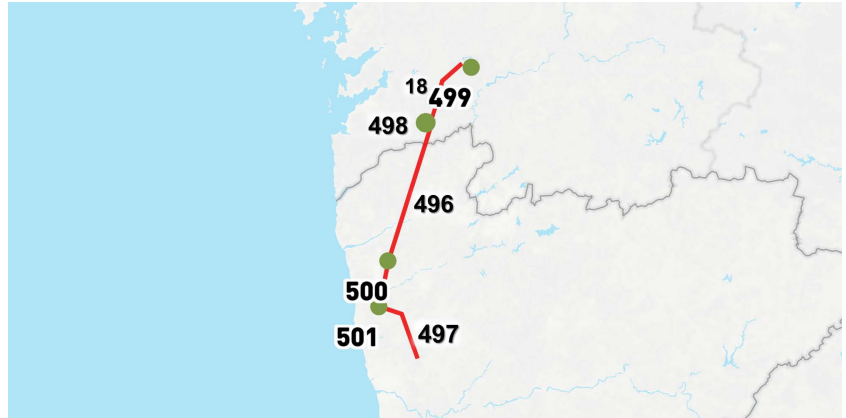


## Project 4 - Interconnection Portugal-Spain

In order to reach a complete operational Iberian Electricity Market (MIBEL), and strengthening the Internal Energy Market (IEM), the increase of the interconnection between Spain and Portugal is needed. A new OHL 400kV interconnection between Fontefría (Spain) and Ponte de Lima (Portugal). Internal reinforcements complement the cross border section, such as the axis in Spain between Fontefría and Beariz and in Portugal between Ponte de Lima (previously Viana do Castelo), Vila Nova de Famalicão (previously Vila do Conde) and Vermoim/Recarei. This project was included in the 2013 and 2015 PCI list (PCI 2.17).

Classification	Mid-term Project
Boundary	Portugal - Spain
PCI label	2.17
Promoted by	REE;REN



Investments								
Investment ID	Description	GTC Contribution	Substation 1	Substation 2	Present Status	Commissioning Date	Evolution since TYNDP 2014	Evolution Driver
18	New northern interconnection. New double circuit 400kV OHL between Beariz (ES) - Fontefría (ES).	100%	Beariz (ES)	Fontefría (ES)	Permitting	2017	Delayed	The delay of this investment is affected by the explanation in the investment 496. Also, environmental problems lead to re-routing.
496	Interconnection 400kV Fontefría (ES) - Ponte de Lima (PT) - Vila Nova de Famalicão (PT).	100%	Fontefría (ES)	Vila Nova de Famalicão (PT) (By Ponte de Lima)	Permitting	2018	Delayed	Due to local opposition in the border area REN had to withdraw the Portuguese section of the interconnection of the ongoing EIA process to maintain the schedule of other investments included in the EIA needed for connecting new hydro in Cávado
497	New double circuit 400kV OHL between Vila Nova de Famalicão (PT) - Recarei/Vermoim (PT).	100%	Vila Nova de Famalicão (PT)	Recarei/Vermoim (PT)	Commissioned	2015	Investment on time	Line commissioned
498	New northern interconnection. New 400kV substation Fontefría (ES), previously O Covelo.	100%	Fontefría (ES)		Permitting	2017	Delayed	The delay of this investment is affected by the explanation in the investment 496. Also, environmental problems lead to re-routing

499	New northern interconnection. New 400kV substation Beariz (ES), previously Boboras	100%	Beariz (ES)	Permitting	2017	Delayed	The delay of this investment is affected by the explanation in the investment 496. Also, environmental problems lead to re-routing
500	New 400/150kV substation Ponte de Lima (PT), previously V. Castelo.	100%	Ponte de Lima (PT)	Permitting	2018	Delayed	Substation renamed to Ponte de Lima. See Investment 496.
501	New 400kV substation Vila Nova de Famalicão (PT), previously Vila do Conde.	100%	Vila Nova de Famalicão (PT)	Commissioned	2015	Investment on time	Substation commissioned.

## Additional Information

Clustering: the project consists on a set of investments in the same transport corridor, based on a 400 kV OHL axis linking the substations of Beariz and Fontefría, in Spain, with P. Lima-V. N. Famalicão-Recarei/Vermoim, in Portugal. These reinforcements are all needed (as they are in series) to achieve the main objectives of the project: reinforcement of the interconnection capacity between Portugal and Spain having in mind the MIBEL targets agreed by the Portuguese and Spanish governments and also to allow Portugal to achieve the 10% interconnection ratio defined by the EC, both contributing for the IEM.

