RED ELÉCTRICA DE ESPAÑA

# INFLUENCE OF INTERCONECTIONS ON MARKET PRICE. Case study: Spain

3th November 2017

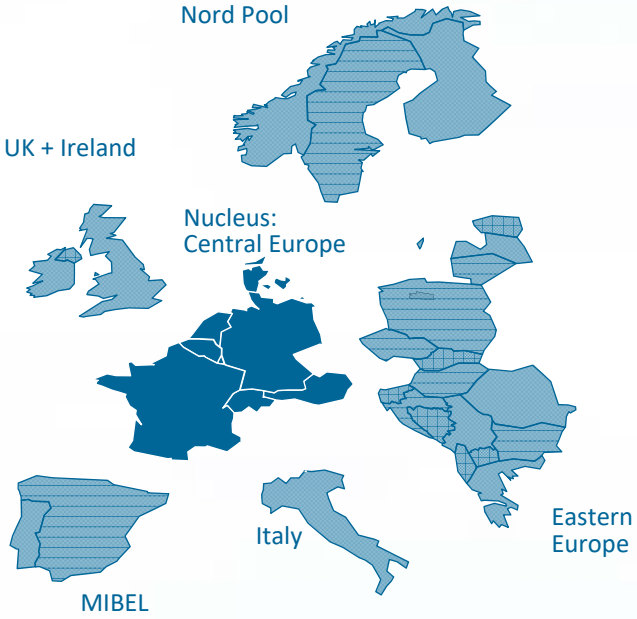
# Introduction

## Background

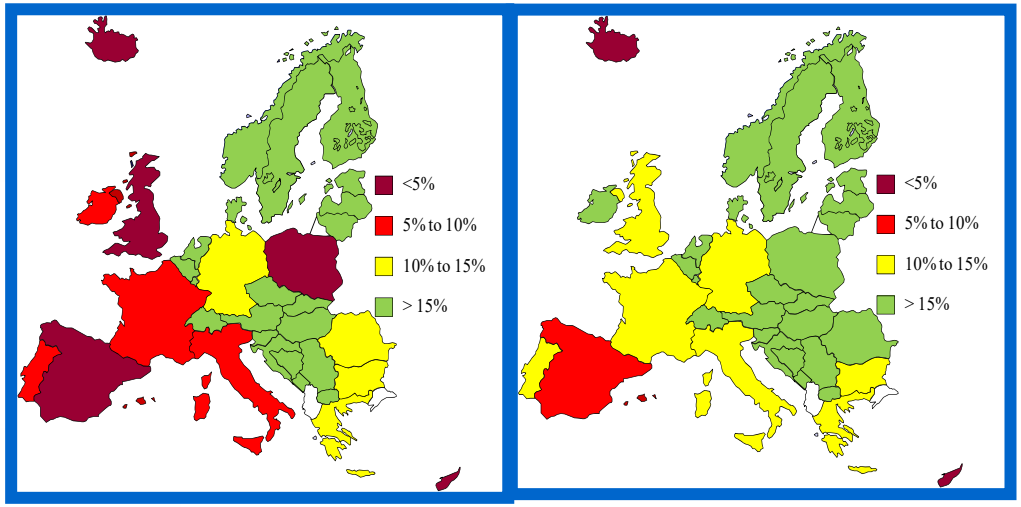
- The European Commission is encouraging Member States to increase electricity interconnection with the aim of promoting a more efficient single electricity market and integrating renewable energy sources.
- Unfortunately the Iberian Electricity Market (MIBEL), despite the fact that the capacity of interconnection between France and Spain has increased in the last few years, it is still far from the goals established in the 2015 Madrid Declaration.
- Red Eléctrica de España (REE), the Spanish TSO, has the responsibility, to develop the interconnections, as well as, to manage the system so that it operates in secure and reliable conditions, thus integrating renewable energy sources.
- In this context, this study analyzes the impact of the lack of interconnection capacity on electricity market prices.

# Introduction

## Interconnection Capacity in Europe




% Import capacity/Generation capacity




2011 2020

Source: "ENTSO-E 10-Year Network Development Plan 2012 Project for consultation" www.entsoe.eu

