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Duration: 05/2011 – 04/2014

Facilitating energy storage to allow high penetration of intermittent renewable energy

Co-funded by the Intelligent Energy Europe Programme of the European Union

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Project Summary & Objectives

stoRE aims to facilitate the high penetration of variable renewable energies in the European grid by unblocking the potential for energy storage infrastructure, through:

- Analysis of the energy storage status and potential
- Assessment of the environmental considerations for the development and operation of energy storage facilities
- Identification, assessment and reviewing together with key stakeholders of the regulatory and market framework conditions
  - at European level
  - in the 6 target countries
- Dissemination activities for improving the understanding of the benefits of energy storage for the energy systems of Europe.

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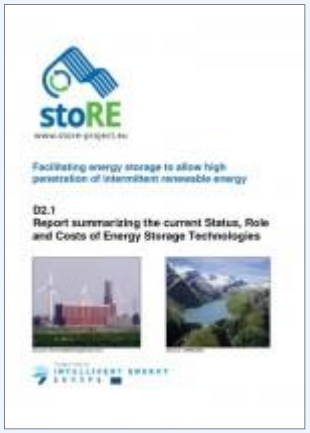
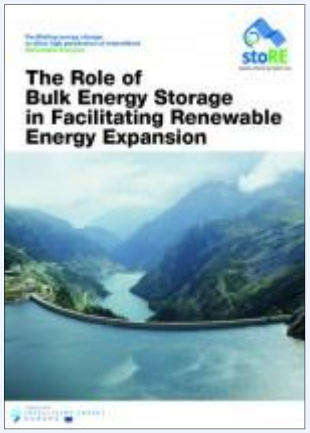
Results (1)

- 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
- Recommendations for furthering the Sustainable Development of Bulk Energy Storage Facilities – **consultation process closed**





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Results (2)

- Guidelines for the development of PHES in environmentally sensitive sites – **ongoing consultation process**
- European Regulatory & Market Framework for Electricity Storage Infrastructure – **consultation process closed**
- Energy Storage Needs in Austria, Denmark, Germany, Greece, Ireland and Spain
- Regulatory & Market Framework for Electricity Storage Infrastructure – **ongoing consultation process**

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What are the requirements for energy storage in Europe?

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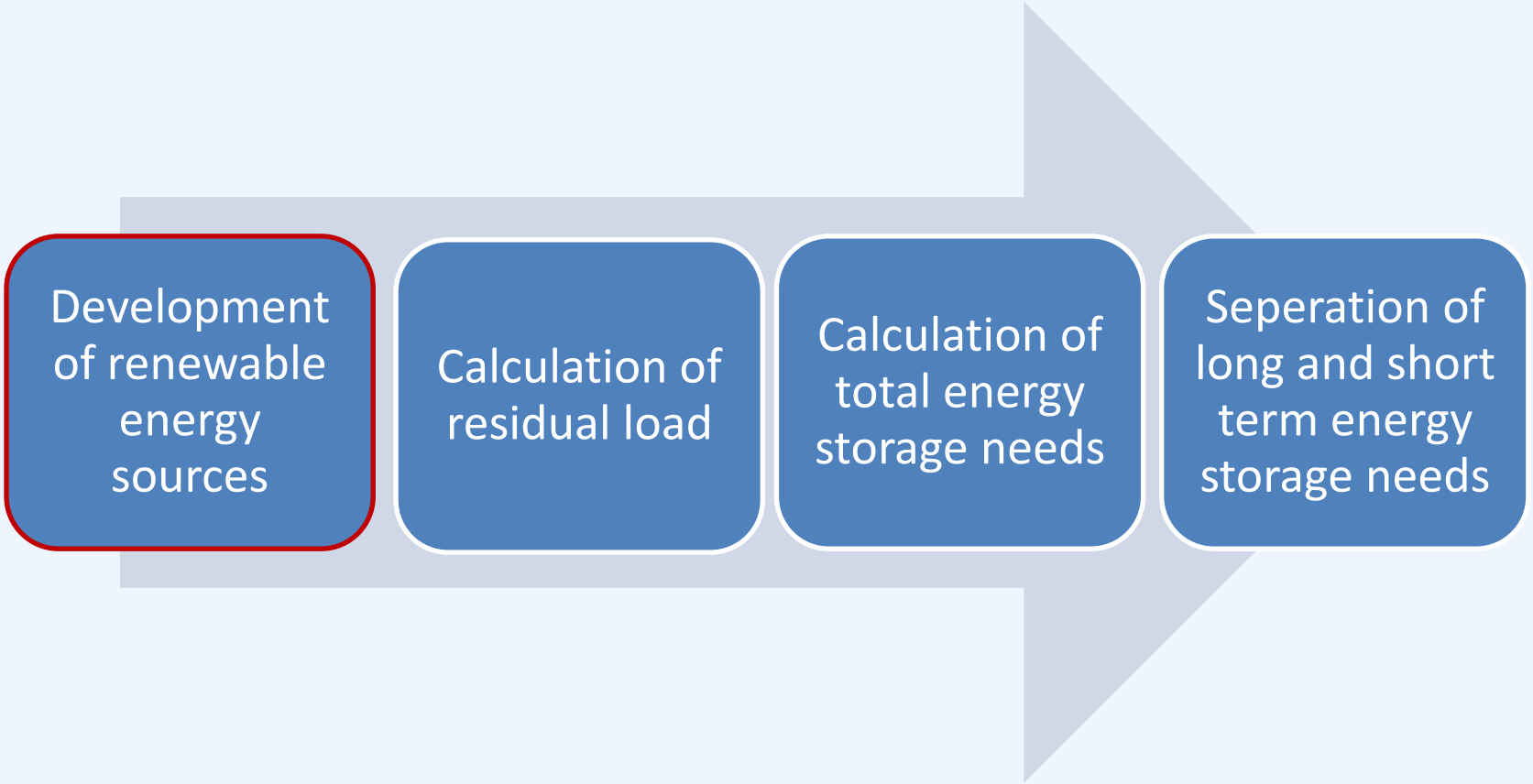
Process



