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TOMORROW TODAY

ENERGY FLEXIBILITY IN AUSTRIA

in the Framework of an European Energy Transition

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AIT Austrian Institute of Technology

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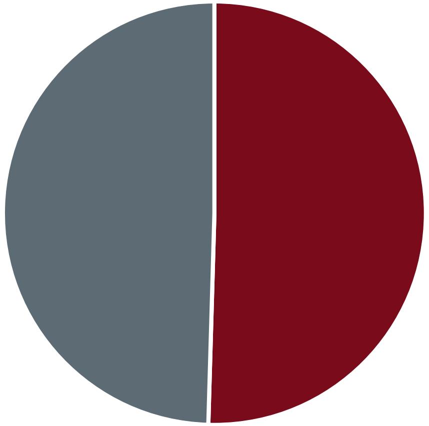
OWNERSHIP STRUCTURE



49.54 %

FEDERATION OF AUSTRIAN INDUSTRIES

50.46 %

REPUBLIC OF AUSTRIA
(through the Federal Ministry for Transport, Innovation and Technology)

1.370

EMPLOYEES

162,9 m EUR

TOTAL REVENUES
as of YE 2018

87,1 m EUR	Contract research revenues (incl. grants)
50,4 m EUR	bmvit funding
21,3 m EUR	Other operating income, incl. Nuclear Engineering Seibersdorf
4,1 m EUR	Profactor (51% of 8 m EUR)

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Seibersdorf Labor GmbH

Nuclear Engineering Seibersdorf GmbH

- Energy
- Health & Bioresources
- Digital Safety & Security
- Vision, Automation & Control
- Mobility Systems
- Low-Emission Transport
- Technology Experience
- Innovation Systems & Policy

CLIMATE TARGETS (I)

- **The Paris Agreement (COP21)**
  - Long-term goal of keeping the increase in global average temperature to well below 2° C above pre-industrial levels
  - Aiming to limit the increase to 1.5° C, (reduce risks and the impacts of climate change)
  - Need for global emissions to peak ASAP

- **Roadmap Low-Carbon Economy 2050**
  - EU GHG emissions towards an 80% domestic reduction
  - All sectors need to contribute
  - The low-carbon transition is feasible & affordable

CLIMATE TARGETS (II)

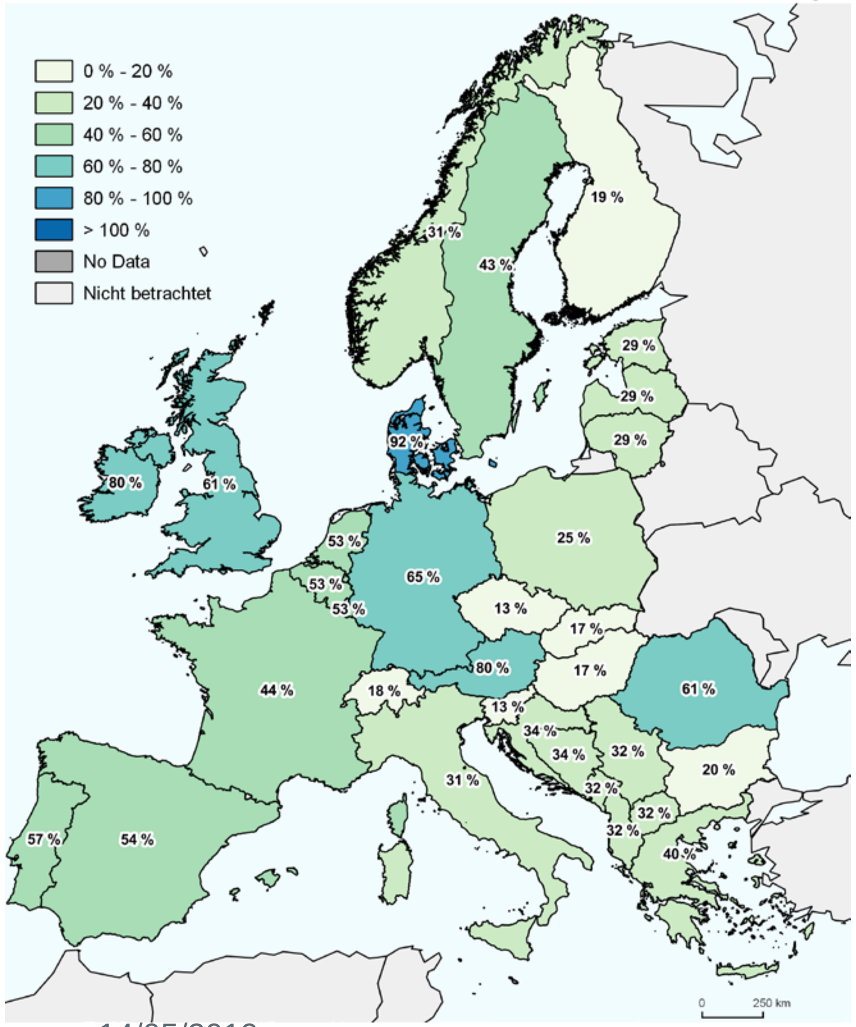
- **National Climate & Energy Strategy**
  - 36% reduction of GHG by 2030
  - 100% of electricity consumption with RES by 2030 (annual balance)
  - Fossil-free mobility sector until 2050 (based on RES, bio-fuels and hydrogen)
  - Innovation boost towards electricity-based industrial processes

