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Studienamiddag COGEN Vlaanderen

Dynamische dispatch van e-boilers

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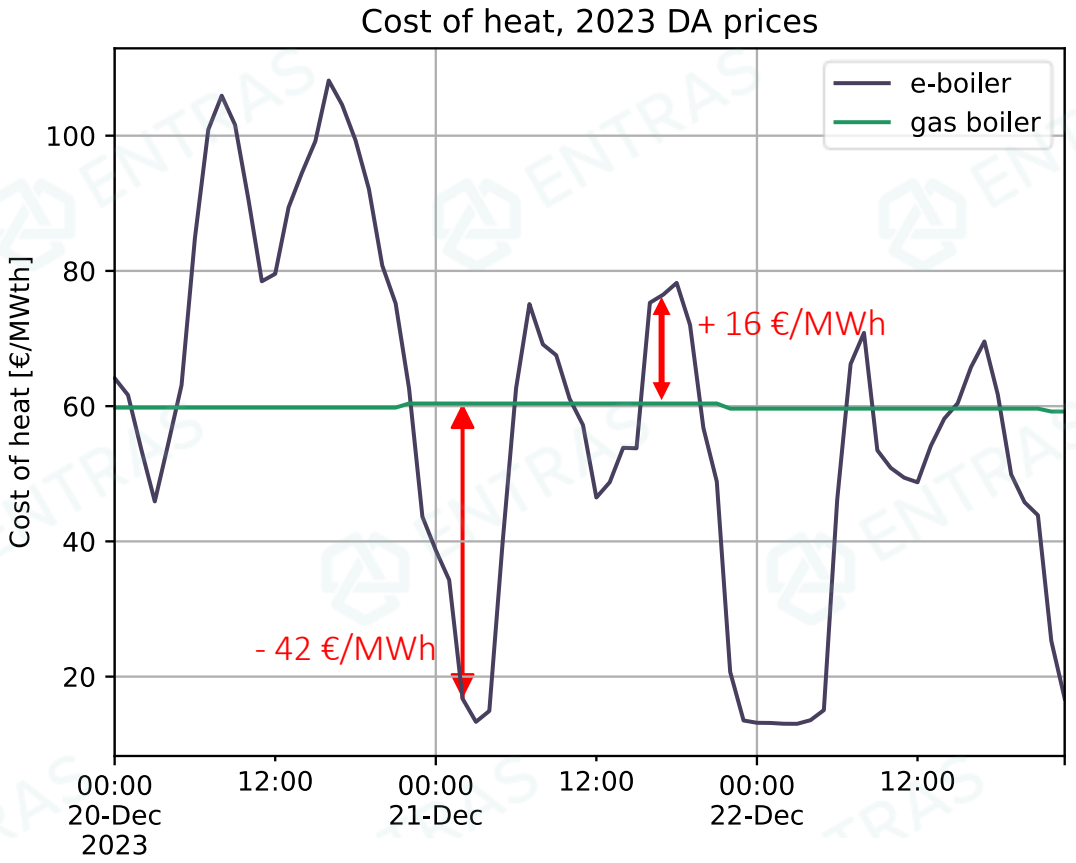
E-boiler dynamic dispatch

Clean e-boiler Spread – concept

- **Dynamic cost of heat**
  - Varies from moment to moment
  - Based on day-ahead 'spot' prices
    - daily for gas, hourly for electricity
  - *Energy market arbitrage*

- **Clean e-boiler Spread - CebS**
  - Difference in cost between 1 MW of heat generated by the e-boiler and the gas boiler
  - 'clean': take into account CO_2 cost
  - Short term energy OPEX only
  - Can be calculated based on different markets
    - look at your contracts

