POWER-GEN EUROPE

RENEWABLE ENERGY WORLD CONFERENCE & EXPO EUROPE

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Bulk Energy Storage in Future Electricity Systems in Europe

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Project Summary & Objectives

The project aims to unlock the potential for energy storage infrastructure, through:

- Analysis of the energy storage status and potential
- Assessment of the environmental considerations
- Reviewing together with key stakeholders the regulatory and market framework conditions
  - at European level
  - in the 6 target countries
- Improving the general understanding of the energy storage benefits for the European power system.

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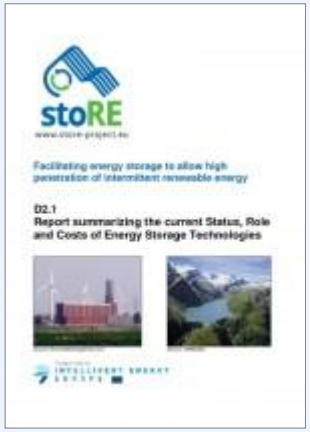
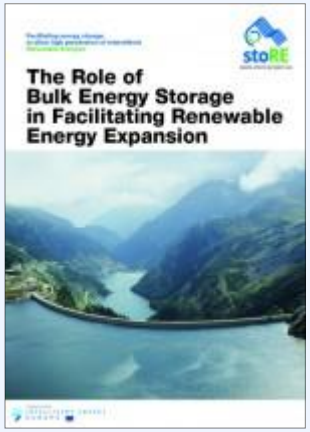
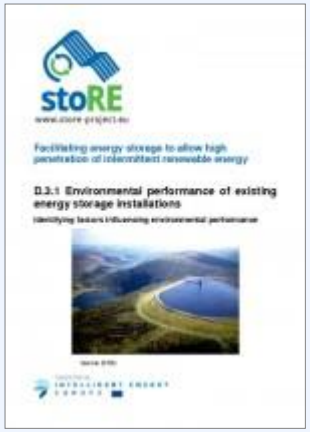
Results

- Current Status, Role and Costs of Energy Storage Technologies
- The Role of Bulk Energy Storage in Facilitating Renewable Energy Expansion
- Environmental Performance of Existing Energy Storage Installations
- Furthering the Sustainable Development of Bulk Energy Storage Facilities
- Guidelines for the development of PHES in environmentally sensitive sites
- European Regulatory & Market Framework for Electricity Storage Infrastructure
- Energy Storage Needs in the target countries







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Part 1

European Regulatory & Market Framework for Electricity Storage Infrastructure

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- *Identify the key elements of the European market framework that potentially create unfavourable conditions for the development and operation of electricity storage infrastructure*
- *Provide policy makers with recommendations for possible improvements*

Directives, policies, funding instruments and other initiatives

Single Energy Market for Europe

- The Electricity Directive - Directive 2009/72/EC
- The Renewable Energy Directive - Directive 2009/28/EC
- Framework Guidelines and Network Codes
- Better Governance for the Single Market - COM(2012) 259
- Making the Internal Energy Market Work - COM(2012) 663

Energy Infrastructure Package

- Blueprint for an integrated European energy network - COM(2010) 677
- Guidelines for trans-European energy infrastructure - COM(2011) 658
- Establishing the Connecting Europe Facility - COM(2011) 665
- The Ten Year Network Development Plan (TYNDP)
- The list of “Projects of Common Interest” (PCIs)

- Policies, directives & other initiatives directly related to RE

Survey Methodology

- Feedback Collection and analysis of from overall 55 experts, through a questionnaire, telephone interviews, four round table discussions, feedback to draft versions of the report, advisory board meetings

Utilities / Industry	Associations	Developers	Research Institutes	TSOs and others
DONG Energy	EASE	Gaelectric	École Polytechnique Fédérale de Lausanne	50Hertz
E.ON	EREF	HSE Invest	JRC	ELIA
Endesa	HEA	JUWI	KU, Leuven	Red Eléctrica de España
RWE	Renewables Grid Initiative (RGI)	UPB/ROSHA	RSE	Philippe & Partners (law firm),
Verbund	Climate Parliament	Hydrowatt	SiTI	Electricity Authority of Cyprus
Panasonic Europe	Smart Energy for Europe Platform (SEFEP)	ELZACO Ltd	University of Zagreb	

Recommendations to the EC

1. Re-evaluate the exemption of PHES from the financing provision of the **infrastructure package**, restricting only financing to plants that could be profitable without support.

