

# Potentials of Variable Renewable Energy Sources and “Low-Hanging Fruits” Electrification in Europe

Energiepolitik

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## Motivation and core question

A prerequisite for decarbonization through electrification is emission free electricity. Especially the transition towards an “all-electric society” has been challenged, as it is questionable whether supply side expansion potentials for variable renewable energy sources (vRES) are sufficient to cover a strong surge in electricity demand [1]. In Germany, the topic of electrification and the associated challenges are mainly discussed on a national scale [2]. This poster therefore aims at providing a comprehensive overview of vRES potentials across 15 EU member states. Furthermore, these potentials are compared to a surge in electricity demand as it could occur in a “low-hanging fruit electrification” scenario.

## Methodology

The implemented methodology is split into a supply and a demand side component. On the supply side the vRES potential calculated with spatial analyses including land and sea use, regulations and height of the terrain or seabed. For the assessment of the wind onshore and solar potential restrictive factors such as agricultural land competition is considered. The offshore potential represents the entire technical potential. On the demand side the “low-hanging fruit electrification” scenario was developed based on nation energy application balances for the 15 countries under consideration. While energy application balances exist for each energy end-use sector in Germany (e.g. [3]), the other analyzed countries solely publish aggregated energy consumption data. In a first step a variety of statistical data were therefore merged, in order to derive national sectoral energy application balances. In a next step, the theoretical electrification potential for all countries was calculated based on an analysis of the fossil energy application shares [4]. Across all sectors, applications were identified which can be considered „low-hanging fruits“ with respect to the technical possibility of substituting fossil final energy consumption by electrical appliances. For these applications a fossil reference technology and electrical alternative were defined and the additional electrical energy demand was calculated.

## Results and conclusion

**Figure 1** shows the resulting values for vRES potentials in the 15 analyzed countries including Germany. In total 17.5 TW and 45 PWh of vRES potential across all 15 countries exists. This potential represents an upper theoretical limit and is significantly higher than the installed vRES capacities in scenarios with extreme RES expansion. Besides economic reasons, one of many factors which leads to a significant gap between installed capacities and vRES potential is sustainable land use.

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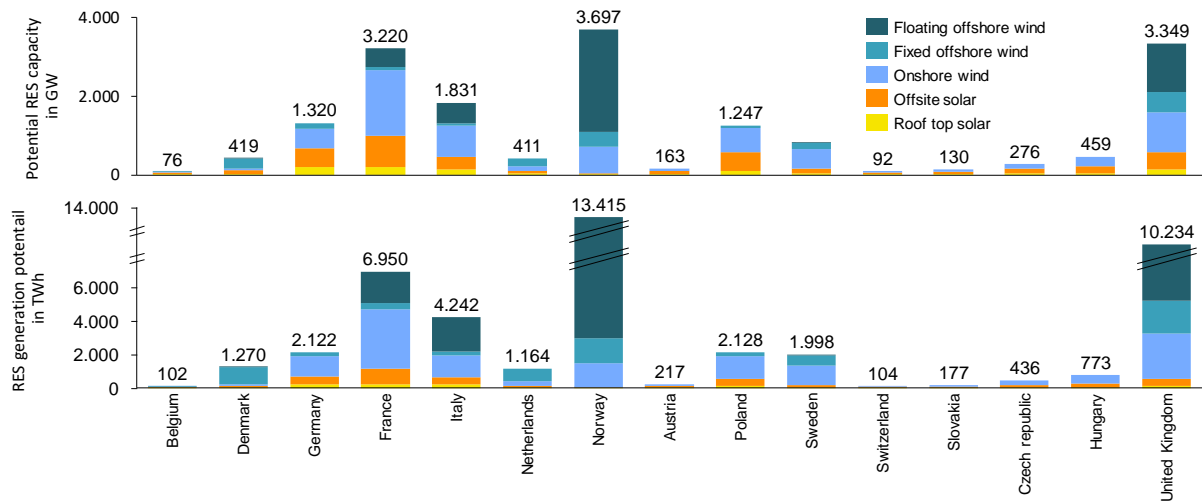


Figure 1: vRES potentials in the analyzed countries

Figure 2 shows selected results for the low-hanging fruits electrification case in comparison to the identified RES potential and the current electricity production for France, Italy, Norway and Slovakia. The figure shows that for all four countries the RES potential (second bar from the left) significantly outweighs the additional electricity demand evolving from extensive demand-side electrification measures. However, comparing the current electricity production from vRES to additionally required RES production in case of electrification, highlights the challenge that energy systems face if decarbonization through electrification is implemented. From a system perspective this challenge is magnified if several European countries follow a similar strategy. The figure shows that the challenge is two-fold as both demand and supply side need to undergo a fundamental transition for decarbonization through electrification to work.

