



# industRE

## Flexibility potential of industrial plants

*“Mapping flexibility in industry”*

October 13, 2016

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*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*



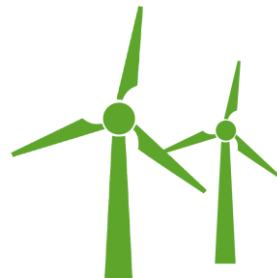
# Contents

**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?





# industRE

Using the

# flexibility potential



Chemicals



Non-ferrous metals



Steel



Cold storage



Water treatment



BECKER BÜTTNER HELD



European  
Copper Institute  
Copper Alliance



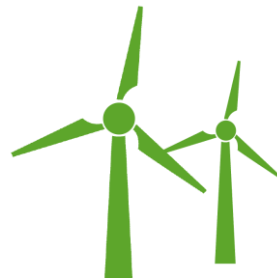
# The challenge

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



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



# 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

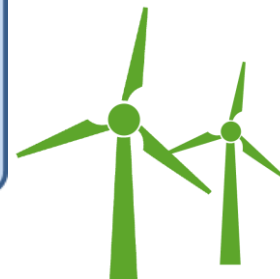
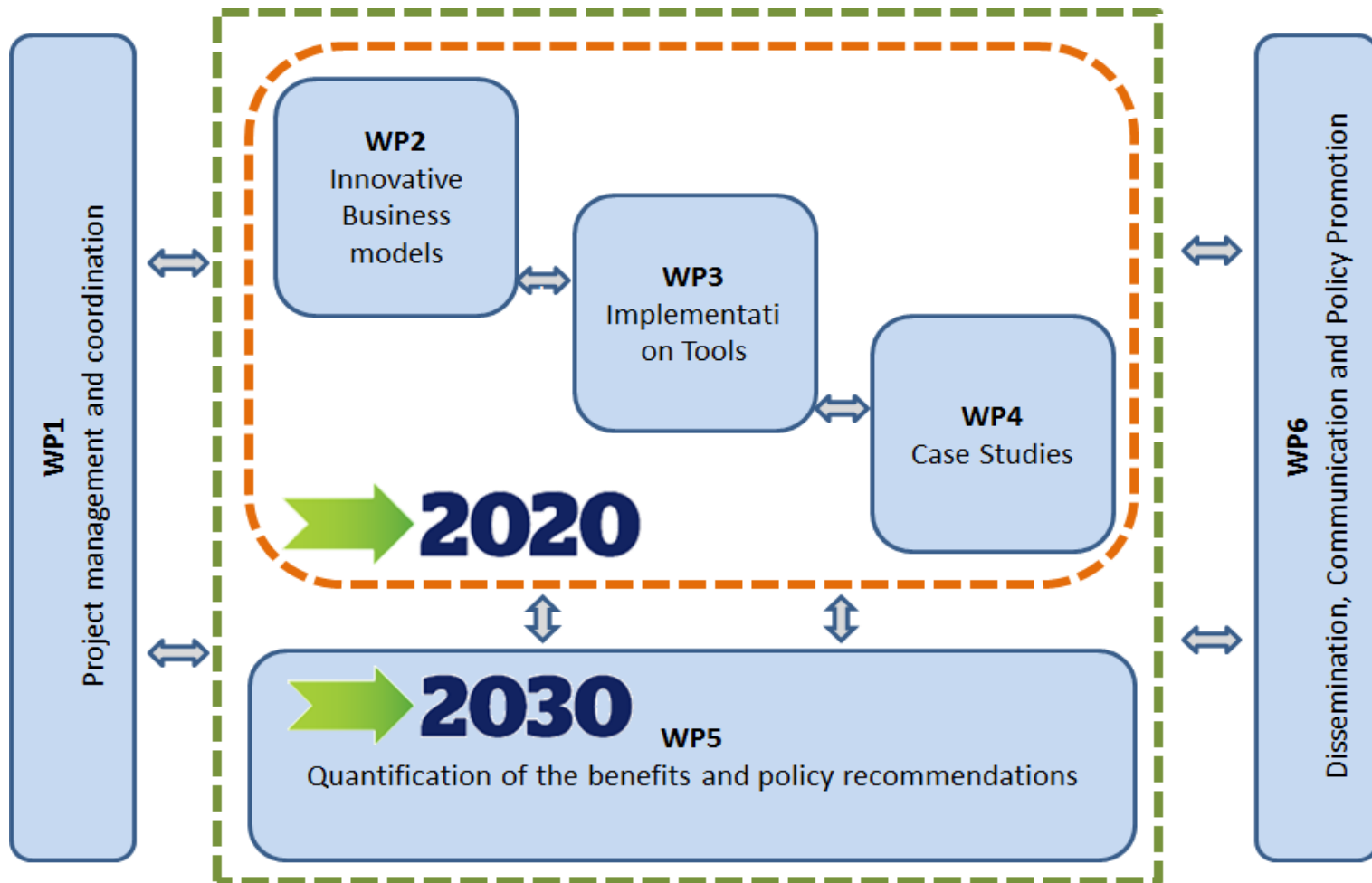
➔ **2030**

Quantify potential leading  
to policy improvements





# Work programme



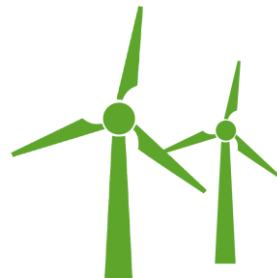
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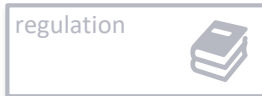
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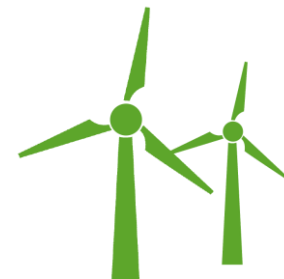
Part IV How does this simplified methodology work?