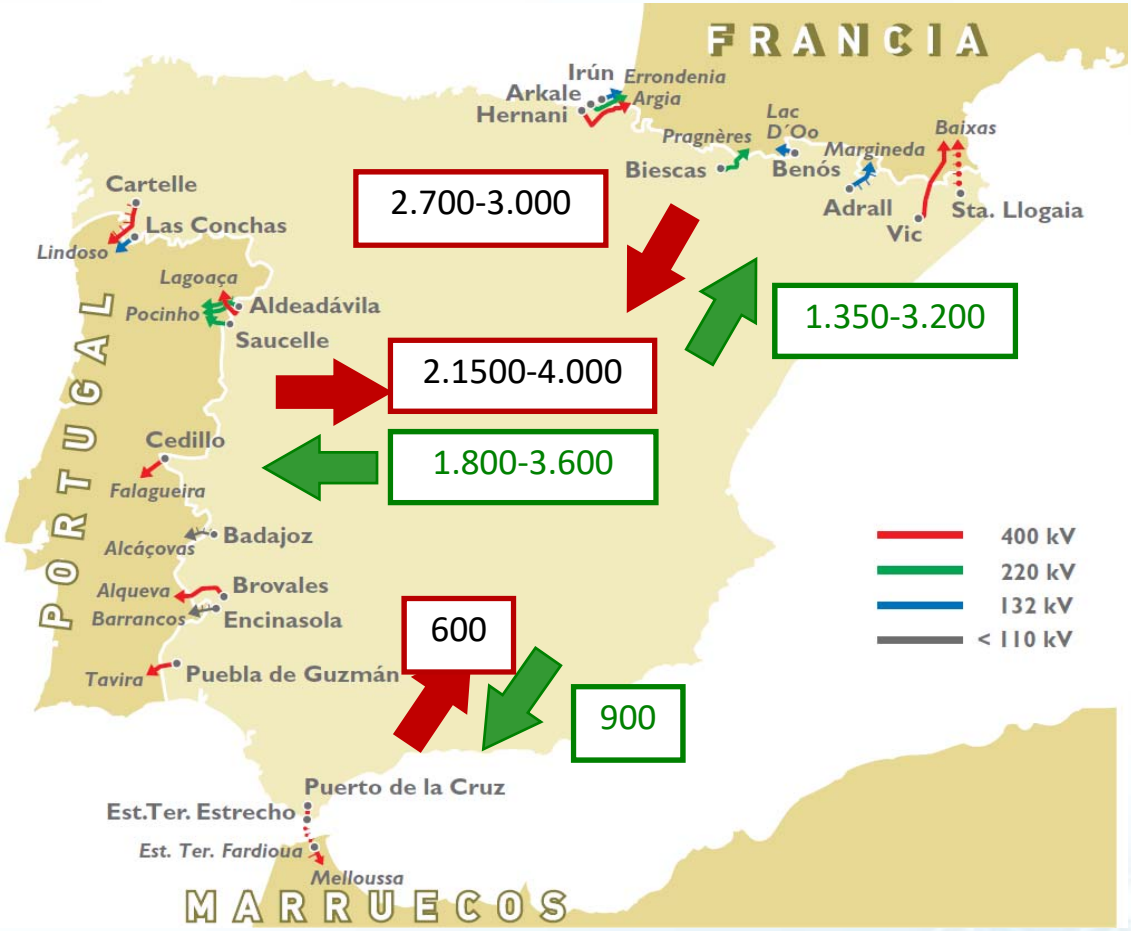
One nucleus + 'satellites'

Insufficient import capacity

Iberian peninsula is an 'energy island'

# Introduction

## Commercial Exchange Capacities (MW). Typical Ranges




- *In specific situations, normally linked to the unavailability of certain elements in the transmission grid, capacity values may appear which are lower than the ranges shown.*
- *These values are not contemplated due to their low frequency of appearance and representativeness.*
- *Maximum values under ideal conditions in both electricity systems.*

http://www.ree.es/en/activities/operation-of-the-electricity-system/international-interconnections

# Brief description of the analysis

- The evolution of Iberian Market prices depends on:
  - The hourly mix of generation.
  - The market conditions and the real capacity of the interconnections.