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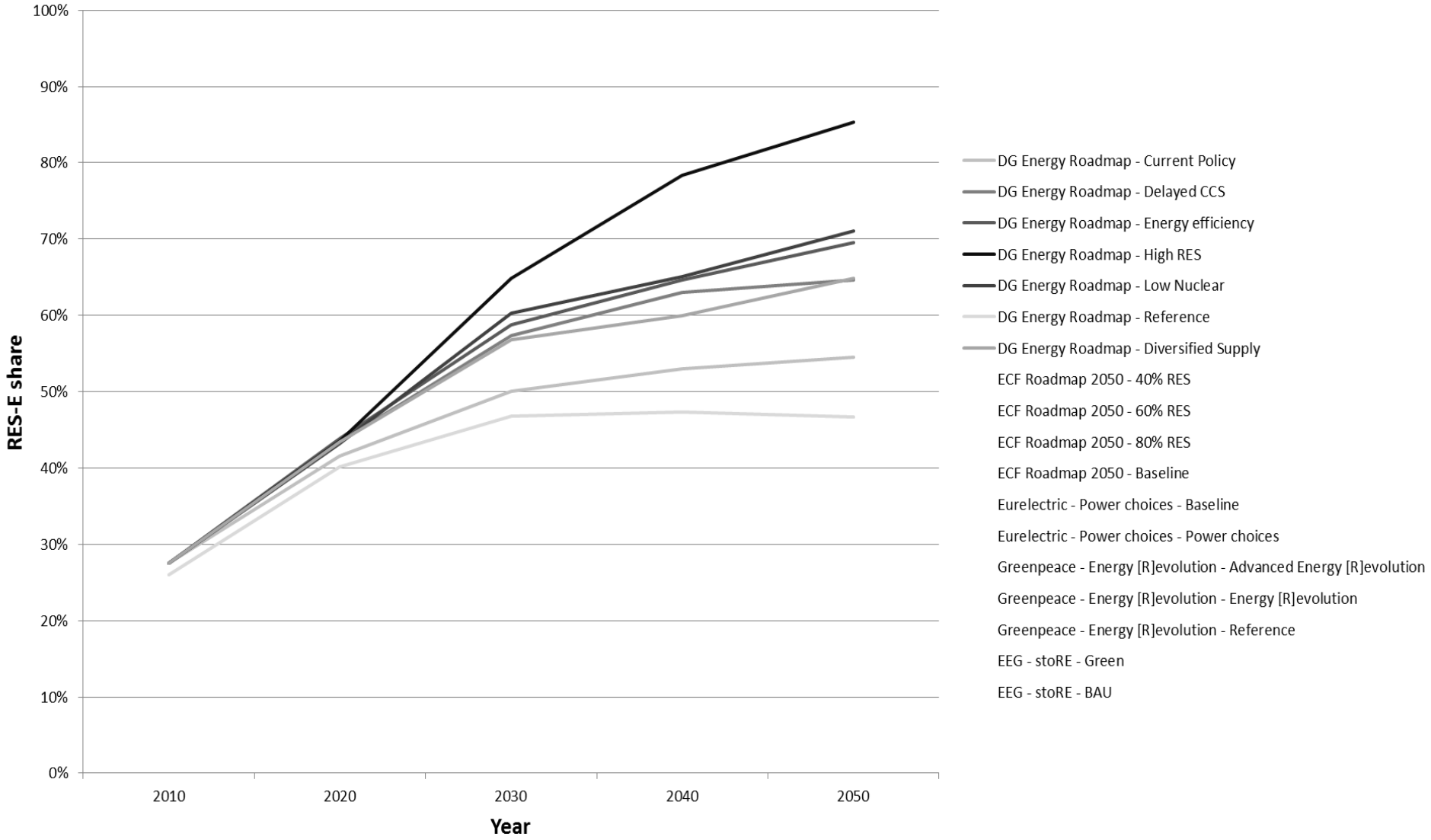
RES share development according to 18 different scenarios from 5 different studies



