TECHNISCHE UNIVERSITÄT WIEN

Modelling activities related to the Austrian 100% RES electricity target for 2030

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15th Regional Exchange of Modelling Experts involved in the Development of Integrated National Energy and Climate Plans (NECP) in the WB6 | 18th May 2022

Austrian electricity targets & TUW modelling works

2016
RES share* **72.6%**

* in gross el. demand

07/2017
Stromzukunft 2030
„Electricity future Austria“

1st detailed study for a 100% RES-E system in Austria

05/2018
#mission 2030

100% RES-E (annual national balance) by 2030

01/2019
Mission#Impact

Resulting investment and support needs for 100% RES-E

12/2019
Austrian NECP

09/2020 – 02/2023
SECURES

Securing Austria's Electricity Supply in times of Climate Change

07/2021
Renewable Energy Expansion Act (EAG)

100% RES-E by 2030: timeline, budget, support scheme

02/2022
Flexibility options and needs in the electricity system 2020/2030

for E-Control (energy regulation authority)

01/2022
Amendment Renewable Energy Expansion Act due to EU legislation

„Electricity Future Austria 2030”

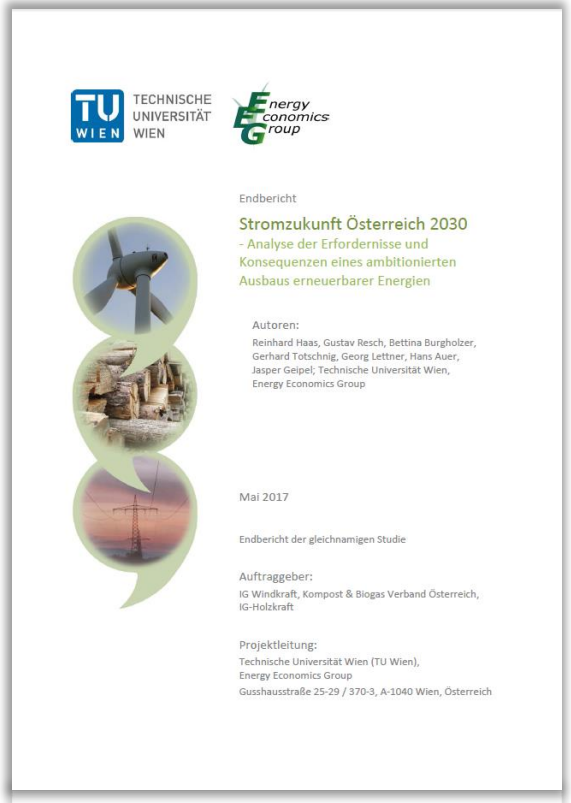
Assessment of prerequisites and impacts of an ambitious renewable electricity uptake in Austria

Focus

- How can the transformation towards a renewable-based electricity supply in Austria take place from a **techno-economic perspective**?
- **Detailed analysis** (high temporal and spatial **resolution**)
- Energy **policy framework conditions** and **support instruments** to reach the target

platform towards 2030

Stromzukunft 2030



Haas et al. (2017)
A study performed by TU Wien (Energy Economics Group) on behalf of Austrian Wind Energy Association, Kompost & Biogas Verband Österreich, IG-Holzkraft

Modelling background „Electricity future 2030“

The interplay of three models

1) Power System Model (Dispatch) HiREPs

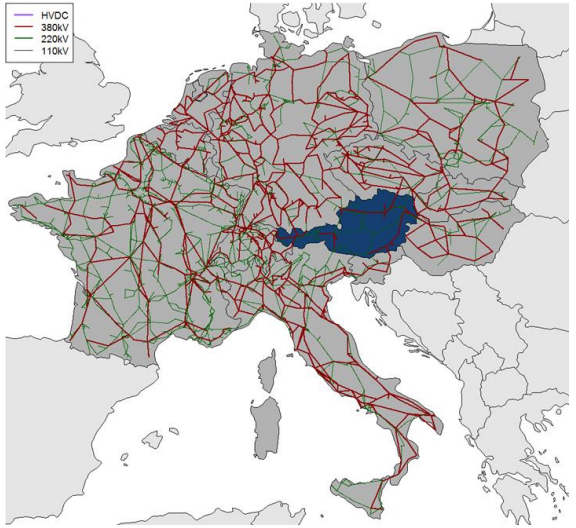
Modelling of the interplay between supply & demand in the electricity and district heating sector (incl. sector coupling)

- High temporal resolution (hourly)

2) Power System Model EDisOn

A closer look at supply security – i.e. the stability of the transmission grid

- Detailed modelling of the European transmission grid (with focus on Austria)