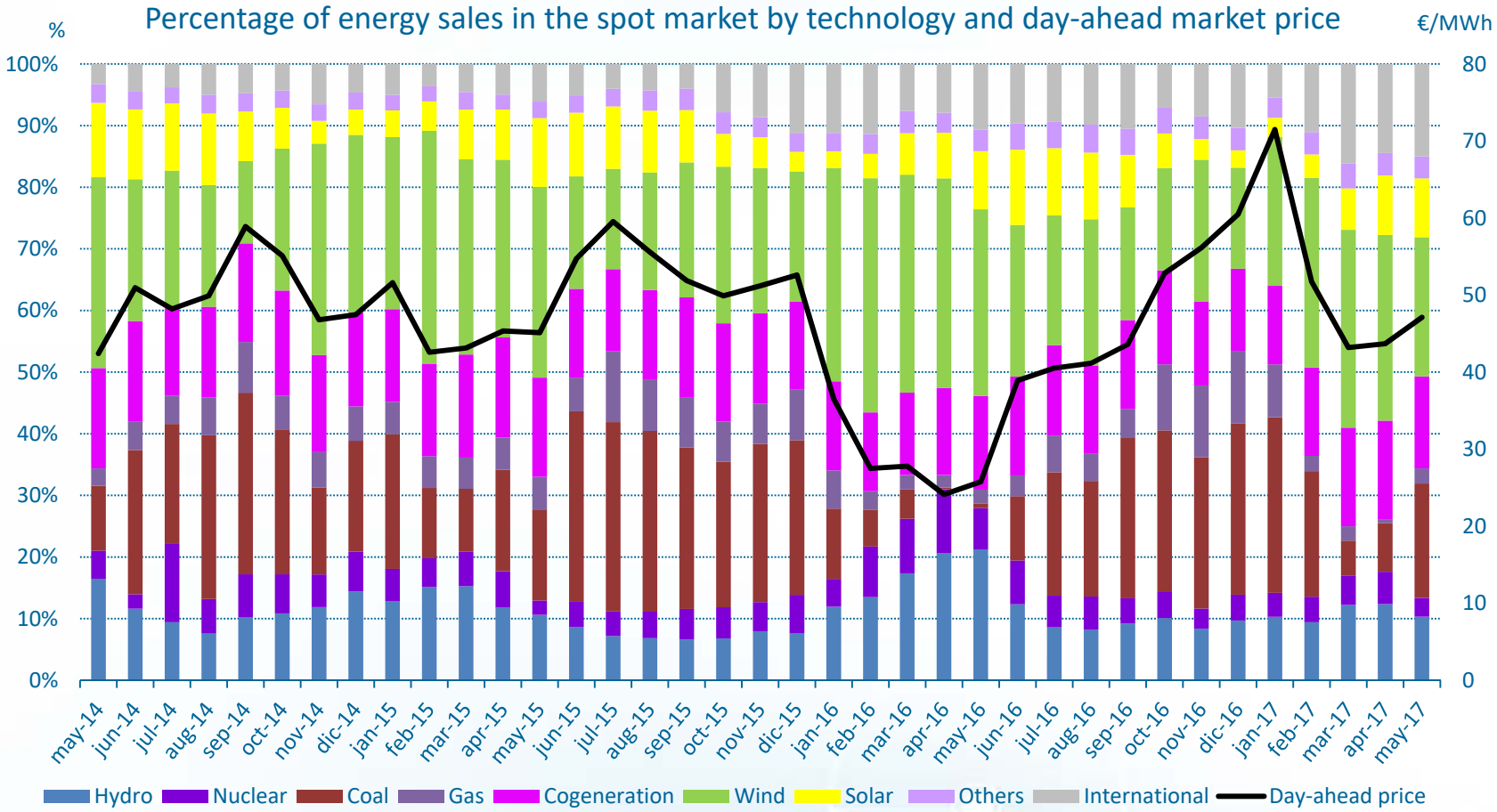
The period of the analysis has been selected from May-2014 to May 2017:

Main events:

- May 2014. Starting of PCR initiative
- October 2015. Commissioning of new ES-FR interconnection
- November 2016. Nuclear outages in France