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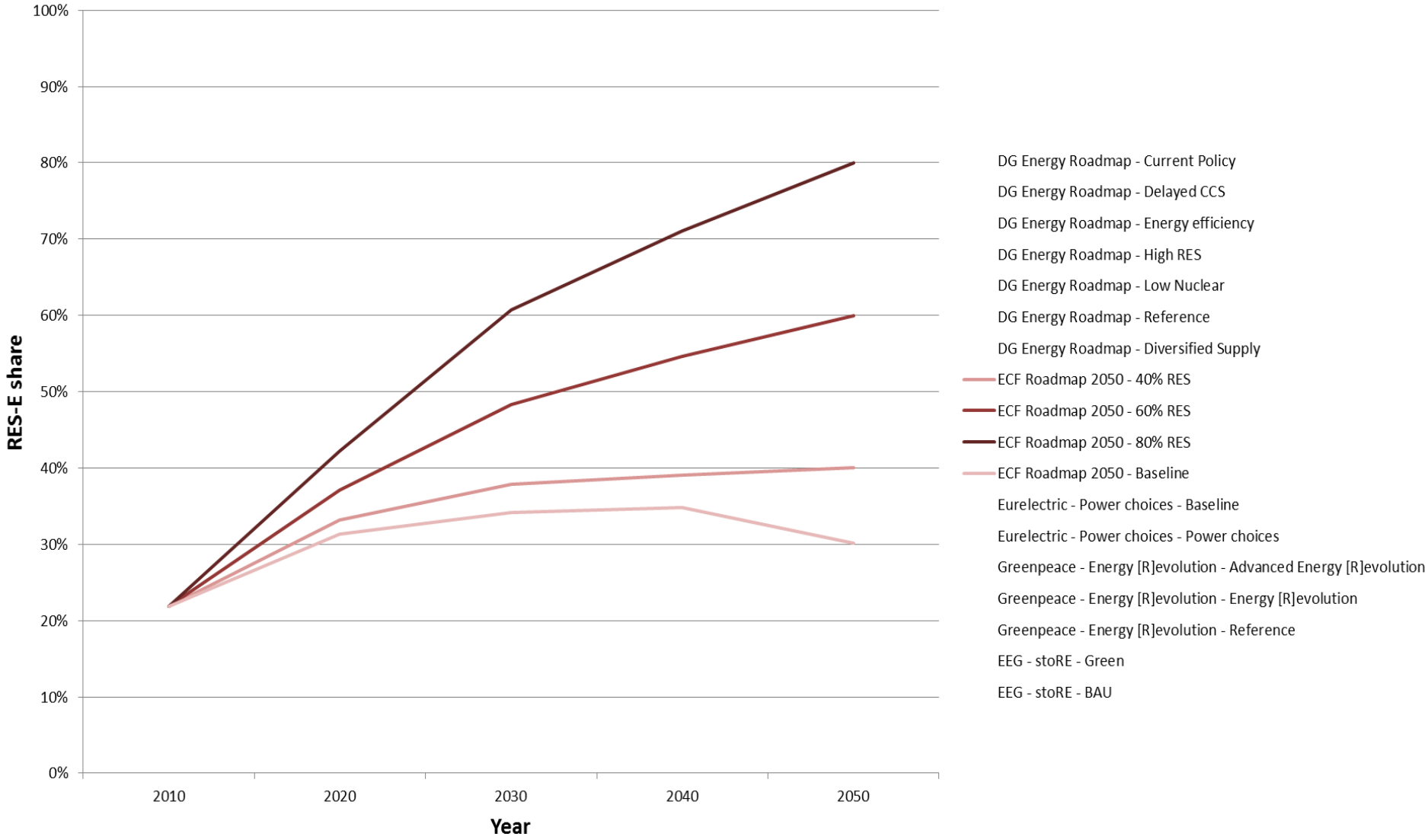

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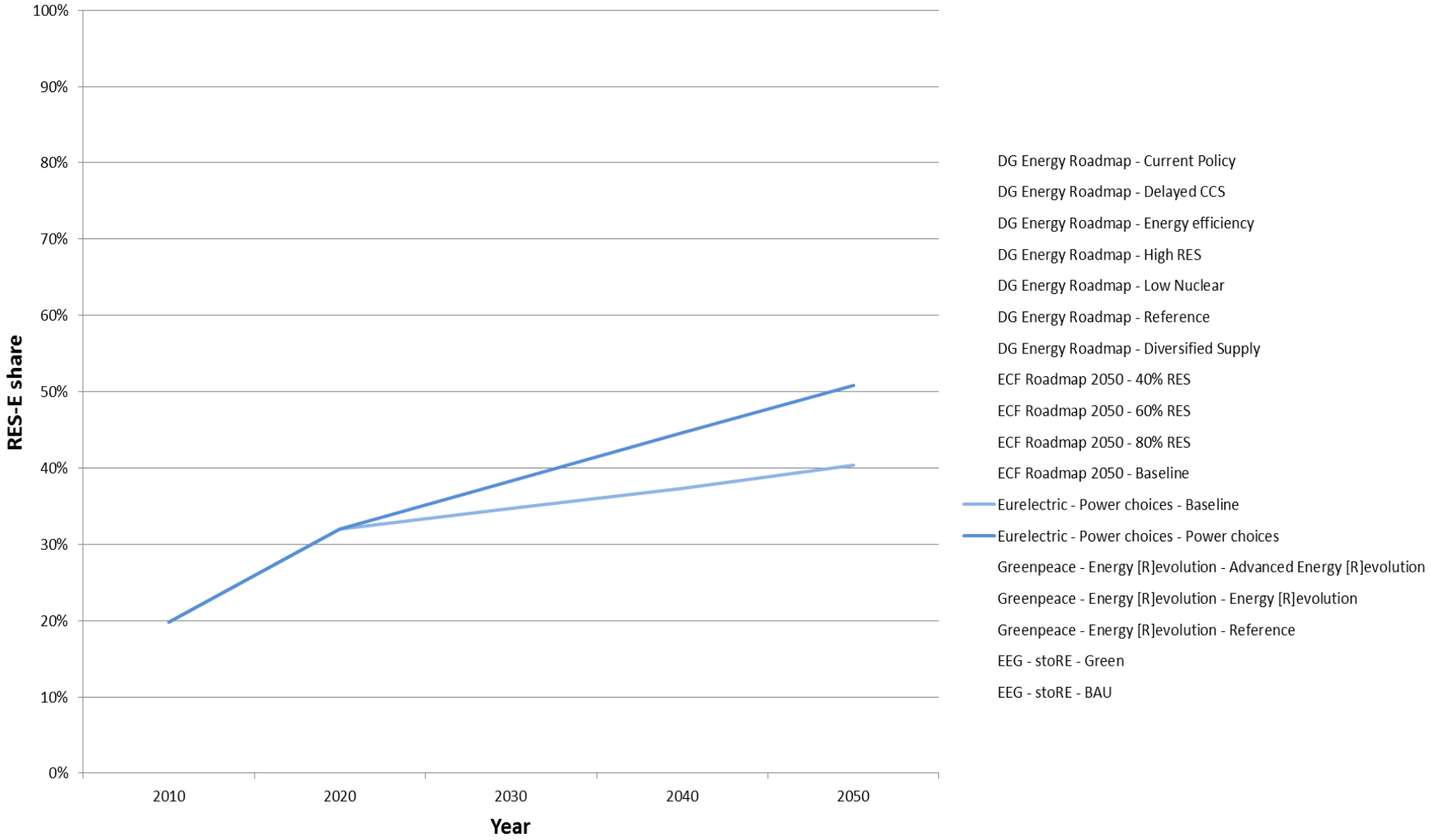

