Cost Benefit Analysis of a CVPP

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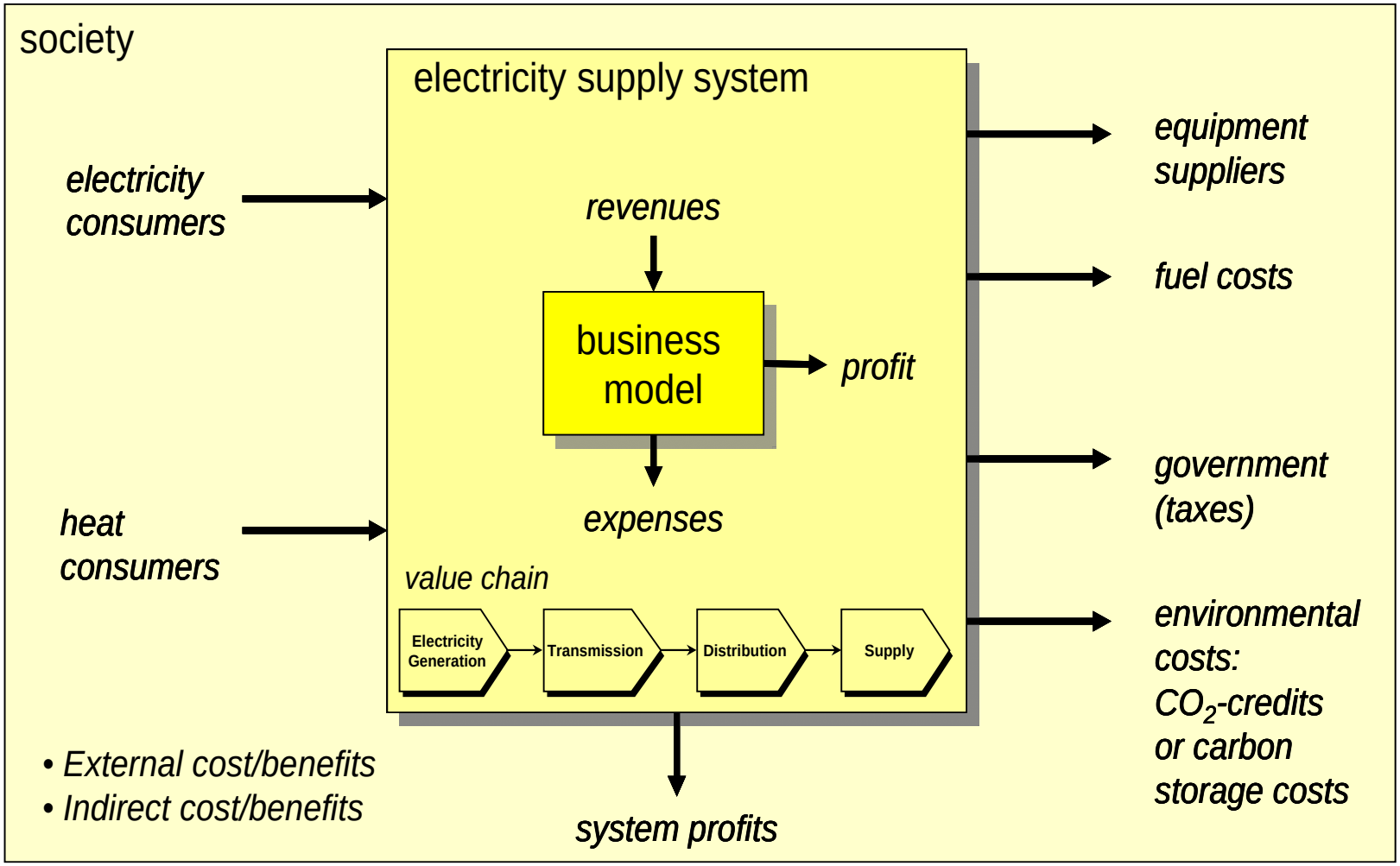
fenix
'...a step towards the future of electricity network'

