

Reaping the benefits of low-cost renewables

*Insights from the SEE Electricity Roadmap
and Power System Studies*

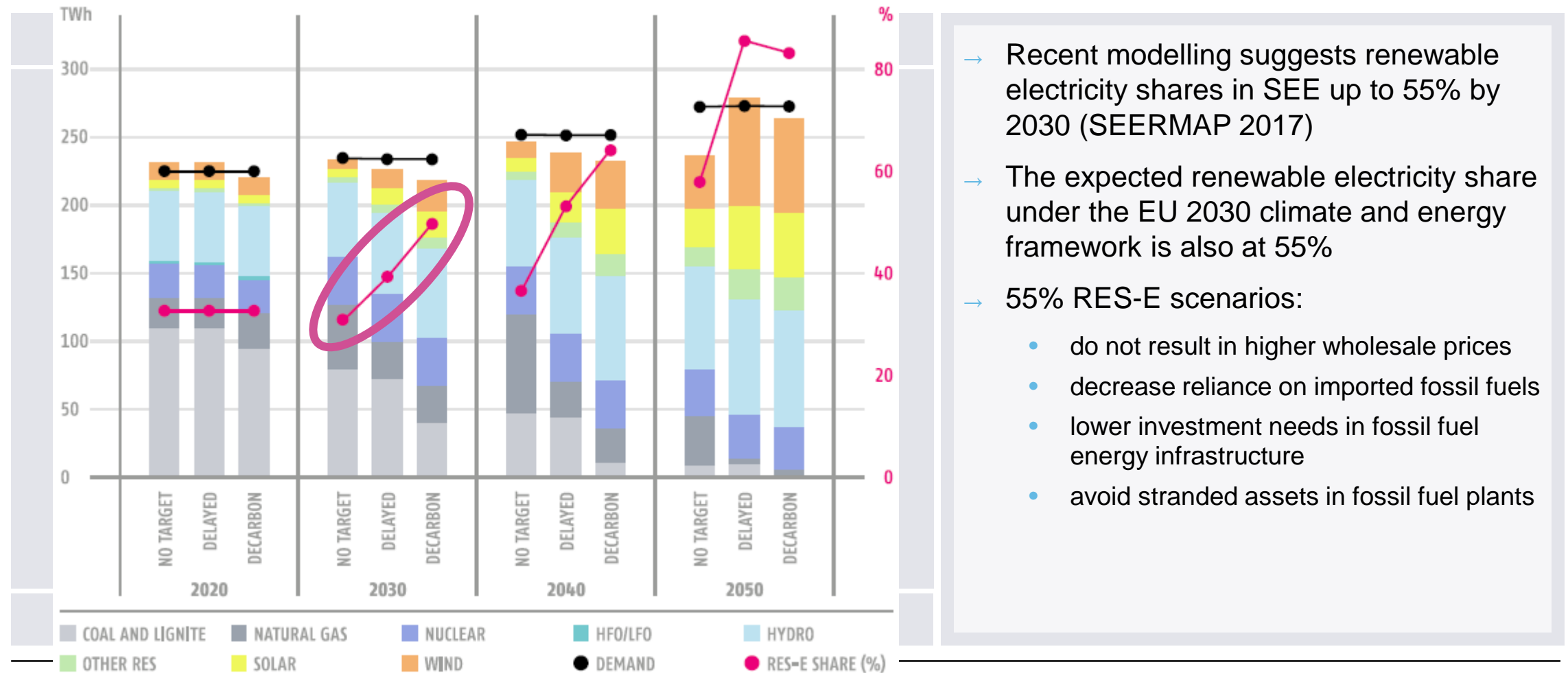
Christian Redl

VIENNA, 6 NOVEMBER 2018

RE Coordination Group, Energy Community



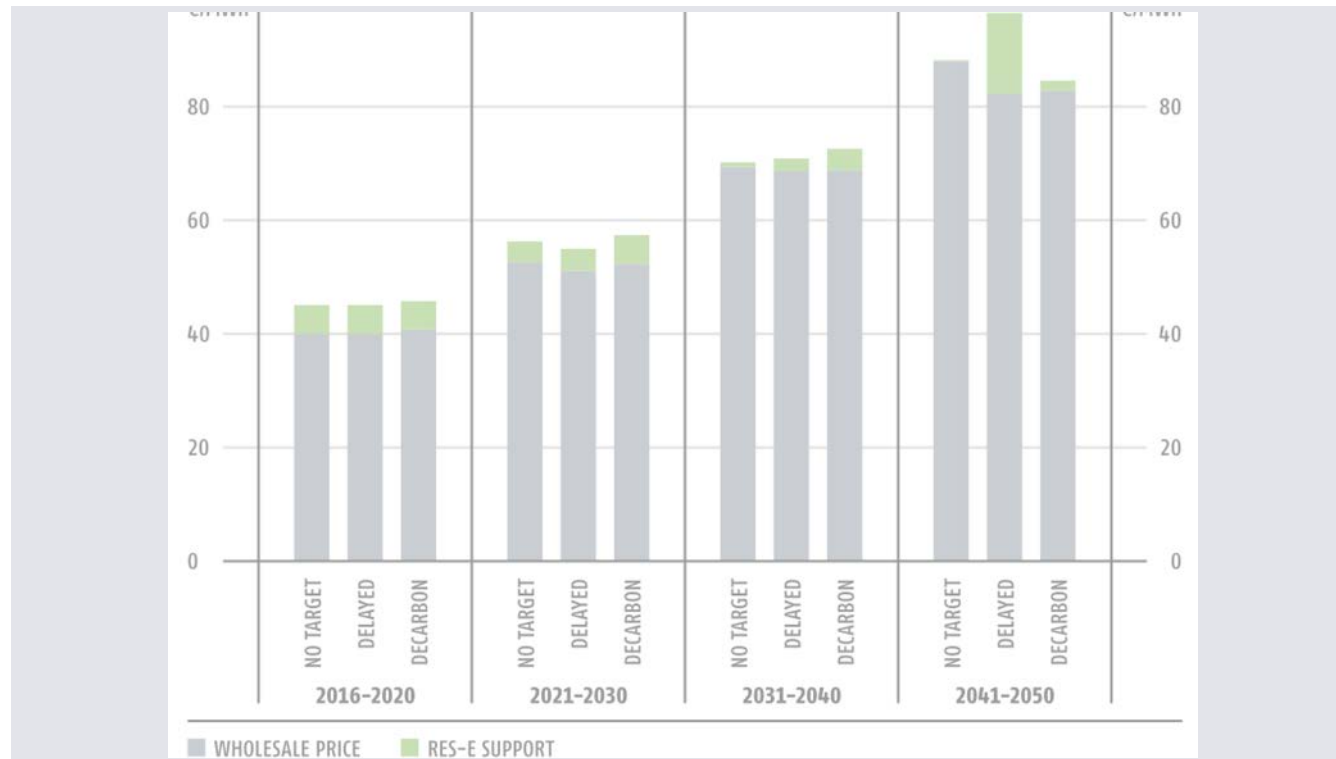
50% of installed SEE coal generation capacity to be replaced by 2030 → huge opportunity for SEE energy transition