# How can you make money with flexibility?



Business model		BE	FR	DE	IT	ES	UK
<b>Standard contract optimization</b>	Commodity						
	Network charges						
<b>Day-ahead optimization</b>	Commodity						
	Network charges						
<b>Reserve capacity</b>	FC reserve						
	FR reserve						
	R reserve						
<b>Imbalance optimization</b>							
<b>On-site VRE optimization</b>							





# What is possible from a legal point of view?



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

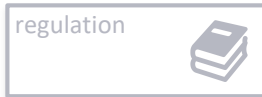


Business model		BE	FR	DE	IT	ES	UK
<b>Standard contract optimization</b>	Commodity	●	●	●	●	●	●
	Network charges	●	●	●	●	●	●
<b>Day-ahead optimization</b>	Commodity	●	●	●	●	●	●
	Network charges	●	●	●	●	●	●
<b>Reserve capacity</b>	FC reserve	●	●	●	●	●	●
	FR reserve	●	●	●	●	●	●
	R reserve	●	●	●	●	●	●
<b>Imbalance optimization</b>		●	●	●	●	●	●
<b>On-site VRE optimization</b>		●	●	●	●	●	●




- business case is viable in existing regulatory framework
- business case limited viability/restricted in current regulatory framework
- business case impossible in existing regulatory framework

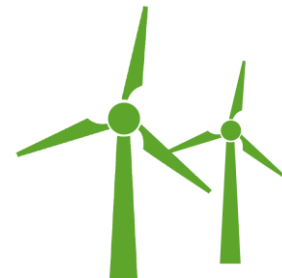


# Which price data is available?

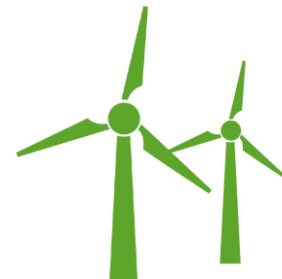
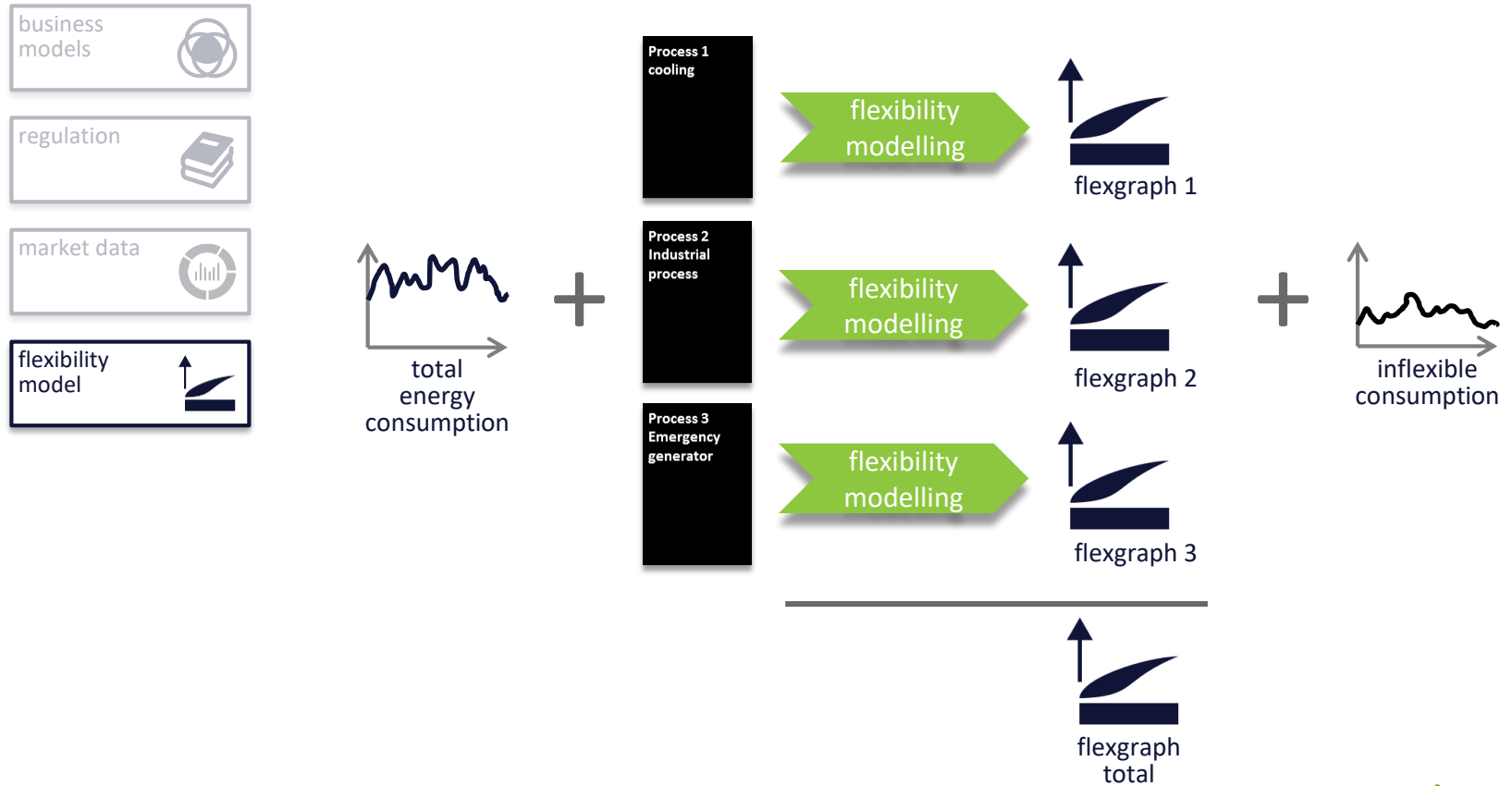


Business model		BE	FR	DE	IT	ES	UK
<b>Standard contract optimization</b>	Commodity	●	●	●	●	●	●
	Network charges	●	●	●	●	●	●
<b>Day-ahead optimization</b>	Commodity	●	●	●	●	●	●
	Network charges	●	●	●	●	●	●
<b>Reserve capacity</b>	FC reserve	●	●	●	●	●	●
	FR reserve	●	●	●	●	●	●
	R reserve	●	●	●	●	●	●
<b>Imbalance optimization</b>		●	●	●	●	●	●
<b>On-site VRE optimization</b>		●	●	●	●	●	●

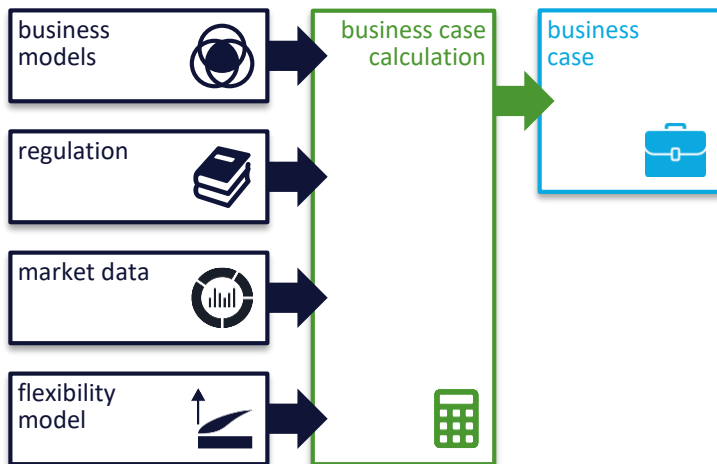
 public price data available  
 bilateral price data estimates available  
 (bilateral) price data not available



