

Windy Willow

IE MBD

STREAM PROCESSING AND REAL-TIME ANALYTICS

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Allison Black, Dennis Pedersen, Eleonora Jimenez, Georgy Eremin, Leonard Valencia, Rayan Alghamdi

pipeline

01

Turning wind
into electricity

02

Business
case

03

Architecture

04

Why we need
streaming data

05

Live demo with
visualizations

06

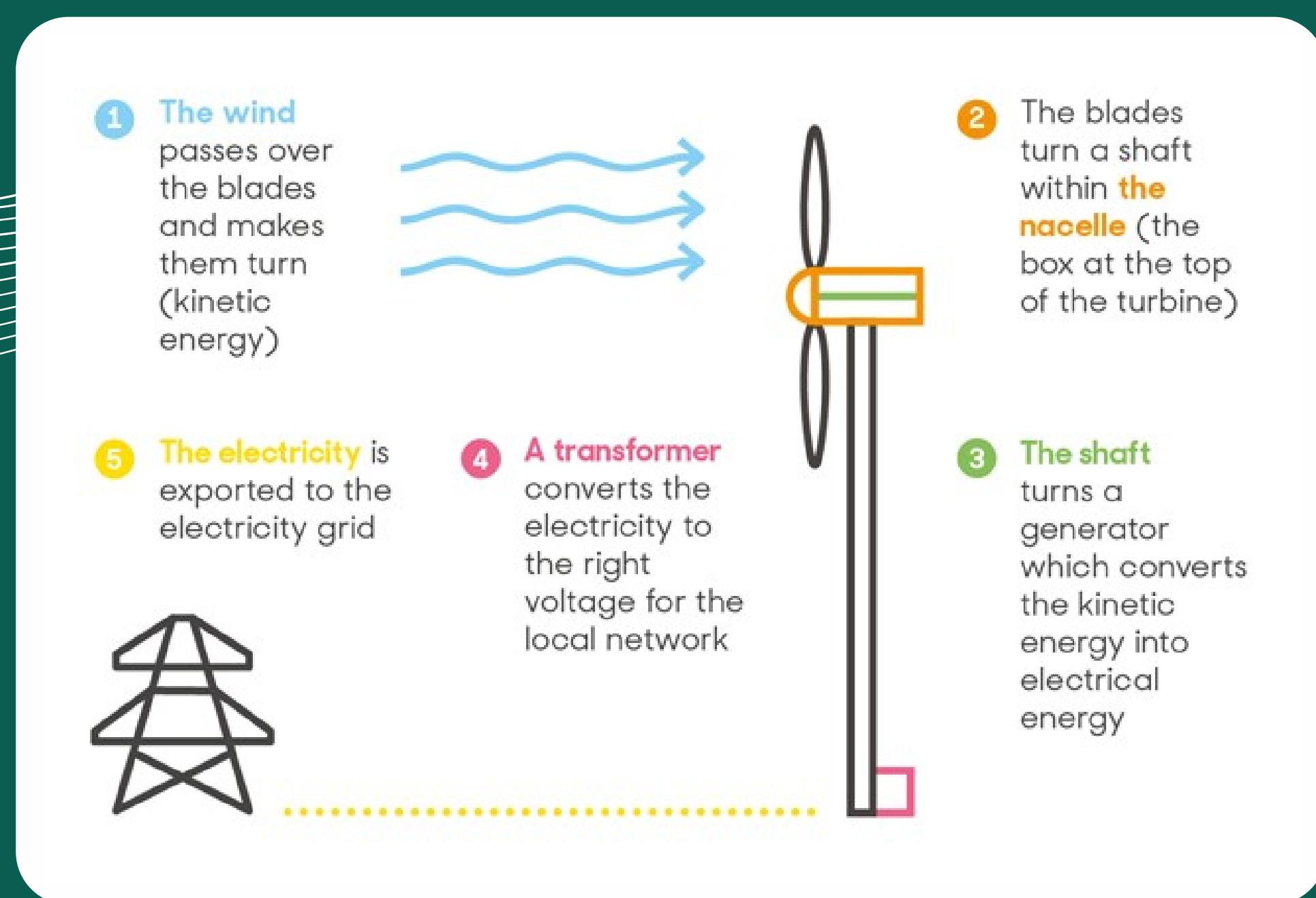
Business results &
the future



How do we turn wind into electricity?