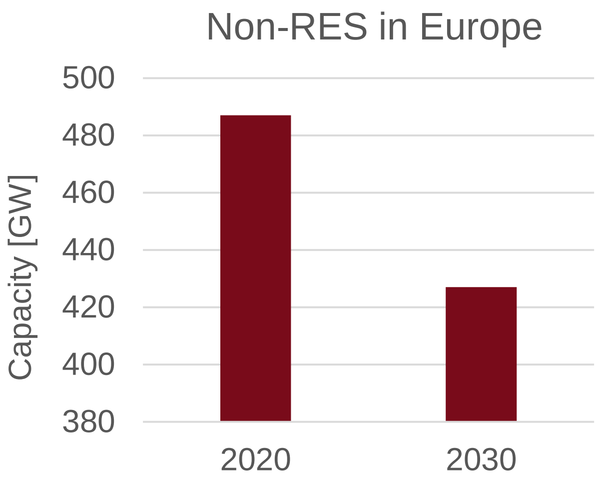
#mission2030

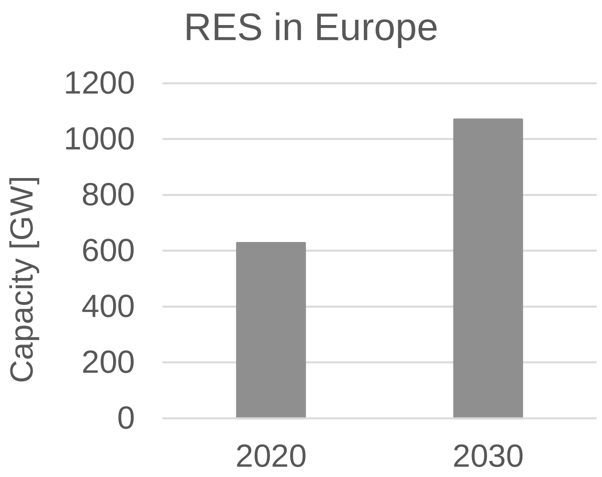
Die österreichische
Klima- und Energiestrategie

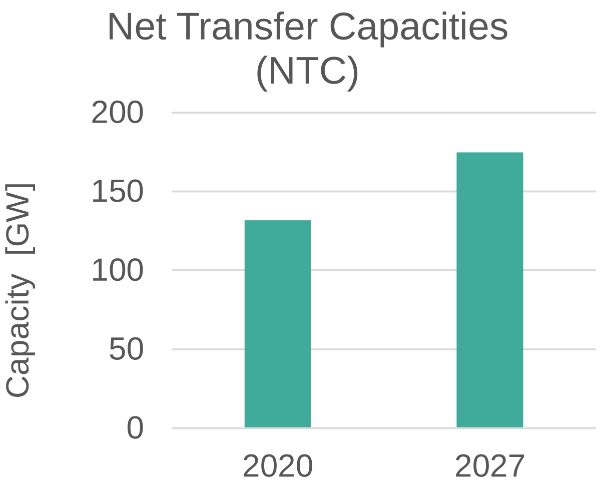
ELECTRICITY SYSTEM IN TRANSITION EUROPE

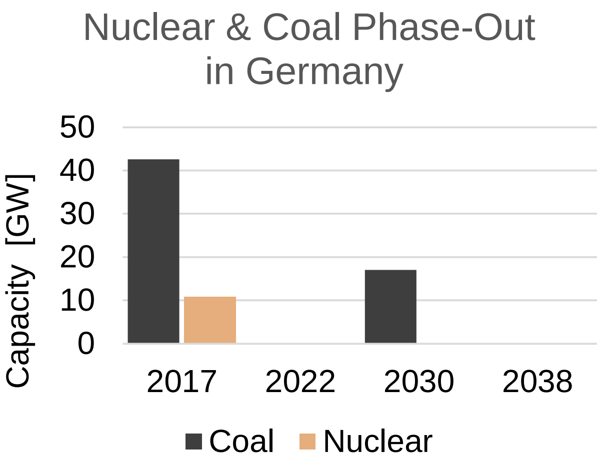
Kern-Flex-2030: Anteil PV, Wind + Laufwasserkraft an Nachfrage











Developments in Europe: Based on **ENTSO-E Distributed Generation Szenario (TYNDP 2018).**

AUSTRIAN TARGET FOR RENEWABLE ELECTRICITY SUPPLY BY 2030

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#mission2030

- Electricity generation from domestic renewables shall cover 100% of total electricity consumption in an annual balance by 2030
  - Austria`s electricity system is about to undergo a significant transformation
  - Significant increases in variable renewable energies in the system (PV, wind, hydro)
  - More flexibility is needed to safeguard supply

- Electricity demand is estimated to increase from 72.4 TWh in 2016 to ca. 88 TWh in 2030 according to the Association of Austrian Electricity Companies (OE)
  - Balancing needs and control energy to stabilize network operations (about 0.5 TWh) and highly efficient industrial auto-production of electricity (about 6.4 TWh) are disregarded from the renewables target.