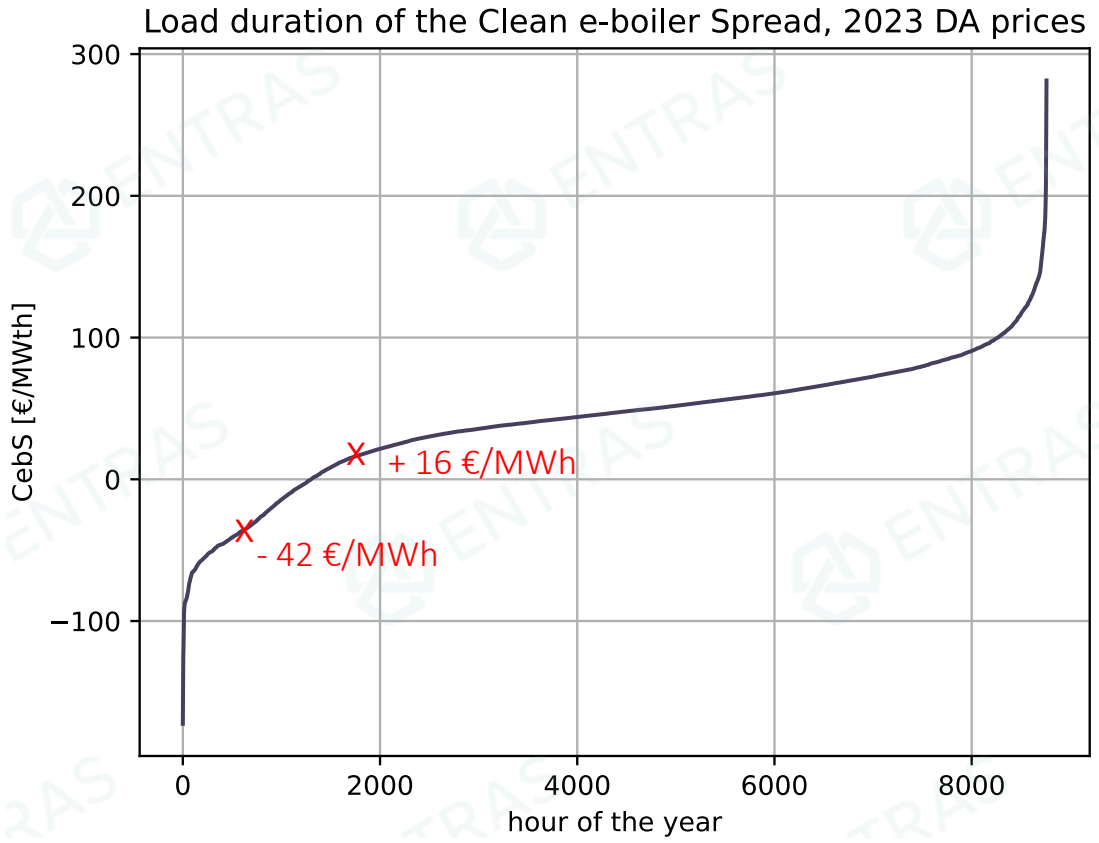


Cost of heat calculated with the following assumptions: gas boiler efficiency = 81% HHV, e-boiler efficiency = 99%, CO2 price = 80 €/ton, gas grid cost & taxes = 1,42 €/MWh HHV, electricity grid cost & taxes = 13,15 €/MWh. Capacity tariffs not included. TTF DA EOD spot prices for gas and Belgian DA spot prices for electricity.

E-boiler dynamic dispatch

Clean e-boiler Spread – duration curve

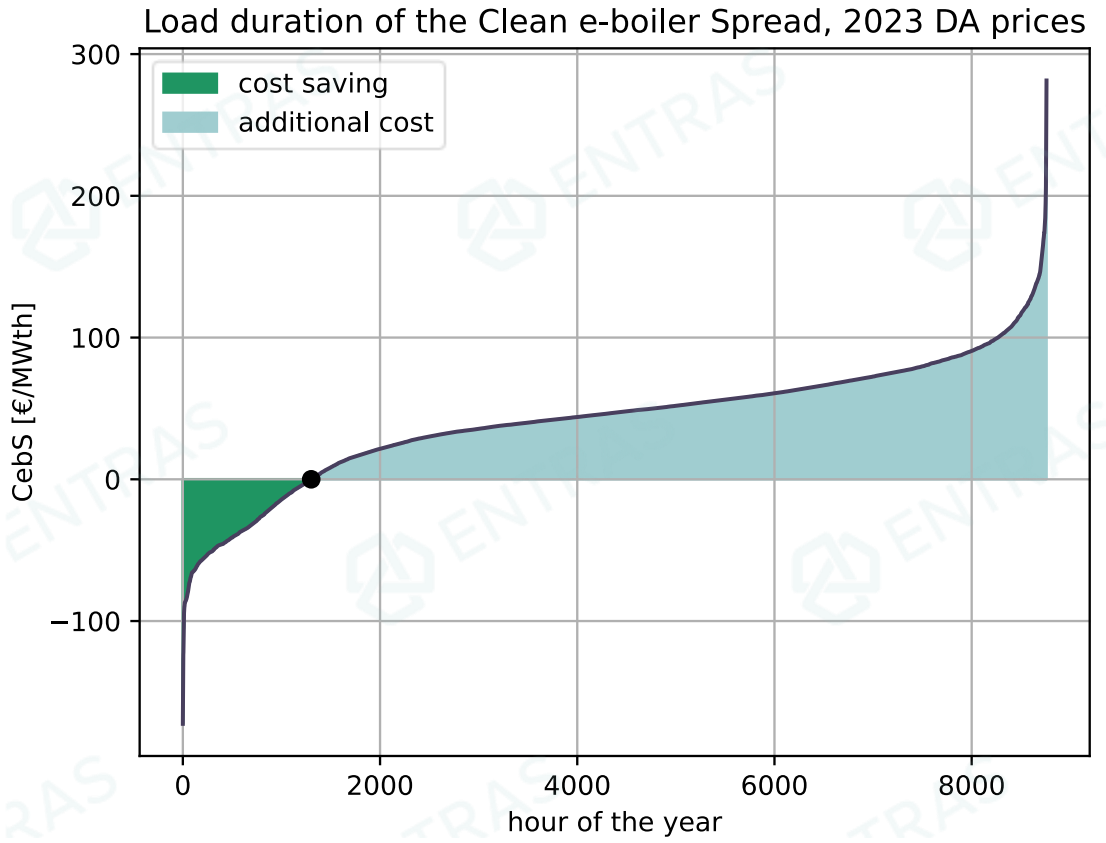
- **CebS duration curve**
  - Sort the values from low to high: check how many hours it is cheaper to dispatch the e-boiler
  - Extremes at both sides of the curve