2. Officially clarify the applicability of the **unbundling principle** to electricity storage (Article 9(1) of the Electricity Directive), by including a clear definition of electricity storage and propose an approach that:

- Introduces clear restrictions to the use of electricity storage facilities by system operators if and when they are allowed some kind of control over them
- Facilitates the market selection of the most efficient solution for transmission vs. storage.

3. Maintain the possibility to include in the **PCI** also projects not foreseen in the TYNDP.

4. Introduce **targeted regulatory interventions** and initiatives to ensure the **timely** development of storage infrastructure to the extent necessary.

5. Monitor and encourage the **transposition of Electricity Directive Article 15 (7) to national legislation** for transparent and market based mechanisms for balancing

Recommendations to ACER & ENTSO-E

1. Include **definitions of electricity storage in the network codes**, also taking into account smaller scale systems, in order to facilitate the development of similar administrative procedures in the Member States for their connection to the grid.

2. Develop a method to calculate **grid fees** that will take the real impact of the electricity storage system on the grid into account.

3. Apply **common rules** across Europe regarding grid fees in order to avoid deployment of a project in one country and provision of services in another, due to different framework conditions.

4. Critically review the **Cost Benefit Analysis** methodology developed for the evaluation of the proposed Projects of Common Interest to ensure that it is fair and treats electricity storage projects in equal terms with transmission and generation projects.

Recommendations to project developers & other stakeholders

1. Closely **monitor the on-going development of the network code on balancing** in order to ensure that electricity storage facilities will gain full access to cross border markets.

2. Monitor the **transposition of Electricity Directive Article 15 (7) to national legislation** for transparent and market based mechanisms for balancing

3. Critically review the **Cost Benefit Analysis** methodology developed for the evaluation of the proposed Projects of Common Interest to ensure that it is fair and treats electricity storage projects in equal terms with transmission and generation projects.

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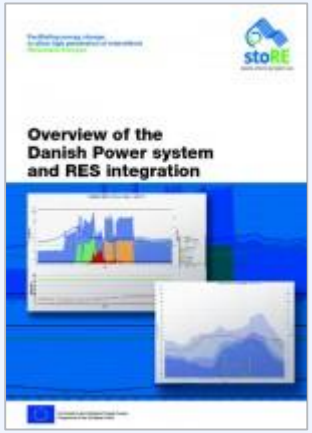
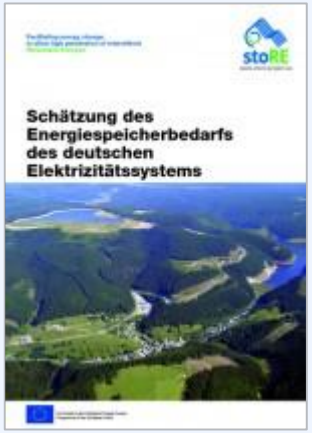
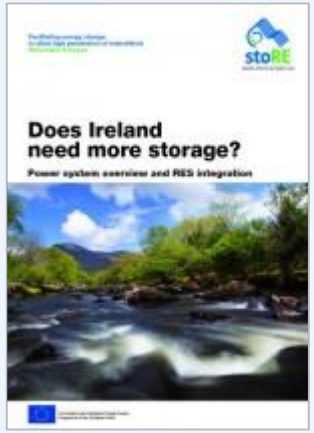
Part 2

Estimating the energy storage needs in Austria, Denmark, Germany, Greece, Ireland and Spain







