Project Sheet

FR-ES project -Aragón-Atlantic Pyrenees

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Key Information

Cross Border Project
DC transmission line
New

PCI number 2.27.1 (4th list, 31 Oct. 2019)
Planned But Not Yet Permitting

Description

This project consist of a new HVDC interconnection between France and Spain located in the Central part of the Pyrenees between Aragón region (Spain) and Marsillon (France). Internal AC reinforcements in Spain complement the cross border section, in order to connect the new converter station to the existing network. This project was included in the 2015 and 2017 PCI list (PCI 2.27.1)

Project promoters

Red Eléctrica de España
RTE

Countries

Spain
France

National development plan(s)

French NDP, SDDR (Schéma Décennal de Développement du Réseau -Ten Year Network Development Scheme), France, 2019, project n°1039, page 442, https://www.rte-france.com/fr/article/evolution-du-reseau-electrique-francais-l-horizon-2035 , Spanish NDP, Spain, 2015-2020, in tables in Annex II, page 6 as Ejea de los Caballeros-French Border. Definition of the project has evolved since the publication of the last NDP towards the current definition in this TYNDP.

Additional information on the project

- Spanish National Development Plan:

https://energia.gob.es/planificacion/Planificacionelectricidadygas/desarrollo2015-2020/Documents/Planificación%202015_2020%20%202016_11_28%20VPublicación.pdf

- French National Development Plan
http://www.rte-france.com/fr/article/schema-decennal-de-developpement-de-reseau

- Inter-Governmental agreement (Madrid and Lisbon Declarations):
https://ec.europa.eu/energy/sites/ener/files/documents/Madrid%20declaration.pdf

https://ec.europa.eu/info/sites/info/files/lisbon_declaration_energyinterconnections_final.pdf

- Constitution of the High Level Group on Interconnections for South West Europe: http://europa.eu/rapid/press-release_IP-15-5187_en.htm

Project sheet backlog

21 Jan. 2021 - Update of the commissioning year for 3 investments, previously 2027 now 2030

6 Nov. 2020 - Publication as part of the draft TYNDP 2020 package for consultation

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Project Description & Context

Project Investments

Main investment(s): New axis Aragon region -Marsillon

Type of element	Total route length (km)	From substation 1	To substation 2	Present status	Commissioning year	Progress of the investment	Explanation in case of delay or reclustering
DC transmission line	230	Aragon region	Marsillon	Planned But Not Yet Permitting	2030	Rescheduled	

Other investments

Description	Type of element	Total route length (km)	From substation 1	To substation 2	Present status	Commissioning year	Progress of the investment	Explanation in case of delay or reclustering
New AC line (double circuit 400kV) between Ejea and Aragon region where the converter station is located	AC transmission line	110	Ejea de los Caballeros	Aragon region	Planned But Not Yet Permitting	2030	Rescheduled	
New 400kV Ejea de los Caballeros subestation and connection to the lines La Serna-Magallon and Magallon Peñalba	Onshore substation		Ejea de los Caballeros	Ejea de los Caballeros	Planned But Not Yet Permitting	2030	Rescheduled	
New 400 kV Aragon region subestation	Onshore substa		Aragon region	Aragon region	Planned But Not	2030	Rescheduled	

Description	Type of element	Total route length (km)	From substation 1	To substation 2	Present status	Commissioning year	Progress of the investment	Explanation in case of delay or reclustering
and connection to existing network and future cross border project	tion				Yet Permitting			

Is the project in the reference grid?

No

System Needs addressed by the project

Project promoter(s) selected up to 4 system needs that are addressed by their project in a predefined list. Available needs ranged from reduction of price differentials between countries, improvement of system flexibility and stability, enabling cost-efficient connection of high volumes of RES, improvement of voltage stability...
As part of the TYNDP 2020, ENTSO-E released a study investigating cross-border system needs in the 2030 and 2040 horizons.

Need		How the project addresses each need (explanation provided by the project promoter(s))
€	Infrastructure to reduce price differentials between EU and/or non-EU countries	The IoSN report show high price differentials in FR-ES that would be reduced with a project in this border.
ITEG	Infrastructure to tackle a Need identified by one of the European ITEG indicators referring to the 15% interconnection target for 2030:1. Reduce the price differential between EU countries to below 2EUR/MWh.2. Contribute to pushing ratio between nominal transmission capacity and installed RES capacity past 30%.3. Contribute to pushing ratio between nominal transmission capacity and peak load past 30%.	IoSN report shows that for the 2040 time horizon there is need for developing projects in the French-Spanish border.
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	By increasing interconnection capacity on ES-FR border, the project contributes to enhance flow distribution and RES integration, and to increase exchanges between France and the Iberian Peninsula.
	Infrastructure designed to enable cost-efficient grid	TYNDP shows a reduction of

Need		How the project addresses each need (explanation provided by the project promoter(s))
	connection of high volumes of RES and/or reduce RES curtailment	RES spillage considering the increase of interconnection capacity in ES-FR.

