



2024

# Greening the grid and keeping the lights on – Infrastructure Planning Considering Sector Coupling

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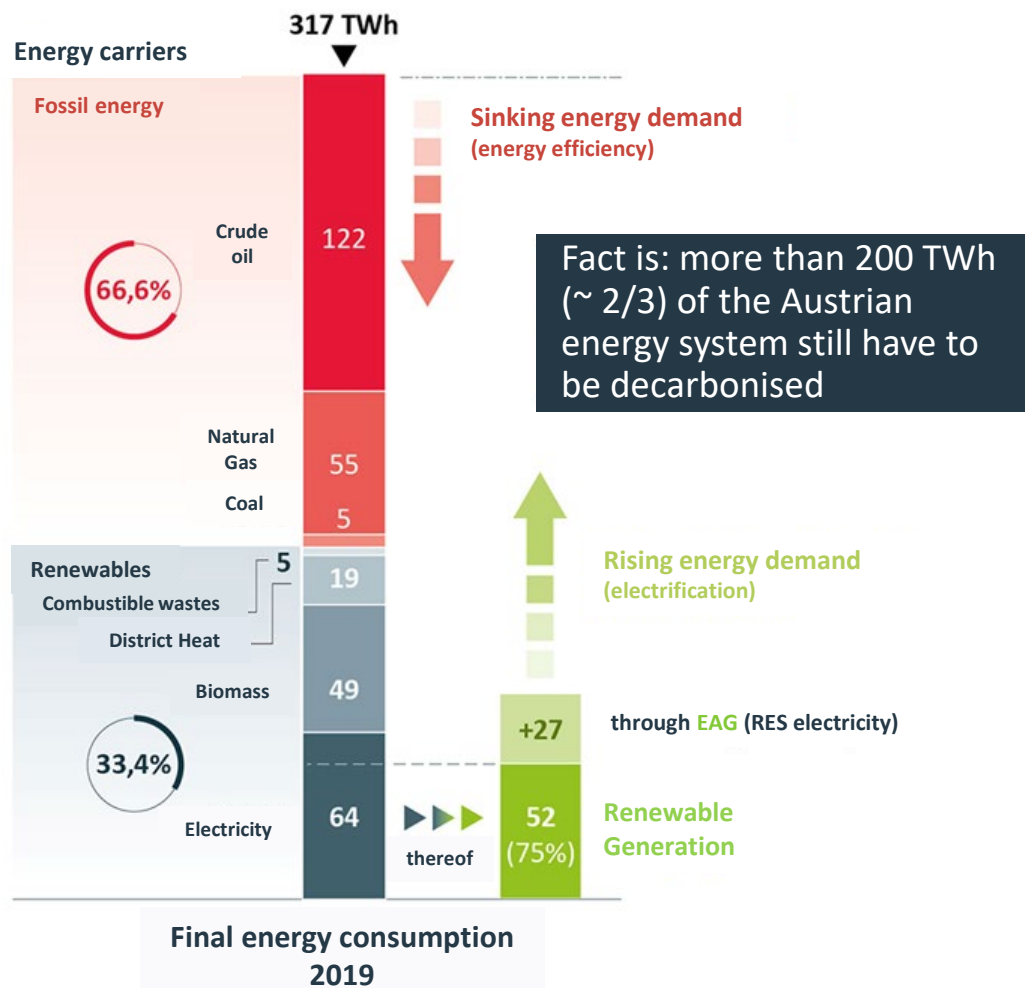
**Department System Development, Austrian Power Grid**

# Decarbonising the electricity sector is only one aspect

To achieve full decarbonisation, deep electrification of the energy system will be needed



## The challenge



## Milestones and key indicators

### Milestone 2030

- ▶ Until **2030**, the electricity sector in Austria will have to be fully decarbonised (national yearly balance; this implies a range of RES expansion of +27 TWh EAG and +39 TWh ÖNIP)