- Recent modelling suggests renewable electricity shares in SEE up to 55% by 2030 (SEERMAP 2017)
- The expected renewable electricity share under the EU 2030 climate and energy framework is also at 55%
- 55% RES-E scenarios:
 - do not result in higher wholesale prices
 - decrease reliance on imported fossil fuels
 - lower investment needs in fossil fuel energy infrastructure
 - avoid stranded assets in fossil fuel plants

Decarbonisation of the electricity sector does not drive up wholesale electricity prices

Average RES support and average wholesale prices in SEE in EUR/MWh

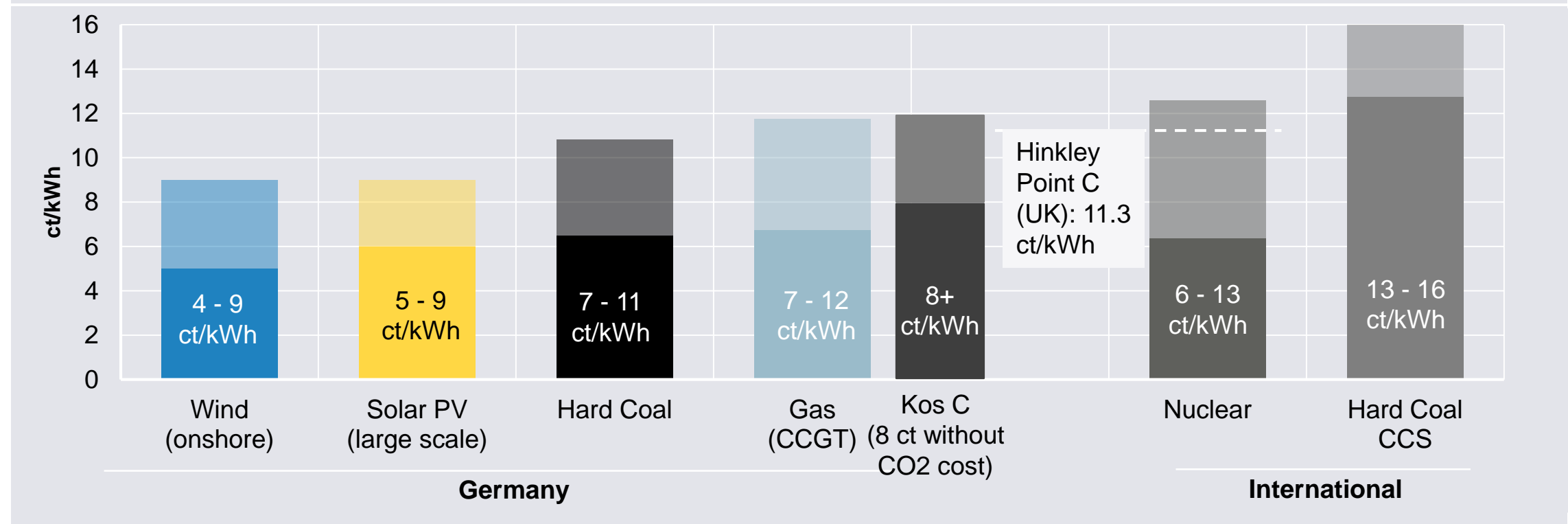


- Wholesale price of electricity follows a similar trajectory under all scenarios irrespective of the level of decarbonisation
- After 2045 higher RES penetration in the electricity mix reduces wholesale prices due to the low marginal cost of renewables
- Wholesale prices rise in all scenarios because of rising gas and CO2 prices
- RES support decreases in the 'decarbonisation' scenario despite increasing investment in RES capacities as rising wholesale electricity price reduces need for additional support and technology cost of RES fall over time

SEERMAP Regional report

Wind & PV are in many parts of the world the cheapest low-carbon option and cost competitive to new fossil power plants

Range* of levelized cost of electricity (LCOE) in 2016

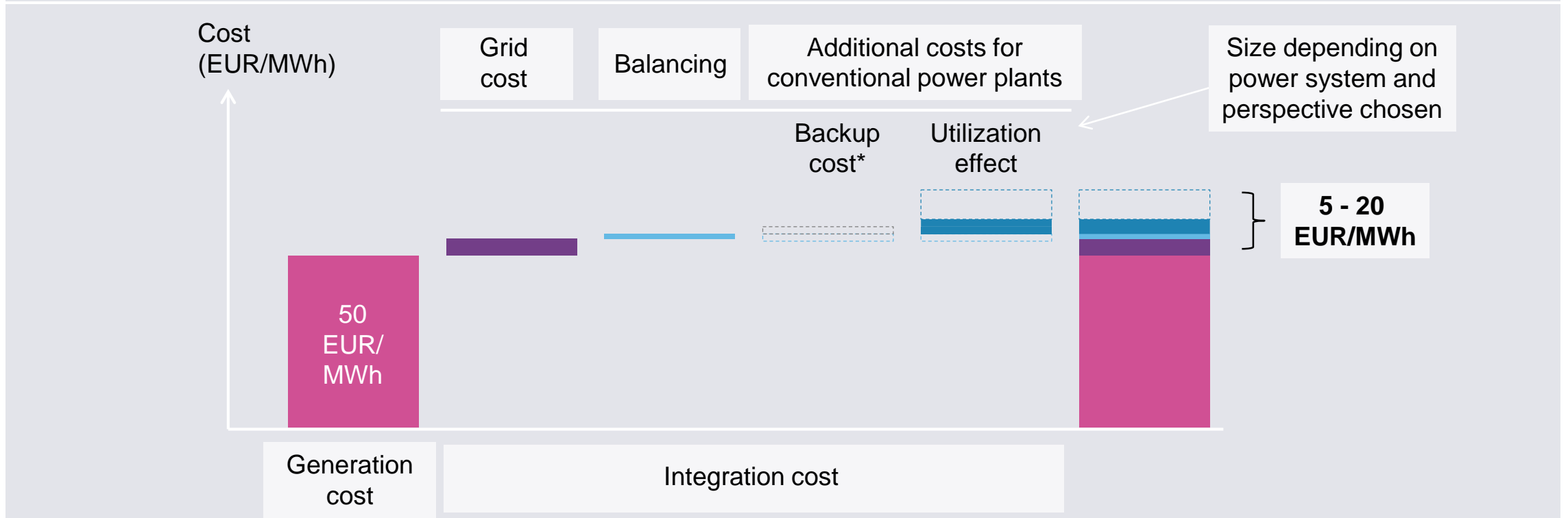


Agora Energiewende (2015, 2016)