Interconnection targets

In 2017, the Interconnection Target Expert Group proposed alternative indicators to the 15% interconnection criteria for every country and electrified island with a new methodology developed collaboratively between the European Commission, ENTSO-E, ENTSOG, industry, universities and other experts. The methodology is based on three indicators:
1. Price differential between EU countries, with an objective to reduce it below 2 EUR/MWh
2. Ratio between nominal transmission capacity and installed RES capacity, with a target of past 30%
3. Ratio between nominal transmission capacity and peak load, with a target of past 30%

The following maps show the ITEG methodology applied to the TYNDP 2030 scenarios, with the 2020 grid.

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Project Assessment

Transfer capacity increase (National Trends 2025)

	Border	A B	B A
Transfer capacity increase (in MW)	Spain - France	1500	1500

Boundary capacity diagram

Network boundary the projects helps mitigate

Iberian Peninsula integration

Boundary capacity diagram

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CBA results

ENTSO-E has assessed the benefits delivered by each project in 2025 (scenario National Trends 2025) and in 2030 (three scenarios: National Trends, Distributed Energy and Global Ambition). Indicators B1 to B6 were computed by ENTSO-E, while promoters had the possibility to compute and submit so-called project-level benefits (B7 to B10). The benefits must be understood as benefits for Europe as a whole, not for the promoters of the project.
Results are presented per scenario.

Central scenario: National Trends

National Trends is the central policy scenario of the TYNDP2020, designed to reflect EU member state's National Energy and Climate Plans (NECP), in line with the requirement to meet current European 2030 energy strategy targets.

			Comparison of the COP21 scenarios with NT2030 average result		
	NT2025	NT2030	DE2030 is < or > than NT2030	GA2030 is < or > than NT2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M € / year)	max average min	69 57 45	102 93 88	>	<	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	11 4 0	23 15 7	>	>	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	21 12 9	142 136 130	>	<	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	-762	-1458	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	-93	-91	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	-583	-1444	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	5906	-24276	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	-51	-102	n/a	n/a	ENTSO-E assessment
B4f Non-methane volatile organic compounds	average	5910	-24208	n/a	n/a	ENTSO-E assessment

B2a Annual CO2 variation from market simulation (ktonnes / year)		max average min	0 -180 -470	-258 -523 -808	< <<	>>>>

year)					

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		3623	n/a	n/a	ENTSO-E assessment
B6_€ Annual Socio-Economic Welfare increase resulting from reduction in Energy Not Served monetised (M€ / year)	average	n/a	36.23	>	n/a	ENTSO-E assessment

Scenarios: Distributed Energy & Global Ambition

DE and GA are two scenarios created in line with the COP21 targets to understand the impact on infrastructure needs agains different pathways reducing EU-28 emissions to net-zero by 2050. For these two scenarios, projects were assessed with a subset of CBA parameters.

		DE2030	GA2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	120	93	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	30	16	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	173	121	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market	average	-559	-454	ENTSO-E assessment

simulation (ktonnes / year)				
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	4 26 76	11 30 70	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	3507	2790	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	**Transient stability**	**Voltage stability**	**Frequency stability**	
HVDC Aragon region - Marsillon (New HVDC)	++	++	+ (between sync areas)	Qualitative assessment by ENTSO-E based on information on the project technology provided by the project promoter(s). This indicator is not dependent on scenarios or time horizons.
New axis Ejea-Aragon region 400 kV (New AC line)	++	++	0	

Sensitivity Study: Current Trends

'Current Trends' describes a future where the energy transition is slower than planned.

	CT2030	

Increase in socio-economic welfare

		ENTSO-E assessment

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	57	
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	8	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	32	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-299	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	10 22 48	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	601	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

Comments on the CBA results by the project promoter(s)

Explanation of the project benefits

The project helps to integrate RES generation of the Iberian Peninsula: it mainly allows to replace nuclear in France by RES generation that would have been curtailed without the project. It

sometimes also helps to decrease thermal generation in Spain and Portugal and farther in Europe substituting it by available RES. This leads to a considerable reduction of the total generation costs (SEW) in all scenarios. Furthermore SEW benefits are higher in 2040 horizon after nuclear phase out in France (see IoSN report).