E-boiler dynamic dispatch

Clean e-boiler Spread – duration curve

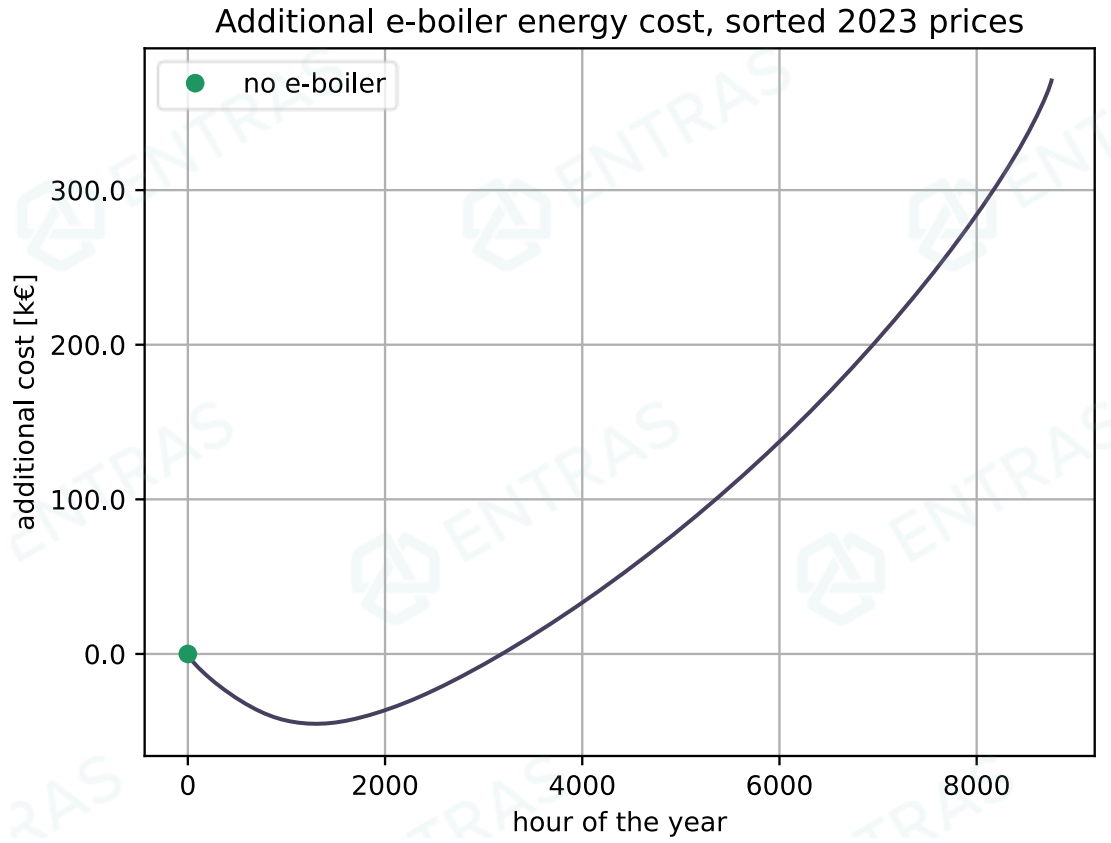
- **CebS duration curve**
  - Sort the values from low to high: check how many hours it is cheaper to dispatch the e-boiler
  - Extremes at both sides of the curve
  - Define the cost savings (or additional cost) potential