Wind turns the propeller-like blades of a turbine around a rotor, which spins a generator, which creates electricity.

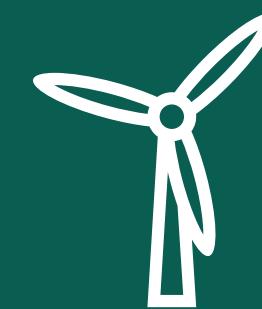


Wind Industry

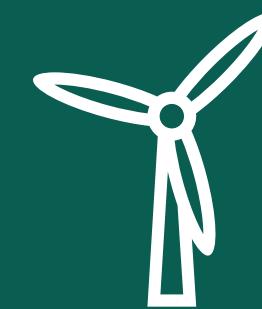
WIND ENERGY
ACCOUNTED FOR 15% OF
EUROPE'S ELECTRICITY
CONSUMPTION IN 2019



Free, unlimited
resource



Non-polluting



Opportunities
are on the rise

Problem

Wind farms are missing out on potential revenue for two main reasons

PPA

- It's a "buyer's market"
- All electricity goes to the buyer
- 10-20 year commitment
- PPA rates can be 30-40% less than the spot market
- Windy Willow does not make more money if the price of electricity goes up
- Carbon dioxide credits go to the buyer, NOT the wind farm

Maintenance

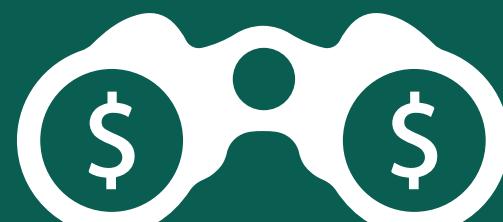
- tens of thousands of euros per year per wind turbine
- money lost when turbines aren't working
- if turbines aren't shut down in time, high damage costs are incurred

Solution

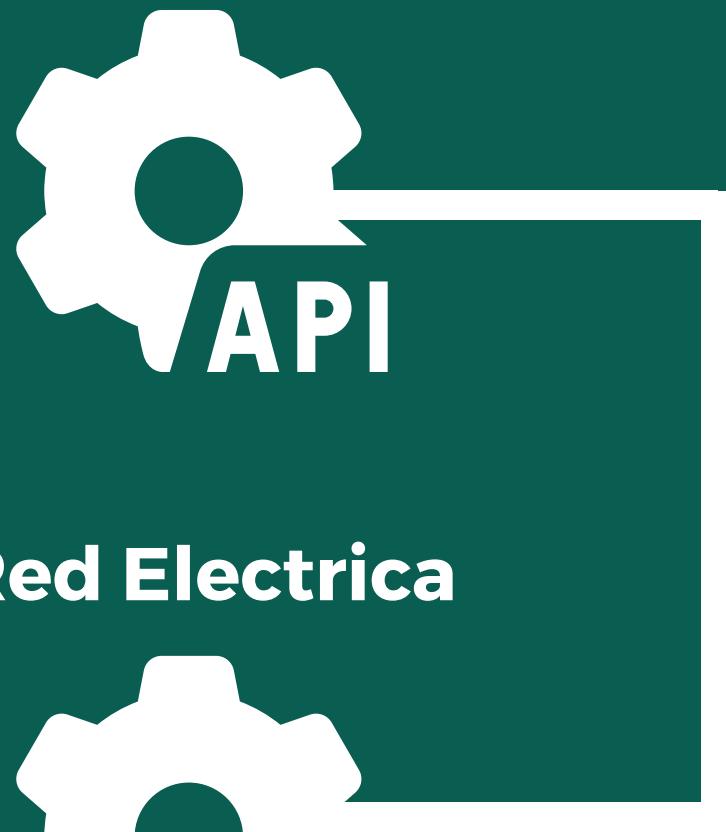
Windy Willow sells electricity to independent bulk buyers and to the wholesale market. Streaming data helps us decide when and to whom we sell.