DEVELOPMENT OF ELECTRICITY GENERATION FROM RES BY 2030

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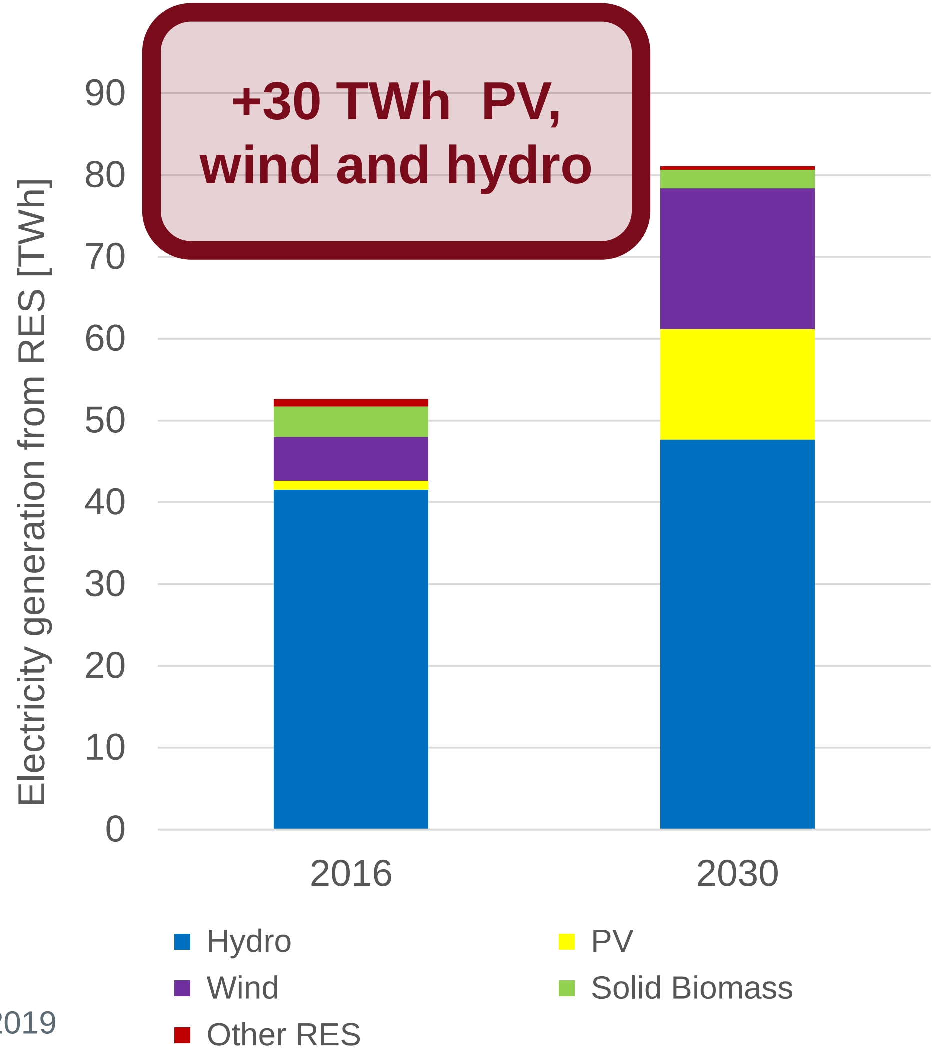