ECN Energy research Centre of the Netherlands

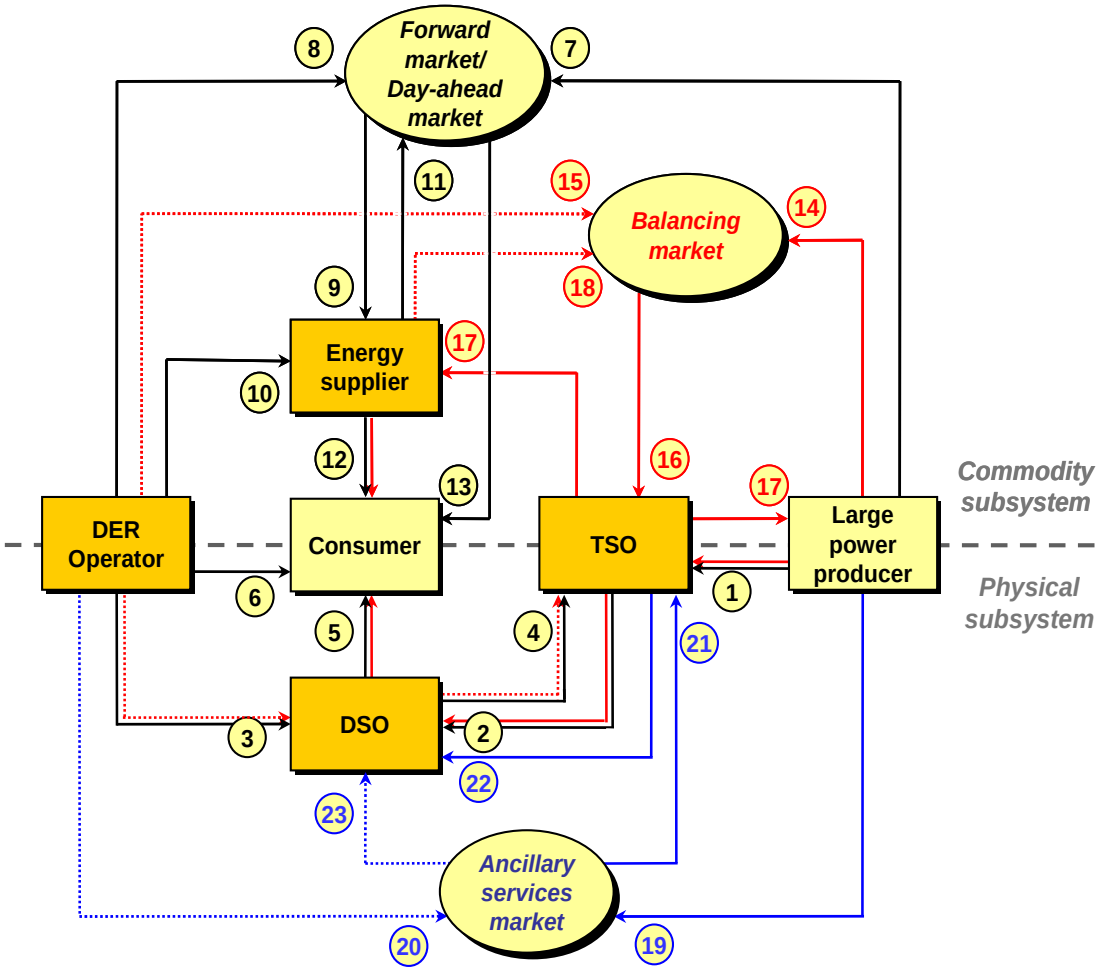
Objective & Approach

- Objective
  - To demonstrate the economic viability of the FENIX VPP Concepts
    - Prove the economic value of flexible DG operations
    - Demonstrate that existing and new business models can profit from this economic value
- Approach
  - Concrete VPP cases in Northern (Woking) and Southern (Alava) scenarios
  - Demonstration based on simulation of the financial flows between business actors in the electricity market
  - Cost-benefit analysis (Reference and Fenix cases)
  - Focus on incremental changes
  - Presentation focus on Northern Scenario

Level and System Boundaries



Transaction Schemes & CBA Model



CBA Inputs

Prices
- Spot Price
- SSP
- SBP

Operating Parameters
- On/off status
- Thermal store status
- ...

