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Facilitating energy storage to allow high penetration of intermittent renewable energy

Minutes Workshop in Spain

Deliverable 5.4

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

Acknowledgements

This report has been produced as part of the project “Facilitating energy storage to allow high penetration of intermittent renewable energy”, stoRE. The logos of the partners cooperating in this project are shown below and more information about them and the project is available on www.store-project.eu

The work for this report has been coordinated by CENER

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Introduction

The Workshop in Spain took place the 10th October 2013 in CENER premises in Sarriguren (Navarra). The attendees list is shown in Annex 1 and Agenda in Annex 2.

The attendees received a hard copy of the D5.2, a draft of the Spanish Regulation that also was forwarded ten days before the Workshop by e-mail, and a preliminary analysis of the Consultation Process to be used as basis for further discussion.

1. Minutes of the Spanish Workshop

1.1. Welcome and overview of the project

According to the agenda, the workshop started at 9 am with a general presentation about stoRE Project. The results of WP4 and WP5, Deliverable 5.2, were discussed as well in the next presentations to end with the presentation of the six national barriers identified during the activities of WP5.

Presentations are collected in Annex 3.

The aim of this first Session of the workshop was to describe first, the Consultation Procedure and Expected Outcomes and secondly to justify the selection of the six national barriers and explain them.

1.2. Discussion and Results

The discussion about the challenges and actions to overcome the main barriers that energy storage has to face took place in Round Table format (see pictures). Three tables were formed with participation of the main stakeholders (utilities, national regulator, technology manufacturers, academia, etc.).

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During the discussion, participants gave their opinions about the six national barriers identified previously and proposed solutions and recommendations to solve main problems of energy storage deployment. Based on recommendations some actions were also identified and will be supported by Cener by means of different activities until the end of the project and latterly.

Challenge 1. Lack of an adequate definition of energy storage in the regulatory framework

In regard to the absence of a Storage definition in the Spanish Regulation, all participants seemed to agree. Except for the pump hydro and heat storage associated with solar thermal power plants, the rest of the storage is not covered by the current legislation which limits installation to not being able to legalize the plants.

It was mentioned that this "definition" of storage should not be given in a general manner as there are different technologies with different sizes and applications and even within the energy system can be applied in different parts of the value chain (generation, transmission, distribution, end-users). One possibility would be to identify specific applications or services that some technologies can provide and incorporate in regulating these new options.

The reason of this position comes from the fact that many of the services some storage systems can provide, given the size, would take place in the distribution network which is a regulated market. The current regulation does not allow DSOs to own these plants and providing those services. And sometimes storage systems such as batteries of the order of MW connected to a substation for example, may carry out arbitrage services as part of the free market and therefore are also prohibited for DSOs.

This point is related to the ownership of generation plants and consumption.

The conclusion of the discussion was the need to identify and demonstrate the different capabilities of storage systems so that the regulator can define the future role and participation of

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the various technologies in the electrical system.

Challenge 2. Lack of definition of the energy storage capabilities and services that can provide

This discussion led directly to the second barrier identified and the difficulty of carrying out demonstration facilities as an initial step in characterizing the storage capabilities.

Some participants felt that the capabilities are already demonstrated and analyzed and the results are published in numerous research papers and reports. However, most attendees agreed with the fact that these studies are generally performed in the laboratory and for small power equipment so the scalability of the results remains to be demonstrated in many cases.

It was also discussed the difficulties of installing these plants despite being demonstration and/or R & D projects by the inability to legalize. In fact, in Spain some projects could not be completed due to the lack of legislation.

Challenge 3. Inadequate sizing of the electrical system

In regard to the barrier 3, regarding the configuration and dimensions of the current generation mix, most participants agreed that the flexibility of the electrical system in Spain is secured in the coming years. For that reason, the discussion turned to the future needs of flexibility that may arise beyond 2020 and may be covered by conventional and renewable generation systems and storage.

Some participants believed that the storage is very expensive and that flexibility can be obtained with more competitive conventional systems. Others responded to this by saying that the uncertainty about the future cost of both the conventional and storage plants, makes it very difficult to ensure the non-competitiveness of storage. However, some technologies such as pumped hydro, require many years from planning to final installation so that forecasts and schedules must be made now. Otherwise, even if the storage is the most competitive technology in the future new plants could not settle due to legal issues and lack of planning.

In these planning are also advised to consider the CO2 footprint of all technologies and externalities balances (security, social costs, etc.).

Challenge 4. Electricity market distorted and / or inappropriate

At this point there was a great difference of opinion. On one hand, some participants are of the view that the market is capable of regulating itself so storage if it could participate in, should do so on equal footing with other technologies and should not be incentivized in view of the results obtained in previous cases with this type of promotion.