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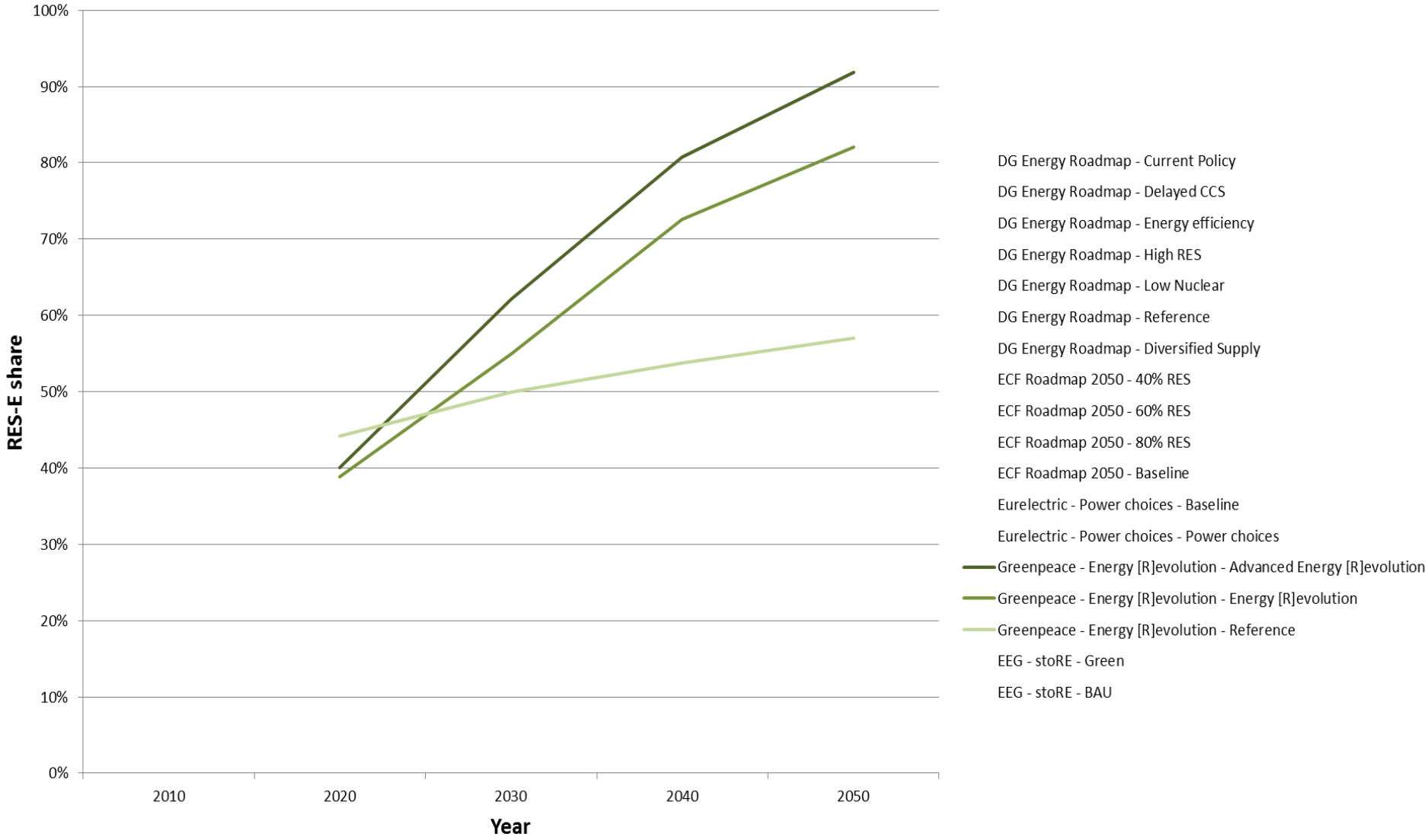