Other Inputs
- Local Heat Demand
- ...

Model Runs

Calculations for every Settlement Period
- Optimization or Pre-determined operating profile
- Tr1 = DER_Production * DAPrice
- …
- Update of operating parameters, etc.
- Next settlement period

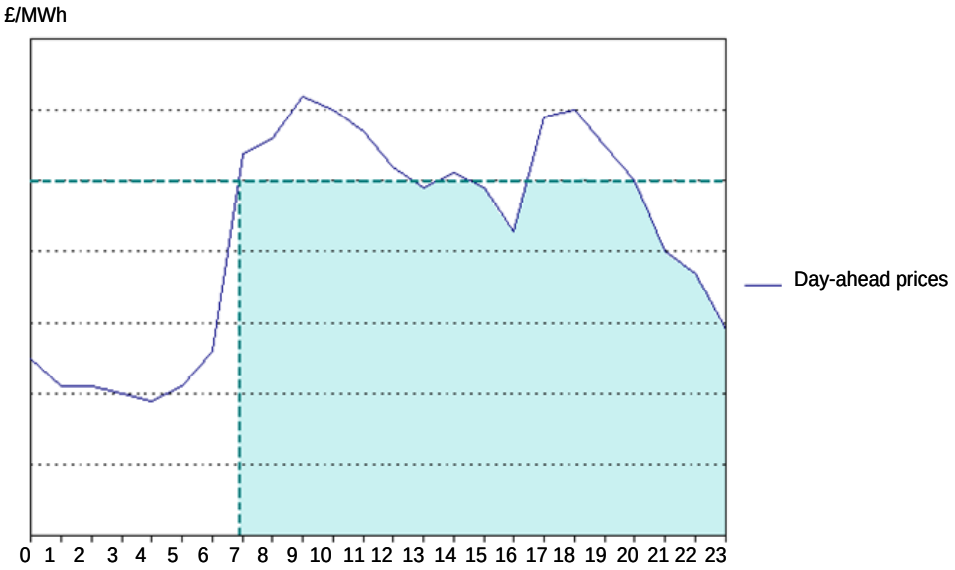
Output

- Detailed results for every transaction for every settlement period
- Aggregated revenues/costs for every stakeholder
  - DER
    - Revenues from electricity sold
    - Fuel & Variable Costs, etc.
  - …

Notice: Only the two main installations of Woking are considered in the CBA, i.e. the Pool in the Park and Town Centre CHPs (installed capacity 2426 kW)

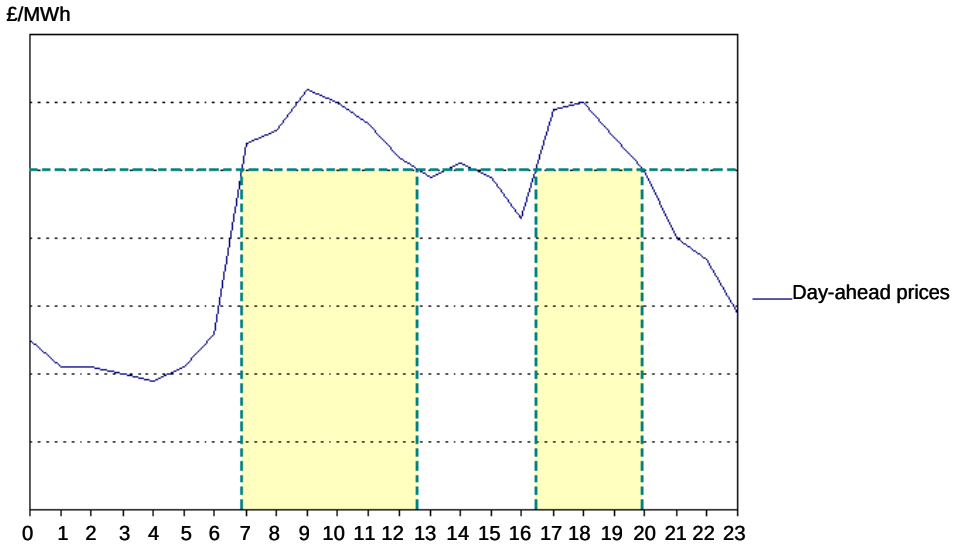
Cases Description – Reference Case

- CVPP is operating as an Aggregator
  - DER Operation is not optimized with respect to DA market
  - Pre-determined production profile
  - CVPP (Aggregator) role is limited to aggregating production for market access and proceeding transactions