# How much flexibility is available?



# Calculate the business case



Business model		BE	FR	DE	IT	ES	UK
<b>Standard contract optimization</b>	Commodity	● PP	● PP	● PP	● PP	● PP	● PP
	Network charges	● PP	● PP	● PP	● PP	● PP	● PP
<b>Day-ahead optimization</b>	Commodity	● PP	● PP	● PP	● PP	● PP	● PP
	Network charges	● PP	● PP	● PP	● PP	● PP	● PP
<b>Reserve capacity</b>	FC reserve	● C	● C	● C	● -	● -	● C
	FR reserve	● -	● C/PP	● C/PP	● -	● -	● C
	R reserve	● C	● C	● C/PP	● -	● -	● C
<b>Imbalance optimization</b>		● DIP	● DIP	● PP	● DIP/PP	● DIP	● DIP
<b>On-site VRE optimization</b>		● DS	● DS	● DS	● DS	● -	● DS

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)



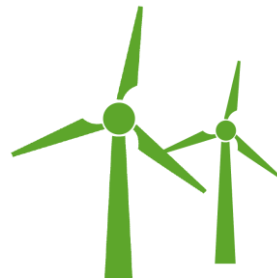
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# Skills for creating a flexibility model ...



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





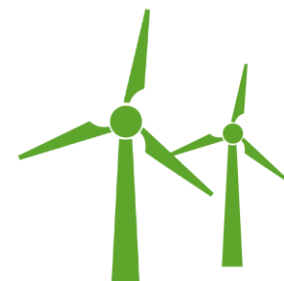


# Accuracy of the business case value

*“Building up interest in demand response is for many companies a long, time consuming, multi-stage process...”*

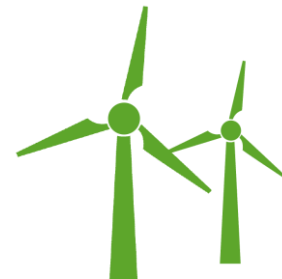


*... but an order of magnitude business case estimation is enough to plant a seed”*



# 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



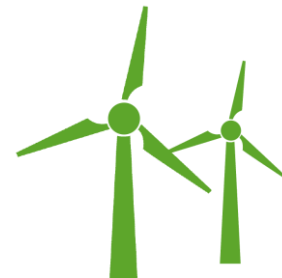
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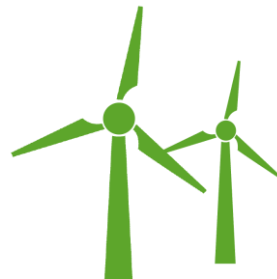
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## The approach

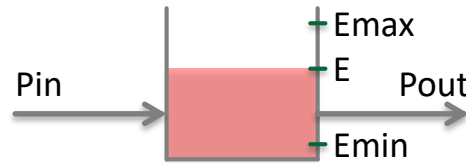
*“Generating normalized business case graphs for a limited number of reference processes”*

- 1** *reference process*
- 2** *normalized business case graph*

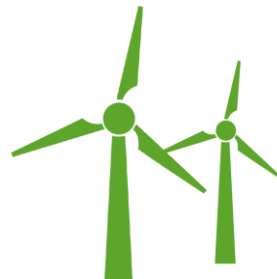
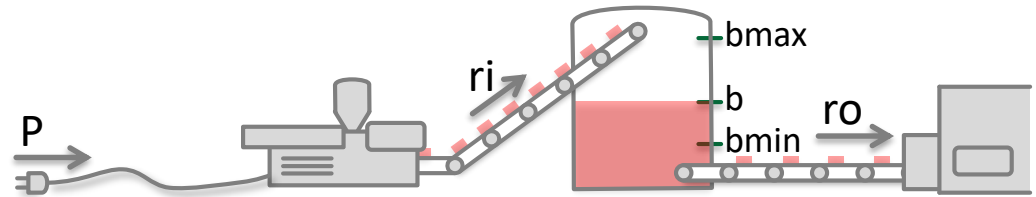


# Reference process example: generic battery model

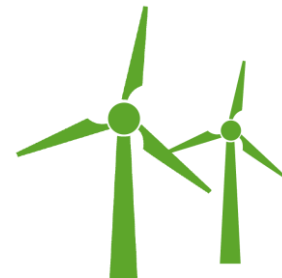
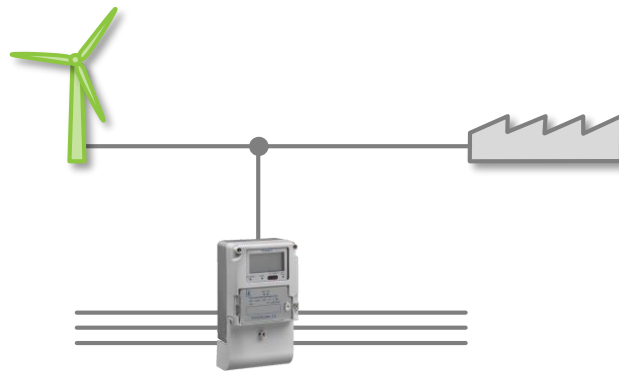
generic  
battery model



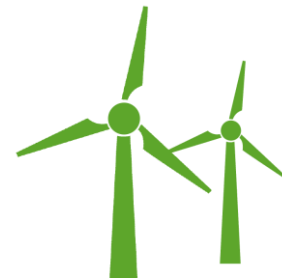
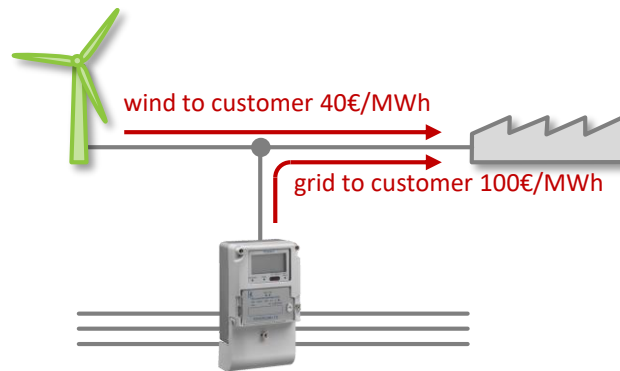
buffered  
industrial process