E-boiler dynamic dispatch

Cost & CO_2 reduction strategies

- E-boiler not dispatched= no cost or CO_2 savings

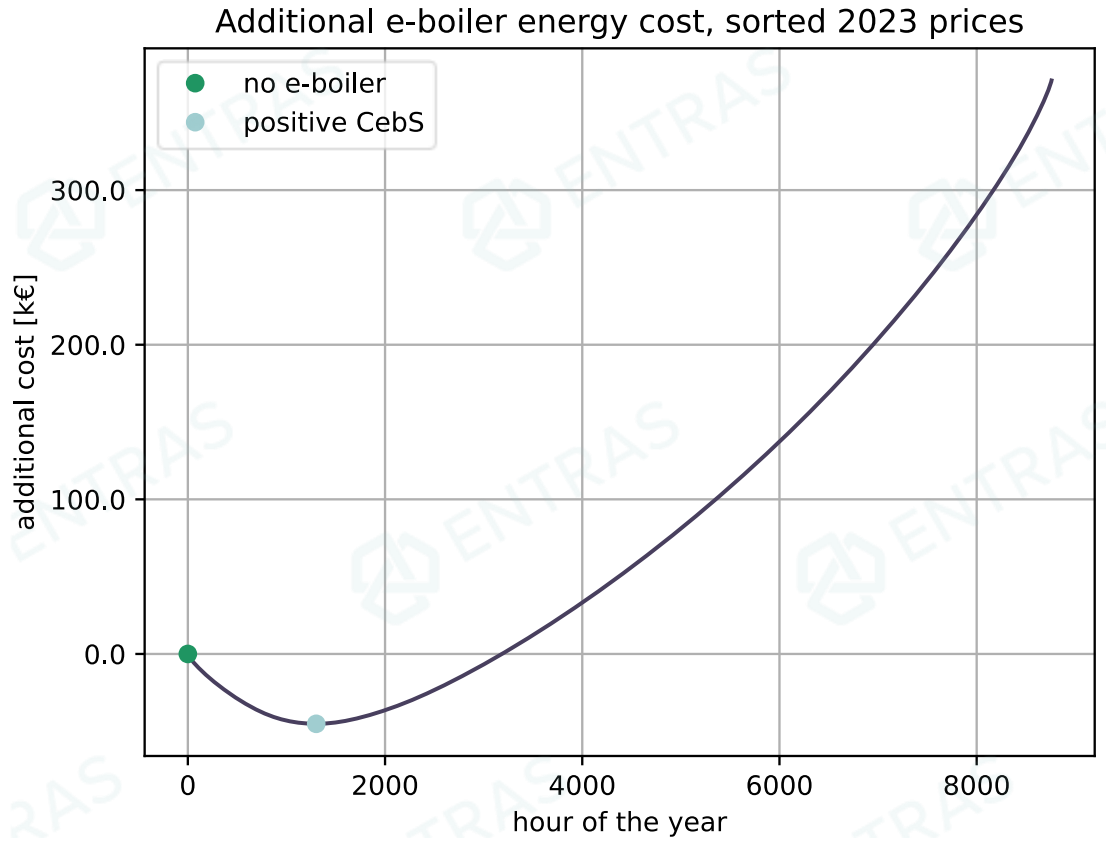


Assumption of a 1 MWth baseload heat consumption.

E-boiler dynamic dispatch

Cost & CO_2 reduction strategies

- No e-boiler = no dispatch = no cost or CO_2 savings
- Dispatch only when CebS is positive
  - Realise cost saving, but limited CO_2 savings



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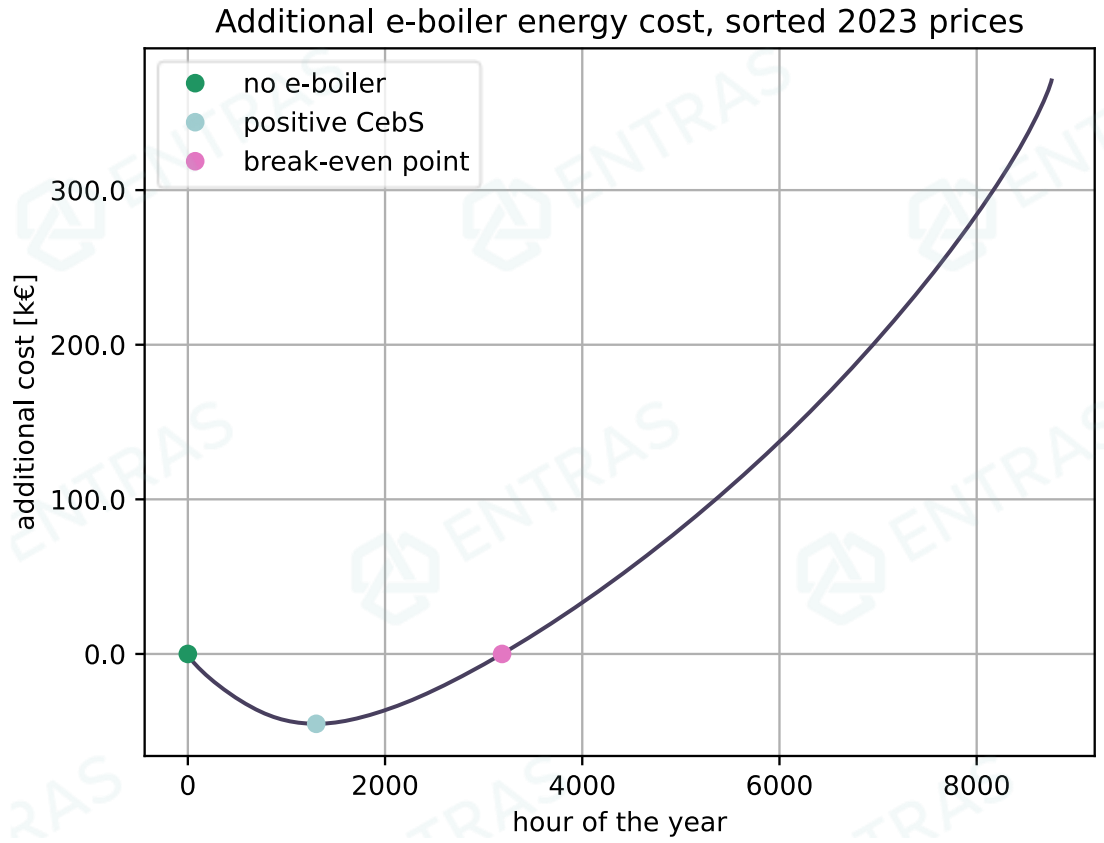
E-boiler dynamic dispatch

Cost & CO_2 reduction strategies

- No e-boiler = no dispatch = no cost or CO_2 savings
- Dispatch only when CebS is positive
  - Realise cost saving, but limited CO_2 savings
- Dispatch to reach break-even point
  - No cost saving, larger CO_2 savings
  - Moments of negative CebS compensate moments of positive CebS