* based on varying utilization, CO₂-price and investment cost

The integration cost of wind and solar (5 to 20 EUR/MWh) do not change the picture

Components of integration costs of renewables: Case study for a 60% RES-E German power system

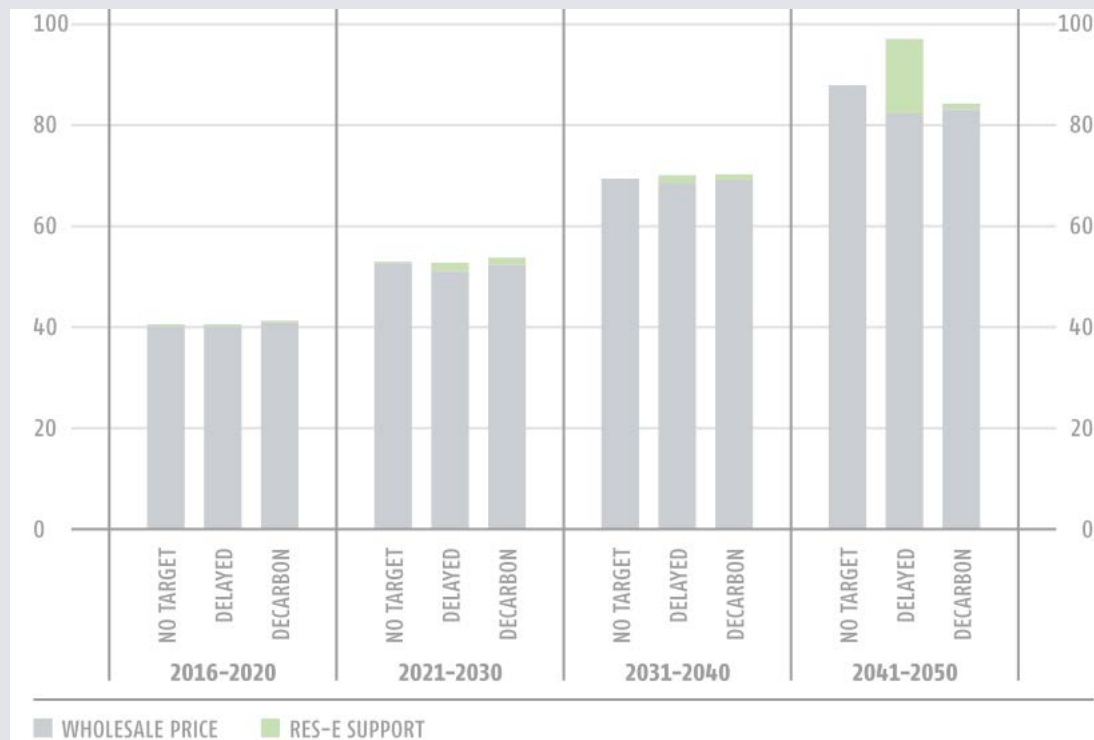


Agora Energiewende (2015a)

* part of utilization effect

RES do not increase the price of electricity

Average RES support and average wholesale prices in SEE in EUR/MWh in Macedonia

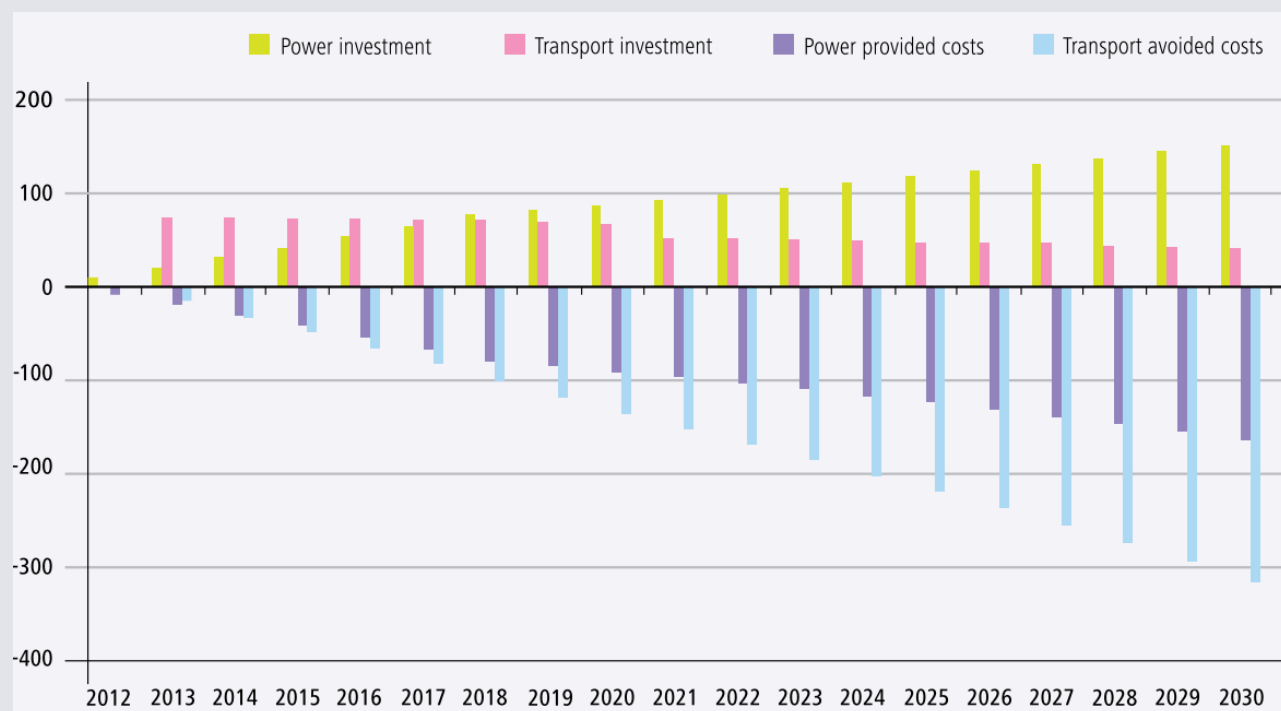


- Wholesale price of electricity follows a similar trajectory under all scenarios irrespective of the level of decarbonisation
- After 2045 higher RES penetration in the electricity mix reduces wholesale prices due to the low marginal cost of renewables
- Wholesale prices rise in all scenarios because of rising gas and CO2 prices
- Despite significant RES investment in 'decarbonisation' scenario, RES support remains low, from 0.4 EUR/MWh to below 2 EUR/MWh

