

Energy sector coupling: electric-thermal interaction through heat pumps

eurac Tuesday 23th of October 2018
research – *Institute for Renewable Energy*
NOI Tech Park, via A. Volta 13/A, Bolzano



This workshop has received funding from the EFRE- FESR 2014- 2020 programme- project “INTEGRIDS” n. 1042

eurac research

Brief introduction about Eurac Research and the Institute for Renewable Energy

David Moser

Eurac Research – Institute for Renewable Energy

Workshop on “Energy sector coupling: electric-thermal interaction through heat pumps”
Bozen October 23rd, 2018

The background image shows a close-up of solar panels with a white cylindrical component in the foreground. In the background, two people in white lab coats are crouching outdoors. The text is overlaid on a semi-transparent white banner.

The Institute for Renewable Energy at Eurac Research

The Institute for Renewable Energy at Eurac Research conducts **applied research** on how to **produce energy** using **advanced energy systems** based on sustainable energy sources, how to **manage** them and **reduce** their consumption.

We study and execute **products, technologies** and **solutions** for private businesses, utilities, public administrations, researchers and professionals working in **several sectors**.

Sustainable Heating and Cooling Systems

Photovoltaic Energy Systems

Energy efficient buildings

Energy Retrofit of Historic Buildings

Urban and Regional Energy Systems

Some figures



100 people



47 running projects



7 labs

The background of the slide is a photograph of an industrial laboratory or factory floor. It features large blue industrial machines, overhead lighting fixtures, and a complex network of pipes and cables. The floor is concrete with yellow and black safety markings. A semi-transparent grey box is overlaid on the top half of the image.

Currently we are working in close contact with **122**
companies in R&D&I projects



> 15.000.000 €

**Funding for industrial partners in 5 EU
projects* coordinated by the Institute**

*(iNSPiRE, commONEnergy, Buildheat, 4RinEU, EnergyMatching)

eurac research

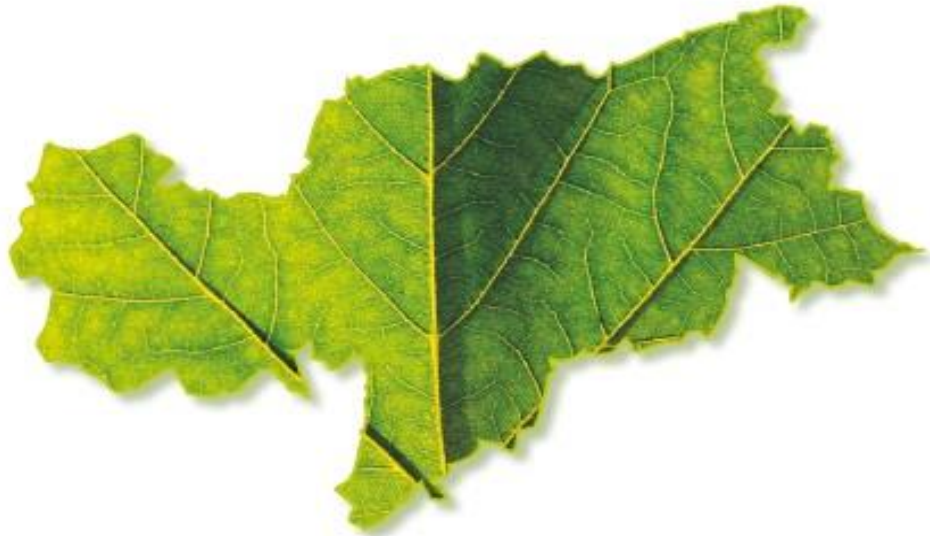
Workshop on “Energy sector coupling: electric-thermal interaction through heat pumps”

David Moser

Eurac Research – Institute for Renewable Energy

Workshop on “Energy sector coupling: electric-thermal interaction through heat pumps”

Bozen October 23rd, 2018



PIANO CLIMA

Energia-Alto Adige-2050

South Tyrol's Climate plan

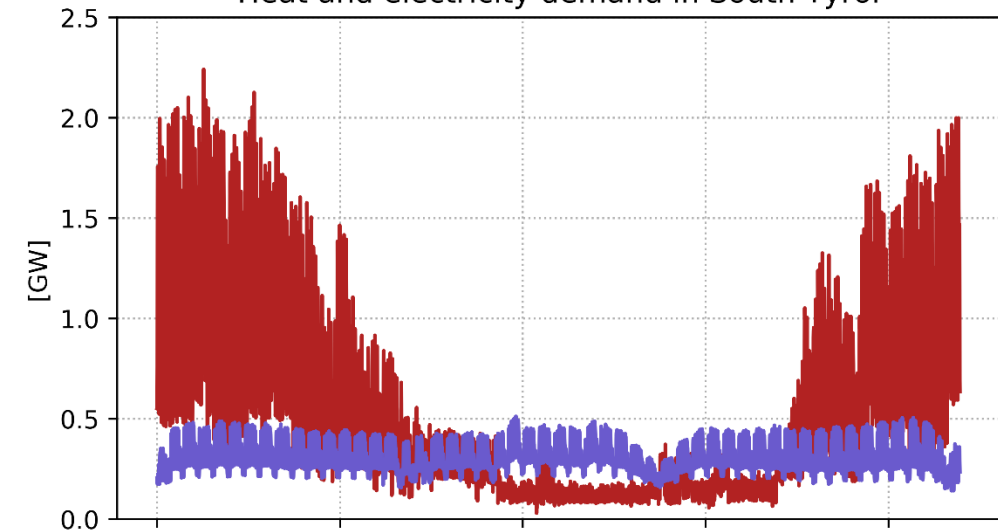


Target

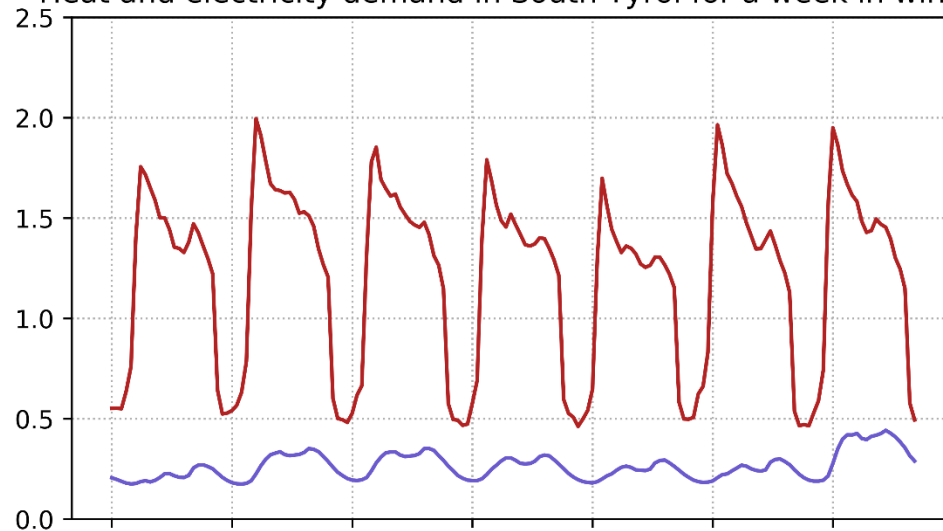


1.5 tons of CO₂ emissions per
person/per year

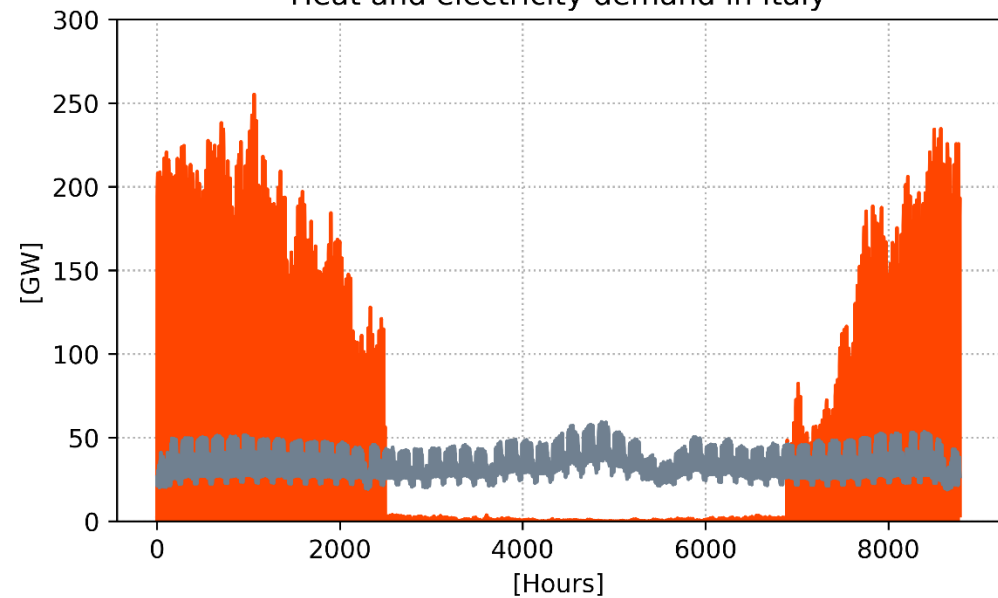
Heat and electricity demand in South Tyrol



