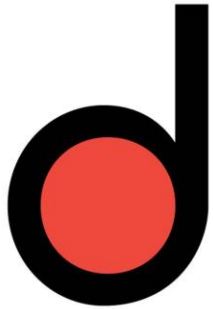# Electricity Market Trading

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In consultation with Delaware
Consulting Group

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Brief Introduction **1**

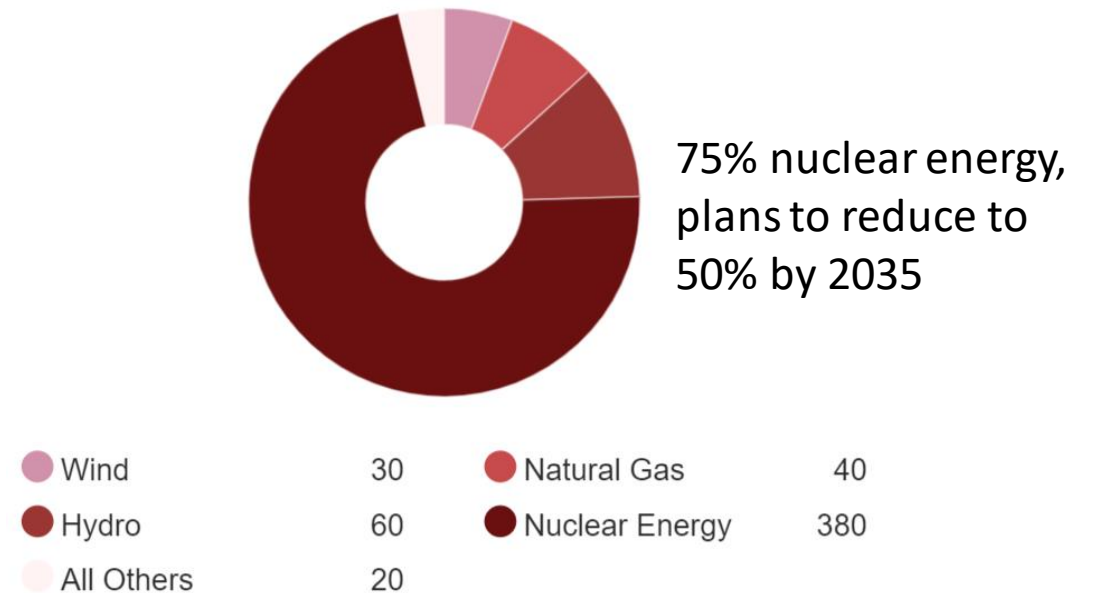**2** Methodology

Results **3**

4 Business Impact

Introduction

French electricity market:

- Trading of Electricity happens on **›epexspot**

- EPEX is a market for power spot trading in Europe operating in Germany, France, the U.K., BENELUX, Austria and Switzerland

- Market participants include energy generators, energy suppliers and traders (who help to ensure market liquidity)

French Electricity Sources, 2017

75% nuclear energy, plans to reduce to 50% by 2035

|			
Wind	30	Natural Gas	40
Hydro	60	Nuclear Energy	380
All Others	20		

RTE France, 2017 generation data

Market Design

DayAhead:
- One day before delivery
- Submit orders until 12 PM day ahead
- Needs to be in balance at end of day
- Coupled with other markets zones

IntraDay:
- Traded on delivery day
- Continuous Market
- Corrects for shifts in day ahead nominations

Market design

IÉSEG
SCHOOL OF MANAGEMENT
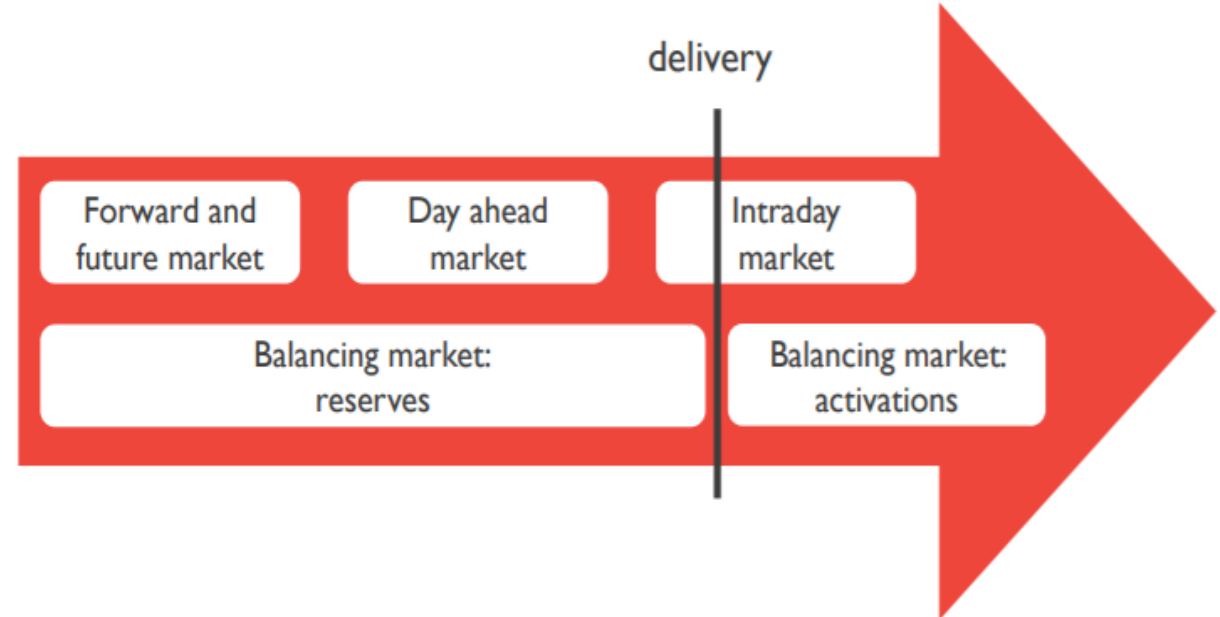
Managerial Problems

