

'decarbonisation' scenario, electricity expenditure is around 10% lower compared to the 'baseline' towards the end of the modelled time horizon. Finally, there is only a small increase in the 'no target' scenario compared to the 'baseline', reflecting slightly higher real wholesale electricity prices.

6 | Policy conclusions

The modelling work carried out under the SEERMAP project identifies some key findings with respect to the different strategic choices in the electricity sector that countries in the SEERMAP region can take. We review these findings and suggest some policy relevant insights. **The analysis has uncovered robust findings relevant for all scenarios, from which no regret policy options can be identified.**

MAIN POLICY CONCLUSIONS

Regardless of whether or not countries in the SEERMAP region pursue an active policy to decarbonise their electricity sector, a significant shift from fossil fuels to renewables will take place:

- Countries in the SEERMAP region will, due to aging power plants, need to replace around 95% of their existing fossil fuel generation fleet by 2050;
- Results show that the replacement of current capacities will result in a large increase of renewable and disappearance of fossil based generation, with the exception of natural gas;
- The renewable share is almost 60% in the 'no target' and more than 80% in the 'delayed' and 'decarbonisation' scenarios in 2050;
- Lignite electricity generation will account for only 3-4% by 2050 in all scenarios, regardless of active renewable policies;
- Natural gas plays a transitional role on the path towards low carbon generation;
- The high penetration of renewables in all scenarios suggests that energy policy, both at the national and regional level, should focus on enabling RES integration;
- High renewable penetration does not compromise regional energy security.

Decarbonisation is worth it:

- The 'decarbonisation' scenario demonstrates that it is technically possible to reach decarbonisation targets suggested by the EU 2050 Roadmap in the SEERMAP region due to high RES potential;
- Decarbonisation does not drive wholesale prices up relative to other scenarios with less ambitious RES policies, but on the contrary, it reduces them after 2045;
- The macroeconomic analysis shows that despite the high absolute increase in wholesale electricity prices, household electricity expenditure relative to household income will only increase slightly, this increase is unavoidable in the 'no target' scenario as well;
- Decarbonisation reduces the cost of stranded investments by more than 75% from 2.5-2.6 EUR/MWh to 0.6 EUR/MWh in the region as a whole;
- The 'decarbonisation' scenario enables the region to reduce its reliance on imported fossil fuels, in particular natural gas, compared with the 'no target' scenario;

- Decarbonisation will require a significant increase in investment needs from about 83 bn EUR to about 128 bn EUR over the 35-year period under various scenarios, however:
 - ▶ Scenarios with a decarbonisation target exhibit higher GDP growth as well as higher employment levels;
 - ▶ Increased investment needs are balanced by reduced electricity and fuel imports resulting in a negligible positive effect on the fiscal balance and current account;
 - ▶ External debt is found to decrease by 4% over the long term in the region.
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6.1 Main electricity system trends

The SEERMAP region will need to replace more than 30% of its current fossil fuel based generation capacity by the end of 2030, and more than 95% by 2050. This provides both a challenge in terms of the need to ensure a policy framework which will result in the necessary new investment, but also an opportunity to shape the electricity sector over the long term without being constrained by the current capacity mix.

Whether or not countries in the region pursue an active policy to support renewable electricity generation, a significant replacement of fossil fuel based generation capacity will take place; coal and lignite based generation phase out gradually under all scenarios due to the increasing carbon price and oil disappears from the electricity mix by 2030.

Under scenarios with an ambitious decarbonisation target and corresponding RES support schemes, the region will have an electricity mix with around 83% renewable generation, mostly hydro and wind, and a significant share of solar by 2050. If renewable subsidies are phased out and no CO₂ emission target is set, as assumed in the 'no target' scenario, the share of RES in electricity consumption will reach approximately 58% in 2050, a significant increase on current levels.

The high penetration of RES in all scenarios suggests that a robust no-regret action for countries in the SEERMAP region is to focus on enabling RES integration. This involves:

- investing in transmission and distribution networks including cross border capacities,
- enabling demand side management and RES generation through a combination of technical solutions and appropriate regulatory practices, and
- promoting investment in storage solutions including those with regional relevance such as pumped hydro as well as small scale storage.

Natural gas will remain a relevant fuel source over the coming decades, with its utilisation for electricity generation growing in all scenarios initially. However, under a 'decarbonisation' scenario in line with the EU indicative decarbonisation target of 93-99% for the electricity sector, **the role of natural gas is transitory**, as gas plays only a very minor role by 2050. In this scenario total gas capacity decreases after 2020 new capacity does not fully replace outgoing capacity. This decreasing capacity is still sufficient to bridge the transition from fossil to renewable based electricity mix between 2025 and 2035 with higher utilisation rates. Under a scenario with no emission reduction target gas remains relevant even in 2050, but gas based generation peaks around 2035. In all scenarios gas capacity is concentrated in the EU3 countries.

If significant investments are made in gas based generation and infrastructure (as well as in coal based generation) this may result in stranded assets. Choosing to decarbonise the electricity sector with long term emission reduction targets in mind, as demonstrated by the 'decarbonisation' scenario, enables a 75% reduction of stranded costs in fossil based generation, but poses challenges such as addressing high RES penetration and increased investment needs.