By contrast, other attendants believe that some storage technologies still need assistance to develop and reach maturity enabling them to be competitive in the future and therefore, it must be seen in the regulation.

A modification of market regulation entails great complexity and nowadays much more, with the development of the Internal Energy Market for the European Community. At present, new remuneration schemes are being assessed based on power services or capacities rather than energy services, which would facilitate the entry of renewable energies and other technologies with similar capabilities and higher. However, it is not known yet how will this market´s operation be which severely impedes the business models development for storage and therefore, the assessment of the economic viability of these technologies.

Challenge 5. Long or nonexistent administrative procedures for the installation of energy storage

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systems

At this point there was virtually no discussion as all agreed that the procedures in the case of pumped hydro are too long and complicated and should be simplified. in the case of other technologies there are not at all procedures and all that makes difficult or even prevent new plants installation (see challenge 2).

Challenge 6. Impact of the new Royal Decrees in the development of renewable and storage technologies

This challenge raised more controversy. According to most participants, the Royal Decrees of small power plants and the Draft of net balance are hindering renewable energy, specifically photovoltaic energy. Some participants think the "auto-consumption" with storage has the same right as pumping systems to purchase energy during the night and sell it during the day. Furthermore, the distributed storage installed near the place of consumption is much more efficient than pump hydro energy storage because the consumption is made in the vicinity of the loads avoiding losses and congestion of networks.

However, the explicit exclusion of storage in small power plants RD is justified by some participants on the basis that the DR of small power facilities precludes storage since it would be necessary to ensure that the stored energy fed-in to the network (receiving compensation primate) comes solely from renewable sources.

The minority interpretation of Royal Decree was pending of review by CENER to determine whether it is ultimately this challenge. However, the net balance RD would eliminate any potential business as it considers the difference of energy consumed and produced and not their prices. Therefore, higher energy consumption would not make sense taking into account the efficiency losses in the storage process.

1.3. Actions proposed

As a result of this discussion some actions were identified that will be completed after analyzing the results of the questionnaire on-line.

1. Coding storage technologies in the Spanish Regulation.

This involves the definition of different storage systems capabilities and services that can be provided in the electrical system so that the regulator is able to incorporate properly these technologies in the Regulation.

This action must be performed by the regulator with the collaboration and / or support of technologists and other stakeholders.

2. Defining a simplified methodology in administrative procedures for demonstration / R & D projects development.

To characterize the capabilities of storage systems, apart from the pumped hydro, it was identified the need for demonstration and / or R & D projects that sometimes are hampered by administrative and regulatory issues. To facilitate the development of these projects that are not intended to make business activities and participate in the market, it was proposed the development of a methodology or simplified administrative procedure to allow the legalization of these test facilities in short periods of time.

This work should be done by the government (eg. regional industry departments) with the

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collaboration of experts from all related fields.

3. Identification of business cases in the Spanish market (economic scenarios) to determine storage support systems, including CO2 footprint.

To facilitate the development of the regulation relating to the operation of the electricity market and analyze the economic viability of storage, it is proposed to develop future energy scenarios that include storage and their economic analysis, including parameters such as carbon footprint, social impact, etc.. of the different technologies.

This would make it possible to identify financial support that storage may need for its development and implementation, should not be competitive in the future market of capabilities, and the scope of these grants.

Likewise R & D programs that favor the development of less mature technologies could be planned, optimizing economic resources.

This work can be done from within the administration with the help of R & D groups, consultants, financial institutions, etc.

4. Experts Panel / technological platform establishment in communication with the CNMC

This action was proposed in order to support the national regulator and the government agencies involved for technical consultation. In Spain currently numerous technological platforms for various technologies exist but not for the case of storage.

During the discussion it was mentioned that it was planned to create a cross-platform specialized on storage and that the first meeting would take place on October 28.

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Annex 1

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Workshop Proyecto stoRE

CENER, Sarriguren (Navarra)

10 de Octubre de 2013

Lista de asistentes

Nombre	Organización	Firma
Amunategui, Belen	Técnicas Reunidas	
Alba Rios, Juan Jose	Endesa	
Alonso, Oscar	UPNA	OSCAR ALONSO
Alzola Echazarra, Jose Angel	Tecnalia	
Arceluz, Jose	Iberdrola	
Aristu, Esperanza	Gobierno de Navarra	
Arribas, Luis	Ciemat	
de Castro, Manuel	Nexer	
Clerigué, Alberto	Sodena	
Chacón, Joaquín	Jofemar	
Chacón, Jorge	Cegasa	
Dávila, Mª Carmen	REE	
Flox, Cristina	IREC	
Galbete, Santiago	Acciona	
García, Pedro	ERBI	

