Scenarios for 2050
The Role of Hydropower and Geoenergies

SCCER-SoE Annual Conference

SCCER FURIES

sccer future energy efficient buildings & districts

sccer mobility

SCCER SoE
SWISS COMPETENCE CENTER for ENERGY RESEARCH
SUPPLY of ELECTRICITY

SCCER CREST

SCCER EIP
EFFICIENCY OF INDUSTRIAL PROCESSES

HEStorage
Swiss Competence Center for Energy Research

biosweet
Swiss Competence Center for Energy Research

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Innosuisse – Swiss Innovation Agency

KLIMANEUTRALE SCHWEIZ

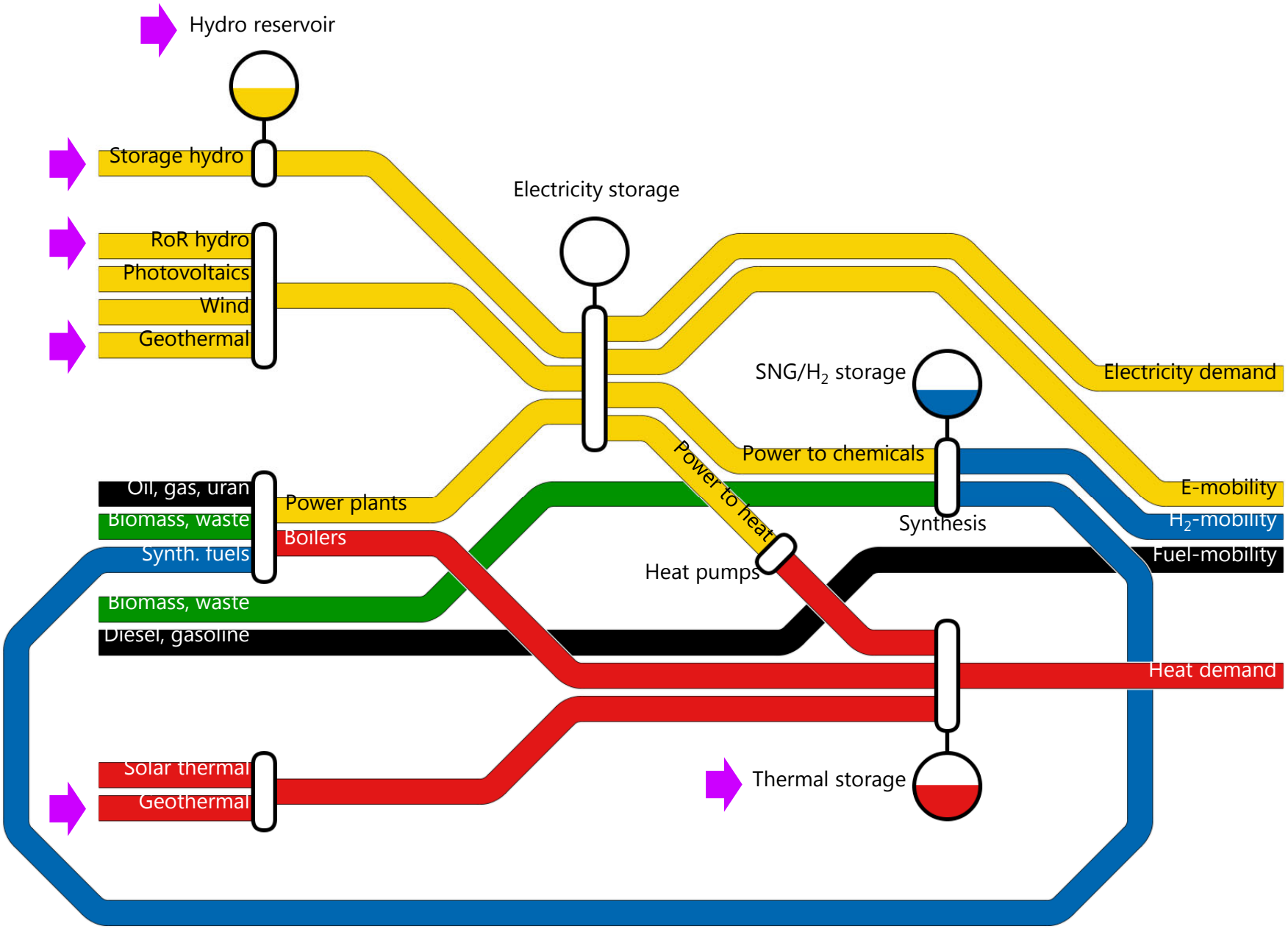
Bundesrat will bis CO2-Emissionen bis 2050 netto auf Null senken

sda • Zuletzt aktualisiert am 28.8.2019 um 16:05 Uhr

Die Schweiz soll bis 2050 klimaneutral werden. "Wir dürfen keine Zeit verlieren", sagte Umweltministerin Simonetta Sommaruga vor den Medien.

© KEYSTONE/ANTHONY ANEX

Die Schweiz soll bis 2050 klimaneutral werden. Das will der Bundesrat. Er hat am Mittwoch auf Basis neuer wissenschaftlicher Erkenntnisse entschieden, das bisherige Ziel zu verschärfen.


Hydro reservoir
Storage hydro
RoR hydro
Photovoltaics
Wind
Geothermal
Electricity storage
SNG/H2 storage
Electricity demand
Power to chemicals
E-mobility
H2-mobility
Power to heat
Synthesis
Oil, gas, uran
Biomass, waste
Synth. fuels
Power plants
Boilers
Heat pumps
Fuel-mobility
Biomass, waste
Diesel, gasoline
Heat demand
Solar thermal
Geothermal
Thermal storage

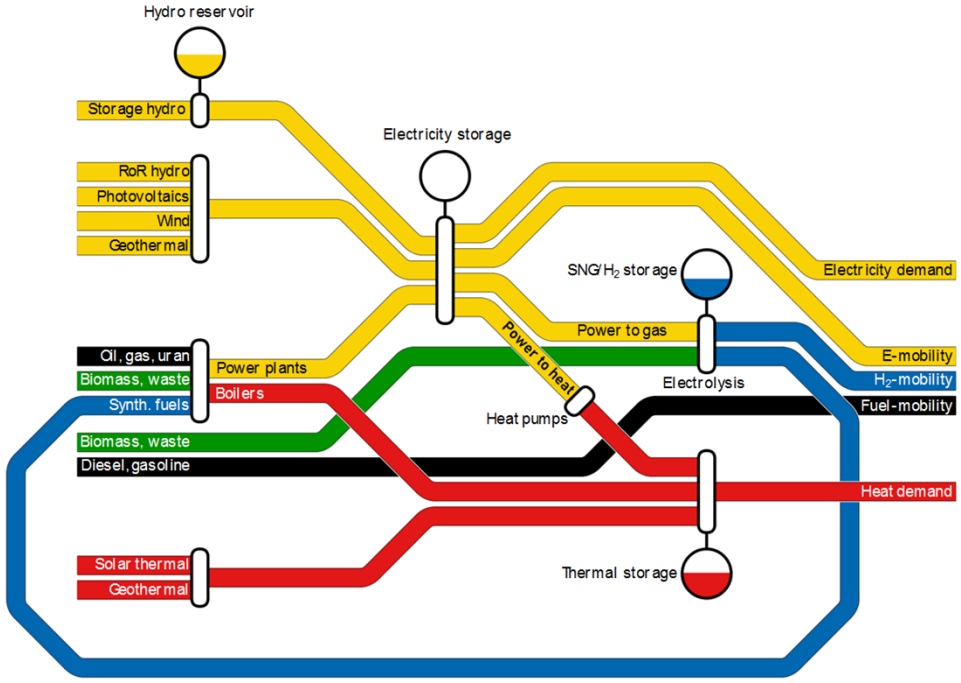
Sectoral models
UNIGE, UNIBAS, EPFL, HSLU, EMPA, etc.

