STORY

Energy Storage Regulation

Ariana Ramos Leonardo Meeus



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Demonstration of multi energy grid in an industrial area

Olen, Belgium Duration of demonstration October 2015 - April 2020

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Navarra, Spain Duration of demonstration: April 2016 - May 2020

READ MORE >



Demonstration of medium scale battery Suha, Slovenia Kranj, Slovenia Start: 2018

READ MORE >

Demonstration at residential neighbourhood

scale

Oud-Heverlee, Belgium Duration of

demonstration: May 2017 - October 2019

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Demonstration of storage in residential district

Lecale, Northern Ireland Start 2017

READ MORE >



Demonstration at residential building scale Oud-Heverlee, Belgium Duration of demonstration July 2015 - November 2016

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Vlerick in STORY WP8 Business Preconditions

- Business models
- Regulation for storage



20.00.2010





Energy Storage Our take on business models and regulation

Story Highlight May 2019

> Authors: Saskia Broecko Ariana Ramos Luisa Fernandez Leonardo Meeus

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3



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Who has developed plans for energy storage?

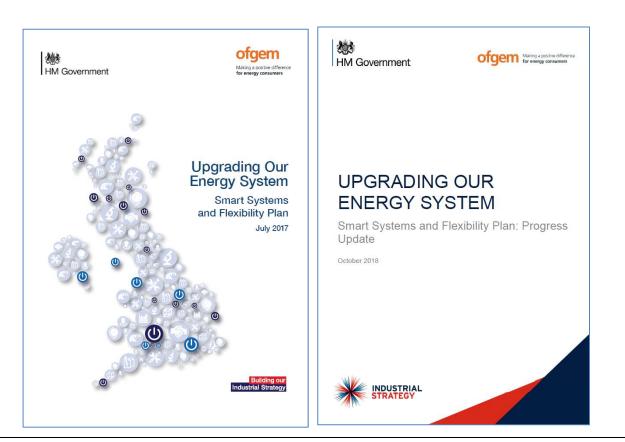






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UK Flexibility plan and progress report



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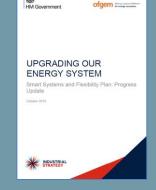
Issues related to energy storage



- Regulatory clarity
- Network charges
- Ownership
- Co-location with renewables
- Balancing service design

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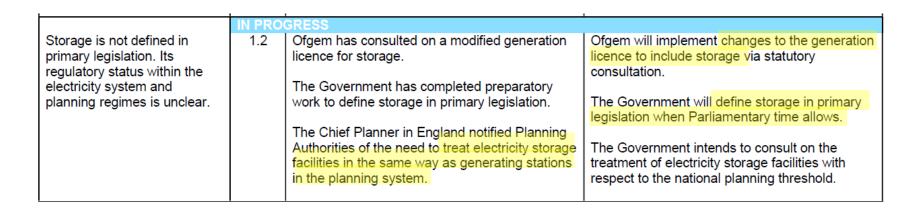


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Storage is not defined in primary legislation. Its regulatory status within the electricity system and planning regimes is unclear

AGREE/ DISAGREE?

UK Flexibility plan and progress report



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EU clean energy package

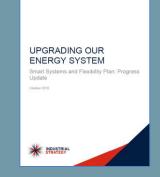


'energy storage' means, in the electricity system, deferring *the final use of* electricity to *a later* moment *than when it was generated or the conversion of electrical energy into a form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical* energy or *use as* another energy carrier.

	Council of the European Union	Brussels, 11 January 2019 (OR. en)				
	tutional File:	5076/19				
	380(COD)					
NOTE		ENER 3 ENV 5 CLIMA 2 COMPET 9 CONSOM 3 FISC 12 CODEC 17				
From:	General Secretaria	at of the Council				
To:	Permanent Repres	Permanent Representatives Committee				
No. Cion doc.:	15150/1/16 REV 1 + ADD 1 REV 1	15150/1/16 REV 1 + ADD 1 REV 1				
Subject:	Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast) - Analysis of the final compromise text with a view to agreement					

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ofgem

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HM Government

Network charges can, in some scenarios, put storage at a relative disadvantage to other network users, preventing a levelplaying field

AGREE/ DISAGREE?

