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Energy Strategy & E-Mobility

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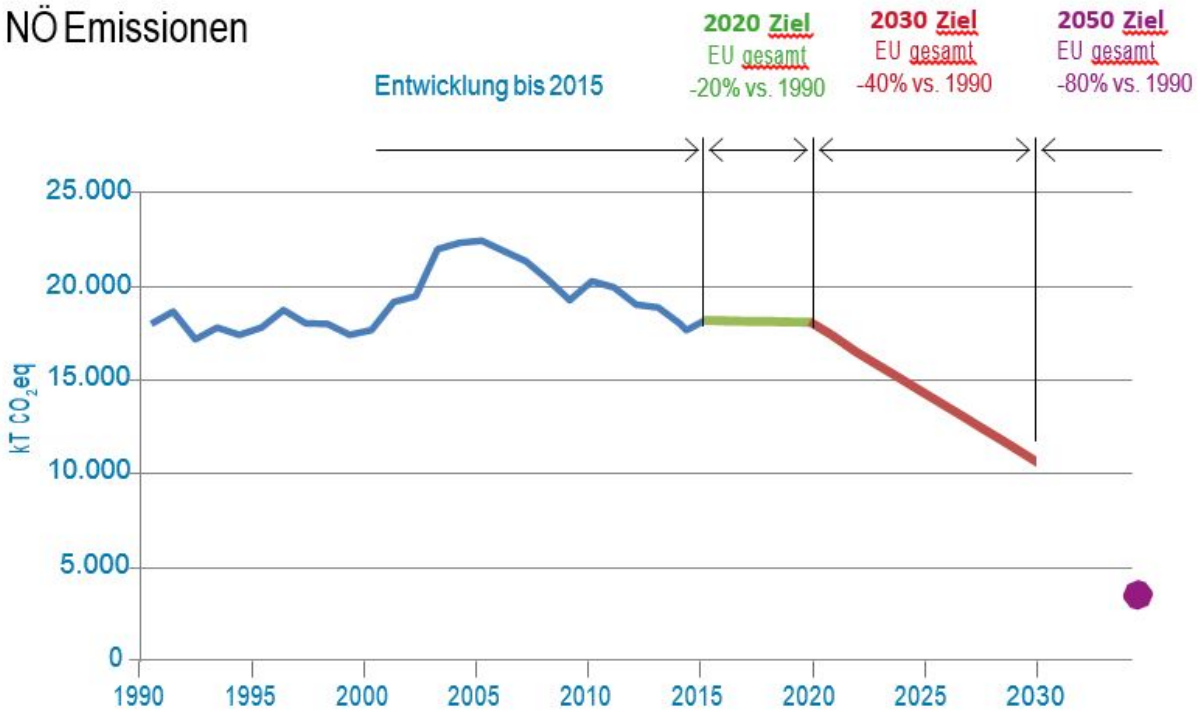
Example Niederösterreich 2050

Durnstein Niederösterreich | Source: Chris De Wit, www.goodfreephotos.com

NÖ Climate plan

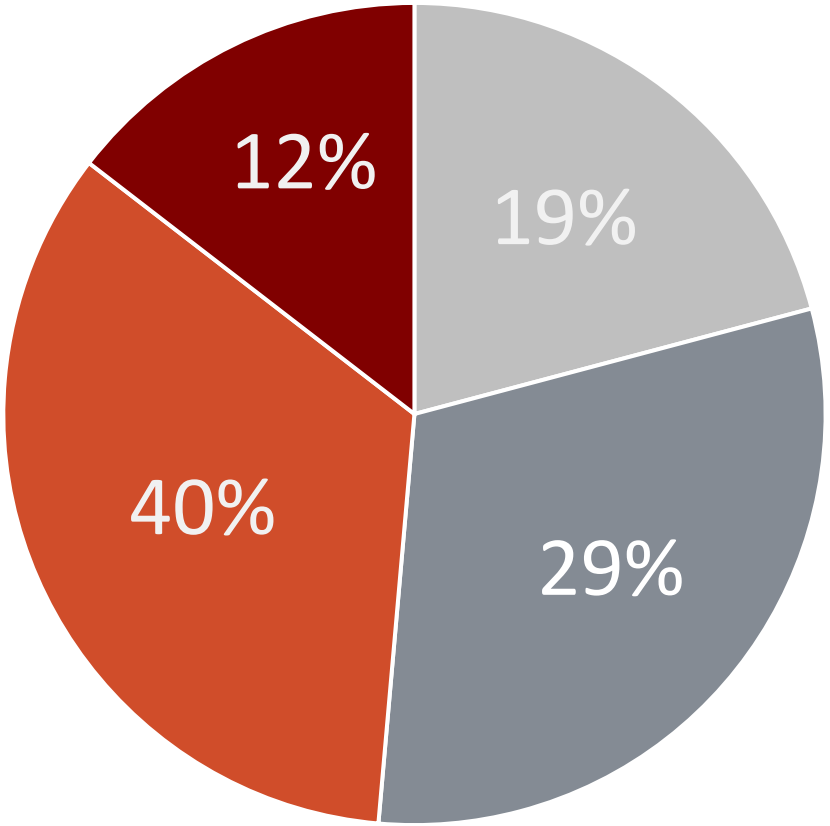
Target

-80% emissions
at 2050 in respect
to value of 1990



Source: Klima- und EnErgiEprogramm, November 2017

Final energy consumption* in Niederösterreich: 2016



Heat
19.9 TWh

Transport
22.2 TWh

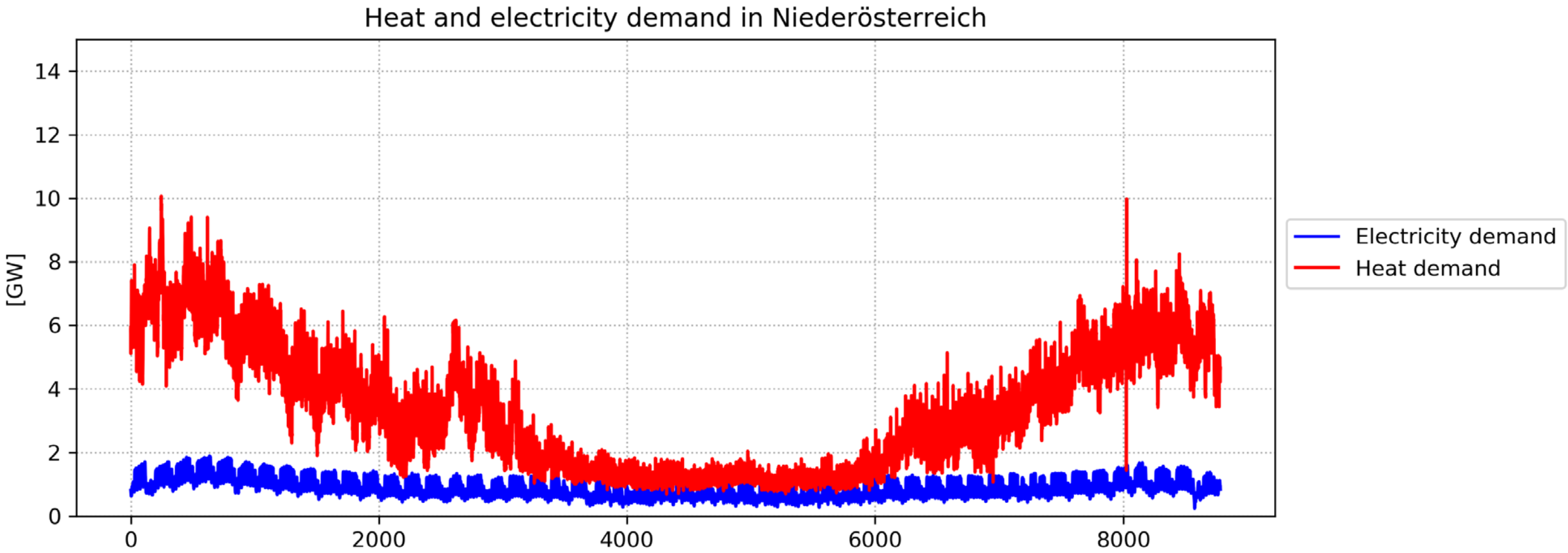
Electricity
13.6 TWh

Industrial heat
9.5 TWh

Total final energy consumption
65.1 TWh

*Including distribution losses and consumption of the energy system itself for heat fuels and electricity

Comparison of heat and electricity demand profiles



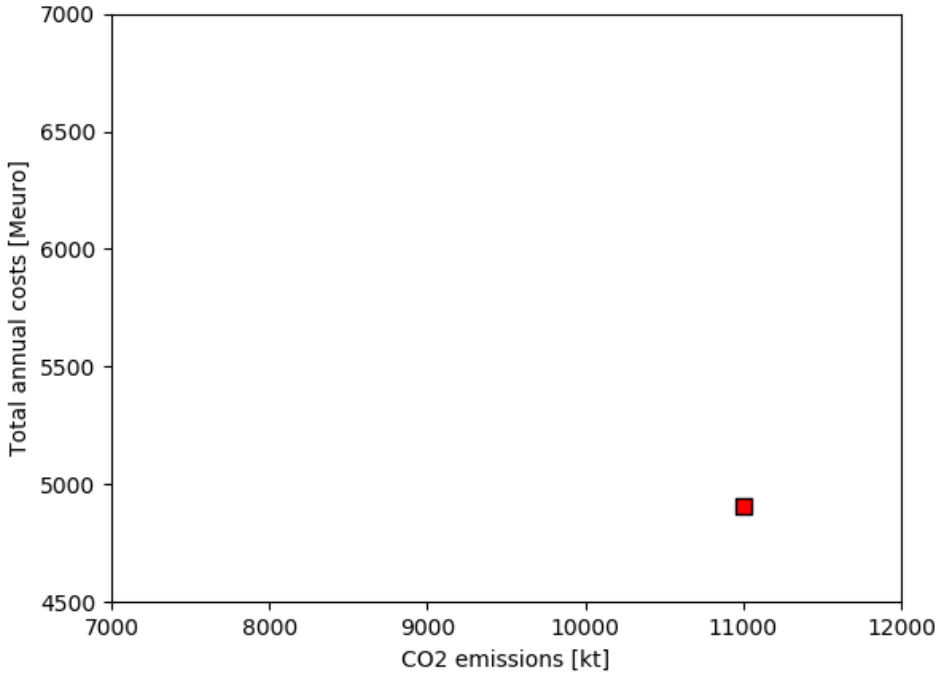
The heat demand peak in Lower Austria (as in most EU regions) is significantly higher than the electric power peak and subject to significantly greater fluctuations