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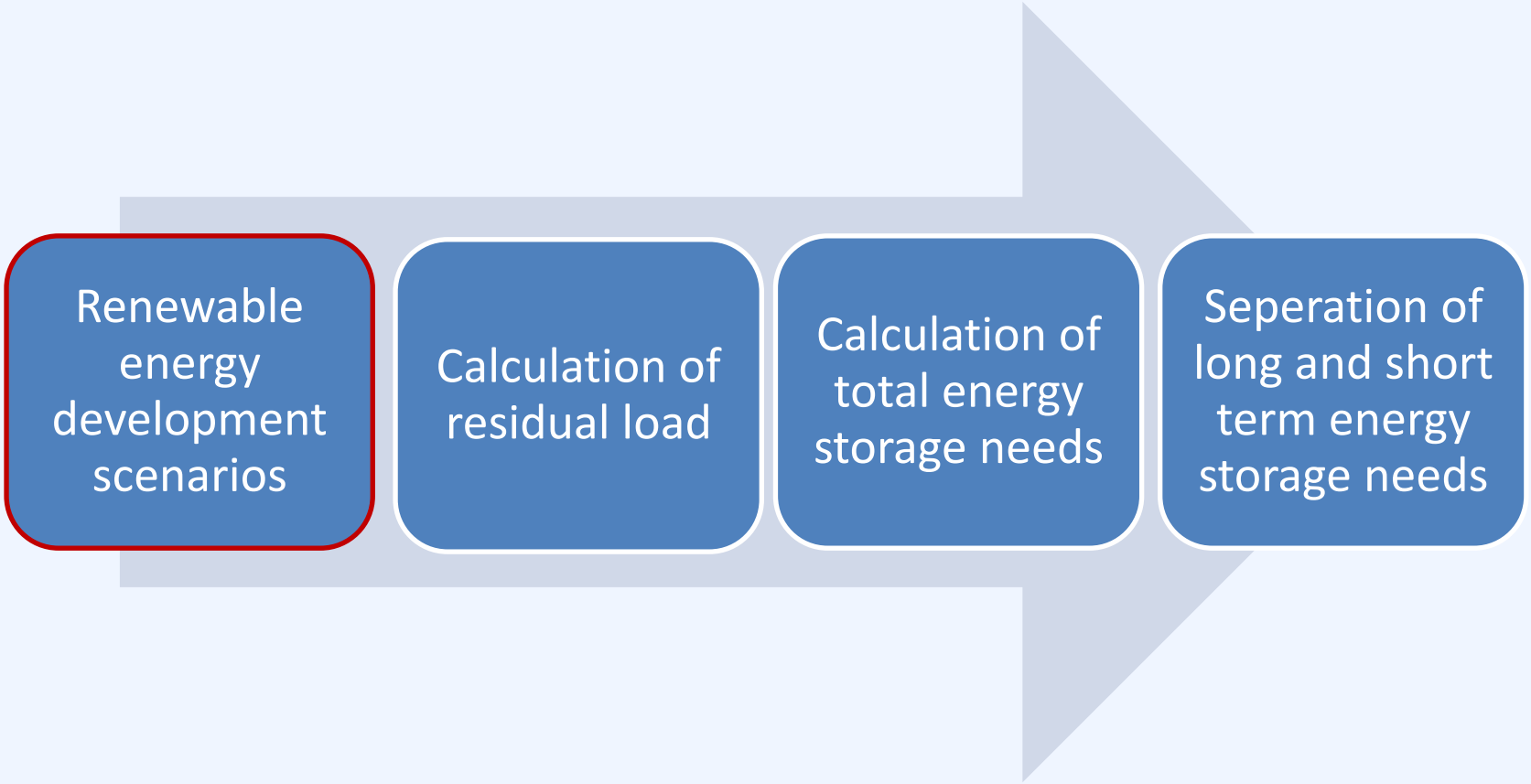
Process


Renewable energy development scenarios
Calculation of residual load
Calculation of total energy storage needs
Seperation of long and short term energy storage needs