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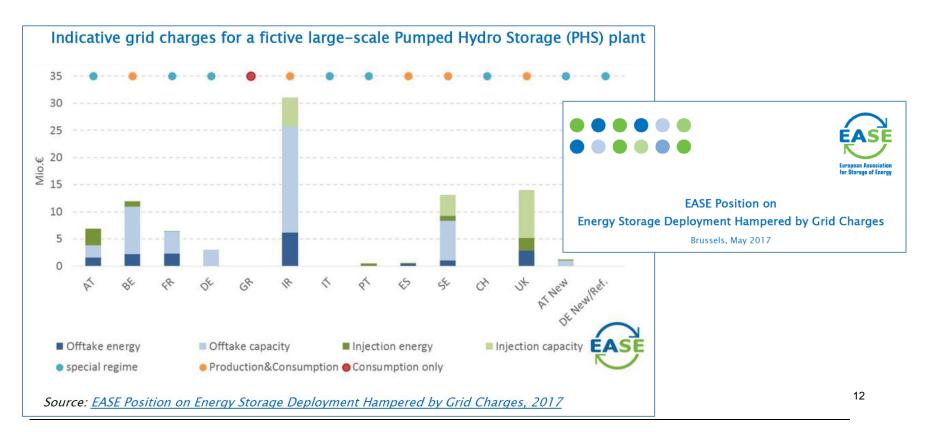
Issue	Action	What we have done	What we will do next
Issue Network charges can, in some scenarios, put storage at a relative disadvantage to other network users, preventing a level playing field.	Action IN PRO 1.1	ł	What we will do next Industry will finalise charging code modifications to address the storage issues identified in the Plan, and it is expected that these will be submitted promptly to Ofgem for approval.
ievei playing neid.		Industry has raised modifications for reform of transmission, distribution and balancing charges which aim to reduce disproportionate network charges for storage.	
		The Energy Networks Association (ENA) published a statement that Distribution Network Operators (DNOs) consider that electricity storage falls within the definition of non- intermittent generation.	

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Transmission network charges

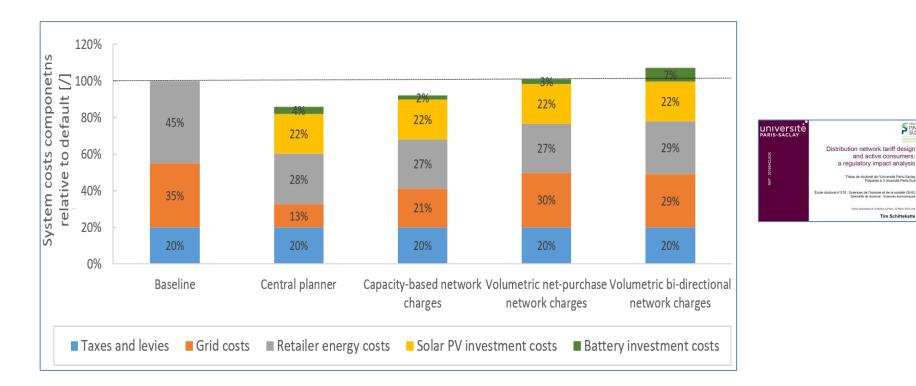






Distribution network charges





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S PARIS

and active consumers:

hèse de doctorat de l'Université Paris-Saclay Préparée à l'Université Paris-Suo

ma at de la société (SHS

ham, 22 Mars 2019, pd

Tim Schittekatte

Belgium: Exemption of network tariff for Storage installations in transmission network

- Exemption lasts 10 years for installations after July 1st 2018.
- 80% exemption during 5 years to installations extended by more than 7.5% of their capacity.



STORY

Besluit tot vaststelling van de tariefmethodologie

§ 9. De installaties voor de opslag van energie aangesloten op het transmissienet of op netten met een transmissiefunctie en waarvan de indienststelling gebeurt na 1 juli 2018 genieten gedurende een periode van tien jaar na hun initiële indienststelling van een vrijstelling op de transmissienettarieven, met uitzondering van de tarieven voor de aansluiting.