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Gomez, Melchor	UPV/EHU	
Guelbenzu, Eugenio	Acciona	
Gutiérrez de la Roza, Gonzalo	ERBI	
Hernaiz, Pedro Pablo	Inypsa	
Iriarte, Victoria	Sodena	
Martinez, Cesar	Endesa	
Martinez, Jaime	G.E. Asecor	
Morante, Juan Ramon	IREC	
Németh, Gabriella	~~CNE~~ CNMC	
Ordiales, Miguel	REE	
Pascual, Cristina	Sodena	
Peropadre, Carlos	Inypsa	
Plaza, Rosana	Repsol	
Rodriguez, Maria	Codelse	
Ruiz, Beatriz	Jofemar	
Santos, Luis Manuel	EDP España	
Simón, Jesús	Fundación H2 Aragón	
Soto, Jesus	Ayto. de Vegadeo	
Valle, Jose	Vallealvar Servicios	

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Vela, Ricardo	**Codelse**	

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Annex 2

stoRE Workshop. Marco Regulatorio Español para el Almacenamiento de Energía

stoRE
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CENER

FACILITATING ENERGY STORAGE TO ALLOW HIGH PENETRATION OF INTERMITTENT RENEWABLE ENERGY
stoRE WORKSHOP AGENDA

(Jueves, 10 de octubre de 2013)

- ***Lugar:*** Sede de CENER, Avda. Ciudad de la Innovación nº 7, 31621 Sarriguren (Navarra) www.cener.com

Hora	
8:30h-9:00h	Recepción de asistentes
9:00h-10:00h	• Descripción del Proyecto y Presentación de resultados • Marco Regulatorio Europeo • Necesidades de Almacenamiento en España
10:00h – 10:30h	Análisis preliminar de Marco Regulatorio Español
10:30h – 11:00h	*COFFEE BREAK*
11:00h – 12:40h	Discusión en Mesas Redondas (moderadas por CENER)
12:40h – 13:00h	CONCLUSIONES
13.00h – 15:00h	*COMIDA*
15:00h – 17:30h	Visita a la Microrred ATENEA (Sangüesa)

- ***Contacto:*** Tfno: 948 25 28 00/ Dpto. De Integración en Red de Energías Renovables de CENER: Raquel Garde, (rgarde@cener.com) y Gabriel García (ggarcia@cener.com)

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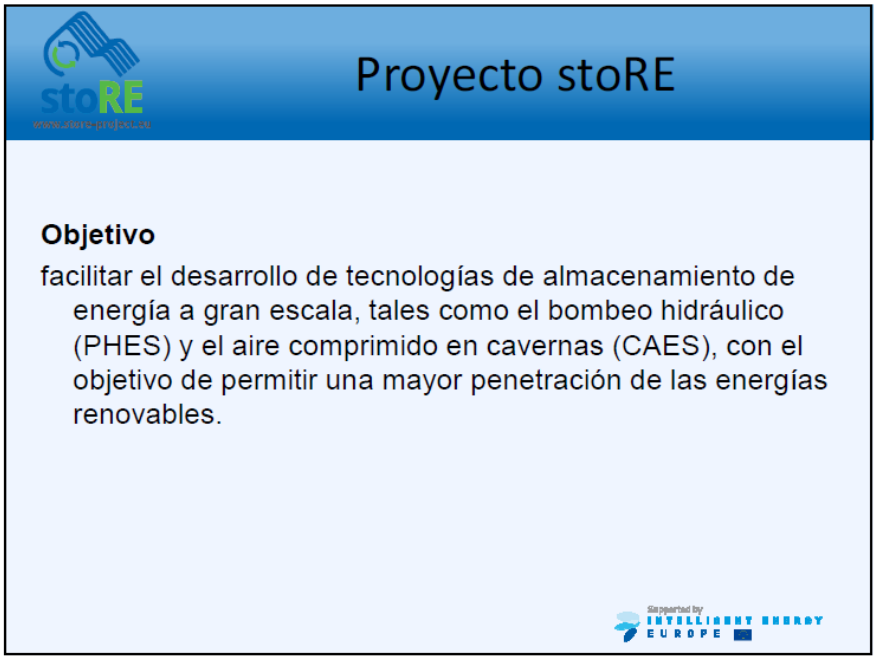
Annex 3



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Resultados

1. Identificación de retos no tecnológicos para el desarrollo del almacenamiento
2. Recomendaciones para simplificar los procedimientos administrativos de Análisis del Impacto Medioambiental (WP3)
3. Recomendaciones para actualizar el marco regulatorio y de mercado europeo incluyendo el almacenamiento (WP4)
4. Identificación de las potenciales necesidades de almacenamiento en los países objetivo en 2020 (WP5)
5. Propuesta de acciones para promover el desarrollo del almacenamiento en los países objetivo (WP5)