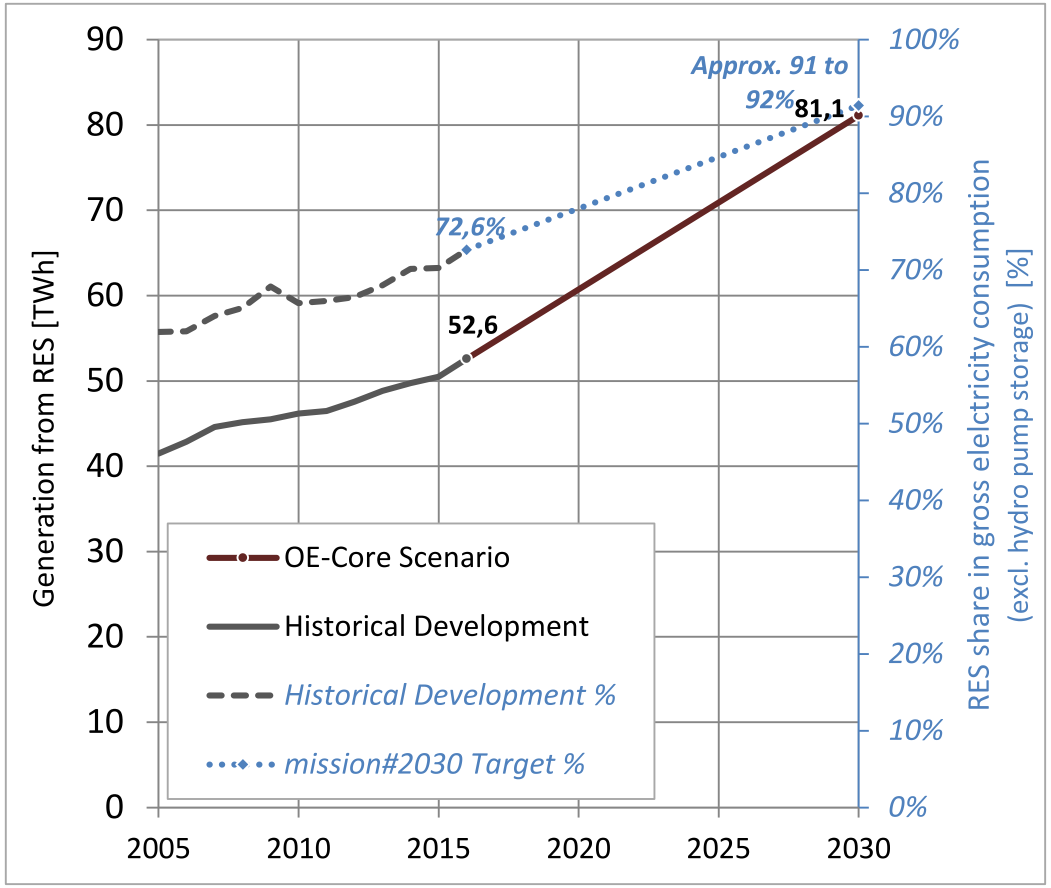

Source: TU Wien

FLEXIBILITY OPTIONS

- Flexible generation technologies: CHP and other thermal power plants (gas, waste, biomass etc.)
- Storage technologies: Pumped-storage hydropower, adiabatic compressed air storages, lithium-ion batteries and power-to-gas
- Demand management through power-to-heat (electric boilers and heat pumps in district heating and decentralized buildings), e-mobility and industrial load management
- Transmission grid: cross-border exchange of electricity
- Curtailment of PV, wind and run-of-river hydropower plants

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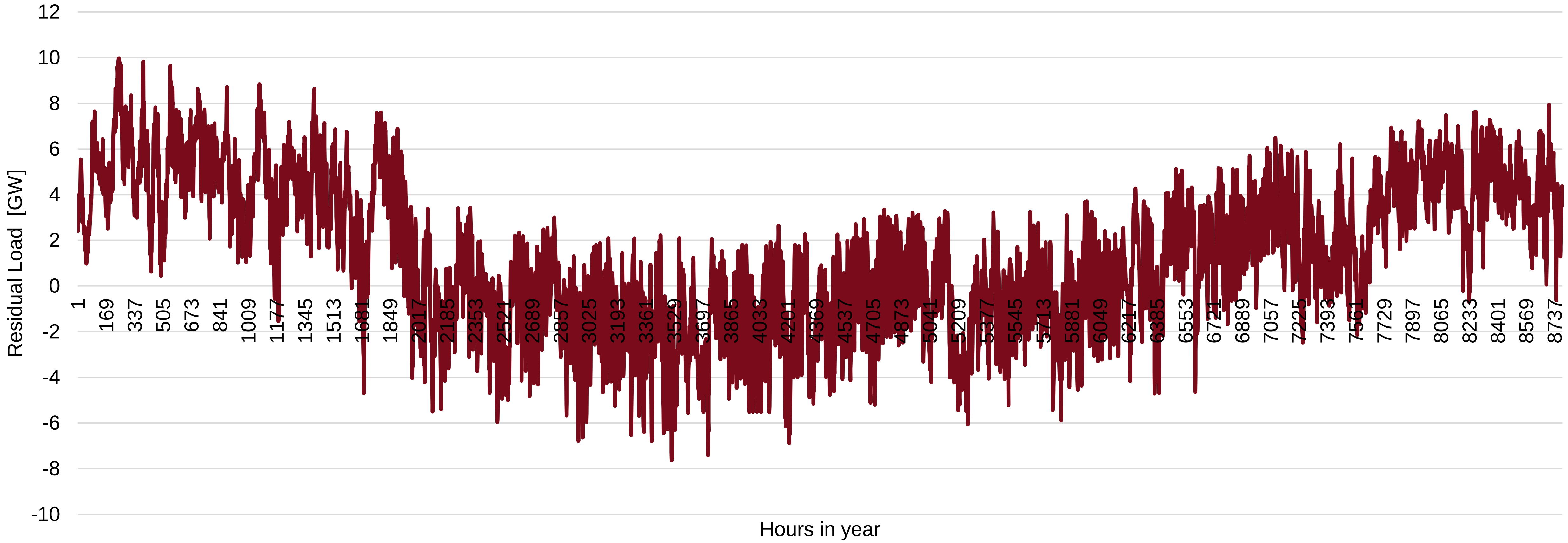
FLEXIBILITY NEEDS AND RESIDUAL LOAD