De installaties voor de opslag van energie aangesloten op het transmissienet of op netten met een transmissiefunctie waarvan zowel het geïnstalleerd vermogen als de opgeslagen energie na uitbreidingswerken verhoogd werden met meer dan 7,5% in vergelijking met hun niveau op 1 juli 2018 genieten van een vrijstelling van 80% op de transmissienettarieven, aansluitingstarieven uitgezonderd, en dit gedurende een periode van vijf jaren na het opnieuw in dienst stellen na de uitgevoerde werken. Deze opslaginstallaties kunnen vanaf het einde van de eerste fase van de uitbreidingswerken (geïnstalleerde capaciteit of opgeslagen energie) van deze vrijstelling genieten, echter, de vrijstelling moet binnen de twee maanden aan de transmissienetbeheerder terugbetaald worden indien de tweede fase van de uitbreidingswerken (opgeslagen energie of geïnstalleerde capaciteit) niet zijn beëindigd binnen de drie jaar na het einde van de eerste fase van de uitbreidingswerken.



UK Flexibility plan and progress report



Issue	Action	What we have done	What we will do next
Electricity presured by storage	IN PRO	GRESS	The Covernment and Officer are working with
Electricity procured by storage facilities from suppliers anomalously includes the cost of final consumption levies.	1.3	Ofgem has consulted on a modifying the generation licence to include storage and will finalise these changes shortly. Holding the licence will enable electricity storage facilities to avoid overpayment of final consumption levies (FCLs). Electricity supplied to generation licence holders is excluded from the supply volumes used to calculate the costs of the Renewables Obligation (RO) and Feed in Tariff (FIT) schemes (which currently make up over two thirds of FCLs), and this will also apply to the Contracts for Difference (CFD) scheme and Capacity Market auctions. The Government has clarified that the electricity received and stored by electricity storage	The Government and Ofgem are working with Elexon, the Low Carbon Contracts Company and the Electricity Settlements Company to ensure that the supply volumes used to settle amounts due under the CFD scheme and Capacity Market auctions are calculated appropriately for storage.
		facilities may be supplied to them free from the Climate Change Levy, where relevant conditions are met. ⁵⁴	

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Where flexibility assets are owned and/or operated by network operators there is a potential to distort competition in markets for flexibility services or deter new entrants.

AGREE/ DISAGREE?

EU clean energy package



Member States shall ensure that active customers owning a storage facility:

- (a) have the right to a grid connection within a reasonable time following the request if all necessary conditions such as balancing responsibility and adequate metering are fulfilled;
- (b) are not subject to any double charge, including network charges, for stored electricity remaining within their premises and when providing flexibility services to system operators;
- (c) are not subject to disproportionate licensing requirements and fees;
- (d) are allowed to provide several services simultaneously, if technically feasible.



Brussels, 11 January 2019 (OR. en)

Interinstitutional File: 2016/0380(COD)

> ENER 3 ENV 5 CLIMA 2 COMPET 9 CONSOM 3 FISC 12 CODEC 17

5076/19

NOTE	
From:	General Secretariat of the Council
To:	Permanent Representatives Committee
No. Cion doc.:	15150/1/16 REV 1 + ADD 1 REV 1
Subject:	Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast) - Analysis of the final compromise text with a view to agreement

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	IMPLEN		
Where flexibility assets are owned and/or operated by network operators there is potential to distort competition in markets for flexibility services or deter new entrants. More clarity on the application of existing unbundling rules to storage is required and further consideration is needed on the necessity to strengthen those rules.	1.8	Ofgem has consulted on a new condition in the electricity distribution licence to ensure that DNOs cannot operate generation, including storage, without Ofgem's consent.	Ofgem published draft guidance alongside its statutory consultation. If after considering responses, these licence changes are implemented, Ofgem will publish the final guidance with the decision document that implements the licence changes.