SEERMAP Country report Macedonia

Case study Serbia: Benefits from transition to green economy in energy demand, supply, agriculture and transportation

Comparison of annual investments (positive values) and avoided costs (negative values) for power and transport in million EUR

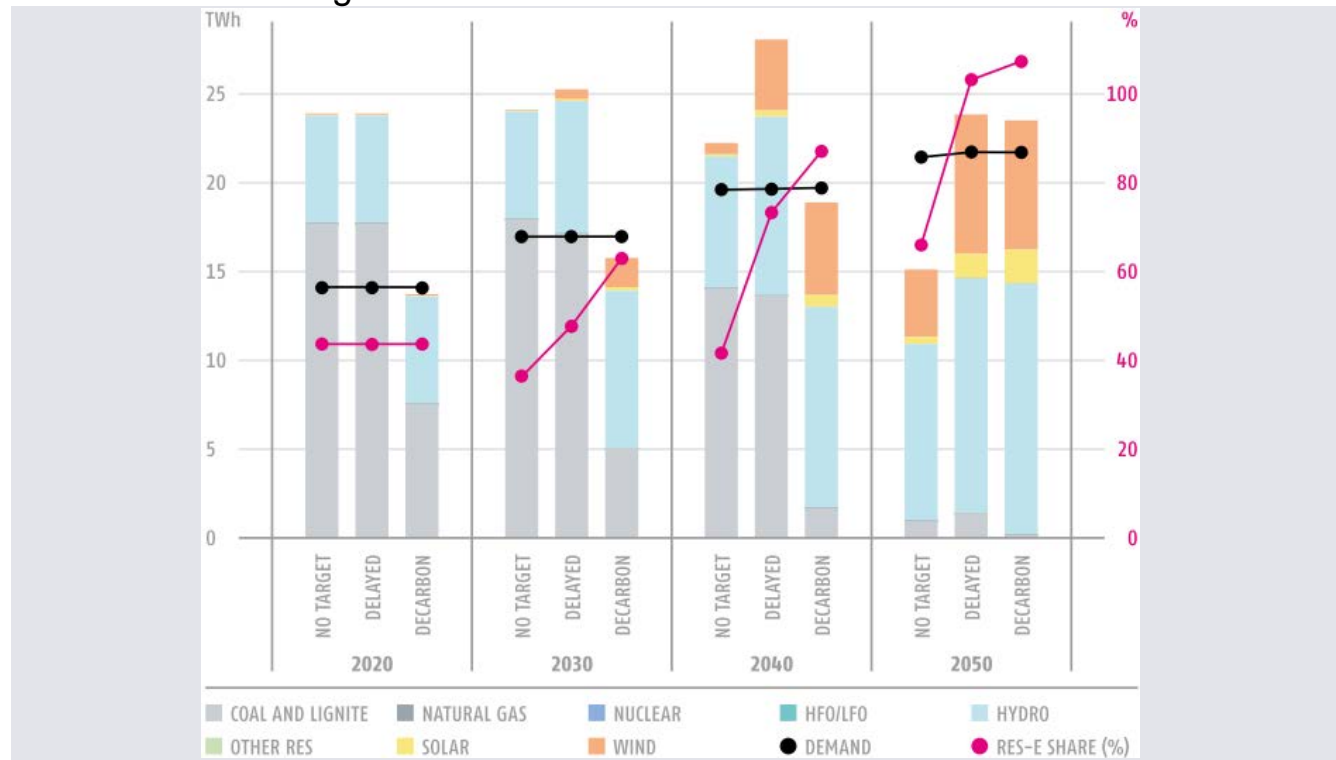


- Avoided costs from energy efficiency investments in residential, commercial and industrial sectors reach 170 million EUR in 2030
- Total cumulative avoided costs of 1.8 billion EUR from 2012 to 2030
- Average avoided costs of 95 million EUR per year, compared to 89 million EUR additional investment
- Residential, commercial and industrial sectors were projected to yield positive returns within three to five years
- Additional potential avoided health costs are not included

UNEP (2013): Green Economy Scoping Study: Serbia

High RES potential can cover energy demand

Electricity generation and demand (TWh) and RES share (% of demand) in Bosnia and Herzegovina