Residual Load = **Load** - **Wind** - **PV** - **Hydro Run-of-River**



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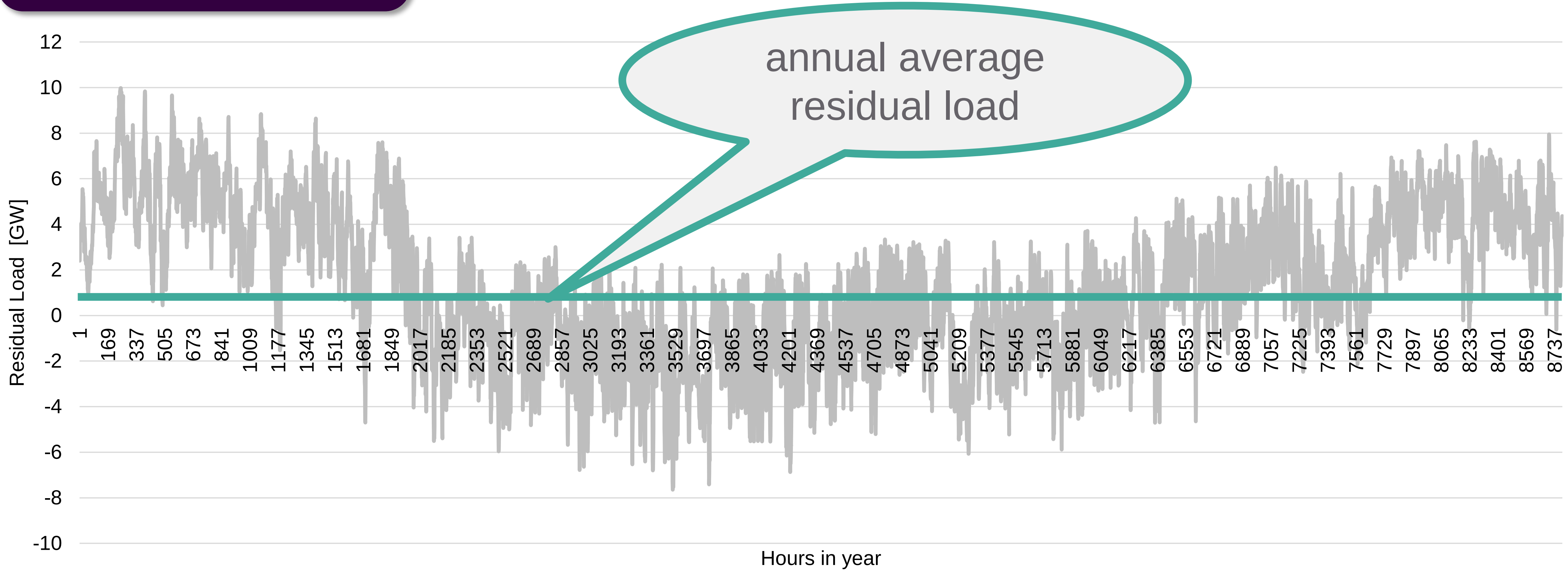

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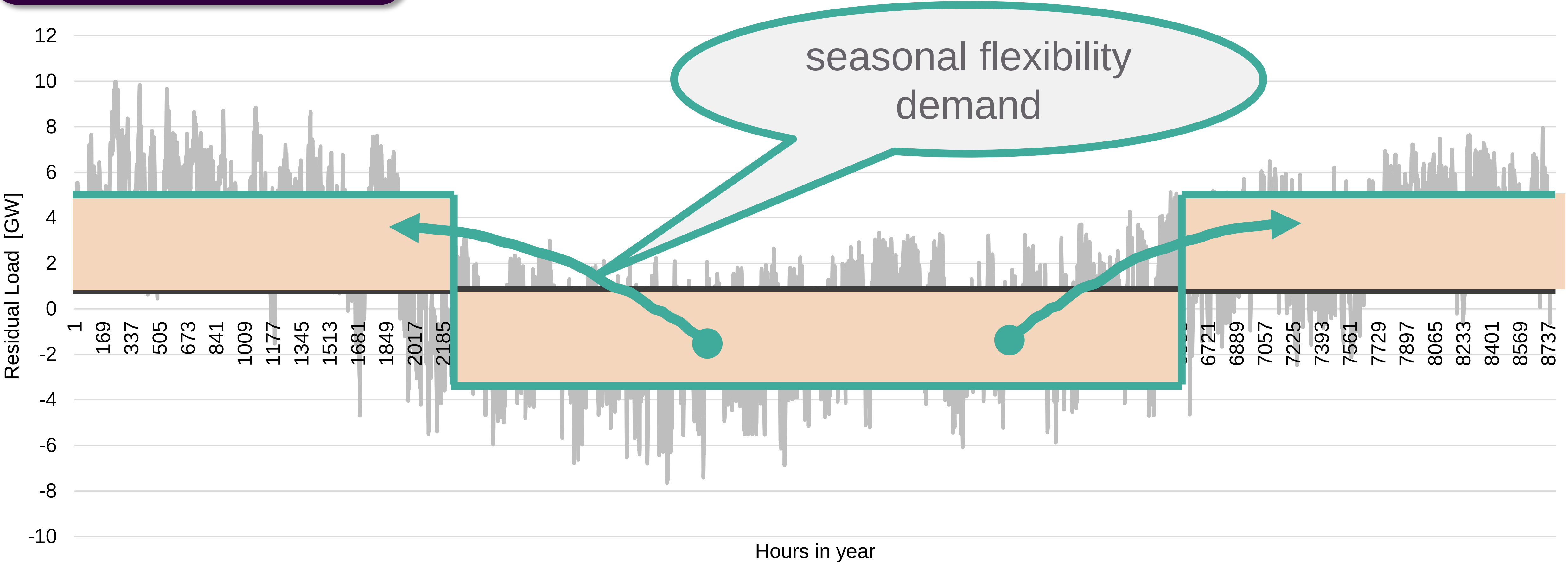

