

# How Sympower uses data to speed up the energy transition

Rien Dijkstra (Data Scientist)

[sympower.net](https://sympower.net)

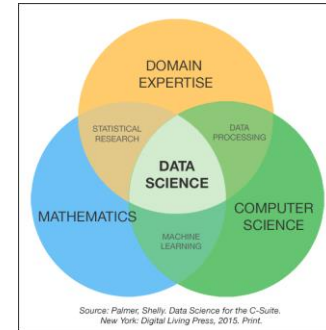
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## Content

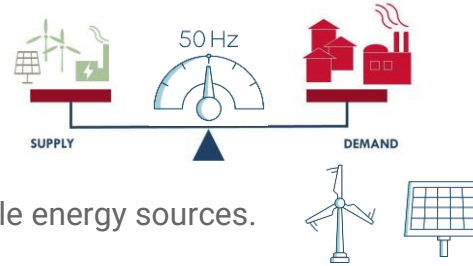
1. About Sympower.
2. Sympower processes.
3. Sympower's platform.
4. Data on Sympower's platform.

# About myself

- Catharinus (Rien) Dijkstra
- Astrophysics
- Earth observations
- Business Intelligence (BI)
- Data Science



# About Sympower



- Electricity supply and demand must be balanced at all times.
- Challenging due to increased electricity generation by renewable energy sources.
- Demand response is:
  - “a change in the power consumption of an electric utility customer...”
  - “... to better match the demand for power with the supply of power”.
- Demand response leads to:
  - a more flexible way to respond to the unpredictable power generation by renewables ...
  - ... less reliance on power plant frequency reserves for balancing the grid.

# About Sympower

- Sympower is a demand response aggregator.
- Sympower has created a cloud platform that
  - provides flexibility services by connecting grid operators and electricity consuming appliances...,
  - ...to accelerate the transition to a low carbon energy system.



# About Sympower



Founded in 2015  
as an independent  
aggregator

We work collectively  
with a team of over

**70 people**  
based in 8 countries.



Providing services  
to **5 TSOs** in:  
Israel, Netherlands, Norway,  
Sweden, Finland

Always working  
with a **local team**



With more than  
**450 MW**  
of flexible distributed  
energy resources  
under management.

Currently **expanding to:**  
Denmark, Spain, Germany,  
Czech Republic, Greece,  
Japan and Italy

We are already working with more than 200 commercial and industrial companies, including greenhouses, steel mills, food factories, solar parks, batteries, waste incineration plants, energy companies, and industrial parks.



