ACHIEVING 100% RENEWABLE ELECTRICITY IN AUSTRIA – ANALYSING THE EAG-GOALS

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Motivation

Austria's electrical energy system faces new challenges through its expansion of renewable energies. The Renewable Energy Expansion Act (Erneuerbaren Ausbau Gesetz; EAG) stipulates that from the year 2030, electricity consumption is to be covered 100% nationally on balance from renewable energy sources [1]**.** To achieve this goal, the EAG prescribes an increase in electricity production from biomass by 1 TWh, hydropower by 5 TWh, wind by 10 TWh, and photovoltaics by 11 TWh to meet the expected demand of 82 TWh in 2030 purely from renewable energy sources. This addition of renewables is transforming our electricity system with currently a few large and on-demand power plants to one with many small generators with volatile generation. Despite the massive change, system stability must continue to be ensured in the future.

This paper is dedicated to the analysis of the Austrian electricity system in 2030 by replicating the electricity sector in the open source "Low-carbon Expansion Generation Optimization" (LEGO) model available on GitHub[2].How will the planned expansion affect the system? A further analysis is made comparing the expansion targets set in the EAG with results of a cost-minimizing expansion of renewables to achieve the goal of 100% renewable electricity generation (national balance) in 2030.

Methodology

The LEGO model is an optimization model for cost minimization - depending on the selection of modules to be treated. It provides a wide range of results. The model is flexible in two ways: (i) in terms of time and (ii) in terms of thematic modelling blocks that can be combined with each other. The existing model is described in more detail in [2].

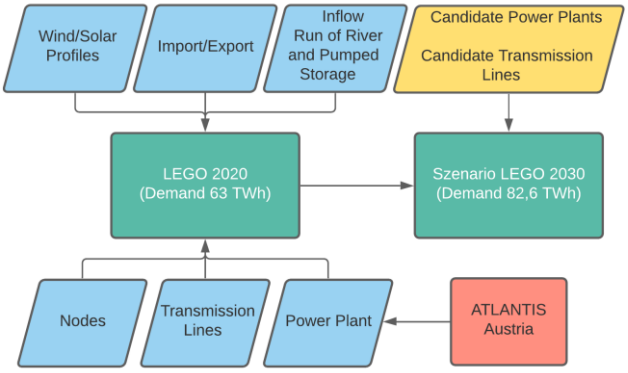

Figure 1: Description of the scenario analysis

For the implementation of the Austrian electricity system, the data from the ATLANTIS model [3] are converted into a format compatible with LEGO. This involves a total of 911 lines, 184 transformers, 2 phase shifting transformers, 1 304 power plants and 468 nodes. For each node, there are solar and wind profiles over an entire year that reflect the hourly generation coefficient. These profiles were provided by Renewables Ninja [4]. Water inflows for each pumped storage, reservoir, and run-of-river power plant were calculated using data from APG [5] and E-Control [6] and incorporated into the model. As a further step, candidate power plants are included in the model. For this purpose, the wind and solar

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[2] https://github.com/wogrin/LEGO

potentials are integrated from existing studies. In Austria, the renewable power supply is expected to increase by 27 TWh by 2030. Of this, 11 TWh will be generated from photovoltaics and 10 TWh from wind power [7].

Preliminary and expected Results

The first result is the validation of Austria for the year 2020. For this purpose, the results are compared with existing reports from Statistics Austria for the year 2020, evaluated and partially adjusted [8].

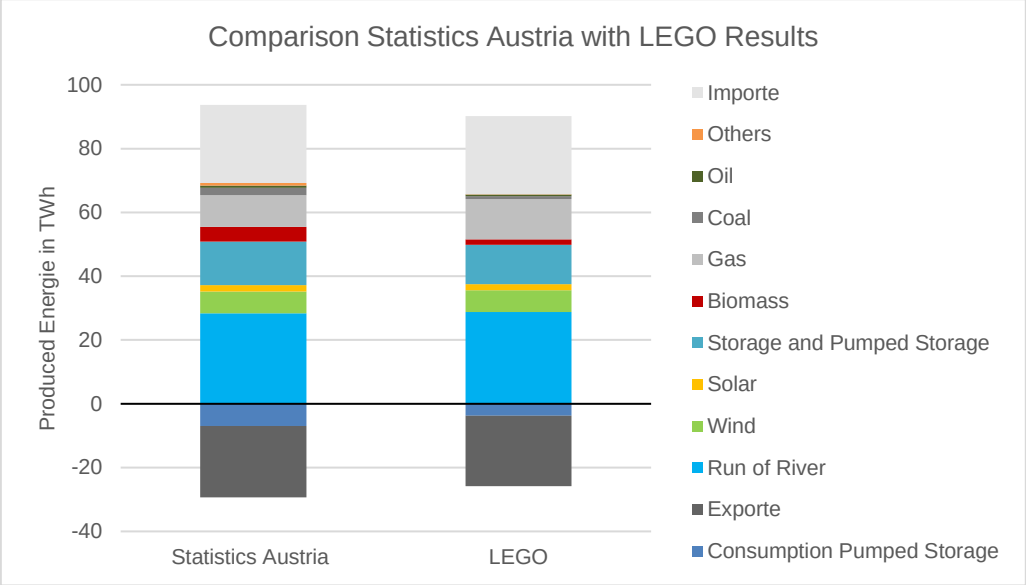

Figure 2: Comparison for produced electricity between Statistics Austria and LEGO for 2020

The year 2030 is simulated with candidate power plants and candidate lines. The consumption is increased to 82.6 TWh. A comparison will be made between a scenario that follows the EAG expansion plans for each power plant type and second cost-effective scenario realizing the 100% renewable electricity goal. The results of this work will also be relevant for the project START2030.

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