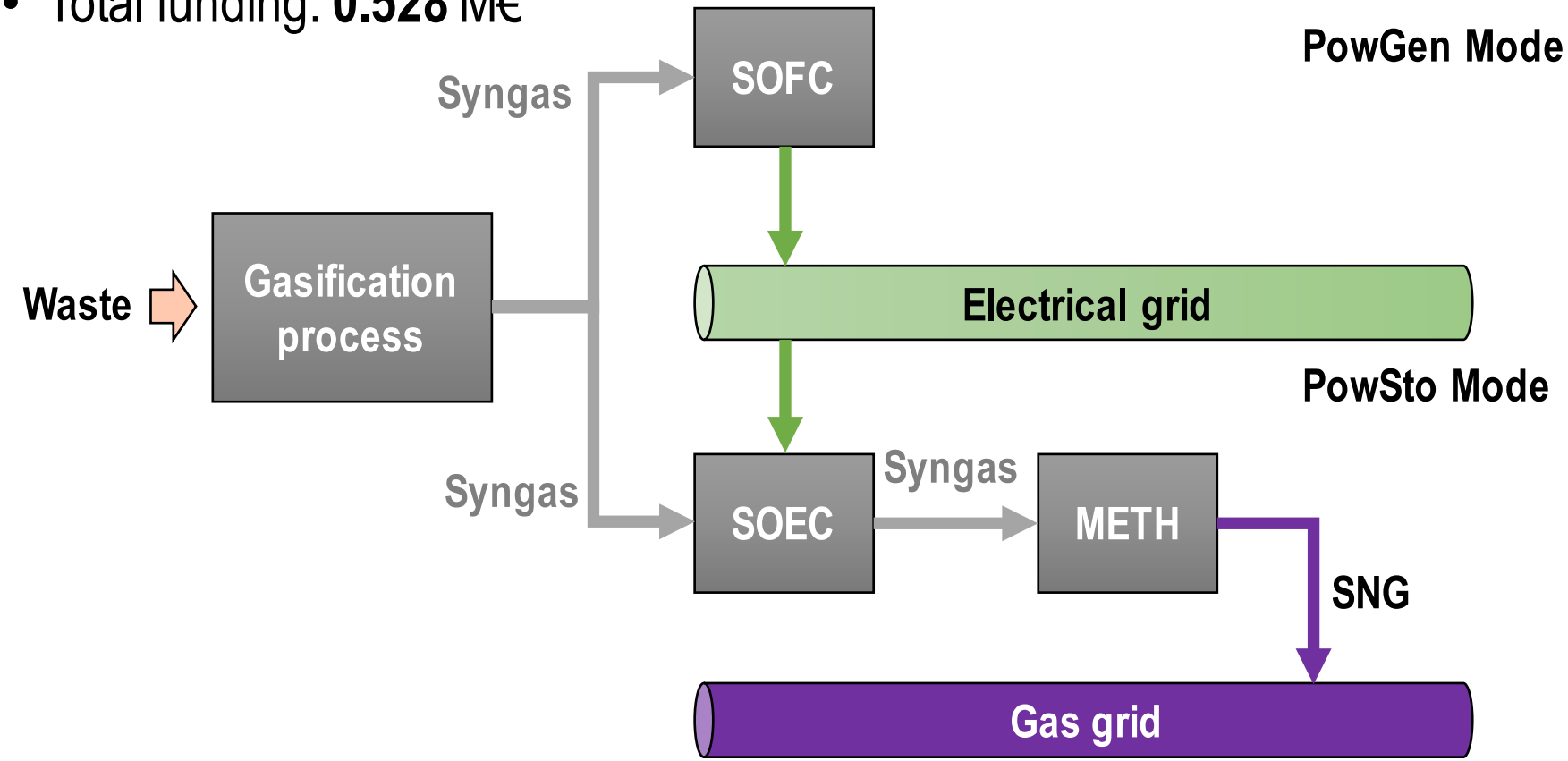
Waste2GridS

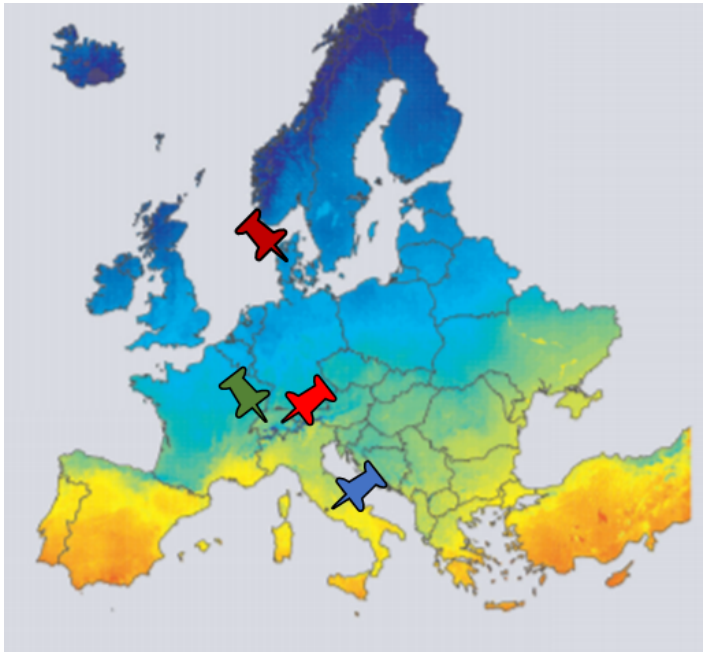
Technical overview and progress

W2G Facts

- Duration: 01 Jan 2019 – 30 June 2020 (**18 months**)
- Topic: Converting **WASTE** to offer flexible **GRID** balancing **S**ervices with *highly-integrated, efficient solid-oxide plants*
- Objective: ***Deploy specific plants in specific zones for 2030***
- Total funding: **0.528** M€