Energy system models
PSI, EPFL, ETHZ

Technologies
Costs, efficiency

Primary energy
Potential, cost, time series

Drivers
Population, GDP, climate



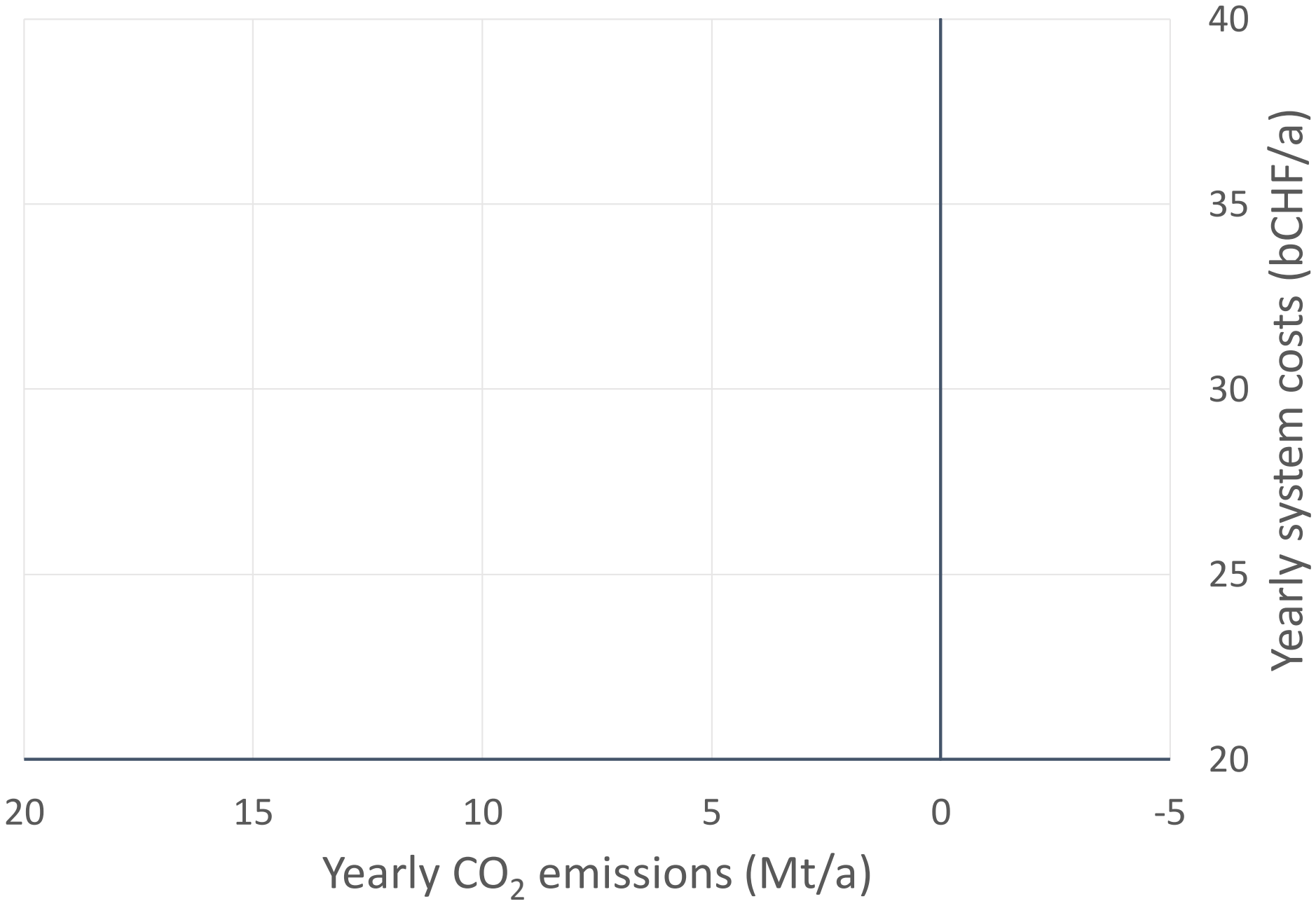
Macro-indicators
Emissions, system costs

Technology mix
How much PV, BEV, etc.

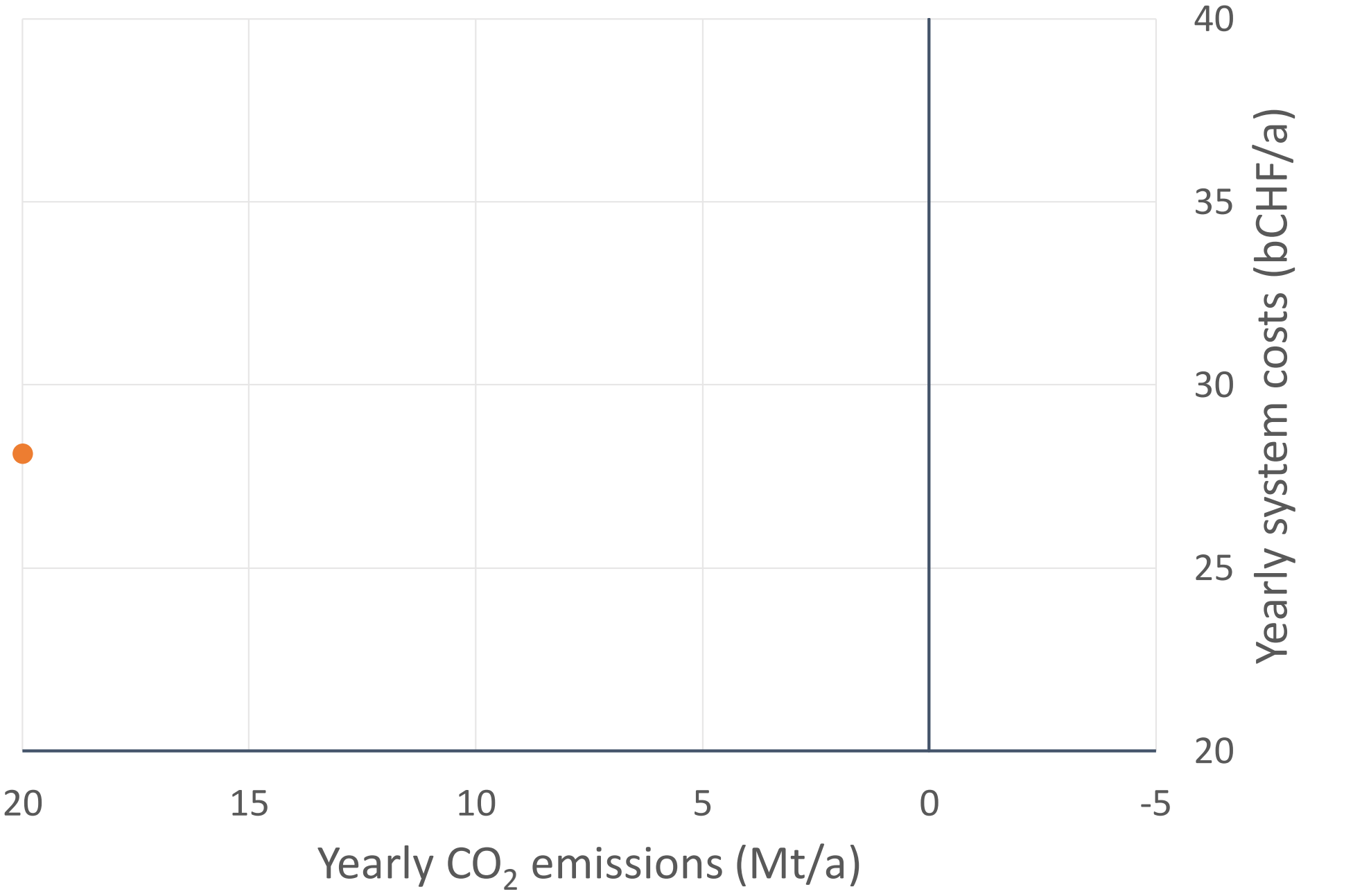
Recommendations
Measures, P&D priorities