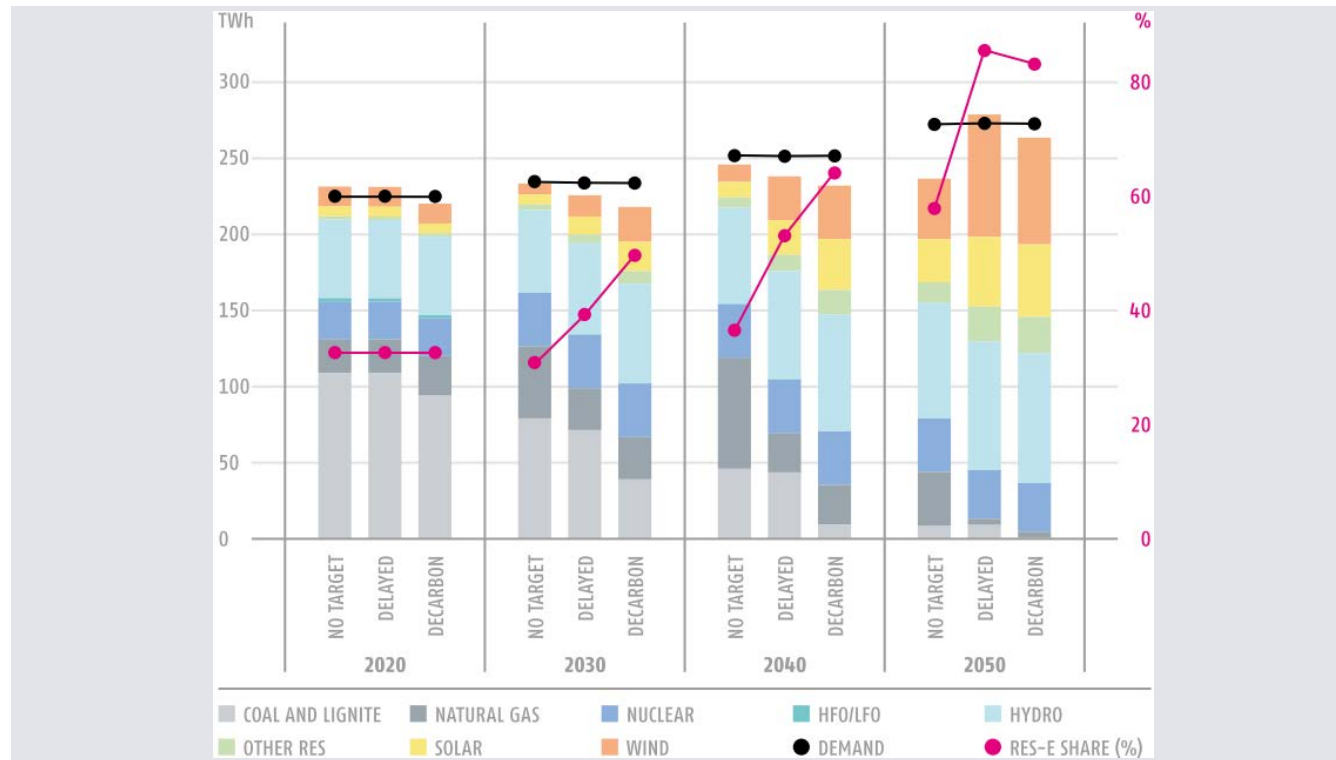


- In Bosnia and Herzegovina, more than 35% of current fossil fuel generation capacity is expected to be decommissioned by end of 2030 and nearly 85% by 2050
- Across all scenarios, Bosnia and Herzegovina will experience a significant shift away from fossil fuel-based electricity generation towards renewables
- RES-share as percentage of gross domestic consumption reaches 66% in the 'no target' scenario, 103% in the 'delayed' scenario and 107% in the 'decarbonisation' scenario by 2050

SEERMAP Country report BiH

Decarbonisation lowers the reliance on imported natural gas

Electricity generation and demand (TWh) and RES share (% of demand) in SEE

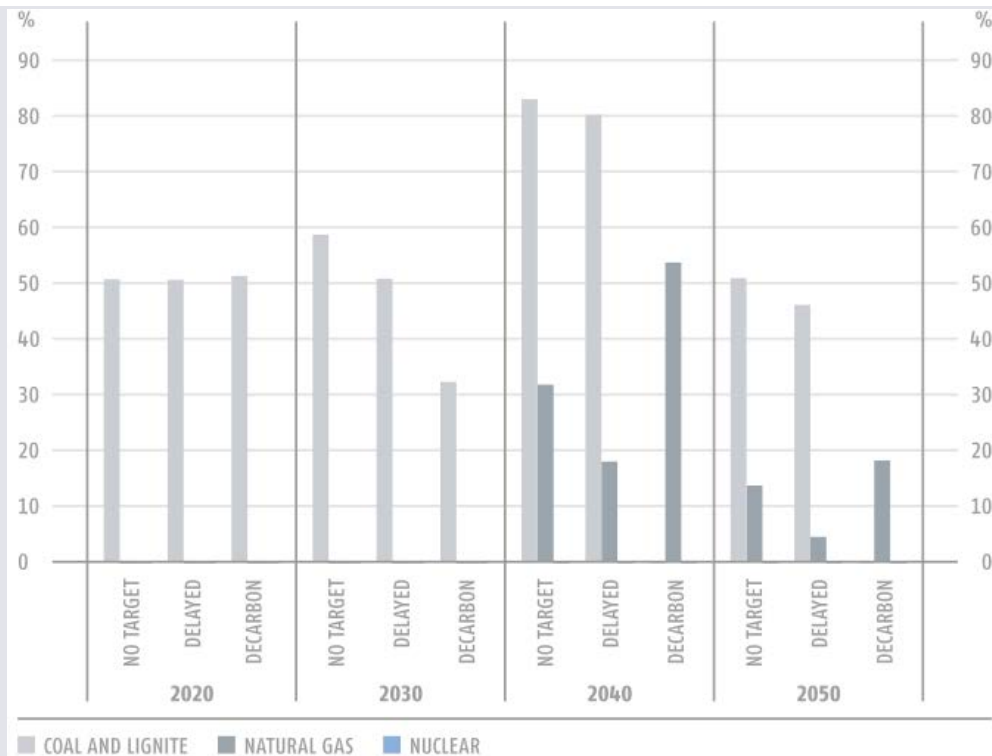


- In 'decarbonisation' scenario regional natural gas-based generation plays only minor role towards the end of the modelled period
- 1.5% of gas generation in 2050 in the decarbonisation scenario, while in the 'no target' scenario, gas still provides 15% of regional electricity generation in 2050 with peak production expected around 2035
- 8500 MW installed natural gas capacity for 'no target' and 2200 MW capacity for 'decarbonisation' scenario by 2050 in SEE
- In the 'decarbonisation' scenario total gas capacity declines from 2020 onwards
- Even without an increase in capacity, gas-based electricity generation is still sufficient to bridge the transition from fossil to renewable based electricity mix due to higher utilisation