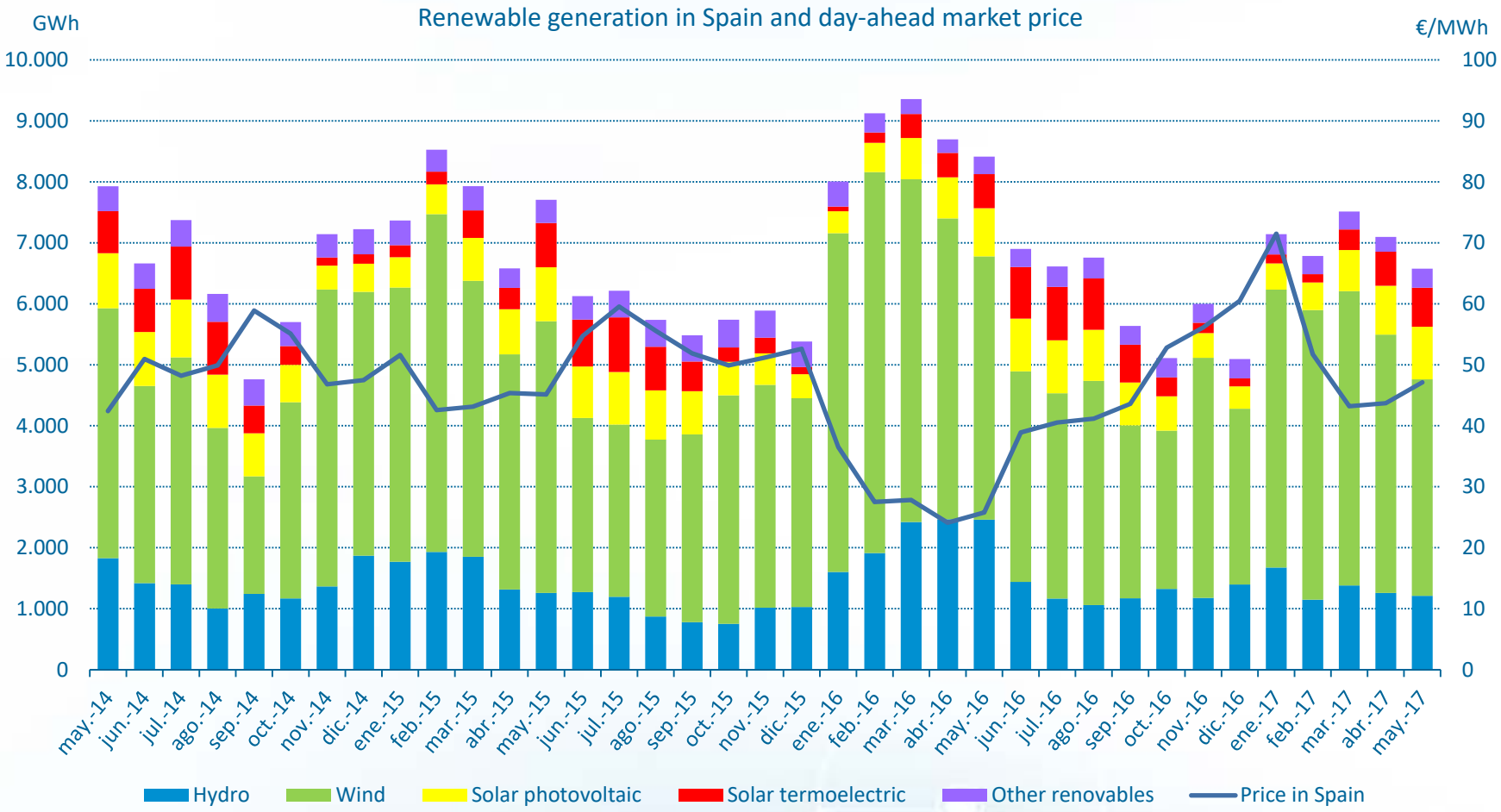
# Brief description of the analysis

## Market behavior: generation mix and price



# Brief description of the analysis

## Market behavior: impact of renewable energy technologies



# Brief description of the analysis

- The evolution of Iberian Market prices depends on:

  - The hourly mix of generation at every hour.

  - The market conditions and the real capacity of the interconnections.
    - Focus on the exchanges France-Spain
    - Market coupling

The period of the analysis has been selected from May-2014 to May 2017:

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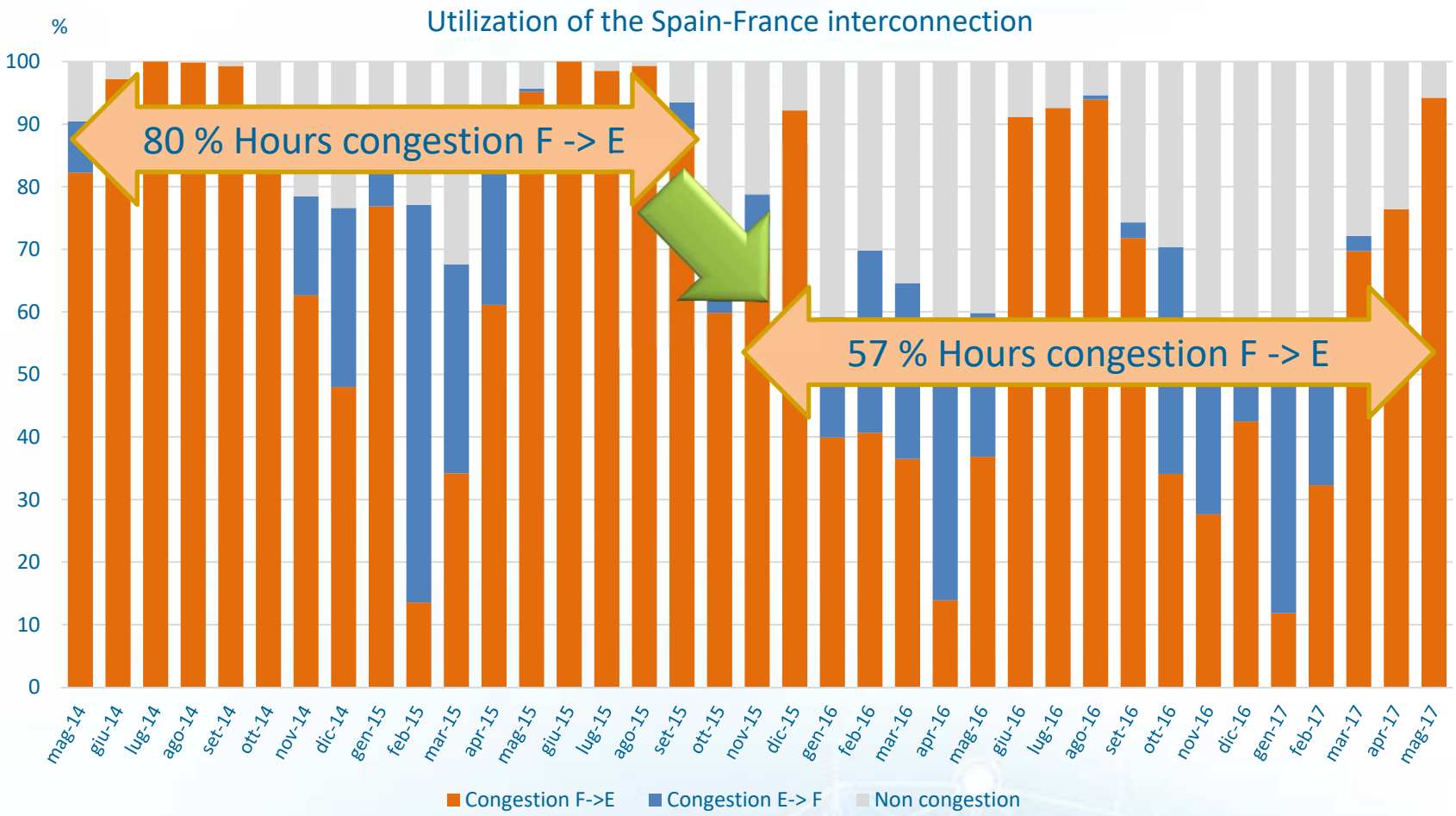
# Brief description of the analysis