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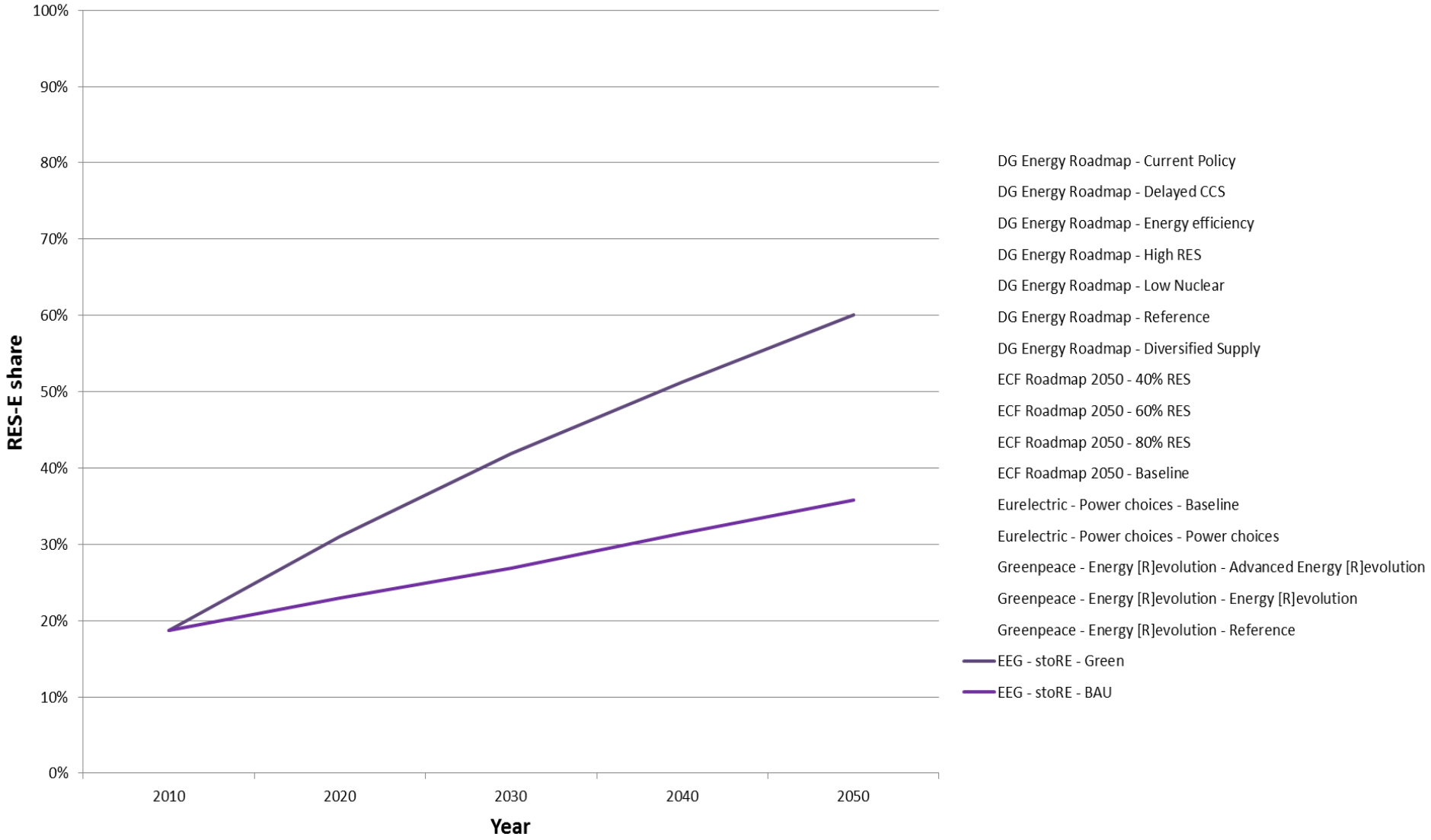