3) (Sectoral) Energy System Model Green-X

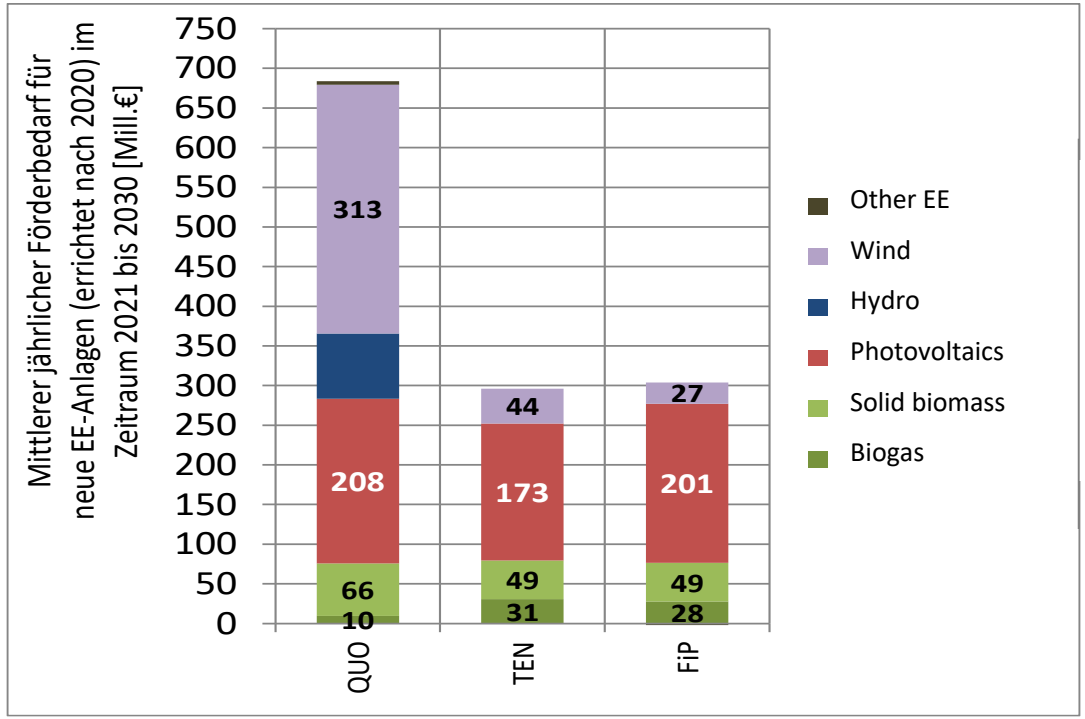
Policy analysis: Market incentives and support expenditures

- Assessment of costs and benefits of support instruments

Comparison of support schemes: Assessed instruments

RES-Scenario: 3 Policy concepts

- **QUO: Technology-neutral quota („Least-Cost“)** – Support via Green Certificates
  → highly **inefficient**
- **TEN: Auctions** – sliding feed-in premium system, competitive price determination
  → Advantages of auctions are **offset by disadvantages** due to the **limitations of the domestic market**
- **FiP: („Classical“) Feed-in premium** – sliding feed-in premium system, administrative price setting
  → Comparable to auctions



Average (2021-2030) annual support need for new RES-E plants (built after 2020)
Source: Green-X Modell
Remark: All cost are expressed in €$_{2010}$ (real)

