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FROM WIND TO POWER: UNLOCKING LATVIA'S RENEWABLE ENERGY POTENTIAL FOR CLIMATE NEUTRALITY

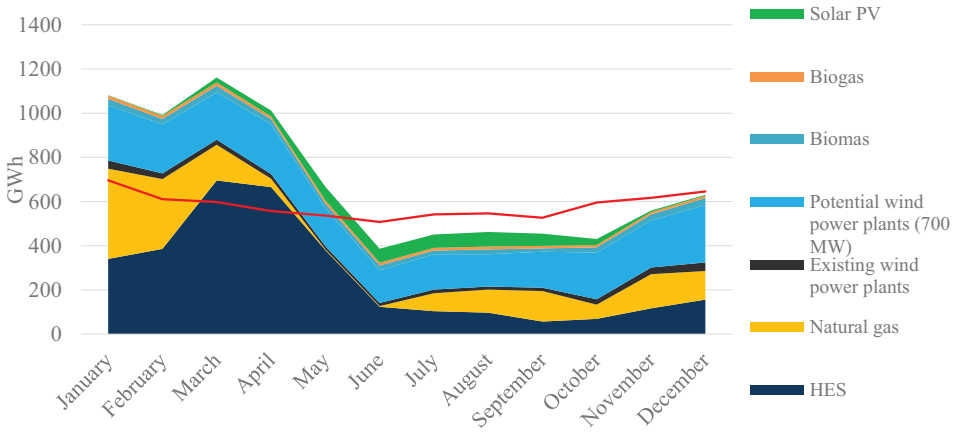
Evelina BEHMANE[1*], Liga ROZENTALE[2], Dagnija BLUMBERGA[3]

[1–3] *Institute of Energy Systems and Environment, Riga Technical University, Azenes iela 12/1, LV-1048 Riga, Latvia*

[*] ***Corresponding author.*** *Email address: evelina.behmane@edu.rtu.lv*

Abstract – The European Union has set an ambitious goal to achieve climate neutrality by 2050. To meet this target, it is essential to significantly increase renewable energy production. However, electricity generation from renewable energy sources is intermittent, meaning energy can only be produced when the respective resources (e.g., sun, wind, favorable hydrological conditions) are available. This often does not align with the electricity consumption demand curve and to meet the demand, electricity must be generated from fossil energy sources. In Latvia, according to 2024 data, the largest share of electricity is generated by hydropower plants (53 %), followed by thermal generation (29 %), with natural gas accounting for most of this share. Meanwhile, only 4 % of total electricity production comes from wind energy, which is a low figure considering Latvia's geographical conditions and wind energy potential. However, several large-scale wind power projects with a combined capacity of 700 MW are currently in the planning stages. The implementation of all planned projects could make a significant contribution to achieving the EU's climate goals. In the energy sector, meteorological data plays a crucial role in calculating and forecasting the availability of renewable energy resources and energy production potential. To assess electricity generation from planned wind farms, calculations were carried out to determine the potential wind energy available. To estimate wind speed at a height of 185 meters, available wind speed data from ground measurement stations were adjusted using the logarithmic function most frequently employed in literature. The calculations provided an estimate of the potential electricity generation from wind farms, with results visually represented by calendar months. The findings indicate that the total electricity output from wind farms could increase by 2383 GWh/year, allowing decreased use of natural gas during spring and consequently reducing GHG emissions. The data shows that during winter and spring months, the available electricity exceeds the electricity demand. Consequently, it is essential to find solutions to balance electricity consumption and production loads, ensuring the efficient use of valuable renewable electricity. Such solutions include energy storage, for example, battery energy storage systems or converting electricity into other energy carriers, such as hydrogen. Results can further be used to identify the most suitable methods for electricity storage.

Keywords – Climate; demand; electricity; intermittent; renewable energy; storage; wind



Electricity produced and consumed in Latvia by source (GWh), 2024.

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