Architecture

Price Forecast



Wind Generation



Red Electrica



Python Script
(Wind Producer)

Spark
Streaming



Data Sources - Ingestion - Processing - Storage - Serving

*Future architecture

Why do we need streaming data?

01

DATA-DRIVEN BUSINESS DECISIONS

Sell or store electricity? Call the insurance or shut down the machines?

02

MAXIMIZE HIGH-VALUE TRANSACTIONS

We can be more selective as to whom we do business with

03

TURBINE MAINTENANCE

Near real-time alerts allow for quicker maintenance and reduced costs



Live Demo

The tablet screen displays a live demo of a data pipeline. It includes:

- A terminal window for "windProducer" showing log output:

```
ing line', '12/01/20 8:15,2229\r\n')
ing line', '12/01/20 8:20,2201\r\n')
ing line', '12/01/20 8:25,2137\r\n')
ing line', '12/01/20 8:30,2111\r\n')
ing line', '12/01/20 8:35,2070\r\n')
ing line', '12/01/20 8:40,2045\r\n')
ing line', '12/01/20 8:45,2048\r\n')
ing line', '12/01/20 8:50,2073\r\n')
ing line', '12/01/20 8:55,2080\r\n')
ing line', '12/01/20 9:00,2107\r\n')
ing line', '12/01/20 9:05,2136\r\n')
ing line', '12/01/20 9:10,2151\r\n')
ing line', '12/01/20 9:15,2229\r\n')
ing line', '12/01/20 9:20,2276\r\n')
```

- A terminal window for "forecastProducer" showing price data:

Timestamp	Price	eur
12/01/20 4:00	32.2	eur
12/01/20 5:00	39.52	eur
12/01/20 6:00	39.39	eur
12/01/20 7:00	32.98	eur
12/01/20 8:00	30.37	eur
12/01/20 9:00	39.39	eur

- A Tableau dashboard titled "Tableau - tableau_demo" showing a line chart of "Wind Generation" over time. The chart has a Y-axis scale from 0K to 1K and an X-axis showing hours from 1 AM to 9 AM. The chart shows a fluctuating line with several peaks and troughs.



Business Results

How does Windy Willow measure up?

Streaming data means more revenue and less maintenance costs!

revenues: price
of wind power

costs:
maintenance

extra value
captured

Windy Willow: Streaming Data & No PPA

average yearly price:
€40.33 (+13%)

**30% cost savings & hours of
O&M time saved**

up to 30% increase in profits



Future

- More sensors on turbines (up to 200) will provide more precise information for maintenance
- Windy Willow Software: Take our architecture and scale it for other wind farms. Individual wind farms can join our "network" and benefit from aggregated data.

Global Results

- If wind farms are more profitable, there will be more wind farms, more power generated from wind, and therefore less reliance on fossil fuels.

Team C: Allison Black, Dennis Pedersen, Eleonora Jimenez, Georgy Eremin, Leonard Valencia, Rayan Alghamdi