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Regulators have given consent in exceptional cases

Project owner	Location	Year	Size	R&D	Emergency	Temporary	Small-scale
UK Power Networks	Leighton Buzzard, UK	2013	6 MW	✓			
Scottish and Southern Energy Power Distribution	Orkney Islands, UK	2013	2 MW	~			~
Terna – EI	Southern Italy	2011	34.8 MW 3 locations		\checkmark	~	
Terna – PI	Sicily and Sardinia	2013	16 MW + 24 MW (planned)	~			
Electric Transmission Texas	Presidio, Texas	2010	4 MW		\checkmark	\checkmark	

Table 5.1 System operator investments in storage

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EU clean energy package



'fully integrated network components' means network components that are integrated in the transmission or distribution system, including storage facility, and are used for the only purpose of ensuring a secure and reliable operation of the transmission or distribution system but not for balancing nor congestion management;



Ownership of *energy* storage *facilities* by transmission system operators

- Transmission system operators shall not be allowed to own, *develop*, manage or operate energy storage facilities
- 2. By way of derogation from paragraph 1, Member States may allow transmission system operators to own, *develop*, manage or operate *energy* storage facilities *which are fully integrated network components and the regulatory authority has granted its approval* or, if *all of* the following conditions are fulfilled:

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	Council of the European Union						
		Brussels, 11 January 2019 (OR. en)					
		5076/19					
	itutional File: 3380(COD)						
		ENER 3 ENV 5 CLIMA 2 COMSON 3 FISC 12 CODEC 17					
NOTE							
From:	General Secretari	at of the Council					
To:	Permanent Repre	ermanent Representatives Committee					
No. Cion doc.:	15150/1/16 REV 1 + ADD 1 REV 1						
Subject:	Proposal for a Dir common rules for	Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast)					
	 Analysis of 	of the final compromise text with a view to agreement					

Article 36

Ownership of *energy* storage facilities *by distribution system operators*

- Distribution system operators shall not be allowed to own, develop, manage or operate energy storage facilities.
- 2. By way of derogation from paragraph 1, Member States may allow distribution system operators to own, develop, manage or operate *energy* storage facilities *which are fully integrated network components and the regulatory authority has granted its approval or if all of* the following conditions are fulfilled:

20



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Alternatives to system expansion EU clean energy package

The development of a distribution system shall be based on a transparent network development plan that distribution system operators shall *publish at least* every two years *and submit* to the regulatory authority. *The regulatory authority may request amendments to the plans.* The network development plan shall *provide transparency on the medium and long-term flexibility services needed*, contain the planned investments for the next five to ten years, with particular emphasis on the main distribution infrastructure which is required in order to connect new generation capacity and new loads including recharging points for electric vehicles. The network development plan shall also *include* the use of demand response, energy efficiency, energy storage facilities or other resources that distribution system operator is using as an alternative to system expansion.

When elaborating the ten-year network development plan, the transmission system operator shall *fully take into account* the *potential* of the *use of demand response*, energy storage *facilities or other resources as an alternative to system expansion in addition to expected* consumption and *trade* with other countries *and* investment plans for regional and Union wide networks.





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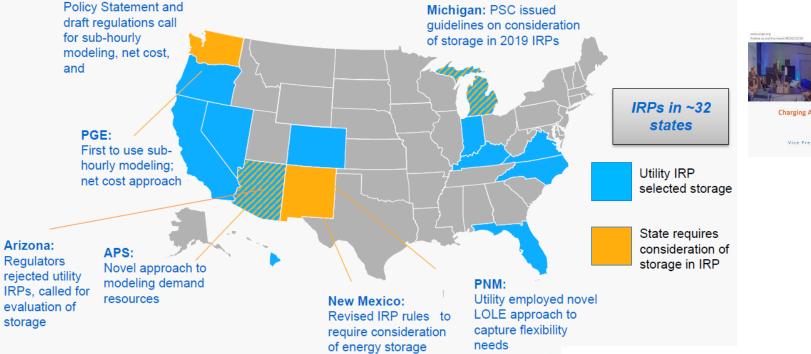
Trade-offs between network reinforcement and flexibility

S T O R Y



Charging Ahead on U.S. Storage Markets & Policy Session: Energy Storage Policy. The International Perspective Jason Burwen Vice President of Policy, Energy Storage Association

(USA)





Washington:

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Some renewable generators receiving support under the RO, CFD, or FIT schemes are concerned they may put their accreditation at risk if they apply to install storage assets on the same site AGREE/ DISAGREE?