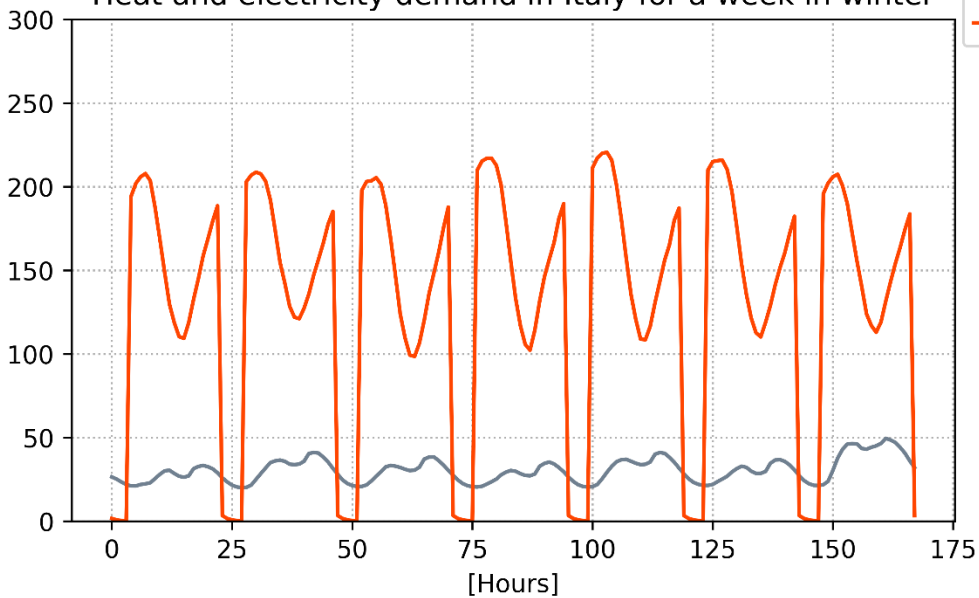
Heat and electricity demand in South Tyrol for a week in winter



Heat and electricity demand in Italy

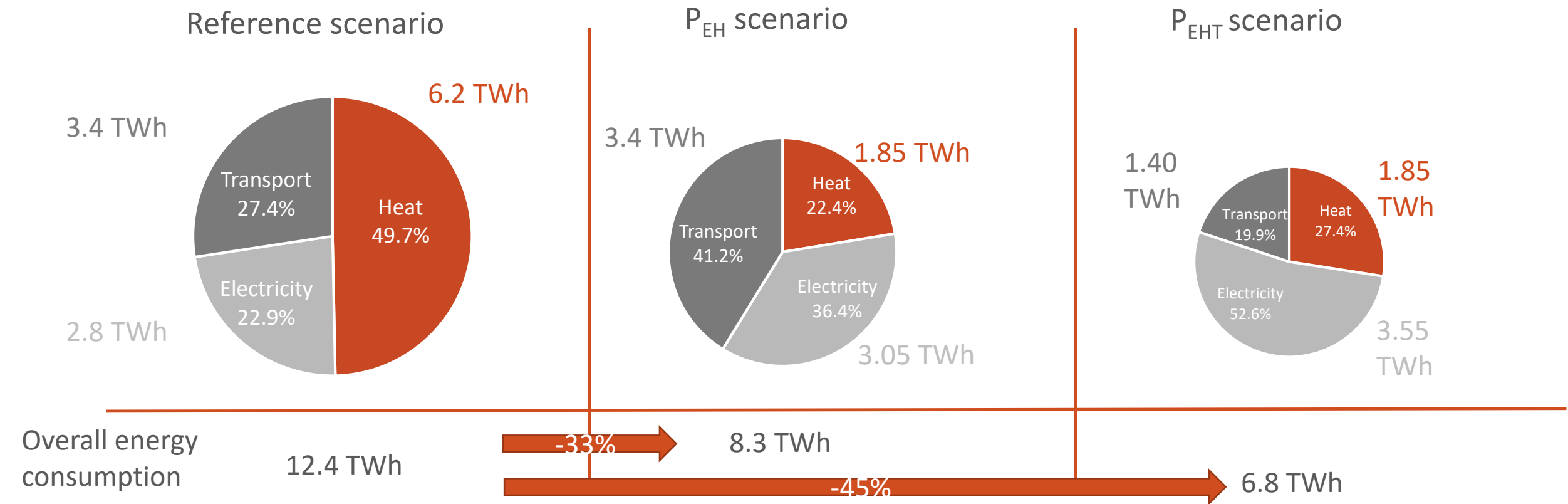


Heat and electricity demand in Italy for a week in winter



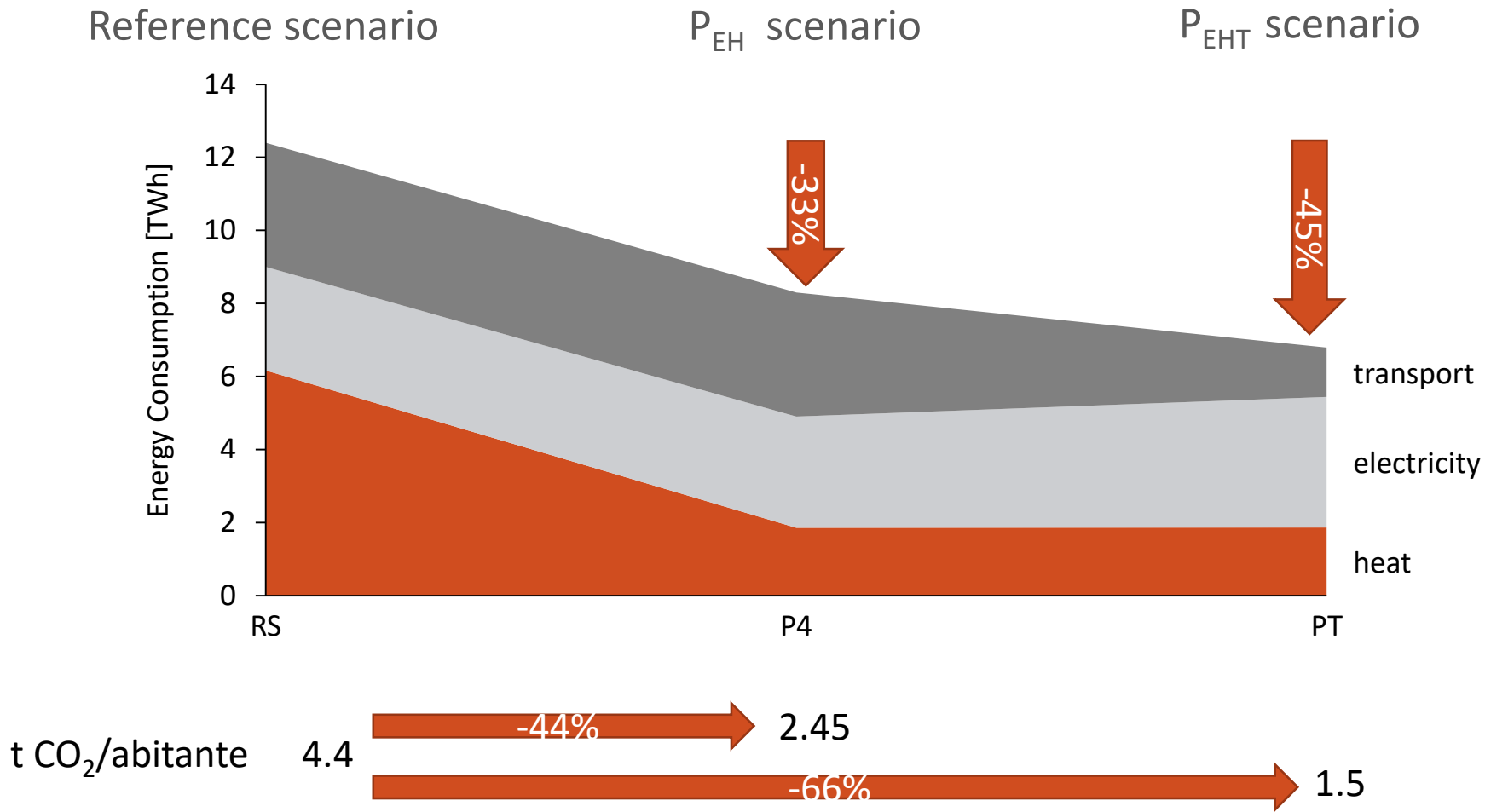
- South Tyrol Heat demand
- South Tyrol Electricity demand
- Italy Electricity demand
- Italy Heat demand

