



India
SMART GRID
Week 2015

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Bangaluru International Exhibition Centre
Bangaluru, India

www.isgw.in



International Conference and Exhibition on Smart Grids and Smart Cities

Batteries, key enabler for renewable energy

How can batteries support the EU electricity networks?

International Smart Grid Action Network - ISGAN
Bo Normark, Chairman Annex 6

An energy think tank informing the European Commission

INSIGHT_E

INSIGHT_E: Energy think-tank for the European Commission with KIC InnoEnergy

Innovation Highlight 23/05/2014

Together with 11 European partners, KIC InnoEnergy have launched the Insight_E project, with the aim to serve as an energy think-tank informing the European Commission. Gathering experts from the energy sector, the INSIGHT_E consortium will provide decision makers on a European level with unbiased policy advice and insights on policy options, including an assessment of their potential impact.

Moreover, it will bring to the attention of policy makers new trends in technology as well as the objectives and activities of important stakeholders that shape energy policy-making in Europe.

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PR1: How can batteries support the EU electricity network?

EC Policy officer: Rémy Denos (ENER, C2)
Lead author: Bo Normark (KIC InnoEnergy)
Authoring team: Aurélie Faure (Ifri)
Reviewers: Paul Deane (UCC), Steve Pye (UCL)



Hot Energy Topic (HET)

Time: 4 weeks
Pages: 1 - 5
Issues: 18 - 21
in 3 years

Rapid Response Energy Brief (RREB)

Time: 6 weeks
Pages: 4 - 10
Issues: 12
in 3 years

Policy Report (PR)

Time: 6 months
Pages: 60 - 100
Issues: 12
in 3 years

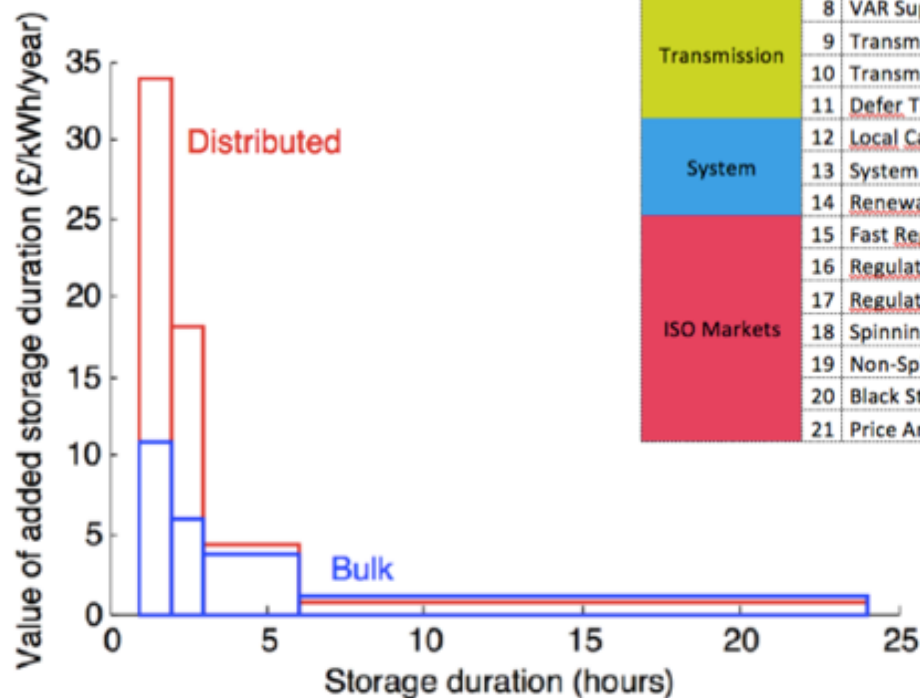
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The role of storage

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Value of storage examples, EPRI, GB