Project website

<http://www.ree.es/es/actividades/gestor-de-la-red-y-transportista/proyectos-de-interes-comun-europeos-pic> ;

[http://www.ren.pt/pt-PT/o\\_que\\_fazemos/projetos\\_interesse\\_2015/](http://www.ren.pt/pt-PT/o_que_fazemos/projetos_interesse_2015/)

PCI page – link to EC platform

[http://ec.europa.eu/energy/infrastructure/transparency\\_platform/map-viewer/m/main.html](http://ec.europa.eu/energy/infrastructure/transparency_platform/map-viewer/m/main.html)

Other links:

*Spanish National Development Plan*

<http://www.minetur.gob.es/energia/planificacion/Planificacionelectricidadygas/desarrollo2015-2020/Paginas/desarrollo.aspx>

*Portuguese National Development Plan*

[http://www.erse.pt/pt/consultaspublicas/consultas/Documents/53\\_Proposta%20PDIRT-E\\_2015/PDIRT%202016-2025%20Junho%202015%20-%20Relat%C3%B3rio.pdf](http://www.erse.pt/pt/consultaspublicas/consultas/Documents/53_Proposta%20PDIRT-E_2015/PDIRT%202016-2025%20Junho%202015%20-%20Relat%C3%B3rio.pdf)

*Inter-Governmental agreement (Madrid Declaration)*

<https://ec.europa.eu/energy/sites/ener/files/documents/Madrid%20declaration.pdf>

*Constitution of the High Level Group on Interconnections for South West Europe*

The High Level Group is responsible to prepare a plan to implement the [Madrid Declaration](#) and ensure regular monitoring of progress of the projects and provide adequate technical assistance to the Member states. The group will deal with both gas and electricity infrastructure.

[http://europa.eu/rapid/press-release\\_IP-15-5187\\_en.htm](http://europa.eu/rapid/press-release_IP-15-5187_en.htm)

XXII Portuguese-Spanish Summit (main conclusions)

Main conclusions from the XXII Portuguese-Spanish summit where both governments agreed to continue working on the definition and routes for two new interconnection in order to reach a interconnection capacity of 3000 MW by 2010 between both countries.

[http://www.erse.pt/pt/mibel/construcaoesdesenvolvimento/Documents/CONCLUS%C3%95ES%20CIMEIRA\\_BADAJOS\\_2006](http://www.erse.pt/pt/mibel/construcaoesdesenvolvimento/Documents/CONCLUS%C3%95ES%20CIMEIRA_BADAJOS_2006)

## Investment needs

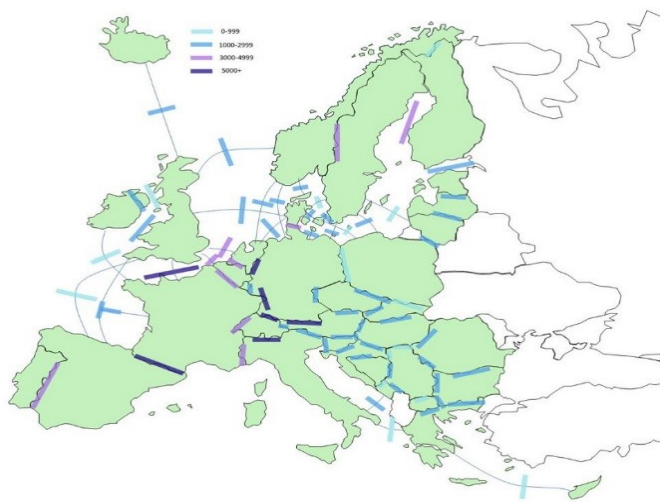
In 2006 the Spanish and Portuguese governments set the goal to reach 3000 MW of exchange capacity in the ES-PT border (in both directions) in order to reach a complete operational Iberian Electricity Market (MIBEL). It has been identified the need to have, in 2010, two new interconnections, one in the south and another in the north

In 2014 the new Southern interconnection Puebla de Guzmán (ES) – Tavira (PT) entered into full operation, reinforcing the capacity, mainly in the direction from Portugal to Spain, and reducing the congestion level in around 6%.

However, the Spain to Portugal direction still needs to overcome existing (and future) restrictions in the northern part of the border. In fact according to the market studies performed in TYNDP framework it is expected that this direction will be the most used in the following decade. Although the congestion rate in the Spain to Portugal direction in 2014 was low (4%), without this new project it can increase up to 17%-53% in 2030 (depending on the scenario), while with the new project the congestions are limited to 3%-9% in 2030 (depending on the scenario).

The Declaration of Madrid of the Energy Interconnection Links Summit among the Governments of France, Spain and Portugal, the EC and the EIB, highlights the urgency of implementing the already planned interconnections Portugal-Spain and Spain-France and conduct further investigations aiming at developing electrical interconnection projects in order to reach 8 GW capacity for the France-Spain border in order to meet the ambitious deadline of achieving the interconnection objective by 2020.