Comparison of the overall energy consumption: South Tyrol in 2050



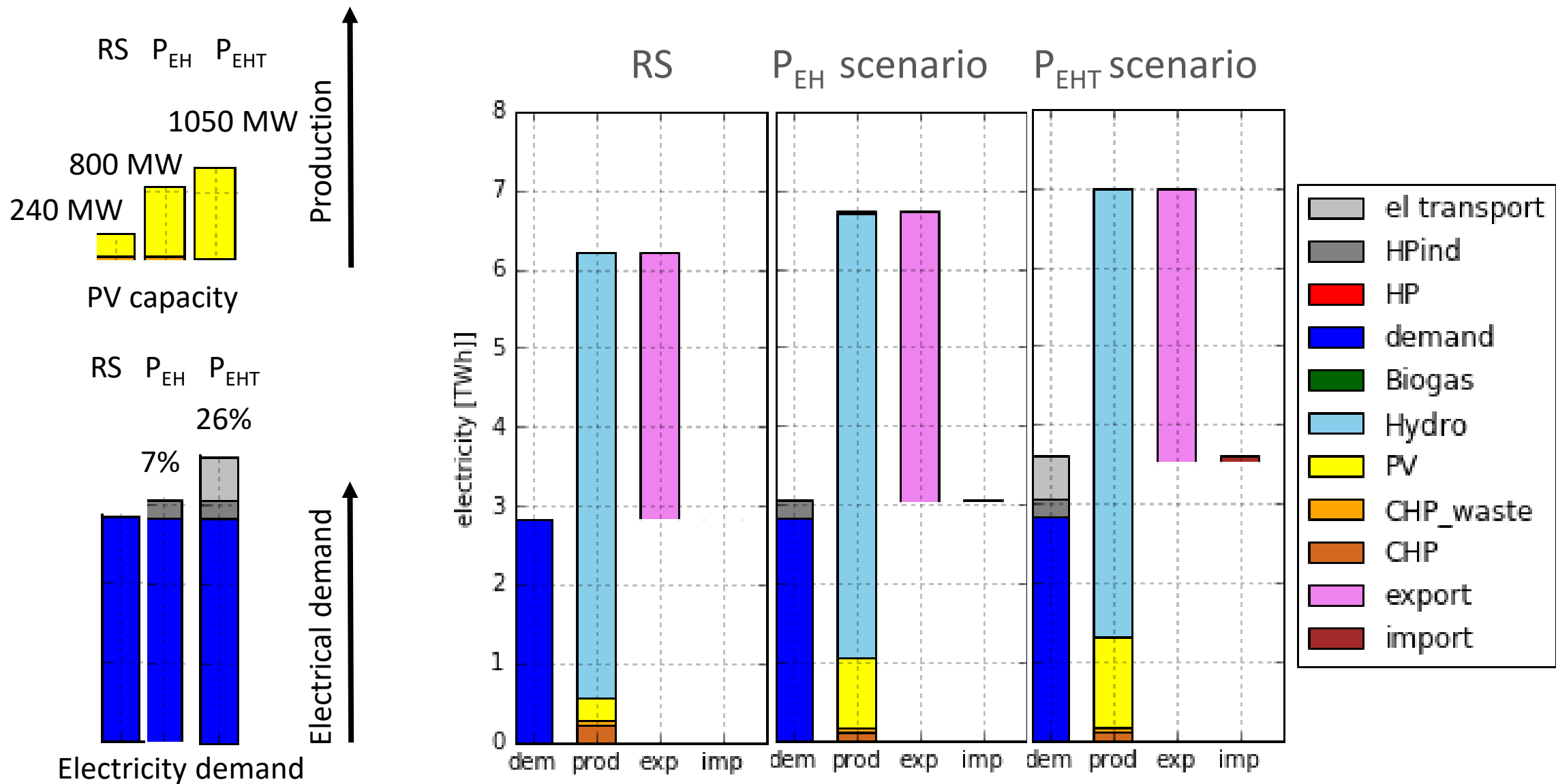
Use of hourly simulations and sector coupling combining an optimisation algorithm with the simulation software EnergyPlan

Comparison of the overall energy consumption: South Tyrol in 2050

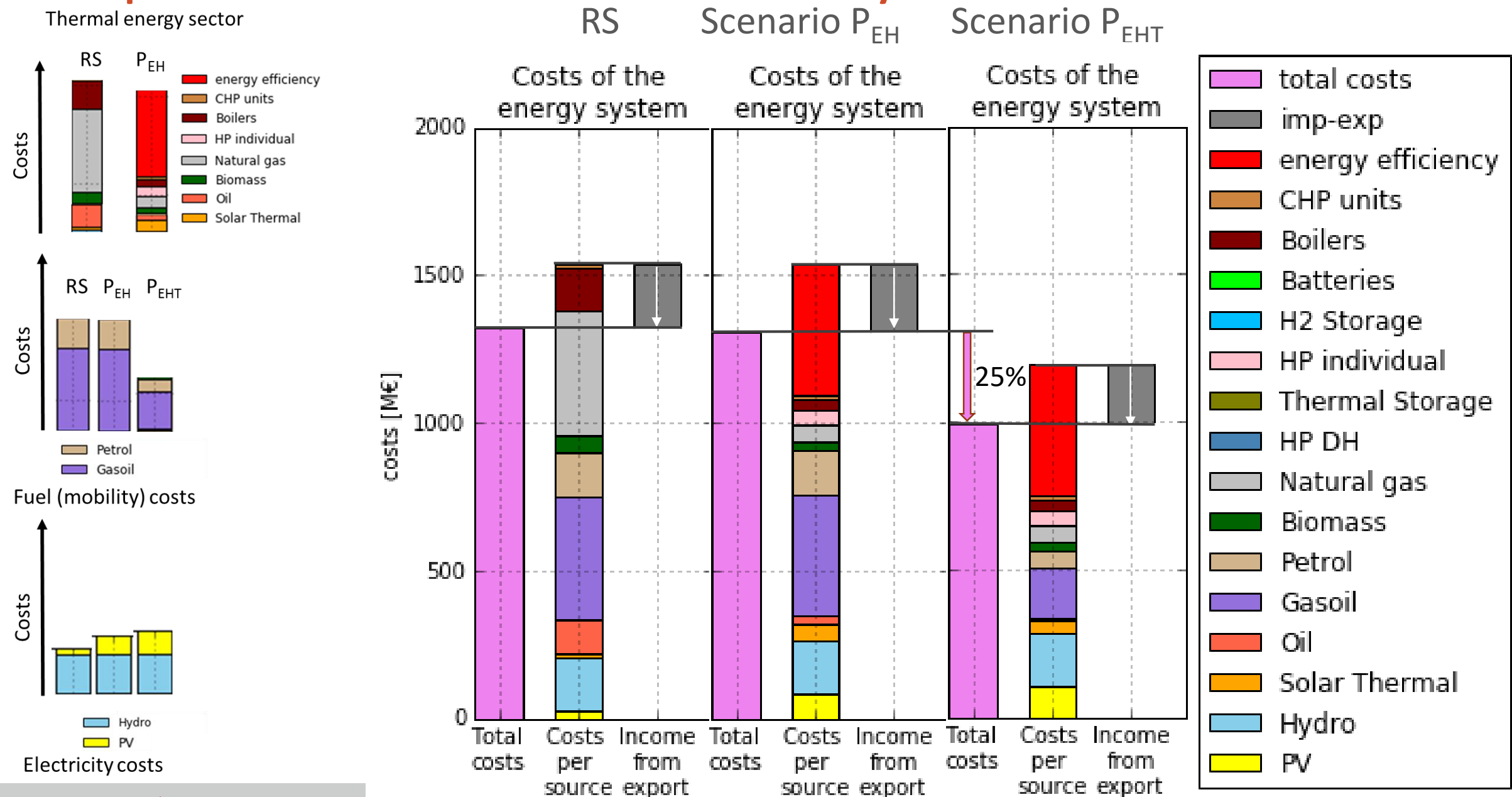


Use of hourly simulations and sector coupling combining an optimisation algorithm with the simulation software EnergyPlan