### Milestone 2040

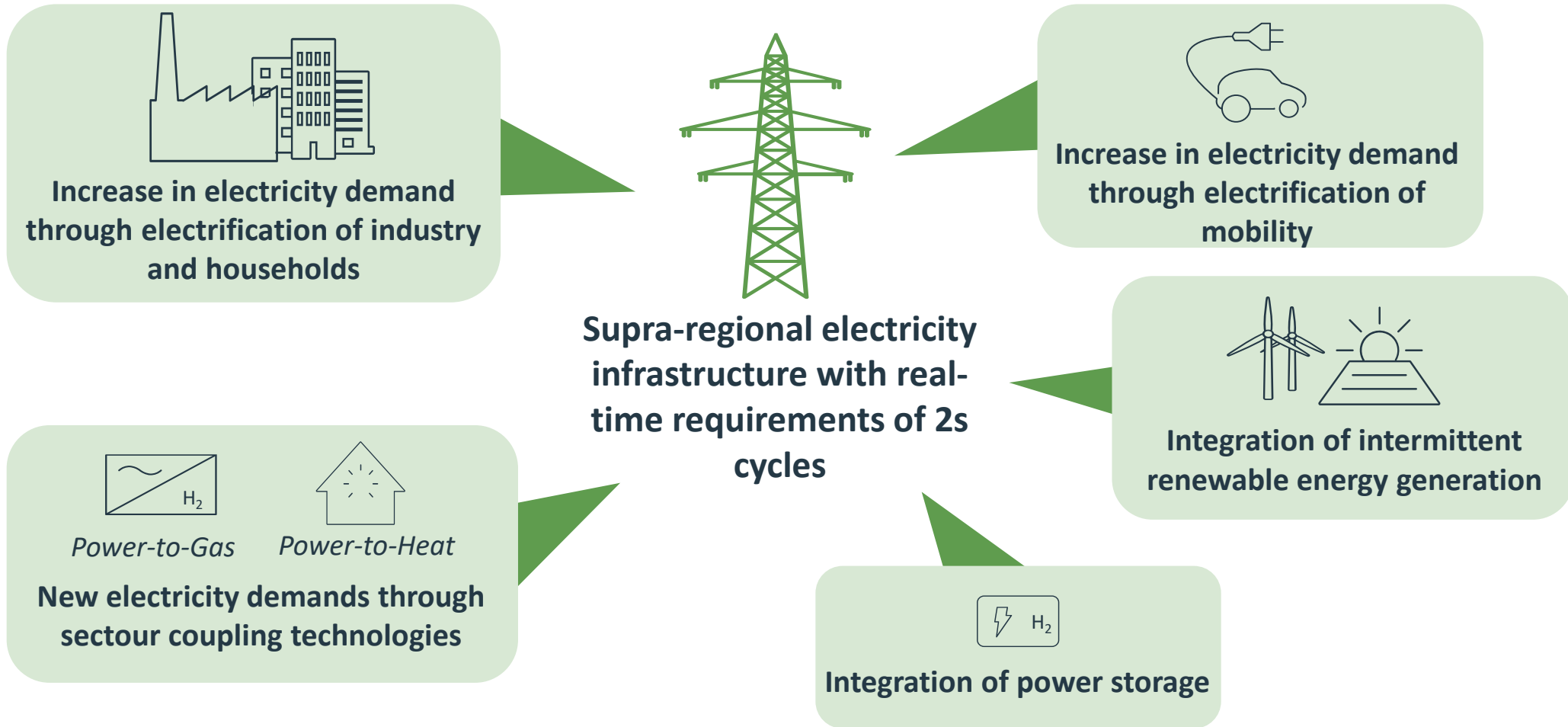
- ▶ Until **2040**, Austria aims to have reached full decarbonisation. This implies that > 200 TWh still need to be decarbonised.

### Sector coupled perspective essential to efficient planning

- ▶ Massive investments are needed. Sector coupling is the key enabler of a cost-efficient energy transition. If it is done well, the chances of the transition outweigh the risks

# Electrification is the central pillar of the energy transition

System-wide changes have multiple effects on the power system



- The transmission grid carries the changes of the overall energy system
- A coordinated approach is needed to ensure a cost-efficient energy transition

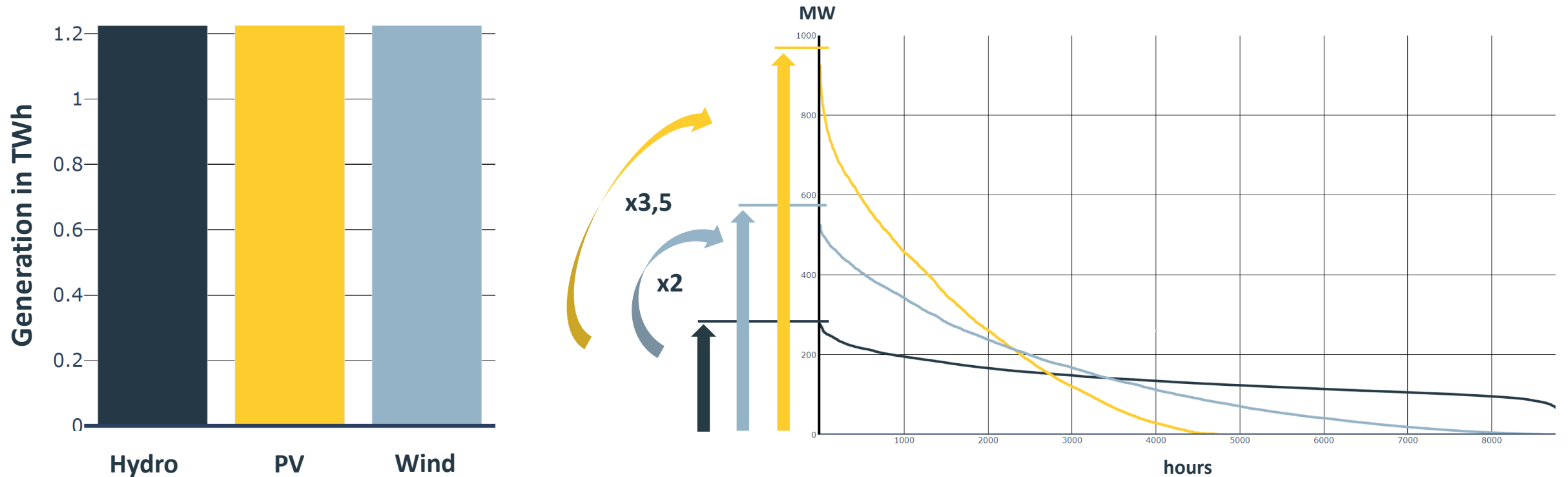
# Key technical challenge: Massive increase of generation capacity

Peak capacity sets the threshold for grid development

Direct comparison between hydro power, wind and solar PV shows:

In order to produce the same amount of energy...