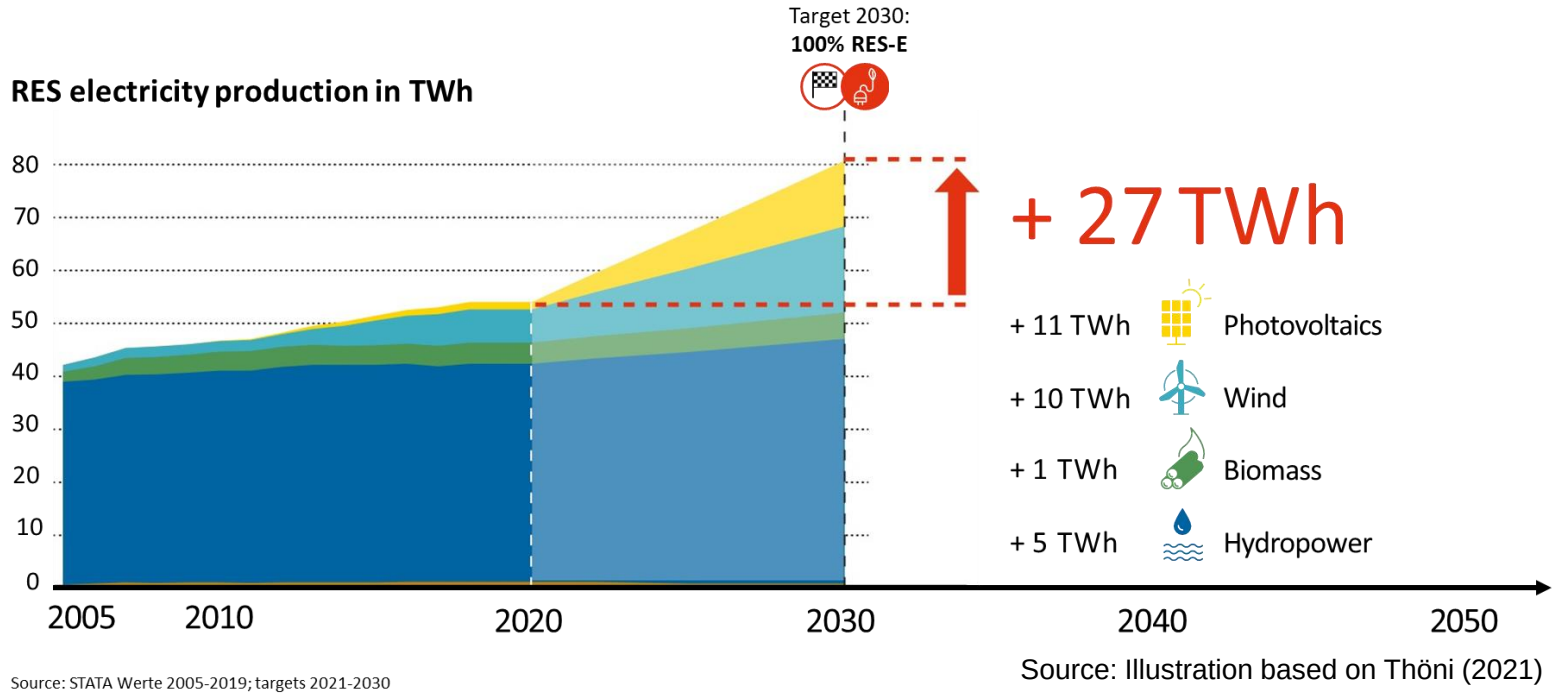
→ EAG: Austria introduced a FiP system (mix of auctions and administrative price setting) coming into action in 2022

RES investments and support for achieving the #mission2030 target – the required RES uptake (1)

Mission#Impact (2019) by TU Wien:

- Focus on **investment & support expenditures**

- **Electricity demand trends:** Development of electricity demand is a central parameter for RES ambition
- Assumption: **positive economic development, increasing sector coupling**, and increasing energy efficiency
- The **required net increase** in electricity generation from **wind, PV and hydro** is consequently ca. **30 TWh by 2030** (compared to 2016).



Source: STATA Werte 2005-2019; targets 2021-2030

Source: Illustration based on Thöni (2021)

→ EAG (2021): Increase in annual electricity generation from renewable sources by 27 TWh by 2030 (compared to 2020)

Resch et al. (2019)
A study performed by TU Wien (Energy Economics Group), commissioned by Oesterreichs Energie.

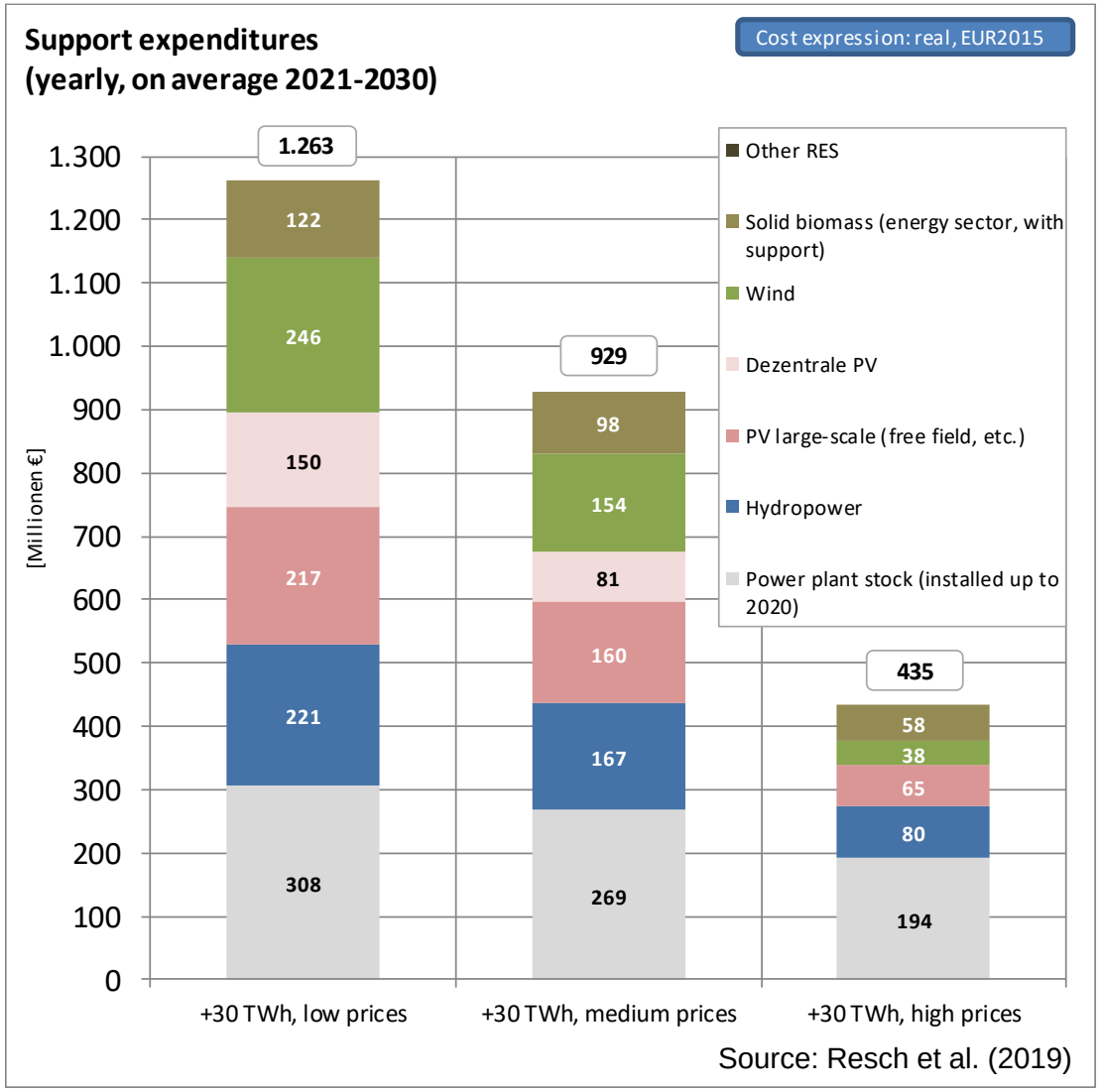
RES investments and support for achieving the #mission2030 target – Investments and support (2)