Comparison of heat and electricity demand (electricity and heat demand of the industry sector are not included)

Optimization model of the energy system

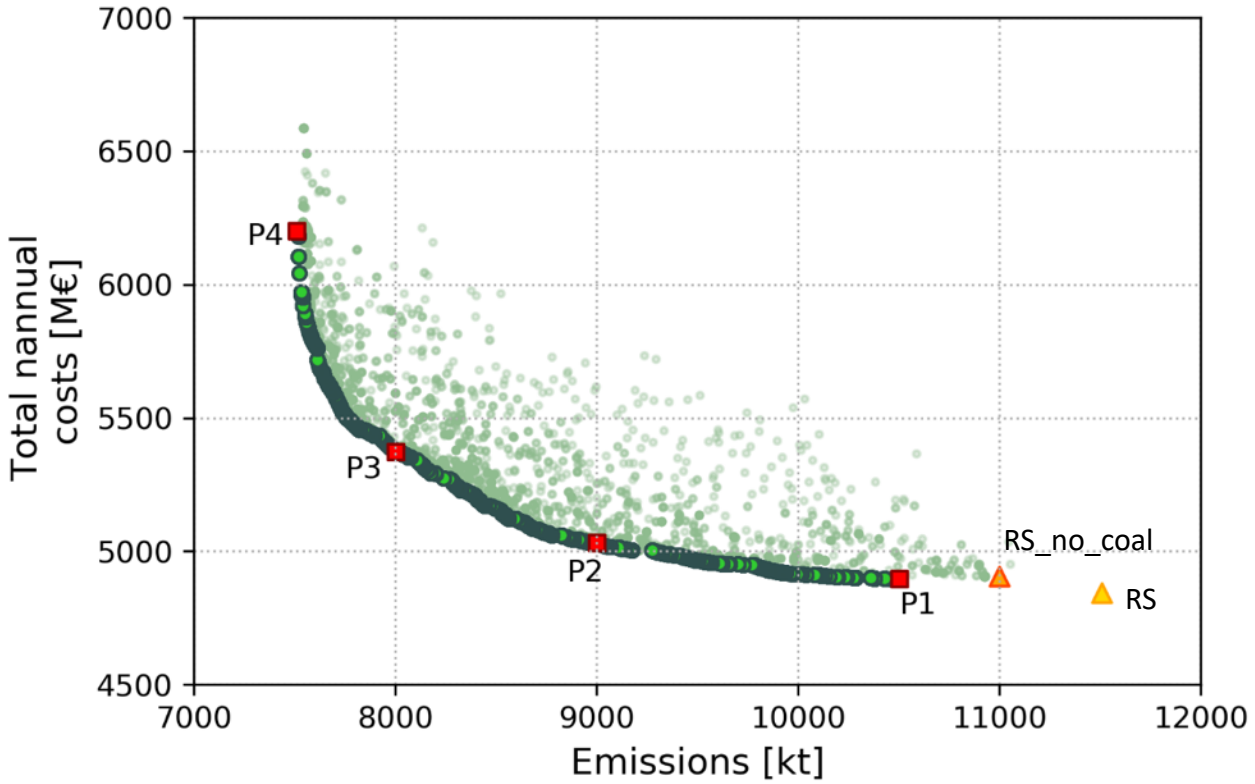
Model n objectives - Eurac Research

Simulation model		Optimization model
EnergyPLAN (Aalborg University)	+	Multi objective evolutionary algorithm MOEA



The energy model consists of a coupling of the entire energy system simulation model EnergyPLAN and an optimization algorithm. The algorithm tries to find the combination of technologies that reduces CO_2 emissions and costs.
Each point in the graph represents the total cost and total annual CO2 emissions of a specific combination of technologies of the energy system.

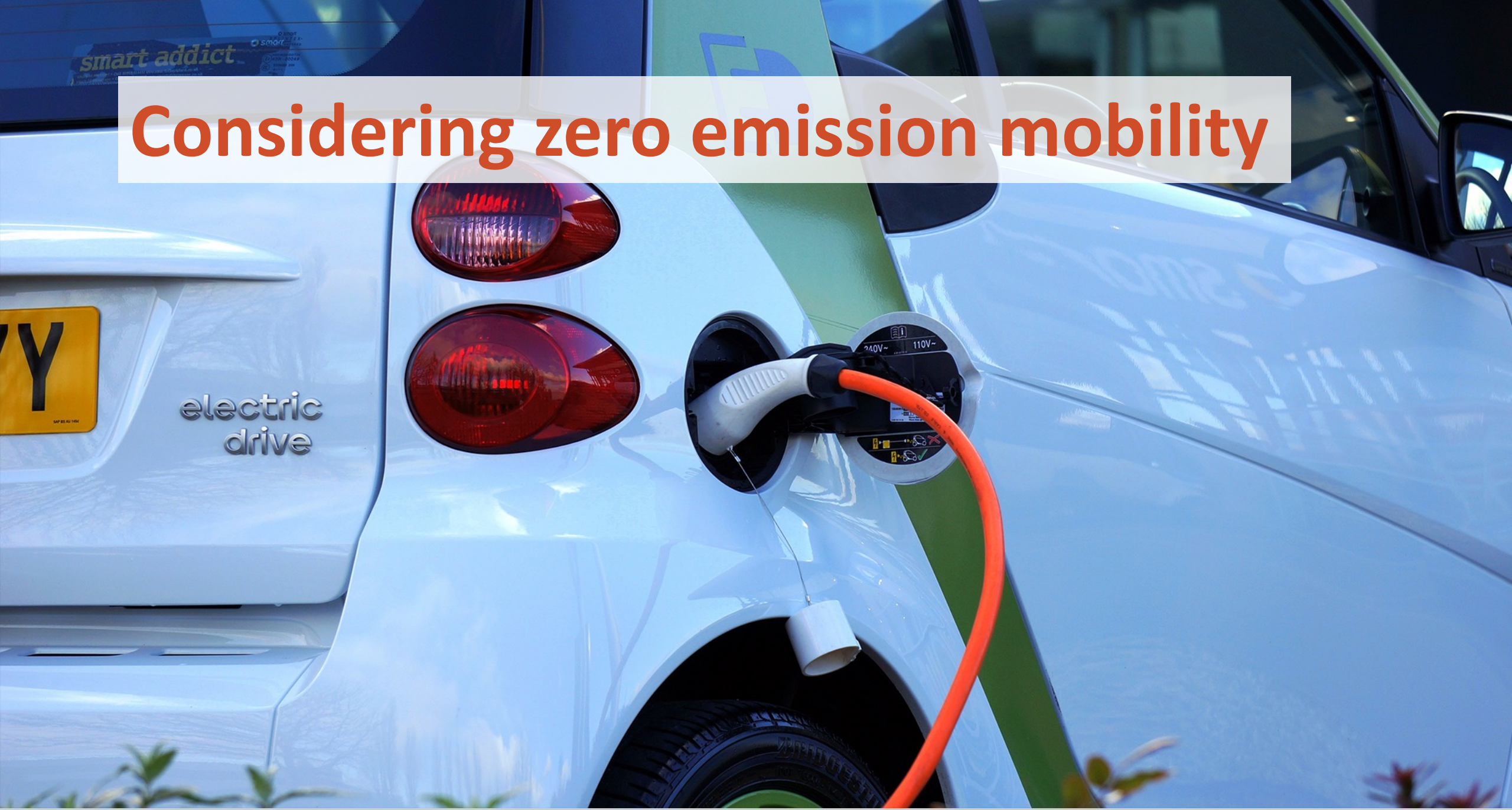
Results of system simulation by optimizing the power and heat sectors



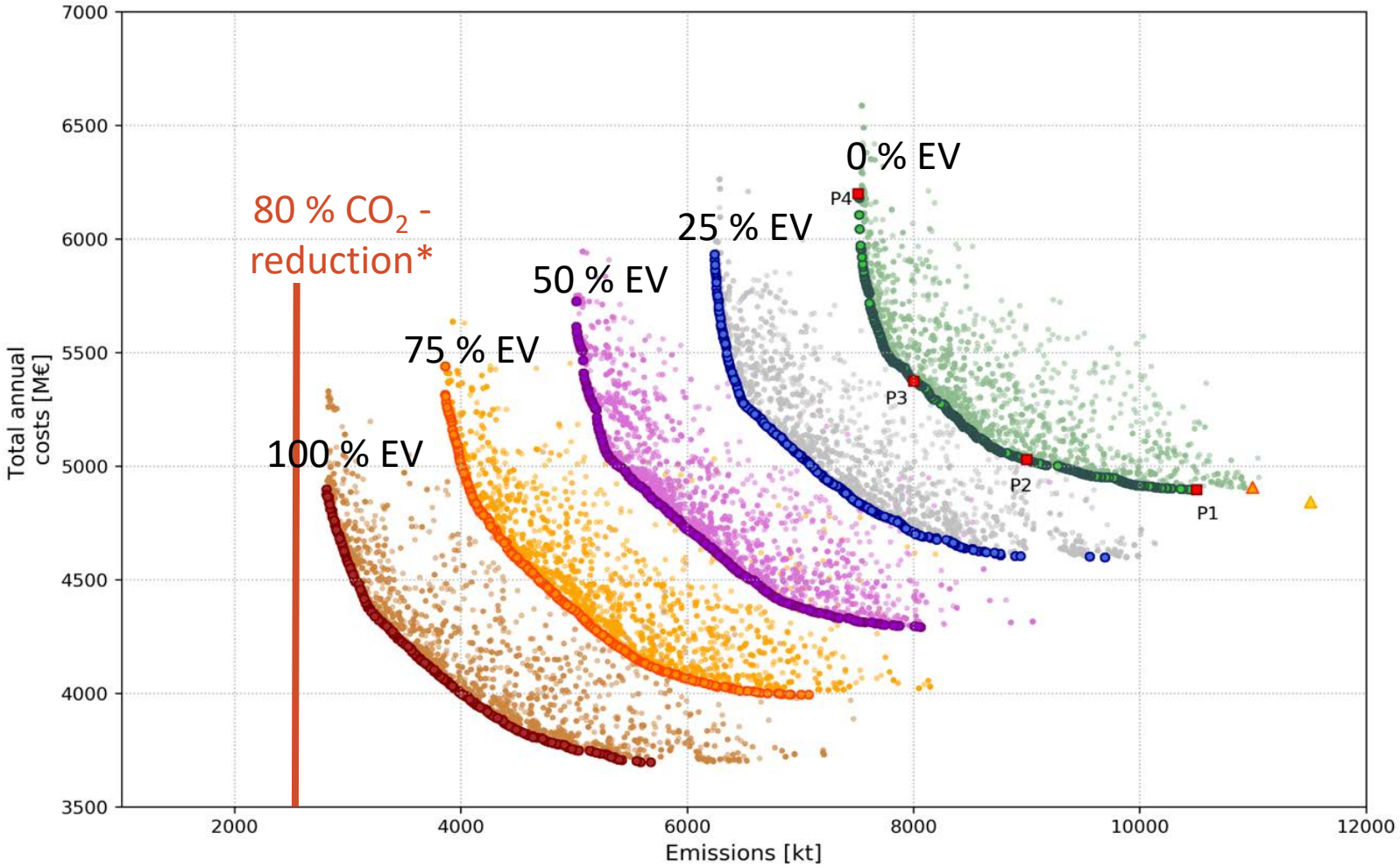
Each point in the cloud represents the annual cost and CO_2 emissions of a specific energy system scenario (combination of exploited potential of each renewable energy sources and energy efficiency measures). The details of the energy scenarios represented by the points P1-P4 are listed in the following slides.