SEERMAP Regional report

The share of baseload power plants will be much lower

Utilisation rate of conventional plants in Kosovo in %

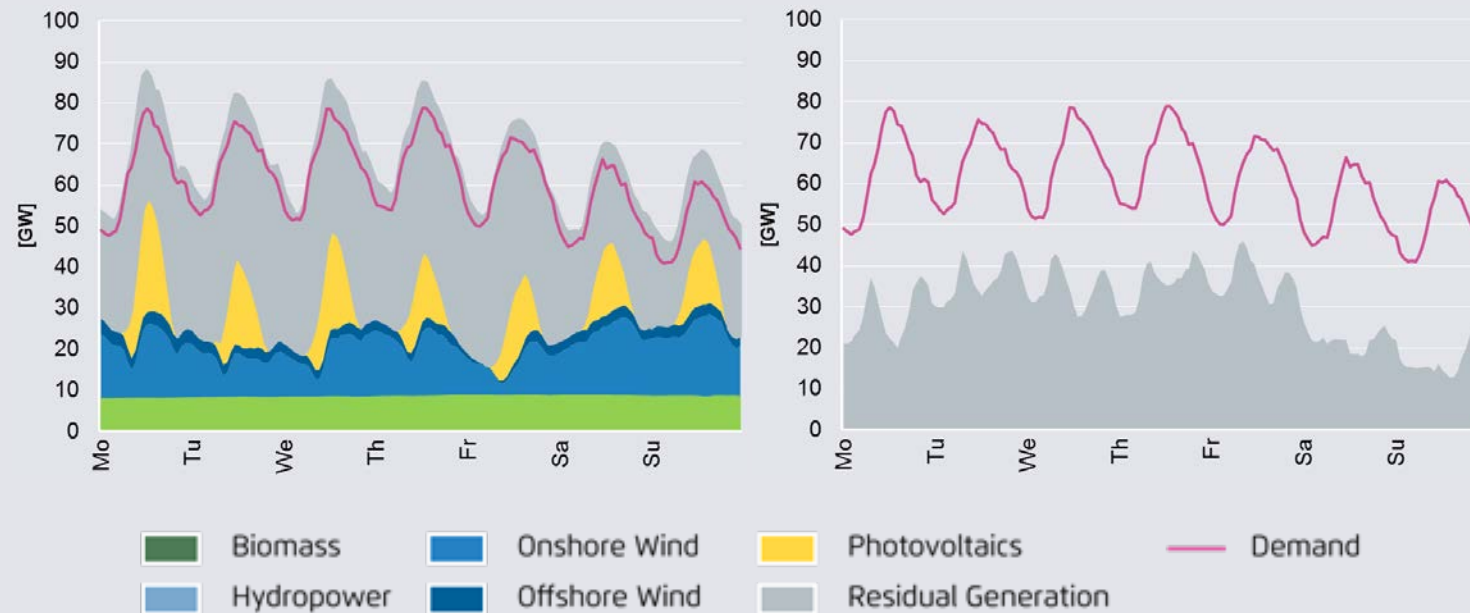


- Due to expected carbon price increases (around 30 EUR/tCO₂ by 2030), coal & lignite-electricity less competitive in future
- Newly built coal and lignite plants face significant sunk cost risks as their utilization will be below 50% in 2050
- These rates are lower than current levels (typically more than 70%). Utilization rates drop below commercial viability
- Investment costs of new coal & lignite plants cannot be earned back in the power market
- **Stranded costs** of new lignite plants:
- Kosovo: 7.8 EUR/MWh (no target scenario) to 8.1 EUR/MWh (delayed scenario)
- BiH: 7.3-7.6 EUR/MWh in all scenarios

SEERMAP Country report Kosovo

Flexibility is the paradigm of the new power system to cope with fluctuating wind and solar production

Power generation and consumption in Germany, 9 to 15 May 2016 (50% RES-E share)



Key flexibility options

Flexible fossil and bioenergy power plants (incl. CHP)

Electricity grid infrastructure (domestic and cross-border)

Demand Side Management

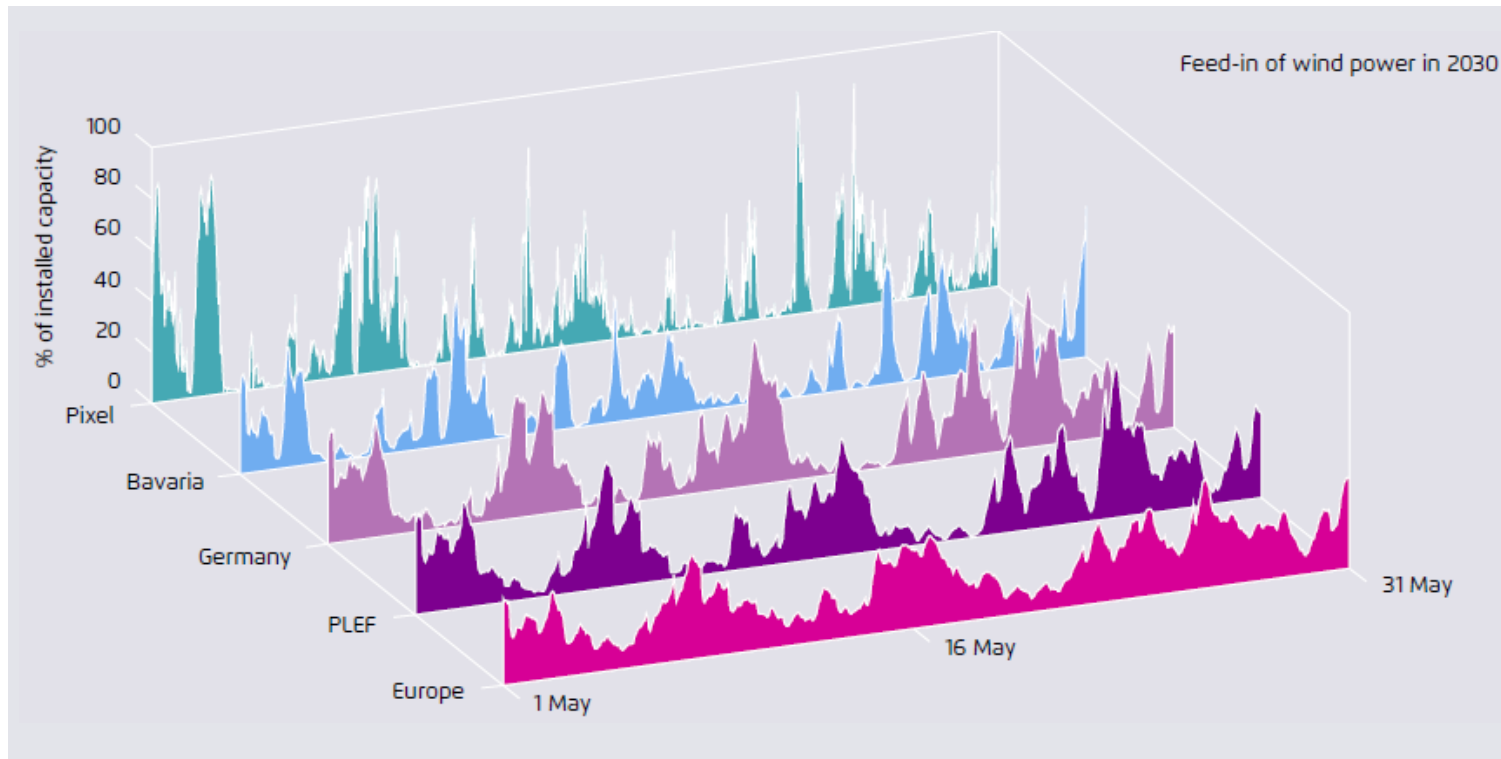
Storage technologies (Hydro storage, batteries)

Integration of the power, heat and transport sectors (P2H, electric mobility, P2G)

Agorameter

Cross-border cooperation between neighbouring countries significantly reduces the flexibility challenge

Time series of onshore wind generation in May 2030 at different levels of aggregation



Power system integration mitigates flexibility needs due to smoothing effects

Hourly wind ramps decrease by ~50% comparing the national and European scale

Reduced residual load gradients & balancing requirements; Minimised renewables curtailment