Development scenarios in stoRE

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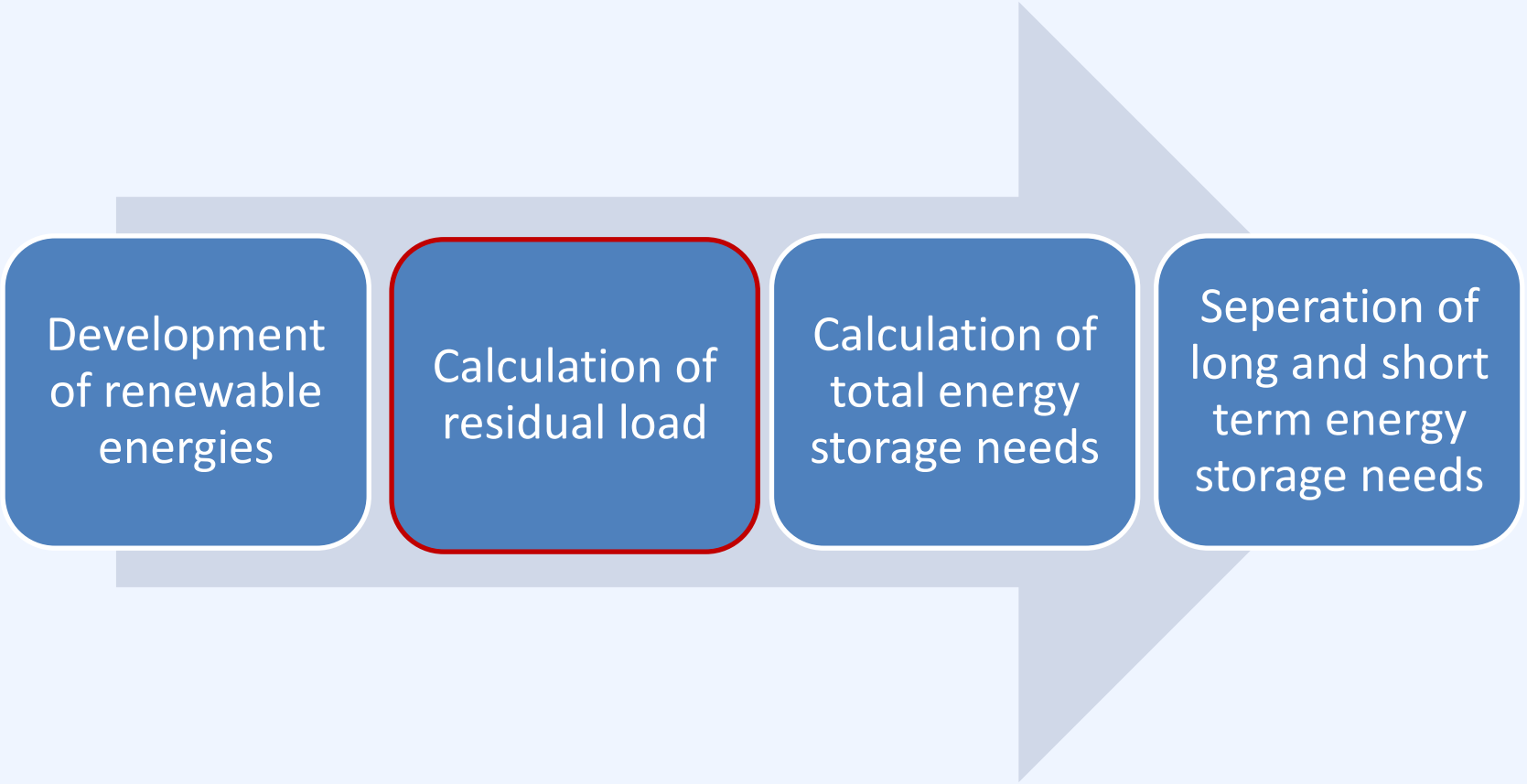
Target country	40% RE	80% RE	Import/Export	Heating sector
Austria	Already more than 40% RE ➔2020 scenarios A,B,C	2050 scenarios GREEN, BAU	Yes, combined system Germany - Austria	No
Denmark	Scenarios 2020 A,B,C Different wind development	One scenario	Yes, import/export via AC to Germany	Yes, for 80% RE
Germany	3 scenarios A,B,C Different RE development	3 scenarios A,B,C Different RE development	No	No
Greece	2 Scenarios A,B Strong PV, strong Wind	3 scenarios A,B,C Different RE development	No	No
Ireland	Scenarios 2020 A,B,C Different wind development	One scenario	Yes, import/export via HVDC to GB	No
Spain	2 Scenarios A,B Strong PV, strong Wind	2 Scenarios A,B Strong PV, strong Wind	No	No