Value Chain		Benefit	Value USD/kWh		Value USD/kW	
			Target	High	Target	High
End User	1	Power Quality	19	96	571	2 854
	2	Power Reliability	47	234	537	2 686
	3	Retail TOU Energy Charges	377	1 887	543	2 714
	4	Retail Demand Charges	142	708	459	2 297
Distribution	5	Voltage Support	9	45	24	119
	6	Defer Distribution Investment	157	783	298	1 491
	7	Distribution Losses	3	15	5	23
Transmission	8	VAR Support	4	22	17	83
	9	Transmission Congestion	38	191	368	1 838
	10	Transmission Access Charges	134	670	229	1 145
	11	Defer Transmission Investment	414	2 068	1 074	5 372
System	12	Local Capacity	350	1 750	670	3 350
	13	System Capacity	44	220	121	605
	14	Renewable Energy Integration	104	520	311	1 555
ISO Markets	15	Fast Regulation (1 hr)	1 152	1 705	1 152	1 705
	16	Regulation (1 hr)	514	761	514	761
	17	Regulation (15 min)	4 084	6 845	1 021	1 711
	18	Spinning Reserves	80	400	110	550
	19	Non-Spinning Reserves	6	30	16	80
	20	Black Start	28	140	54	270
	21	Price Arbitrage	67	335	100	500

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Storage's specific role is to

- **Improve liquidity in the balancing markets**, while reducing volatility of balancing, therefore improving system adequacy.
- Provide **short term ancillary services** (from seconds, to minutes or hours) in reserve regulation while acting in **ancillary services system stability and congestions reduction at DSO levels**.
- **Reduce or shift load at end-consumer level**.

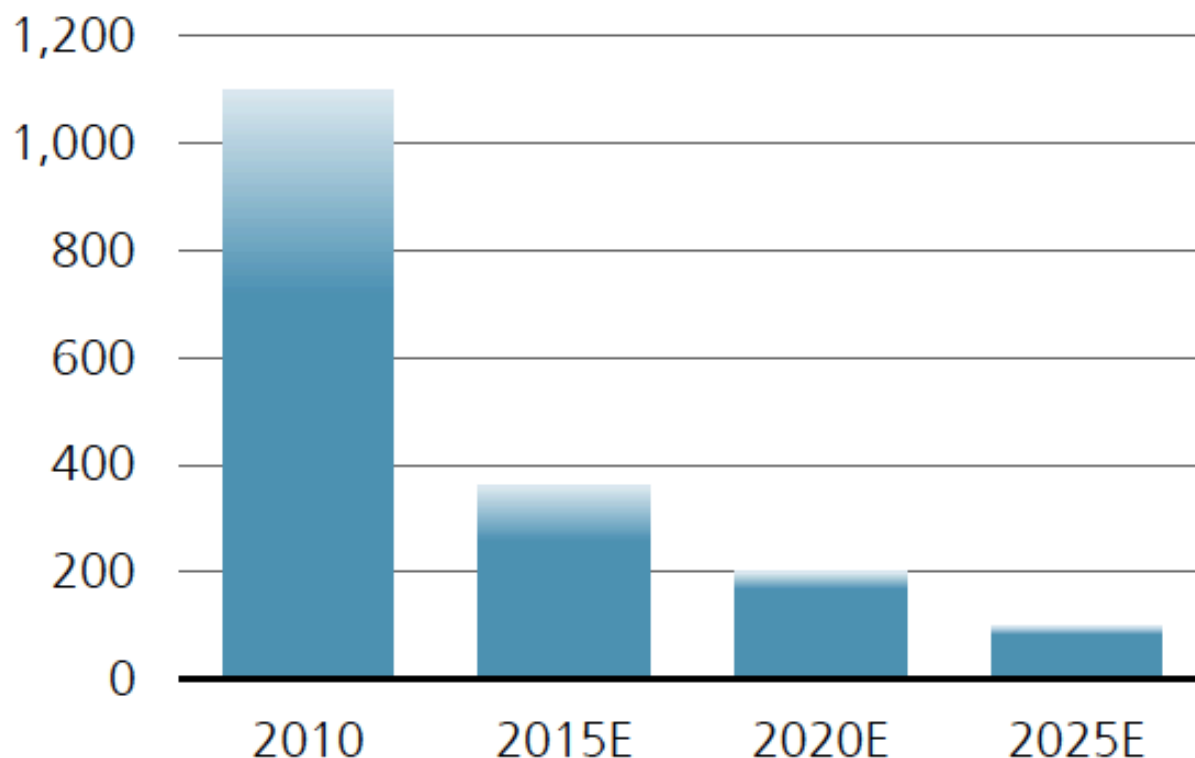
The role of battery storage for energy applications to 2020

