

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

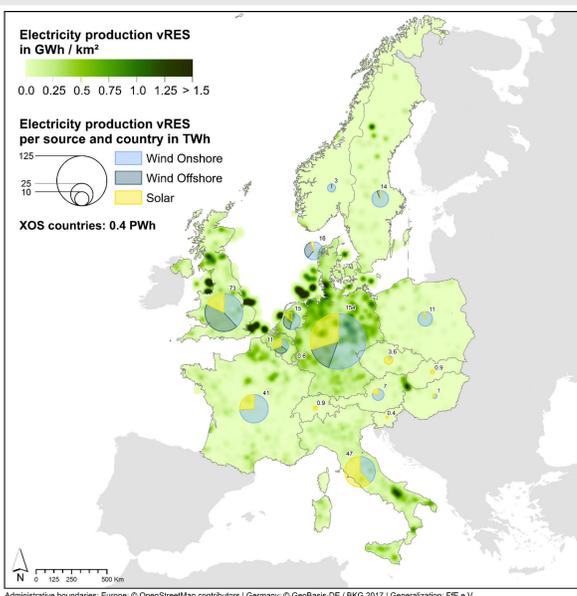
Motivation

- The topic of **decarbonization through electrification** should be viewed in a **European context**. A scenario in which only Germany is electrified can lead to false conclusions
- A common **argument against** wide-spread **electrification** is that the **potential** for renewable energy sources is **insufficient** to cover the additional electricity demand
- Variable renewable energy (vRE)** potentials are therefore **compared to** the electrical energy consumption in case of a **“low-hanging fruits” electrification scenario**
- Analyzed vRE sources are **onshore and offshore wind** and **offsite and onsite solar power**. Electrification is assumed for passenger road transport, heating and hot water and process heat

Key messages

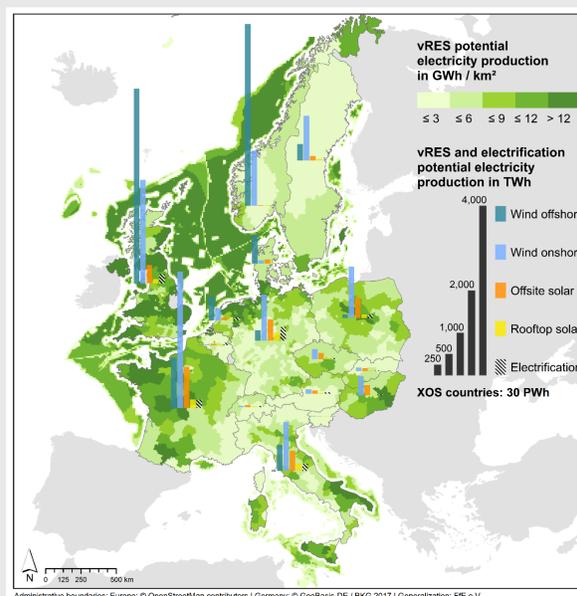
- The **theoretical potentials** for variable renewable energy sources in Europe are **significantly higher** than the total electrical energy demand in case of a **“low-hanging fruits” electrification scenario**
- Comparing today’s** production from variable renewable energy sources to the total electricity demand after electrification highlights the challenge with respect to the **transformation speed**
- Load centers and areas with high potentials** for variable renewable electricity production **rarely correlate**, indicating further challenges for the transmission system
- All countries** face a **two-fold challenge** as decarbonization requires a significant transformation of the supply and demand-side

Status quo (2018): Regionalized electricity production from variable renewable energy sources



