Coupling of Heating/Cooling and Electricity Sectors in a Renewable Energy-Driven Europe

(3) Sektorkopplung und Flexibilität

Alexander WIEDERMANN [(1)]
[(1)]ETIP SNET - European Technology and Innovation Platform Smart Networks for Energy Transition

Motivation

The "Fit-for-55" package [1] - further boosted by the REPowerEU-plan [2] - is the first important milestone to reach carbon neutrality by 2050. It sets out concrete measures to reduce net greenhouse gas emissions by at least 55% by 2030, increase energy efficiency by 13% and lift the uptake of renewable energy to 45%. Many efforts are still needed to decarbonise the heating and cooling sector, it is lacking behind the electricity sector (2020: 23,1% vs. 37,5%, source Eurostat). This comprehensive and interconnected set of proposals include several aspects related to the activities of the European Technology and Innovation Platform Smart Networks for Energy Transition (ETIP SNET) and Renewable Heating and Cooling (ETIP RHC). They have recently published a joint White Paper on this topic [3] whose main messages shall be presented in this contribution.

Technologies and storage as a requirement for system integration

An overview of different sector coupling technologies is given: Renewable energy conversion technologies (solar-based combined generation, direct conversion of solar energy into heat, geothermal-based generation, biomass technologies, and hydrogen-based technologies), renewable heat and heat recovery technologies (direct conversion of renewable electricity into heat, heat pump technologies, solar thermal technologies, innovative waste heat recovery cycles), Polygeneration (Cogeneration, Trigeneration) and District heating.
The important role of storage technologies (e.g. thermal energy storage, chemical storage, i.e. hydrogen or synthetic fuels as the basis for decarbonised CHP and Cogeneration application) as sector coupling components and their integration in a sustainable and reliable energy system is described.Combining energy systems through sector coupling, including Power-to-Heat and Power-to-X solutions, offers enormous storage potential and contributes directly to the decarbonisation of the economy. They claim only the electricity surplus and, consequently, can be considered a storage solution from the point of view of power grids. *LINK* holistic solution perceives storage as one of the architecture's main components and allows for the practical employment of sector coupling, Figure 1, thus increasing grid flexibility.

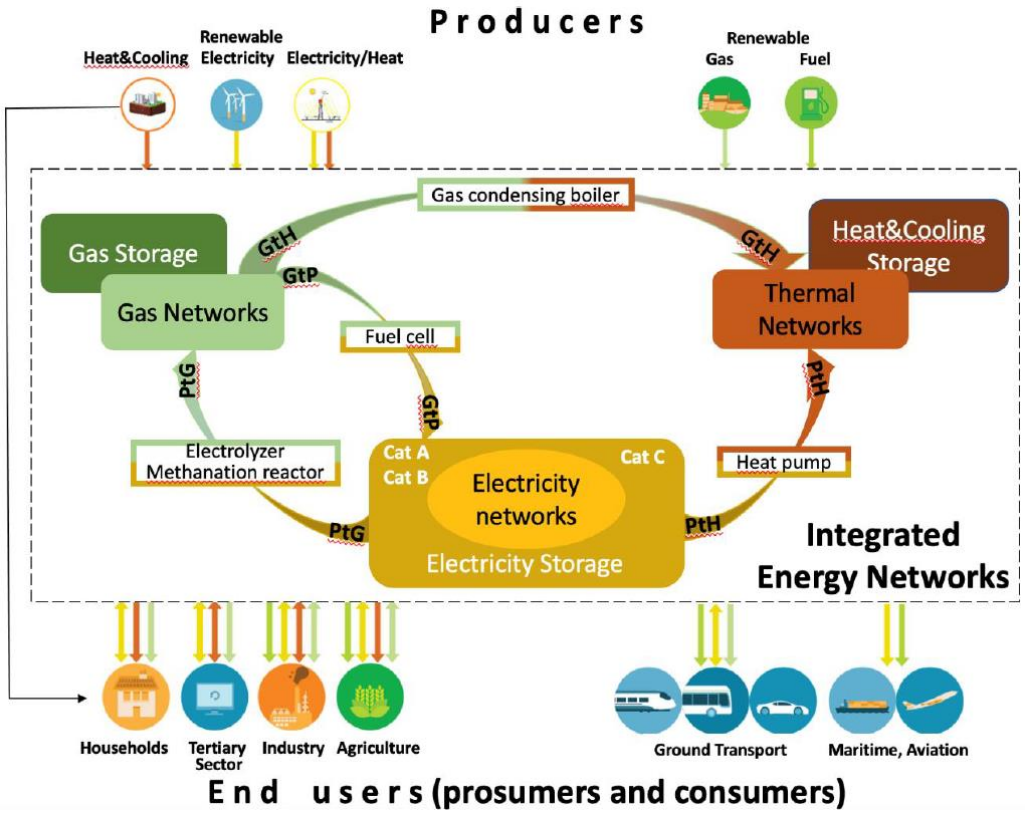

Figure 1 The integrated energy systems through sector coupling, as given by the holistic LINK-Solution

Conclusions and outlook

As the transition towards a green future must be accelerated, new concepts should be already available and verified, at least at the prototype level. Available technologies need to be quickly up-scaled from pilot to real plant sizes, and investments have to be stimulated by regulations and incentives based on, e.g., CO_2-pricing worldwide emission trading systems.

Both the successful implementation of sector coupling (cross-vector sector coupling and the end-use sector coupling) and a fully integrated energy system in a holistic power system architecture comprising all interactions within the power system itself, between the network - generation - and storage operators, consumers and prosumers, through market mechanisms, are mandatory for a successful energy transition and decarbonised supply of heat and cold.

To make clean and integrated technologies the standard, the market framework and the political mindset must change to make renewables-based technologies economically more competitive. Furthermore, solutions should benefit from streamlined permissions and be given financial and institutional incentives while removing administrative burdens. The potential for intensified use of District Heating and Cooling (DHC) systems is meaningful across the EU.

The energy transition towards renewable heating and cooling requires both technical, legal and economic skills. While the economic and legal framework is currently being shaped, a lack of design, planning and installation skills emerges. Hence a thorough assessment and EU-wide coordination effort is recommended to ensure the education and training of a sufficient number of designers, planners and installers by making the "renewable energy" career path attractive and providing enough education and (re-)training facilities.

Literature

[1] Europes-fit-for-55-package,
[2] REPowerEU: affordable, secure and sustainable energy for Europe
[3] Coupling of Heating/Cooling and Electricity Sectors in a Renewable Energy-Driven Europe, Joint White Paper by ETIP SNET and ETIP RHC, November 2022 (ISBN 978-92-76-59663-9;doi: 10.2833/284458)