Waste2GridS Partners



EPFL

WP2
Plant design
WP3
Techno-economics
WP5
Management

ENEA

WP1
Zone identification

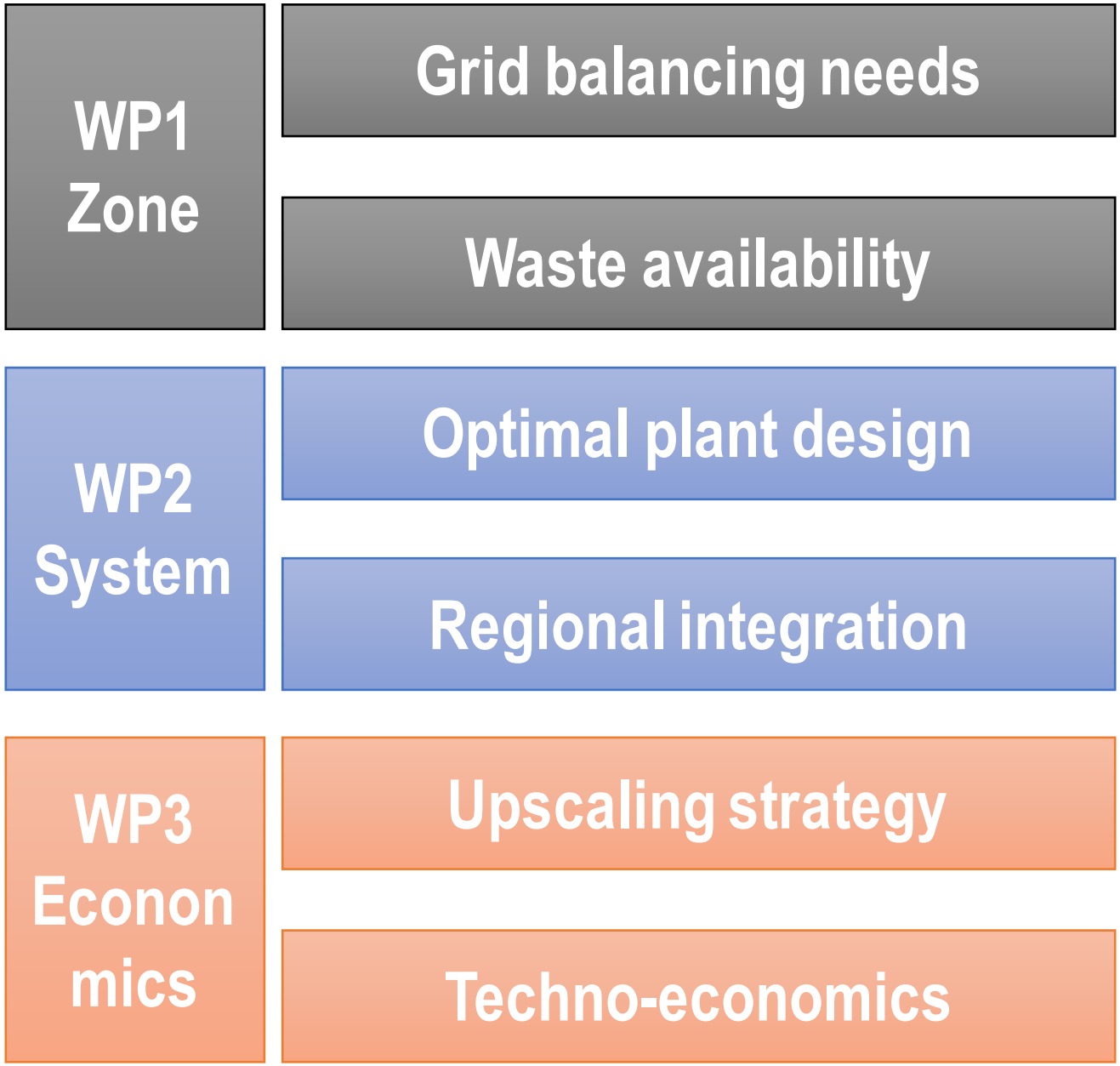
DTU

WP4
Dissemination

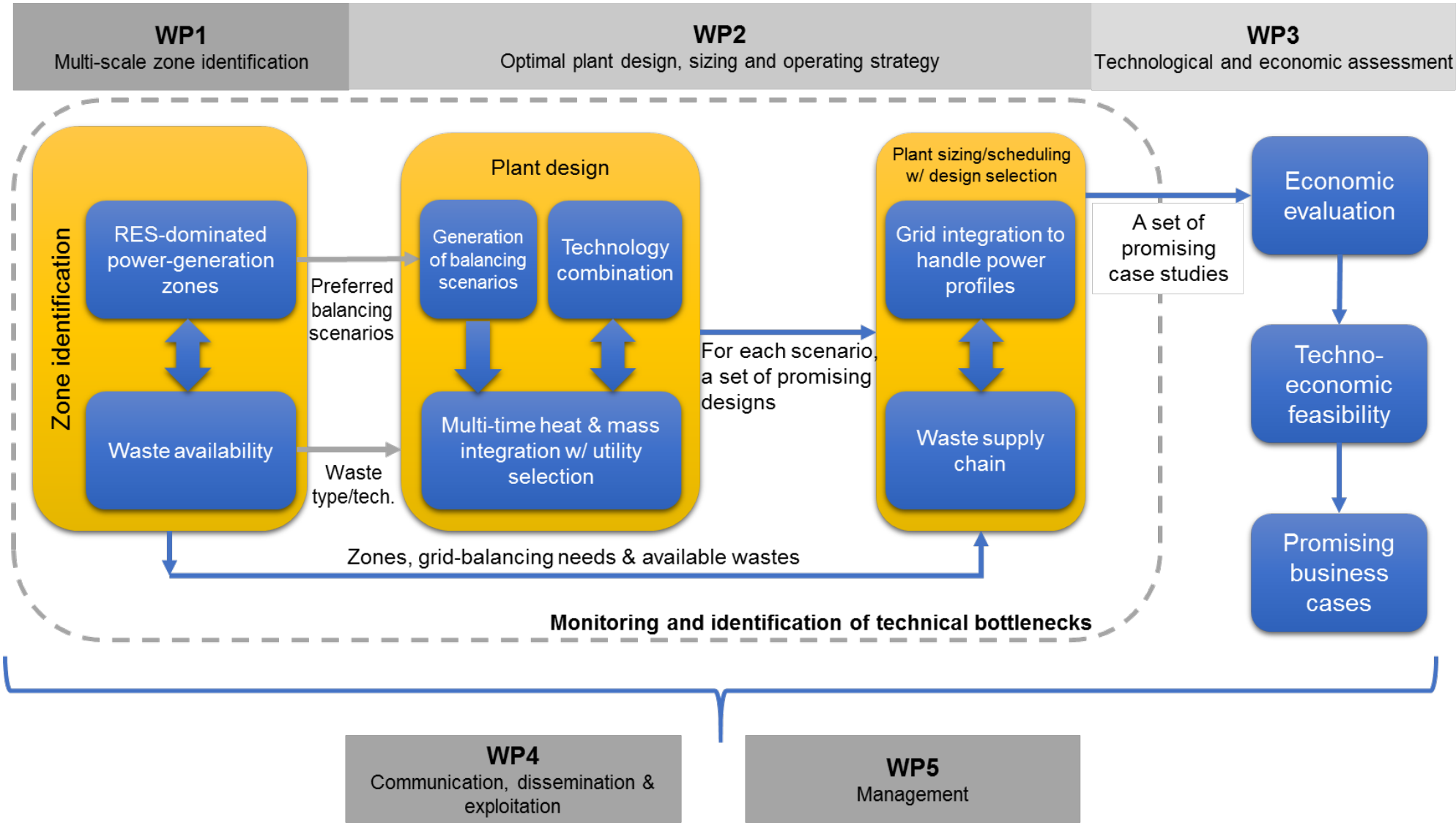
SOLID POWER

WP3
Techno-economics

Key aspects affecting plant deployment



Project organization



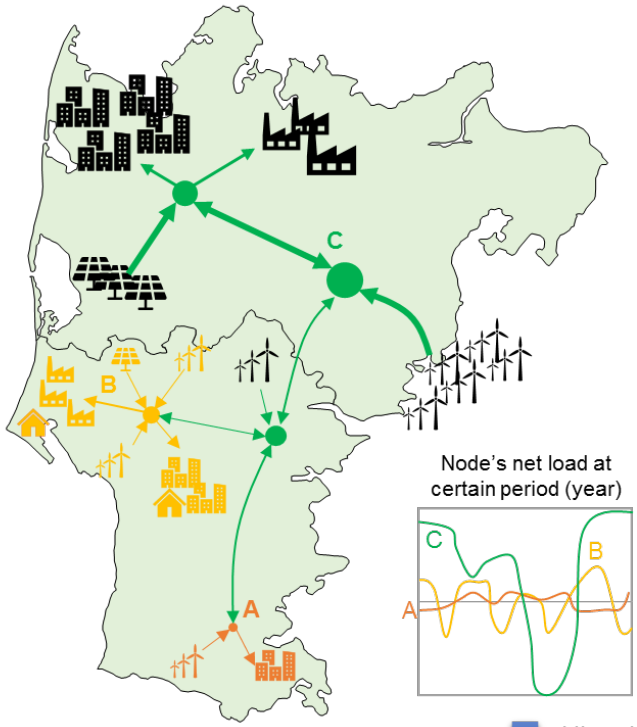
Overall approach

DK & IT