Comparison – electricity: South Tyrol in 2050

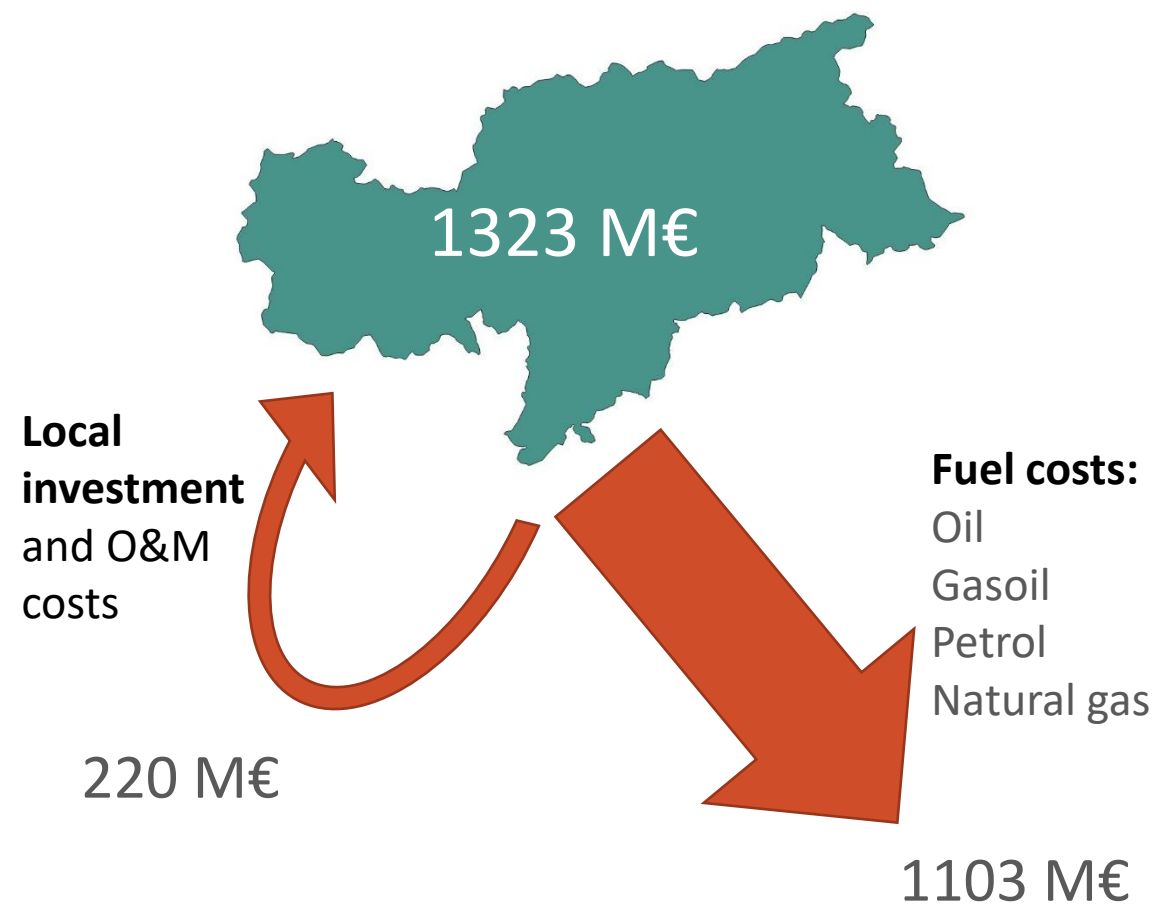


Comparison – cost data: South Tyrol in 2050

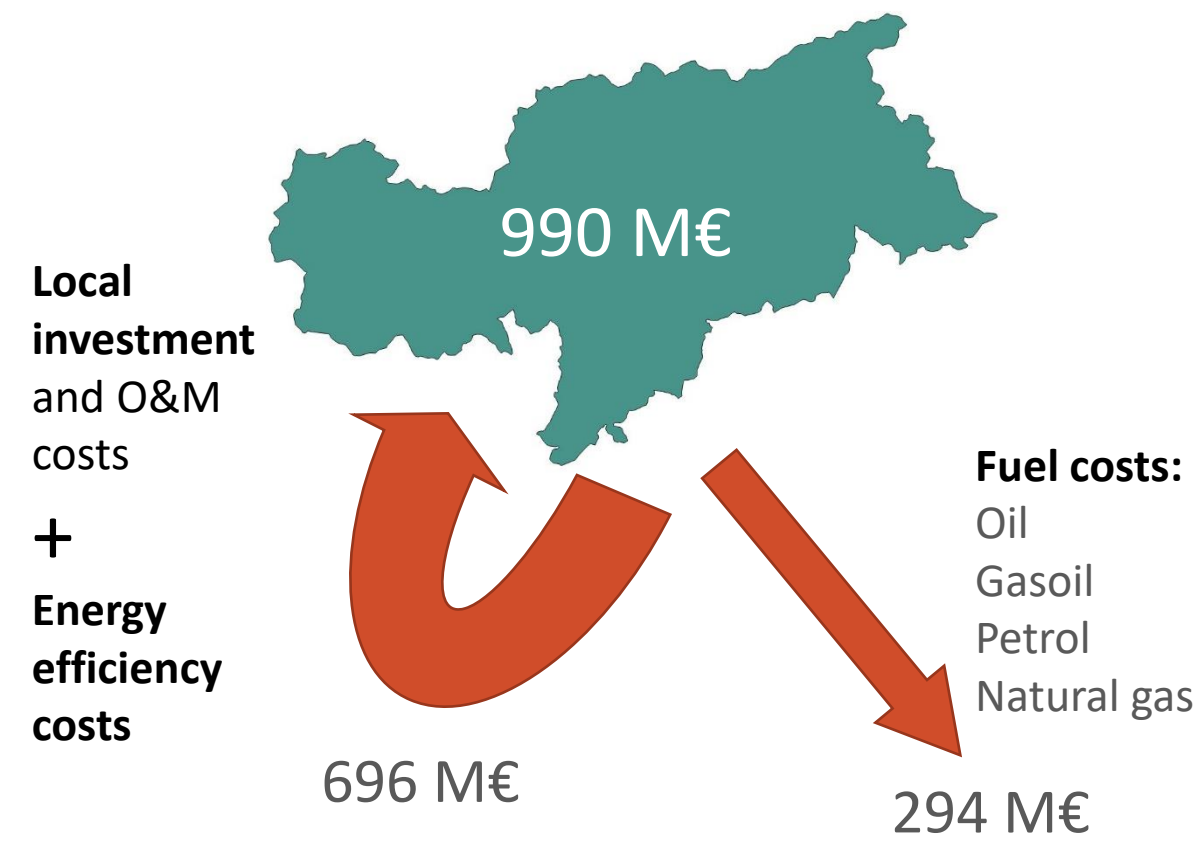


Cost data in 2050