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E-boiler dynamic dispatch

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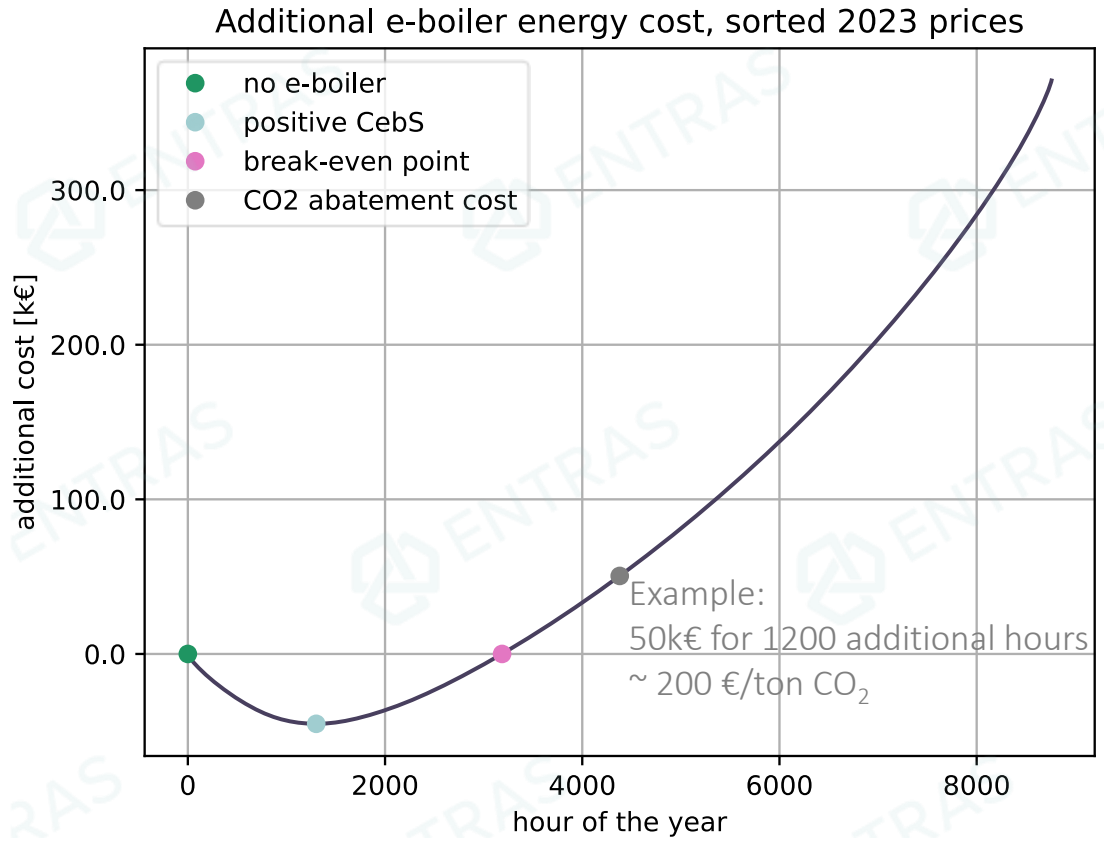
- Dispatch to reach break-even point
  - No cost saving, larger CO_2 savings
  - Moments of negative CebS compensate moments of positive CebS
- Dispatch e-boiler for additional hours
  - Increase CO_2 savings while increasing cost
  - "CO_2 abatement cost": define defendable cost level
  - Each additional hour dispatched will be marginally more expensive