Forest, agri, MSW, etc.

Grid integration and supply chain

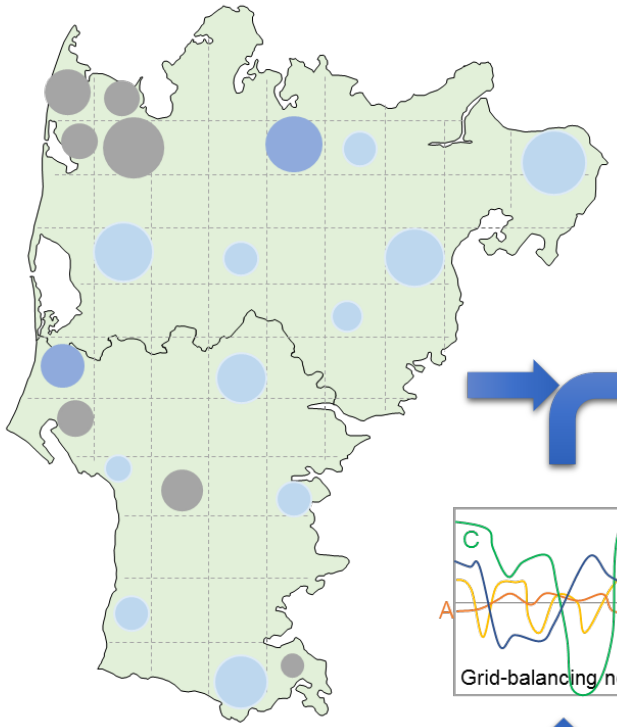
RES-dominated power generation zones
(solid lines: electricity transmission or distribution lines)



Node's net load at certain period (year)

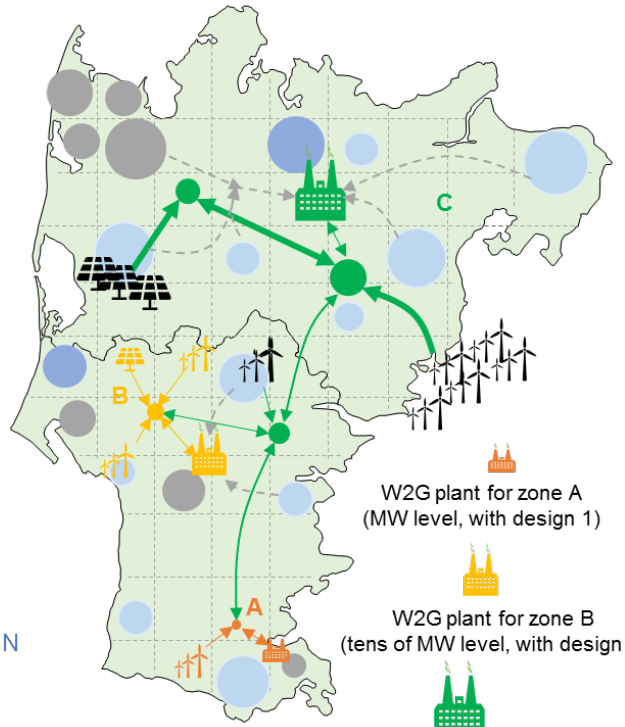
Historic data, future prediction

Waste availability
(grey: municipal; blue: commercial; light blue: agricultural, forest)



Design selection, plant sizing/scheduling

Case studies
(grey dashed curves: waste supply)



W2G plant for zone A
(MW level, with design 1)

W2G plant for zone B
(tens of MW level, with design 5)

W2G plant for zone C
(100 MW to 1 GW level, with design n)

Pool of balancing scenarios (ratios of up/down hours and average up/down loads)

((30/70),(50,50)), ((10/90),(20,80)), ((60/40),(30,50)), etc.

