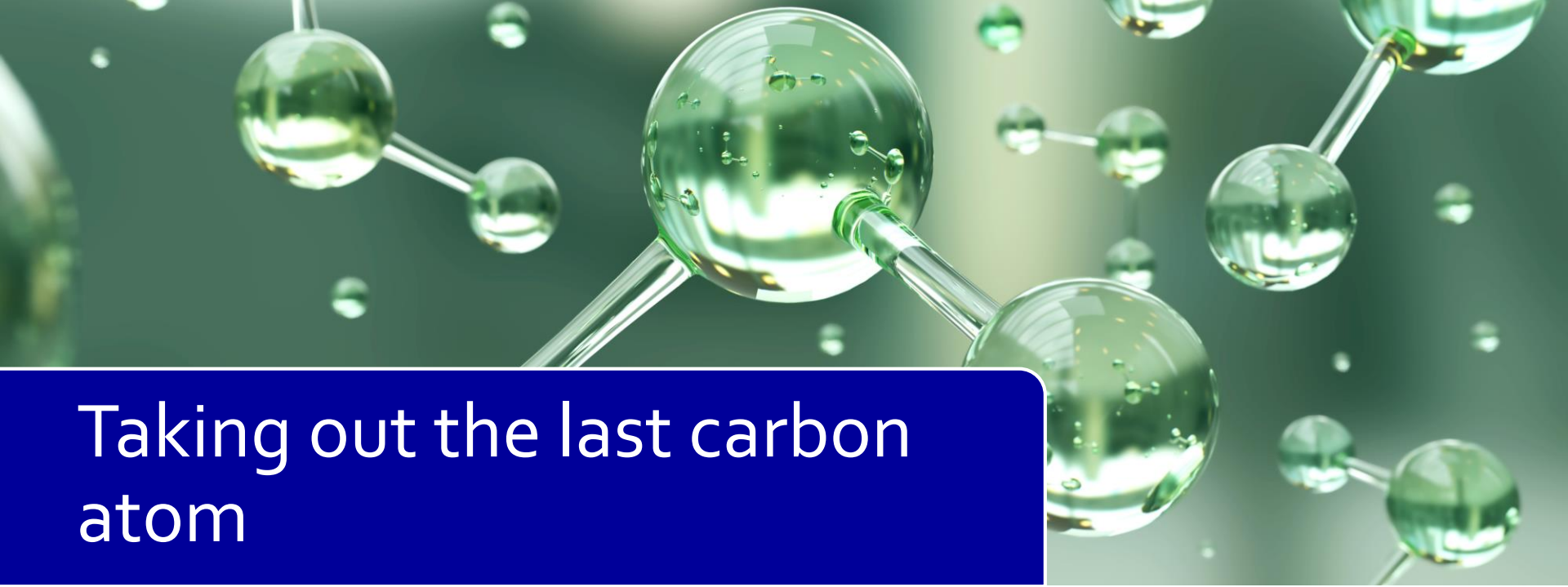

Taking out the last carbon atom

The energy mix and national and EU policies and measures

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The goals and challenges of (EU) energy policy

- EU's three main energy policy targets:
  - Decarbonised energy system
  - High degree of security of supply
  - Provision of competitive and affordable energy
- Challenge: achieve all three targets while maintaining a competitive internal energy market
- To this end: set of EU policy and measures introduced over the past decennia

Need for new policies and measures?

- Additional policies and measures and possibly a shift of focus needed
- Focus on an integrated energy system, not a set of separate markets
  - Need for a more holistic perspective on energy policy?
- Key challenges likely to shape the policy agenda of the future:
  - How can we stimulate investments in renewable electricity generation?
  - What energy mix provides the optimal balance between green energy electrons and decarbonized molecules?
  - How to secure the flexibility required to balance the power grid and provide the back-up capacity needed to guarantee affordability and security of supply?
  - Which new EU and national policies and measures are therefore required?

Statement I – holistic view of the energy system is needed

Traditional distinctions in policy making between steering and regulating stakeholders related to: power, energy molecules, heat, energy feedstock, energy for mobility, build environment and industry, etc. need to be replaced by **policy frameworks dealing with the energy and feedstock markets as a whole**. In other words, in the process towards a carbon-neutral energy system one will have to **optimize the overall energy mix of green power, various decarbonized molecules and green heat**, and recognize that **energy conversion, transport and storage** will become an integral part of finding the socially optimal energy mix.

Statement II – investment in RES needs continued support

Dwindling support and subsidy schemes, the "**profitability paradox**" and the need to invest in additional electricity network capacity could become obstacles for further deployment and investment in RES and the bankability of RES projects. **Continued support of RES** or a **change in electricity market design** (e.g. by introducing CRMs) **is needed** to ensure that NEW meets it renewable electricity production targets.

Statement III – A stronger focus on greening the molecules is needed

In contrast to electricity, the **greening of low-carbon molecules is lagging behind** and is still relatively costly due to costly feedstocks, often still immature technologies and a lack of economies of scale. Given that the share of green molecules in the final energy consumption in NEW is expected to be around 50% in 2050, a **focus on incentives for the production of low-carbon molecules** is key. Policy measures aiming to resolve the "**valley-of-death**" issue related to hydrogen (e.g. a dedicated EU support scheme for hydrogen), to harmonize and standardize policies and measures regarding biofuels, and to create a larger-scale market for low-carbon molecules (e.g. by prescribing '**admixing**' of low-carbon gases) are needed.

Statement IV – More pro-action is needed to ensure sufficient flexibility

Given the growth of RES generation, there is a **need for more flexibility** in the power system, which can be provided by supply or demand flexibility, or energy storage. Both **market incentives** (high price peaks and other financial incentives for DR of industrial and individual customers, aggregators) and **regulatory measures** (harmonized regulation and rules regarding DER, prosumers, aggregators; more responsibilities for households and industries regarding flexibility; clarity about regulatory and ownership roles regarding back-up systems, such as energy storage and PtG).

Conclusions I

- Energy policy design should focus on the energy system as a whole, such that the (social) costs of the energy system can be minimized
- The current set of EU and national policies and measures is promising, additional policies will be needed to reach the EU energy policy targets in 2050
- Greening molecules should increasingly become a focus point, due to the fact that molecules as energy carriers are here to stay and due to their possible role in providing flexibility to the EU power system
- Key technologies for green molecules are PtG and 'blue hydrogen' with CCUS – both on the whole still not market-ready

Conclusions II

- We consider these the most important policy measures to be introduced as a first step:
  - Setting **milestones** and ultimate targets, continue to make sure that intentions are solid
  - Strengthen the demand and supply side of decarbonized molecules by:
    - **Dedicated support scheme** on EU level to scale-up **hydrogen and PtG** production and deal with the 'valley-of-death' issue
    - **Admixing** of carbon neutral gases to stimulate their production and use and cross the molecules valley of death
    - Further facilitate the **uptake of hydrogen on the demand side** by:
      - Introducing policies and measures to rule out the industrial use of grey hydrogen or comparable feedstock
      - Incentivise the development of fuelling infrastructure for hydrogen and other green fuels
      - Tackle the greening of the aviation and shipping sectors