The point RS represents the reference scenario. Since opting out of coal-fired power plant is a clear target of the government, a second reference scenario without coal-fired power generation was calculated and displayed

Considering zero emission mobility



Results System Simulation - Integration of E-Mobility



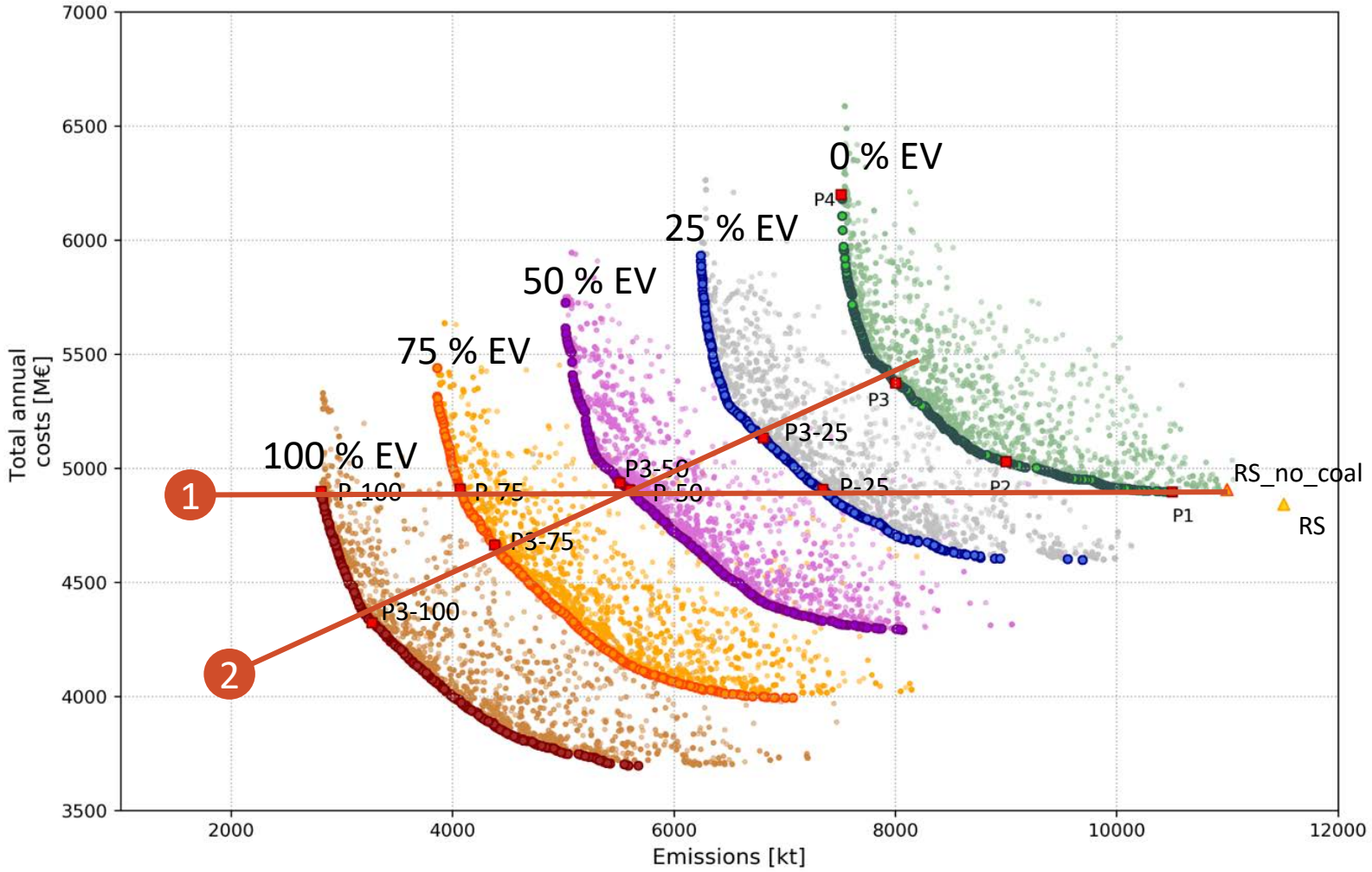
The individual curves result from a gradual increase in e-mobility of 0, 25%, 50%, ... of the total annual driven kilometres.

The increase in e-mobility leads to a gradual reduction of emissions and to a reduction of the total costs based on the high efficiency of electric motors and the reduction of fossil fuels.

Even in the final scenario, the target set cannot be achieved without the inclusion of energy efficiency measures in the industry sector.

*with respect to the value of 2016

Results System Simulation - Integration of E-Mobility



Examination of two different paths related to the scenarios.

Path 1: Constant costs compared to the reference scenario (coal phased out)

Path 2: same relative position on the pareto front, trade-off between cost development and emission reduction; which leads to relevant reduction of the total energy costs with increasing e-mobility.

2 Path 2: Electricity demand in different scenarios including transport sector

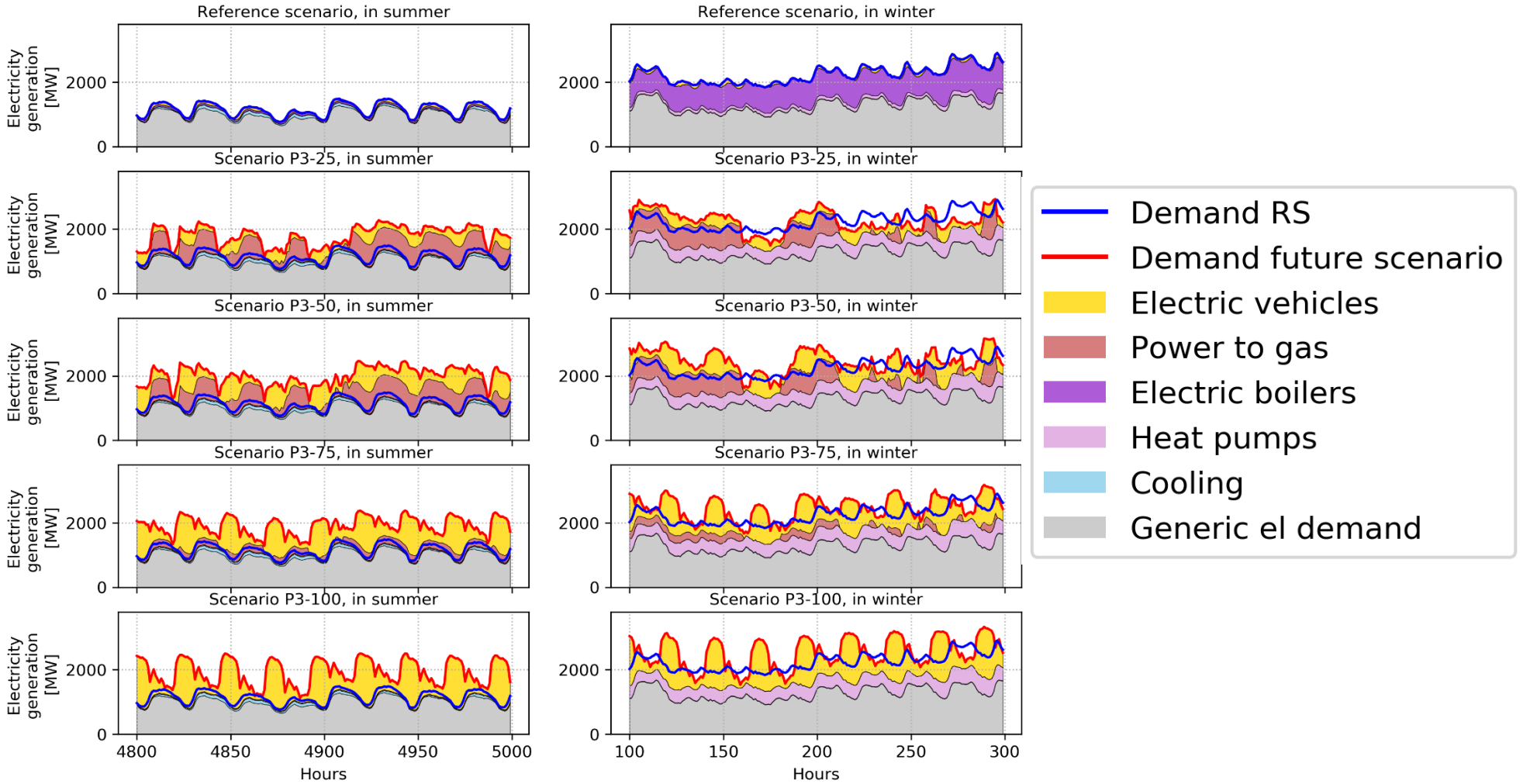
RS

P3-25

P3-50

P3-75

P3-100



The scenarios with 25% to 100% electrified transport sector are characterised by an increasing demand for electricity, and a demand for power to gas that initially assume a relevant role for then disappearing at high penetration of e-vehicles

