IndustRE
Flexibility potential of industrial plants

“Mapping flexibility in industry”

October 13, 2016
Jef Verbeeck - VITO/EnergyVille

This project has received funding from the European Union’s Horizon2020 research and Innovation programme under grant agreement No 646191 - The sole responsibility for the content of this presentation lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither INEA nor the European Commission are responsible for any use that may be made of the information contained therein.
Part I  What is the IndustRE project?

Part II  How calculating a demand response business case?

Part III  Why is there a need for a simplified methodology?

Part IV  How does this simplified methodology work?
Using the flexibility potential
What is the IndustRE project?

The challenge

The IndustRE project sees the **industrial electricity demand flexibility** as an opportunity to deal with both challenges at the same time:

- **The cost-effective integration of variable renewable electricity into the European power systems**
- **The rising cost of electricity and its effects on the competitiveness of the European Industry**
What is the IndustRE project?

Objectives

The project brings together the large industry with the renewable energy community in order find common ground and create win-win situations.

- Formulate business models
- Develop tools to facilitate their adoption
- Quantify the potential benefits for the power system
- Formulate policy recommendations

Two aims within two timeframes

2020
- Practical tools for immediate impact

2030
- Quantify potential leading to policy improvements
What is the IndustRE project?

Work programme

WP1
Project management and coordination

WP2
Innovative Business models

WP3
Implementation Tools

WP4
Case Studies

2020

WP5
Quantification of the benefits and policy recommendations

2030

WP6
Dissemination, Communication and Policy Promotion
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Part II How calculating a demand response business case?
Part III Why is there a need for a simplified methodology?
Part IV How does this simplified methodology work?
### Business model

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**Part II: How calculating a demand response business case?**

**What is possible from a legal point of view?**

“Although EU guidelines are quite clear, implementation pace is different...”

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- ● business case is viable in existing regulatory framework
- ● business case limited viability/restricted in current regulatory framework
- ● business case impossible in existing regulatory framework
Part II: How calculating a demand response business case?
Which price data is available?

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- **Public price data available**: ![Green](#)
- **Bilateral price data estimates available**: ![Yellow](#)
- **(Bilateral) price data not available**: ![Red](#)
Part II: How calculating a demand response business case?

How much flexibility is available?

- Business models
- Regulation
- Market data

Flexibility model

Total energy consumption

Process 1: Cooling

Process 2: Industrial process

Process 3: Emergency generator

Flexibility modelling

Flexgraph 1

Flexgraph 2

Flexgraph 3

Flexgraph total

Inflexible consumption

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Part II: How calculating a demand response business case?

Calculate the business case

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**PP**  Price profile optimization method (energy + peak)
**DS**  Dual supplier optimization method (supplier + own production + peak)
**DIP** Dual imbalance price optimization
**C**   Total costs optimization method (capacity only)
Part I  What is the IndustRE project?

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Part IV  How does this simplified methodology work?
Skills for creating a flexibility model ...

A flexibility model is the result of a 2 stage process:

**selection stage:**
- identification of flexibility during a site survey or audit
- requires good top-level understanding of industrial processes with focus on energy flows

**modelling stage:**
- construction of a mathematical model which describes production process and constraints from energy consumption point of view
- requires understanding of modelling and optimization techniques

→ The combination of skills is not so obvious
Part III: Why is there a need for a simplified methodology?

Business case calculation complexity ...

\[ \sum_{t=1}^{t_{\text{end}}} x(t) \left[ \frac{1}{2} (r(t) - Q(t) - X(t) - Y(t)) \right] \\
+ \sum_{t=1}^{t_{\text{end}}} \left[ \left( X(t) + Y(t) \right) \left( k(t) - g(t) \right) \right] \\
0 \leq s(t) \leq s_{\text{max}} \quad \forall t \\
\sum_{t=1}^{t_{\text{end}}} \delta s(t) \leq \Delta s_{\text{max}} \]
“Building up interest in demand response is for many companies a long, time consuming, multi-stage process...”

... but an order of magnitude business case estimation is enough to plant a seed”
Part III: Why is there a need for a simplified methodology?

Requirements of a simplified methodology

1. Being cost effective and time efficient
2. Order of magnitude accuracy estimation is good enough
3. No specific modelling and optimization knowledge and tools needed
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"Generating **normalized business case graphs** for a limited number of **reference processes**"

1. **reference process**
2. **normalized business case graph**
Part IV: How does this simplified methodology work?

Reference process example: generic battery model

generic battery model

buffered industrial process
Part IV: How does this simplified methodology work?

Normalized business case graph example
Part IV: How does this simplified methodology work?

Normalized business case graph example

wind to customer 40€/MWh

grid to customer 100€/MWh
Part IV: How does this simplified methodology work?

Normalized business case graph example

wind to customer 40€/MWh
wind to grid
Normalized business case graph example

Part IV: How does this simplified methodology work?

Slide 24
Part IV: How does this simplified methodology work?

Normalized business case graph example
Part IV: How does this simplified methodology work?

Normalized business case graph example
Part IV: How does this simplified methodology work?

Normalized business case graph example

![Graph showing the value of different battery capacities (0.1MW, 0.2MW, 0.3MW) in relation to battery capacity (MWh). The x-axis represents battery capacity in MWh, and the y-axis represents value in euro/MWh.](image-url)
Part IV: How does this simplified methodology work?

Normalized business case graph example
Part IV: How does this simplified methodology work?

Normalized business case graph example

![Graph showing normalized business case example](image-url)
Part IV: How does this simplified methodology work?

Normalized business case graph example
Part IV: How does this simplified methodology work?

Normalized business case graph example

“... and if you plot it differently, you even see that there are optimal ratio’s ...”
Next steps with the methodology

- Methodology will be tested and refined (if needed) during a **number of case studies**
- Case studies will take place **Q4-2016 till Q2-2017** in the 6 target countries
Questions?

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