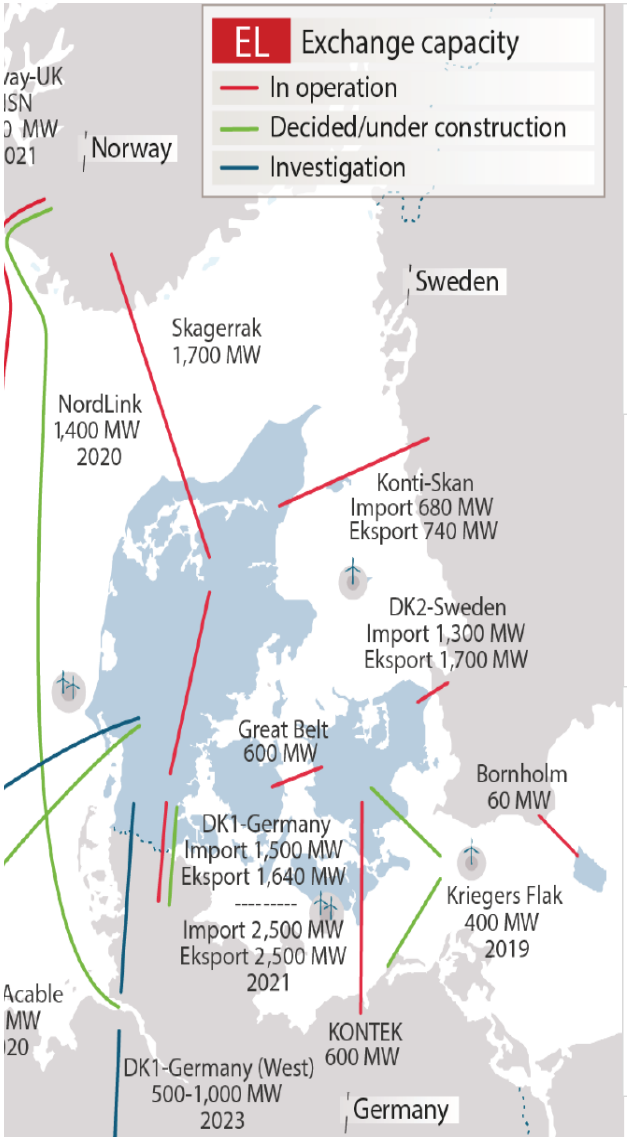
OSMOSE

Pool of optimal plant designs for different balancing scenarios

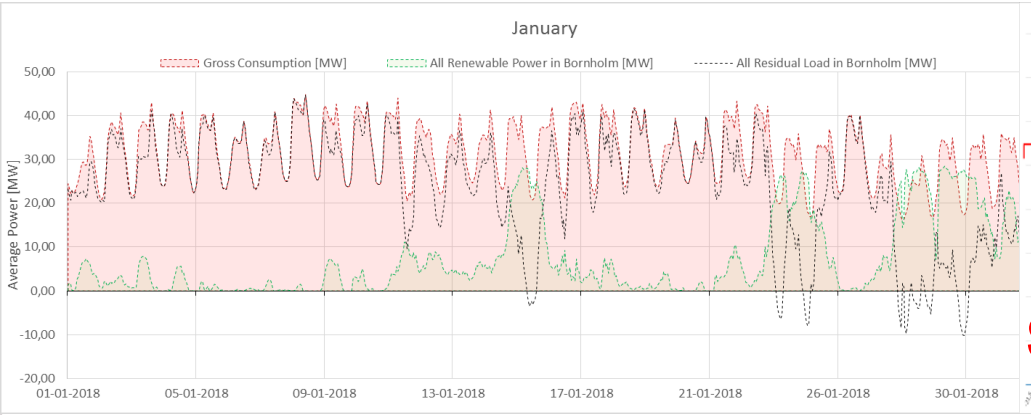
design 1, design 2, design 3, etc.