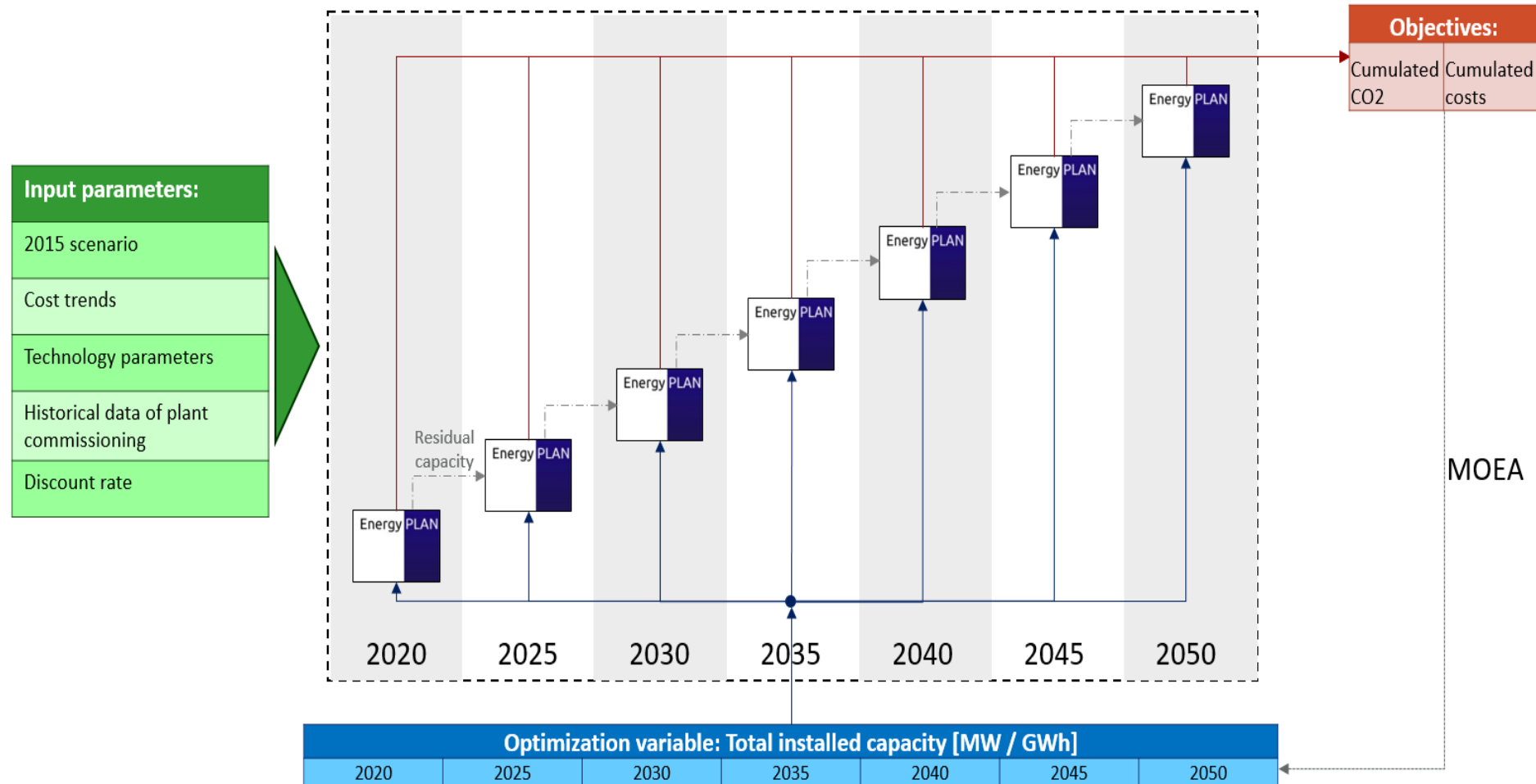
Reference scenario



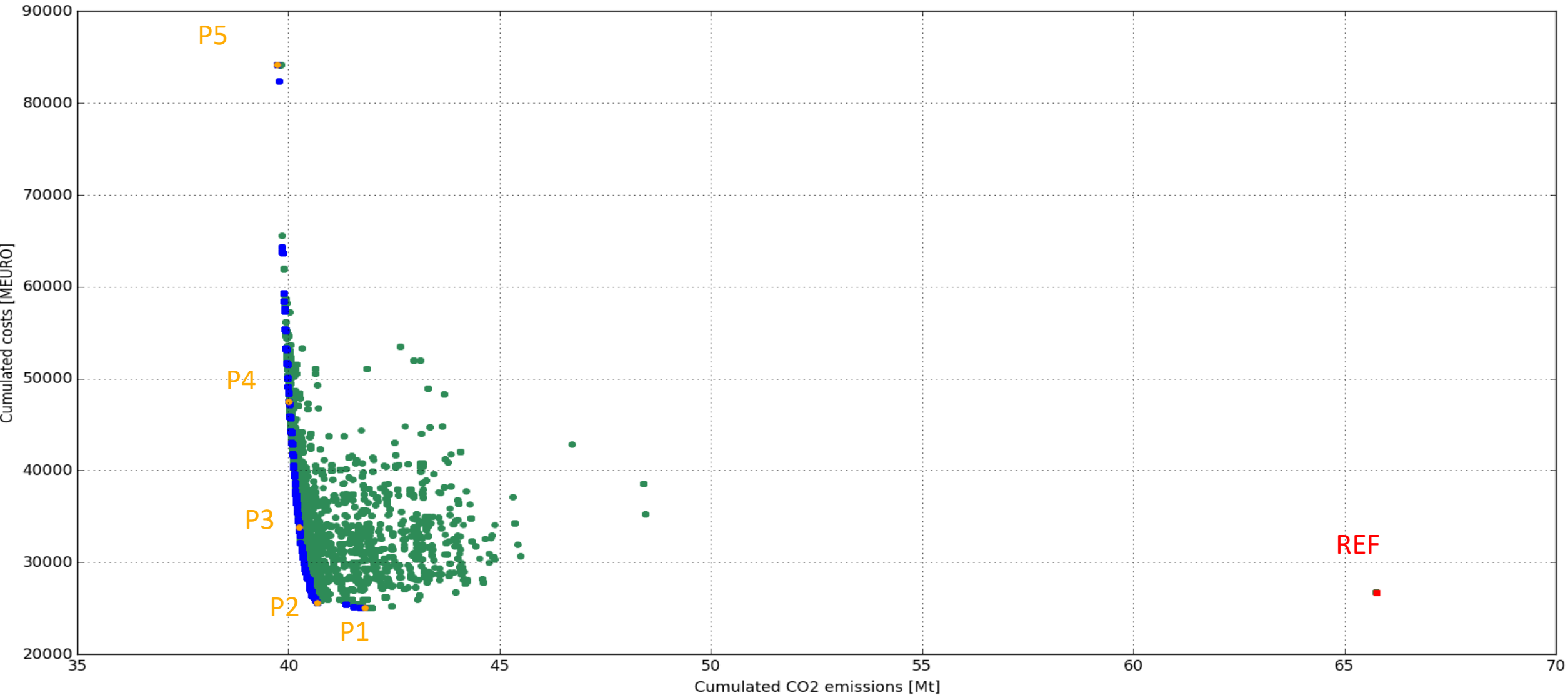
PeHT scenario



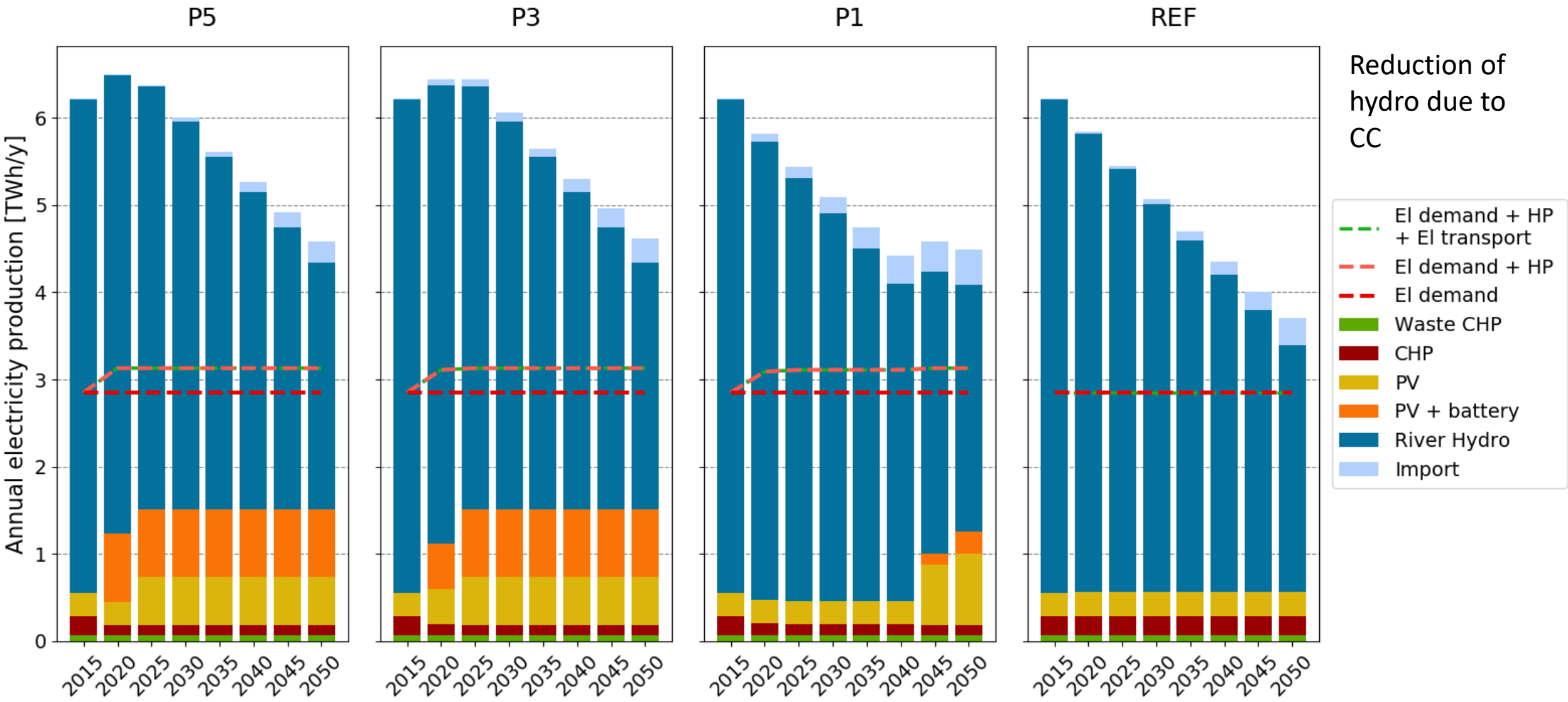
What about the transition pathways to 2050?