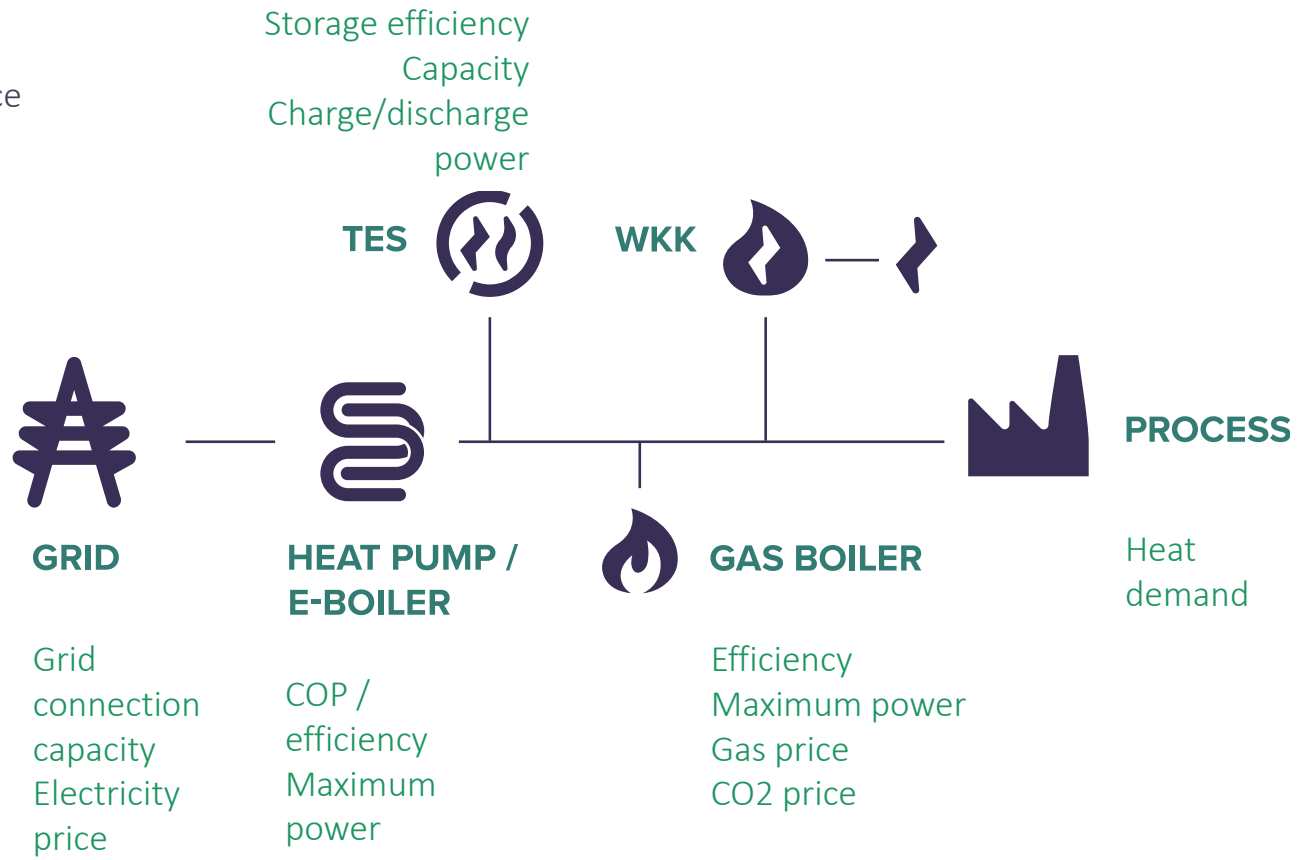


Assumption of a 1 MWth baseload heat consumption.

E-boiler dynamic dispatch

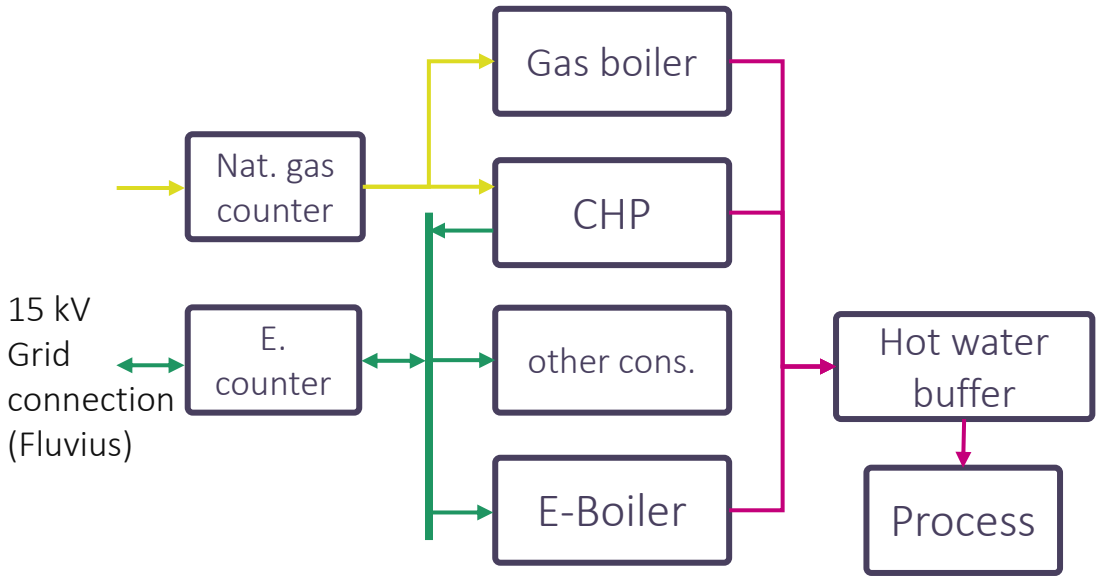
What about…

- Other markets & ancillary services
  - React to price signals: day-ahead spot, intraday, imbalance
  - Sell flexibility to system operator: FCR, aFRR, mFRR
  - Optimal valorisation on markets? Value stacking?
- Integration with other assets
  - Standalone vs heat production park; *time & energy market arbitrage*
  - Local generation: CHP, PV & wind; avoid grid costs & taxes
- Grid connection
  - Limiting factor? Capex of upgrade?
  - Firm vs flex capacity?
  - What about capacity tariffs (€/MWpeak)?
- ETS I and II
  - Counteracting dispatch incentives?