WP4. Regulación Europea

Proceso

- Análisis de la regulación y el mercado a nivel europeo
- Consulta a distintos actores implicados mediante cuestionarios, workshops, entrevistas personales, etc.
- Identificación de barreras/retos
- Propuesta de recomendaciones
- Promoción de resultados en distintos foros europeos

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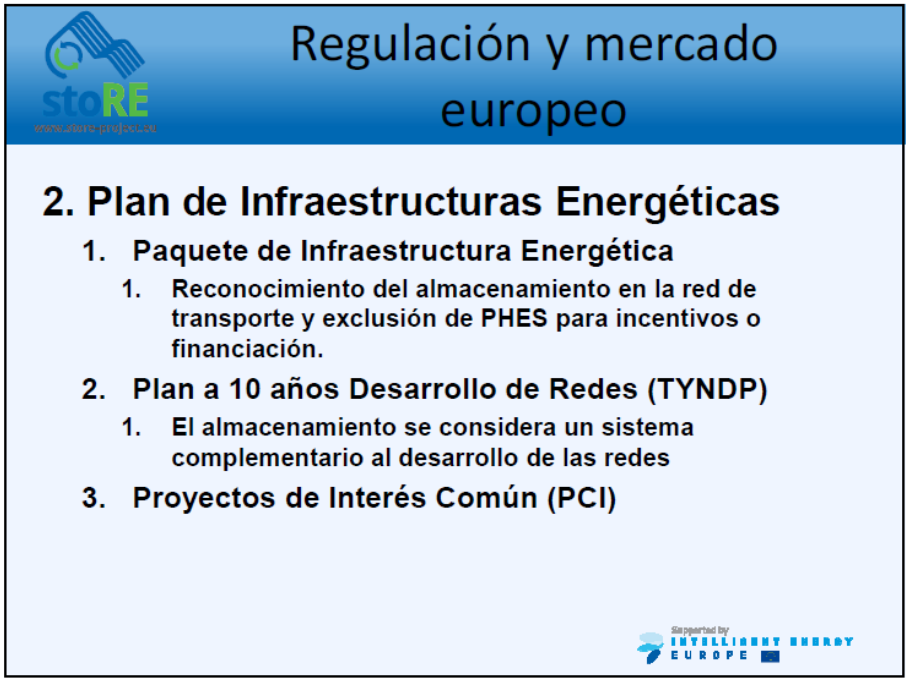

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Análisis de opiniones

1. Modelos de negocio actuales
   1. Viabilidad
   2. Soporte financiero
2. Marco regulatorio
   1. Unbundling Principle
   2. Definicion del almacenamiento
3. Diseño del mercado
   1. Señales
   2. Peajes
   3. Balance

Recomendaciones

- Reevaluación de la exclusión de financiación de PHES salvo en los casos en los que las plantas sean viables sin ayuda
- Ejecutar los mecanismos de mercado promovidos en la Directiva Eléctrica para el mercado de balancing
- Definición del almacenamiento en la Directiva y clarificación de la aplicación del Articulo 9(1)
- Revisión por parte de diversos organismos de los PCIs para asegurar que compiten en igualdad con los proyectos de redes

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Recomendaciones (cont.)

- Definiciones oficiales del almacenamiento incluidas en los códigos de operación (procedimientos administrativos)
- Reglas iguales en todos los Estados Miembros referentes a los peajes y que se revisen los costes de los peajes
- La introducción de iniciativas de regulación debe hacerse a nivel Europeo para manejar las posibles distorsiones del mercado