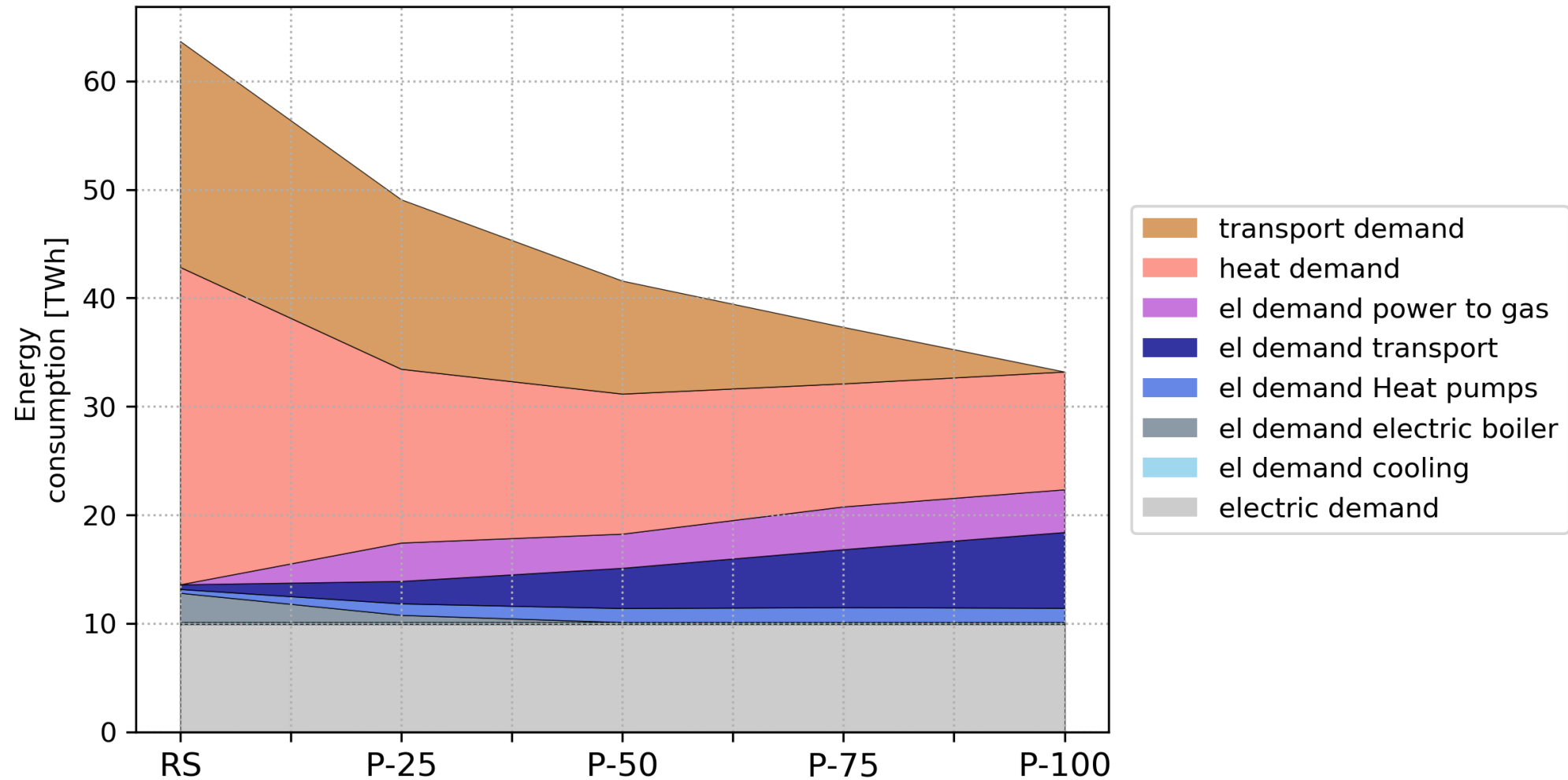
- Optimization results for South Tyrol in terms of cumulative costs and CO2 reduction 2015-2050
- (without considering the transport sector)



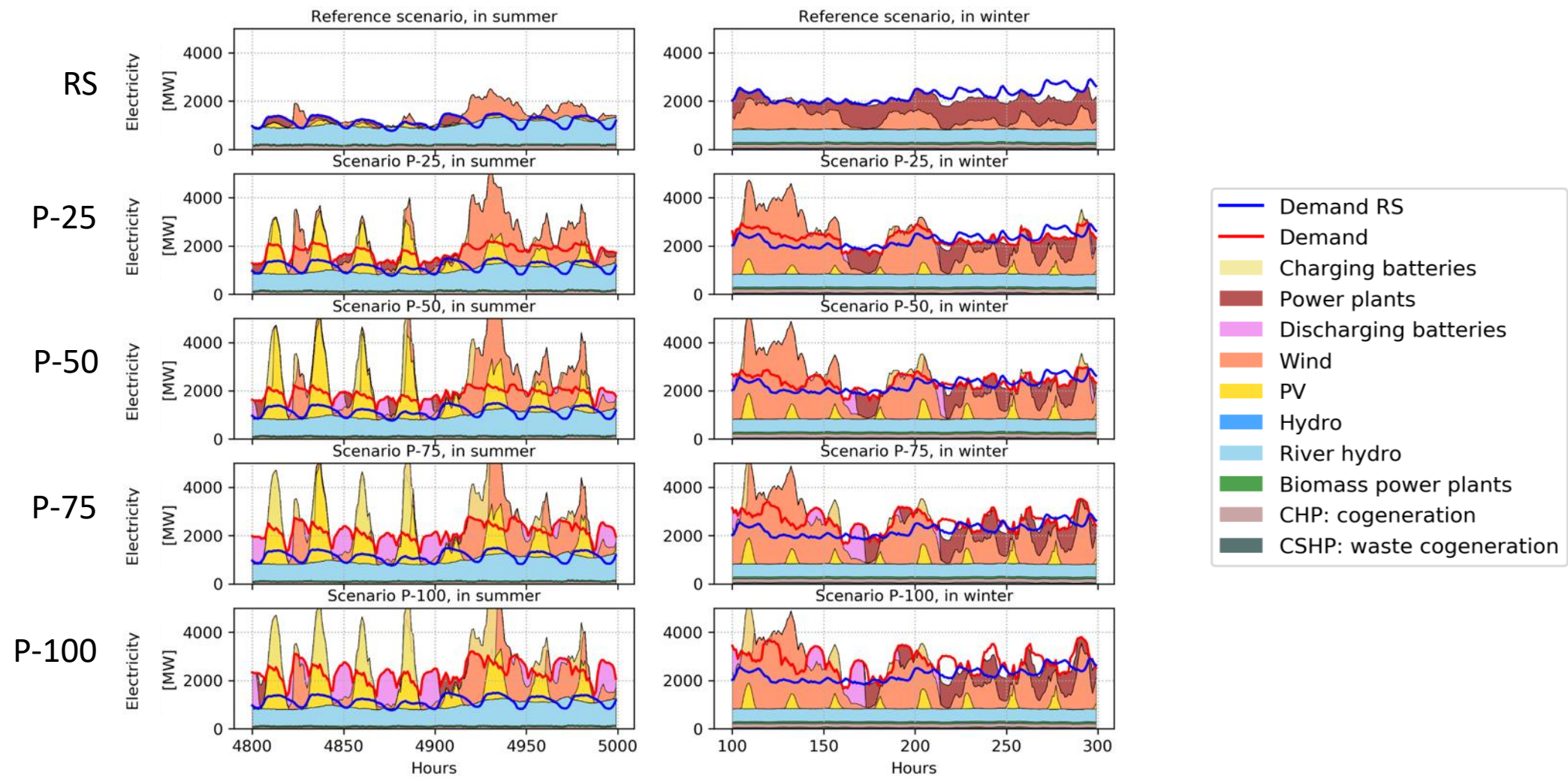
➤ Optimization results: Energy mix evolution for 3 pareto front solutions



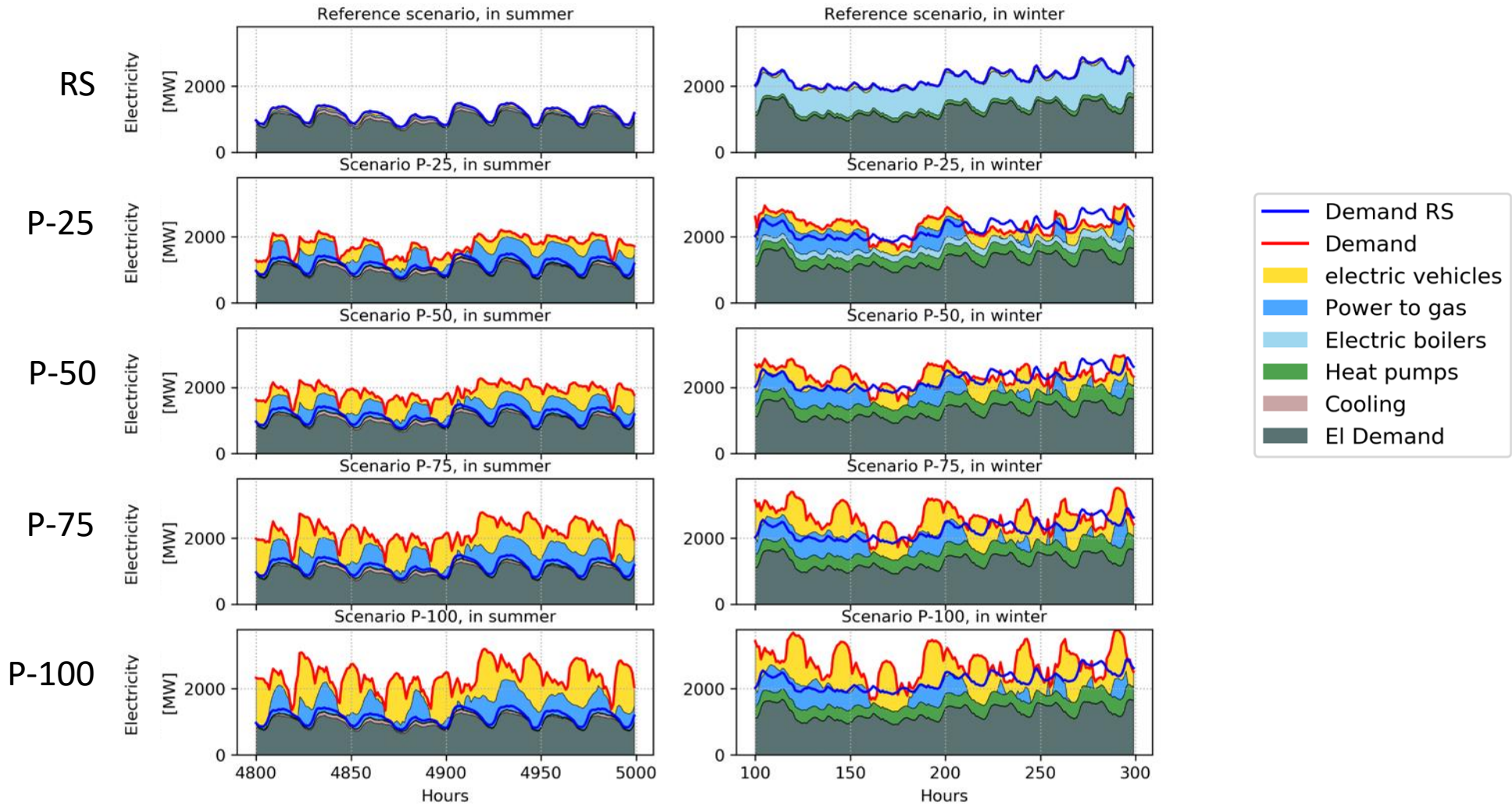
Overall final energy consumption in another regional case study