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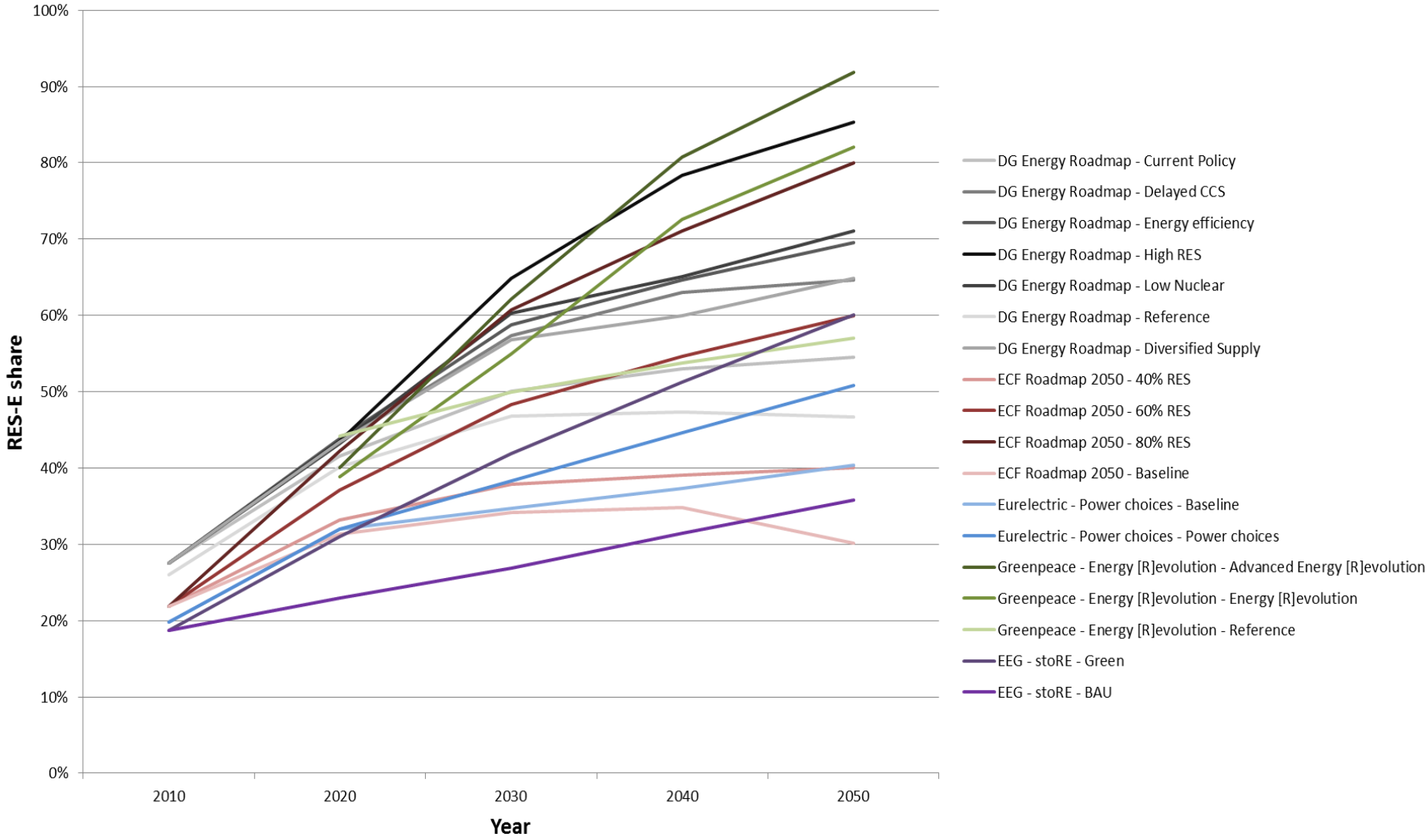

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stoRE Target Countries

Development scenarios in stoRE

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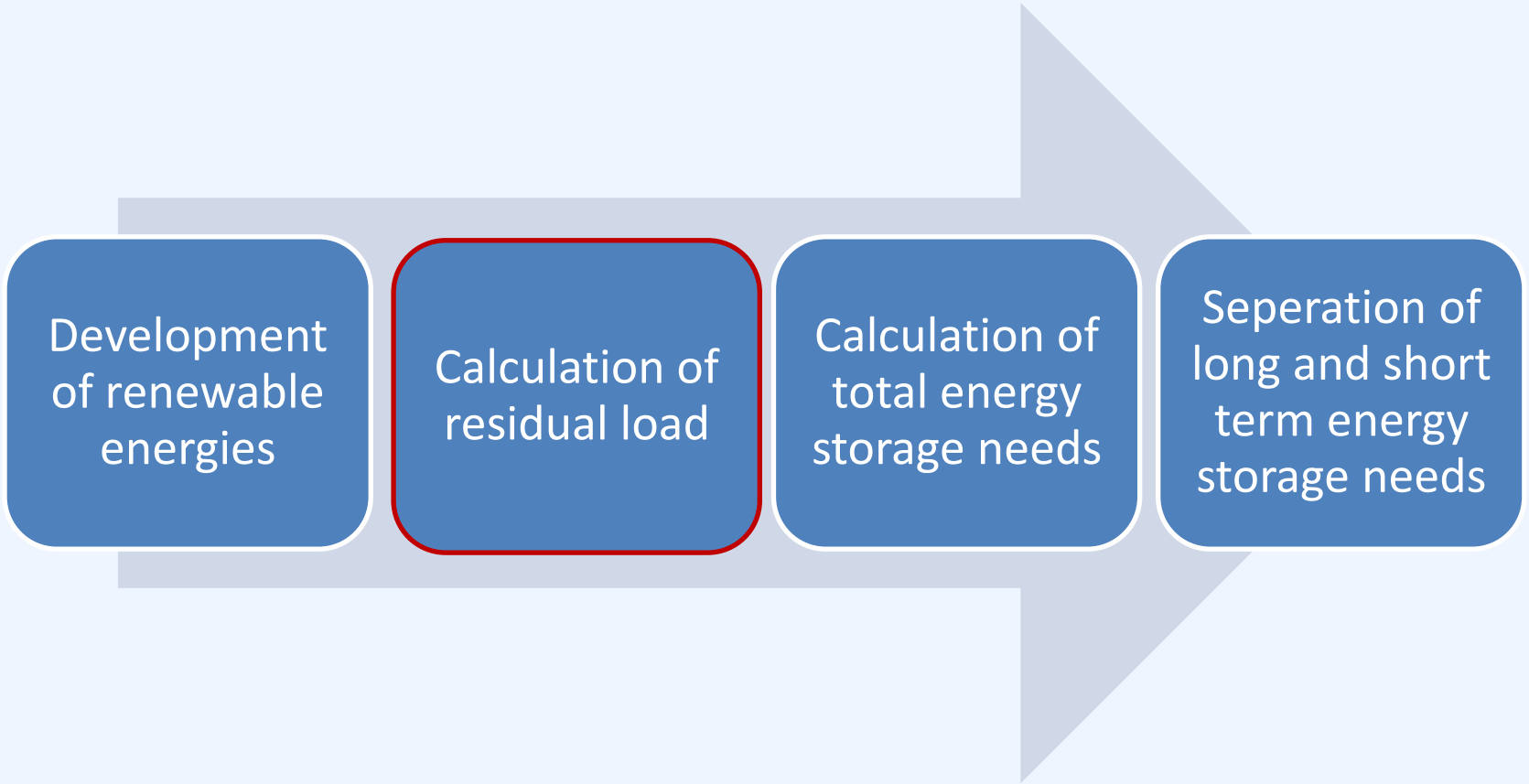
Target country	40% RE	80% RE	Import/Export	Heating sector
Austria	Already more than 40% RE ➔2020 scenarios A,B,C	2050 scenarios GREEN, BAU	Yes, combined system Germany - Austria	No
Denmark	Scenarios 2020 A,B,C Different wind development	One scenario	Yes, import/export via AC to Germany	Yes, for 80% RE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