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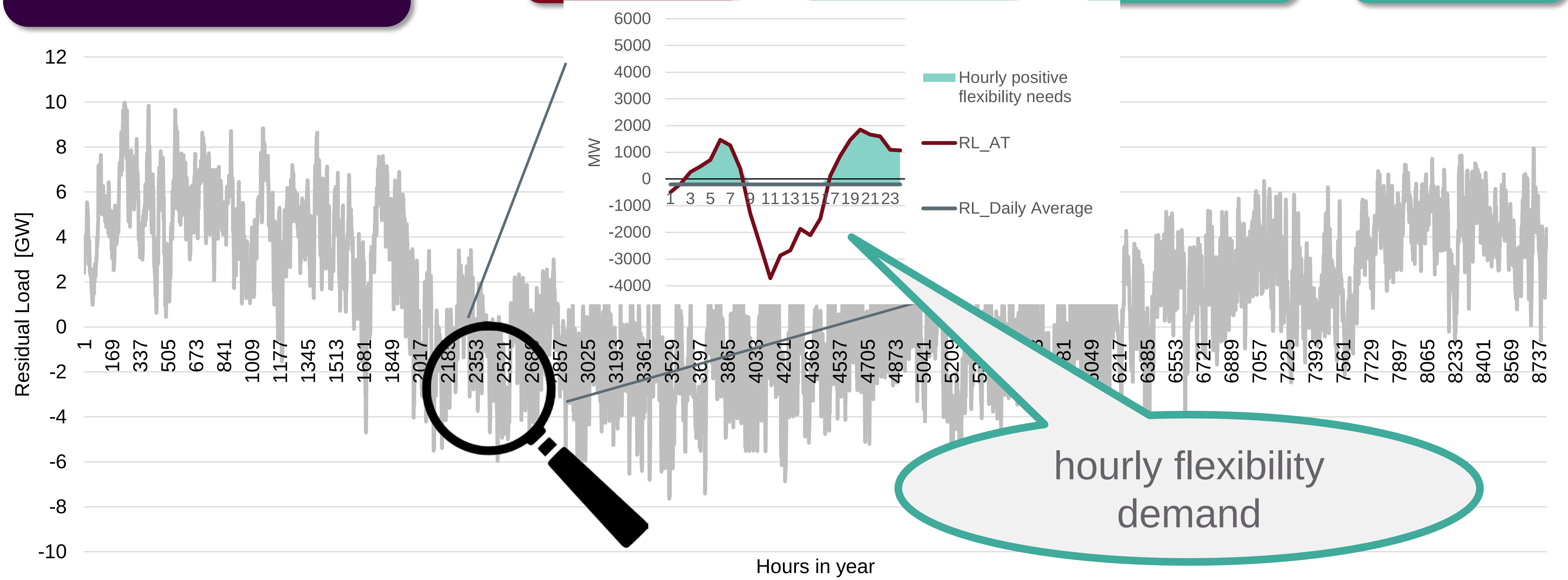
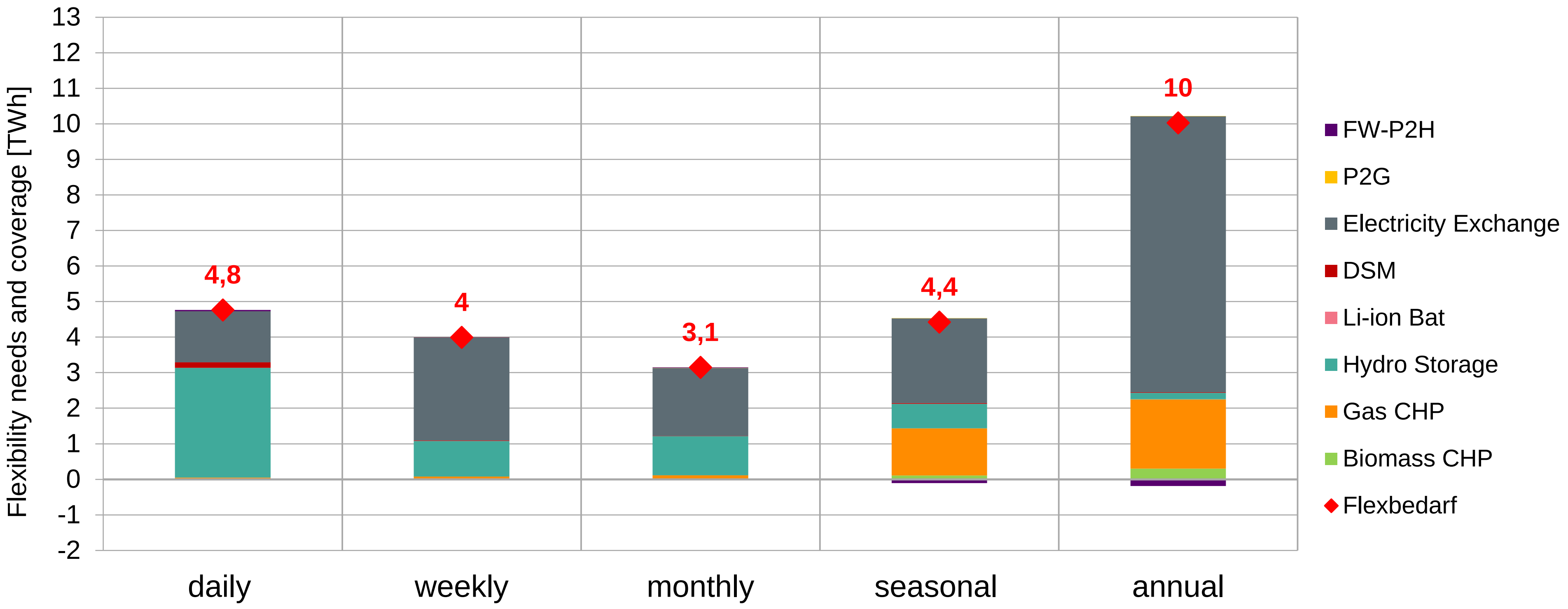