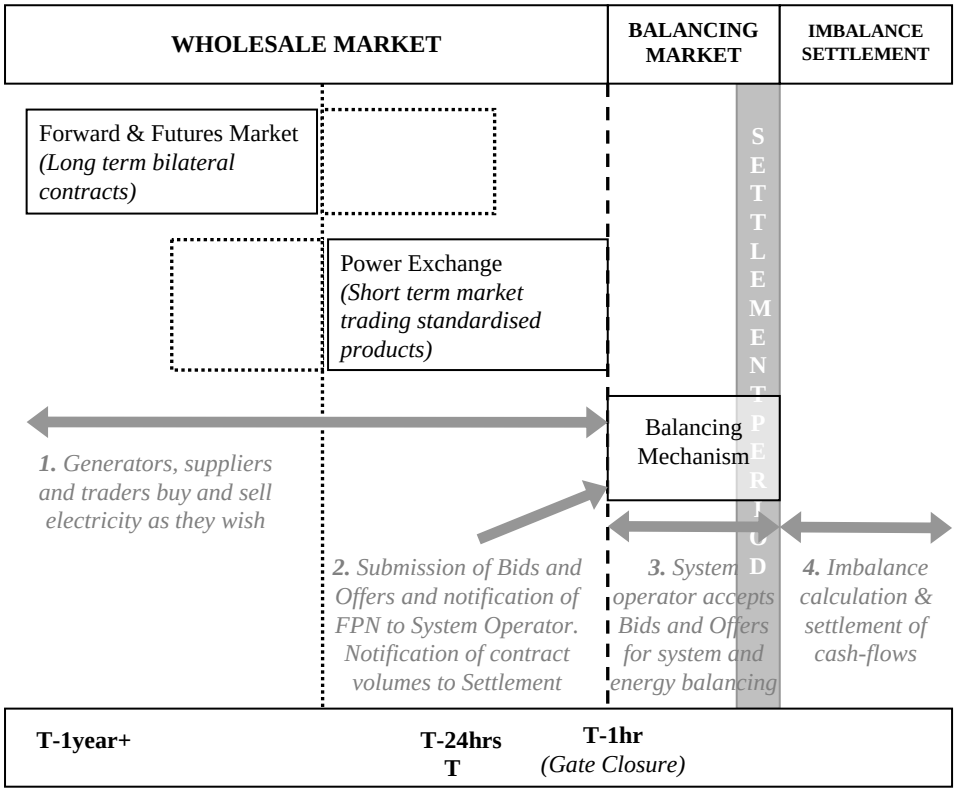
Cases Description – Case 1 (Access to DA Market)

- CVPP optimizes DER operation with respect to wholesale power market
  - CVPP forms bids for DA market, regarding operational parameters of DERs, local heat demand, etc.
  - If bids lower than observed DA prices, DER deliver power
- CHPs coupled with thermal store to exploit whole range of flexibility
  - Effective electric efficiency is used for useful heat production



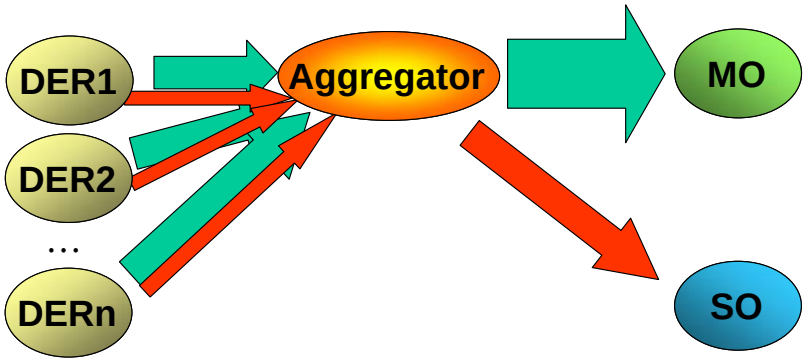
Cases Description – Case 2 (Access to DA Market and Balancing Mechanism)