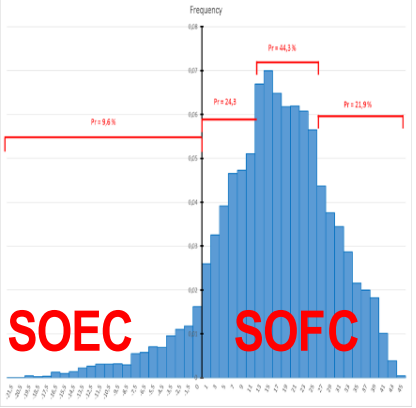
Grid balancing needs - Denmark

3 market zones

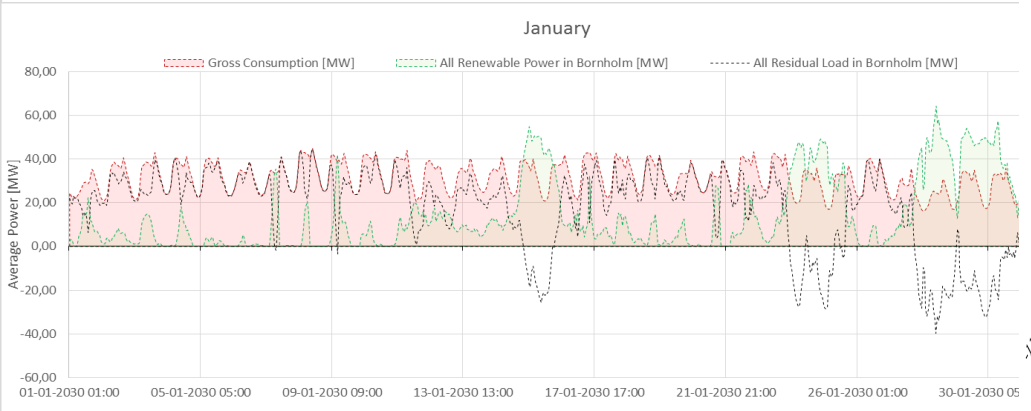


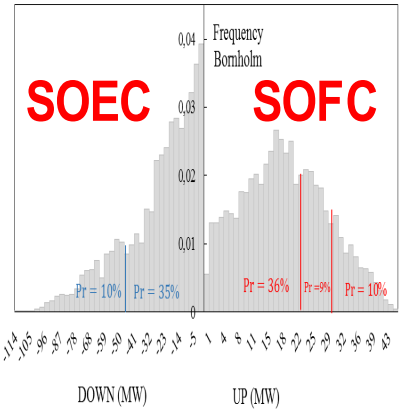
Historical hourly generation-demand profiles





Prediction for 2030

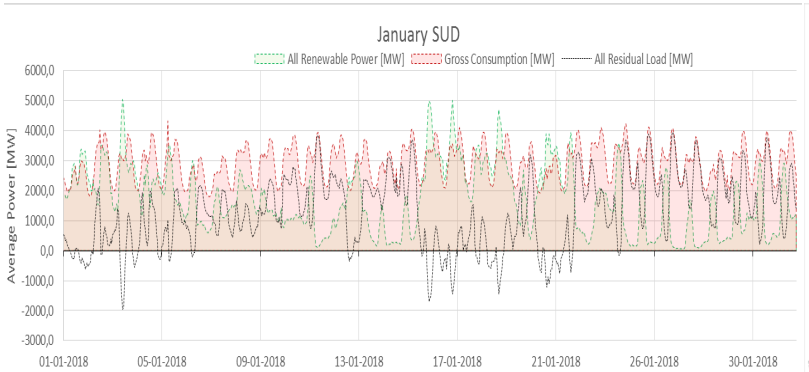


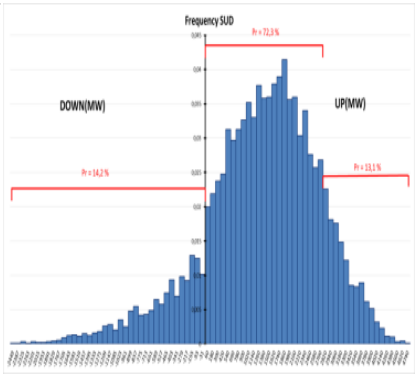


Grid balancing needs - Italy

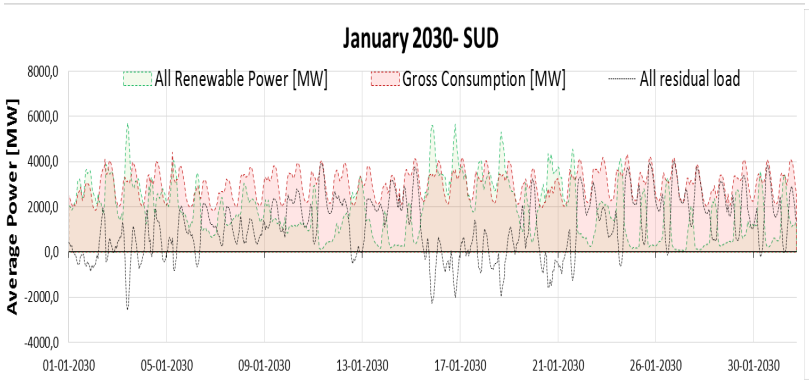
6 market zones

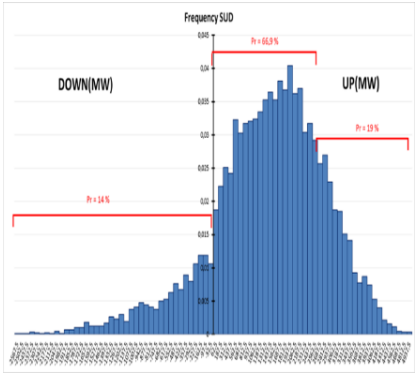
Historical hourly generation-demand profiles