... almost twice the capacity for wind and 3.5 times the capacity for PV are needed



► Generation from wind and solar PV have fundamentally different characteristics than generation from (flexible) hydro or gas. This effect is greatly enhanced by additional electricity demand through the electrification of the economy!

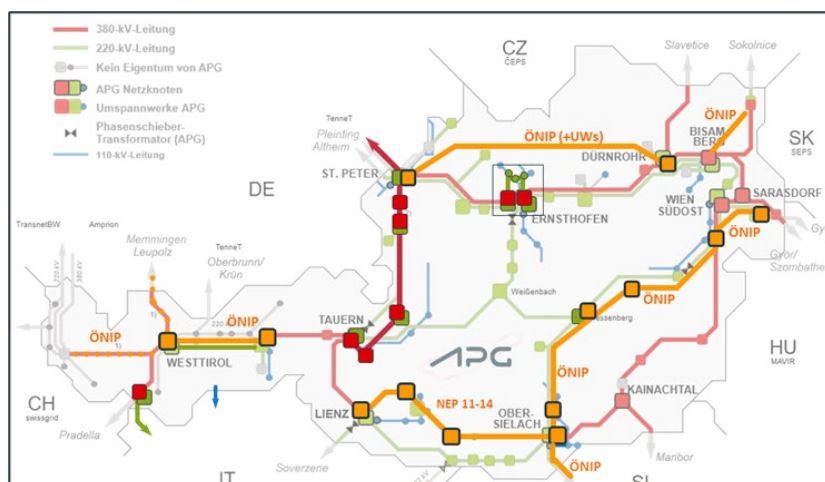
# Outlook 2030+: Quantifying the challenges from APG perspective

Necessary grid expansion based on ÖNIP and APG projections

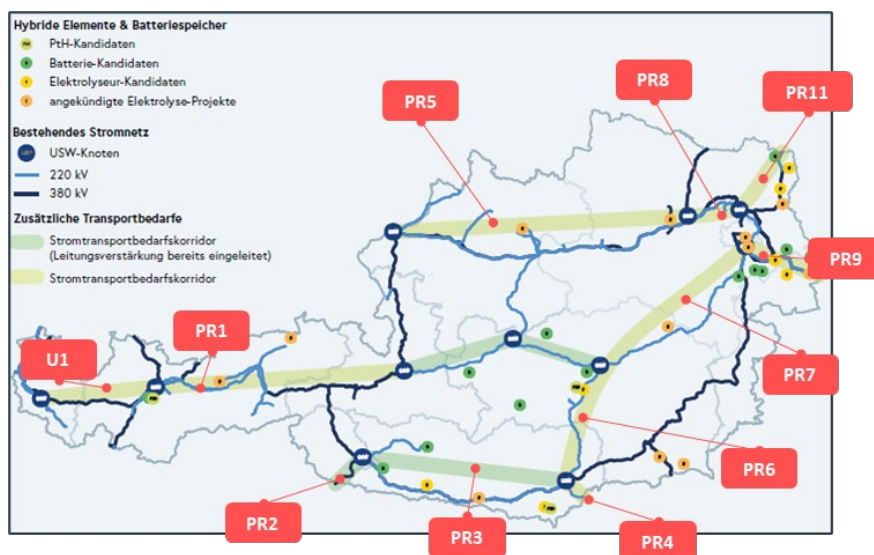
## APG assessment confirmed by ÖNIP

## Massive challenges until 2030+

APG



ÖNIP



	Today	Tomorrow (ÖNIP 2030+)	Increase
Grid length [380 kV]	1.200 km (in 60 years)	+ 1.200 km (in 13 years)	+100%
„UVP“ Processes [environmental impact]	2 (max.)	5-6 (in parallel)	+200%
Substations	65	+45	+70%
Transformers	95	+110	+120%

Today Tomorrow (ÖNIP)