1. How can we trade between the day ahead and the intraday market?

2. Hard to predict price fluctuation (many factors have influence)

3. Decision between DayAhead and IntraDay can be very costly if not analyzed closely

4. Must develop a model and strategy to **maximize profit**
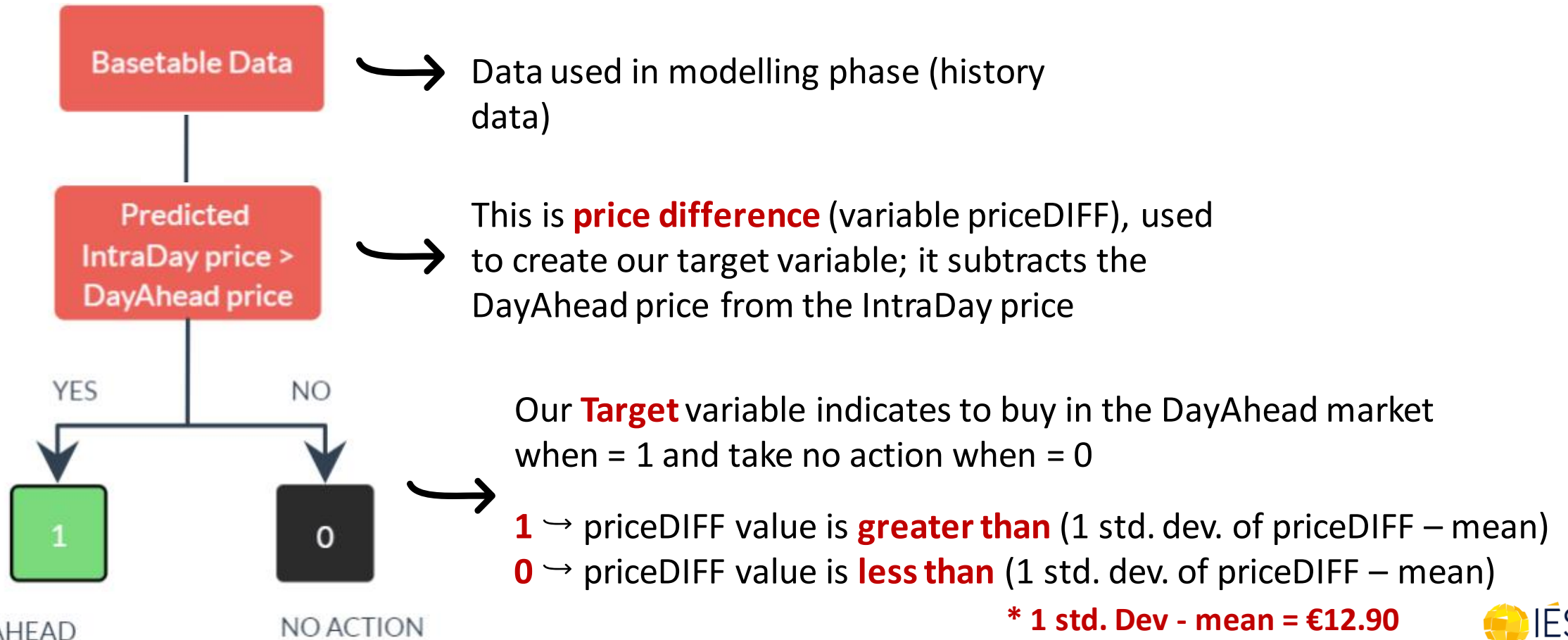
Data Sources

1. epexspot
Electricity market data

2. WORLD WEATHER ONLINE
Weather data

3. NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Weather data

4. PUBLIC HOLIDAYS GLOBAL
Calendar and holiday data

5. entsoe   European Network of Transmission System Operators for Electricity
Electricity market data