Coupled optimization problem:
Cost-optimal system design and operation

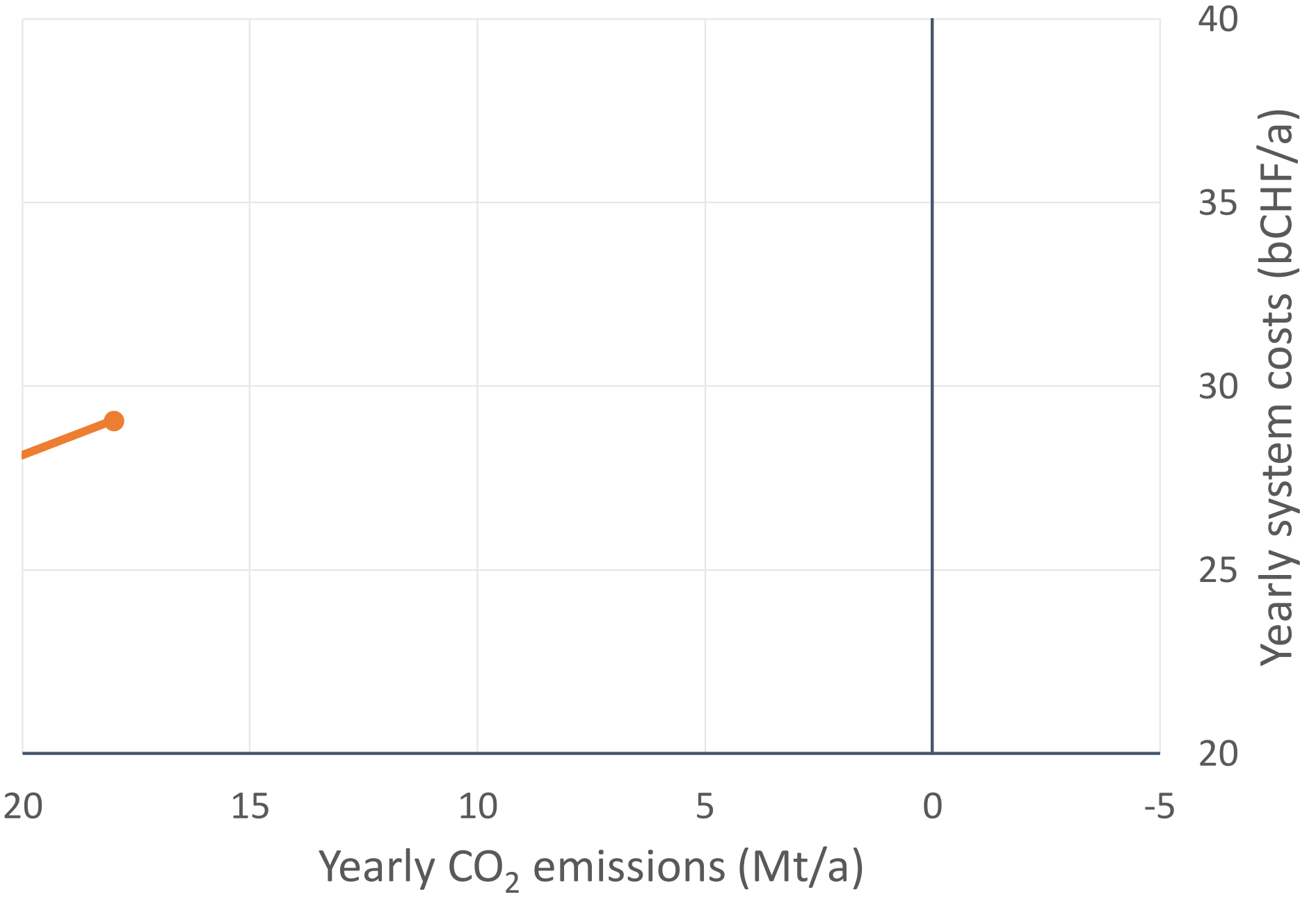
The value of SCCER-SoE technologies



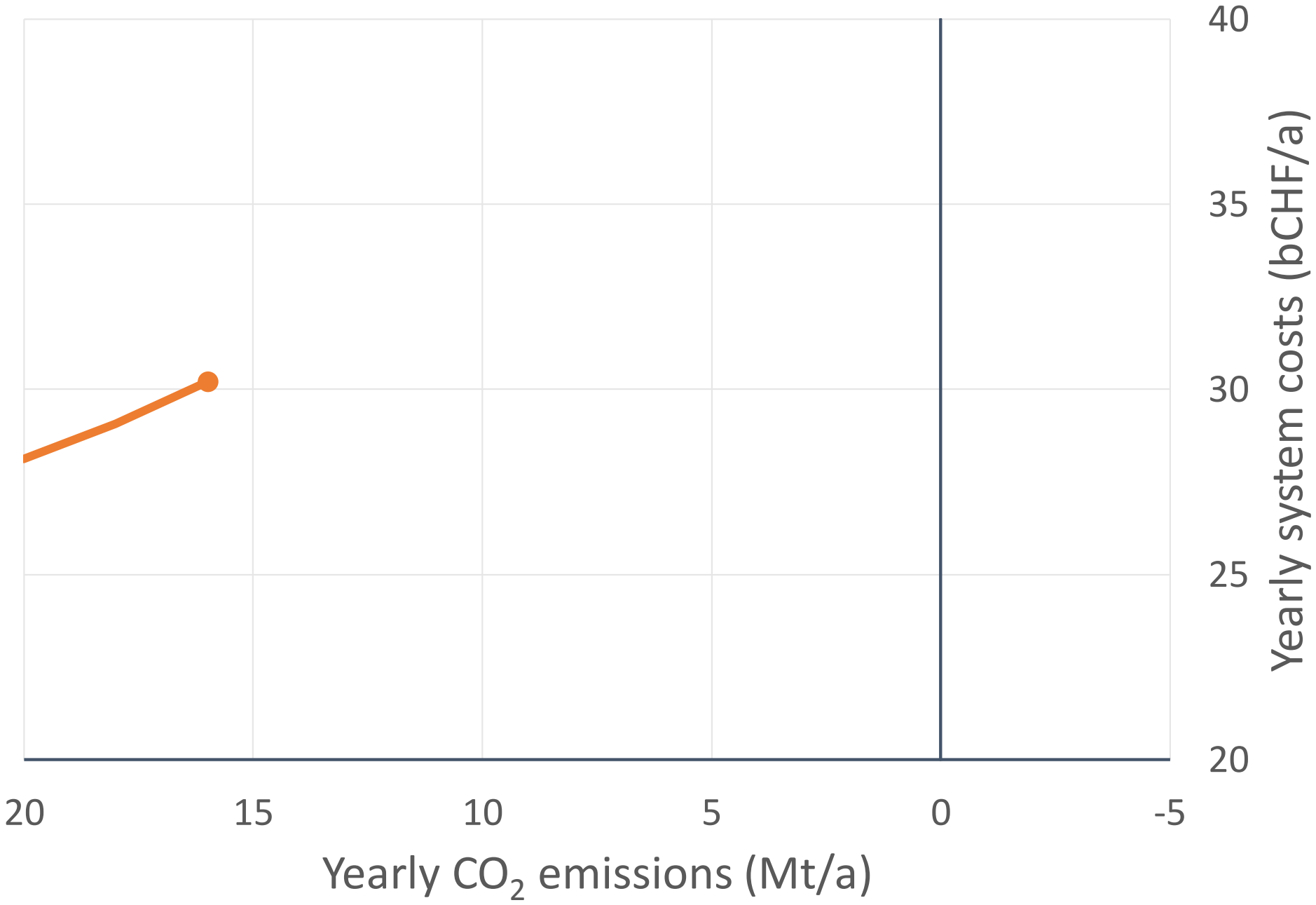
The value of SCCER-SoE technologies



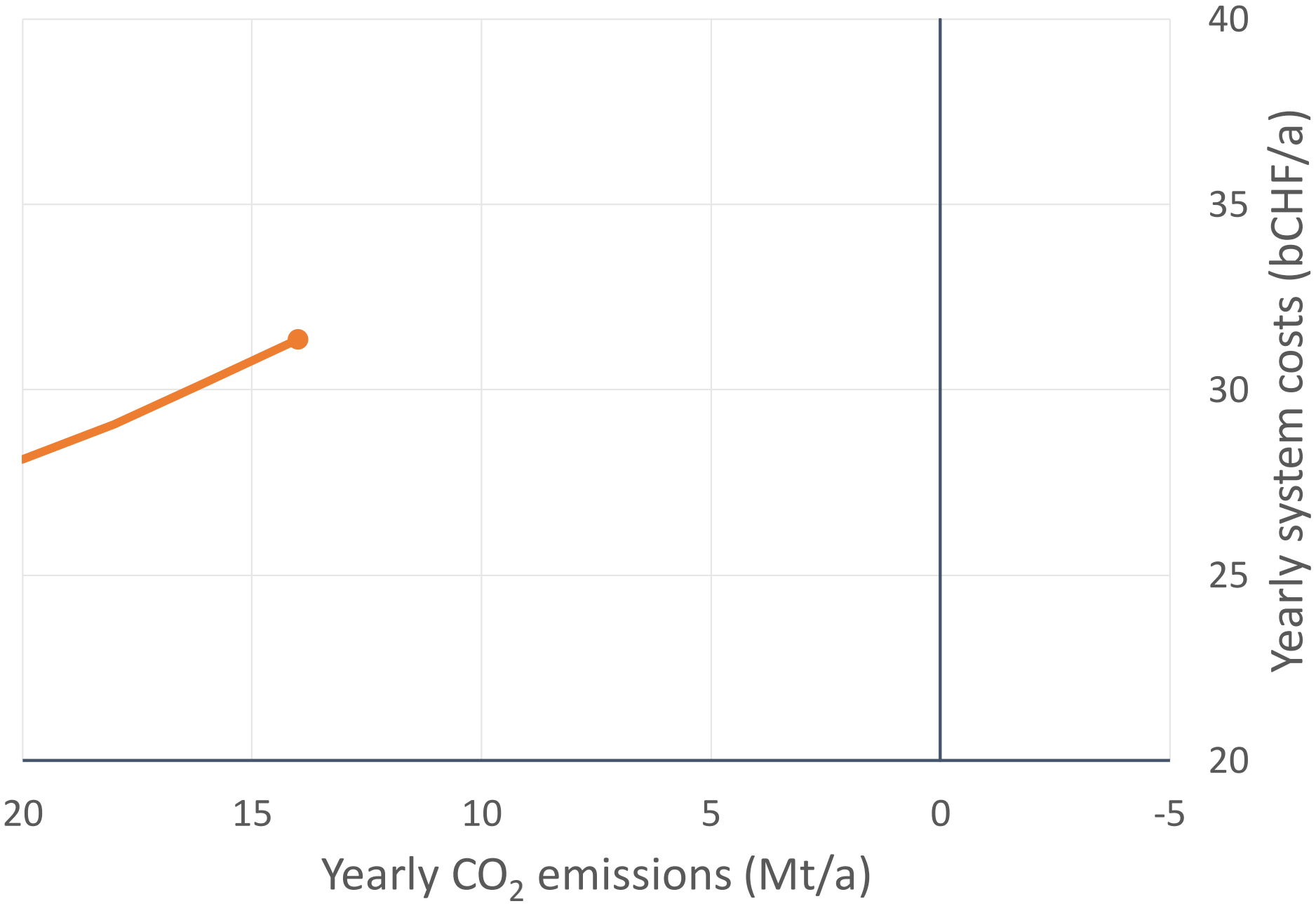
The value of SCCER-SoE technologies



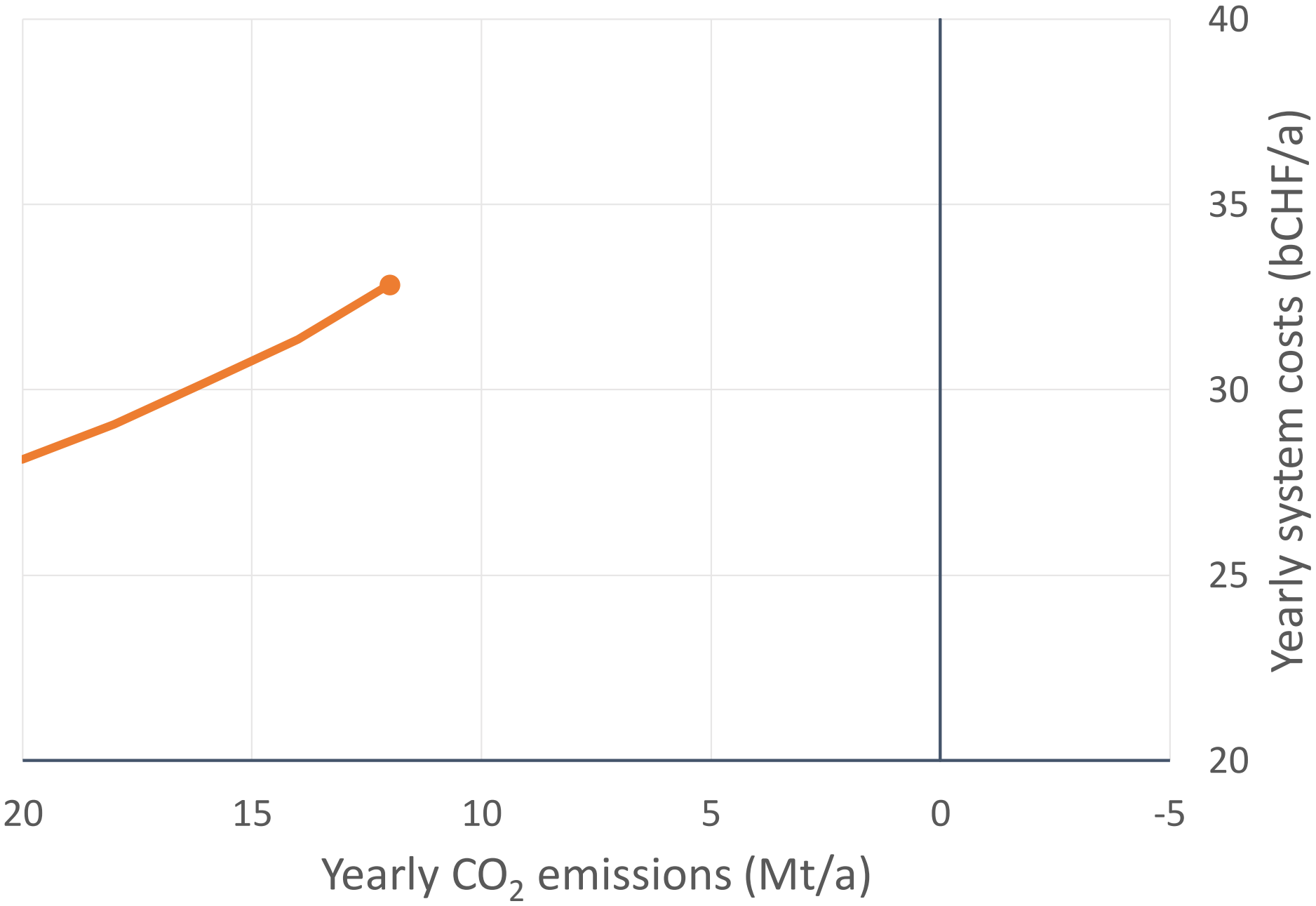
The value of SCCER-SoE technologies



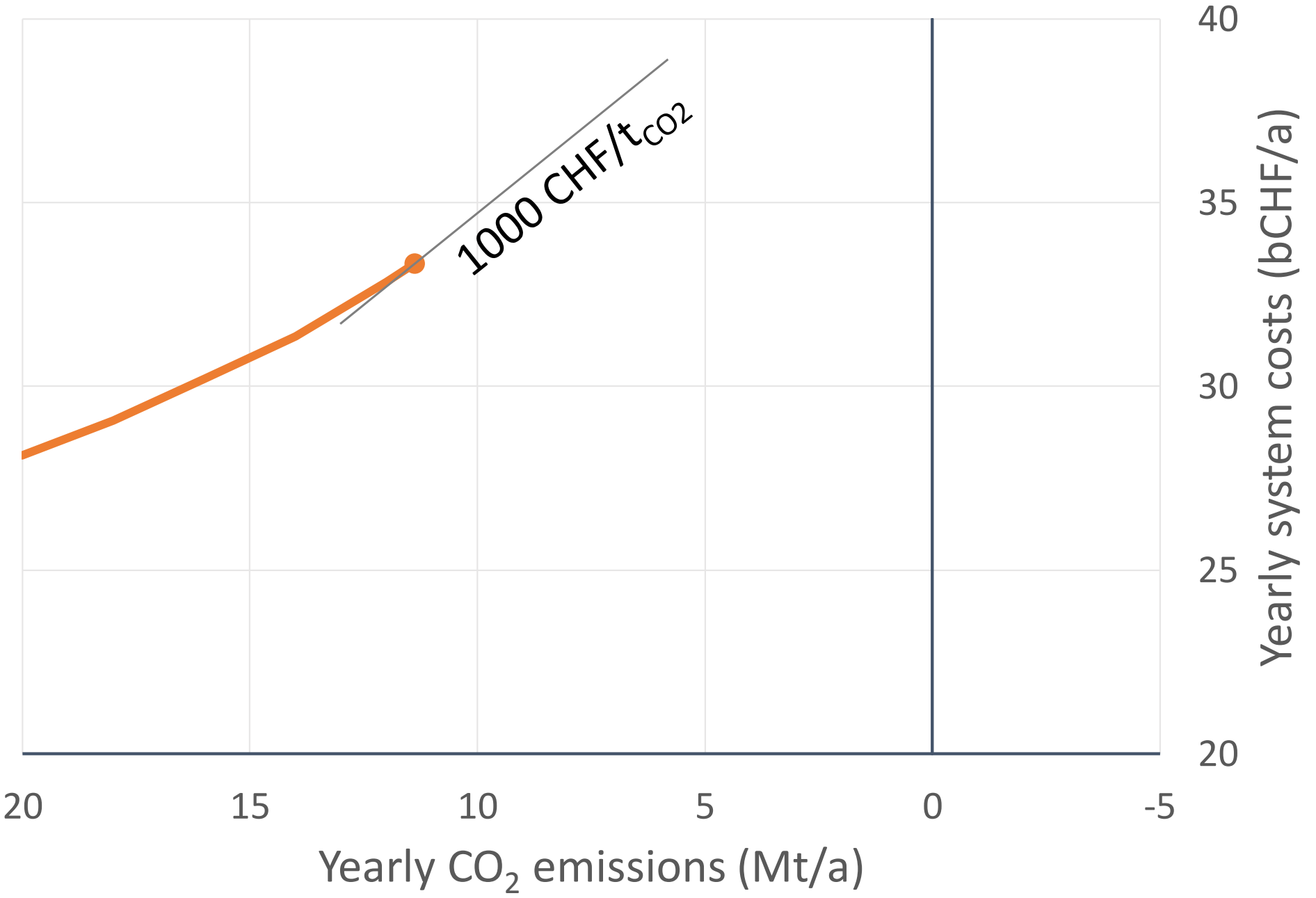