Process


Development of renewable energies
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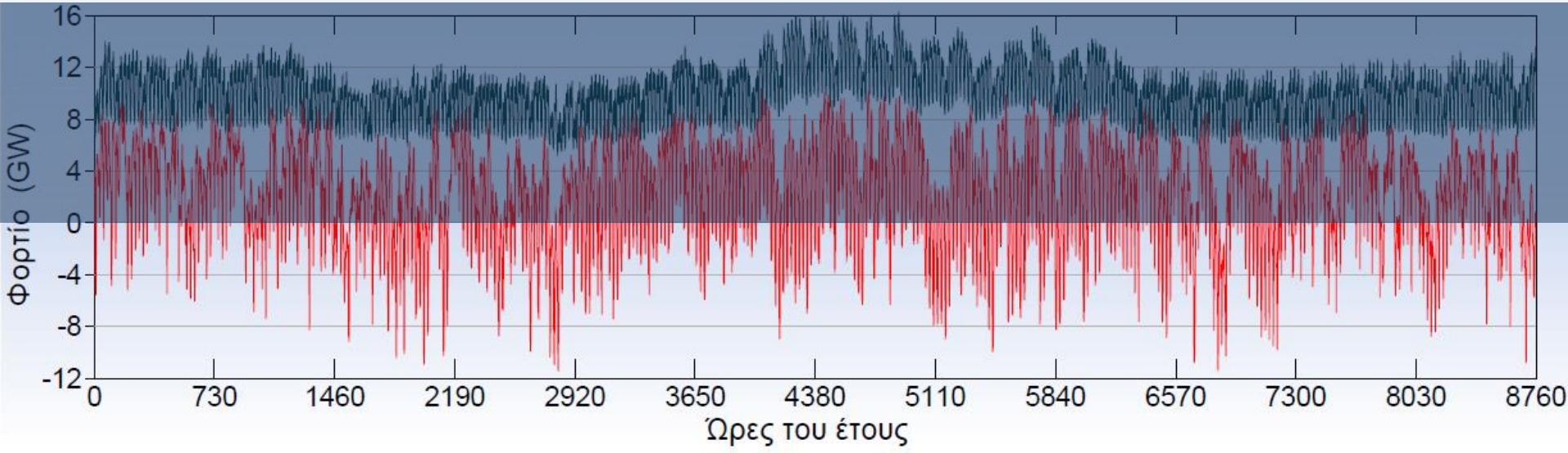
Calculation of residual load

Calculation of residual load in Greece – 80% RES scenario



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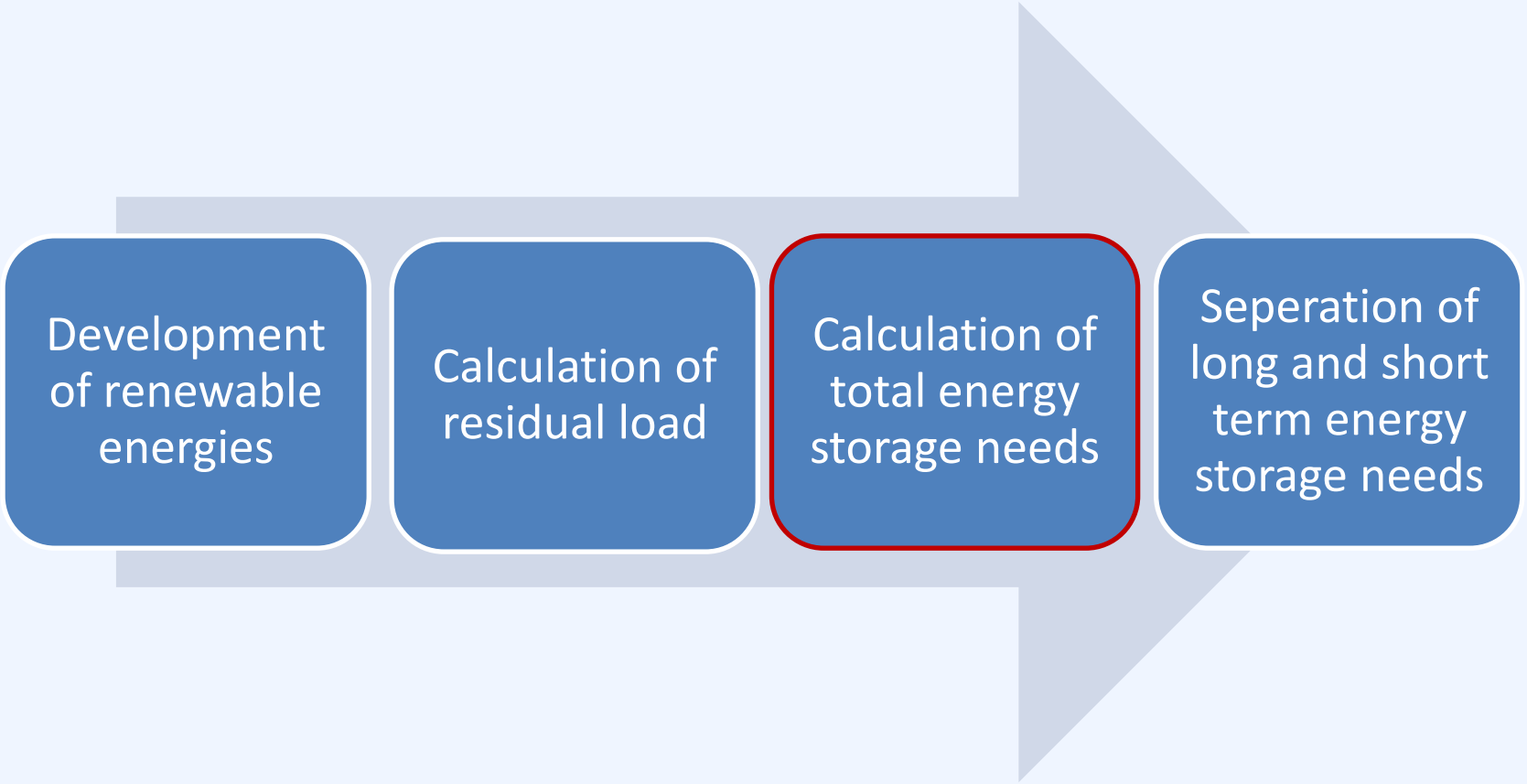
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Storage needs for 80% RES