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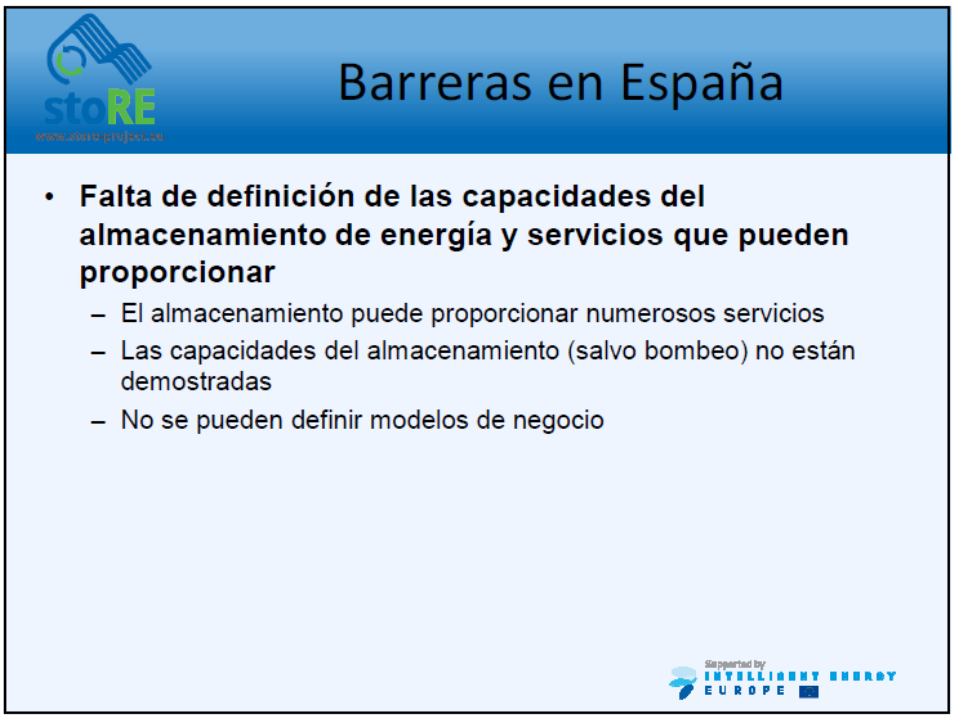

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Barreras en España

- **Inadecuado dimensionamiento del sistema eléctrico**
  - Mas del doble de potencia instalada respecto del pico de demanda
  - Plantas inoperativas lo que incrementa el riesgo para futuras inversiones
  - Flexibilidad asegurada a corto-medio plazo
  - Estimaciones de las necesidades a futuro

Barreras en España

- **Mercado eléctrico distorsionado y/o inadecuado**
  - Las primas y subvenciones a determinadas tecnologías introducen distorsiones en el mercado eléctrico
  - La operación del mercado actual se basa en tecnologías convencionales con bajos CAPEX y altos OPEX
  - El modelo futuro con alta penetración de Renovables (y almacenamiento?) debería tener en cuenta que se trata de tecnologías con altos CAPEX y bajos OPEX
  - Nuevos sistemas de generación distribuida

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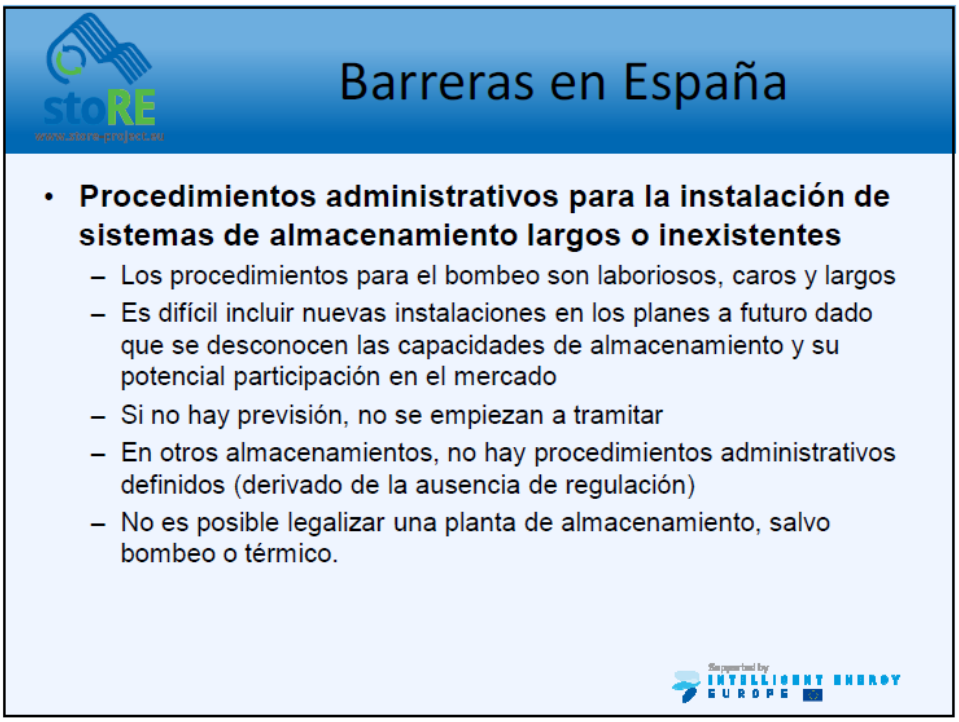

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Workshop Marco regulatorio español para el almacenamiento de energía
10 de Octubre 2013, Sarriguren

stoRE
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Necesidades de almacenamiento en España

Gabriel García Naveda

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stoRE Project Workplan

- WP1 – Management
- WP2 – Technology and needs overview
- WP3 – Environmental issues
- WP4 – European regulatory and market framework analysis
- WP5 – Target countries analysis and recommendations
- WP6 - Communication