When analyzing the results of the different scenarios studied, it can be concluded that the higher the penetration of RES in the Iberian Peninsula, especially solar generation, the higher the SEW of the project is. Thus, the SEW is the lowest in scenarios NT 2025 and CT 2030, and the highest in scenario DE 2030. These scenarios frame the results of scenarios NT2030 and GA2030 in terms of SEW results.

The TYNDP 2018 showed greater benefits. Indeed, the scenarios used at that time corresponded to a more ambitious objective of nuclear phase-out in France and the French nuclear installed capacity was therefore much lower. Thus, the avoided curtailed energy in the Iberian Peninsula, instead of replacing cheap French nuclear generation, replaced a much larger share of thermal generation. Additionally the Spanish thermal capacity in TYNDP 2018 scenarios was greater than the one considered in these new scenarios in which the forecasted gradual closure of coal-fired power plants is considered.

The project shows a significant contribution to avoid ENS: the SOS indicator shows that this interconnection project gives large benefits to use existing thermal generation in the Iberian Peninsula to avoid potential ENS in Western Europe. In addition, an increase of transfer capacity between Iberia and the rest of Europe would improve the system security and its robustness from the dynamic point of view.

Amount of losses are quite high as the project allows higher long transit power flows on long distances in order to supply the demand with the cheapest generation available through Western Europe. These results are aligned in volume (MWh) with TYNDP 2018. Nevertheless, the cost of losses are significantly lower due to particularly low marginal costs in France and Spain in NT2030 scenario.

Navarra-Landes project reduces the congestion rate in a range from 11 to 12% in NT 2030 scenario, depending on the climate year. Nevertheless after the commissioning of the project the congestions are limited to 48-56%.

Aragón-Atlantic Pyrenees project reduces the congestion rate in a range from 11 to 12% in NT 2030 scenario, depending on the climate year. Nevertheless after the commissioning of the project the congestions are limited to 48-56%.

Disclaimer:

Preliminary studies show that a number of internal reinforcements could be necessary on both sides of the border to reach the net transfer capacity targets of 6500 and 8000 MW which are the main NTC objectives of projects 276 and 270 respectively.

REE and RTE should further develop a thorough joint study in order to design more precisely these reinforcements, to assess the appropriateness and relevance of clustering some of these

reinforcements with projects 270 or 276, and thus make their economic analysis more robust, and also to define how to optimize the distribution of flows between east and west of the border by better adjusting the HVDCs set points, which could have a high impact on the overall NTC. All the needed internal reinforcements will have to be coordinated with internal energy transition objectives, which will require further analyses and review of the benefits, costs, and social and environmental impacts.

How the project fits to the regional trends:

This project helps to integrate the Iberian Peninsula in a full-integrated European internal energy market, as it reduces its historical electric isolation (Spain won't yet fulfill the 10% objective for 2020 in spite of the strong technical and political efforts, as Spain would still be a range of 6-7%. This project also helps to integrate the high RES potential in the Iberian Peninsula. In addition, it also contributes to the security of supply, not only regarding adequacy (especially in tight situations), but also regarding flexibility and stability of the system.

Residual impact

Information on the residual impact of the project was provided by the project promoter(s).

Residual environmental impact

Investment	Investment status	Distance (km)	Type of sensitivity
HVDC Aragon region - Marsillon	Planned But Not Yet Permitting	61	

Note based on CBA Guideline 3.0: Given that the actual route of the project might not be defined due to the low degree of maturity of its investment(s), an environmental assessment is not yet available.

Residual social impact

Investment	Investment status	Distance (km)	Type of sensitivity
HVDC Aragon region -Marsillon	Planned But Not Yet Permitting	12	Sensitivity regarding population density - Land that is close to densely populated areas

Note based on CBA Guideline 3.0: Given that the actual route of the project might not be defined yet because of the low degree of maturity of its investment(s), a residual social impact assessment is not yet available.

Project Costs

The project costs were provided by the project promoter(s).

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1211. HVDC Aragon region -Marsillon	1089.41	10%	3.26

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1212. New axis Ejea-Aragon region 400 kV	62.59	10%	2.72
1214. Ejea de los Caballeros subestation	8	10%	0.02
1215. Aragon region subestation	10	10%	0.03
Total	1170		6.03

Explanation provided by the project promoter on the CAPEX uncertainty range:

1211	Procurement / construction cost uncertainties Disclaimer: the uncertainty range does not result from any on field study and should therefore be cautiously considered
1212	Procurement / construction cost uncertainties Disclaimer: the uncertainty range does not result from any in field study and should therefore cautiously considered
1214	Procurement / construction cost uncertainties Disclaimer: the uncertainty range does not result from any in field study and should therefore cautiously considered
1215	Procurement / construction cost uncertainties Disclaimer: the uncertainty range does not result from any in field study and should therefore cautiously considered