## Use of interconnection: congestions France→Spain



# Brief description of the analysis
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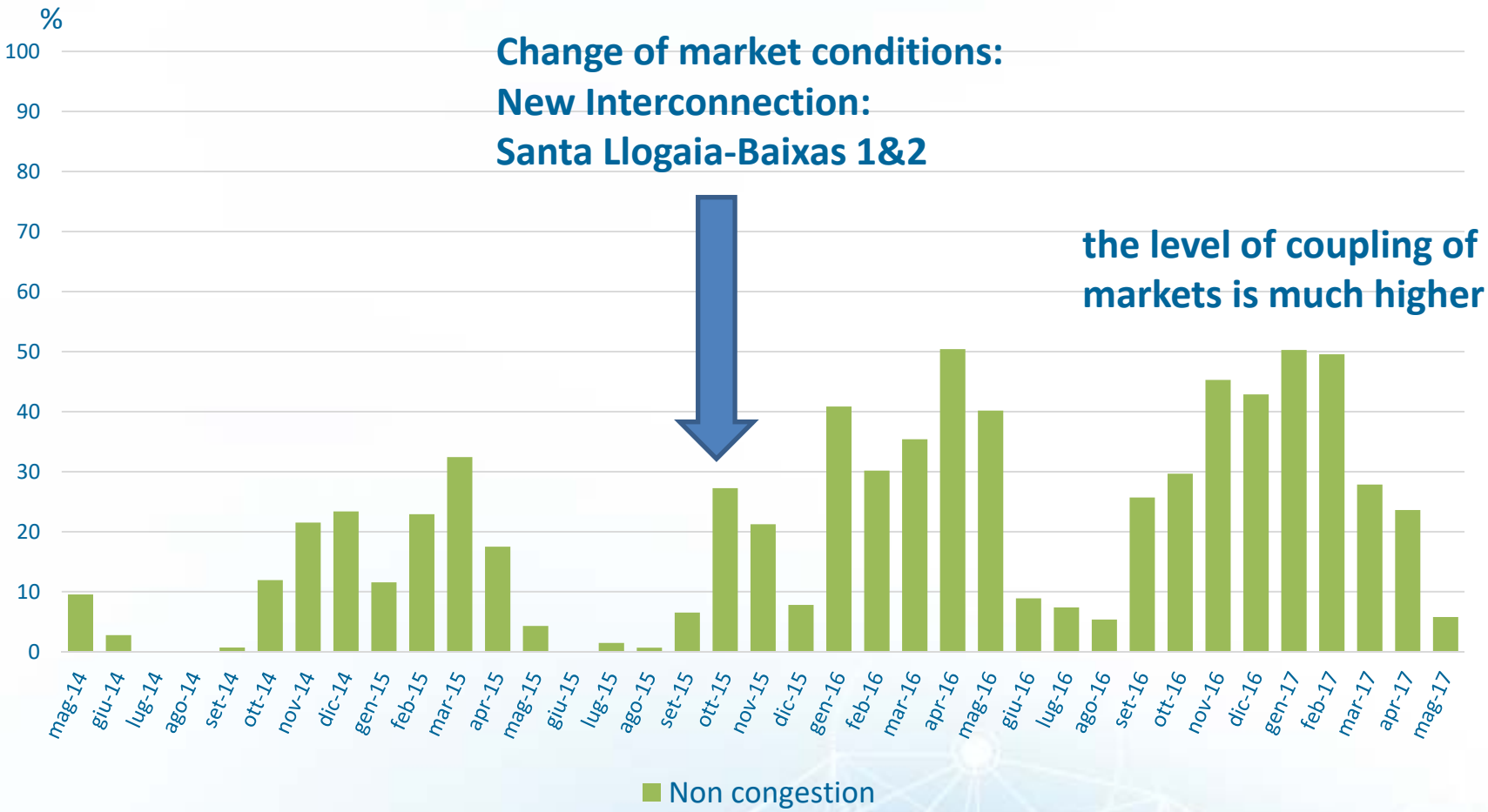
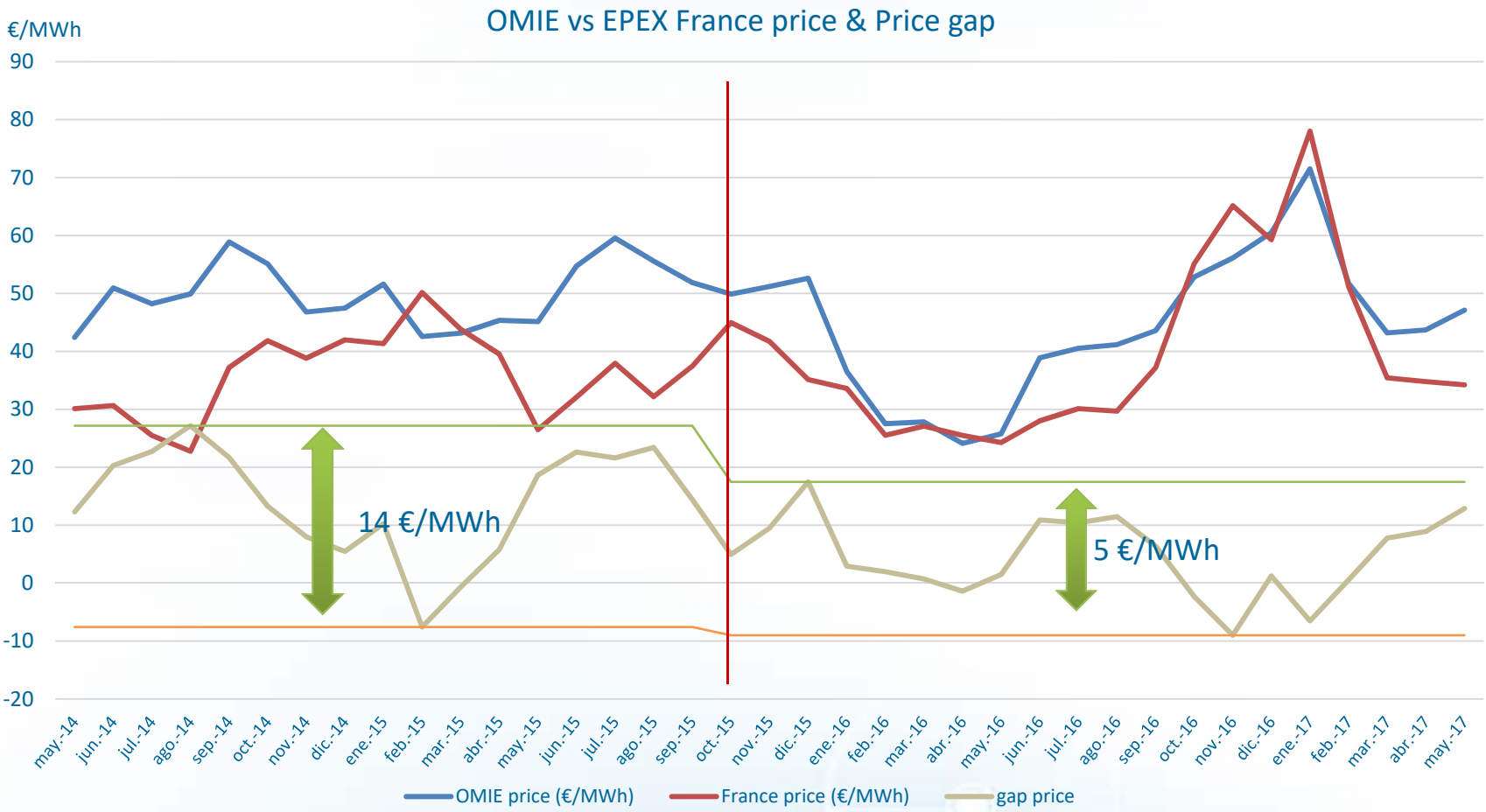
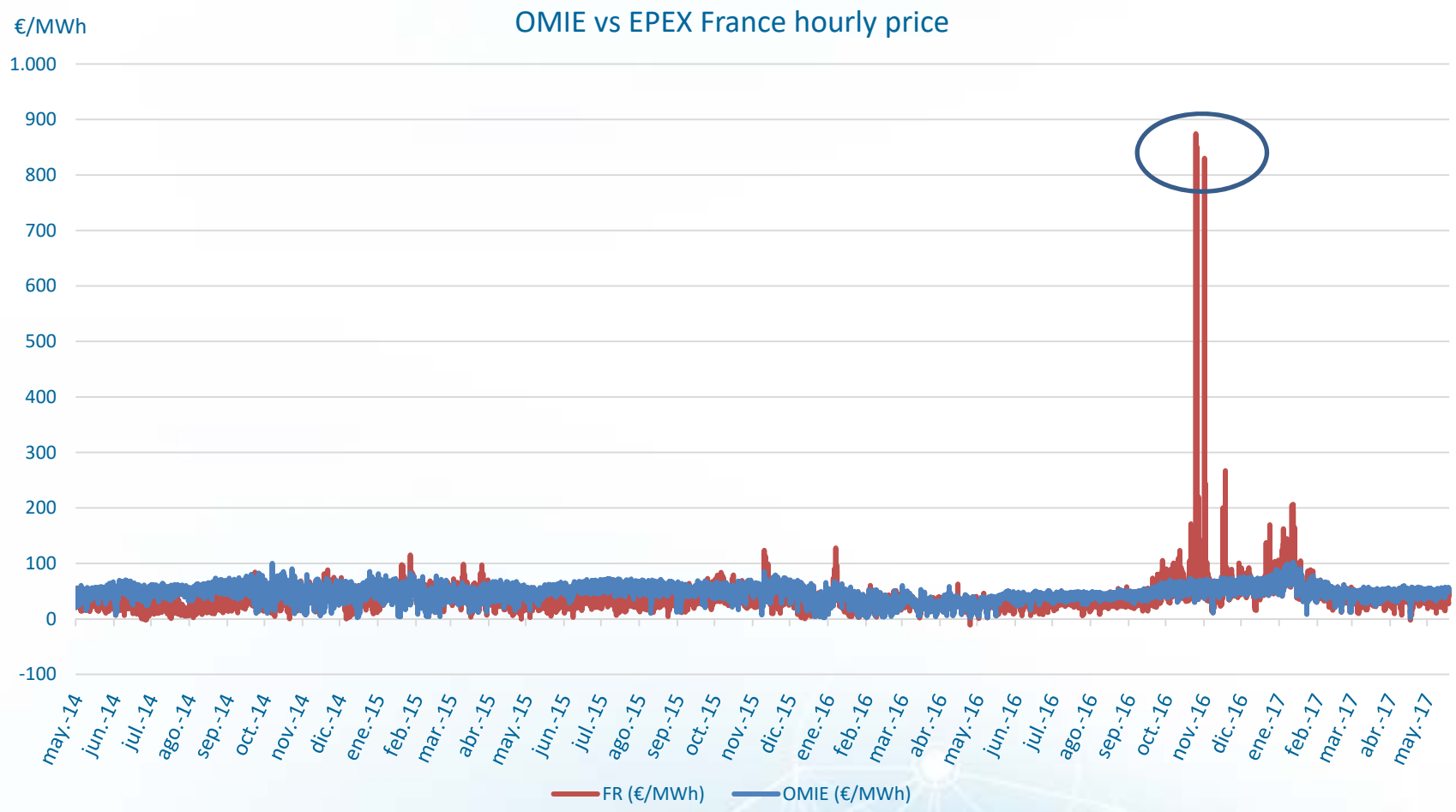