# Normalized business case graph example

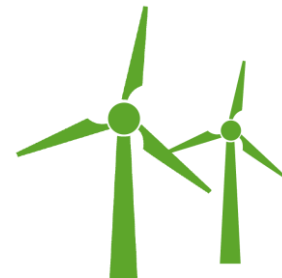
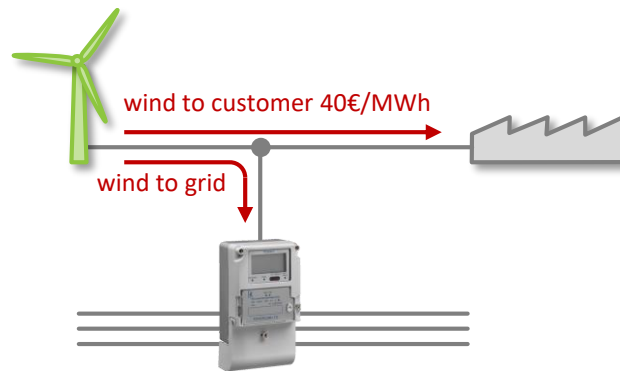


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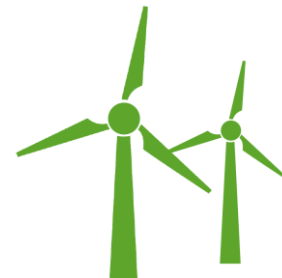
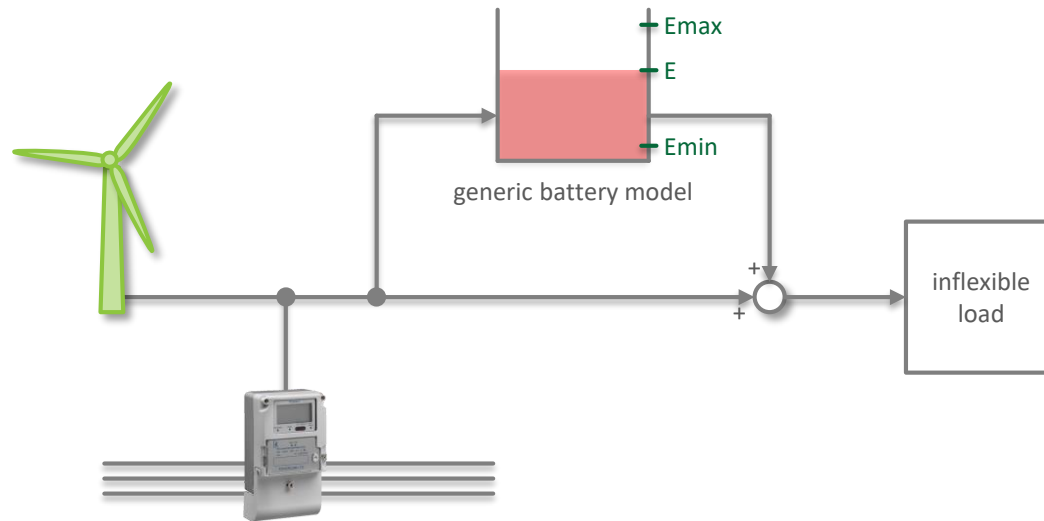




