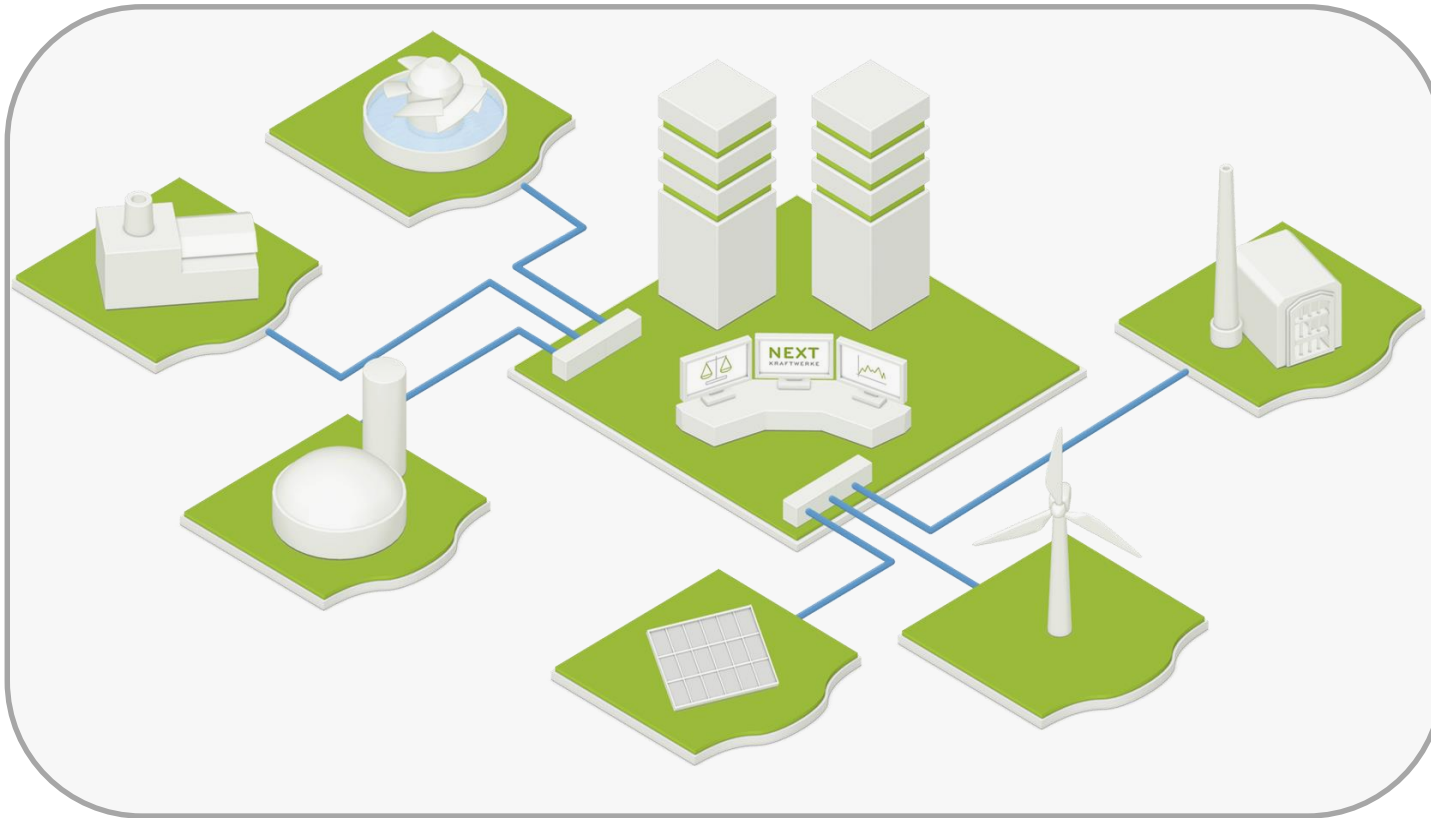




Optimization of a Virtual Power Plant Portfolio in the German Electricity Market



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- Master Thesis in collaboration with -



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Virtual Power Plant - the profitable solution for a safer power management?

How the future of the power industry will look like?

Major changes in tomorrow's electricity world ...

Renewable assets

- PV panels, Wind power, Biomass...

Distributed generation

- Small decentralized power plants

Increasing demand

- Electrical cars, growing population, batteries

Improved physical network

- Smart grids, new transmission lines

Complex energy market

- Spot/ Reserve power market

New energy players

- Prosumers, new technologies



... that will lead to important technical challenges!

Intermittent power supplies

- Stochastic production from wind and solar power plant can lead to lack/excess of power

Zero tolerance for black-outs

- Ensuring a reliable frequency management with less large assets providing flexibility

Adapting the grid to new assets technologies

- Smaller and distributed assets which can be remote-controlled

Increase of demand during peak hours

- Constrained transmission lines, power shortage, high prices for consumers

Solution: why a VPP?