# On the way to a real European market.
## Price spread.



# On the way of to a real European market.
## Hourly prices in Spain and France: outlier



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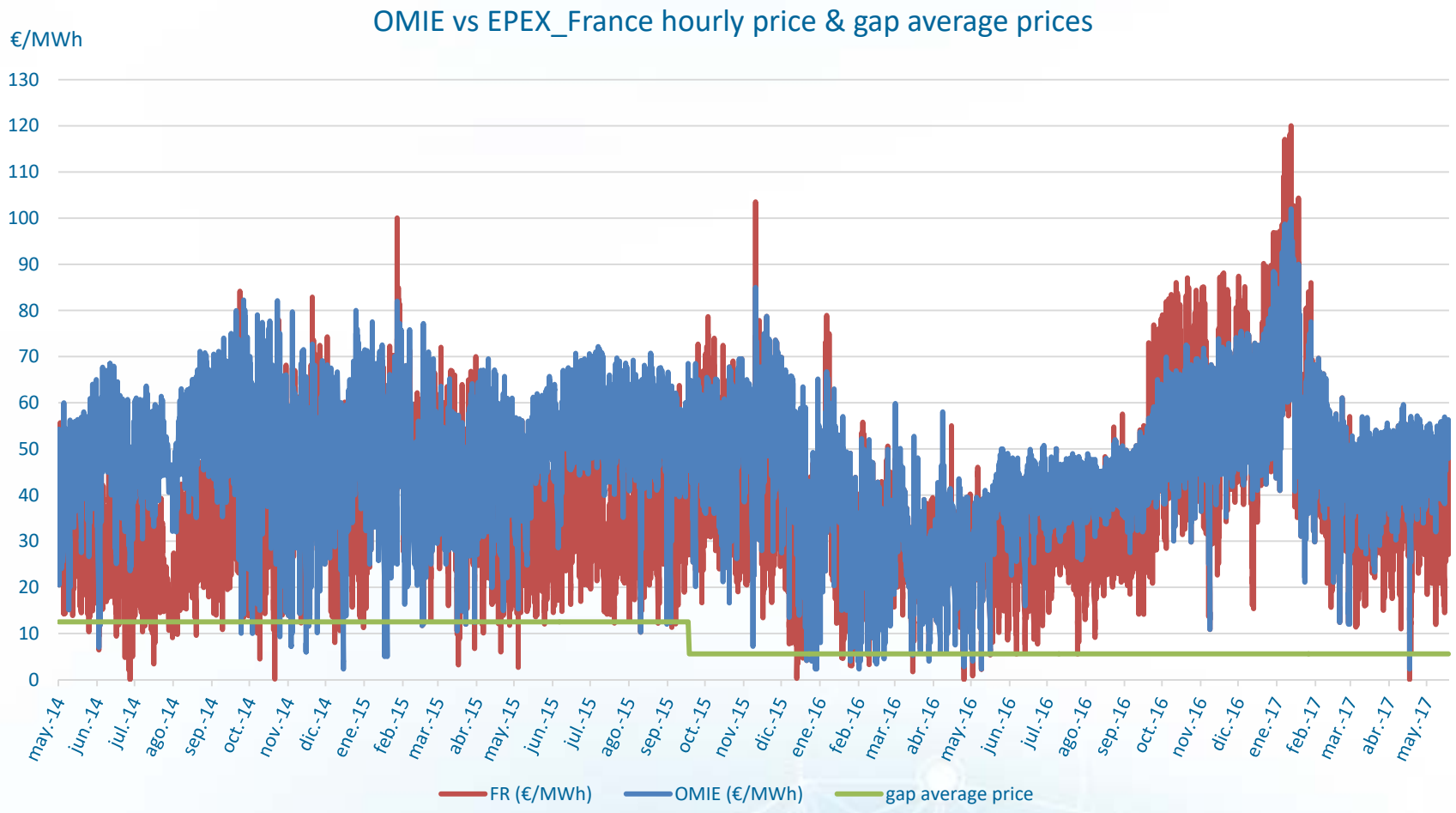