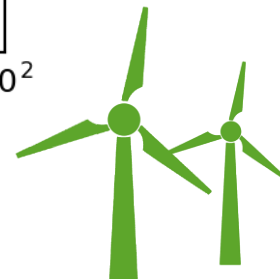
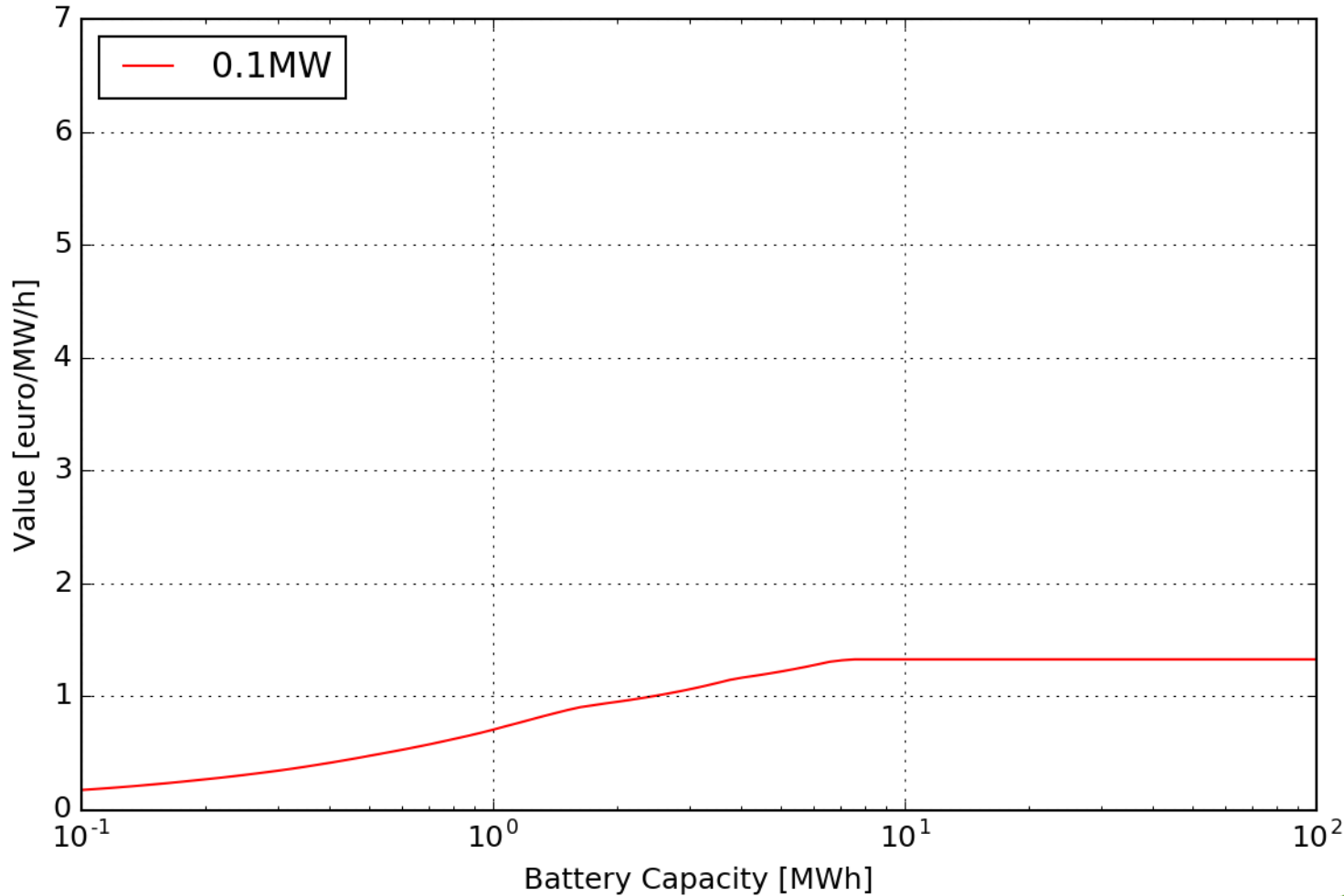
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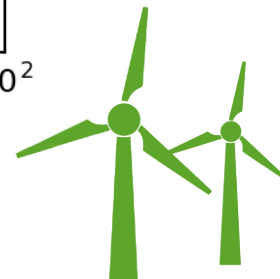
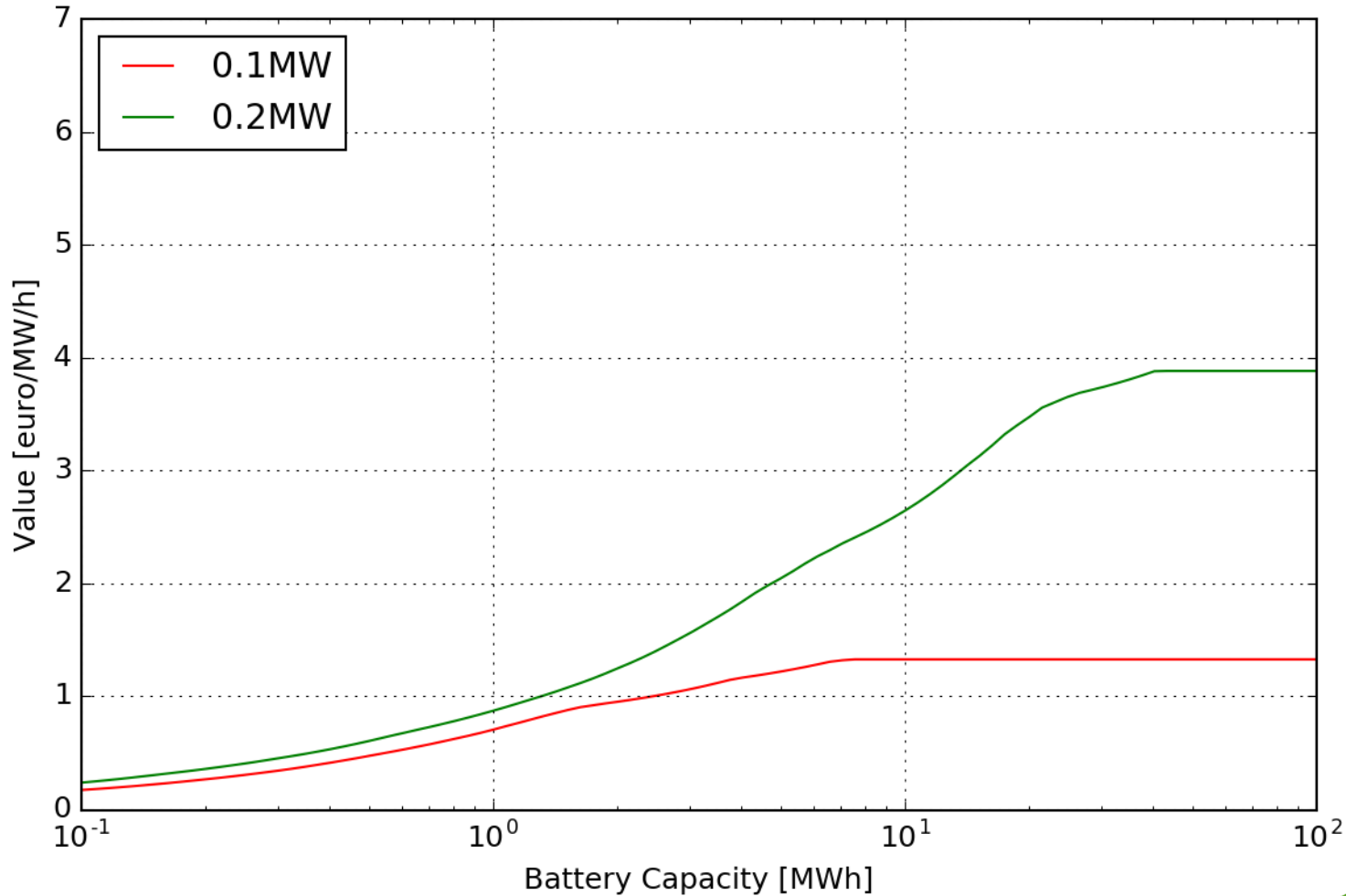
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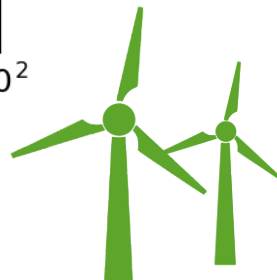
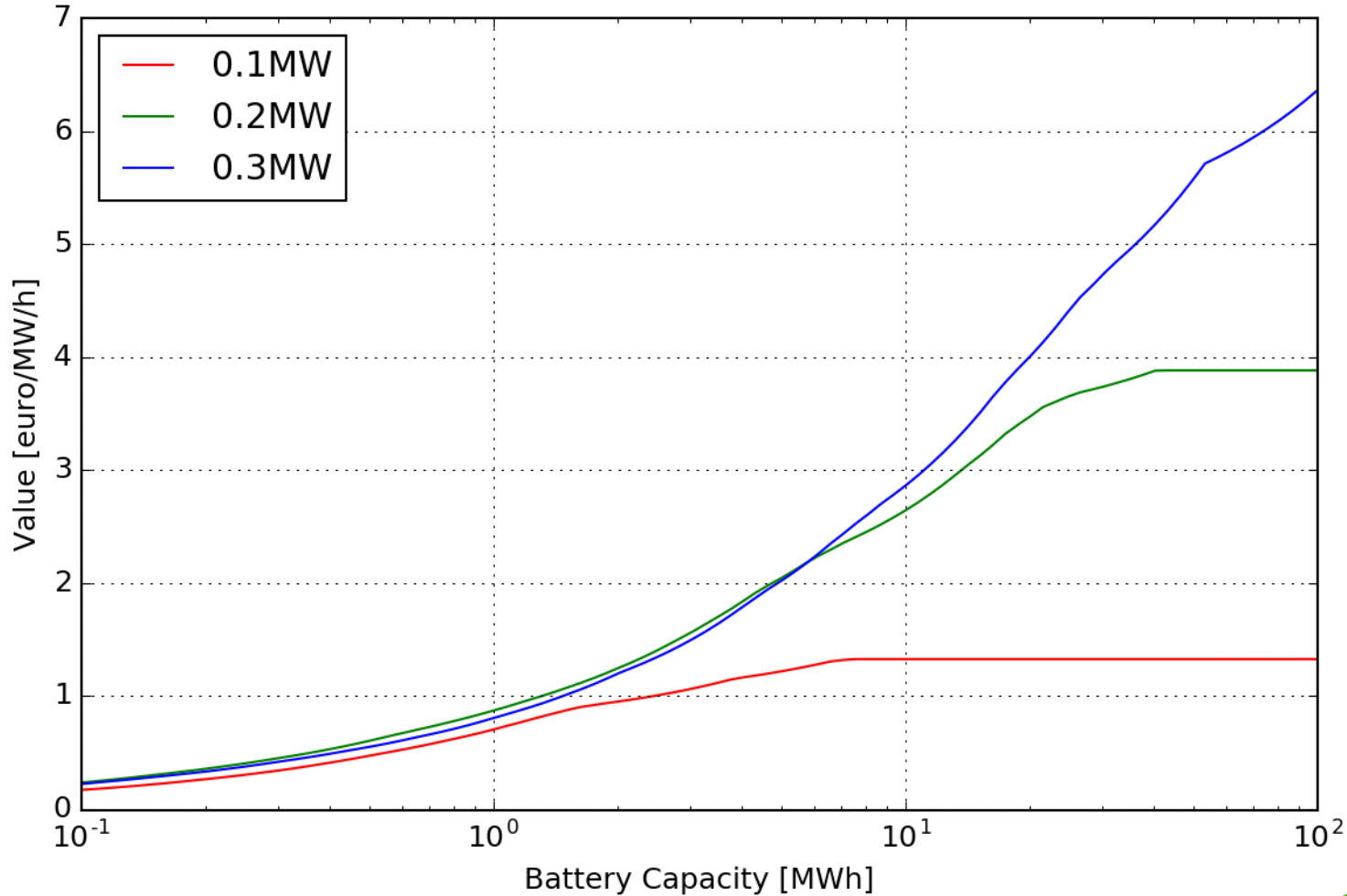