- Key parameter in a sliding premium system: **Wholesale electricity price trends**

  (net) **support** =
  technology costs –
  market value of the injected electricity into the grid

- **Support expenditures** range from € 0.4 to 1.3 billion per year

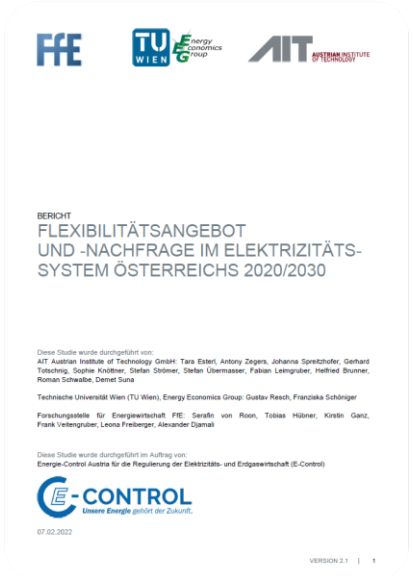
→ EAG (2021): 1 billion € per annum until 2030



Source: Resch et al. (2019)

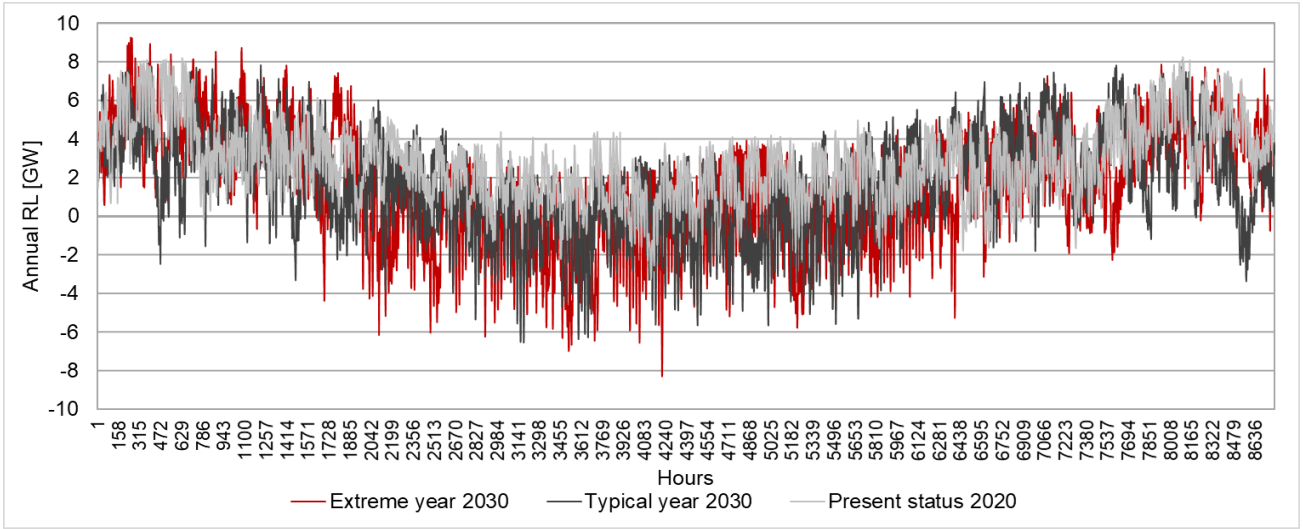
Flexibility options and needs in the electricity system 2030