# Explanation of prices evolution.
## Model Specification

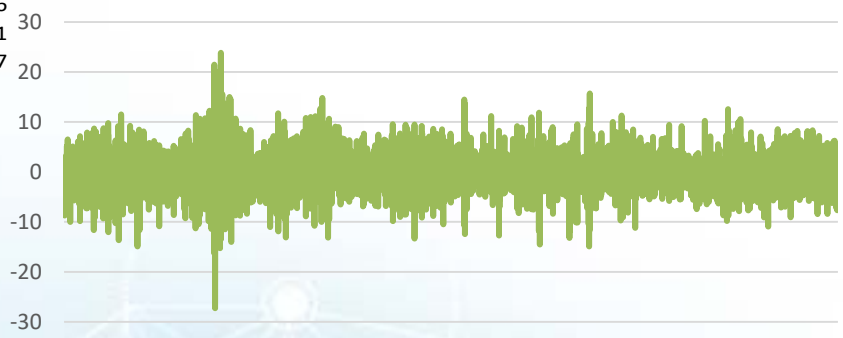
- Econometric model in which the spot prices evolution is explained as the a function of the following variables:
  - Constant that represents an average price reference
  - Price in France
  - Renewable non-hydro generation
  - Coal generation
  - Change in market conditions
  - Hydro reserves
  - The impact of the situation of nuclear power plants in France
  - The consumption in the market
  - An Autoregressive variable to take into account short-term dynamics of prices

# Explanation of prices evolution.
# Model Specification

Dependent Variable: OMIE_PRICE
Method: Least Squares
Sample: 5/14/2014 00:00 12/31/2017 23:00 IF HORAS_CONG=100
Included observations: 17853
Convergence achieved after 11 iterations

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 30,13085 | 1,679691 | 17,93833 | 0 |
| EPEX_FR_PRICE | 0,085908 | 0,004691 | 18,31224 | 0 |
| RENEW_NON_HYDRO | -0,001878 | 3,39E-05 | -55,35796 | 0 |
| COAL | 0,000658 | 4,97E-05 | 13,23673 | 0 |
| CHANGE_CAPACITY | -12,23104 | 0,471562 | -25,93727 | 0 |
| RESER_HYD | -1,06E-06 | 1,36E-07 | -7,836877 | 0 |
| UA_NUCLEAR_FR | 1,730821 | 0,750174 | 2,307228 | 0,0211 |
| CONSUMP_PBC | 0,002652 | 2,80E-05 | 94,78649 | 0 |
| AR(1) | 0,913119 | 0,003028 | 301,5691 | 0 |

| | | | |
|---|---|---|---|
| R-squared | 0,958231 | Mean dependent var | 49,4248 |
| Adjusted R-squared | 0,958212 | S.D. dependent var | 11,19083 |
| S.E. of regression | 2,287647 | Akaike info criterion | 4,493429 |
| Sum squared resid | 93383,52 | Schwarz criterion | 4,497356 |
| Log likelihood | -40101,59 | Hannan-Quinn criter. | 4,494721 |
| F-statistic | 51169,78 | Durbin-Watson stat | 1,702147 |
| Prob(F-statistic) | 0 | | |



# Results of the analysis

- During a period of around 67 % of the hours, on average, there have been import congestions.
  - The price spreads between the Iberian Electricity Market and the rest of European Markets, are significantly higher than the spreads among the rest of European countries, except Italy.
  - Prices in France are, on average, are around 8.5 €/MWh lower than prices in Spain.
  - According to the simulation results, we have estimated that the range of prices in the Iberian Electricity Market could be reduced and approached to prices in the rest of European Markets. The price spread will tend to converge.
- Regarding exports, the hours with congestion are lower than in the importing cases, more or less 13% of the hours. These hours matched with the period of highest availability of renewable generation. Therefore, only when both factors come together, the prices of the Iberian Market are lower than the prices in the rest of Europe.
- In fact, the increase of the interconnection capacity will allow larger integration levels of RES in Europe and a much more competitive market.

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Thank You