The value of SCCER-SoE technologies



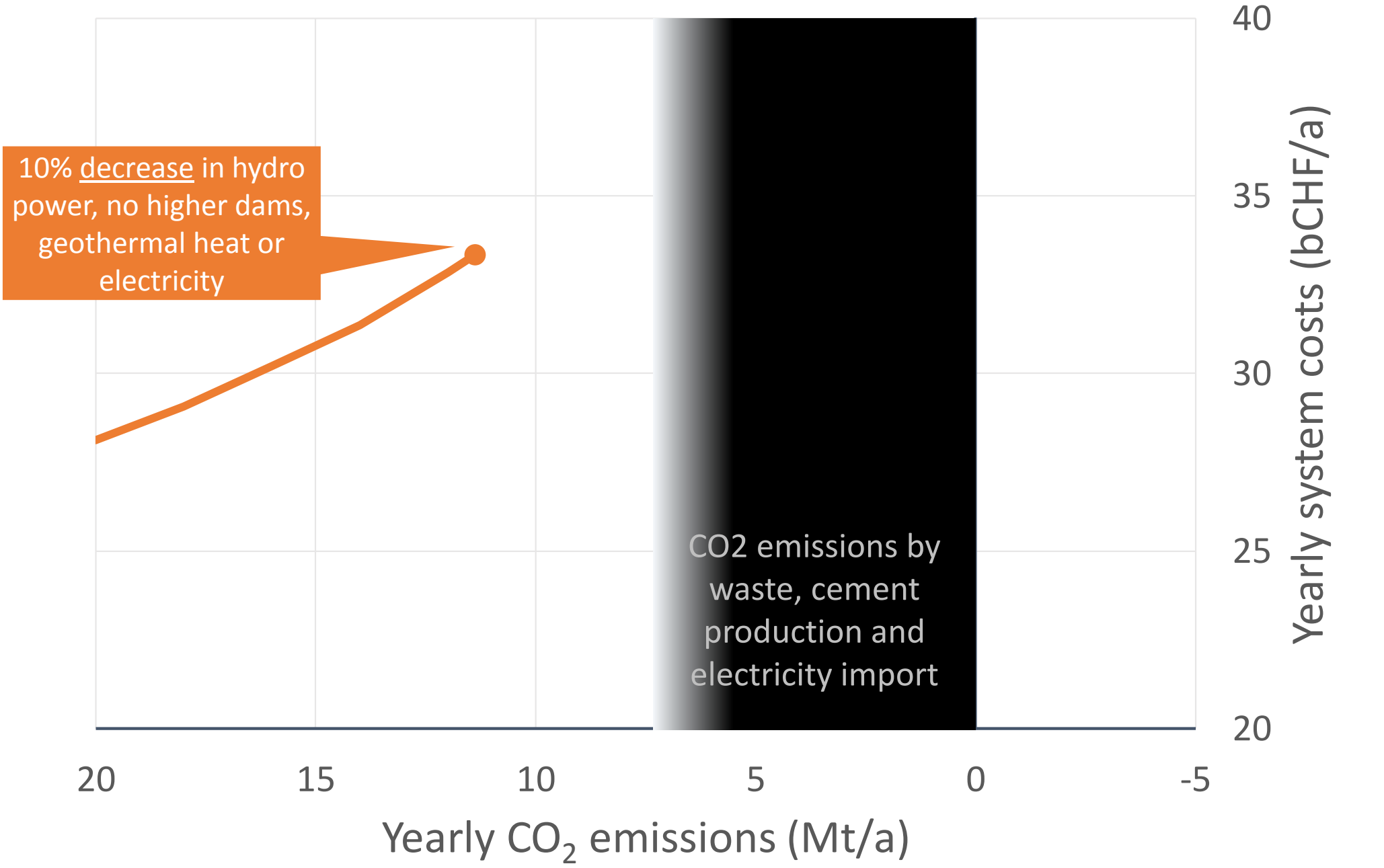
The value of SCCER-SoE technologies



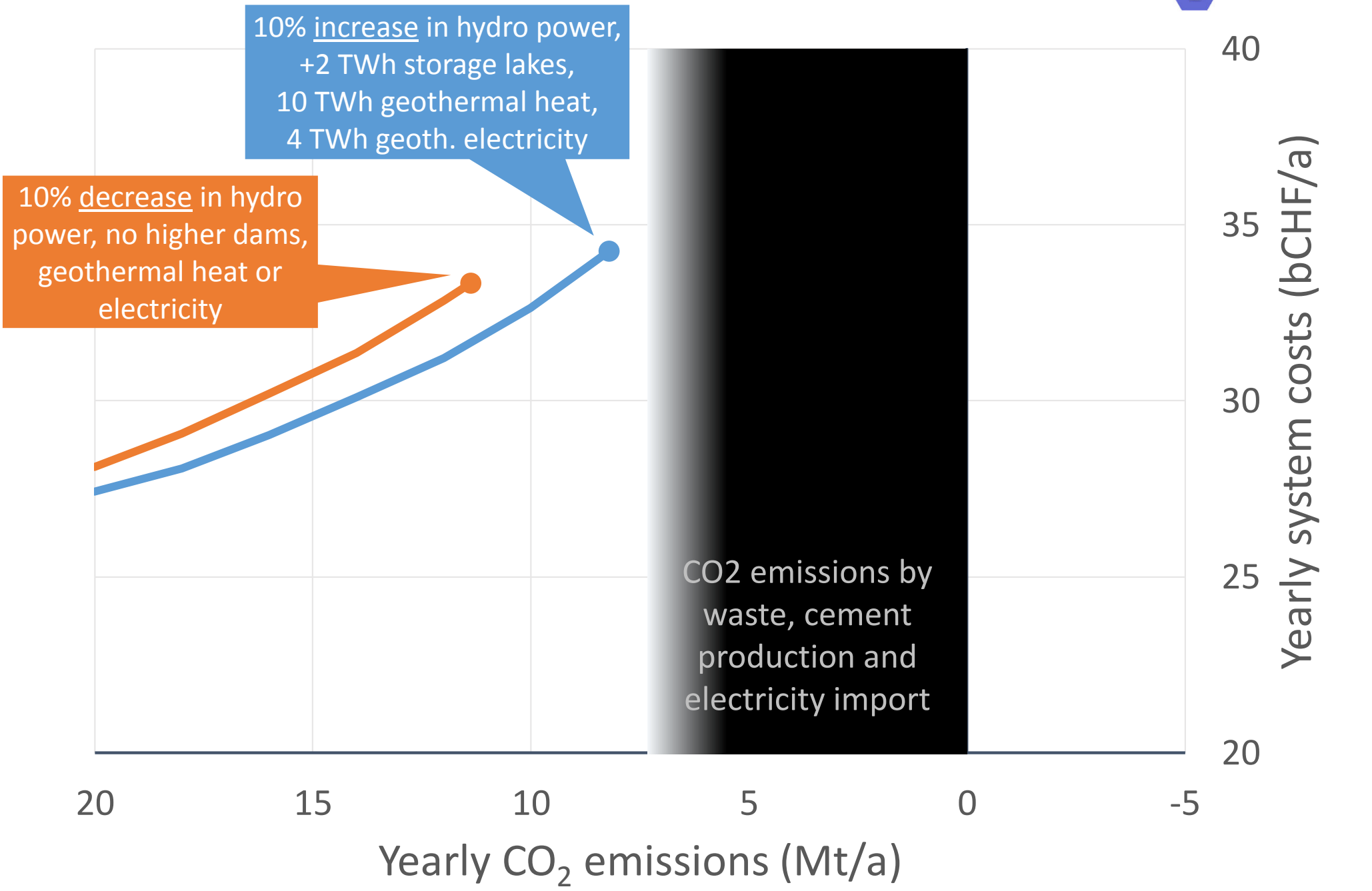
The value of SCCER-SoE technologies



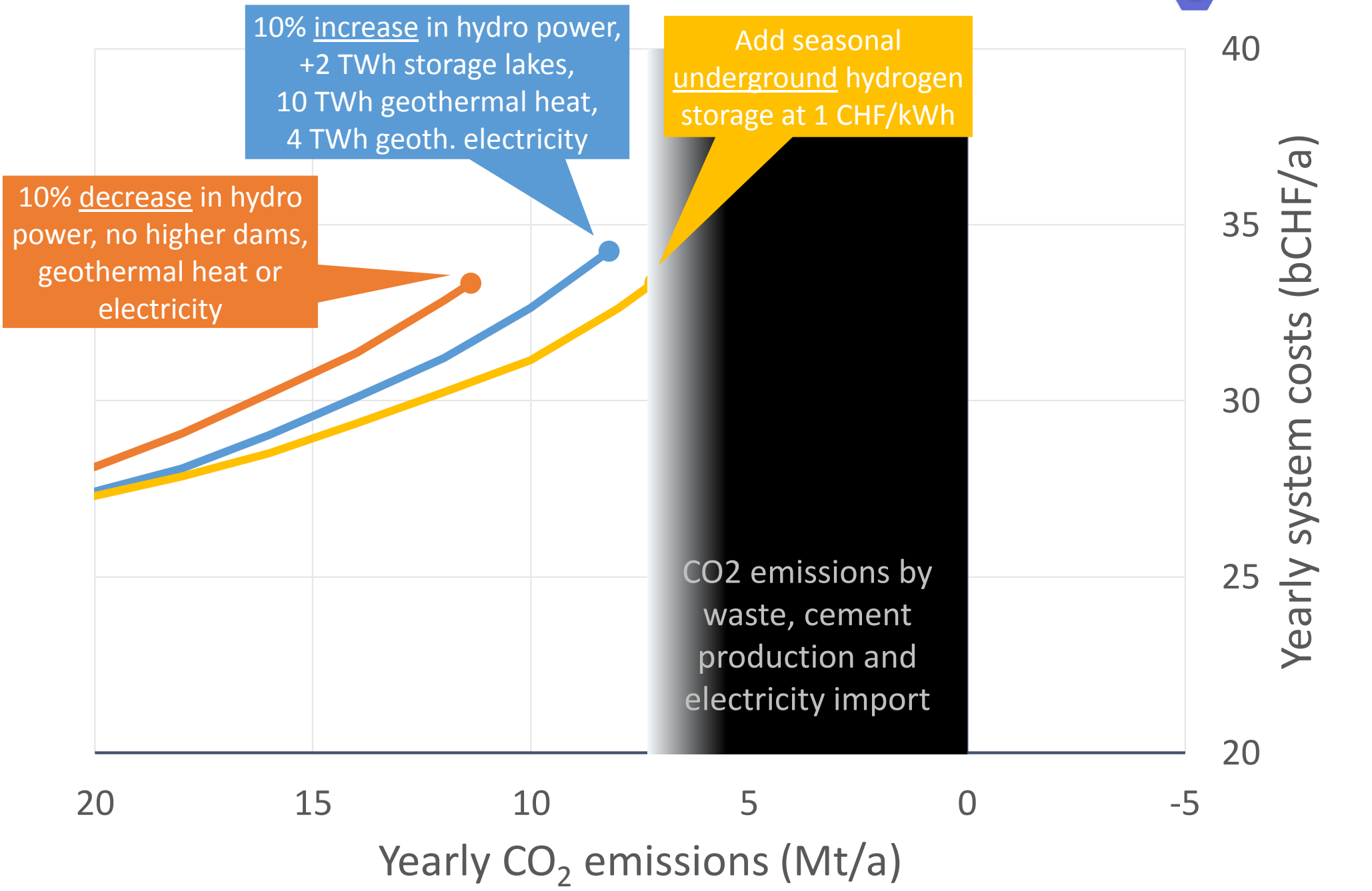
The value of SCCER-SoE technologies



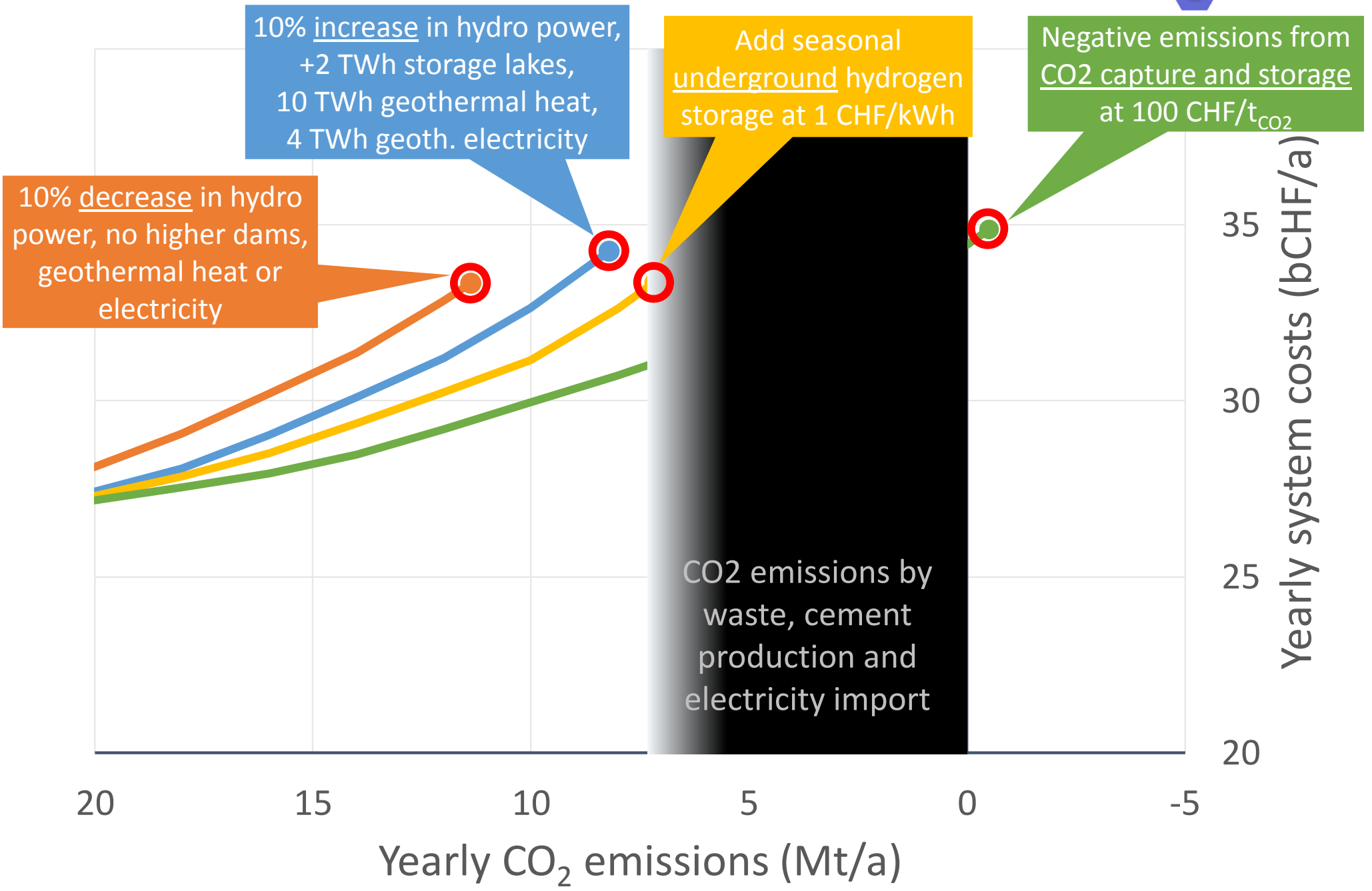
The value of SCCER-SoE technologies

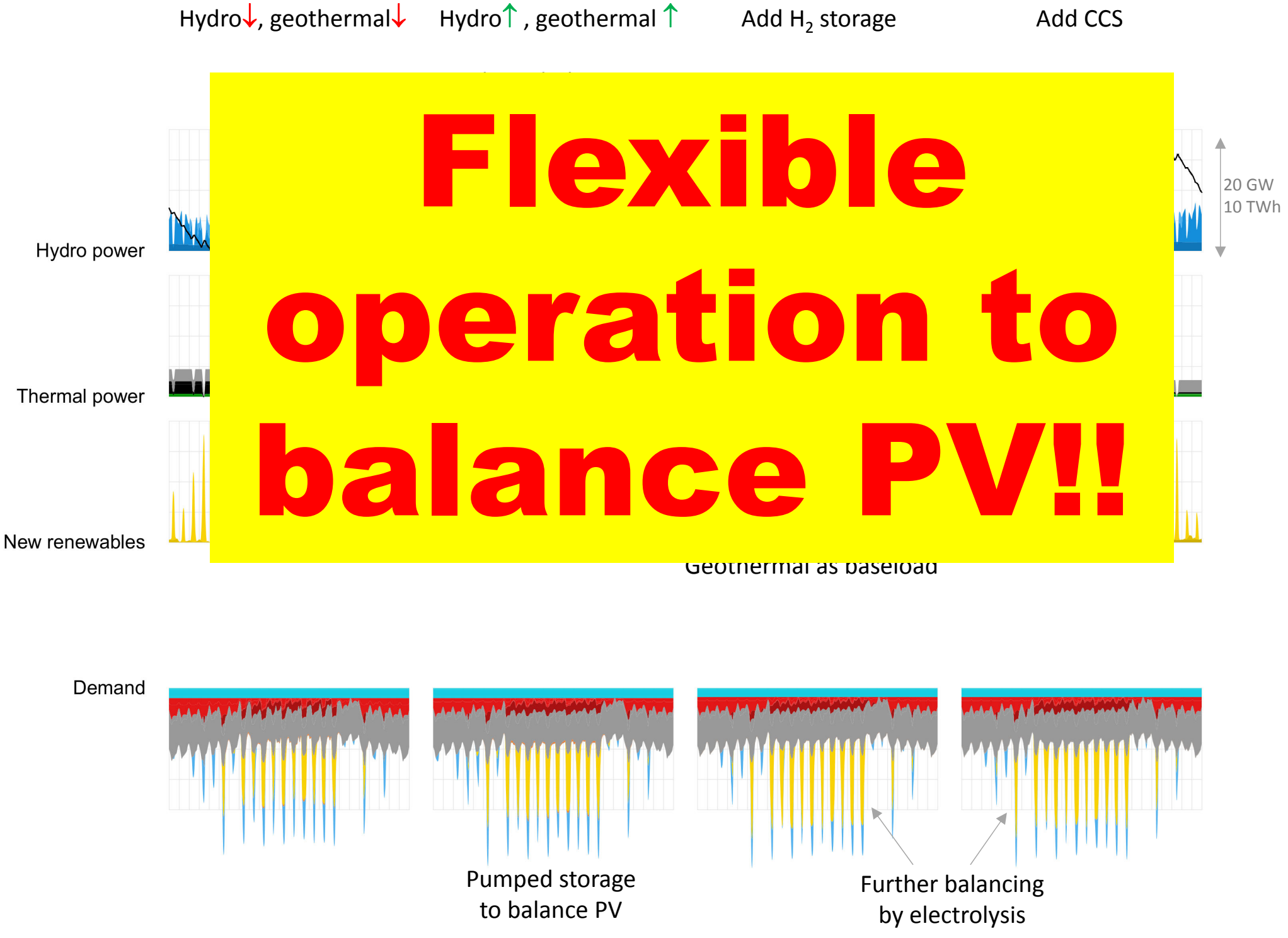


The value of SCCER-SoE technologies