- **Fluctuations** of high shares of hydro, wind, and solar electricity
- Rising focus: Modelling of related **flexibility needs and options** in high RES share energy systems



Study for the Austrian regulator E-Control
Esterl et al. (2022): *Flexibilitätsangebot und -nachfrage im Elektrizitätssystem Österreichs 2020/2030.*

Residual load (RL) = load – non-dispatchable electricity (hydro, solar, wind)

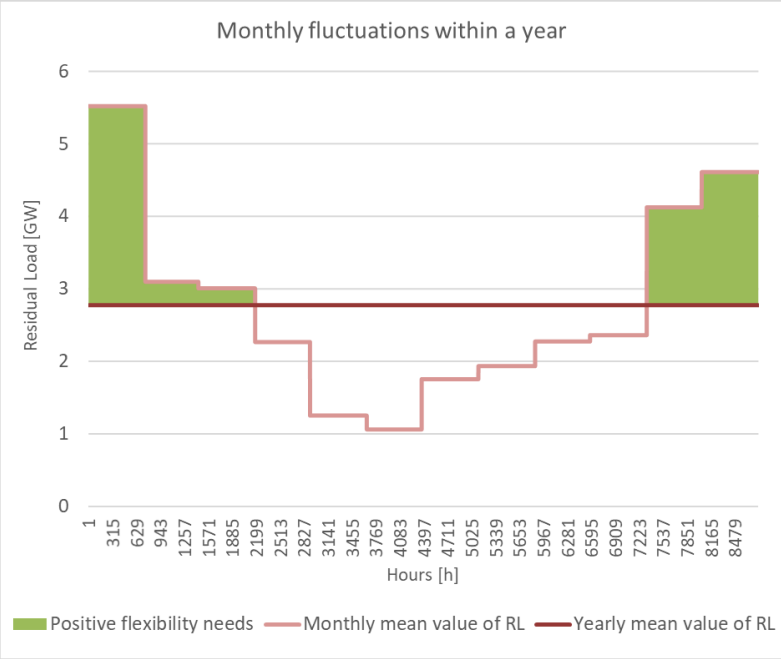


Status quo (2020) and comparison of scenarios (2030) for the temporal development of RL in Austria