COVERAGE OF FLEXIBILITY NEEDS 2030

Example: based on ***Scenario Extrema-LimitHydro-2030 (conducted for OE)***

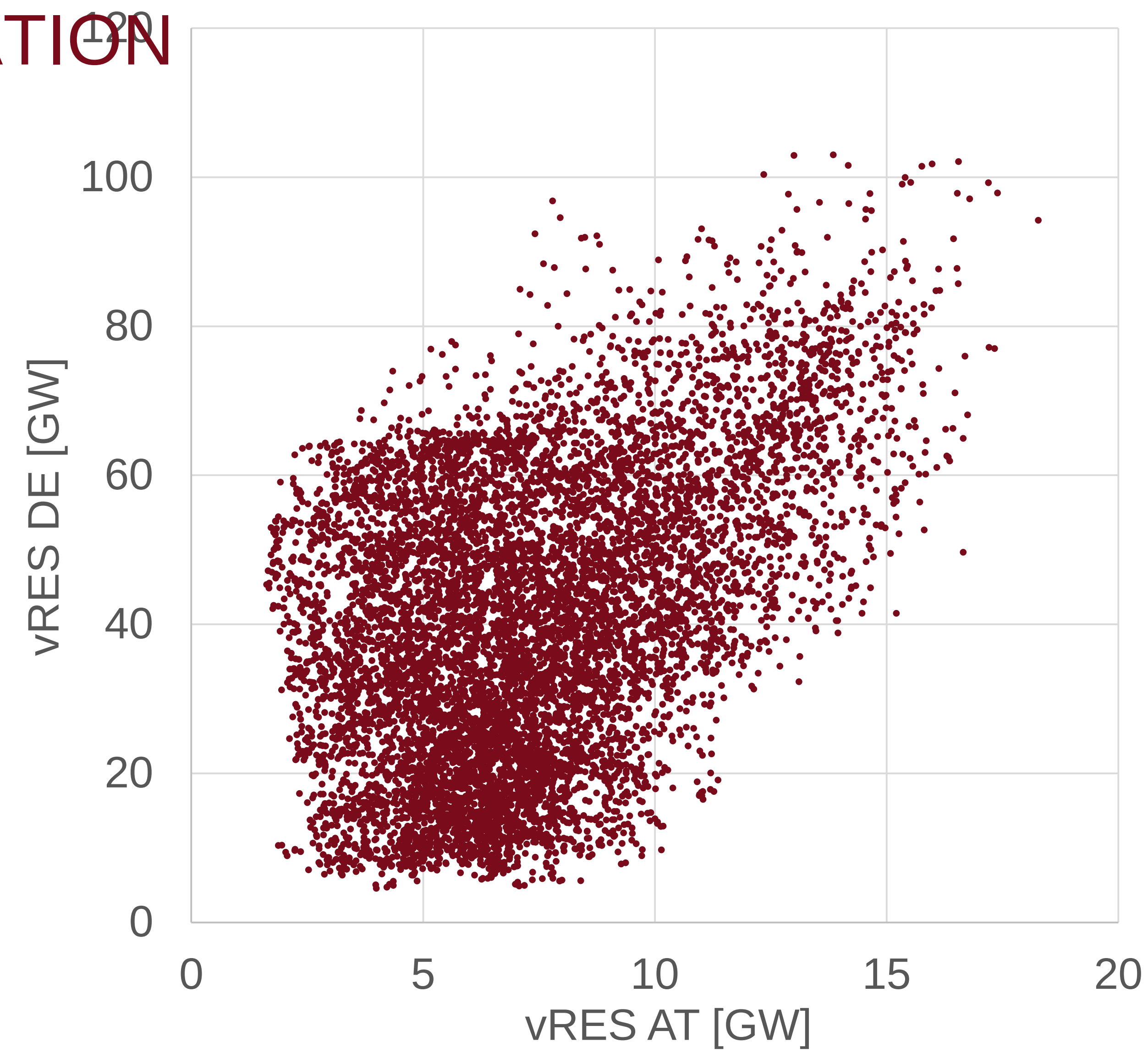


Annual flexibility demand in 2030: ca. 10 TWh
- with the exception of daily flexibility, most of the flexibility is provided by cross-border power exchange.

CORRELATION OF GENERATION

Analysis of simultaneity of variable RES between neighboring countries is becoming of greater importance

- Simulated for the year 2030 considering extreme weather conditions
- The scatter plot of variable RES (PV, wind, (run-of-river) hydro) generation in Austria and Germany shows that there is no strong correlation in RES generation across these countries.
- Simultaneity of variable RES between AT and DE is much less than commonly expected.
- Surplus electricity from variable RES can be exchanged through transmission lines



SECURITY OF SUPPLY (SYSTEM ADEQUACY) - EU VS NATIONAL LEVEL

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- Clean Energy for all Europeans (Winter Package, 2016) from EC
  - Emphasizes the role of ENTSO-E in terms of development of methodology for system adequacy and preparation of EU report (expected by end of 2019)
  - Member States "may" carry out complementary national analyzes
  - National analyzes must have regional focus (including neighboring countries)
  - National reports must use the same methodology as the EU report
  - In the case of divergences between the EU and national reports, the Member States must explain the origin of the divergences, consult the EU Agency for the Cooperation of Energy Regulators (ACER) and explain where and for what reasons the ACER opinion is not followed.

CONCLUSIONS

- The electricity system in Austria and in Europe is in transition (AT: 100 % RES for electricity in an annual balance by 2030, DE: nuclear phase-out (by 2022) and coal phase-out (by 2038), Europe: continuing strong expansion of renewable energies)