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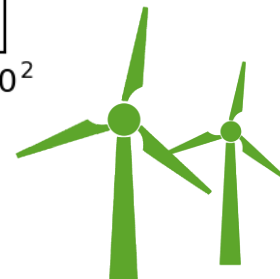
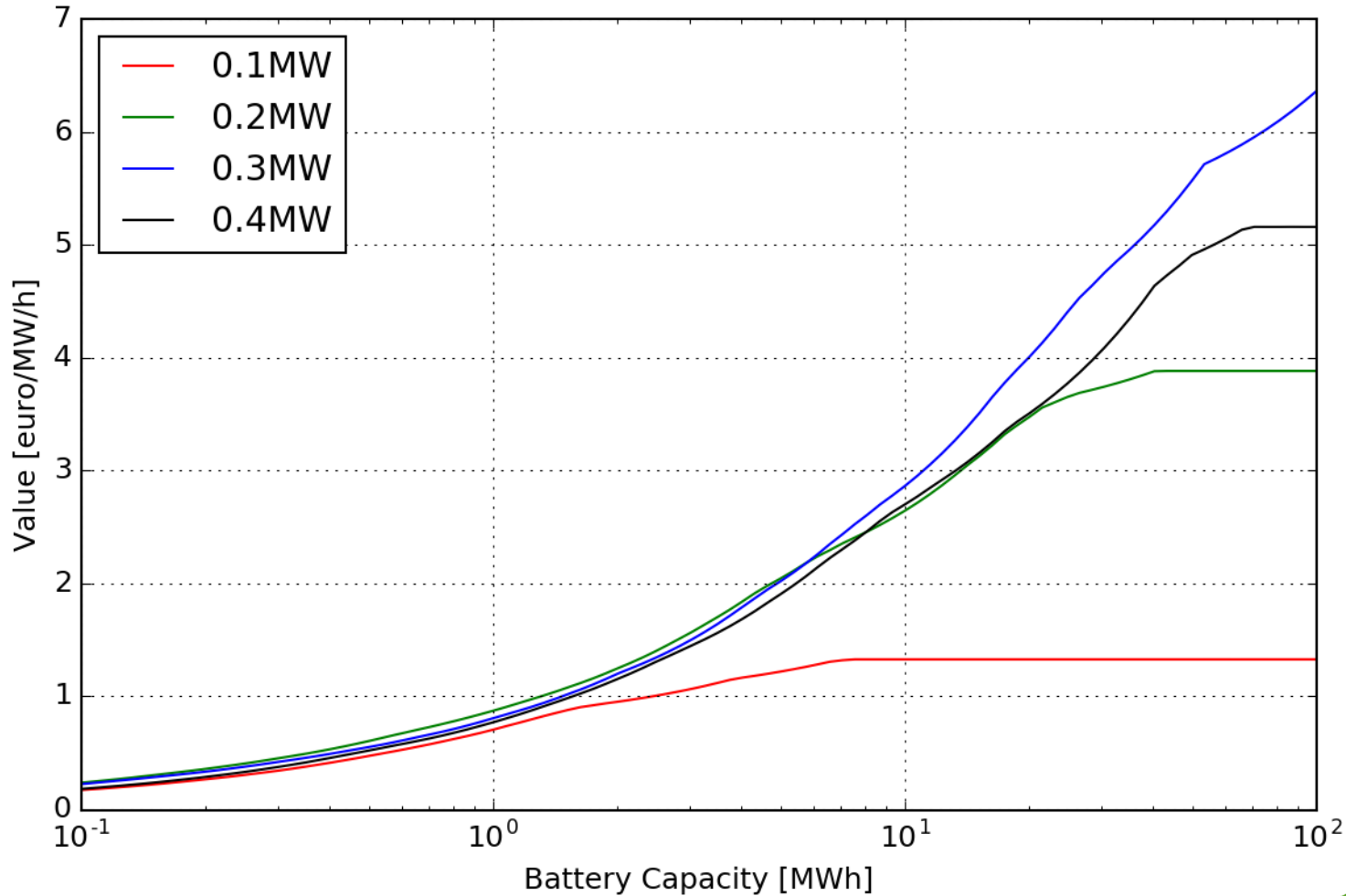
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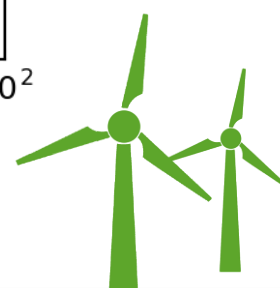
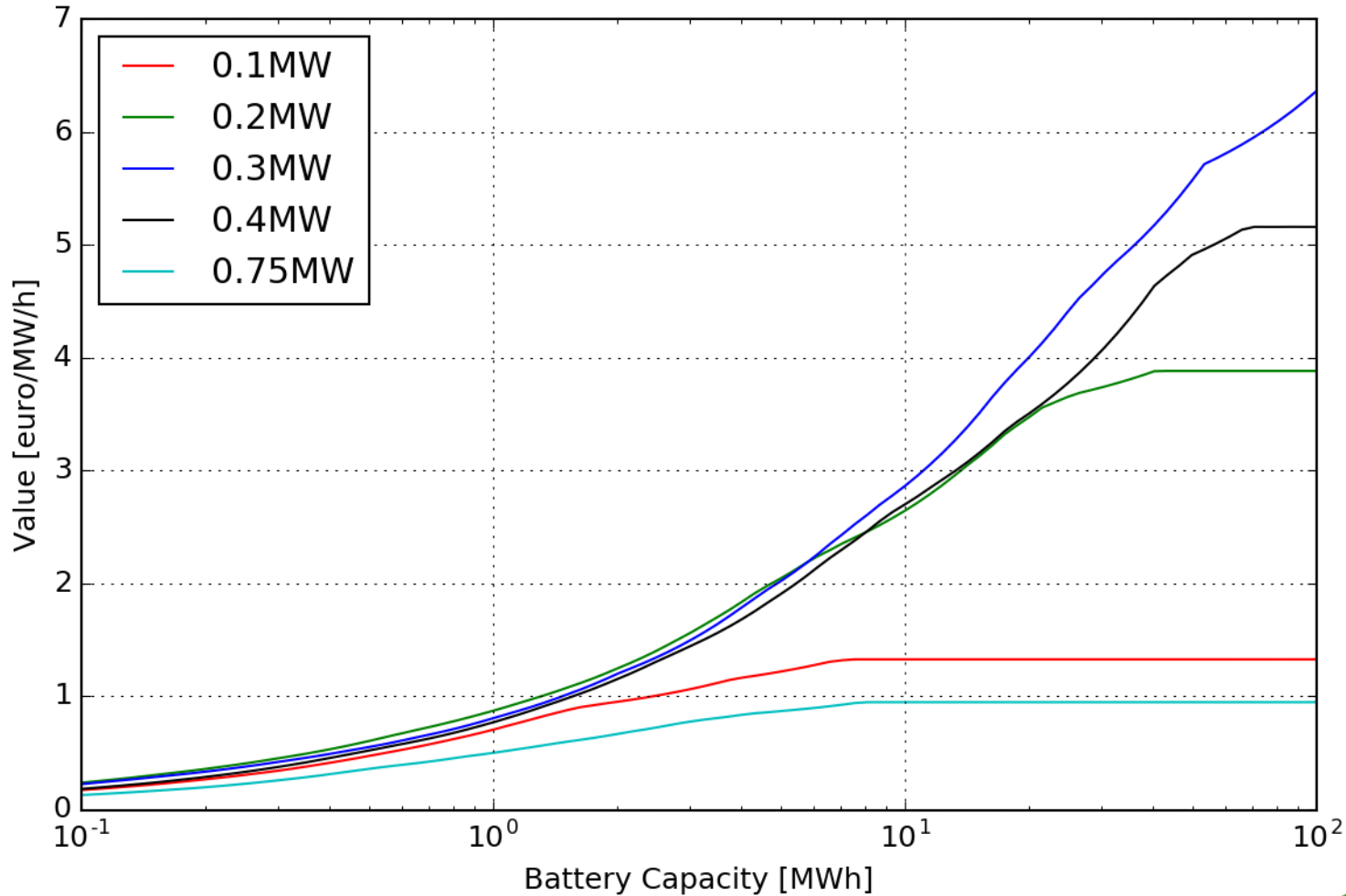
# Normalized business case graph example