E-boiler use cases

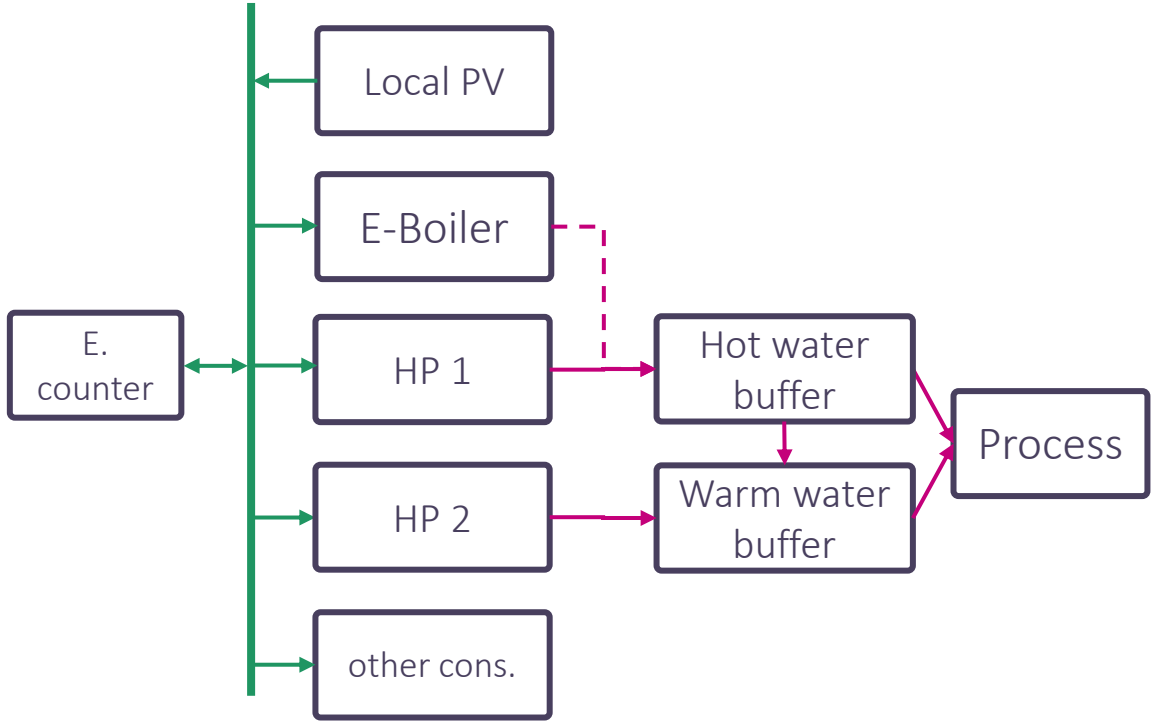
Combi with CHP on DSO grid, feeding hot water buffer



- Client can produce heat with gas boiler, CHP or e-boiler. All heat is buffered in a hot water buffer
- 15 kV Fluvius grid connection
  = high grid tariffs & capacity tariff!
  - Stand-alone e-boiler on grid connection probably not economically feasible
- Day-ahead CHP dispatch with e-boiler imbalance
  - Take advantage of dynamic character of e-boiler, frequent & fast switching on imbalance market
  - Keep grid costs (captar) & taxes limited by preventing offtake peaks
  - *Time arbitrage*: buffer heat in storage tank
  - *Energy market arbitrage*: gas vs electricity

E-boiler use cases

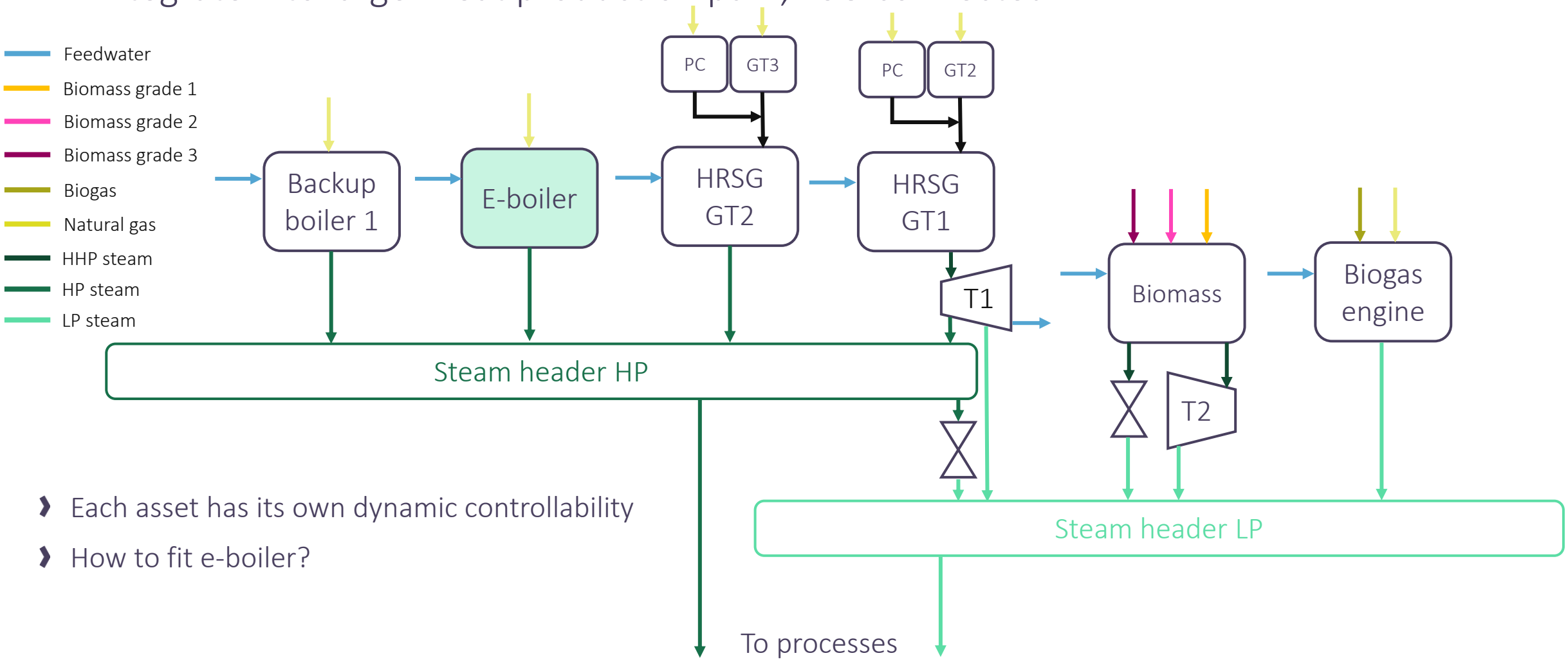
As backup for heatpumps, including heat buffers & local generation