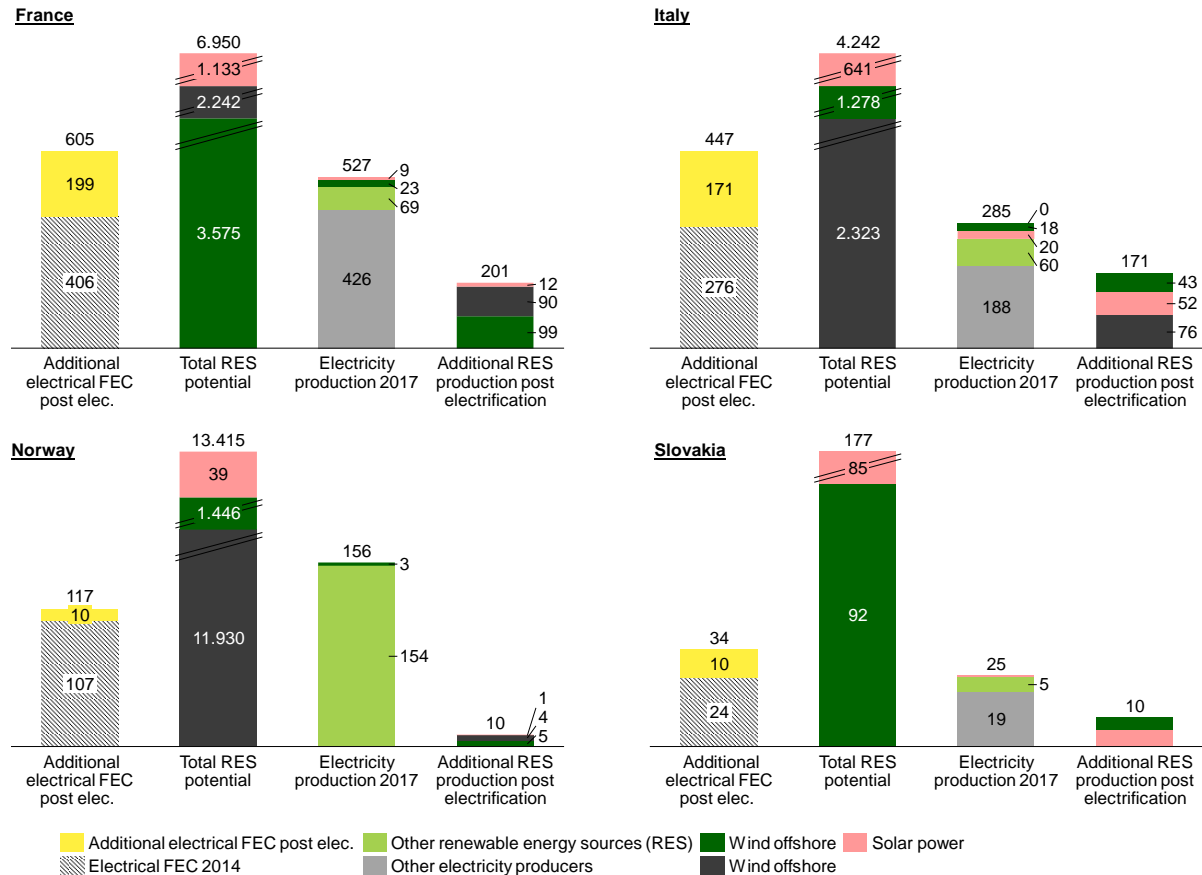


Figure 2: Comparison of low-hanging fruits electrification scenario, current electricity consumption and vRES potentials for France, Italy, Norway and Slovakia

## Literatur

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