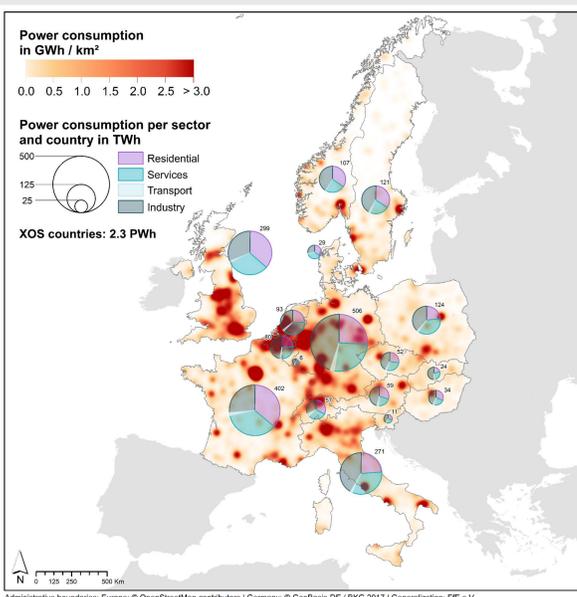
- The diagram shows the regionalized electricity production from variable renewable energy sources (vRES) for Germany and its electrical neighbors
- Total production** from vRES in the analyzed countries amounts to **400 TWh**
- Countries with the **highest electricity production** from variable renewable energy sources are: **Germany, United Kingdom, Italy and France**
- Supply centers** are mainly located in the north sea

Potential for variable renewable energy sources and “low-hanging fruits” electrification scenario



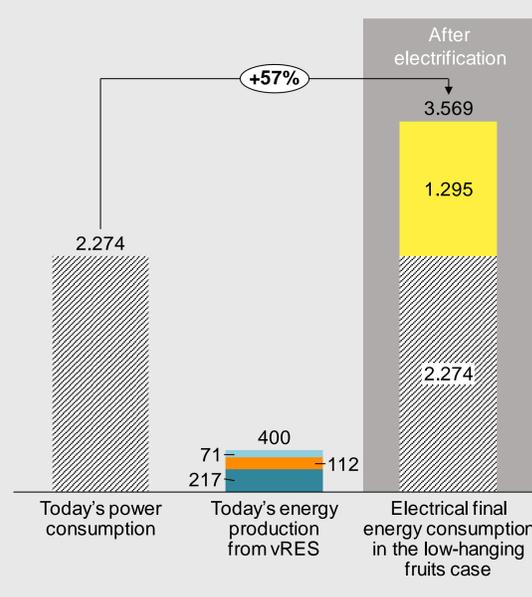
- The diagram shows the regionalized potential for electricity production from variable renewable energy sources (vRES) and the additional electrical final energy consumption in a “low-hanging fruits” electrification scenario for Germany and its electrical neighbors
- Total (theoretical) potential for electricity production** from vRES amounts to **30 PWh**
- Total post-electrification electricity consumption** across all end-use sectors is **3569 TWh**

Status quo (2014): Regionalized electrical final energy consumption



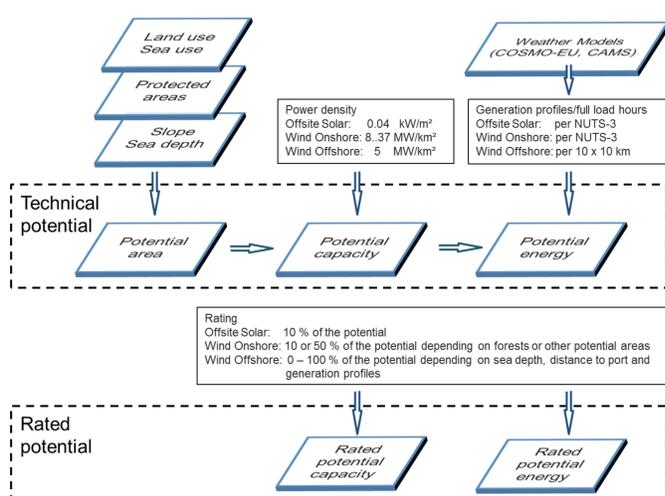
- The diagram shows the regionalized electrical final energy consumption for Germany and its electrical neighbors
- Total electricity consumption** across all end-use sectors in the analyzed countries is **2300 TWh**
- Countries with the **highest electricity consumption** are: **Germany, France, United Kingdom, and Italy**
- Load centers** are focused on areas with a high population density and/or industrial production

The resulting challenge: Comparison of today’s electricity production from variable renewable energy sources to electricity demand



- The diagram compares today’s production from variable renewable energy sources to the current and post-electrification electricity consumption for Germany and its electrical neighbors
- Covering the additional electricity demand requires a **three-fold** increase of vRES production compared to today
- Considering the costs and elapsed time involved in reaching today’s production level of vRES, highlights the **magnitude** of the future challenge

Methodology – variable RES



Methodology – electrification