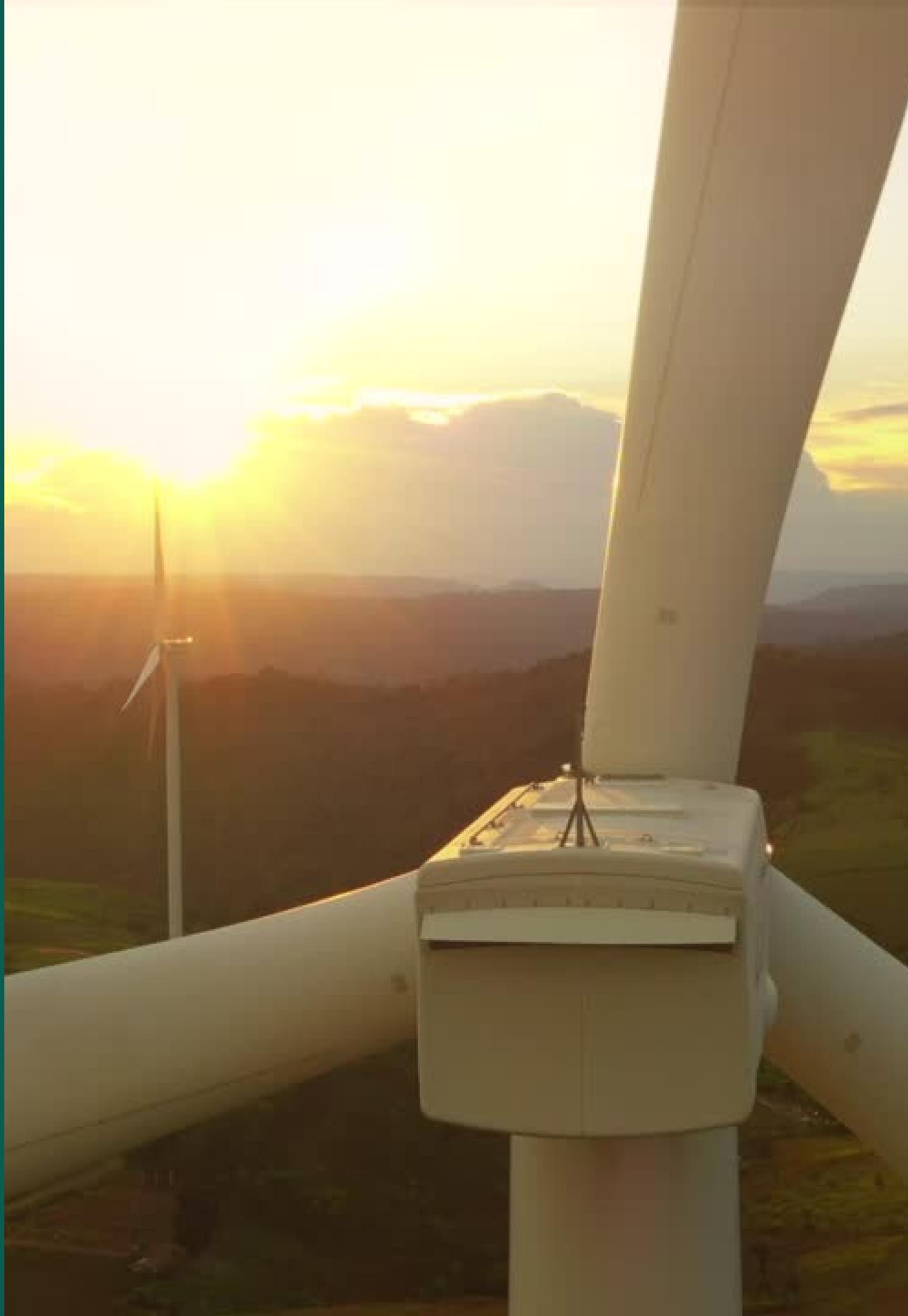
Thank you!