- Seasonal mismatch of supply and demand

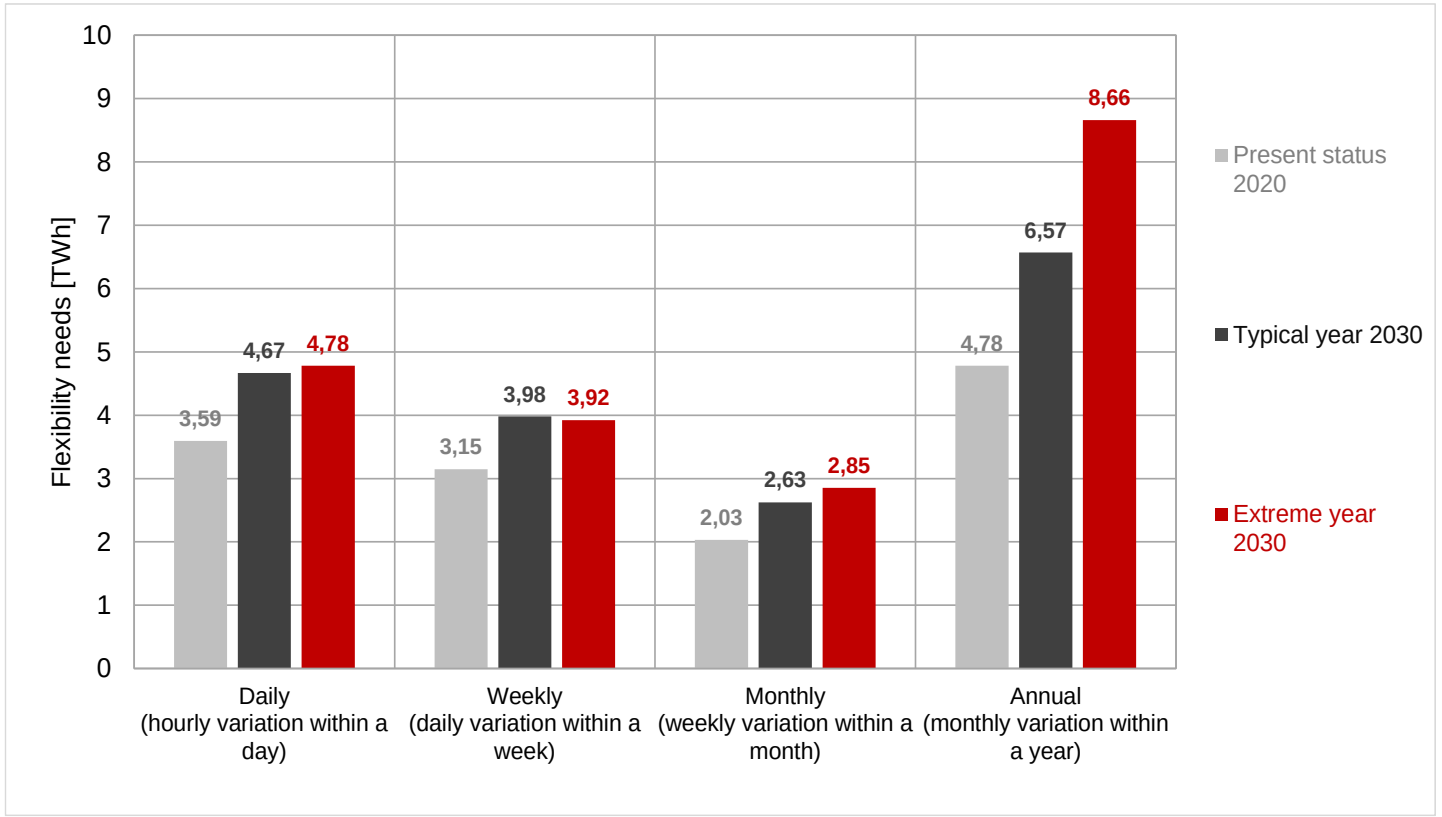
Method to analyse flexibility

- Analysis of the residual load (RL) at distinct time scales (daily, weekly, monthly, annual)



Definition of the flexibility needs to balance the monthly fluctuations within a year, exemplified based on historical generation and consumption data for Austria in 2020

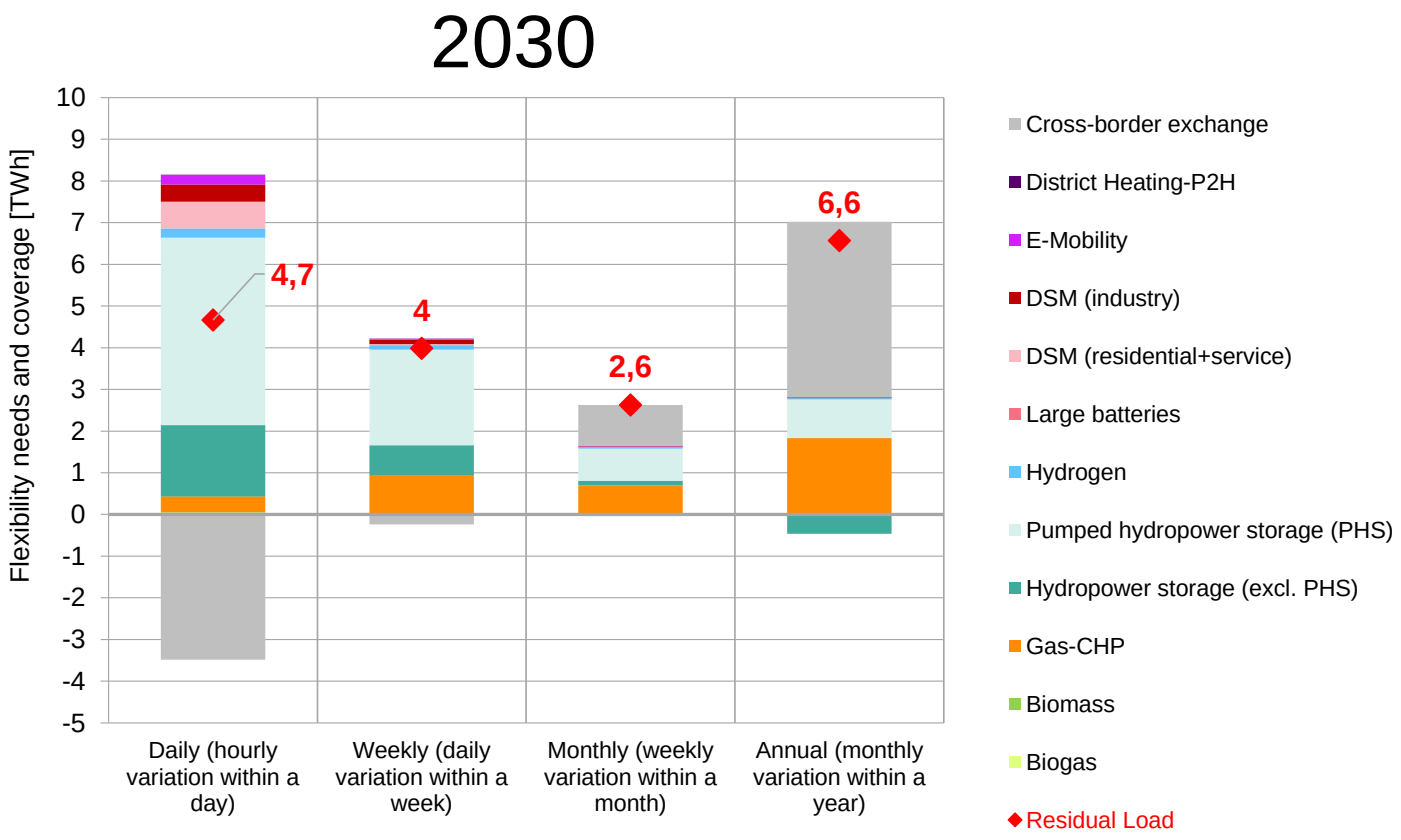
Source: Suna et al. (2022) *Assessment of Flexibility Needs and Options for a 100% Renewable Electricity System by 2030 in Austria.*