Do I loose my RES-Support if I self-consume?

Annex 23 - Right to Self-consumption of Electricity

Member Estonia	Is self - consumption in principle allowed? Yes	Is self-consumption of self- generated RES electricity allowed in combination with a support payment? Yes	s electricity nbination with If 'yes', please specify in the comment box below.						
Austria	Yes	Yes	There are no restrictions to self-consumption for supported RES plants. For PV-installations you	Public report					
Austria	165	103	even have to indicate an estimated sef-consumption on supported when you apply for a FIT and the plants are ranked according to this share (the more you will consume on-site the better you'll be ranked). FIT is granted on a FCFS basis.	Ref: C18-SD-63-03 14 December 2018					
Belgium	Yes	Yes	Green certificates for RES production, except for PV installed after january 2015 in the Flemish and Walloon region with a capacity less than 10 kVA. In the Brussels region, PV installations smaller than 10kW still receive						
UK	Yes	Yes	For FITs, payments are received separately on generation and export. However, installations <30kW can 'deem' their export, meaning it is assumed they export 50% of their generation, in the absence of an export meter. This currently means that if they introduce storage and use all of their generation themselves, they still receive payments for export. This can be the case even if an export meter is installed. For RO, self-consumption is allowed for the operation of the generating station itself but not for other uses.						

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	IMPLEN	IENTED	
Some renewable generators receiving support under the RO, CFD, or FITs schemes are concerned they may put their accreditation at risk if they apply to install storage assets on the same site.	1.4	Ofgem has published guidance for participants of the RO and FIT schemes who are considering co-locating electricity storage facilities with their accredited RO generating station or FIT installation, without risking their existing accreditations. This follows guidance that had been issued previously for the CFD scheme.	

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Balancing services can suffer from complexity, overlap and lack of transparency. They may also reflect a historical focus on generation

AGREE/ DISAGREE?

National Grid-Enhanced frequency response

201 MW procured from storage in first tender in 2016

Enhanced frequency response (EFR)

Enhanced frequency response (EFR) is a dynamic service where the active power changes proportionally in response to changes in system frequency. This service is aimed at improving the management of system frequency pre-fault to maintain system frequency closer to 50Hz.

											Does this
											tender
				Enhanced						Average price	exclude
				Response	Estimated	Total C	Cost of	GWh of EFR		of tender £/MW	typical TRIAD
Provider Name	Site Location/Name	Type of service	Provider Type	(MW)	Start Date	tende	er £m	holding	Service Hours	of EFR/ h	hours
EDF Energy Renewables	T_WBURB-4	Service 2	Storage	49	Dec-17	£	12.035	1719.312	35088	£ 7.00	FALSE
Vattenfall	Pen Y Cymoedd	Service 2	Storage	22	Apr-17	£	5.749	771.936	35088	£ 7.45	FALSE
Low Carbon	Cleator	Service 2	Storage	10	Dec-17	£	2.681	337.6	33760	£ 7.94	TRUE
Low Carbon	Glassenbury	Service 2	Storage	40	Mar-18	£	12.668	1350.56	33764	£ 9.38	TRUE
E.ON UK	Sheffield	Service 2	Storage	10	Nov-17	£	3.891	350.88	35088	£ 11.09	FALSE
Element Power	TESS	Service 2	Storage	25	Feb-18	£	10.079	877.2	35088	£ 11.49	FALSE
RES	RESEFR7-PT	Service 2	Storage	35	Feb-18	£	14.651	1228.08	35088	£ 11.93	FALSE
Belectric	Nevendon	Service 2	Storage	10	Oct-17	£	4.200	350.88	35088	£ 11.97	FALSE
Total				201		£	65.954			£ 9.44	



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nationalgridESO



Ireland & Northern Ireland- DS3 System Services

- Batteries can tender to provide reserve services:
 - Fast frequency response
 - Primary, secondary, and tertiary reserve.