Questions & Answers

Duration 5 minutes

If possible, please submit your
questions via the Chat



Appendix 1:

Tableau Dashboard



Appendix 2:

Spanish PPA

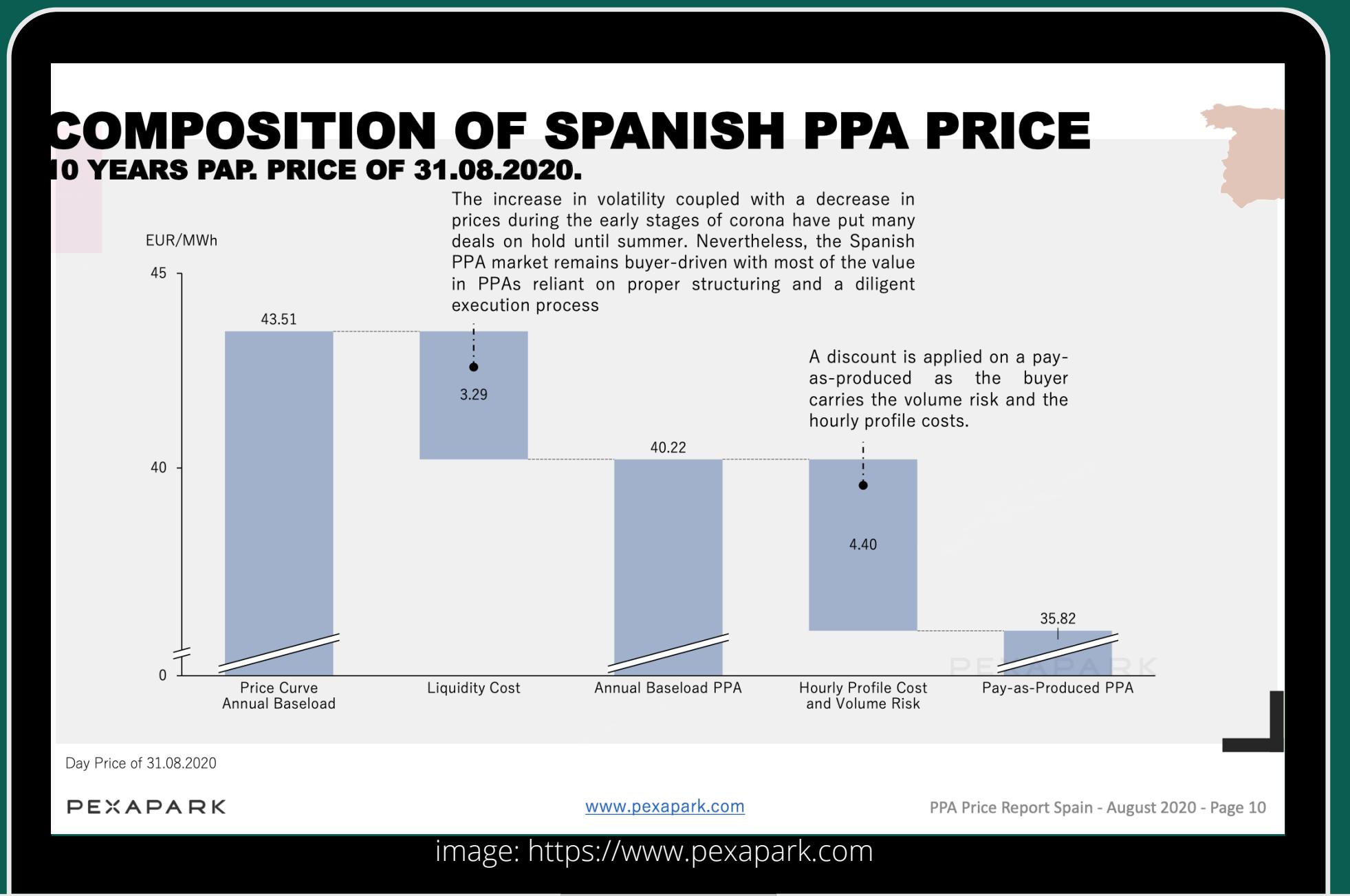
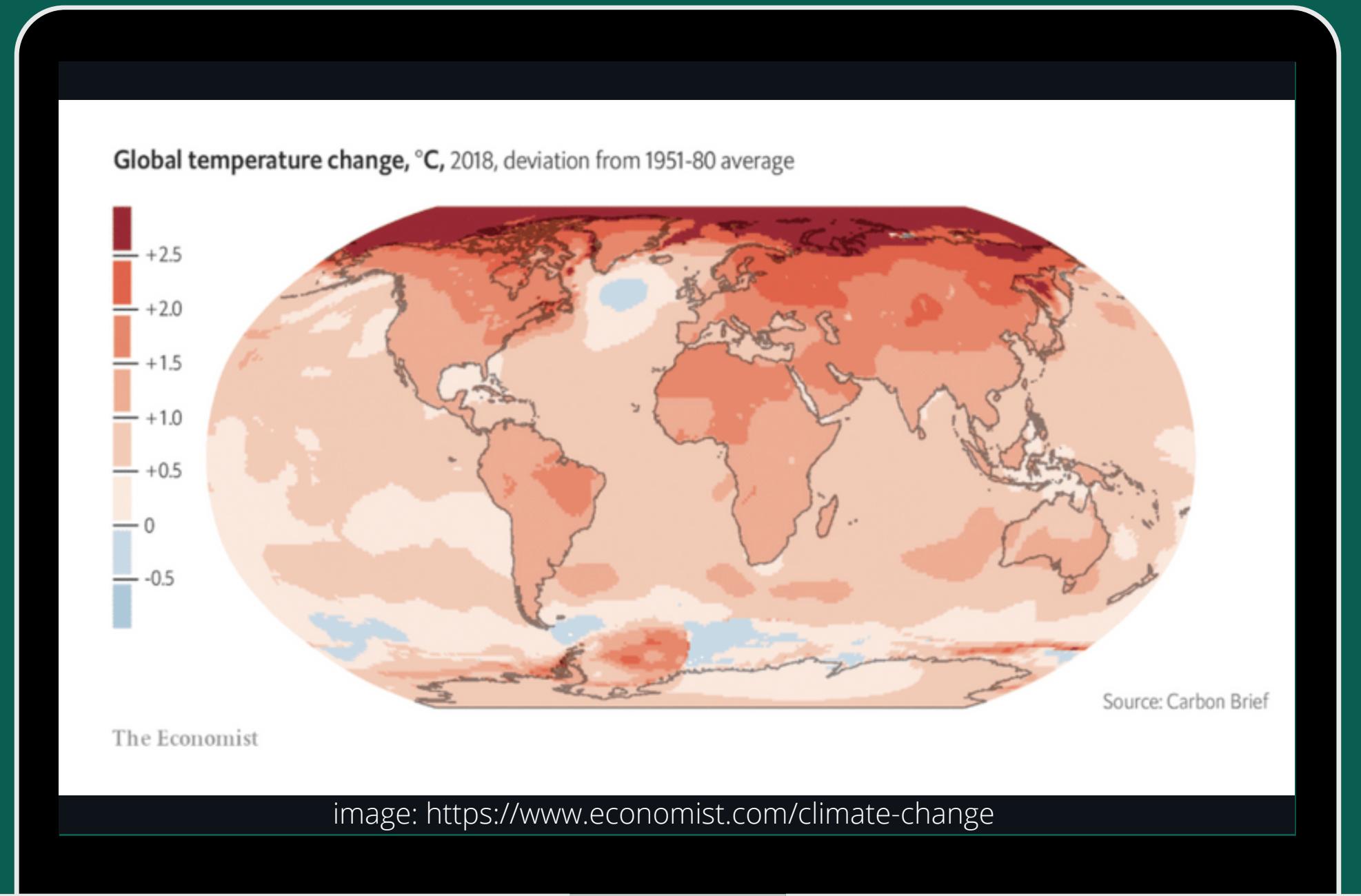


image: <https://www.pexapark.com>

Appendix 3:

Climate Change



Appendix 4:

Kafka Architecture