- **Lithium Ion batteries will be the main area of development to 2020.**
- Existing academic research shows that **high efficiency rate and high energy and power density** of Lithium-ion batteries ...
- ... make them particularly suitable for **energy applications**: Transport and Distribution (T&D) deferral, Black-start services, intermittent balancing, power fleet optimisation and power quality.

How low will battery costs go ?

Cost year 2000 about 2000 € / kWh

Figure 2: Lithium battery cost to decline >50% by 2020



Source: Tesla, Umicore, UBSe. Cost estimates are for the battery pack (€/kWh).

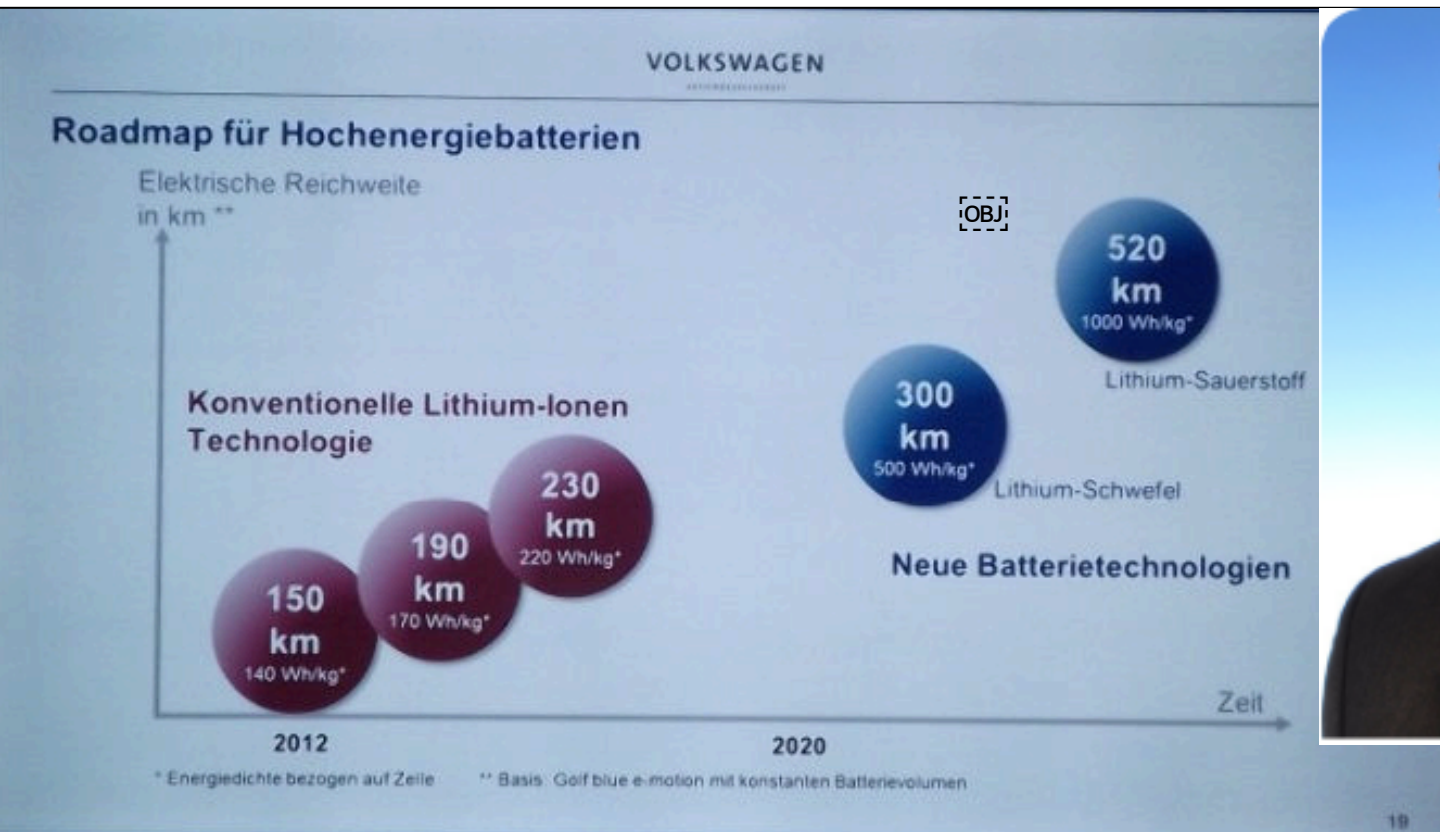
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Disruptive technologies beyond 2020