- CVPP optimizes DER operation with respect to UKPX & BM
- Two Step Optimization
  - 1st Step: Same as Case 1
  - 2nd Step: Depending on contingent availability, CVPP submits offers/bids to TSO. Bids/offers formulation similar to DA bids + Profit Mark-Up
- Bids/Offers are compared against lowest bid/highest offer of relevant settlement period

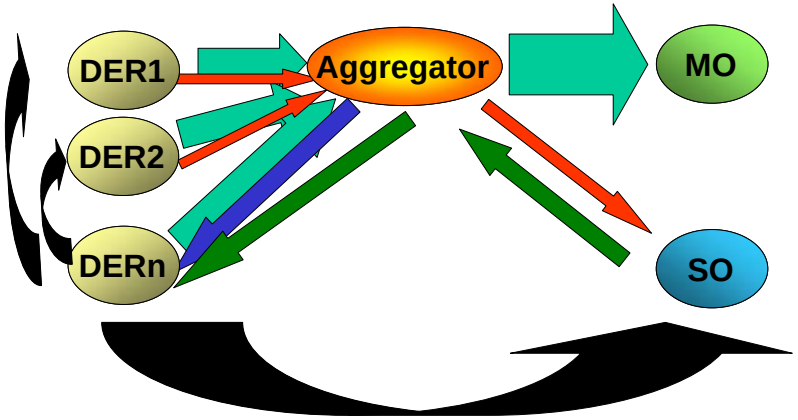


Southern Scenario – Cases Description

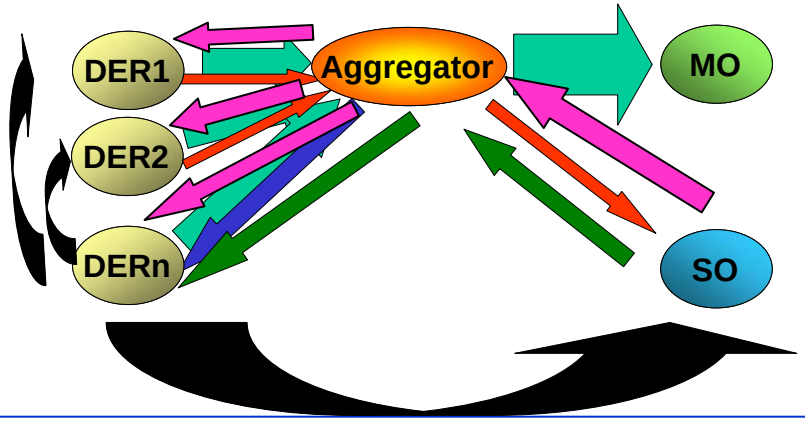
Ref. Case - DER THROUGH AGGREGATOR



Case 1 - DER THROUGH A CVPP WITH INTERNAL AND EXTERNAL BALANCING



TVPP Case: Voltage VAr control

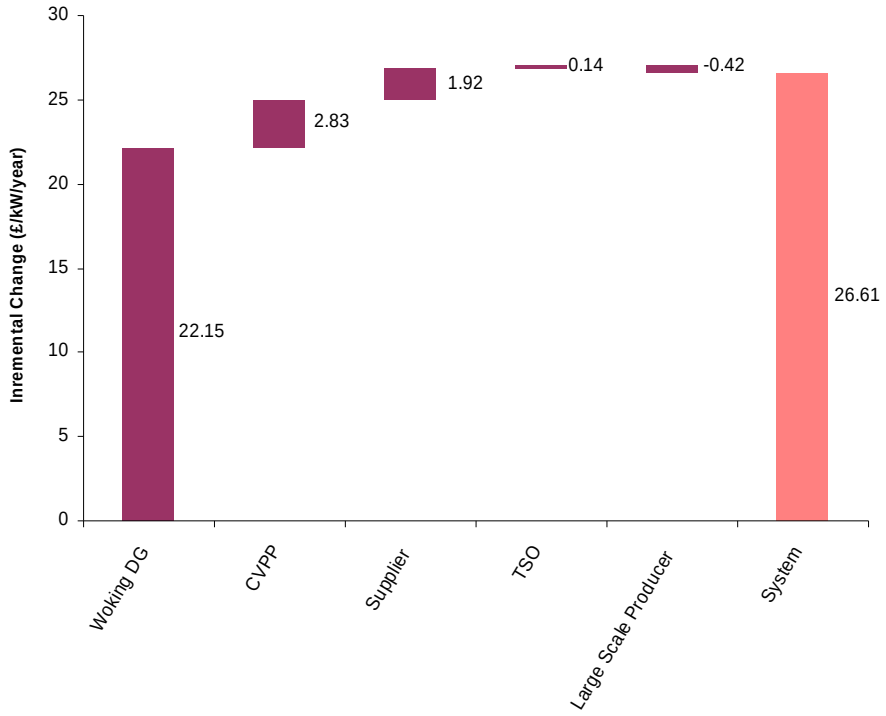


TVPP case comments

- Fenix value is very dependant on the grid layout and use in this case, and hence…
- It is very difficult to estimate the CBA on a general basis

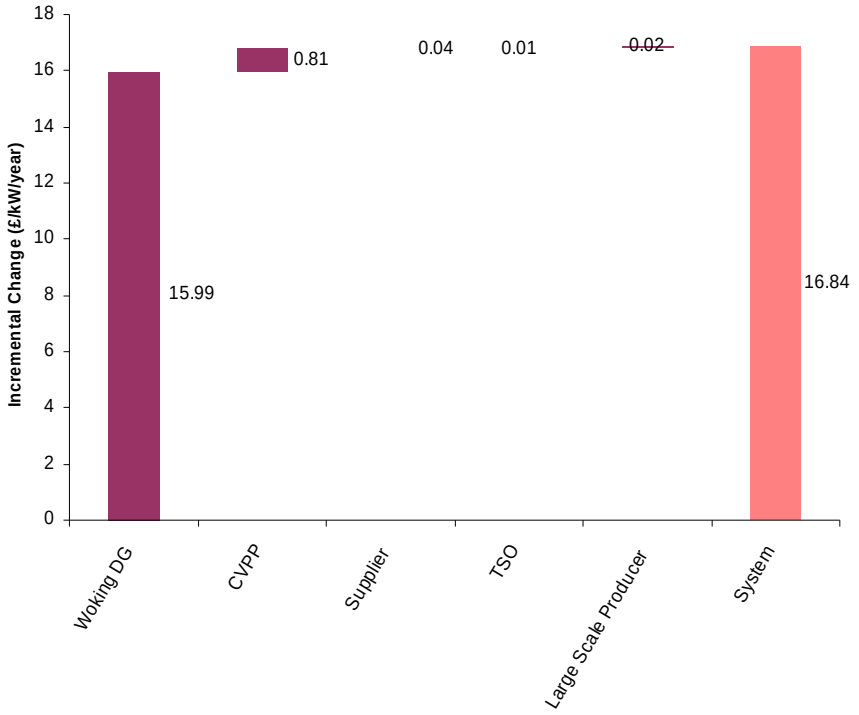
CBA Results (1)

- Intelligent Operation of DERs
  - Operation responsive to price signals
  - Total DER utilization decreases, but profitability increases (by 22.15 £/kW/year or 35%)
  - CVVP net revenues increase (2.83 £/kW/year or 14%), as revenues proportional to DER revenues
- Value Proposition: Substitution of more expensive power producers



CBA Results (2)

- DER benefit from opportunities in BM
  - DER offer both downward and upward balancing services
  - DER profitability increase by 20% (or 16 £/kW/year).
  - Part of increased revenues is attributed to CVPP (0.81 £/kW/year or 5% increase)
  - Overall system efficiency improves
- Value Proposition: DER displace more costly balancing service providers



Conclusions

- CBA clearly illustrates the economic viability of FENIX intelligence to harness DER flexibility
- 3 scenarios were developed and respective transaction schemes were designed
  - CVPP & DERs profitability increases
  - Producers' surplus higher in Fenix cases
- FENIX intelligence necessary to access and exploit opportunities in the different markets

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