Cross border system integration key for minimising flexibility challenge

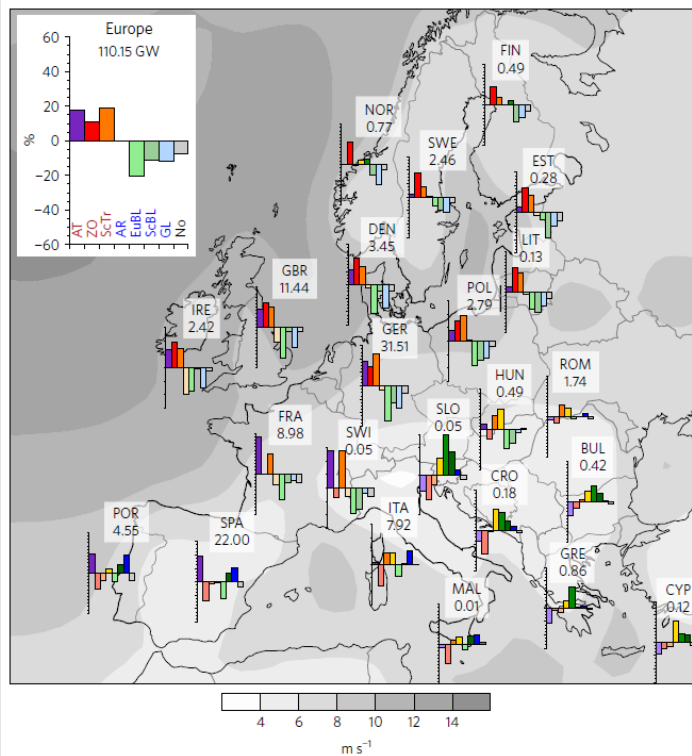
→ Grid interconnections, cooperation in system operations and market design

Fraunhofer IWES (2015)

* One pixel is equivalent to an area of 2.8 x 2.8 km; PLEF are the countries AT, BE, CH, DE, FR, LU, NL

Regional cooperation increases security of supply

Weather-regime-dependent change in wind electricity generation



Enhanced regional cooperation enhances power system security of supply at lower costs

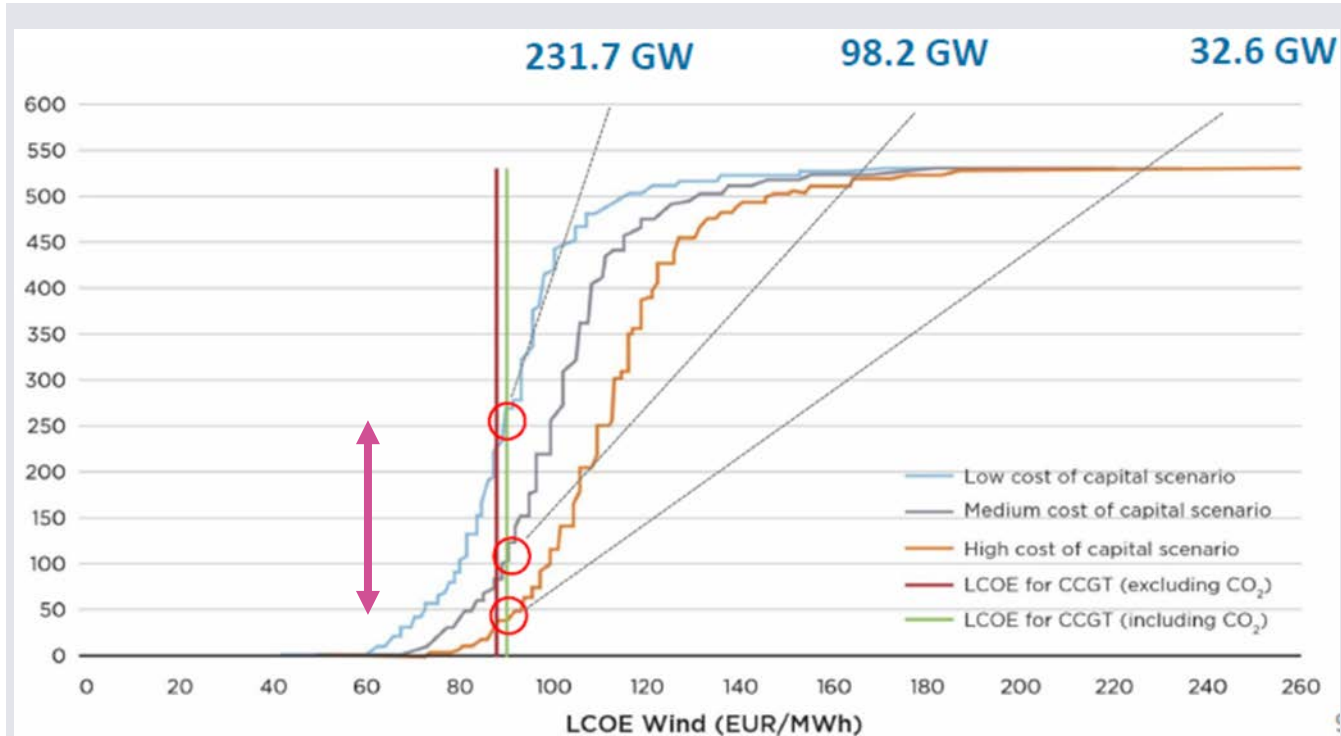
Regional cooperation:

- Maximises system adequacy
- Balancing weather patterns with benefits not only for South-East Europe but for Europe as a whole
- Allows for coordinated (and efficient) grid infrastructure development

Grams et al. (2017)

Preconditions for the clean energy transition in SEE

Cost-competitive wind potential in SEE as a function of cost of capital



IRENA (2017)

South-East Europe has a high renewable energy potential (IRENA 2017)