From 140 Wh/kg to 1000 Wh/kg

Dr. Stefan Schmerbeck,
Head Future Technologies
Volkswagen AG



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Report Aug 2014

Global Utilities, Autos & Chemicals

Will solar, batteries and electric cars re-shape the electricity system?

Can solar ever be economically viable without subsidies due to its intermittent character? Our answer: **YES.**

Will EVs and plug-in hybrids ever be cost-competitive in the mass market? Our answer: **YES**, especially in the case of pure battery EVs.

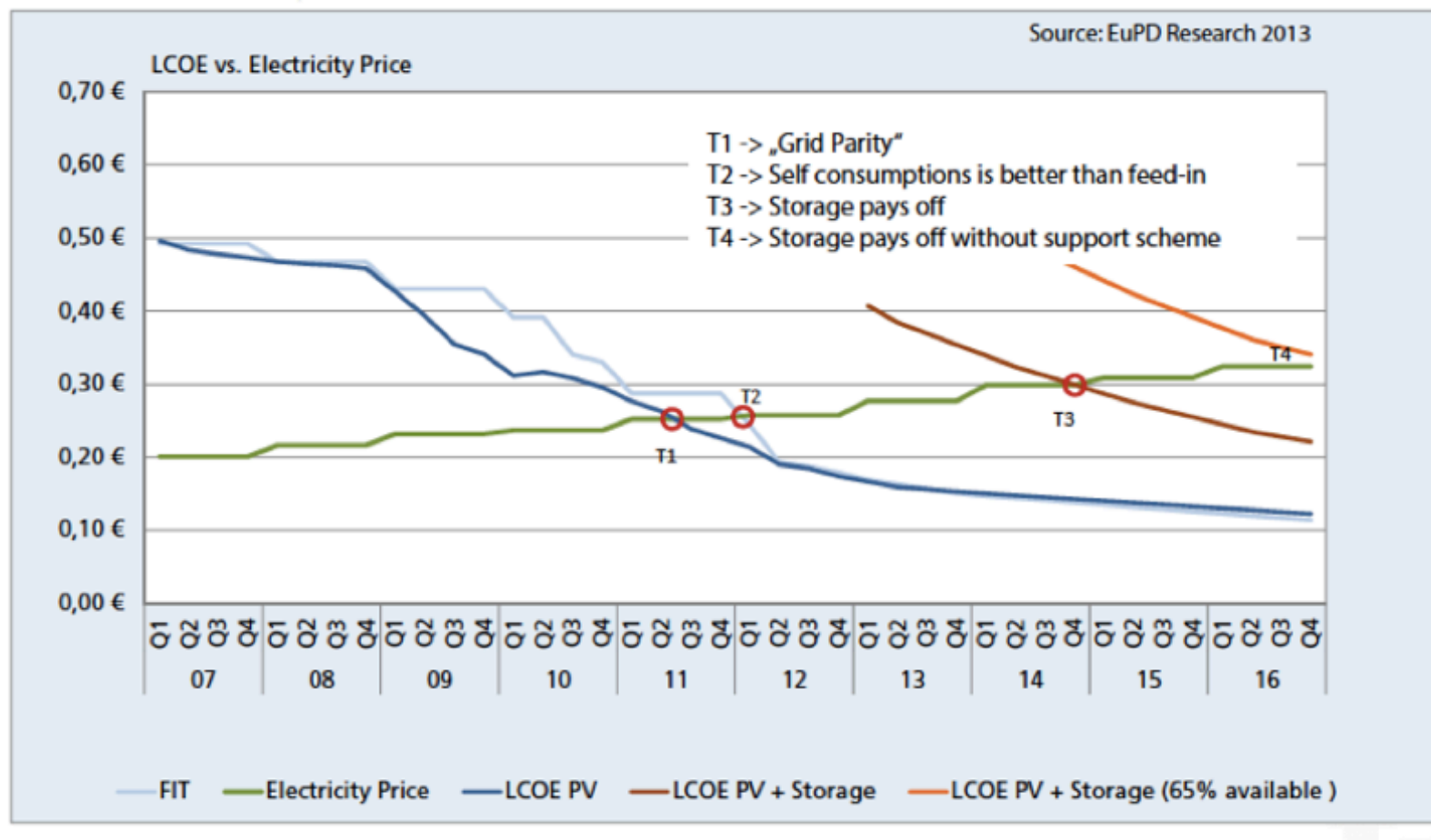
Volume drivers are key factors to 2020

- According to the 'Wright's Law', a prediction model mostly applicable to mass production of well standardized products, it is often proven that every doubling of volume will reduce the cost by about 20%.
- These trends are expected to strongly benefit **home storage market** and **Lithium Ion technologies**, driven by **large volumes expansion** in consumer electronics.
- Based on costs of Electric Vehicles batteries, costs for a home storage system should be around 800 €/kWh in 2016. Looking ahead, if higher volumes are assumed, the costs for home storage battery packs should approach the cost level of EV batteries.
- This would result in systems costs of 400 €/kWh for complete systems by 2020, and even lower by 2025.