Prediction for 2030





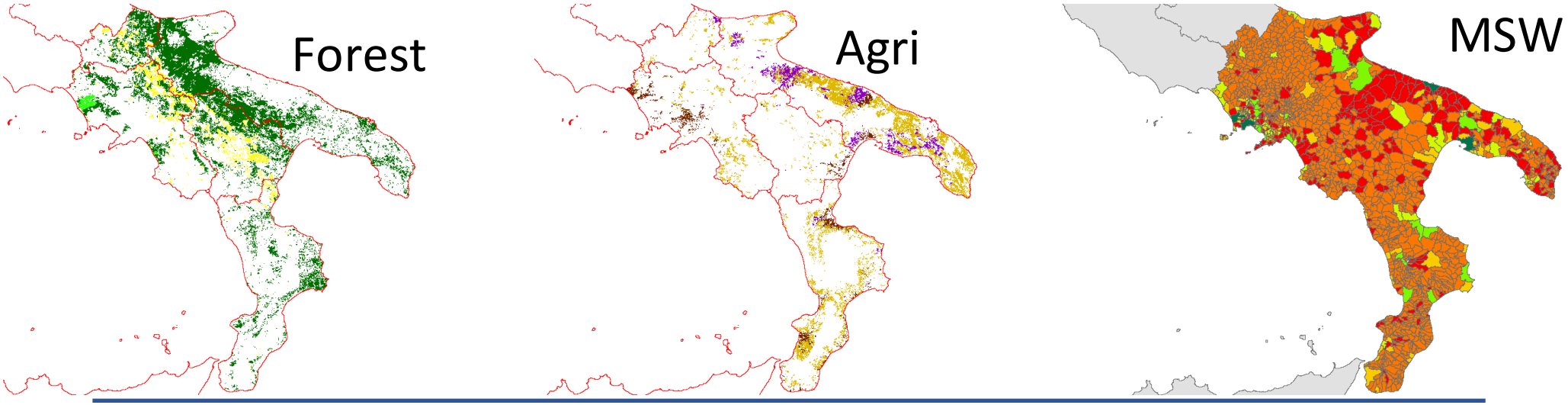
Waste availability

MSW, Straw and wood residues via GIS Waste Database

Sources:

- CORINE Land Cover 2018 1 ha spatial resolution
- National Census for Agriculture and forest inventories
- National Waste Register
- Crop - residues ratio (field investigation/literature)
- Other sources provided by project partners (DK)

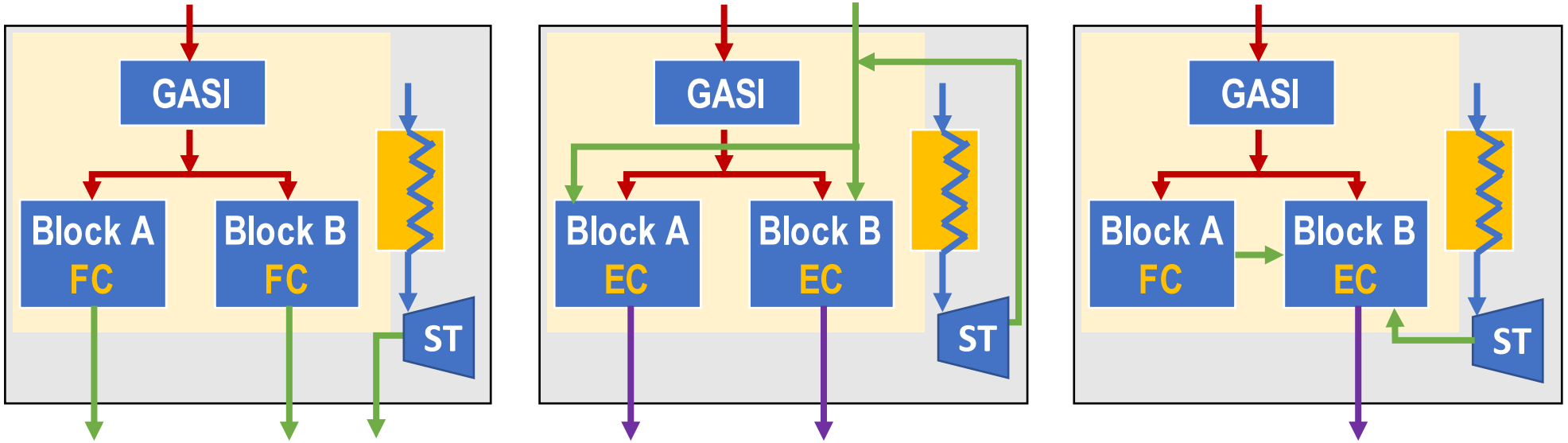
Amount and distribution of various wastes of RES dominated zones