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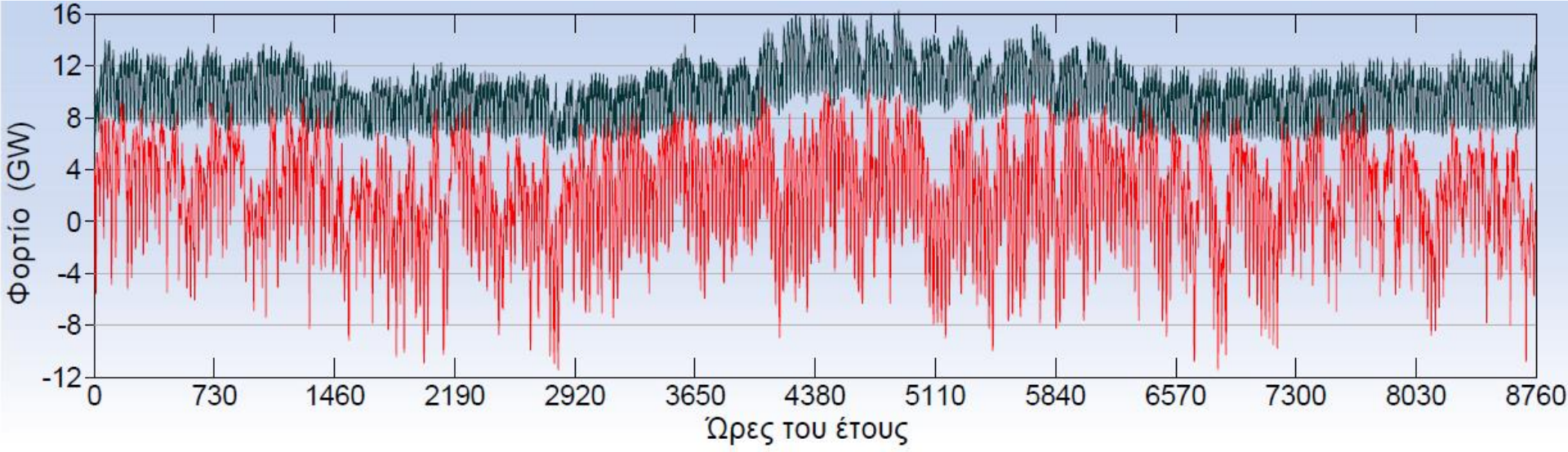
Calculation of residual load

Calculation of residual load in Greece – 80% RES scenario



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Calculation of residual load

