Virtual Power Plant
Altran instrument for dealing with flexibilities in energy markets

Prof. Dr.-Ing. Konrad Mußenbrock
European Utility Week, Amsterdam 2014–11–05
Altran, the international group and global leader in innovation and high-tech engineering consulting

- € 1,633m 2013 Revenues
- 5 Industries
- 21,000+ Innovation Makers
- 20+ Countries
Contents

1. Introduction
2. Altran VPP - Modeling & Demonstrator
3. Conclusion
“Big changes” include besides risks always “big chances”

Virtual Power Plants (VPP´s) are supposed to be the most cost efficient producer of dynamic flexibility in innovative electricity systems.

A Virtual Power Plant (VPP) consists of a portfolio of technical and contractual assets, which are able to deliver electrical capacities when needed.

The main task of a VPP is to spontaneously deliver positive (production) or negative capacities (consumption) of electric energy (Flexibilities) according to a random call signal from the market.
In future a VPP will be the analytical heart of a full working system based on live data from the markets.
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The VPP calculates permanently the value of its assets and exercises its options cost minimal – based on forecasts.

Forecasts expect higher revenue when exercising at point t instead point t+1.
The Altran approach to a VPP

- The main task of a VPP is to spontaneously deliver (Flexibilities) positive (production) or negative capacities (consumption) of electric energy.

- Naturally each of the VPP portfolio’s assets has the ability to deliver electric power on demand and therefore exhibits the value of a real option.

- The altran-VPP consists of an algorithm, which optimizes the exercise decisions of this set of real options.

- Therefore a VPP can be used as a hedging machine against risky short positions in the electrical market.
Modeling Concept for the Virtual Power Plant - bringing together the financial option theory and the energy market

**Market opportunities**
- Price volatilities → Arbitrage trading
- Risk premia in capacity markets
- Risk premia in derivative markets
- OTC-contracts in Balance Grid markets

**Virtual Power Plant**
- Dynamic Valuation of Real Options
- Dynamic Stochastic Optimization of Option Exercise Decisions
- Market Bidding /Trading Decisions

**Real Options**
- Change of energy carrier, power plant
- Demand response, load shift in time
- Physical storages
- Trading derivatives

**Dynamically changing stochastic payoffs**
**Produces Flexibility most efficiently**
**Dynamically changing stochastic costs**

**Short-Positions**
**Real – Hedging**
**Long-Positions**
The stochastic dynamic optimization algorithm finds the perfect decision under uncertainty while maximizing the return.

- For every path of the call signal the VPP calculates the optimal exercising strategy for all available assets.
- As an advantage it guarantees that the decision is also optimal for the near future and not only ad-hoc.

The VPP maximizes the returns and secures a sustainable disposability!
The innovation of the Altran VPP: bringing together two worlds in an interdisciplinary model with a focus on sustainability

The Altran model is not dominated by one discipline but consists of an innovative mix of:
- Heuristic models
- Option theory models
- Mathematical models
- Engineering models

With regard to different stakeholders we also reflect:
- Human Intuitions
- Rules of thumb
- “Country sayings”

Our model is the optimal combination regarding realistic technical behavior, calculation time and risk consideration.

The practical use of our model assumes the existence of state-of-the-art information & communication technology.
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The Altran VPP delivers direct and indirect new added value potential by increasing revenue and decreasing costs.

**Decreasing Costs**

- Decreasing Costs due to better grid balance
- Decreased network charges (companies only)
- Decreasing Costs for Energy Trading

**Increasing Revenue**

- Added Value due to increased participation on capacity markets
- Better ROI in energy infrastructure
- Added Value by load shift in time

The consequences and relations are only estimated so far and need to be quantified.
Five Business Cases and their Interaction with Regulatory Uncertainties/Opportunities have been analyzed and discussed with the market.

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The core STE²AM Team:

- **Prof. Dr.-Ing. Konrad Mußenbrock**
  Project Director, Senior Expert

- **Konstantin Graf**
  Project Manager, Research, Sales

- **Christopher Muth**
  Solution Architect, Coordination, Regulations

- **Fabrizio Rossi**
  Project Director

- **Catalin Lupu**
  Software Development, Asset Modeling

- **Olivier Terlinden**
  Regulations, Business Cases, Data Research

- **Vera Longinotti**
  Regulations, Model Development

- **Marco di Stefano**
  Regulations, Sales
Prof. Dr.-Ing. Konrad Mußenbrock
Renewable Energies & Energy Management
Telephone: +49 (0) 6021 4206-905
Mobile: +49 (0) 173 5924843
Mail: konrad.mussenbrock@h-ab.de
www.h-ab.de