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Necesidades de almacenamiento en España

Informe completo (en inglés):

Spain - "Overview of current status and future development scenarios of the electricity system, and assessment of the energy storage needs"

Necesidades de almacenamiento en España

- **Estructura del informe**
  - Sistema actual y escenarios futuros
    - El sistema de generación y transporte eléctrico en España
    - Planes energéticos nacionales
    - Otros estudios y previsiones de desarrollo del sistema
  - Estudio de la demanda residual
    - Escenario 2020
    - Escenario 80% renovable
  - Necesidades de almacenamiento en los escenarios futuros
    - Escenario 2020
    - Escenario 80% renovable
    - Estudios paramétricos

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Necesidades de almacenamiento en España

- Sistema actual y escenarios futuros
  - El sistema de generación y transporte eléctrico en España

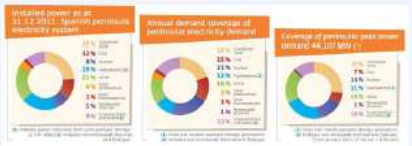

Figure 1.1. Main features of the Spanish electricity system in 2011. Source [8]

Table 1.1. Power capacity installed in Spain (End of 2011). Source [8]

	Peninsular system		Extrapeninsular system		National total	
	MW	%11/10	MW	%11/10	MW	%11/10
Hydroelectric	17,583	0.0	1	0.0	17,584	0.0
Nuclear	7,777	0.0	-	0.0	7,777	0.0
Coal	11,700	2.8	510	0.0	12,210	2.7
Fuel/gas	1,402	-34.6	2,884	0.7	4,376	-10.0
CCGT	25,269	0.1	1,854	-0.5	27,123	0.1
Total ordinary regime	**63,801**	**-0.7**	**5,249**	**0.2**	**69,890**	**-0.6**
Hydroelectric	2,041	0.3	1	0.0	2,041	0.3
Wind	21,091	7.0	149	1.7	21,239	7.0
Solar photovoltaic	4,047	10.7	202	8.8	4,249	10.6
Solar thermoelectric	1,049	97.1	-	0.0	1,049	97.1
Renewable thermal	555	14.0	1	-96.5	556	8.6
Non-renewable thermal	7,282	1.3	119	0.9	7,401	1.3
Total special regime	**36,367**	**7.4**	**471**	**-3.8**	**36,838**	**7.3**
Total	**100,168**	**2.1**	**5,720**	**-0.1**	**105,888**	**2.0**

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Necesidades de almacenamiento en España

- Sistema actual y escenarios futuros
  - Planes energéticos nacionales
  - Otros estudios y previsiones de desarrollo del sistema

Planes y escenarios analizados

- PANER/PER 2011-2020
- Informe de la subcomisión de análisis de la estrategia energética española para los próximos 25 años
- Prospectiva de generación eléctrica 2030, UNESA
- El modelo eléctrico español en 2030, PwC
- Un análisis prospectivo de la electricidad en España, Club Español de la Energía

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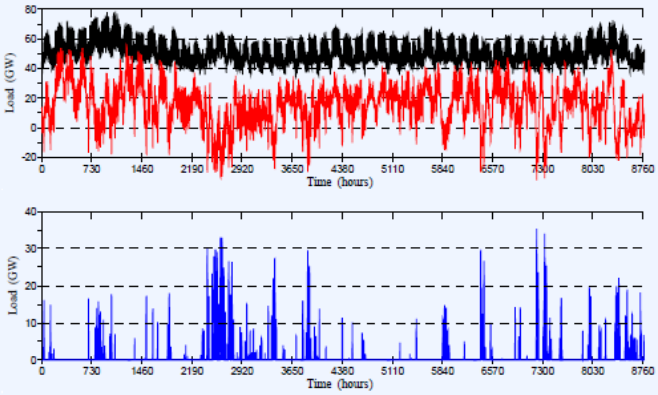
Necesidades de almacenamiento en España

- Casos estudiados
  - Escenario 2020 (~40% renovables)
    - Caso 1 – 3,00 GW bombeo
    - Caso 2 – 6,00 GW bombeo
  - Escenario 80% renovables (~2040)
    - Caso A – 100/35 GW (eólica/solar)
    - Caso B – 85/50 GW (eólica/solar)
    - Caso C – 72/65 GW (eólica/solar)
      - Todos con 12,75 GW bombeo

* 12 h de almacenamiento en todos los casos

Necesidades de almacenamiento en España

- Estudio de la demanda residual



Mínimos técnicos:

- Escenario 2020
  - 15 GW
  - 18 GW
- Escenario 80%
  - 0 GW
  - 10 GW

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Necesidades de almacenamiento en España