The GTC is common to all Visions, so a comparison between the ratio SEW/GTC only depends from the SEW values. The SEW reflects the benefit of a higher market integration provided by the increase of the interconnection capacity allowing a better optimization of the generation mix. For a GTC increase of 1 GW the ratio SEW/GTC is in the range 7 to 48 M€/GW/year (depending on the scenario).



## Project Cost Benefit Analysis

This project has been assessed by ENTSO-E in line with the Cost Benefit Analysis methodology, approved by the EC in February 2015.

The indicators B6/B7 reflect particular technical system aspects of projects based on a summation of qualitative performance indicators, in line with the CBA methodology; these cannot be used as a proxy for the security of supply indicator.

The assessment of losses variations induced by the projects improved in the TYNDP 2016 compared to the TYNDP 2014 with a comprehensive all year round computations on a wide-area model capturing all relevant flows.

The results must however be considered with caution and not totally reliable due to their very high sensitivity to assumptions regarding the detailed location of generation which are not secured.

General CBA Indicators	
Delta GTC contribution (2020) [MW]	PT-ES: [700 ; 1000]
	ES-PT: [1300 ; 1900]
Delta GTC contribution (2030) [MW]	PT-ES: [700 ; 1000]
	ES-PT: [1300 ; 1900]
Capex Costs 2015 (M€) Source: Project Promoter	128 ±12.8
Cost explanation	Uncertainty includes total length of lines, extra costs due to safety, and environmental or legal requirements imposed during permit grating process. The cost magnitude of the project (CAPEX cost) is of the same magnitude as in previous TYNDP.
S1	Negligible or less than 15km
S2	Negligible or less than 15km
B6	+
B7	++

Scenario specific CBA indicators	EP2020	Vision 1	Vision 2	Vision 3	Vision 4
B1 SoS (MWh/yr)	N/A	N/A	N/A	N/A	N/A
B2 SEW (MEuros/yr)	<10	40 ±10	60 ±10	10 ±10	70 ±10
B3 RES integration (GWh/yr)	<10	10 ±10	150 ±20	50 ±20	430 ±140
B4 Losses (GWh/yr)	25 ±25	75 ±25	100 ±25	75 ±25	100 ±25
B4 Losses (Meuros/yr)	1 ±1	4 ±1	4 ±2	4 ±2	6 ±2
B5 CO2 Emissions (kT/year)	300 ±60	500 ±100	300 ±100	±100	-300 ±100

In the Cost Benefit Analysis it was used the GTC increase upper limit (PT->ES 1000MW; ES->PT 1900 MW)

Savings in variable generation costs (SEW) in 2020 EP, 2030 V1 and 2030 V2 are caused mainly by a decrease of CCGTs in Portugal compensated by an increase of coal in Spain and Central Europe (In 2020 EP, 2030 V1 and 2030 V2 generation from coal is cheaper than from gas due to the fairly low CO2 prices). This situation results in a global increase of CO2 emissions as the CO2 emission factor is higher for coal when compared with gas..

In 2030 V3 and V4 the SEW benefits are caused by a decrease of CCGTs in Portugal compensated by an increase of less expensive technologies like nuclear and renewables. This situation results in a global decrease of CO2 emissions. In every scenario Portugal continues to be a net importer and Iberian Peninsula (mainly Spain) reduces spillage.

In addition, SEW in 2020 is lower than in 2030 due to less potential for optimization of unit commitment, and less gas to be substituted by coal and is higher in the 2030 top-down visions, especially in V4 which imply higher efficiency of a European common approach for optimizing the location of RES versus national and independent approaches of RES policies.

The project does not contribute to avoid ENS at national level (as scenarios, according to ENTSO-E assumptions, are build to fulfil adequacy requirements) nor at local level in the area of the connection points. However a higher meshing in Iberian Peninsula would improve the overall system security and its robustness from the dynamic point of view.

The project's SEW accounts for saving in generation fuel and operating costs. The project could also enable savings avoiding investments in generation capacity, in particular for projects connecting electric peninsulas. The aspect has not been considered in the CBA methodology

Complementary information about the border on which the project is located	Vision 1	Vision 2	Vision 3	Vision 4
Average marginal cost difference in the reference case [€/MWh]	0.54	1.18	0.48	2.08
Standard deviation marginal cost difference in the reference case [€/MWh]	3.65	6.23	5.31	11.39
Reduction of marginal cost difference due to all mid-term and long-term projects [€/MWh]	4.96	8.37	4.10	8.92