- Volatile renewables will dominate power generation in Austria and in the rest of Europe in the future, which increases the need for flexibility (daily to yearly)

From an Austrian perspective …

- Expansion of transmission capacities and the expansion of hydro storages (pump and reservoir) will play a decisive role in covering flexibility needs and security of supply

- CHP plants are essential for the provision of district heating, but also for the security of supply in critical cases (“Dunkelflaute”) - but they face international competition, especially at low CO_2 prices.

- Batteries can’t compete out of a wholesale market perspective. However, they are an essential asset for system operation especially at the distribution network level. Depending on the modes of operation, a reduction or increase in system level flexibility is to be expected.

- Demand side management (industrial plus residential) and storage technologies will play a significant role in local energy communities -> impact on the overall flexibility demand to be analysed

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THANK YOU!

DI Dr. Wolfgang Hribernik, 13.05.2019

ELECTRICITY GENERATION AND CONSUMPTION IN AT 2016 AND 2030

Generation Components	Generation (TWh) 2016	Generation (TWh) Extrema-LimitHydro-2030	Capacity (GW) 2016	Capacity (GW) Extrema-LimitHydro-2030	Consumption Components	Consumption (TWh) 2016	Consumption (TWh) Extrema-LimitHydro-2030
Hydro Run-of-River	**26,9**	32,2	**5,6**	6,3	**Load incl. grid losses**	**61,8**	70,2
Hydro Storage Power Plants	**12,5**	16,4	**8,3**	11,1	**E-Passenger Cars**	**-**	4,5
Wind	**5,2**	19,4	**2,7**	6,7	**Pumped Storage**	**4,3**	4,1
PV	**1,1**	13,3	**1,0**	13,5	**Decentral P2H**	**-**	2,7
Biomass Power Plants (incl. CHP)	**2,1**	2,3	**0,5**	0,4	**District Heating-P2H**	**-**	0,9
Gas PP (incl. CHP)	**7,0**	4,6	**4,5**	2,0	**P2G**	**-**	0,0
Other PP	**4,1**	1,0	**1,7**	0,1			
Import	**26,3**	10,7			**Export**	**19,0**	17,4
Total	**85,2**	99,8	**24,3**	40,2		**85,2**	99,8