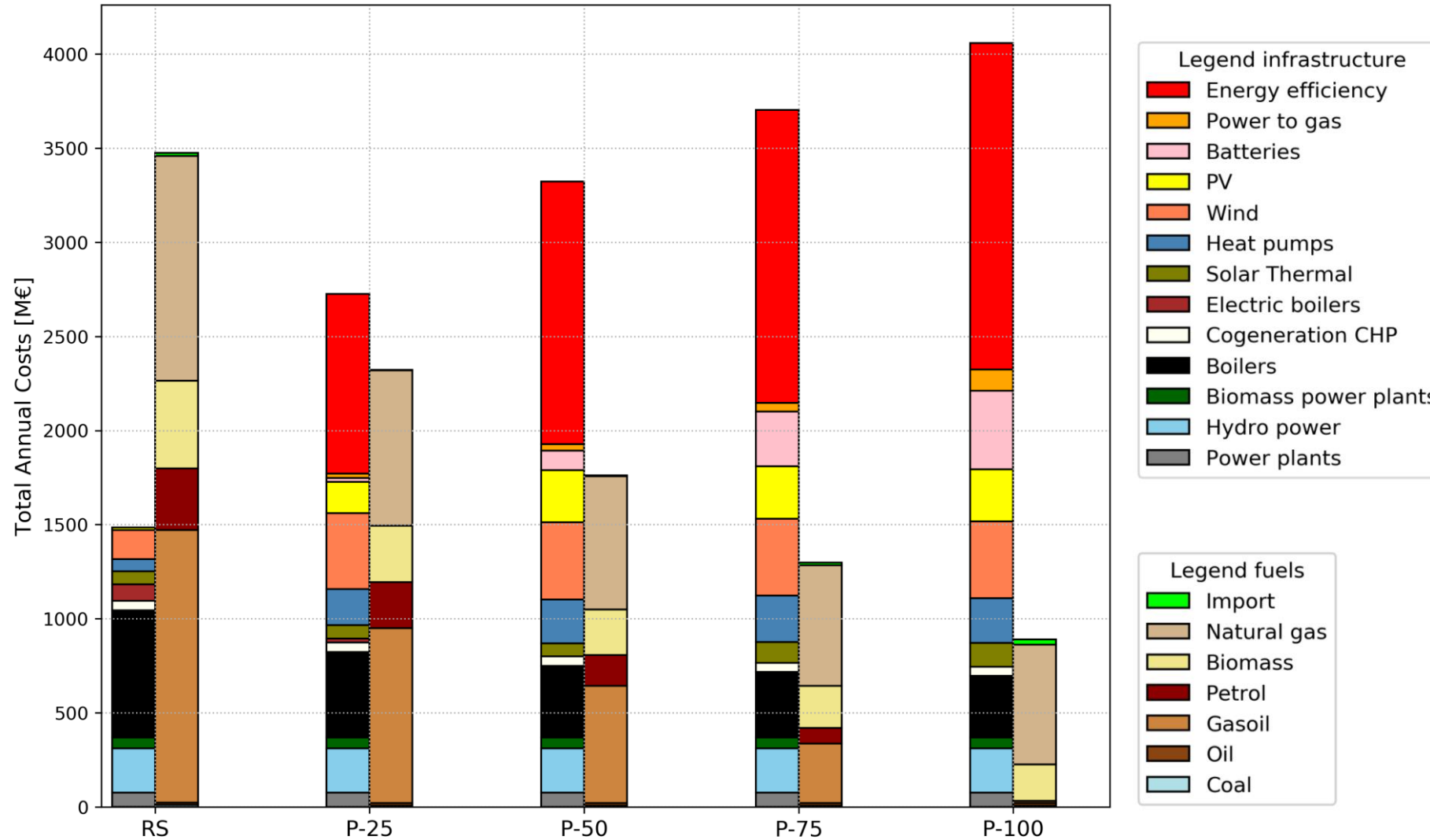
Analysis of electricity dispatch for various scenarios of e-vehicles penetration in another regional case study



Analysis of electricity dispatch for various scenarios of e-vehicles penetration in another regional case study



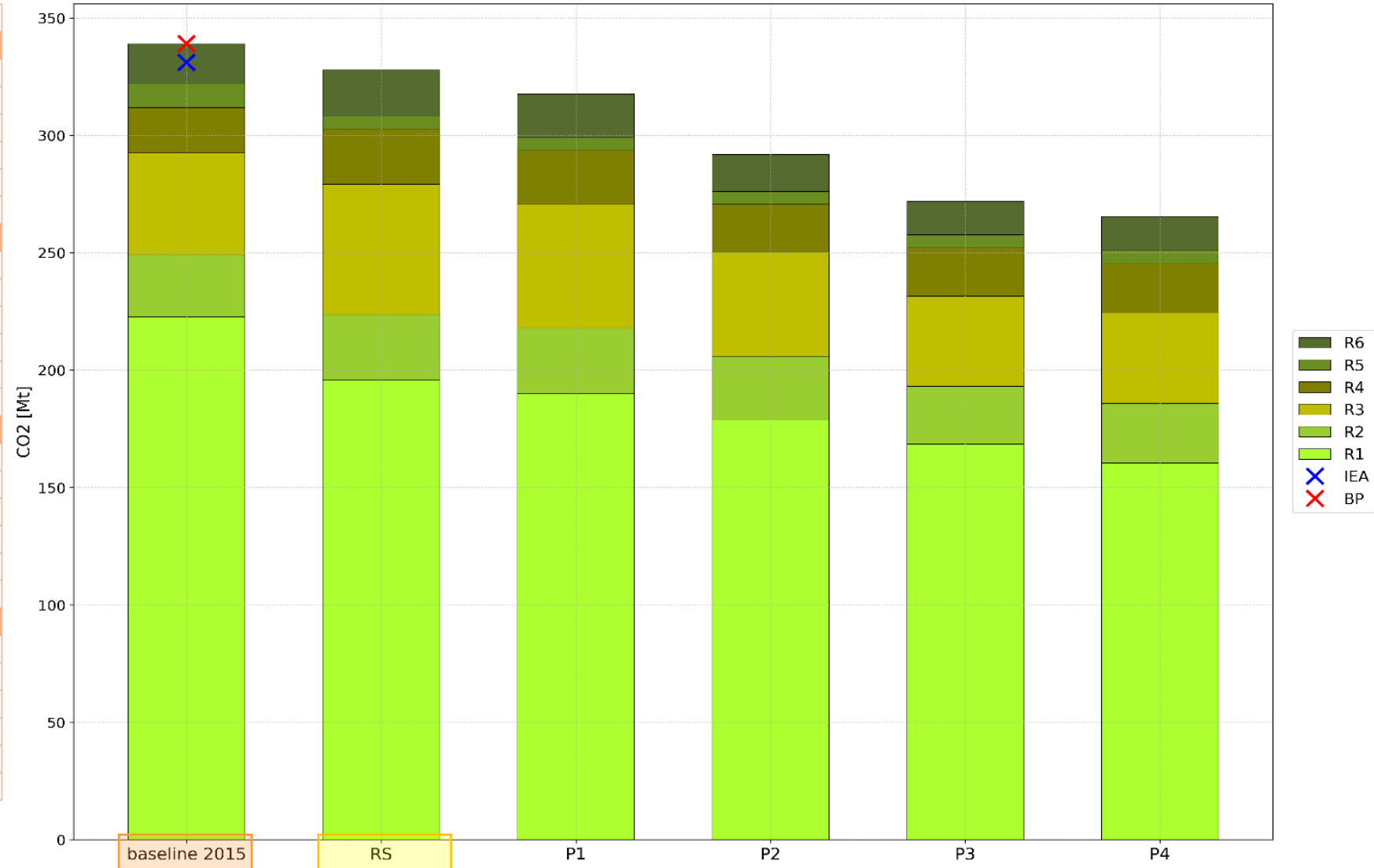
Cost data analysis in another regional case study