▶ According to current NEP: APG plans to invest 9 bn EUR until 2034

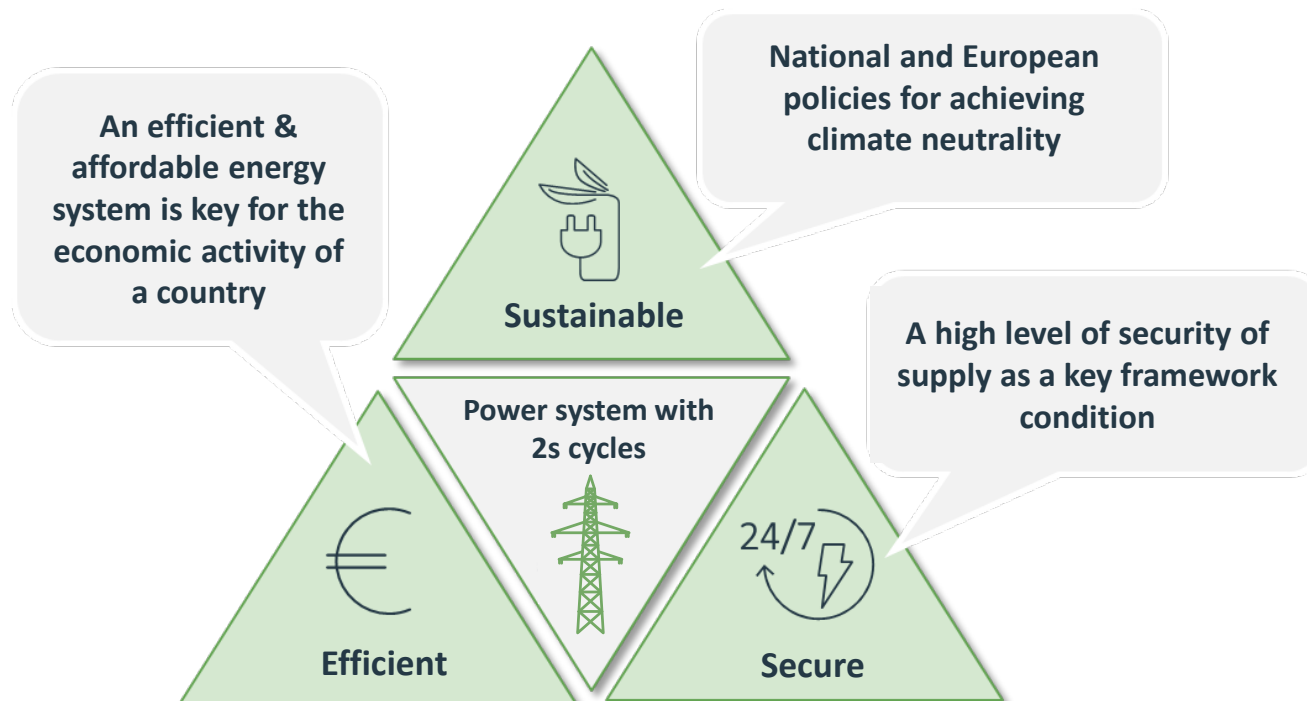
# zusammEn2040 – Our innovative approach

Assessing measures and enabling the necessary coordination

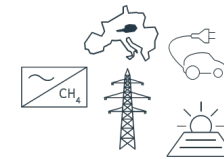
- A holistic and coordinated approach is needed to ensure maximum efficiency
- APG brings the necessary competence – due to APG's responsibility and experience



## The power system is at the centre



## What is needed?

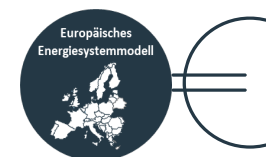


**A sector-coupled energy system with electricity in the leading role**

zusammEn 2040



**A holistic coordination with extensive stakeholder engagement**



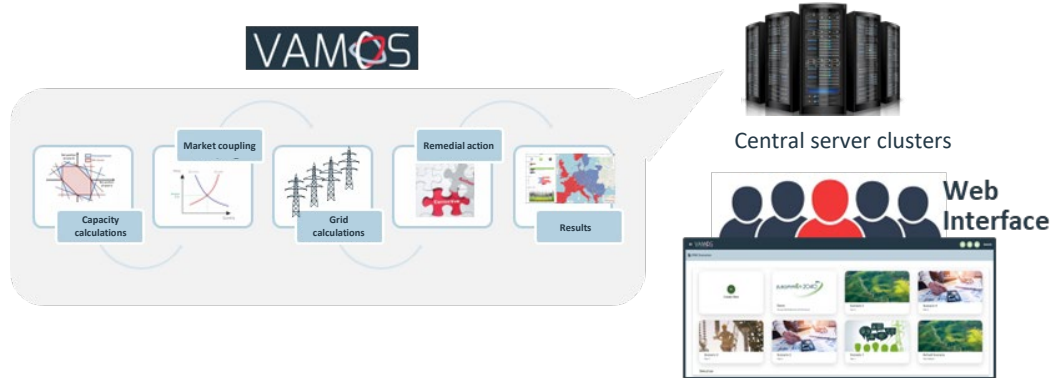
**The creation of economic cost-optimal scenarios and the implementation of modern tariff systems**

# Planning processes at APG with increasing demands

The electricity sector will assume the leading role in the sector-coupled energy system of the future.

## High competence of APG due to long-term experience with planning processes

- Legally prescribed planning processes\* require extensive simulation expertise
- Broad experience with stakeholder/client management in simulation systems (VAMOS)\*\*.