VPP definition: Flexible aggregation of decentralized assets (*production/ consumption*) resulting in a behavior close to a large conventional power plant



Reliability

- Large portfolio manages any outages

Optimality

- Reduction of losses thanks to local optimization of the distributed generation

Competitiveness

- Increasing number of players leading to decreasing costs for end-consumers

Profitability

- Small actors can benefit from portfolio's effect

Accessibility

- Small actors (industry, services...) can access the market



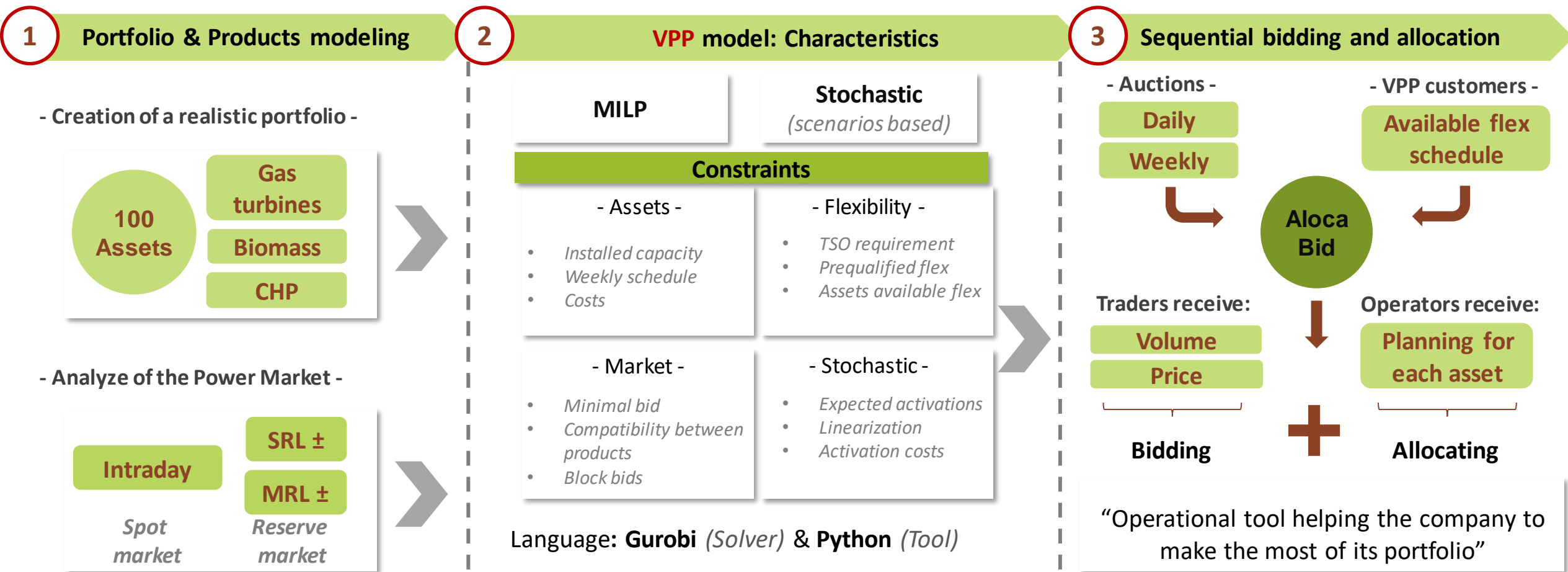
What was at stake?

Optimize the profit of a VPP by bidding to multiple products in the power market

What solution did I provide?

AlocaBid: A tool developed from scratch to bid and allocate the portfolio resources

AlocaBid – 3 steps to build a modeling & decision-making tool for allocating and bidding power



Contribution to the E-World

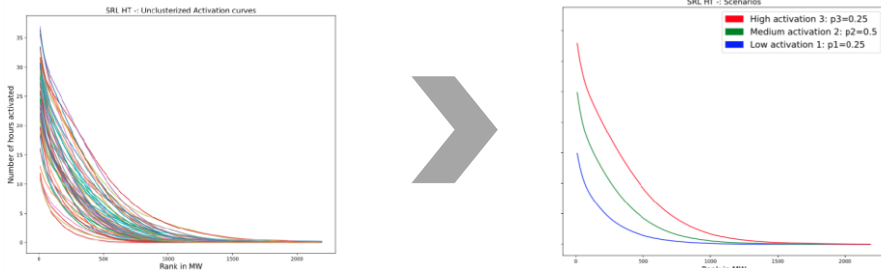
Pricing strategy, VPP modeling, Asset's & Products modeling, Automated tool

Skills used

Market Analysis, Power generation planning, Modeling, Programming

AlocaBid – An automated tool bringing added-value to portfolio managers

Forecasting activations in the reserve market



Clustering into...

Computing the weekly activations curves (2013-2016)

3 scenarios

Activation curve: number of hours per week an asset is being activated regarding its rank in the merit order list of the considered product

3 Case studies to test the performance of AlocaBid

- 3 Case studies -

Base Case

High SRL prices Case

High MRL prices Case

Profit



Optimal Dispatch

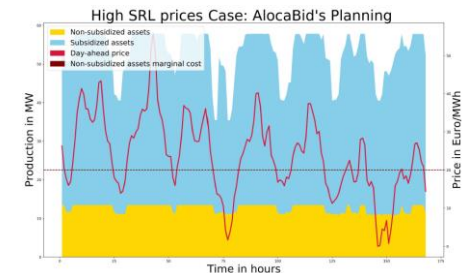


Comparison between the profit a straightforward allocation (*current process*) and the profit generated with AlocaBid on an historical week

+60 %



Straightforward allocation without AlocaBid



Allocation with AlocaBid

Impact: The model developed in the thesis has shown significant results (*minimum +30% profit in all cases*). It can be adapted to any other portfolio of assets. However, the real added-value of the Thesis, was to deliver a production-ready tool, which is currently being daily used to bid and efficiently plan the resources of the VPP portfolio.

Further steps : In the process of publishing an article to promote the model of AlocaBid and the outcome of the Thesis.