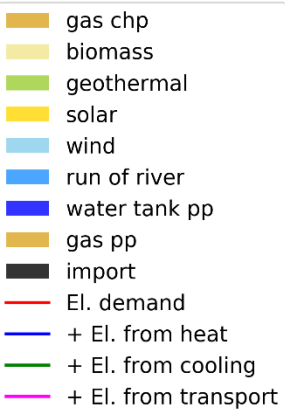
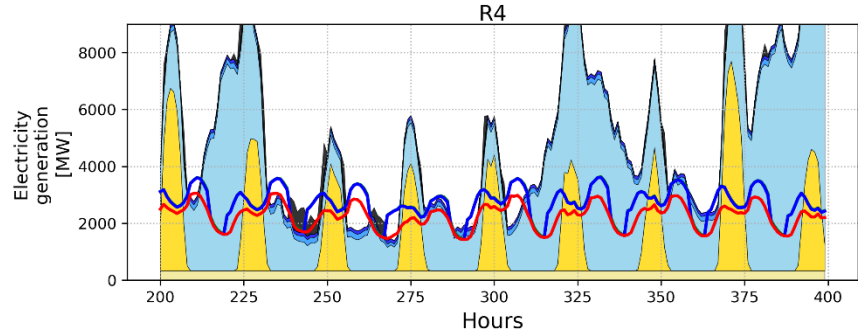
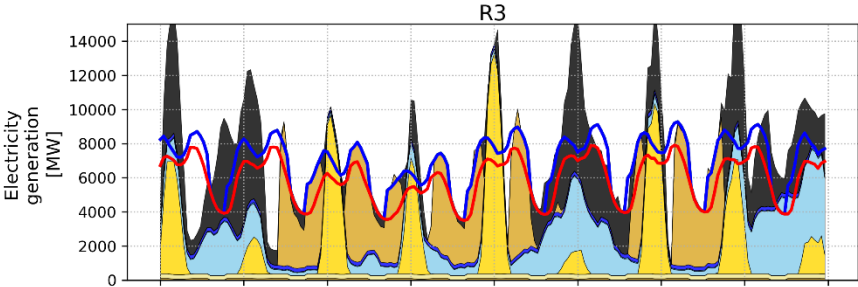
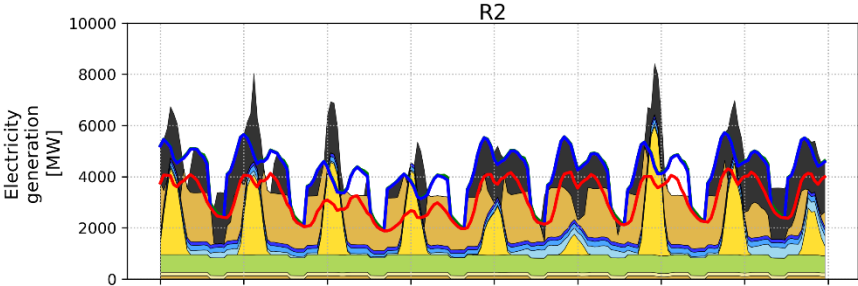
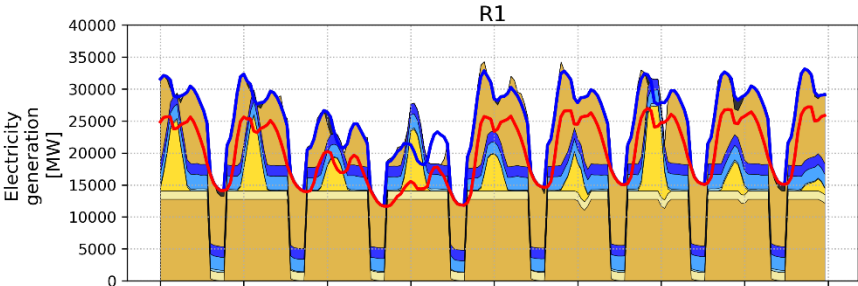
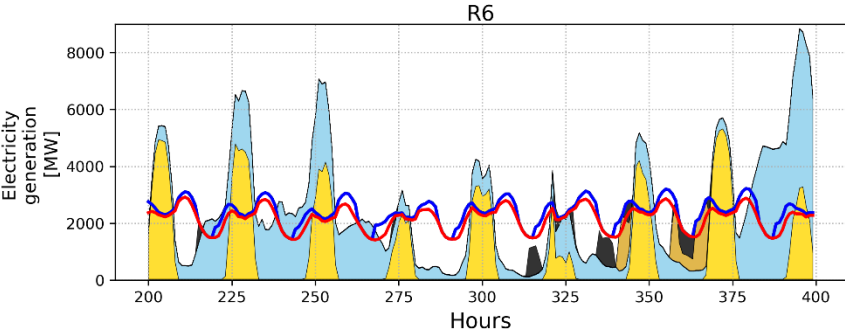
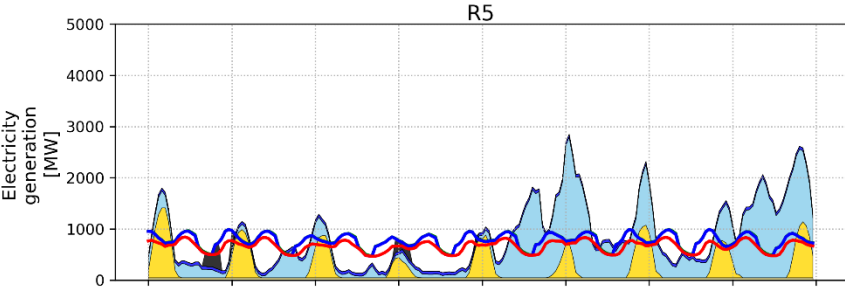
High economic potential
for internal market
for services, product
manufacturers, installers,
etc

Deterministic scenarios in Italy: from single node to multi-node

	RS	P1	P2	P3	P4
PV					
PV_R1	8319	13891.25	27782.5	41673.75	55565
PV_R2	2271	3099.5	6199	9298.5	12398
PV_R3	2654	6539.5	13079	19618.5	26158
PV_R4	3613	3474.75	6949.5	10424.25	13899
PV_R5	726	831.5	1663	2494.5	3326
PV_R6	1309	2541	5082	7623	10164
WIND					
W_R1	115.6	155	310	465	620
W_R2	133.6	186.25	372.5	558.75	745
W_R3	1632.1	2159.75	4319.5	6479.25	8639
W_R4	4517.6	5889	11778	17667	23556
W_R5	1005.5	1403	2806	4209	5612
W_R6	1757.6	2459.5	4919	7378.5	9838
BATTERIES					
B_R1	0	1250000	2500000	3750000	5000000
B_R2	0	1250000	2500000	3750000	5000000
B_R3	0	1250000	2500000	3750000	5000000
B_R4	0	1250000	2500000	3750000	5000000
B_R5	0	1250000	2500000	3750000	5000000
B_R6	0	1250000	2500000	3750000	5000000
ENERGY EFFICIENCY					
EN.EFF_R1	0	19	38	56	75
EN.EFF_R2	0	19	38	56	75
EN.EFF_R3	0	19	38	56	75
EN.EFF_R4	0	19	38	56	75
EN.EFF_R5	0	19	38	56	75
EN.EFF_R6	0	19	38	56	75



Scenarios



P4	
PV	
PV_R1	55565
PV_R2	12398
PV_R3	26158
PV_R4	13899
PV_R5	3326
PV_R6	10164
WIND	
W_R1	620
W_R2	745
W_R3	8639
W_R4	23556
W_R5	5612
W_R6	9838
BATTERIES	
B_R1	5000000
B_R2	5000000
B_R3	5000000
B_R4	5000000
B_R5	5000000
B_R6	5000000
ENERGY EFFICIENCY	
EN.EFF_R1	75
EN.EFF_R2	75
EN.EFF_R3	75
EN.EFF_R4	75
EN.EFF_R5	75
EN.EFF_R6	75

Workshop on “Energy sector coupling: electric-thermal interaction through heat pumps”

Bozen October 23rd, 2018



Energy sector coupling: electric-thermal interaction through heat pumps

Tuesday 23th of October 2018

EURAC – Institute for Renewable Energy, NOI Tech Park, via A. Volta 13/A, Bolzano

Time	Speaker & Topic
09:00	Registration
09:15	Welcome and Introduction
09:30	Grazia Barchi, Marco Cozzini (EURAC) – “The INTEGRIDS project and EURAC research activities on sector coupling through heat pumps”
10:00	Johanna Spreitzhofer (AIT) – “Electricity-market participation of heat pumps in single family houses and district heating networks”
10:30	Meysam Qadrdan (University of Cardiff) – “Hybrid heat pump: a whole-system analysis”
11:00	Coffee Break
11:30	Roberto Fedrizzi (EURAC) - <i>Round Table: HPs, thermal storages, thermal networks: an optimal mix for flexibility?</i>
12:30	Lunch

14:00	Marco Pau (RWTH Aachen University) – “Using heat pumps to support the electric distribution grid: opportunities and challenges”
14:30	Massimiliano Scarpa (IUAV, University of Venice) – “How heat pumps may be leveraged in the management of smart grids”
15:00	Giuseppe Emmi (University of Padova) – “Use of active demand response as possible solution to improve grid reliability”
15:30	Coffee Break
16:00	David Moser (EURAC) - <i>Round Table: Ancillary services, renewable integration, and prices: what the HPs potential for smart grids?</i>
17:00	Conclusions

Thank you for your attention

eurac
research
www.eurac.edu

david.moser@eurac.edu



fb.com/euracresearch



@EURAC



www.linkedin.com/company/euracresearch/