Delayed action on renewables is feasible, but it has two disadvantages compared with a long term planned effort. It results in stranded assets in fossil based generation, including power plants which are currently planned. Translated into a price increase equivalent over a 10 year period, the cost of stranded assets is on par with the size of RES support needed for decarbonising the electricity sector. Assuming delayed action, **the disproportionate effort needed towards the end of the modelled period to enable the CO₂ emissions target to be met means a significant increase in RES support will be required.**

6.2 Security of supply

In both scenarios with a decarbonisation target, by the end of the modelled period the SEERMAP region produces approximately the same amount of electricity as it consumes. Generation and system adequacy indicators remain favourable; installed generation capacity within the region is sufficient to satisfy regional demand in all seasons and hours of the day throughout the modelled period.

However, there are differences between countries within the region. Analysis shows that, in particular, scenarios with a decarbonisation target in 2050 can result in negative generation adequacy for certain countries. In these countries increasing the generation adequacy margin to ensure that demand can be met at all times with domestic capacities would require additional investment in new capacities. This highlights the **importance of regional market integration and increasing the capacity of interconnections as a way of reducing generation investment costs** in scenarios with high shares of renewable generation.

In order to address intermittency associated with significant shares of the installed generation capacity, the region should work on the no regret measures to enable a high share of RES penetration without compromising security of supply, involving demand side measures, increased network connections and storage solutions.

The 'decarbonisation' scenario enables the region to significantly reduce its reliance on imported fossil fuels, in particular natural gas, by the end of the modelled period.

The network modelling results suggests that the need for transmission network investments are insignificant compared to the RES investment level. The present network assessment, however, does not provide any information on the investment need at distribution level.

6.3 Sustainability

The SEERMAP region has a high renewable potential, especially wind, hydro and solar which can be reaped through policies eliminating barriers to RES investment. **An important no-regret step involves de-risking policies addressing high financing cost and high cost of capital.** This would allow for cost-efficient renewable energy investment. Options for implementing regional level de-risking facilities may also be considered.

Regional cooperation towards the realisation of RES targets can significantly lower necessary RES support costs and reduce investment needs. A regional approach to renewables is therefore recommended, but in order to reach a win-win outcome for all involved countries, corresponding regional support mechanisms could also be explored.

6.4 Affordability and competitiveness

Decarbonisation of the electricity sector does not drive up wholesale electricity prices compared to a scenario where no emission reduction target is set. The wholesale price of electricity is not driven by the level of RES integration but by the CO₂ price, which is applied across all scenarios, and the price of natural gas, because natural gas based generation is the marginal plant needed to meet demand in a significant number of hours of the year.

The wholesale price of electricity follows a similar trajectory under all scenarios and only diverges after 2045. After this year, the wholesale electricity prices are lower in scenarios with high levels of RES in the electricity mix due to the low marginal cost of RES electricity generation.

The steady rise in wholesale electricity price has implications for affordability as it will likely translate into end user prices, but also helps to attract needed investment to replace outgoing capacity. Increasing electricity prices can be observed in the entire SEE region, and in fact all of the EU, in all scenarios for the modelled time period. In addition, **the macroeconomic analysis shows that despite the high absolute increase in wholesale prices, household electricity expenditure relative to household income is expected to increase only slightly in all scenarios due to a strong growth in household disposable income.**

Decarbonisation will necessitate a very significant increase of investment in generation capacity. These investments are assumed to be financed by private actors who accept higher investment costs in exchange for lower operation (including fuel) and maintenance costs when making their investment decisions. From a social point of view, the high level of investment in the 'delayed' and 'decarbonisation' scenarios has a positive impact on GDP and a small positive impact on employment. At the same time, the external debt decreases by 8% of GDP in the long term as a result of the displacement of electricity and gas imports by a higher share of renewables, which improves the current account compared with the 'baseline' scenario.

Although not modelled, **wholesale price volatility of electricity is also expected to increase, ceteris paribus, in a world with a high share of intermittent renewables. Demand side measures and supply side measures such as increased storage capacity can constitute an appropriate policy response.** Over the long term policy decisions will need to be made on how to deal with price volatility, and what the acceptable level of price volatility is considering the costs of supply and demand side measures.

High initial investment needs for RES technologies imply that the profitability of the investment is very sensitive to the cost of capital, which is significantly higher in the SEE region than in the Western European member states, especially in Greece. Although much of the value of the cost of capital depends on country risk linked to the general macroeconomic conditions, **the cost of capital can be decreased to some extent through interventions by policy makers, first by ensuring a stable policy framework and second by putting in place de-risking measures. As outlined above, such measures are a no-regret step, as they yield minimal system costs and consumer expenditures.**

The need for RES support is limited by increasing electricity wholesale prices which incentivise significant RES investment even without support. At the level of the region on average auctioning revenues are more than sufficient to cover RES support needs, and although country level results differ, in all countries a potentially significant share of the RES support needed for decarbonisation of the electricity sector can be covered from EU ETS revenues. This can lower the burden of a high RES share on consumers. **The need for long term RES support highlights the need for long term evidence based policy planning**, to provide investors with the necessary stability to ensure that sufficient renewable investments will take place.