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Fast Frequency Response (FFR), Primary, Secondary

and Tertiary Reserve (POR, SOR, TOR1 & TOR2) System Services Test Report Battery

Northern Ireland- DS3 System Services



Technology Specific Trials

Procurement Process

- Tenderers are invited to submit a tender for one or more or all of the applicable Lots in accordance with the RFP:
 - Lot 1: Solar Technology Trial
 - Lot 2: Aggregated Residential Services Trial
 - Lot 3: Other Technology Trial
 - Lot 4: Alternative Communications Method Trial
- Interested Tenderers must submit a tender response through the eTenders portal in respect of the relevant Lot.
- Tender box close time 12 noon, Irish Time, on 5th April 2019 eTenders will not allow upload after this time.





DS3 Programme

Our Delivering a Secure Sustainable Electricity System (DS3) programme seeks to address the challenge of integrating world-leading levels of renewable generation onto our power system.

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Northern Ireland- DS3 SONI

For each DS3 System Service, the "Proven List" sets out the technologies which the TSOs consider to be proven at this time for procurement purposes. The designation of a technology as "proven" does not entitle any individual set System Services contract. Each individual service provider must pass the compliance assessment and meet all service provision standards in terms of performance.

Also, while a technology may be considered proven for multiple services, this does not mean that it can provide all of these services at the same time. Some services can only be provided in certain operational modes. Finally, for some types of service provider (e.g. windfarms, pumped hydro), the ability of the service provider is dependent on the underlying technology used.

Proven Technology List											
Type of Service Provider	Sub-technology (fuel / operational specific)	FFR	POR	SOR	TOR1	TOR2	RR (S)	RRD	RM1	RM3	RM8 S
	Coal	x	x	x	x	x	×	x	x	×	×
	Combined Cycle Gas Turbine - CCGT	x	x	x	x	x	×	x	x	×	×
	Open Cycle Gas Turbine - OCGT	x	x	x	x	x	x	x	x	×	×
	Distillate Oil	x	x	x	x	x	x	x	x	×	×
Thermal/Hydro - Centrally Dispatched Generating Unit - CDGU	Peat	x	x	x	x	x	×	x	x	×	×
	Anaerobic Digester / Waste to Energy	x	x	x	x	x	x	x	x	×	×
	Combined Heat and Power	x	x	x	x	x	×	x	x	×	×
	Biomass	x	x	x	x	x	×	x	x	×	×
	Hydro		x	x	x	x	×	x	x	×	×
Wind Power - WFPS	Wind Farm	x	x	x	x						
	Solid State Batteries e.g. Lithium Ion	x	x	x	x	x	×	x	x	×	x
Storage	Flywheels (Non-Synchronous)	x	x	x	x						
Storage	Pumped Hydro	x	x	x	x	x	×	x	х	×	×
	Compressed Air Energy Storage	x	х	x	x	x	x	x	х	×	x
Synchronous Compensator	Synchronous Compensator	x	x	x	x	x	×	x	x	×	×
HVDC Interconnector	Direct Current – Voltage Source Converters - VSC	x	x	x	x	x					
HVDC Interconnector	Direct Current – Line Commutated Converter LCC	x	x	x	x	x					
	Aggregated Generation Units (fossil-fuel based) - AGU	x	x	x	x	x	×	x	x	×	×
Aggregated Service Providers	Industrial Demand Side Units (demand response) - DSU	x	x	x	x	x	x	x	x	x	x
	Residential Demand Side Mangement (demand response) - RDSM										
	Solar Photovoltaic										
Solar Power	Solar Thermal										
	Concentrated Solar										

FERC Order 755



and ISOs result in rates that are unjust, unreasonable, and]					
preferential. Specifically, current compensation methods for regulation service in RTO						
and ISO markets fail to acknowledge the inherently great						
regulation service being provided by faster-ramping resources. In addition, certain						
practices of some RTOs and ISOs result in economically	¶ 61,064					
frequency regulation resources.		S OF AMERICA JLATORY COMMISSION				
	18 CFR	Part 35				
	[Docket Nos. RM11-7-000 and					
	Frequency Regulation Compensation in the Organized Wholesale Power Markets	Docket Nos. RM11-7-000 AD10-11-000				
28.05.2019	ber 20, 2011)					



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PJM Fast response



"The RegD signal would sometimes move in the opposite direction of the area control error [ACE], exacerbating the frequency regulation problem," Eric Hsia, manager of performance compliance at PJM, told Utility Dive.