Status quo (2020) and comparison of scenarios (2030) of the temporally subdivided flexibility demand (left) (Source: Suna et al. (2022))

- In the long term (i.e., the monthly fluctuations within a year), the **strongest increase in flexibility demand** can be observed

Contributions of different flexibility options



Contribution of flexibility options to cover flexibility needs at different time period in 2030 according to the scenario "Typical Year 2030" (Source: Suna et al. (2022))

- Hydro (pump) storage most important **short-term flexibility**
- Export/import most important **long-term flexibility** option

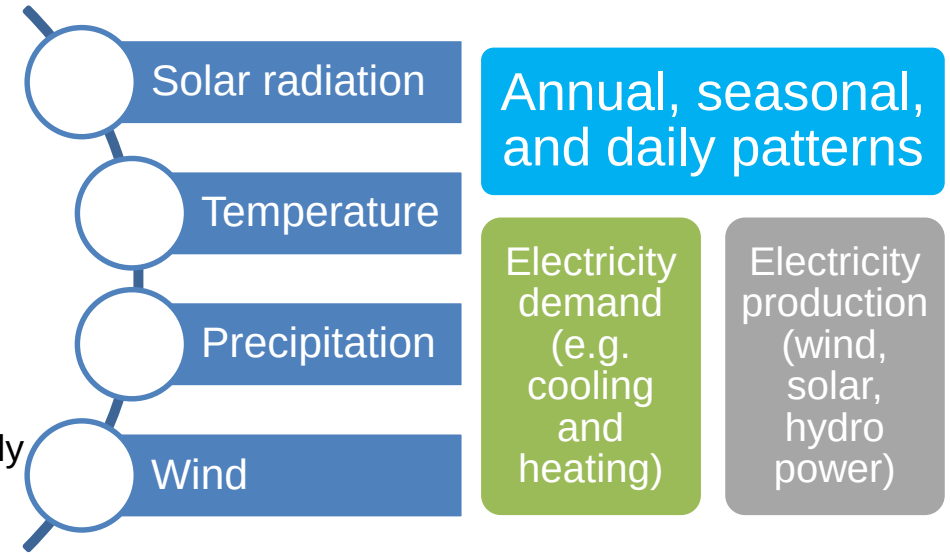
Soon available in English:
Suna et al. (2022) *Assessment of Flexibility Needs and Options for a 100% Renewable Electricity System by 2030 in Austria.*

SECURES Securing Austria's Electricity Supply in times of Climate Change

Focus: Evaluating **the impact of climate change** on **high RES share energy systems**

INSIGHTS from CLIMATE MODELLING …

- Impact of climate change on **meteorological patterns** in Austria and Europe (**extreme events** like cold doldrums, heat waves, etc.) on future electricity demand & supply



… feeding into ENERGY MODELLING and the ASSESSMENT of SUPPLY SECURITY

- Electricity mix, power plant fleet (2030 & 2050)
- Generation behavior
- Climate sensitivity of thermal power plants (lack of cooling - extreme heat periods)

- *Open-source energy system model Balmorel*
- *Comprehensive climate data set for all countries (including energy community countries) will be made available*