2 Path 2: Electricity production in different scenarios including transport sector

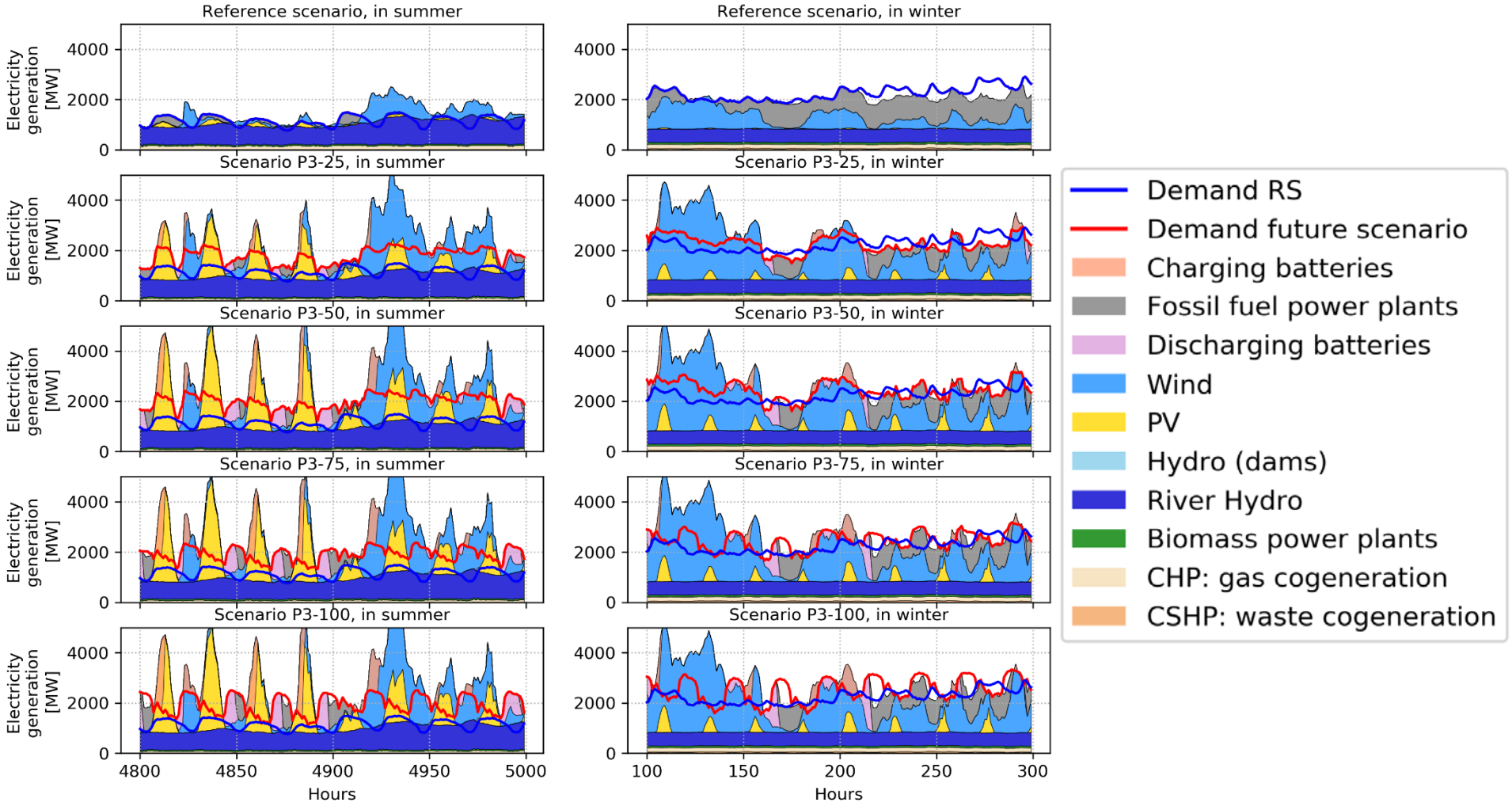
RS

P3-25

P3-50

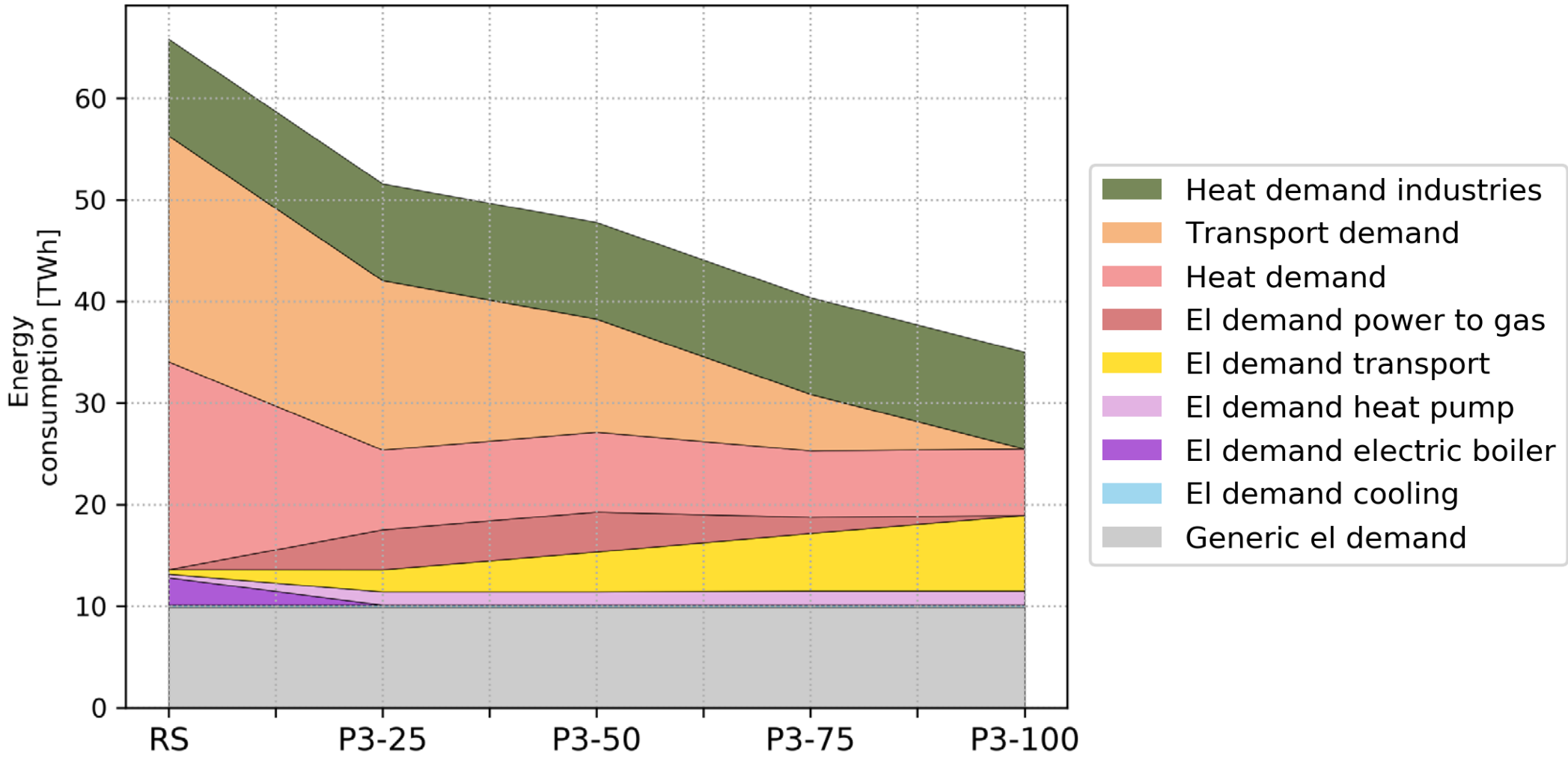
P3-75

P3-100



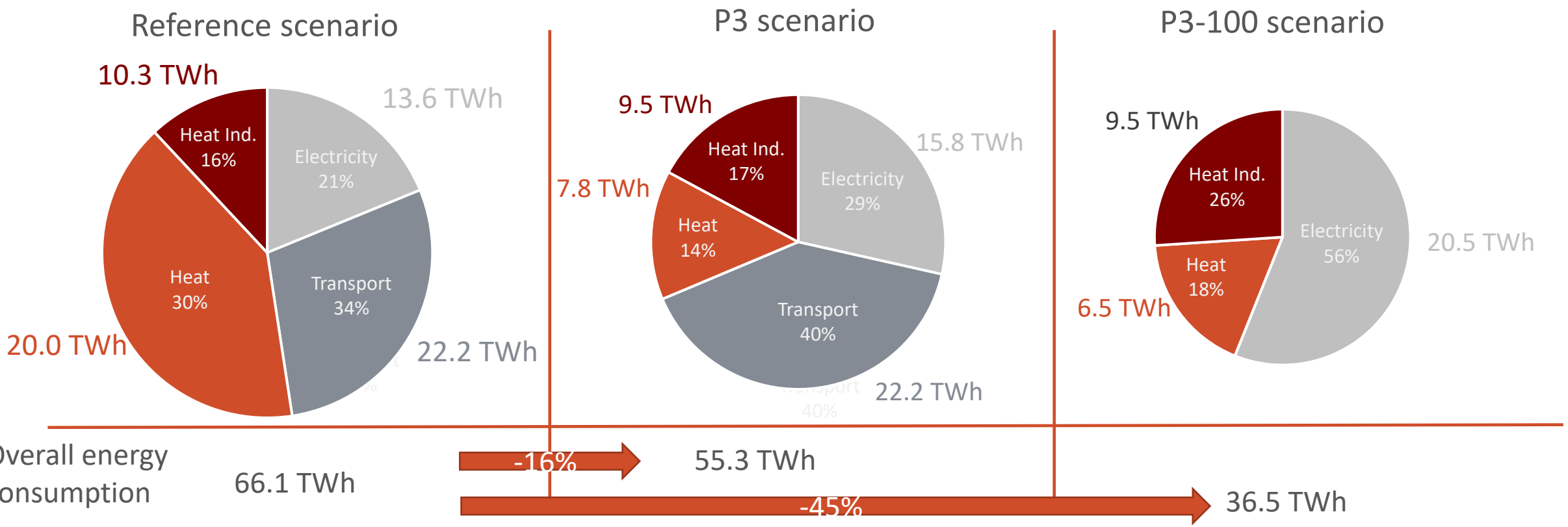
The scenarios with 25% to 100% electrified transport sector are characterised by a even greater use of the existing solar and wind energy potential with corresponding high production peaks

❷ Total energy consumption – a focus on electricity, heat and transport



The graph shows the significant reduction in heat demand and the decreasing fuel consumption due to increasing electrification of the transport sector. Power-to-gas rises and falls, the electricity demand in the transport sector increases.