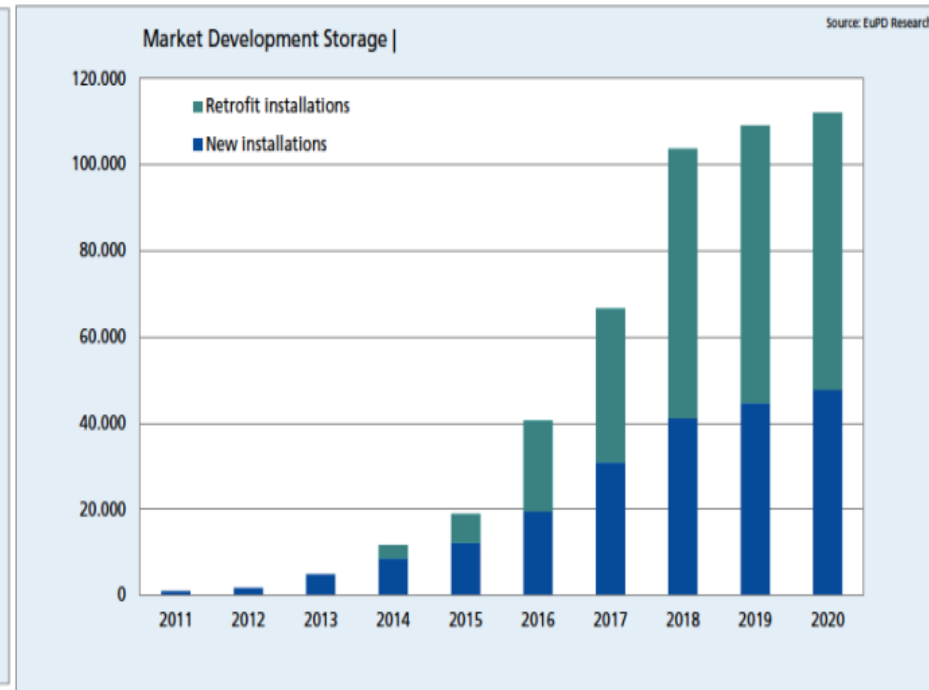
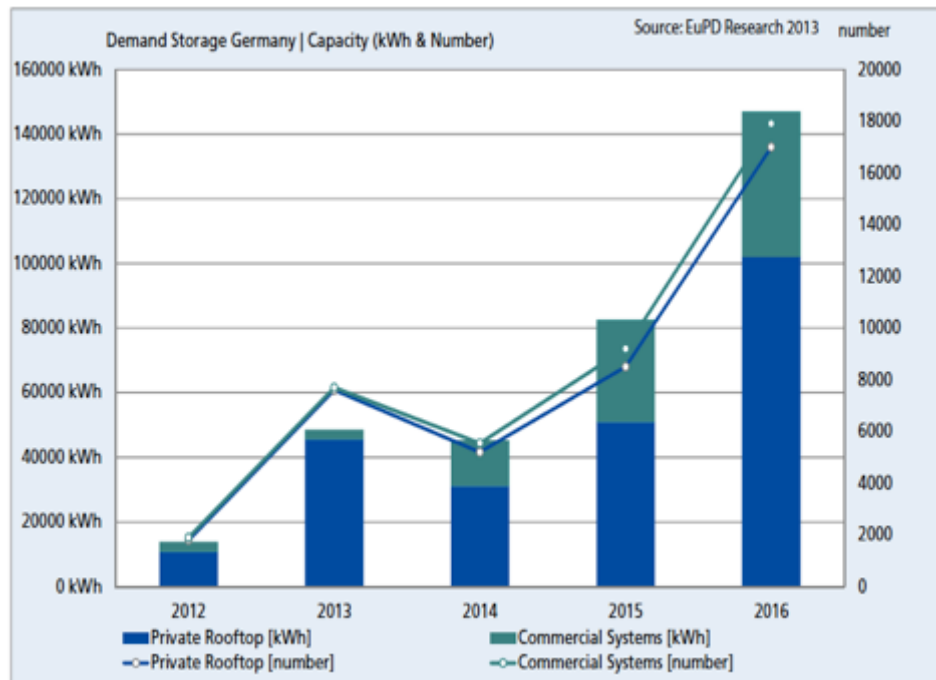
Storage in EU Legislation

- **Directive 2009/28/EC** states: *"Member States shall take the appropriate steps to develop transmission and distribution grid infrastructure, intelligent networks, **storage facilities** and the electricity system, in order to allow the secure operation of the electricity system."*
- However, the clarification of the role of storage in system adequacy and system security (**Directive 96/92/EC** and **Directive 2009/72**) is a necessary in order for storage to become an effective support tool to renewable integration in the Internal Market.
- Storage role to be clarified in **Network Codes**.
- **Recycling obligations:** Commission Regulation 493/2012 requires that producers or pack importers should bear the net costs associated to recycling, but the existence of the Extended Producers Responsibility obligation refrains manufacturers from committing to large volumes, based on the fact that it would lead to uncontrollable recycling costs.

Battery enabled self-consumption is already a factor in Germany



Battery enabled self-consumption is already a factor in Germany



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Australia

UBS: Solar + storage is cost effective already in Australia

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By Giles Parkinson on 10 November 2014

A new study from investment bank UBS says solar plus storage already make economic sense for Australian households, a finding that could dramatically reshape the nature of the energy industry in the country.