DEEP DIVE

Is the bloom off the RegD rose for battery storage in PJM?

Frequency regulation has ups and downs, but with pending changes to PJM's RegD market, it seems more down than up.



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Bidding arrangements should consider physical characteristics of storage.



FERC Order 841: Electric Storage Participation in Wholesale Power Markets

BRIEF AUTHORS : Manfei He

BRIEF EDITORS : Daniel Copple, Jack Zhou, PhD

Requires wholesale electric power markets to create new rules that will allow for the participation of energy storage resources in energy wholesale markets.

This rule mandates that:

- Storage participating in wholesale markets should be able to recover costs through both cost-based and market-based rates.
- Storage should be allowed to provide all capacity, energy, and ancillary services according to its technical capability. This requirement recognizes the rich service potential of storage, including the ability to provide services that certain ISO/RTOs do not procure from organized market mechanisms, e.g., **blackstart services**, **frequency regulation**, and **reactive power services**. In the event that ISO/RTOs provide compensation for these services outside of market mechanisms, storage should be eligible for that compensation.
- The proposed bidding parameters should consider the physical and operational characteristics of different storage technologies.
- The general pricing rules for storage should be the same as energy resources. Storage would participate in the market both as wholesale buyers and wholesale sellers, and should be able to set the wholesale market clearing price. The buying and selling prices of energy storage should be the locational marginal price, or the price specific to a given location.
- The minimum size requirement to participate in the wholesale market must not exceed 100 kW.

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UK Flexibility plan and progress report



Issue	Action	What we have done	What we will do next
	IMPLEM	ENTED	
To balance the system, the Electricity System Operator (ESO) contracts for balancing services from providers, including frequency response and reserve. Balancing services can suffer from complexity, overlap and lack of transparency. They may also reflect a historical focus on generation rather than demand-side balancing solutions.	3.3	The ESO has reviewed how it can improve and simplify the way it procures balancing services and has published roadmaps on frequency response and reserve, restoration and reactive power and wider access to the balancing mechanism. Ofgem published a decision on the ESO's regulatory incentive framework running from April 2018 to 2021 in February 2018. ⁶⁵ The new framework will take a more 'principles-based' approach to regulating the ESO. In September, Ofgem launched a call for evidence for stakeholders to provide views on the ESO's performance across all its regulatory principles, from April to September. This information will form part of the assessment under the ESO's new performance framework.	The ESO will deliver actions set out in its roadmaps on frequency response and reserve, restoration and reactive power and wider access to the balancing mechanism. This includes trialling innovative, closer-to-real time procurement for frequency response by spring 2019. Ofgem will be reviewing this delivery and stakeholder feedback as part of their assessment of the ESO under their incentives framework. Ofgem is appointing an independent panel of experts, who will assess the ESO's performance and stakeholder feedback and will provide recommendations to Ofgem on whether any incentive payments or penalties should be paid. This panel will be in place for the ESO's mid-year review in November.

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EU Clean Energy Package



In order to raise efficiencies in the electricity distribution networks in the Union and ensure close cooperation with transmission system operators and ENTSO for electricity, a European entity of distribution system operators in the Union ("EU DSO entity") should be established. The tasks of the EU DSO entity should be well-defined and its working method should ensure efficiency, transparency and representativeness amongst the Union distribution system operators. The EU DSO Entity should closely cooperate with ENTSO for Electricity on the preparation and implementation of the network codes where applicable and should work on providing guidance on the integration inter alia of distributed generation and storage in distribution networks or other areas which relate to the management of distribution networks. The EU DSO entity should also take due consideration of the specificities inherent in distribution systems connected downstream with electricity systems on islands which are not connected with other electricity systems via interconnectors.



28.05.2019



Thank you!





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