Evolution of total energy consumption in three scenarios



The graph shows the reduction of total energy consumption in the three scenarios. The share of the individual energy sectors changes significantly showing: decreasing heat demand and decreasing energy demand from transport by internal combustion engines with related increasing electrification of the energy system

Example - Italy 2030

[1] Proposta di piano PNIEC, 2018

Italy - PNIEC at 2030

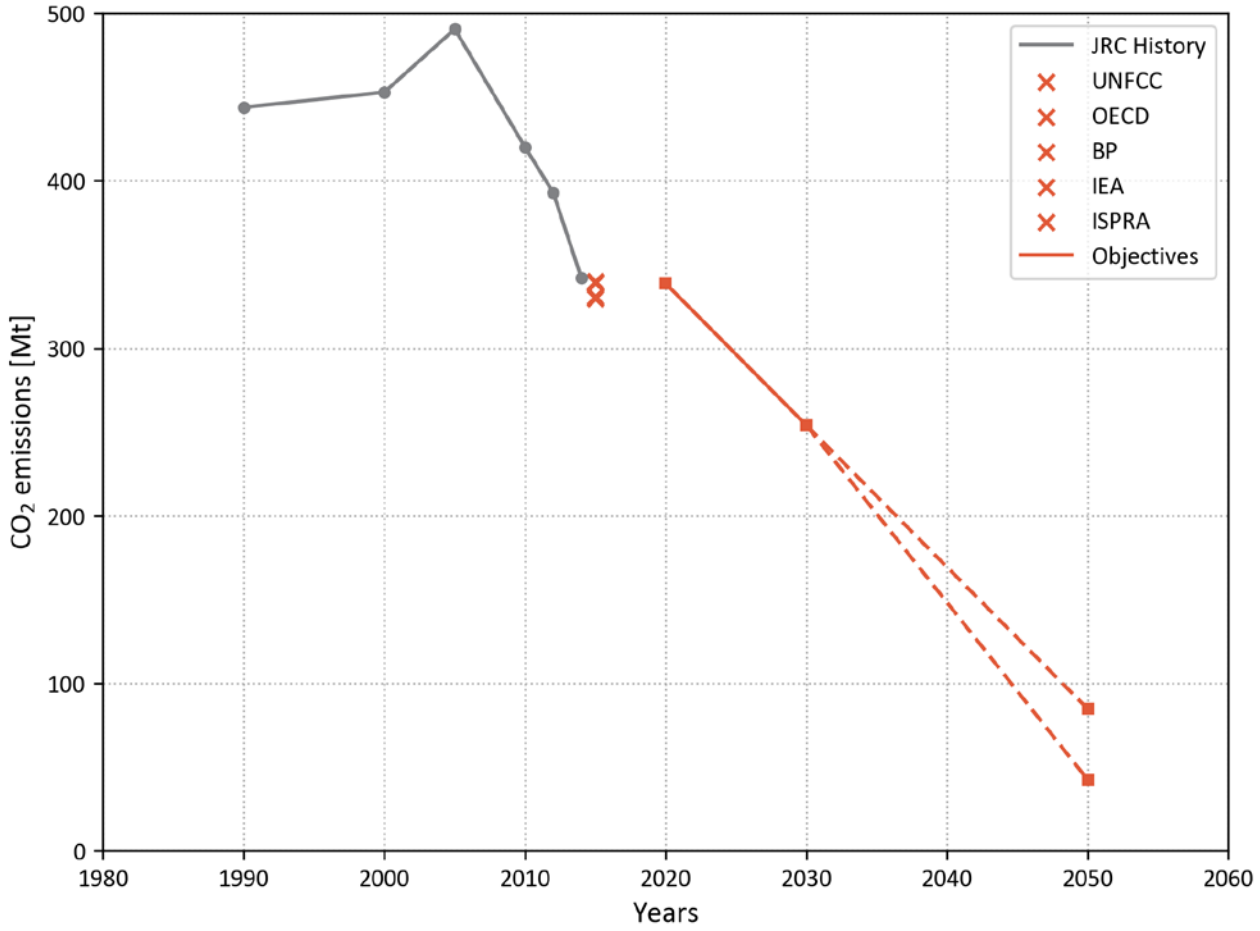
Target

- 40% emissions

at 2030 respect to value of 1990

32% RES share

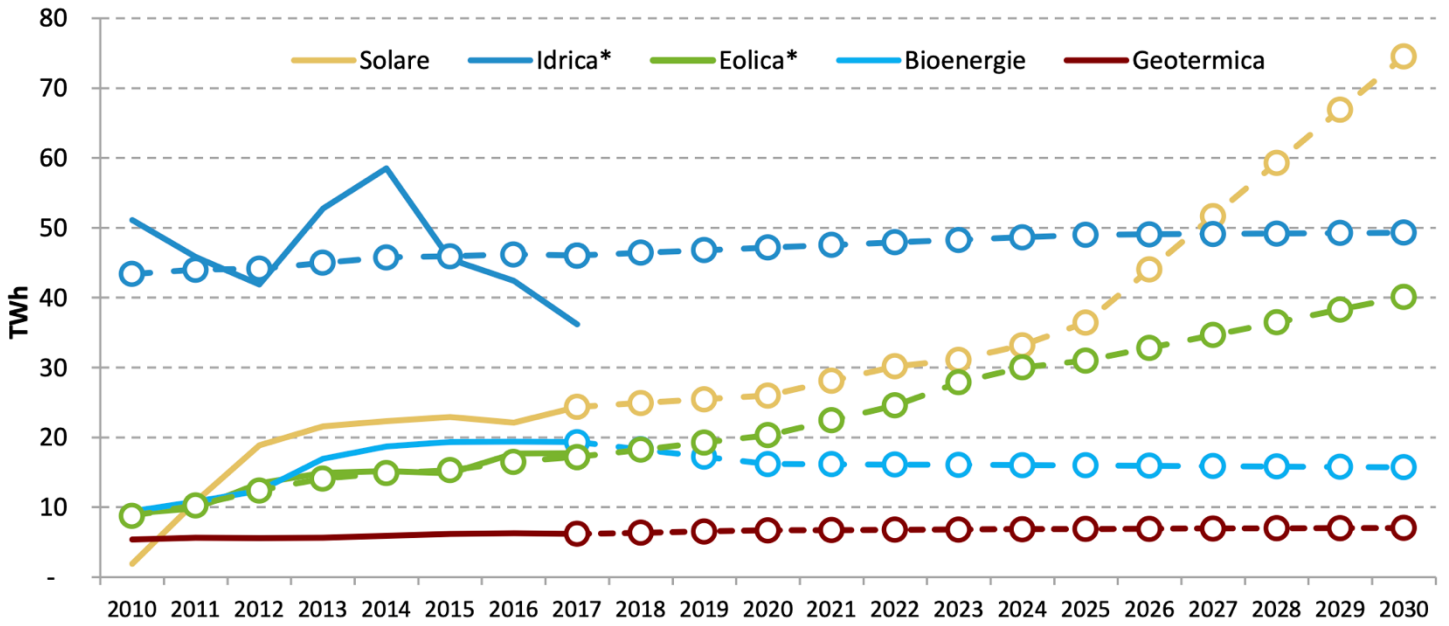
55.4% electricity sector
33% heat sector
21.6% transport sector



[2] EUROSTAT, 2019. [3] UNFCC, 2016. [4] OECD, 2016. [5] BP, 2016. [6] IEA, 2016. [7] ISPRA, 2016. [8] European commission, 2007. [9] European commission, 2014. [10] European commission, 2018