The new report suggests that one million households could invest \$20 billion in storage systems in current years – nearly equal to the investment required for a new LNG export plant.

Source: UBS report Aug 2014

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Recommendations to the European Commission

RECOMMENDATIONS		
Target	Time frame: by 2020	Time frame: by 2030
The European Commission	Reduction of market barriers	
	<ul style="list-style-type: none"> Use battery storage as a reserve provider in order to improve liquidity in the balancing markets, and provide of short term ancillary services. Elaborate guidelines for capacity market development that support the remuneration of battery storage technologies 	
	Reorientation of legislative and regulatory framework	
	<ul style="list-style-type: none"> Clarify the regulatory framework defining the responsibilities of storage operators. Improve understanding of barriers to battery recycling in the different Member States linked to recycling (collection system). Create an Independent Storage Operator. 	<ul style="list-style-type: none"> Clarify if grid batteries should be part of the Eco-Design as part of an element of the power system. Ensure that the implementation of the WEEE and ELV Directives is made through high collection rates, while minimising the costs to manufacturers
	Education of consumers, communities and stakeholders	
	<ul style="list-style-type: none"> Adopt a regulation to stimulate self-consumption and reduction in power consumption, especially for peak-load considerations. Create a specific support scheme for batteries. Build a framework for Prosumer Storage. 	
	Acceleration of technology breakthroughs	
	<ul style="list-style-type: none"> Carry out an investigation of demand response, interconnectors and technologies which might compete with storage on some uses (thermal uses mainly). Compare national interconnection targets and compare them with alternative solutions, in particular storage. Create a plan for electrification of transportation. 	<ul style="list-style-type: none"> Conduct a study in order to identify frameworks and conditions for establishing a pan-European battery industry. Ensure that the feedback from demonstration projects is effectively incorporated into EU wide Storage Technology Roadmap and feed into ENTSO-e's grid code requirements.

Recommendations to other bodies

RECOMMENDATIONS		
Target	Time frame: by 2020	Time frame: by 2030
ENTSO-E/ ACER	<ul style="list-style-type: none">▪ Update the grid code requirements in conjunction with EASE and based on the techno-economic feasibility of batteries.	
National Regulatory Authorities	<ul style="list-style-type: none">▪ Set up DSO regulation to incentivise storage (based on the clarification of Electricity Directive)	

Summary

- **Increased penetration of variable energy production, growing trade of electricity and new demand pattern** will increase the role of battery storage
- **Battery storage could become a game changer in the electricity system and could for example:**
 - Bring **flexibility** to the energy system,
 - Be an **enabling technology** for the achievements of the EU 2020 and 2030 RES targets
 - Become a **service provider** and improve the **liquidity in the balancing market**
 - Stimulate increased **self-consumption** in households and thereby increase penetration of RES

ABOUT INSIGHT_E

INSIGHT_E is a multidisciplinary energy think tank which provides the European Commission and other energy stakeholders with advice on policy options and assesses their potential impact.

The INSIGHT_E consortium is formed by twelve complementary partners representing various sectors: academia, research centres, consultancies, one think tank, one stakeholder organization and one of the Knowledge and Innovation Community of the European Institute of Technology. Our partners are based in ten European countries. This sectorial and geographical diversity is also reflected in the thematic scope of INSIGHT_E, ranging from energy infrastructure, new energy technologies to economic analysis, geopolitics and trade, environmental and climate impact, and social and behavioural change.

To receive regular updates about INSIGHT_E programme of work and to learn more about participation opportunities, please visit the following links:

Website: www.insightenergy.org

Contact us: info@insightenergy.org

THANK YOU!

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ISGAN Website: <http://iea-isgan.org>

SG Case Books, Insight Papers & Discussion Papers are available!

CEM Website: <http://cleaneenergyministerial.org>

IEA page on Implementing Agreements: <http://www.iea.org/techno/index.asp>