**ASSESSING THE VALUE OF DEMAND RESPONSE IN A DECARBONIZED ENERGY SYSTEM**

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**Motivation.** The European Green Deal announced the overarching aim of making Europe climate neutral until 2050. Regarding this ambitious emission reduction target, the power sector plays a crucial role, as the sector is responsible for around 25% of the GHG emissions in Europe. Additionally, the electrification of demand side sectors increases the importance of decarbonization measures for the electricity sector. For a sustainable transition, very high shares of renewable energy sources (RES) have to be integrated into the energy system. However, the intermittent nature of weather-dependent RES leads to an increasingly fluctuating electricity supply and induces a higher demand for power system flexibility, on both supply and demand side. Particularly, demand response (DR) is one promising option to increase load flexibility, since the increasing amount of stakeholder actively participating in energy supply and demand on regional level (e.g. distributed small-scale technologies) are also included.

**Methods.** This research presents extensive insights on the value of applying DR in a system perspective against the background of two strongly contrasting decarbonization pathways for a decentralized and centralized European energy system with a 100% renewable share and sector coupling. The pathways are characterized by structural differences concerning the combination of installed renewable capacities, the acceptance for activated DR potentials and different electricity, heat and hydrogen demands. The objective is to determine the potential role of DR and its impact on the optimal combinations of flexibility options in a decentralized vs. centralized scenario framework model-endogenously. Therefore, openly available data and hourly time series of country-specific DR potentials are implemented into a large-scale linear optimization model. Sensitivities concerning varying shares of DR availability are used to identify main influencing factors on selected components of the electricity system such as the capacity and generation mix, storage requirements, renewable integration and their market value factors, CO2 emissions and total system costs.

**Results.** Model results show a higher reduction of total system costs and CO2 emissions per activated DR unit in the PV dominated decentralized scenario (‑55 MEUR/GWDR, ‑0.045 MtCO2/GWDR), compared to the wind dominated centralized scenario (‑39 MEUR/GWDR, ‑0.037 MtCO2/GWDR). The outcomes conclude that the daily PV feed-in characteristics have a higher correlation with the time pattern of load shifting and shedding DR appliances than wind feed-in characteristics.

**CV.** Steffi Misconelis a PhD Researcher and Research Associate at the Chair of Energy Economics at the Technische Universität (TU) Dresden. Recently, she was one of the coordinators of the REFLEX project funded by the EU’s Horizon 2020 research and innovation programme. The project results are summarized in the open-access book “The Future European Energy System - Renewable Energy, Flexibility Options and Technological Progress”. She is currently working on the project “Model Experiments on Development Pathways for New Electricity Applications and their Impacts on Critical Electricity Supply Situations” (Modex-EnSAVes), which is part of the Energy Research Program of the German Federal Government. Her research focuses on energy system modeling and analysis of possible decarbonization pathways for the European electricity system, in particular flexibility options and sector coupling, and the system integration of renewable energy sources.