Italy - PNIEC at 2030

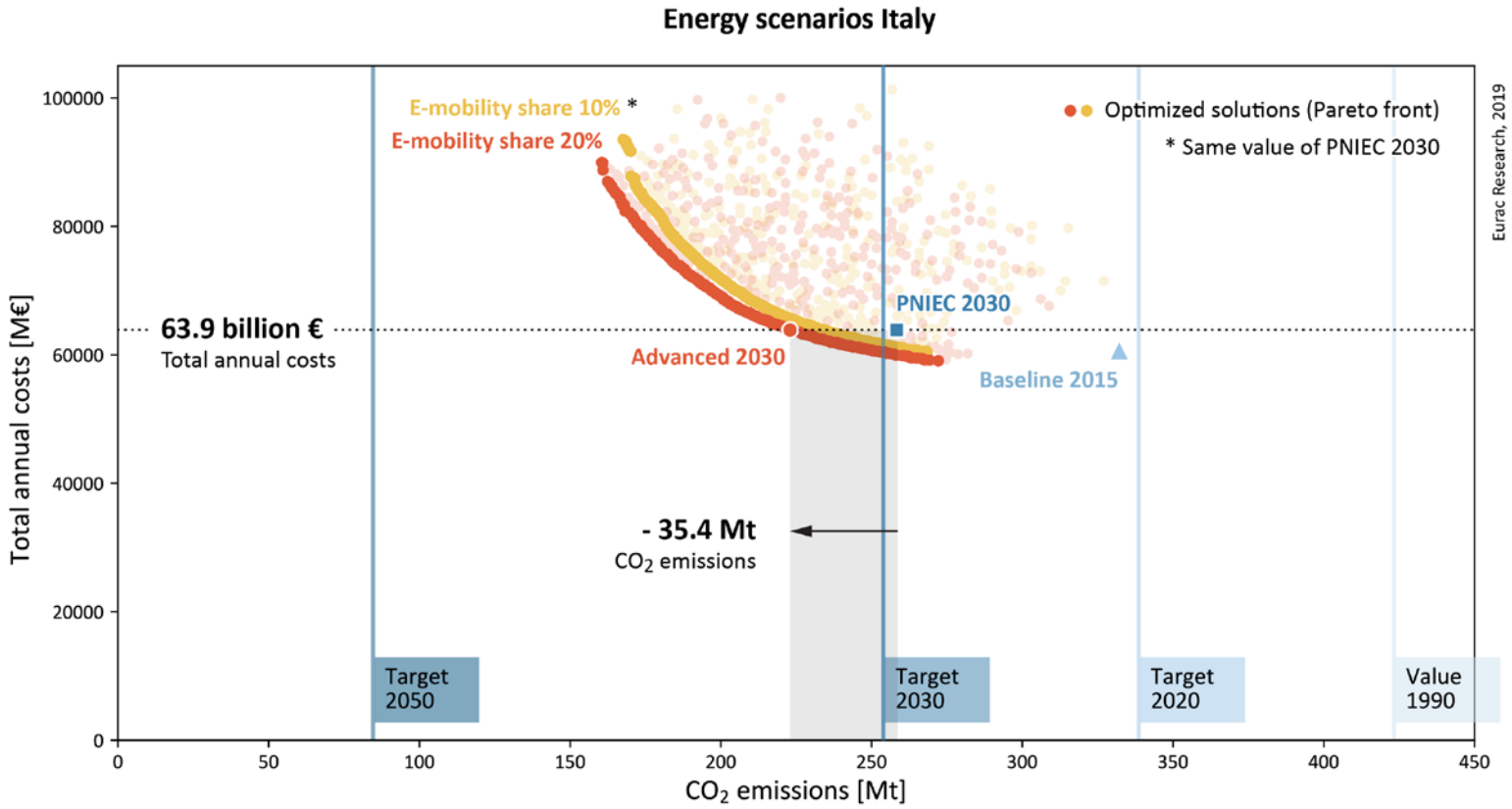
Figura 11 – Traiettorie di crescita dell'energia elettrica da fonti rinnovabili al 2030 [Fonte: GSE e RSE]



* Per la produzione da fonte idrica ed eolica si riporta, per gli anni 2010 -2017, sia il dato effettivo (riga continua), sia il dato normalizzato, secondo le regole fissate dalla Direttiva 2009/28/CE. Per i bioliquidi (inclusi nelle bioenergie insieme alle biomasse solide e al biogas) si riporta solo il contributo dei bioliquidi sostenibili.

[1] Proposta di piano PNIEC, 2018

Results of the simulations



Each single dot shows total annual costs and CO_2 emissions of a specific energy scenario. It can be seen that the PNIEC scenario is close to a cost optimum for the given CO_2 emission target. Still keeping the cost constant other scenarios can be identified further reducing CO2 emission in a relevant way.

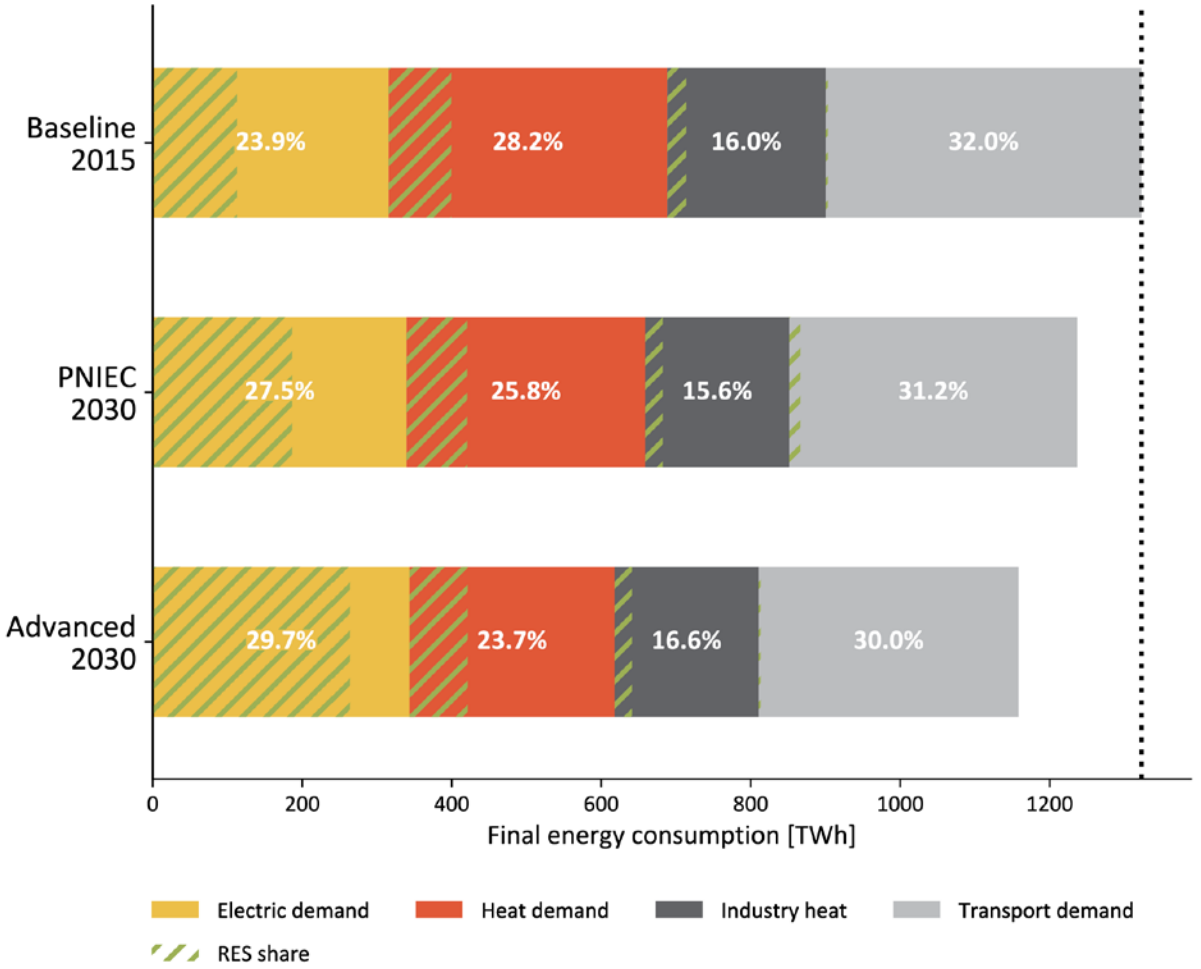
[1] Proposta di piano PNIEC, 2018. [8] European commission, 2007. [9] European commission, 2014. [10] European commission, 2018

Final energy consumption

The **overall final energy consumption is reducing** over the scenarios.

This is based on the energy **efficiency measures** in the building sector, industry sector and electrification of transport.

The **renewable share is increasing** in all sectors but mainly in the electricity sectors



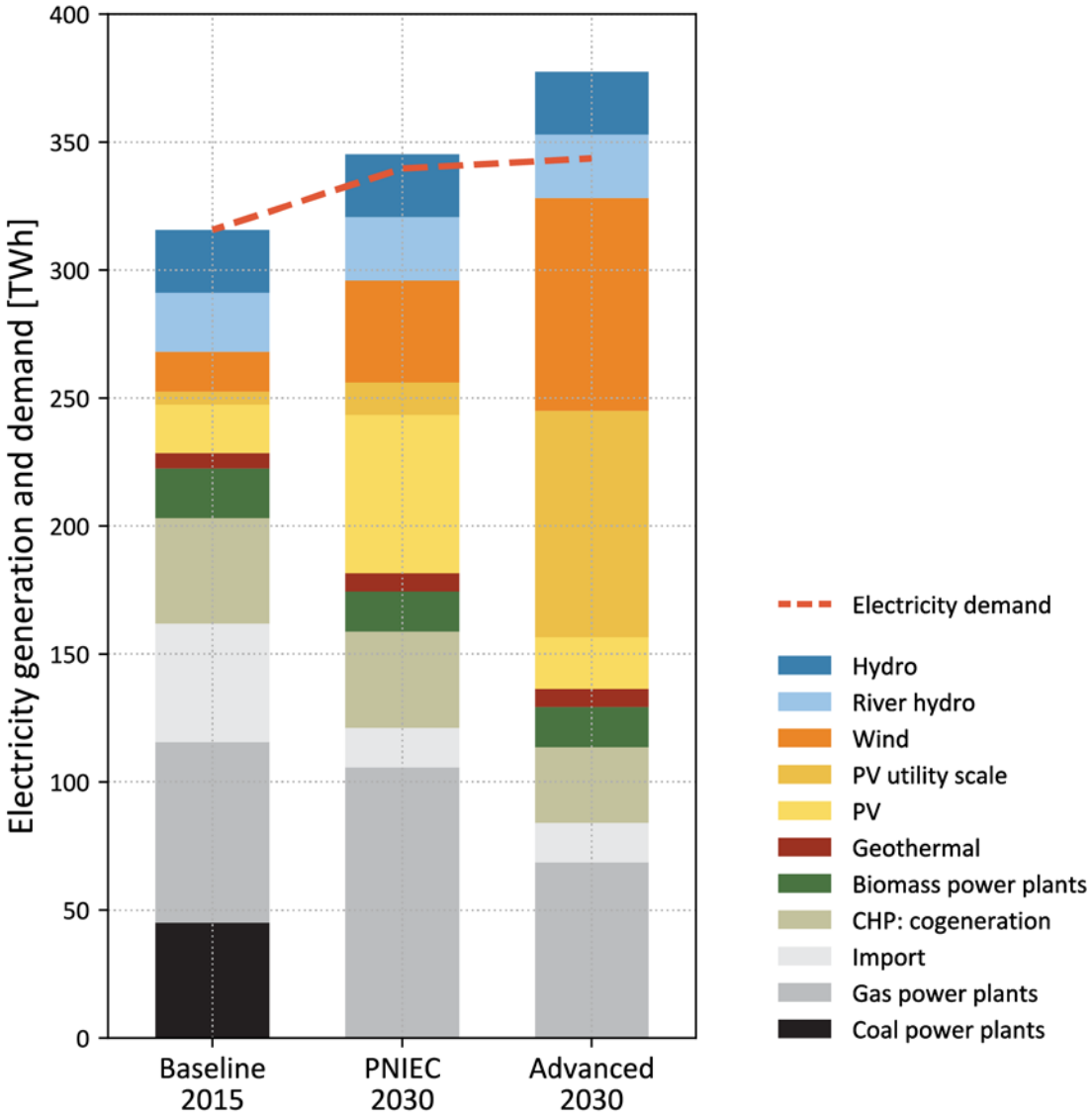
Eurac Research, 2019

Annual electricity generation

The overall structure of the electricity generation is shown in the three scenarios.