- Fully electrified customer: no natural gas!
- All required heat is produced with several heat pumps, and buffered in heat buffers
- E-boiler as backup, when heat pumps do not suffice
  - HP designed on baseload, process heat requirement can be peaking
  - Happens at least once per month: captar cost is already there!
  - Valorise flexibility of e-boiler when not needed for process: aFRR + dispatch on day-ahead market prices
- Local PV: avoid grid costs & taxes

E-boiler use cases

Integrate into larger heat production park, TSO connected

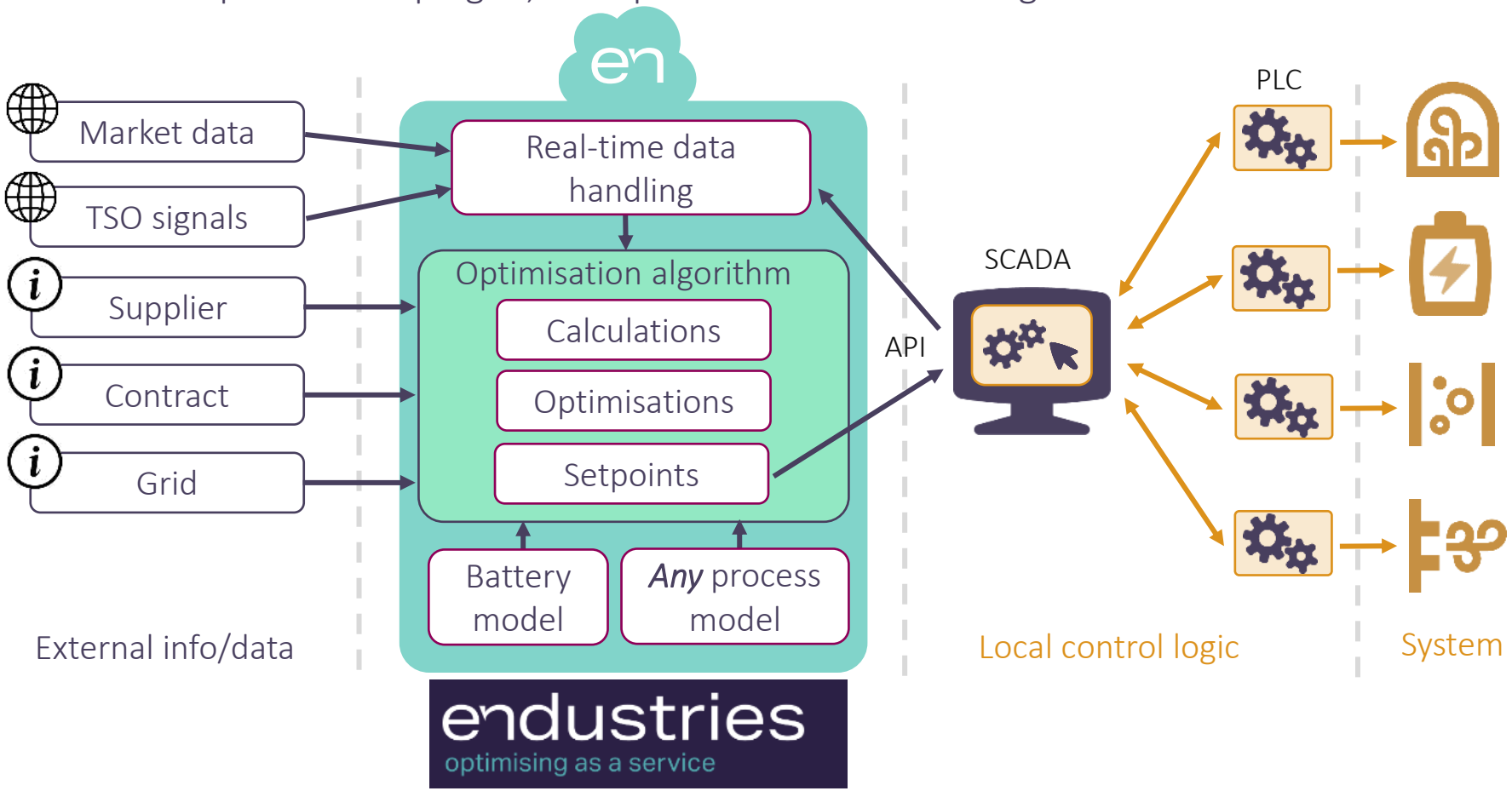


- Each asset has its own dynamic controllability
- How to fit e-boiler?

Asset dispatching tools

Real time steering of assets - How does it work?

- Techno-economic dispatch tool, **economically optimising** the real-time operation of a system
- Dispatch tool as an optimisation plug-in, on top of technical control logic.



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ENTRAS is your trusted and independent partner to guide you through the complex world of energy
We develop concept. We build financial models. We offer a suite of process optimisation tools.

Left to right: Dimitris Nasikas, Jeroen Vanfraechem, Twan Bearda, Joost Vanden Berghe, Filip Lesaffer, Lieven Kenis, Frank Alaerts, Jens Baetens, Stijn Bernaer

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