## Responsibility of APG with growing complexity

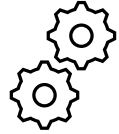
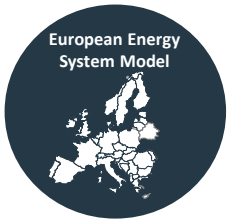
- Security & operation of the transmission network with real-time requirements in 2s cycles
- Interfaces to other sectors (mobility, H2, industry, heat generation, etc.) are becoming deeper
- Strong linkages to the European internal energy market / congestion management

- APG's expertise and existing IT infrastructure can be used for planning the energy transition
- APG takes on a key role in the operation and planning of energy infrastructure and systems

\*TYNDP, Adequacy Prozesse, Bidding Zone Review, strategic network development, etc.

\*\* Currently, 18 TSO use (and finance) APG's VAMOS-system for the the Bidding Zone Review process

# zusammEn2040 lays the groundwork for the necessary coordination of the energy transition



**Cross-sectoral energy system model (ESM)**

zusammEn 2040

**Stakeholder process and networking platform**

- Consideration of all sectors and energy carriers
- European Model with focus on AT
- Scenario-capability and high-performing IT



*Coordination:  
stakeholders together  
with APG experts*

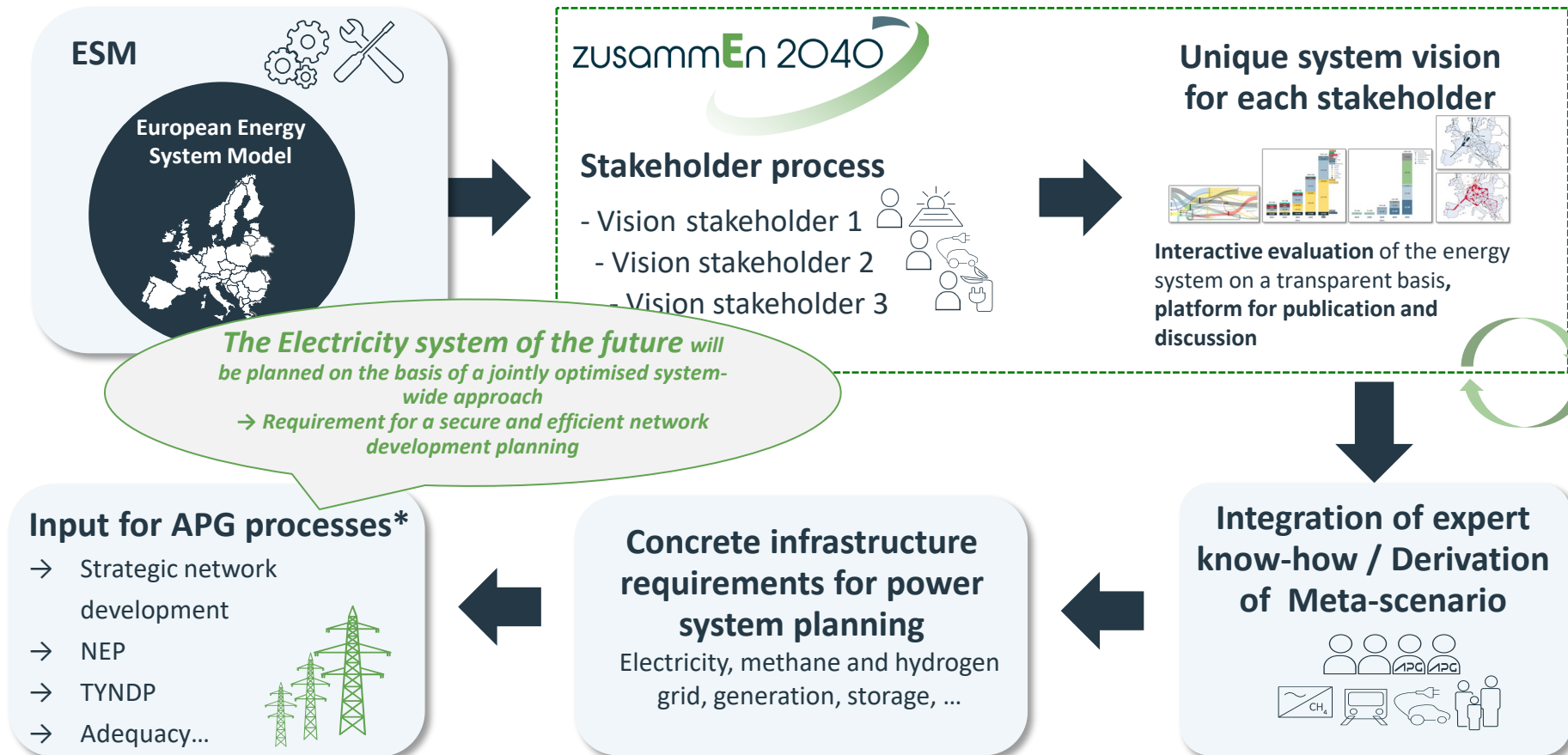
- Own calculation of scenarios for individual energy system visions
- Mutual learning and cross-sectoral exchange in a transparent process

- The ESM and the stakeholder process are essential components of **zusammenEn2040**
- Each stakeholder can create a cost-optimal scenario
- The results serve as the basis for (detailed) planning processes