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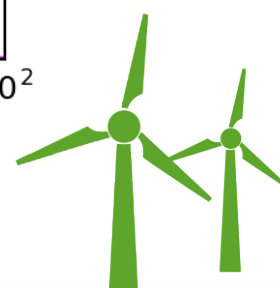
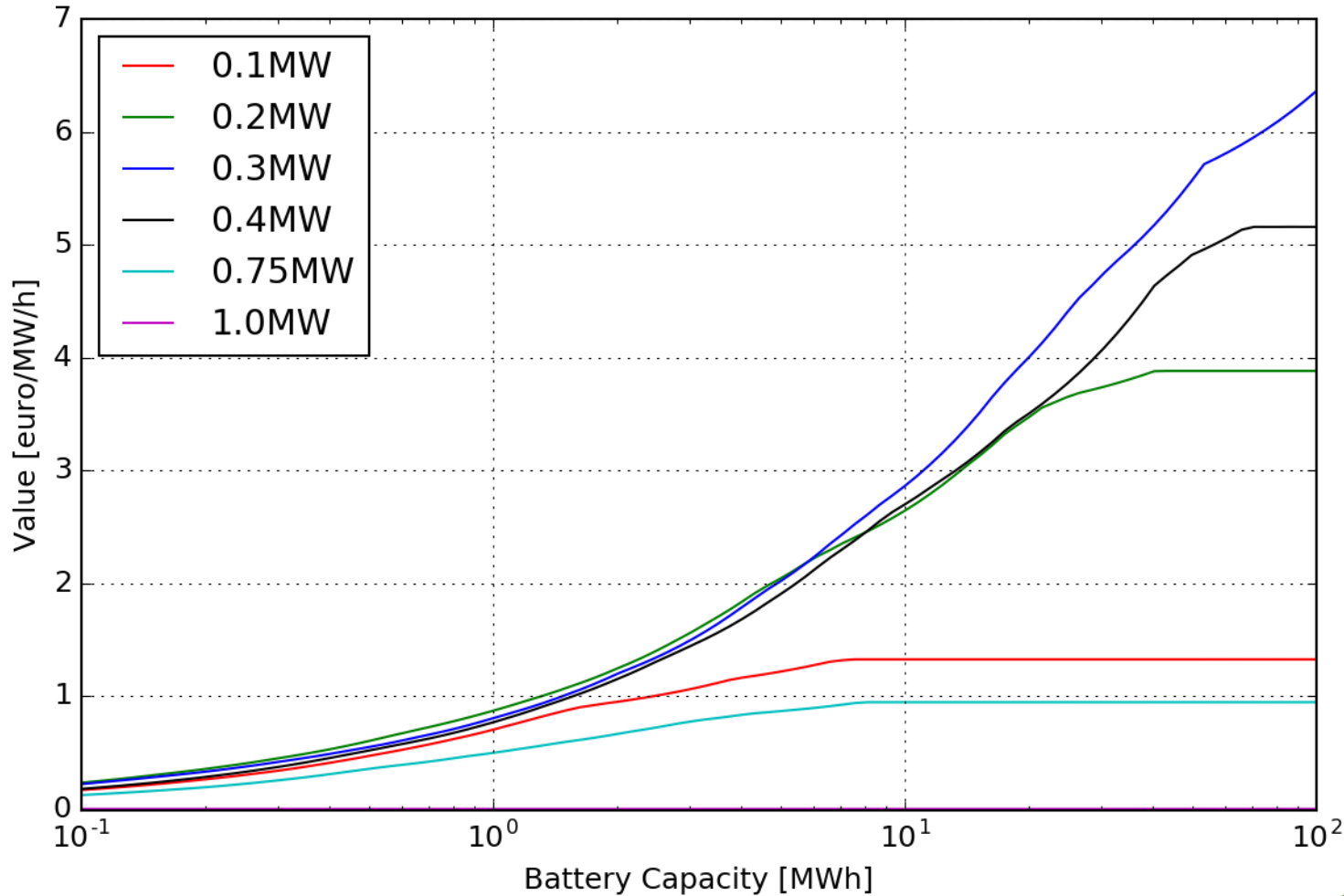