- Los resultados muestran que la configuración del Caso A (mayor desarrollo eólico) es el más efectivo para el sistema eléctrico español
  - mayor penetración de la generación de renovables intermitentes
  - menor cantidad de recortes
  - menor aumento de variaciones en la demanda
  - menor impacto en la estabilidad del sistema
- La extensión de la vida de las centrales nucleares existentes supondrá un obstáculo para una alta penetración de las renovables en el futuro sistema eléctrico español

Caso	Máx. potencia vertida (MW)	% generación vertida Eólica – Solar – acumulado			Energía total vertida (GWh)
A	35.300	4,3	3,9	4,2	11.800
B	34.200	4,0	6,0	4,7	13.100
C	36.800	4,8	9,5	7,3	20.750
Resultados para el escenario nuclear (mínimo técnico 10 GW)					
A-n	45.300	12,0	10,7	11,7	32.800
B-n	44.200	10,6	15,5	12,4	34.600
C-n	46.800	10,5	22,4	16,0	45.300

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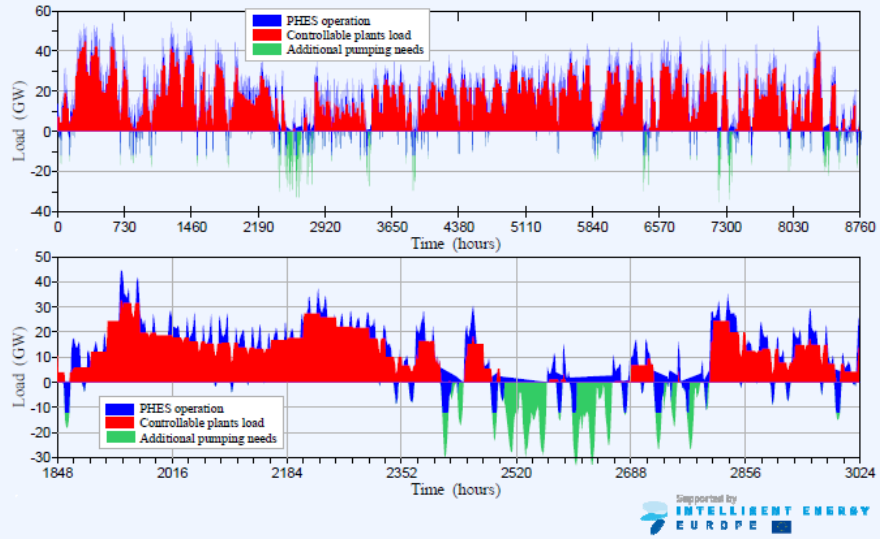
Necesidades de almacenamiento en España



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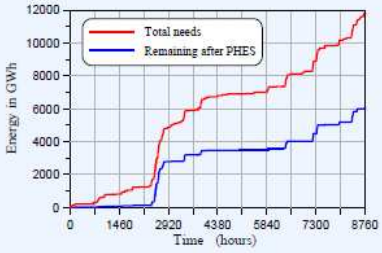
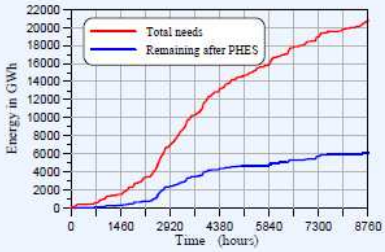
Necesidades de almacenamiento en España





Acumulado de energía vertida/almacenada en el caso 80% renovables A y C

Necesidades de almacenamiento en España

Caso	Generación renovable vertida (GWh)	Generación renovable almacenada (GWh)	Porcentaje recuperado tras pérdidas	Generación almacenada del sistema (GWh)	Descarga total de PHES (GWh)	Factor de capacidad PHES (%)		
						Renovables	Sistema	Total
A	11.800	5.740	36,5 %	21.900	20.730	5,4	20,8	26,2
B	13.100	8.915	51,0 %	25.910	26.120	8,5	24,6	33,1
C	20.750	14.620	52,9 %	23.900	28.890	13,9	22,7	36,6
Resultados para el escenario nuclear (mínimo técnico del sistema 10 GW)								
A-n	32.810	9.665	22,3 %	14.390	18.040	9,2	13,6	22,8
B-n	34.600	14.975	32,7 %	15.950	23.190	14,2	15,1	29,3
C-n	45.300	22.470	37,4 %	12.550	26.265	21,3	11,9	33,2