# How does the energy system model feed into APG planning processes?

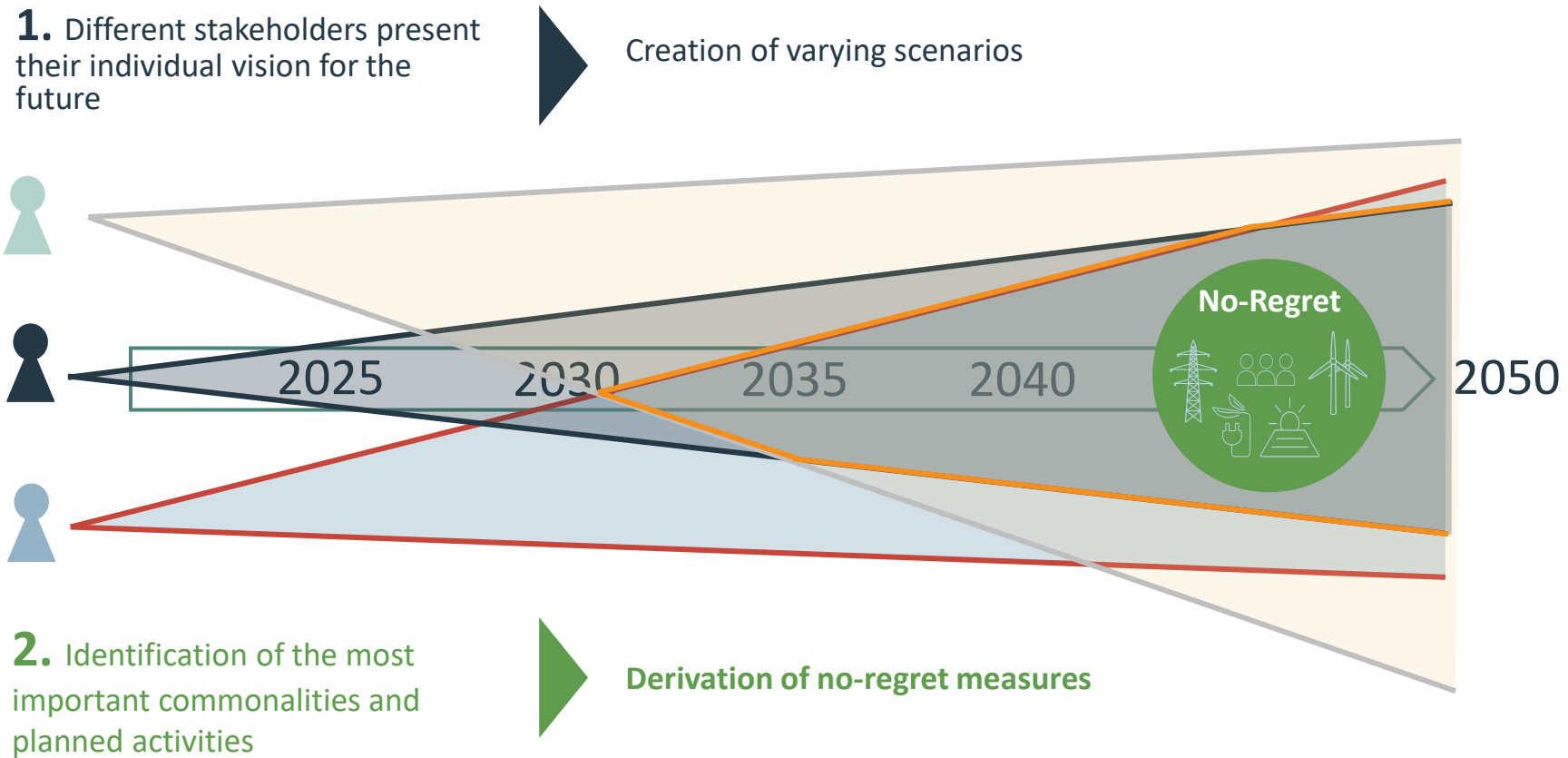
From model inputs to strategic outcomes



\* Process cycle of 1-2 years

# Identification of no-regret measures

## Communicating in a common language



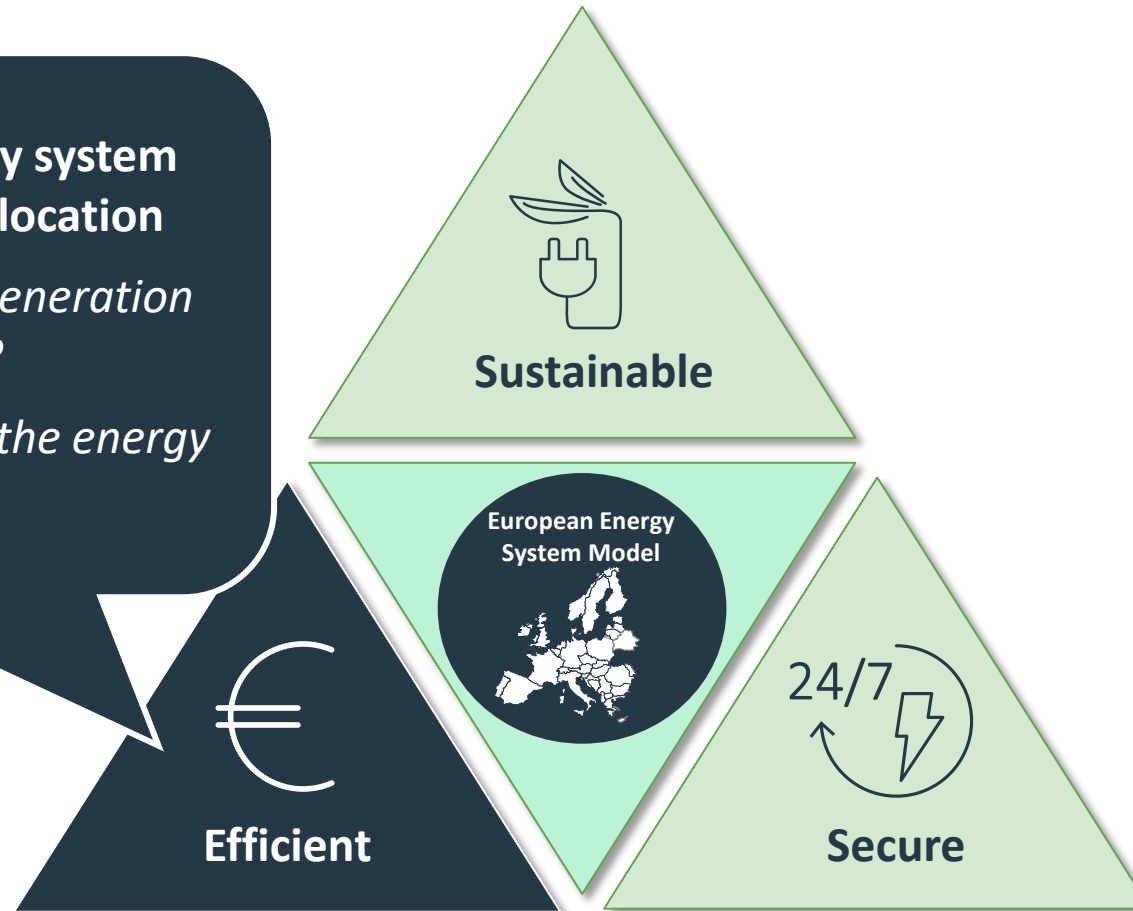
# The energy transition must be affordable, sustainable and secure

## Target vision

**An efficient, cost-effective energy system enables a competitive business location**

*What does decarbonized energy generation cost compared to today?*