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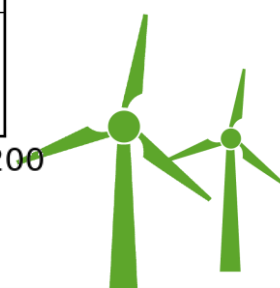
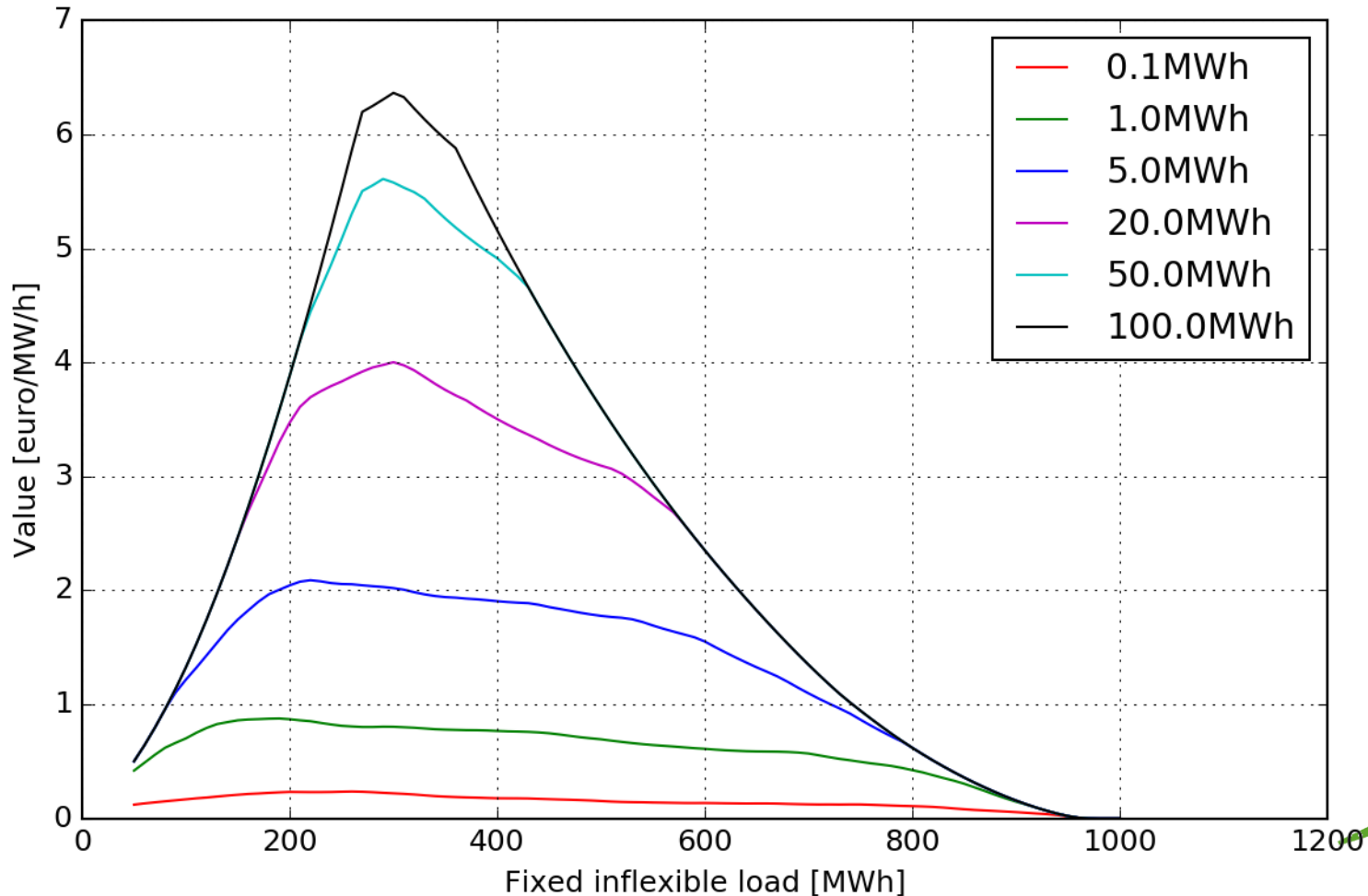


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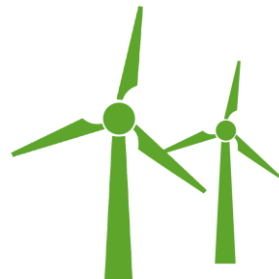
# Normalized business case graph example

“ ... 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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