

Reserve Capacity Provision through Flexible CHP Operation and Power-To-Heat Technology in Industrial Applications

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1. Introduction

Large industrial consumers could help to cope with surplus renewable power by flexibly adjusting their power demand, using Demand Side Management and/or Power-to-heat technologies. The project “e-harbours” investigated showcases in which this is already technically and economically viable.

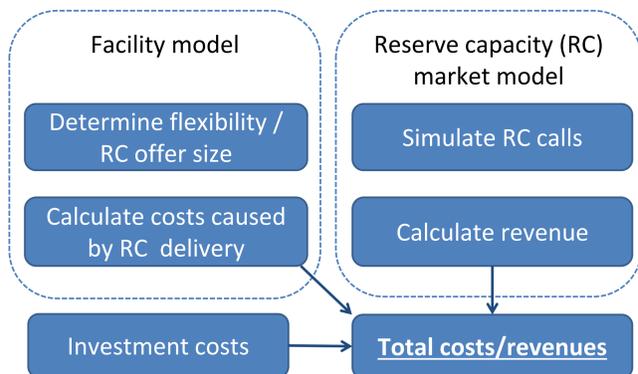
2. Showcase description

- Chemical plant in Hamburg: CHP unit (10 MW_{th}, 5 MW_{el}) + gas boilers
- Electricity is partially fed to grid
- Business case: Providing negative secondary reserve capacity
- Two scenarios: CHP substitution by gas boiler / by Power-to-Heat



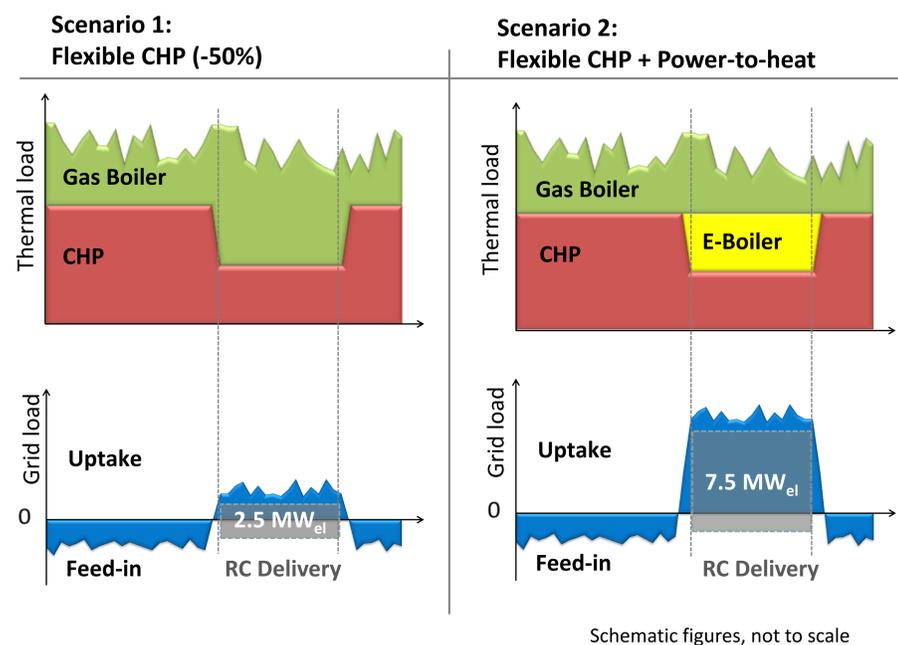
3. Methodology

Techno-economic analysis to determine flexibility and specific costs/revenues.



4. Flexibility analysis

CHP can be regulated down safely by 50%.
Power-to-heat triples available negative reserve capacity!

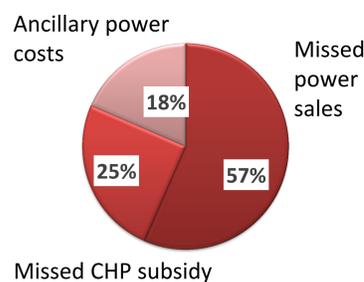


5. Analysis of running costs and revenues

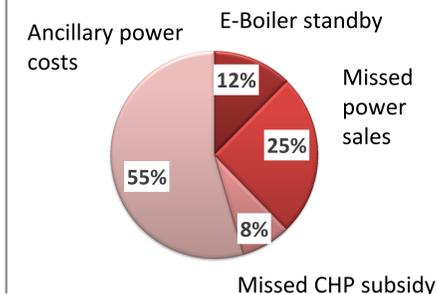
Increased ancillary power costs (Grid fees, RE levy, energy tax etc.) make up most costs for Power-to-heat scenario. However the exact percentage strongly depend on the baseline scenario and the grid uptake as well as gas costs.

Costs:

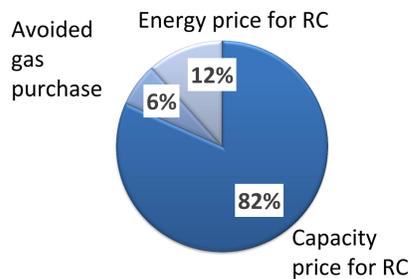
Scenario 1: Flexible CHP (-50%)



Scenario 2: Flexible CHP & Power-to-heat



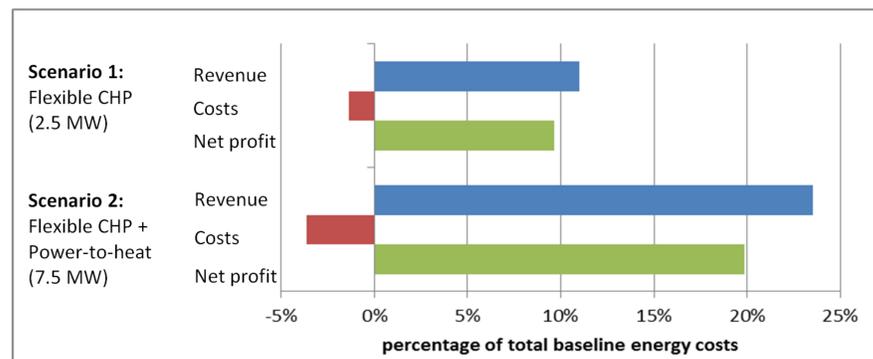
Revenue (both scenarios):



Based on 2012/13 market data. For 2014/15, expect reduced revenue from capacity price, but increased revenue from energy price → comparable overall revenue

6. Analysis of total costs and revenue

Costs for Power-to-heat scenario rise disproportionately due to higher investments, grid fee increase and other regulatory implications.*



*Including depreciated investments (20a). Absolute figures are confidential.

7. Summary & Outlook

- Additional Power-to-heat (P2H) devices can largely increase flexibility for Demand Side Management (DSM) applications
- Unfavorable Energy market regulations limit additional profits. Grid fees also vary vastly from region to region and can completely void DSM and P2H business cases.
- Outlook: Using large-scale P2H, significant amounts of surplus wind power could be used to substitute gas, which can be saved for power generation in times of low wind availability.
- This „Power-to-saved-gas“ approach is much more efficient than „Power-to-gas“ (H₂/CH₄ production from wind power)

Further information: www.e-harbours.eu www.haw-hamburg.de/c4dsi