Trading Strategy

Basetable Data → Data used in modelling phase (history data)

Predicted IntraDay price > DayAhead price → This is **price difference** (variable priceDIFF), used to create our target variable; it subtracts the DayAhead price from the IntraDay price

YES   NO

1

0 → Our **Target** variable indicates to buy in the DayAhead market when = 1 and take no action when = 0

BUY DAYAHEAD   NO ACTION

1 ↪ priceDIFF value is **greater than** (1 std. dev. of priceDIFF – mean)
0 ↪ priceDIFF value is **less than** (1 std. dev. of priceDIFF – mean)

* 1 std. Dev - mean = €12.90

Trading Strategy

Our focus: buying in the **DayAhead** market

Profit calculation = *Profit with model – Profit without model*

Total net **priceDIFF** of positive predictions (April – Dec 2018) - (trading fee * # of positive predictions April – Dec 2018)
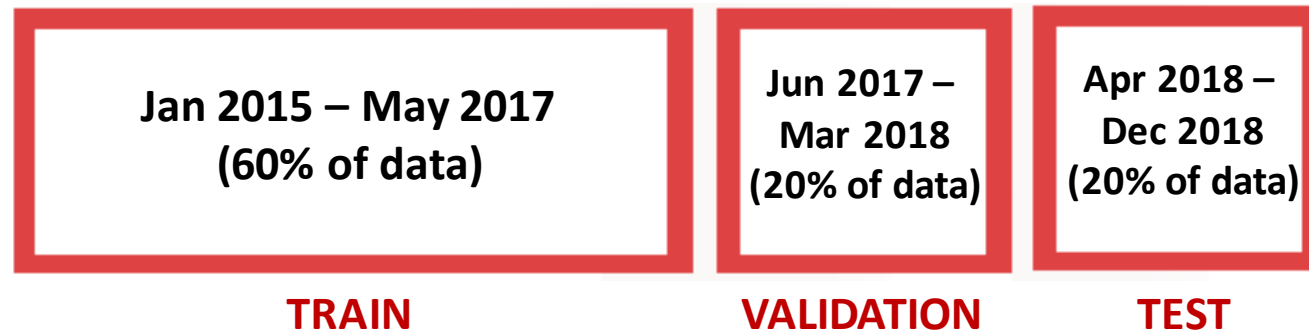
Total net **priceDIFF** of all days (April – Dec 2018) - (trading fee * # of days April – Dec 2018)

Methodological Approach

1. Data specifics

- Gathered external data (weather, weekends, holidays)
- Evaluated 4-year period (Jan 2015 – Dec 2018)

Jan 2015 – May 2017 (60% of data)	Jun 2017 – Mar 2018 (20% of data)	Apr 2018 – Dec 2018 (20% of data)
TRAIN	**VALIDATION**	**TEST**