It can be seen that the **overall electricity consumption rises** based on additional needs from **e-mobility** and the heating sector (**heat pumps**).

At the same time the **renewable share is increasing** with coal phasing out and imports reduced.



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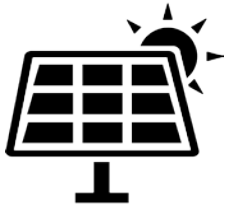
Values of the main technologies in the different scenarios

	 PV	 Wind power	 Stationary Batteries	 Batteries of EV*	 Advanced Biomethane	 Energy efficiency of buildings
Baseline 2015	19 GW	9 GW	0 GWh	0 GWh	3 TWh	0 %
PNIEC 2030	59 GW	23 GW	40 GWh	200 GWh	15 TWh	15 %
Advanced 2030	86 GW	48 GW	0 GWh	400 GWh	3 TWh	30 %

*Vehicle to grid is not considered in the simulations

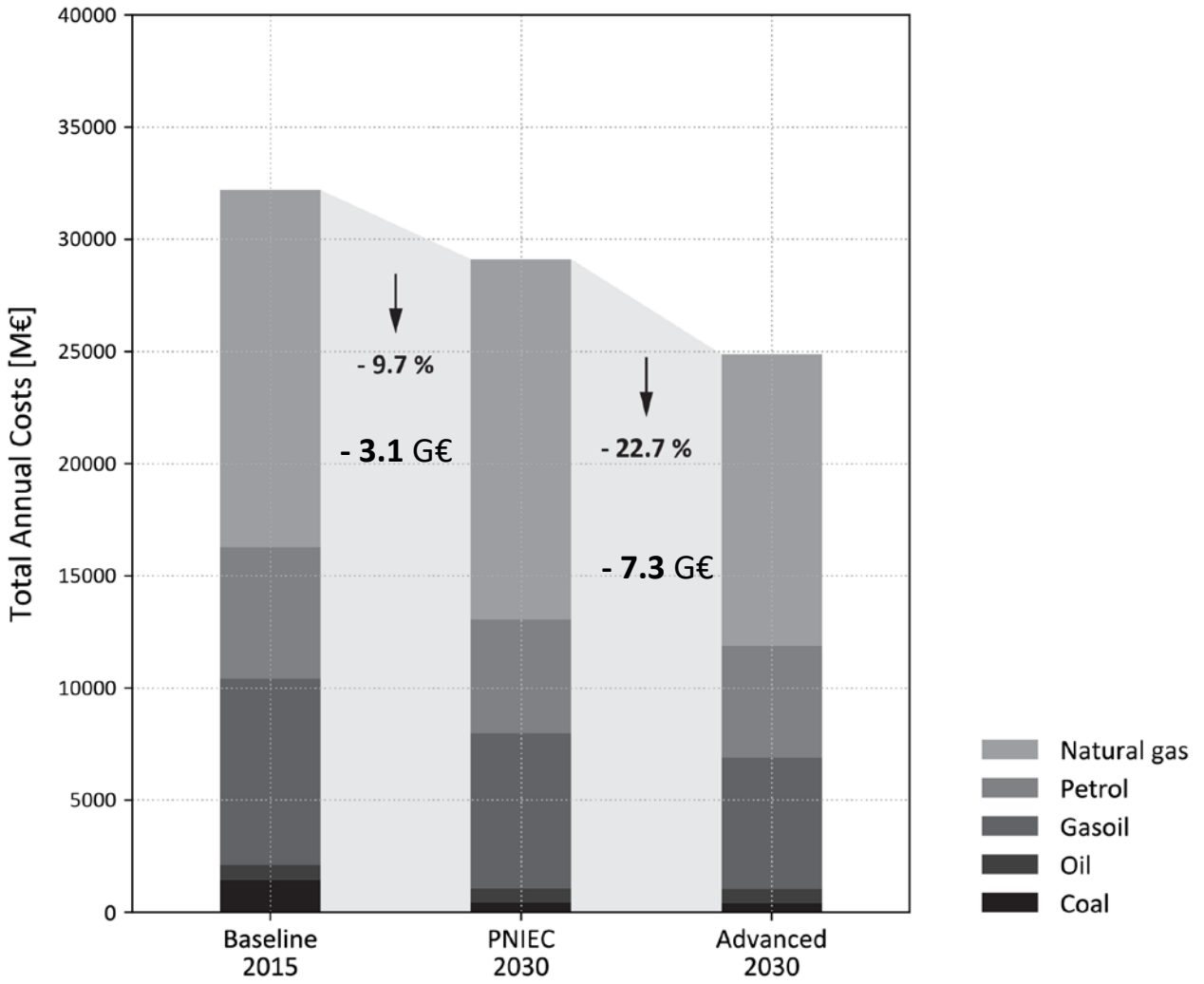
**PNIEC 2030 scenario considers energy production from RES as given in PNIEC, but historical energy equivalent hours leading to differences in installed capacity

[1] Proposta di piano PNIEC, 2018

Fossil fuel costs

By limiting CO_2 emissions as well the **imports of fossil fuels** are being **reduced** by 10% and 23% respectively.

Here through the **energy dependence of Italy** form other countries **is reduced** while the **internal added value** through renewables and efficiency in Italy can be **increased**.



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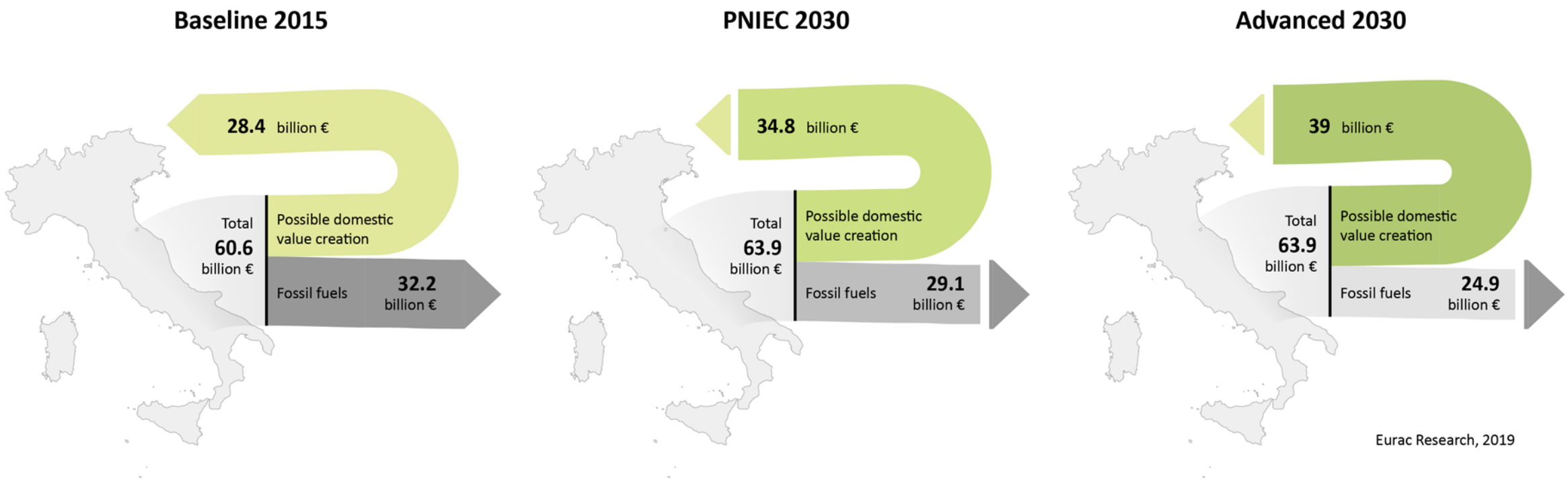
Expenditures for different energy scenarios