Zero curtailment & Unlimited Transmission

Countries	Additional Needed Capacity [GW]		Additional Needed Stored Energy
	Charging	Discharging	[GWh]
Austria	0 - 2,98	0	0
Germany	31,85 - 55,16	25,17 - 29,04	950 - 1.534
Denmark	4,85	3,25	660,75
Ireland	6.8	4.3	2.700
Spain	34,2 - 46,8	30,4 - 36,8	640 - 6.340
Greece	10,6 - 15,1	8 - 8,3	340 - 1.550

Storage needs for 80% RES

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Countries	Additional Needed Capacity [GW]		Additional Needed Stored Energy
	Charging	Discharging	[GWh]
Austria	0 - 2,98	0	0
Germany	31,85 - 55,16	25,17 - 29,04	950 - 1.534
Denmark			
Ireland			
Spain			
Greece			

Scenario 80% RE	Additionally Needed Capacity (GW)		Additionally Needed Stored Energy (GWh)
	Charging	Discharging	
Equal	38.79	25.17	1,308
Wind	31.85	25.74	1,534
PV	55.16	29.04	950

Storage needs for 80% RES

Zero curtailment & Unlimited Transmission

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Countries	Additional Needed Capacity [GW]		Additional Needed Stored Energy
Austria	Scenario 80% RE	Additionally Needed Capacity (GW)	Additionally Needed Stored Energy (GWh)
Germany		Charging / Discharging	
Denmark	Equal	35.3 / 36.5	2240
Ireland	Wind	34.2 / 36.8	1290
	PV	36.8 / 30.4	640
	Nuclear scenarios		
	Equal-n	45.3 / 33.6	6340
	Wind-n	44.2 / 33.6	5000
	PV-n	46.8 / 34.9	4300
Spain	34,2 - 46,8	30,4 - 36,8	640 - 6.340
Greece	10,6 - 15,1	8 - 8,3	340 - 1.550

Regulatory & Market Framework in the Target Countries

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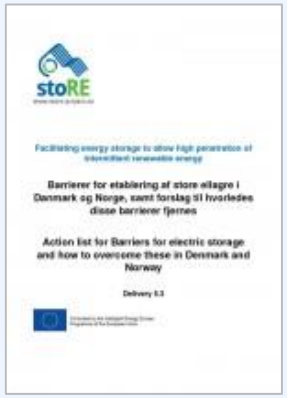
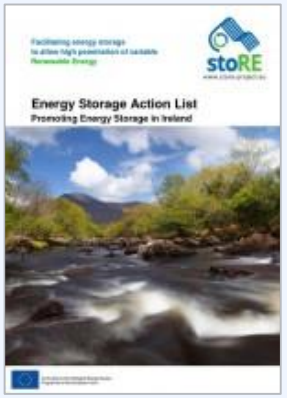
What is the effect of the regulatory and market framework conditions on the development of new and operation of existing energy storage facilities in the target countries?

Aim: Identify possible barriers

Wide consultation process + Questionnaire + Workshop

Recommendations for improvements in the form of Action Lists





Contact

- Visit www.store-project.eu for all project results!
- Join our discussions on the Energy Storage & Grid Technologies group
- Check our new project: www.industre.eu

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