*Which investments are needed for the energy transition?*

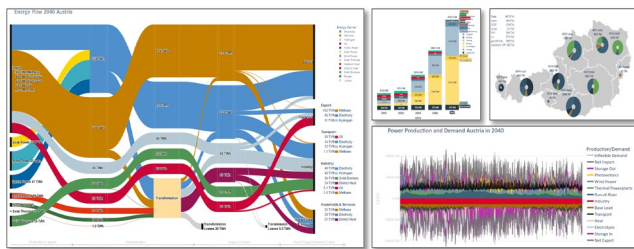
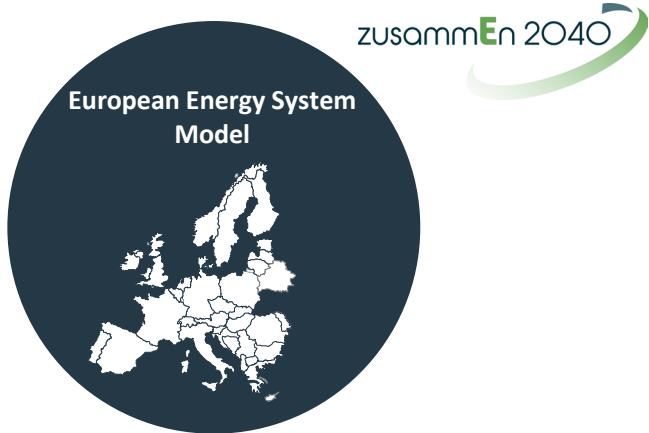


**The energy system model helps identify the key pillars of the system-wide transformation and provides a holistic assessment for secure network planning.**

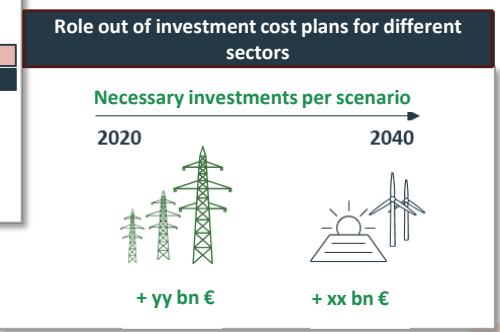
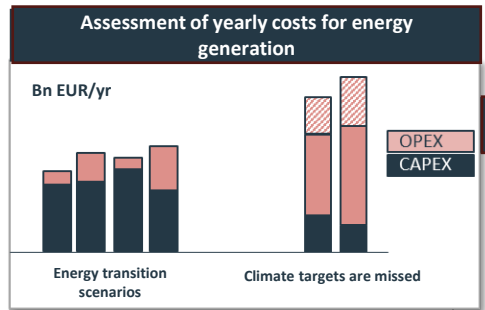
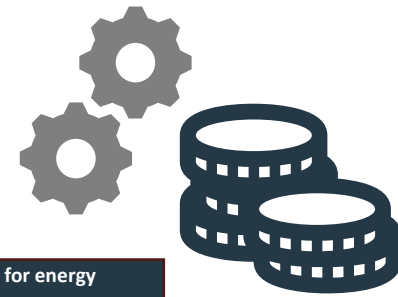
# Consistent derivation of costs on the basis of holistic energy scenarios