Optimal Plant Design

Operating mode and efficiency

Power Generation (PowGen)	Power Storage (PowSto)	Power Neutral (PowNeu)



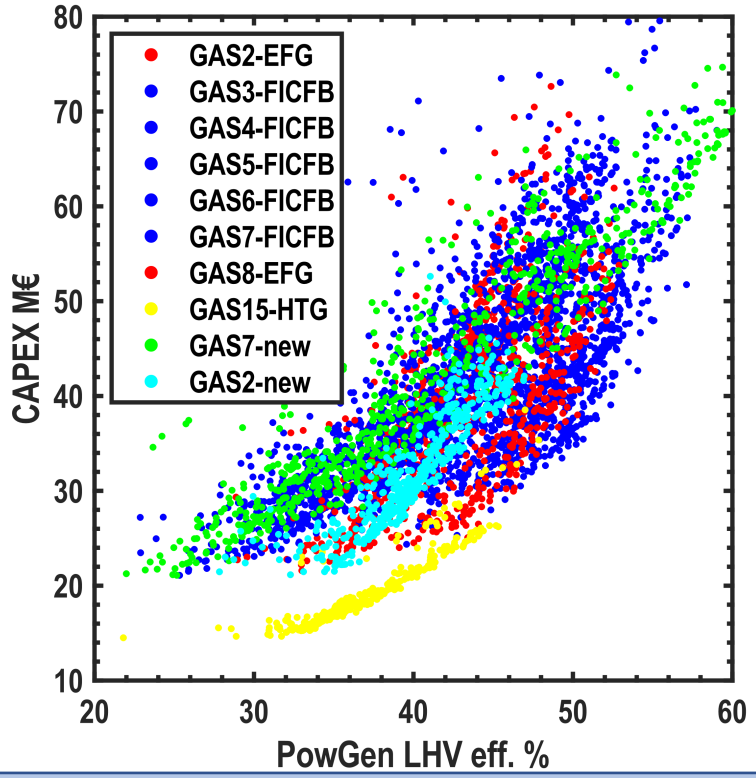
$$\eta = \frac{\text{Net power produced}}{\text{Fuel energy in}} \qquad \eta = \frac{\text{Energy stored in gas}}{\text{Fuel energy in} + \text{net power in}} \qquad \eta = \frac{\text{Energy stored in gas}}{\text{Fuel energy in}}$$

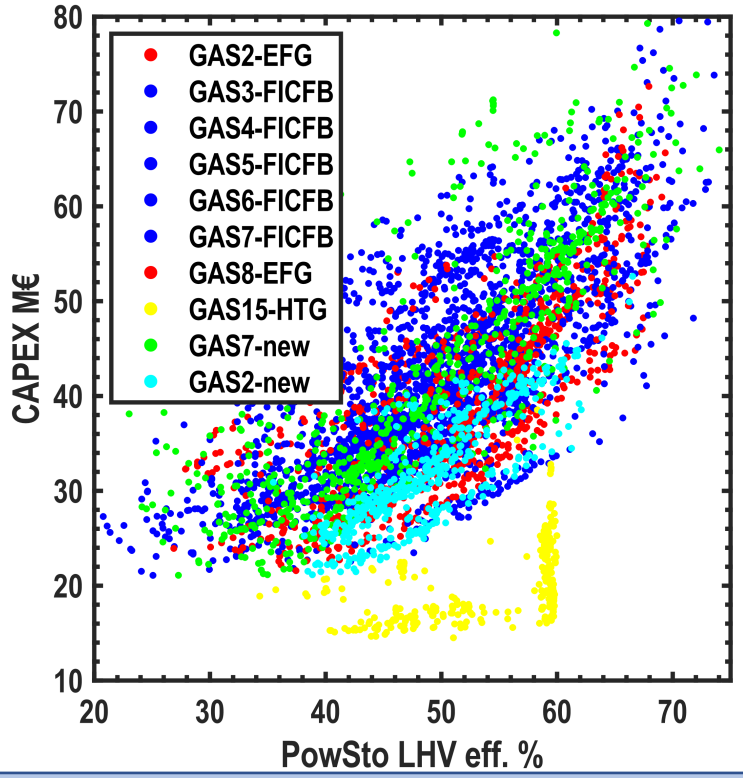
Assumption to size stacks:
Operating points of FC/EC identical among three modes

Optimal Plant Design

EFG/FICFB + SE (2 EFG paths, 5 FICFB paths)

- Three objectives: η_{PowGen}, η_{PowSto}, CAPEX
- Reference size: 20 MWth dry biomass input





- Trade-off between CAPEX and efficiency
- No big difference between EFG and FICFB based systems
- EFG/FICFB LHV eff: PowGen 30–60%, PowSto 30–70%

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