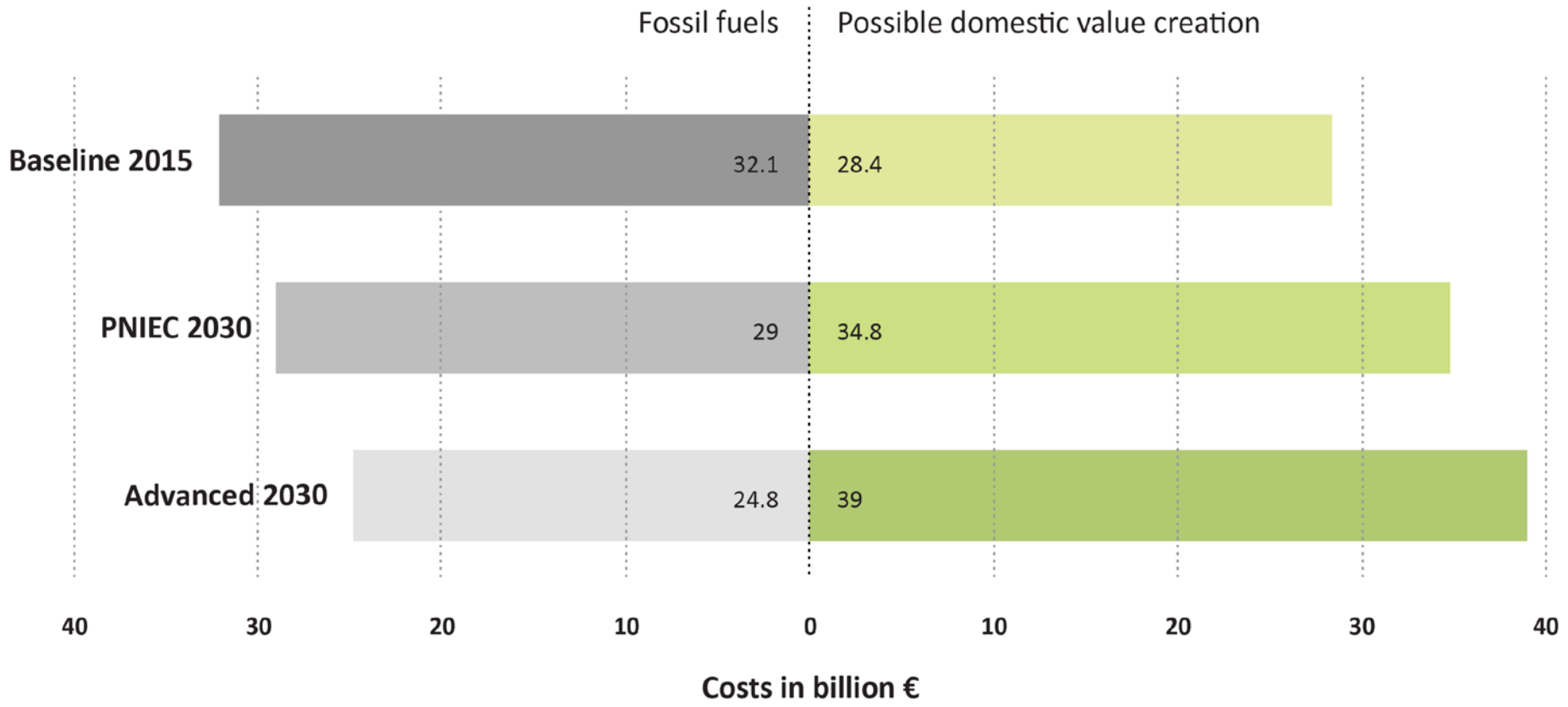


The imports of fossil fuels reduces by **over 7 billion € per year**. Expenditures available for investments in the Italian energy systems

Possible domestic value creation

- Energy efficiency
- Energy infrastructure
- Renewable Energy Sources

Expenditure for different energy scenarios - Italy



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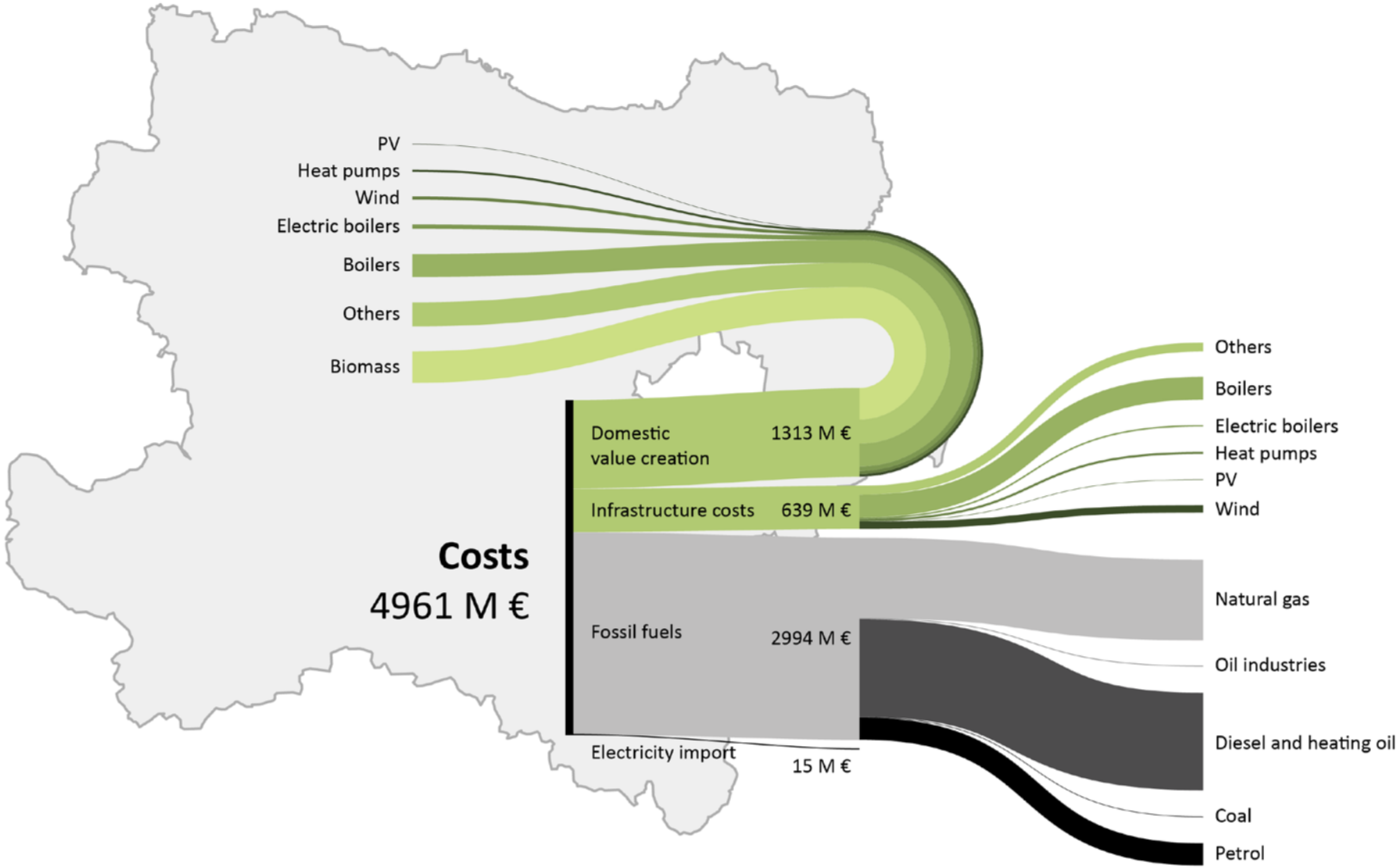
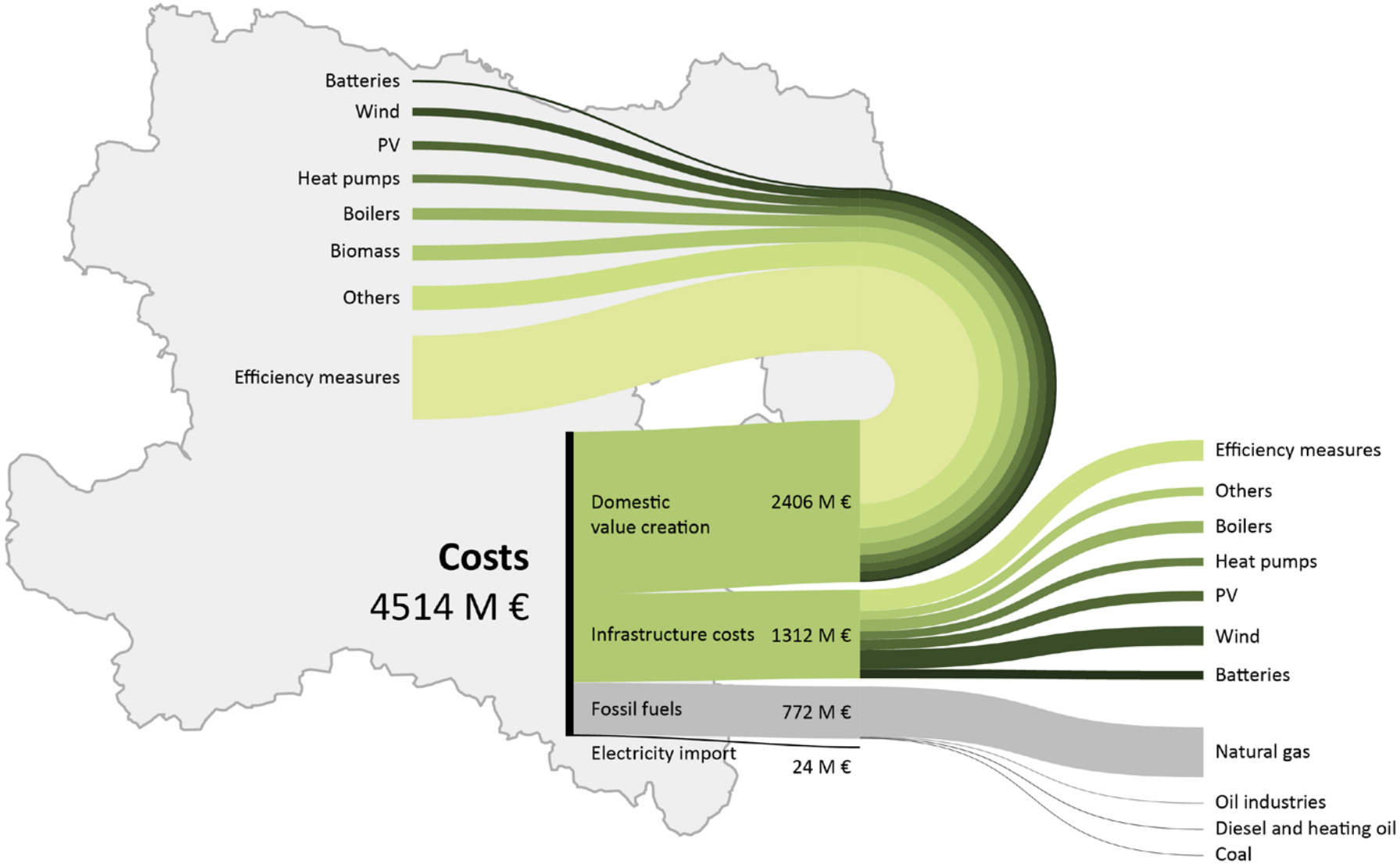
Cost Structure - Reference Scenario Niederösterreich



Subdivision of investments in the region and import of technology and raw materials

Cost structure - target scenario (P3-100) Niederösterreich



Subdivision of investments in the region and import of technology and raw materials

Key messages (1/2)

- The starting point is different country by country, and the renewable potential too, but

- Whatever the scenario is, there are key transformations required
  - Energy efficiency of buildings
  - Transformation towards renewables of the remaining thermal sector
  - Strong growth of renewable electricity
  - Strong growth of e-mobility

Key messages (2/2)

- In countries with relevant heavy road transport a decarbanisation of this sector is needed (direct elctric and hydrogen based)
- In countries with relevant heavy industry a dedicated study sector by sector is necessary
- E-mobility and demand side management can strongly reduce the need of stationary storage systems

- The transformation is a relevant economic opportunity as a large shift from costs for fossil fuels to investments in on place technologies and infrastructures is taking place

Thank you
for your attention

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