## Assessing future investment requirements

**Holistic energy system scenarios for Europe**  
(energy flows, installed capacities, demands, ...)



**Scenario-based direct derivation of costs and investment requirements for the future energy mix**  
(BEATRICE\*)



\*BEATRICE: Benefit Analysis of Transition Investments and Cost Evaluation

# Investments in the future energy system contribute to domestic value added

## Scenario outcomes

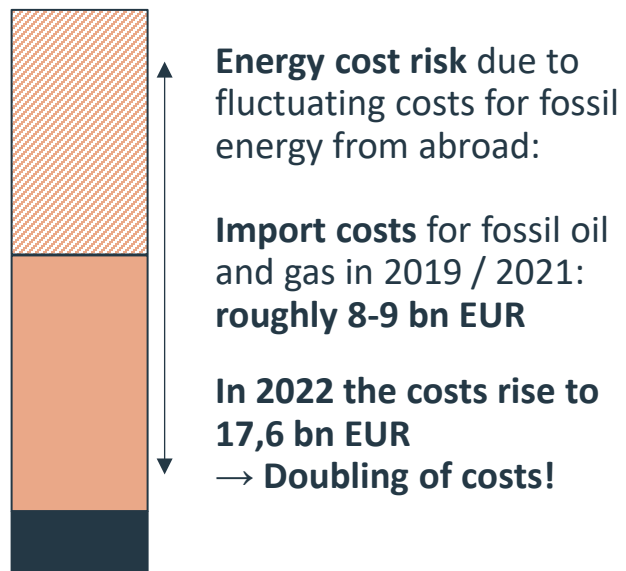


European Energy  
System Model

*Our tools enable the consistent derivation of costs of future energy generation!*

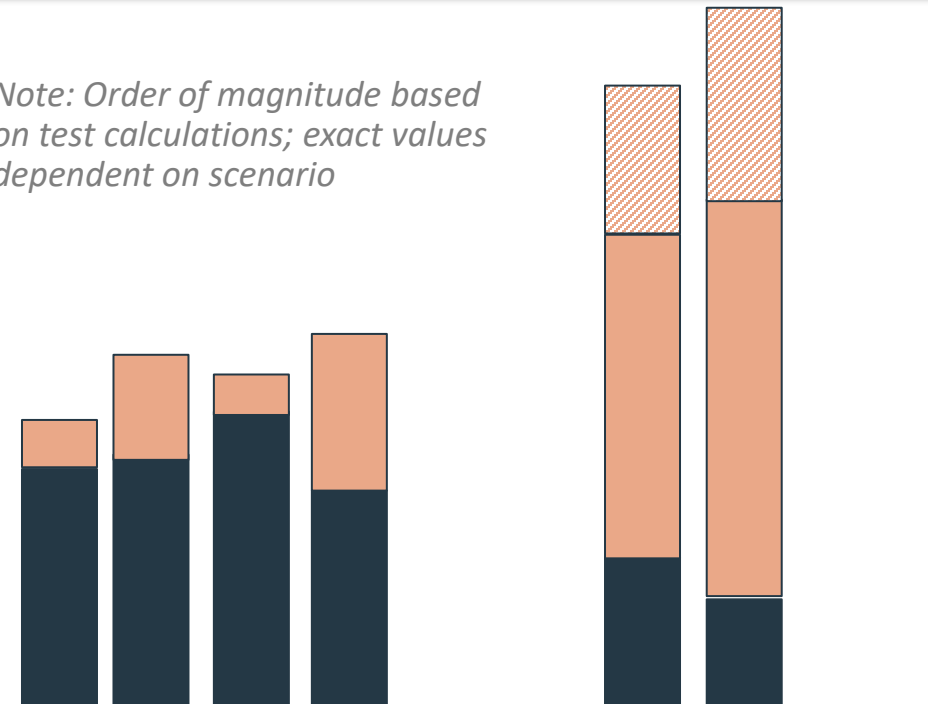
In energy transition scenarios, capital costs dominate over operating costs (commodities). This leads to increased

- domestic value added and the creation of jobs
- Risk minimisation through a decrease in import dependencies



Reference year\*

*Note: Order of magnitude based on test calculations; exact values dependent on scenario*



Energy transition scenarios

Scenarios where climate targets are missed

Operating costs: Commodity costs and CO2 pricing  
Capital costs: Depreciation for assets; fixed operating expenses

\* Illustration based on „Tag der Abhängigkeit von Kohle, Öl und Erdgas“, AEA, 2023