

On the role of storage integration in smart energy systems

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Abstract—Larger shares of renewable energy sources (RES) are considered as a precondition for heading towards sustainable electricity systems. In recent years electricity generation from variable sources like wind and solar has risen. To balance electricity supply over time calls for storages has been launched. Storage has played an important role for balancing generation and demand at least to some extent since the beginning of electricity systems with pumped hydro storage. This balancing has to be done over short – e.g. hours, days – and longer periods e.g. months and year.

The core objective of this paper is to investigate the future market prospects of long-term – as hydro pump storages, and power-to-gas (PtG) technologies like hydrogen (H₂) and methane (CH₄) – and short-term battery storage from an economic point-of-view. In this context it is very important to analyze especially the long-term Learning effects regarding the investment costs of all relevant technologies.

The major results and conclusions are: (i) Despite many calls for a prophylactic construction of new storage capacities with respect to all centralized long-term storage technologies the future perspectives will be much less promising than currently indicated in several papers and discussions; (ii) new long term hydro storages will not become economically attractive in general in the next decades; however, daily storages will remain the cheapest option and the most likely to be competitive; (iii) batteries has the advantage that they do not compete with the low price spreads in the wholesale markets but with the considerably higher retail prices for electricity (between 20 and 30 cent/kWh in Western Europe); (iv) For PtG-technologies it will also become very hard to compete in the electricity markets despite a high technological learning potential. Yet, for hydrogen and methane there are prospects for use in the transport sector. Fuel prices in transport in recent years have rather increased compared to stagnation or decreases in electricity spot markets. Consequently, and given in addition the lack of environmentally benign fuels for mobility hydrogen and methane from renewable electricity might become an economically alternative for fueling passenger cars. However, in any case new storages should be constructed only in a coordinated way and if there is a clear sign for new excess production, in this case of RES.

Keywords – Economics, Storage, Fullloadhours, hydrogen, batteries

References related to the talk:

- [1] Ajanovic A., Haas R. (2018). Economic prospects and policy framework for hydrogen as fuel in the transport sector. *Energy Policy* 123 (2018) 280–288. <https://doi.org/10.1016/j.enpol.2018.08.063>
- [2] Ajanovic A., Haas R. (2018). Electric vehicles: solution or new problem?. *Environ Dev Sustain* (2018). <https://doi.org/10.1007/s10668-018-0190-3>
- [3] Ajanovic A., Haas R. (2018). On the long-term prospects of power-to-gas technologies. *WIREs Energy Environ.* 2018;e318. <https://doi.org/10.1002/wene.318>
- [4] A. Ajanovic, R. Haas: „Prospects for clean and renewable fuels in transport in Europe “International Conference on Energy, Environment and Economics (ICEEE2018) , 14-16 August 2018, Edinburgh Conference Centre, Heriot-Watt University, Riccarton, Edinburgh, Web: <https://www.weentech.co.uk/third-iceee2018/>
- [5] A. Ajanovic, R. Haas: „Energy and mobility: Hydrogen as fuel for mobility and storage for renewable energy “, Biennial International Workshop Advances in Energy Studies 2017, BIWAES 2017, Naples (Italy), 25-28 September 2017
- [6] Auer Hans, Reinhard Haas: On integrating large shares of variable renewables into the electricity system, *Energy*, 1-10, 2016.
- [7] Haas Reinhard, Lettner Georg, Auer Hans, Duic Neven: The looming revolution: how photovoltaics will change electricity markets in Europe fundamentally, *Energy* 57, 2013, 38-53.
- [8] Haas Reinhard, Ajanovic Amela, *Wirtschaftliche und energetische Aspekte von Langzeitspeichern*, e&i, 2013

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