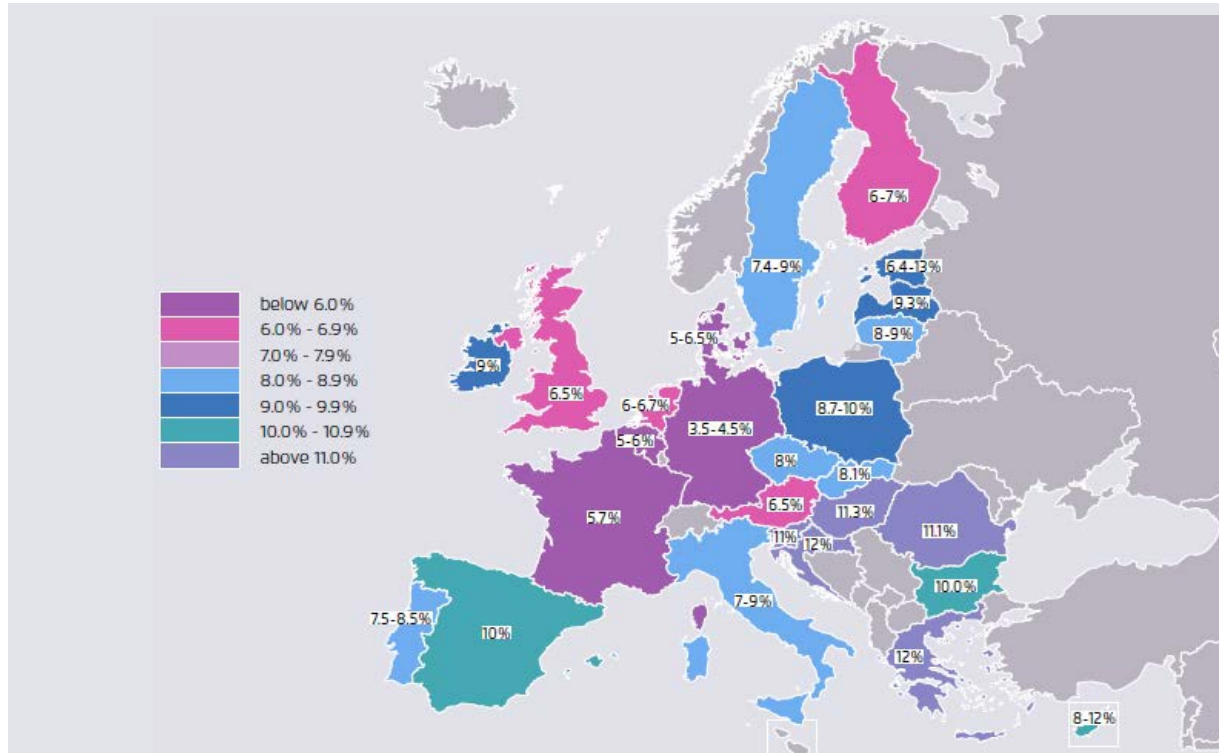
To maximize RES-related opportunities (economic, health, climate, security etc), decision-makers should prioritise:

- **Removing regulatory barriers and lowering financing risks** for renewable energy projects
- **Robust climate & energy planning** to reduce costs and identify the most salient transition challenges lying ahead

Regional cooperation helps meeting the related challenges

Challenge #1: Robust frameworks and smart financing for renewables to benefit from low renewable technology costs

Cost of capital estimations for onshore wind projects in Europe in 2014



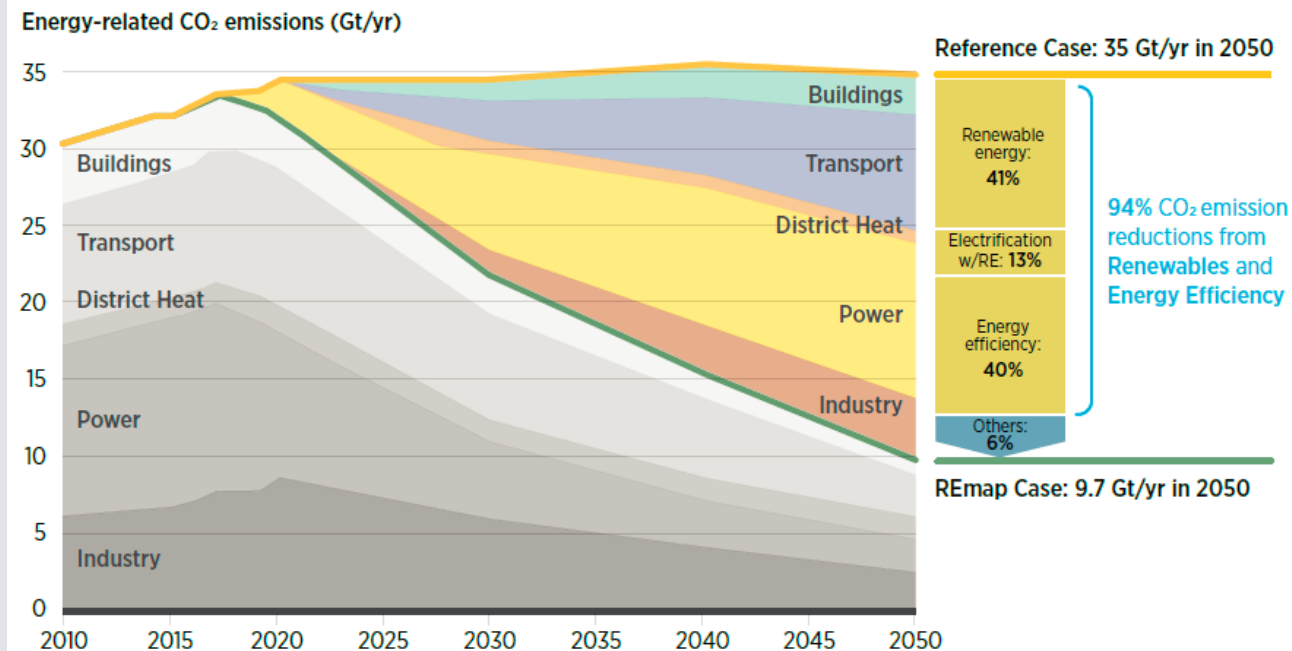
DiaCore (2016)

Renewable energy is now cheaper than coal when investing in new power capacity – if there is a robust regulatory framework and smart financing helps to reduce costs

Opportunities:

- Robust implementation of the EU RES Directive and related best practices
- Use of new financing opportunities under the Multiannual EU Budget 2021-2027
 - “De-risking” renewable energy investments
 - Renewable energy projects of European interest
 - EU renewable energy financing mechanism

Challenge #2: Integrated national energy & climate plans are key opportunity to discuss how to address linked challenges of energy security, competitiveness & climate change



IRENA 2018

The Energy Union Governance Regulation obliges EU Member States to develop integrative national energy and climate plans. The Energy Community countries also engage in this exercise. Developing NECPs is a key opportunity. They must not become desktop-study exercises!

Opportunities from regional cooperation:

- Exchange on topics that reach beyond borders (e.g., infrastructure development)
- Best practices for an inclusive and informed process in developing integrated plans
- Partnerships in mastering the technical challenges involved in long-term and mid-term strategies

Summing up: Wind and solar are now cheap technologies. In many places of the world they are the lowest-cost option for power production





- In places with good wind and or solar conditions, power production costs are now at 2-3 ct/kWh
- Even where there is not much sun (like in Germany or Denmark), new solar is now cheaper than new coal/gas
- **Key requirement:** Low capital costs, as cost structure of wind and solar has low share of operating costs but high share of investment costs
- **Challenge:** Regulations were designed for the old power systems (coal, gas) & are now blocking progress

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Thank you for your attention!

Questions or Comments? Feel free to contact me:
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Agora Energiewende is a joint initiative of the Mercator
Foundation and the European Climate Foundation.



This presentation was created within the framework of the project “Western Balkans Energy Transition Dialogue (WeBET Dialogue) <https://www.agora-energiewende.de/en/projects/western-balkans-energy-transition-dialogue/>



Donor: Austrian Federal Ministry of Sustainability and Tourism

Implementing organisation: Agora Energiewende, Germany

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