SECURES project (2022)

powered by klima+ energie fonds

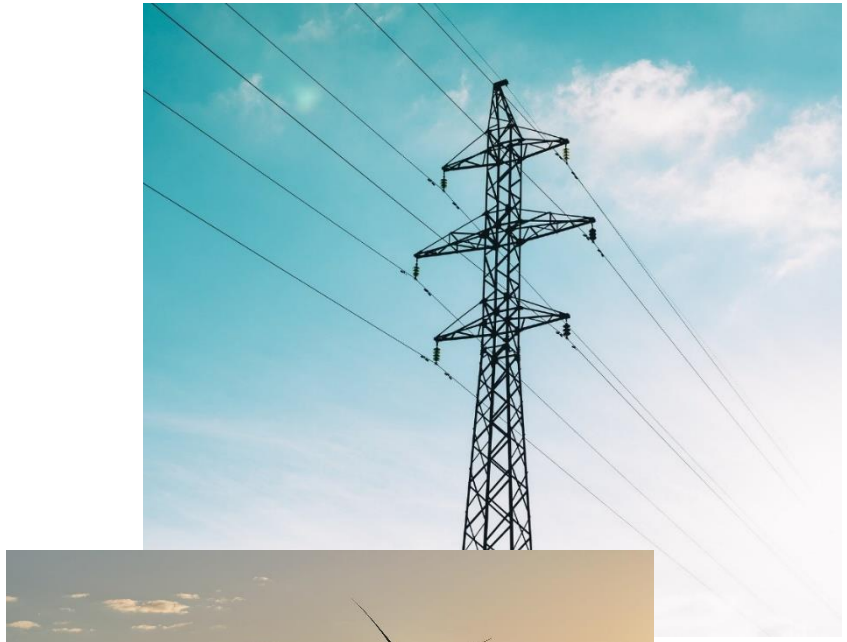
Conclusions

from modelling works related to the 100% RES-E target in Austria

- **Transition** enablers: show the **techno-economic feasibility** and **political will** to let the vision become a REALITY
- **Demand** and **electricity price trends** are **key parameters** when determining **support needs**

- **Flexibility needs and options** have become increasingly the **focus** of energy system analysis in high RES-share scenarios
- A key prerequisite for the transition is the planned grid extension – within Austria but also in the European transmission grid in general

- The **impact of climate change** will gain importance in studies related to **security of supply** and **evaluation of extreme events**



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- Thöni, M. (2021): *Erneuerbaren-Ausbau-Gesetz.* Presentation at IEWT Conference 2021. https://iewt2021.eeg.tuwien.ac.at/download/contribution/presentation/284/284_presentation_20210928_120436.pptx

Thank you!

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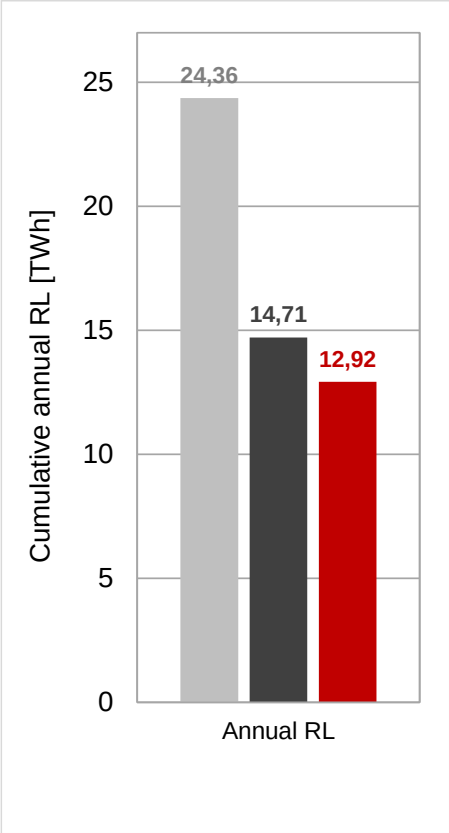
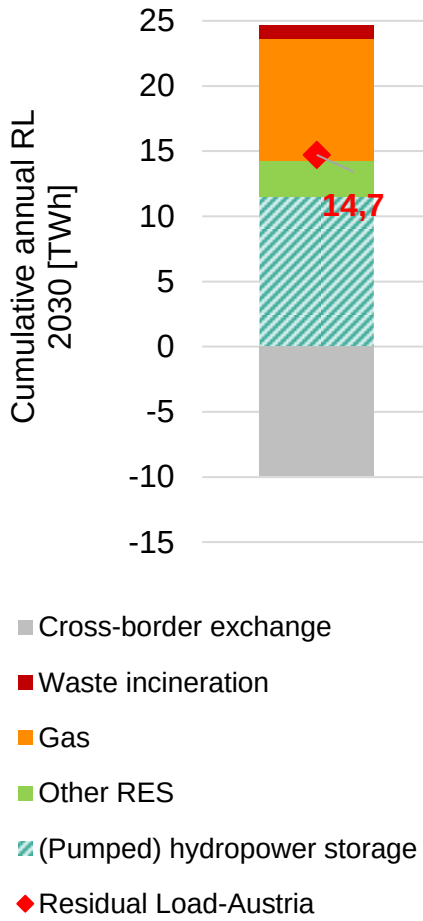
Flexibility analysis: annual RL



Status quo (2020) and comparison of scenarios (2030): indication of the annual balance of RL



Annual cumulative RL in 2030 according to the scenario "Typical Year 2030"

Source: Suna et al. (2022))