2. Modelling specifics

- Classification (predicting price difference increase/decrease)
- Logistic regression, XGBoost
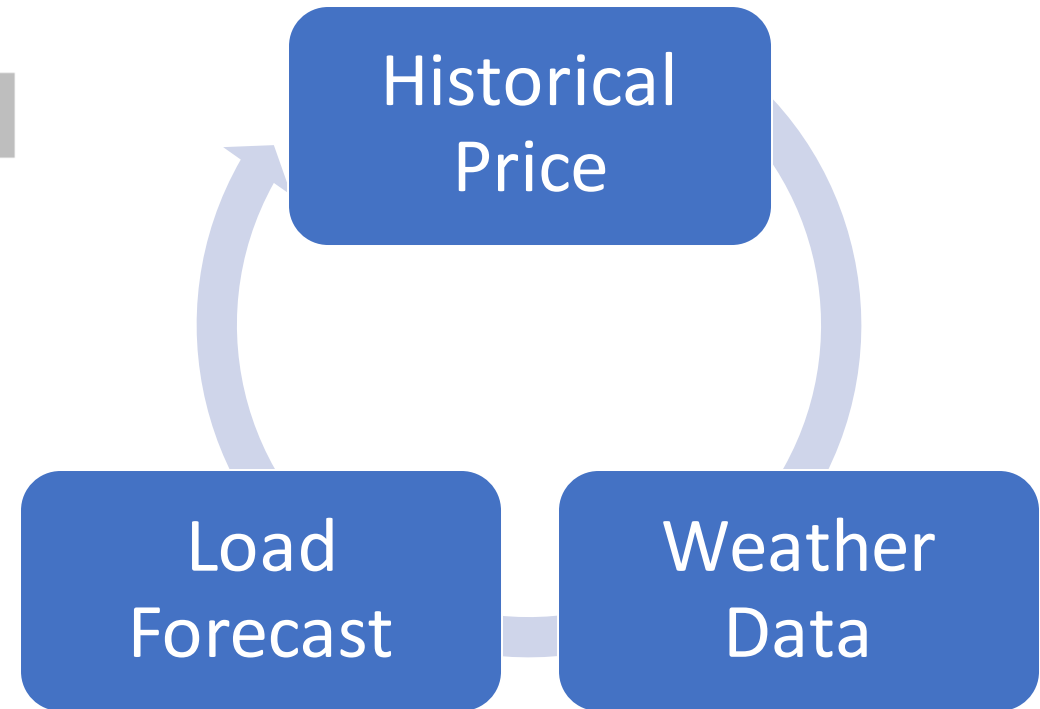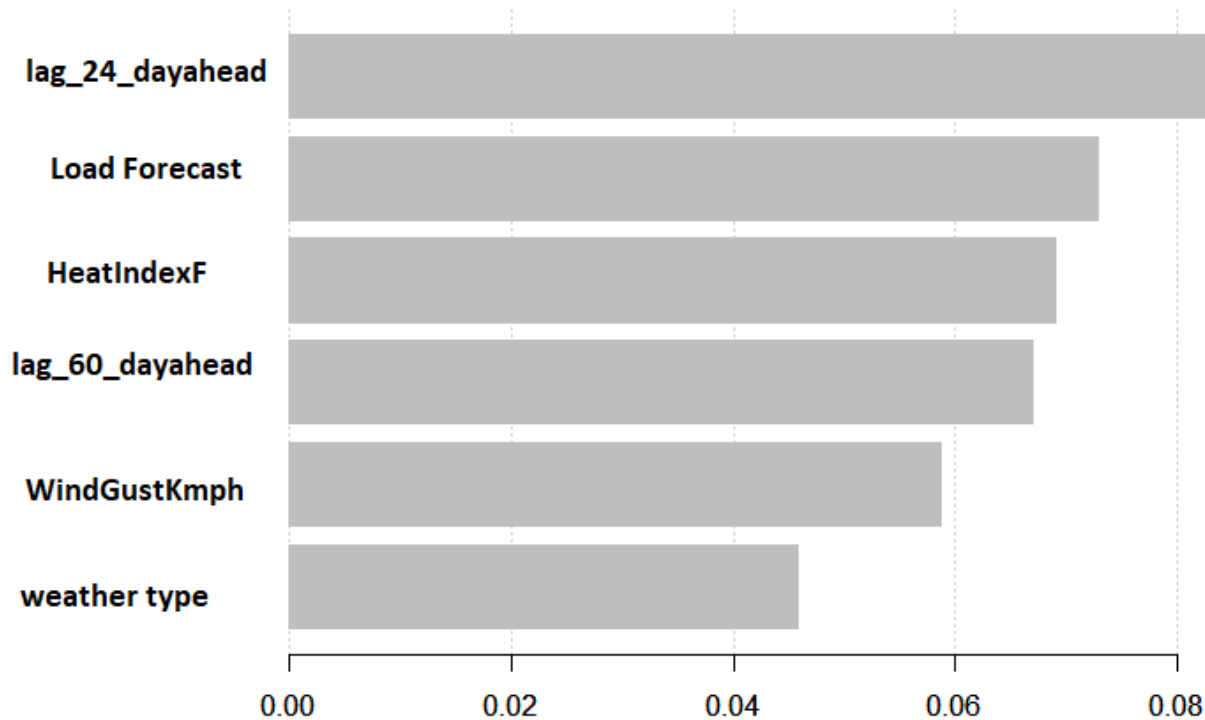- Evaluation metrics used : AUC and F1 Score

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Results Validation

Model Type	Price diff Cut-Off	AUC
Logistic Regression	12.9	.59
XGBoost	12.9	.52

*Higher AUC = better accuracy in predicting price increase/decrease

Therefore, we selected **LOGISTIC REGRESSION** as our best model!

Variable Importance

Most important Variables:

Business Impact

Profit with model   **€ 1,256**

Profit without model   **€ 363**

Monetary gain from model   **€ 893**

Assumptions:
- Each time buying 1 unit (1MWh)
- Trading fee = €0.07 per transaction

Therefore, trader can expect to increase profits in the DayAhead market by **246%** from using the logistic classification model

Business Impact

Demo: Further evaluation + visualization of data done through our R Shiny APP

It covers some of the following:

- If price simulator
- Wind energy forecast
- IntraDay/DayAhead price

https://cyberchain.shinyapps.io/delaware_hackathon/

Thank you !