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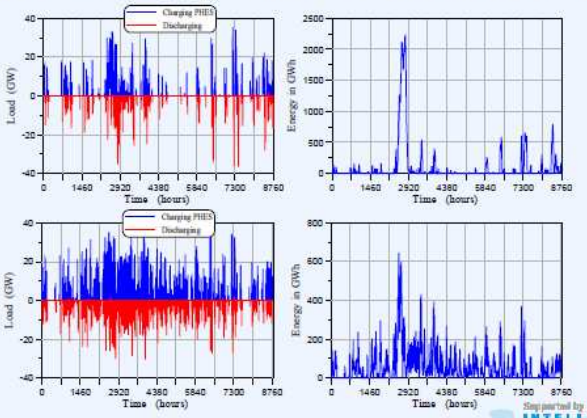
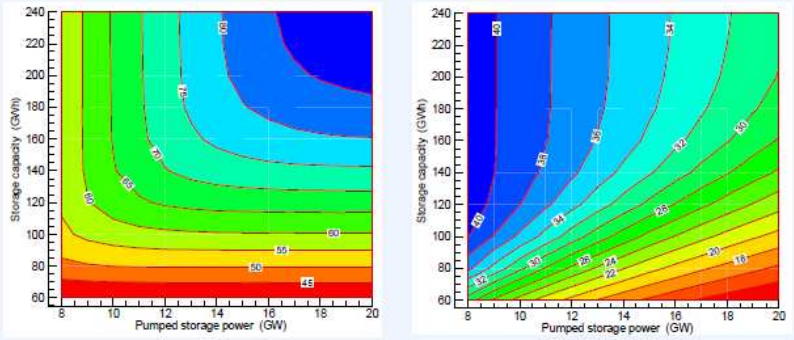
Necesidades de almacenamiento en España

- Estudios paramétricos
  - Estudios de capacidad ilimitada (Figuras A y C)



Necesidades de almacenamiento en España

- Estudios paramétricos
  - Estudios de rentabilidad óptima



Porcentaje recuperado y factor de capacidad; Caso C

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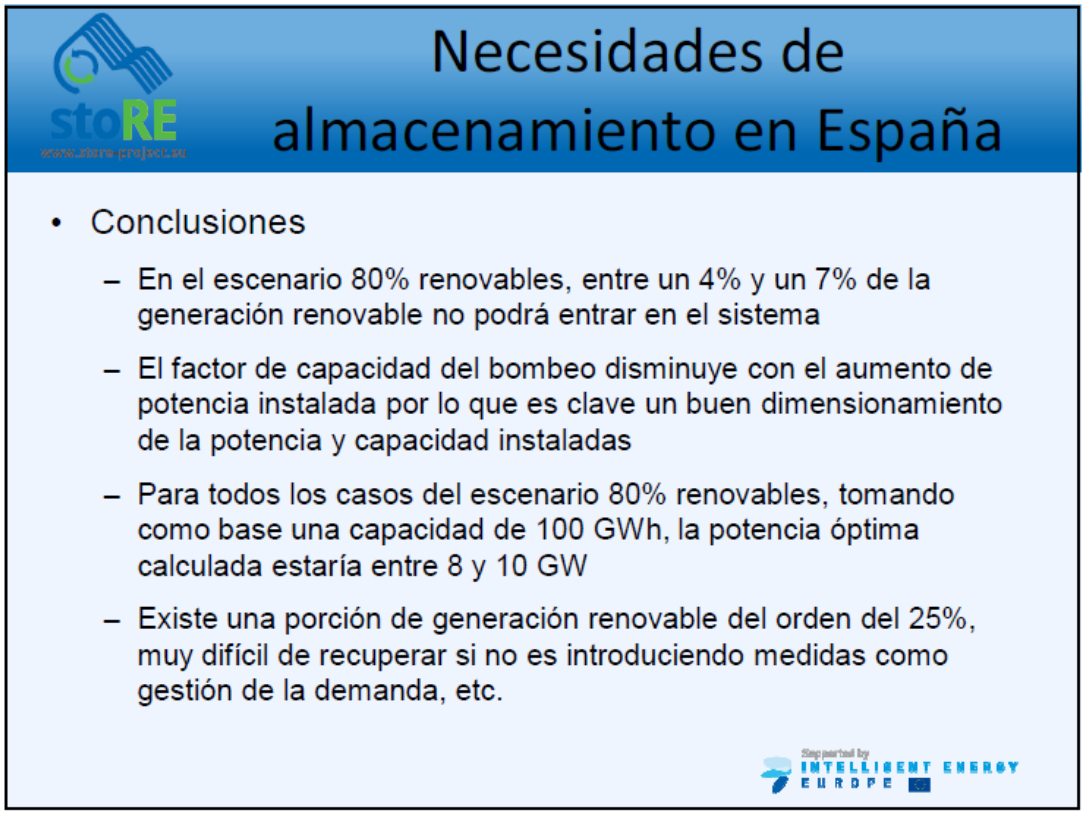

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