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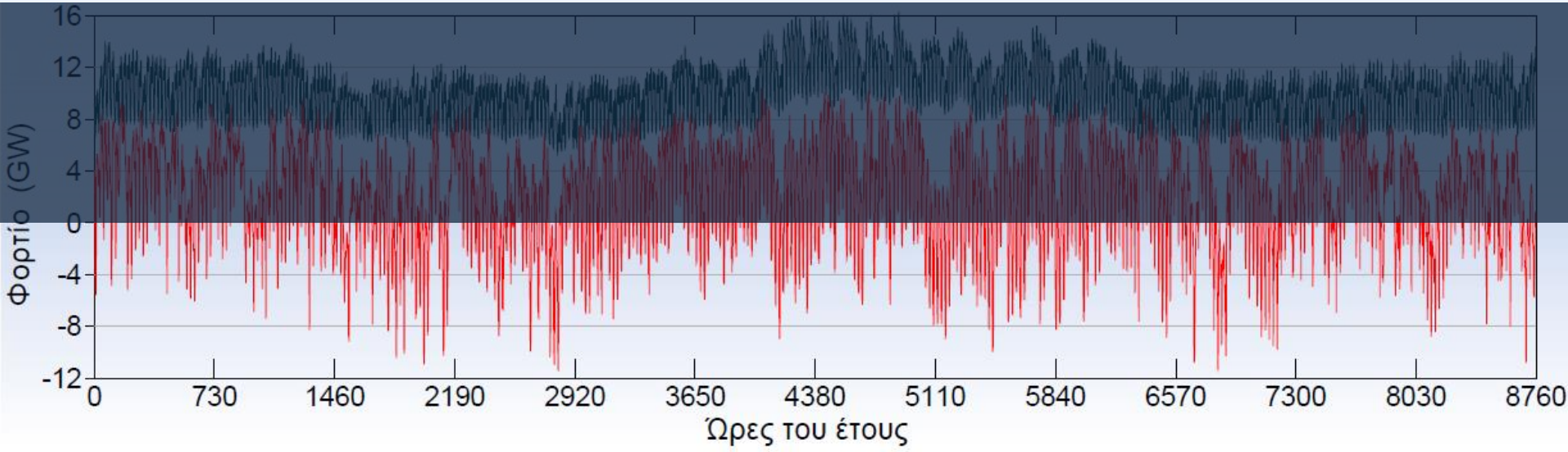

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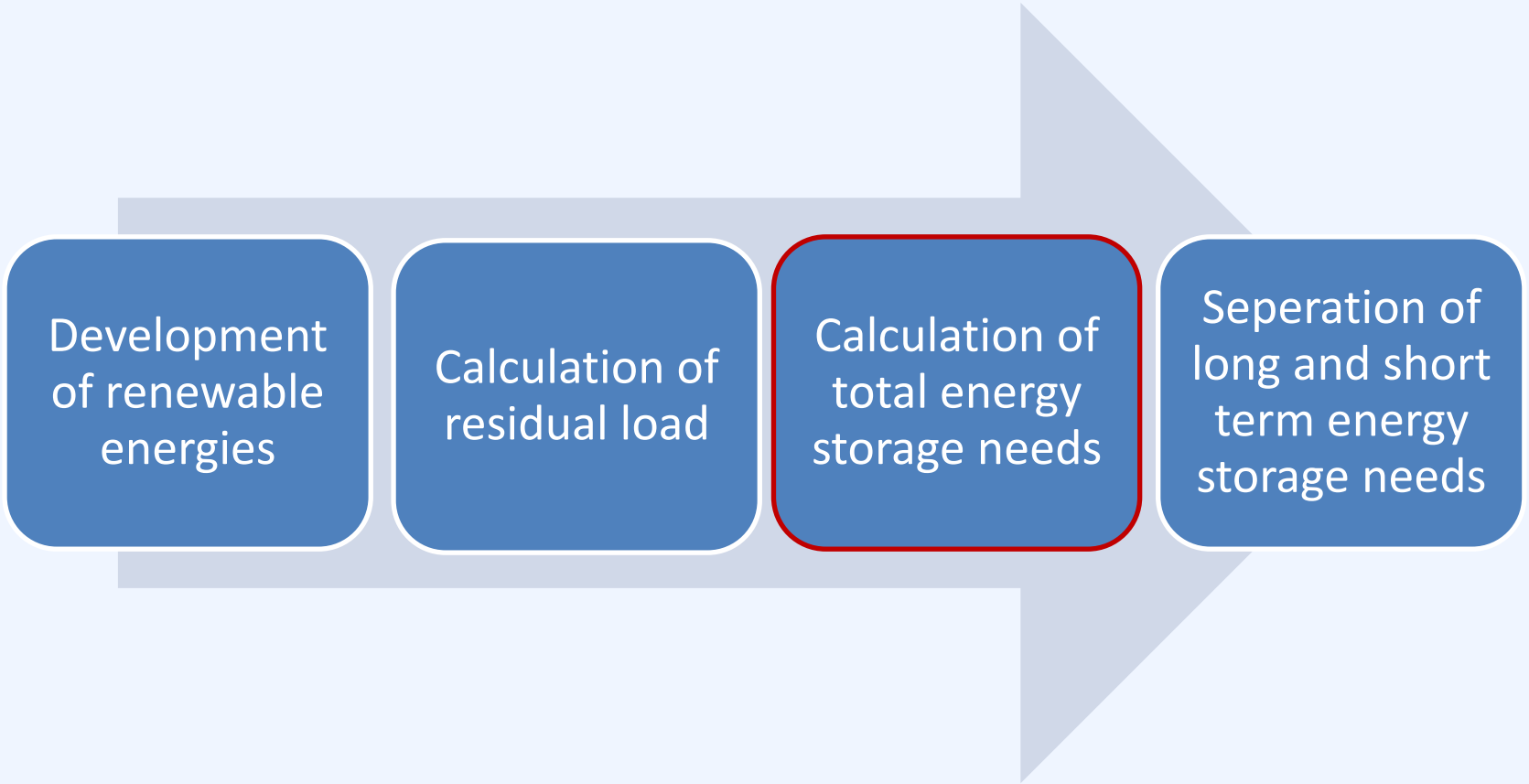
Process



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Storage needs for 80% RES
Zero curtailment & Unlimited Transmission

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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	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
Zero curtailment & Unlimited Transmission

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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

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

Aim: Identify possible barriers

Wide consultation process + Questionnaire + Workshop

Recommendations for improvements

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