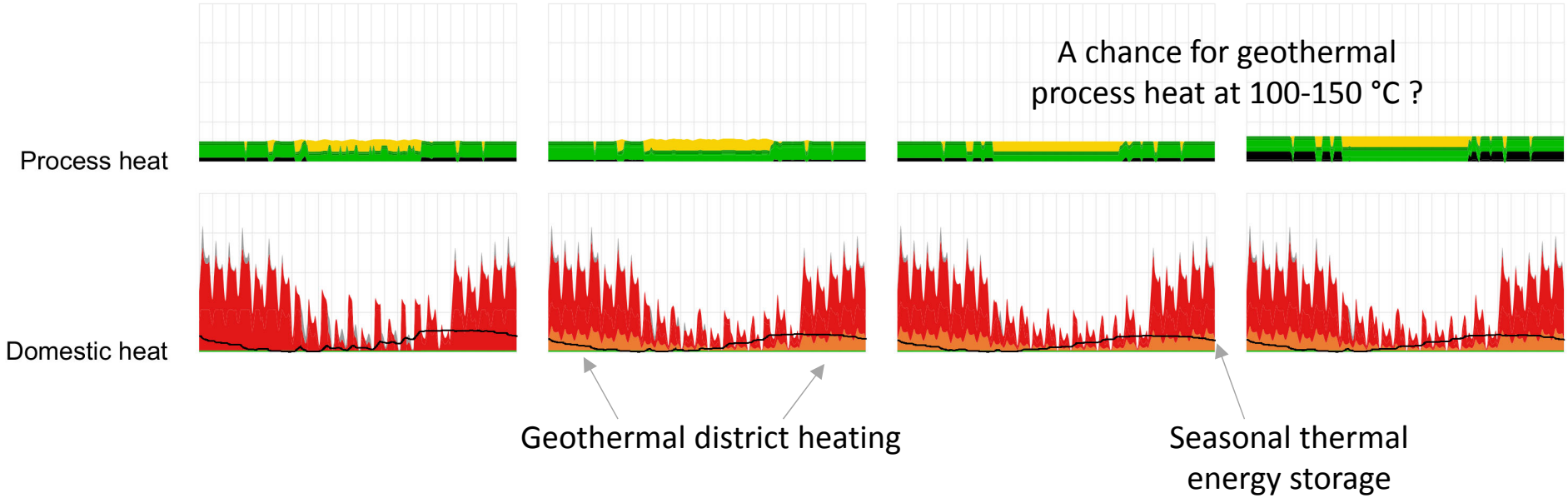


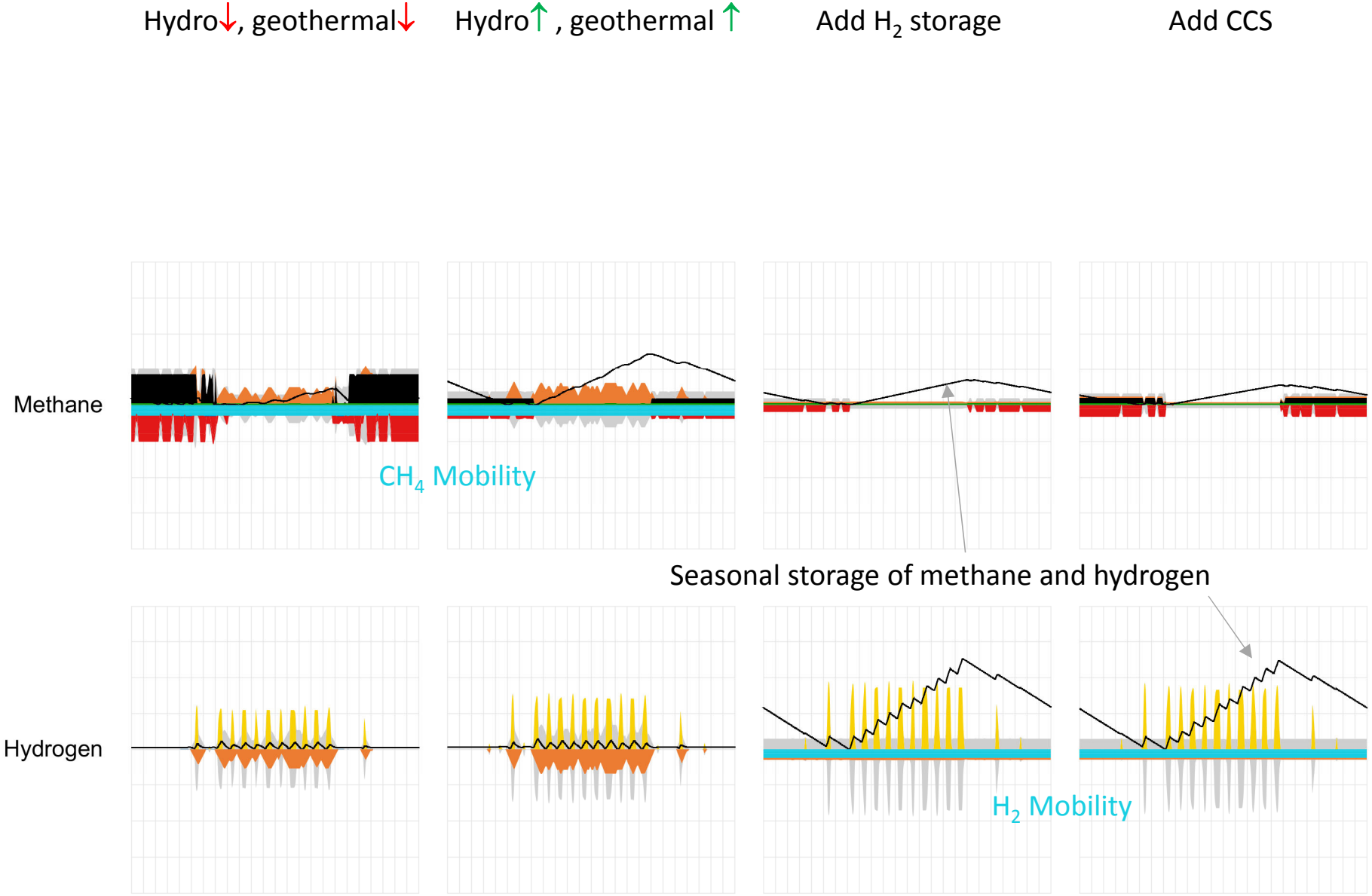
The value of SCCER-SoE technologies

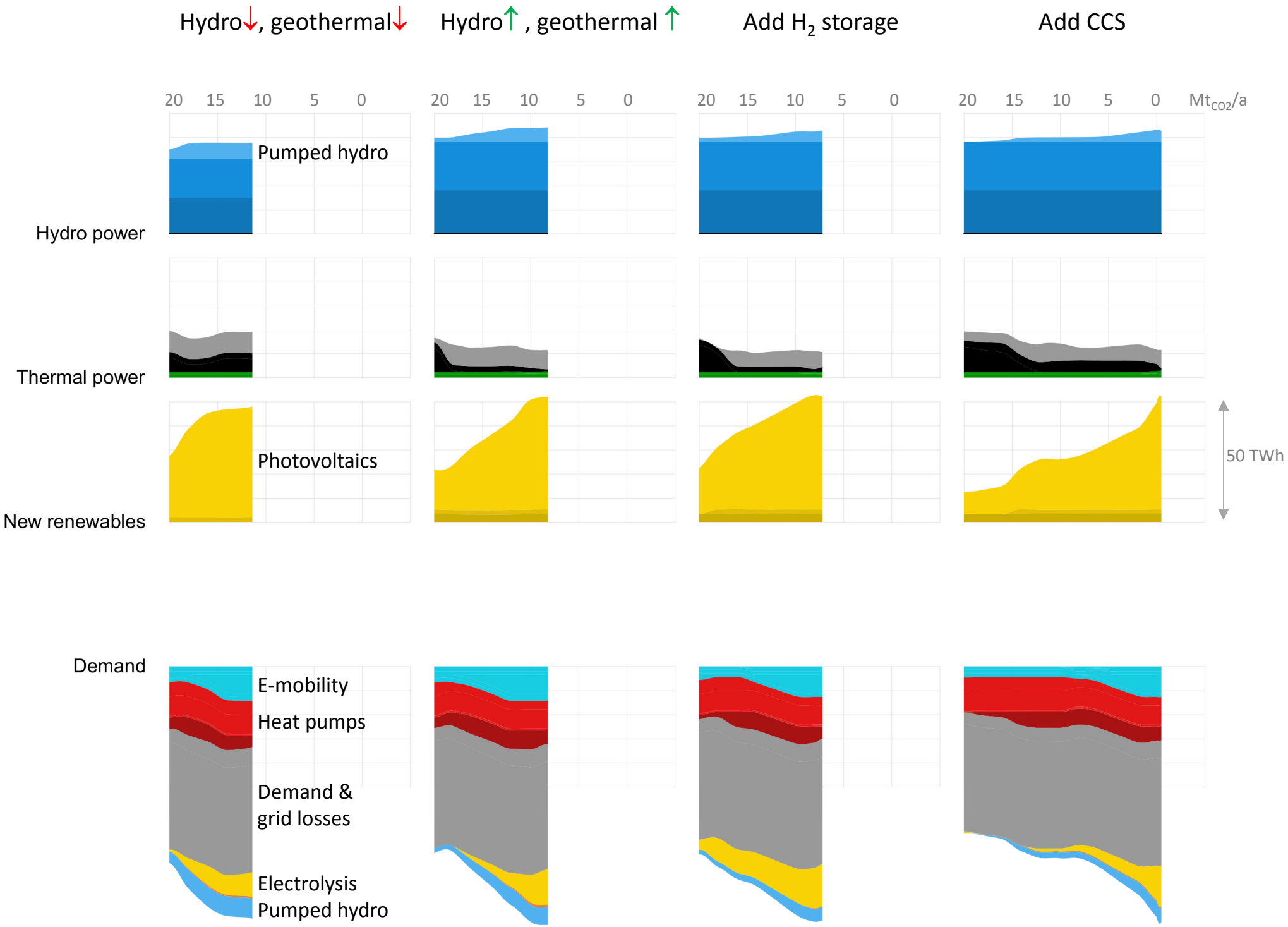


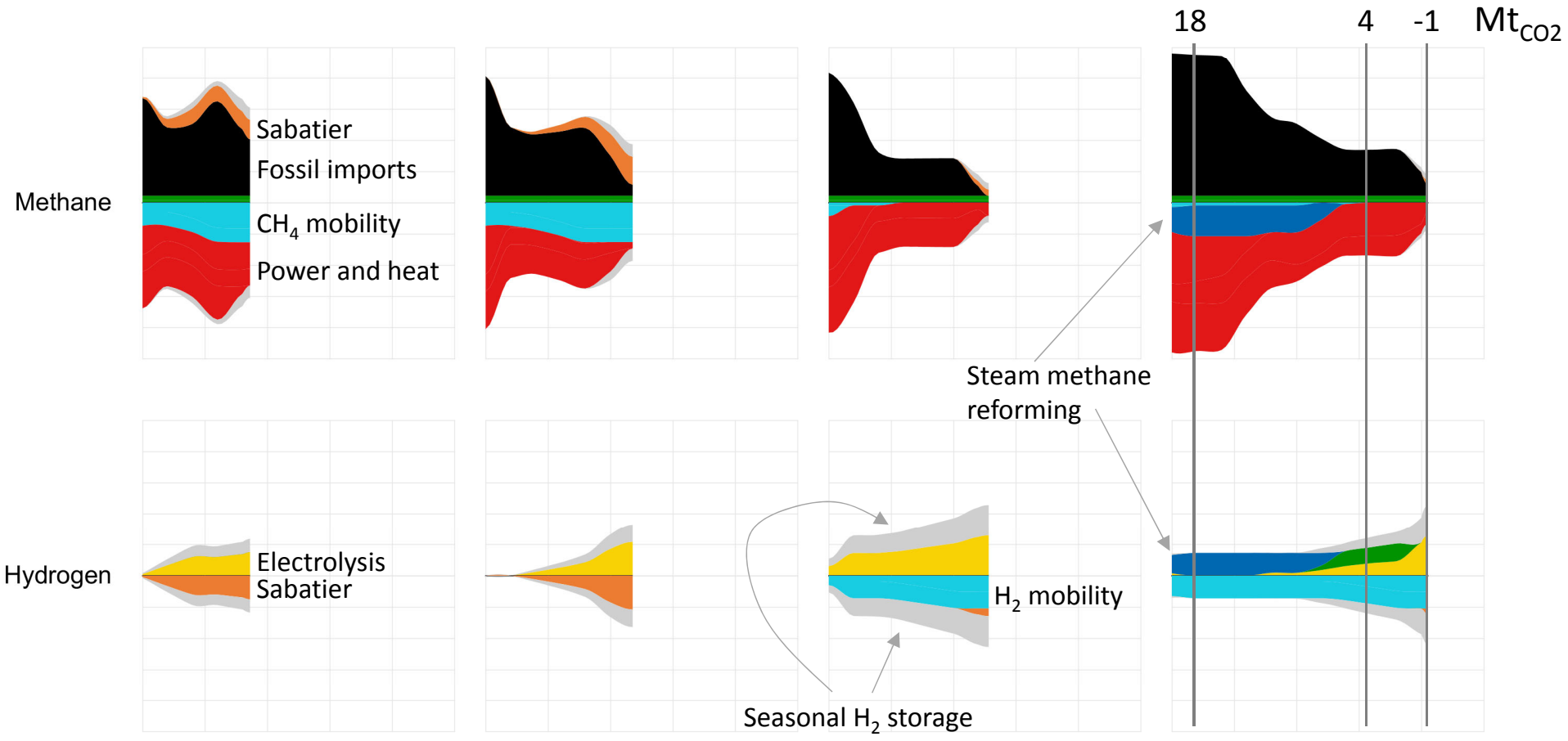

Hydro↓, geothermal↓
Hydro↑, geothermal↑
Add H_2 storage
Add CCS
Flexible operation to balance PV!!
Hydro power
Thermal power
New renewables
20 GW
10 TWh
Geothermal as baseload
Demand
Pumped storage to balance PV
Further balancing by electrolysis

