

<https://doi.org/10.7250/CONNECT.2023.004>

COST-OPTIMAL SECTOR INTEGRATION AND ENERGY BALANCING STRATEGIES FOR REACHING CARBON NEUTRALITY

Ieva PAKERE^{1*}, Rīvars FREIMANIS², Signe ALENA-OZOLINA³, Pauls ASARIS⁴

¹⁻⁴ *Institute of Energy Systems and Environment, Riga Technical University, Āzenes iela 12/1, Riga, LV-1048, Latvia*

* **Corresponding author.** E-mail address: Ieva.Pakere@rtu.lv

Abstract – Sectoral integration will play a major role in the clean energy transition to increase the utilisation rates of available renewable energy sources (RES). Preliminary studies have shown that the decarbonisation of power generation can be reached through well-developed technical solutions such as the integration of hydro, wind, and solar energy. However, emissions in the buildings, transport, and industrial sectors remain stubbornly high. Therefore, the electrification of these sectors and interconnection through smart grids have been identified as promising future development trends to avoid the usage of fossil fuels. The TIMES optimisation model is used to evaluate the future cost-effective pathways for reaching carbon neutrality in the Latvian energy sector. The model includes both the end-use sectors such as transport, buildings, industry and agriculture and the energy sector with a well-developed database of existing and future RES and storage technologies. The modelling framework allows for identifying the cost-optimal future energy mix by considering the electrification potential of each sector. Therefore, it allows analysing of the impact of different policy strategies at sectoral integration levels and the necessity for additional energy storage capacities. The preliminary results show that one of regret-free solutions for reaching the energy efficiency targets in 2030 is the wide expanse of heat pump utilisation in residential buildings instead of inefficient biomass boilers. The building heat supply transformation also brings higher power consumption and interacts with the wider utilisation of wind power. In addition, sensitivity analyses have been performed to evaluate the impact of high uncertainties related to fuel costs, resource availability and other conditions.

Keywords – *Carbon neutral energy generation; energy storage; sectoral integration; renewable energy sources*