Hydro↓, geothermal↓ Hydro↑ , geothermal ↑ Add H_2 storage Add CCS




Hydro↓, geothermal↓
Hydro↑, geothermal↑
Add H_2 storage
Add CCS
Methane
CH_4 Mobility
Seasonal storage of methane and hydrogen
Hydrogen
H_2 Mobility


Hydro↓, geothermal↓
Hydro↑, geothermal↑
Add H_2 storage
Add CCS
20 15 10 5 0
Mt_{CO2}/a
Hydro power
Pumped hydro
Thermal power
New renewables
Photovoltaics
50 TWh
Demand
E-mobility
Heat pumps
Demand &
grid losses
Electrolysis
Pumped hydro


Hydro↓, geothermal↓
Hydro↑, geothermal↑
Add H_2 storage
Add CCS
18
4
-1
Mt_{CO2}
Methane
Sabatier
Fossil imports
CH_4 mobility
Power and heat
Steam methane reforming
Hydrogen
Electrolysis
Sabatier
H_2 mobility
Seasonal H_2 storage

Conclusions

- Scenarios analysis can help to illustrate / quantify the value of the SoE technologies
  - More hydro power, higher dams, increased flexibility
  - Geothermal electricity, heat and heat storage
  - CO2 capture and storage
  - Let's think about geological hydrogen storage
- Optimum mix depends strongly on the exact target
  - Zero emissions in Switzerland?
  - +10 Mt_{CO2}/a in Switzerland compensated by –10 Mt_{CO2}/a elsewhere?

Thank you for your attention!

Visit us on www.sccer-jasm.ch

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Innosuisse – Swiss Innovation Agency