Metsä

VATTENFALL

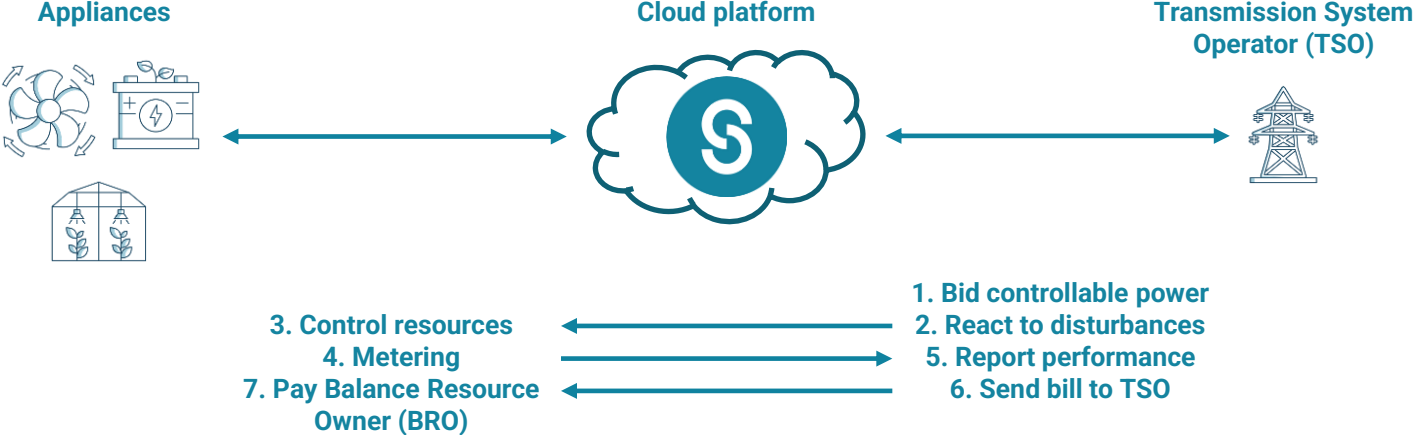


SOLARIGO

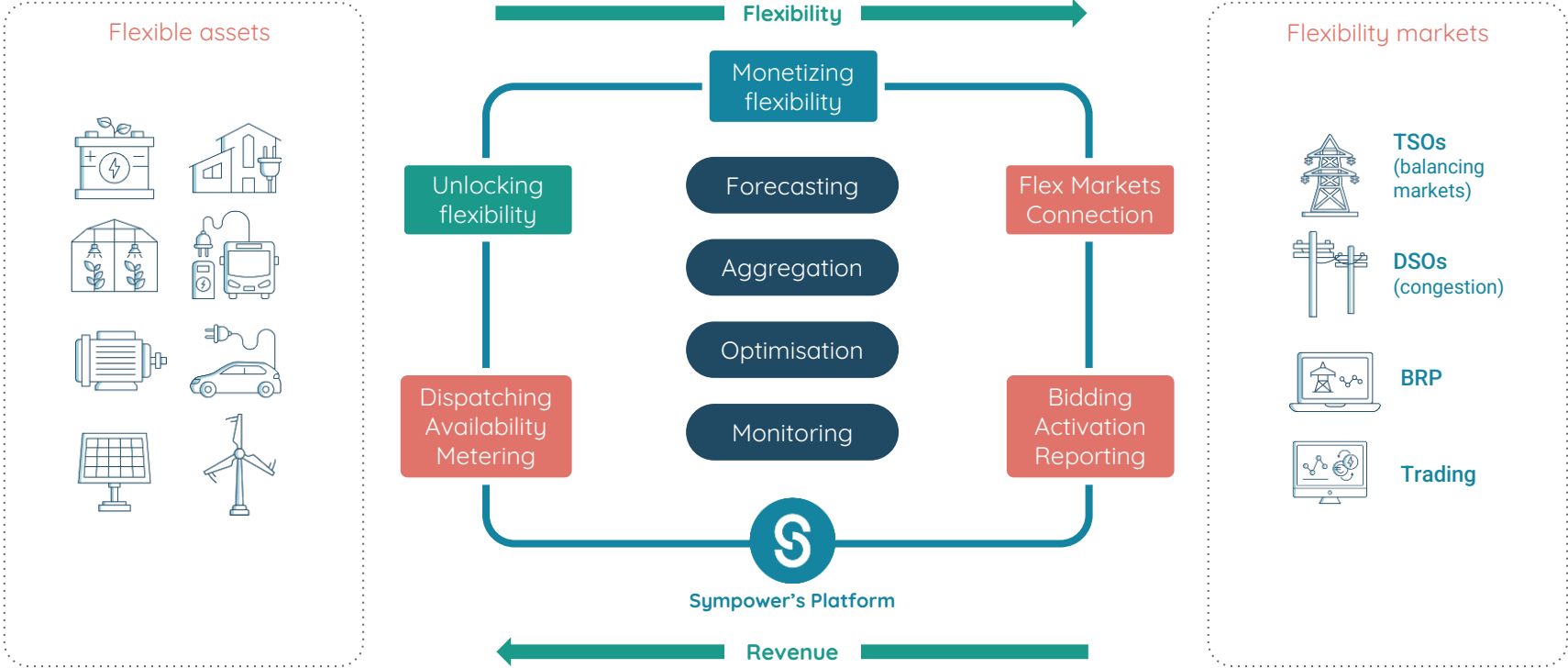


GETEC  
PARK.EMMEN

# Sympower processes



# Sympower processes



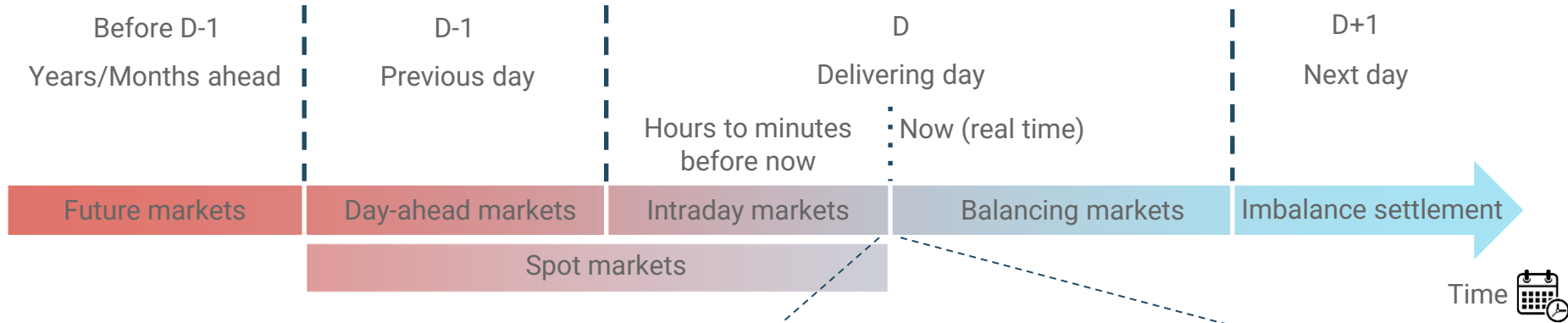
Platform monitors, manages, and aggregates distributed industrial and commercial energy assets to help sustainably balance the grid.



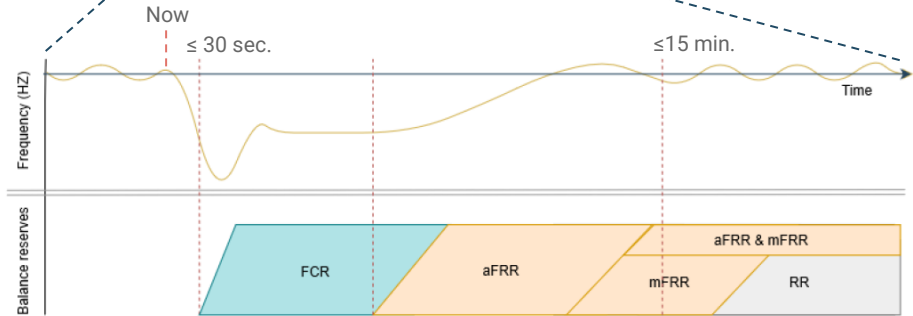
# Appliances (assets/resources)

- Data centers
- Cryptocurrency mines
- Combined heat and power (CHP) installations
  - Pulp and paper industry
  - Food processing industry
  - Chemical & Pharmaceutical Production
  - Wood processing
  - Metal production
- Heating, Ventilation, and Air Conditioning (HVAC) systems
  - Hotels
  - Commercial building
- Lighting
  - Greenhouses
- Water treatment plants

# Energy markets



Reserve market name	Reserve market type
Frequency Containment Reserve (FCR)	Primary
automatic Frequency Restoration Reserve (aFRR)	Secondary
manual Frequency Restoration Reserve (mFRR)	Tertiary

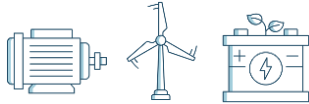


Source: Zijlstra, M., 2019, *Identifying the demand response potential of the Dutch water boards*, MSc. Thesis University Utrecht, page 10.



# Benefits

## Commercial & industrial businesses



- Lower energy bill
- More insights into energy usage
- Become active participant in energy transition

## Energy companies & energy service providers



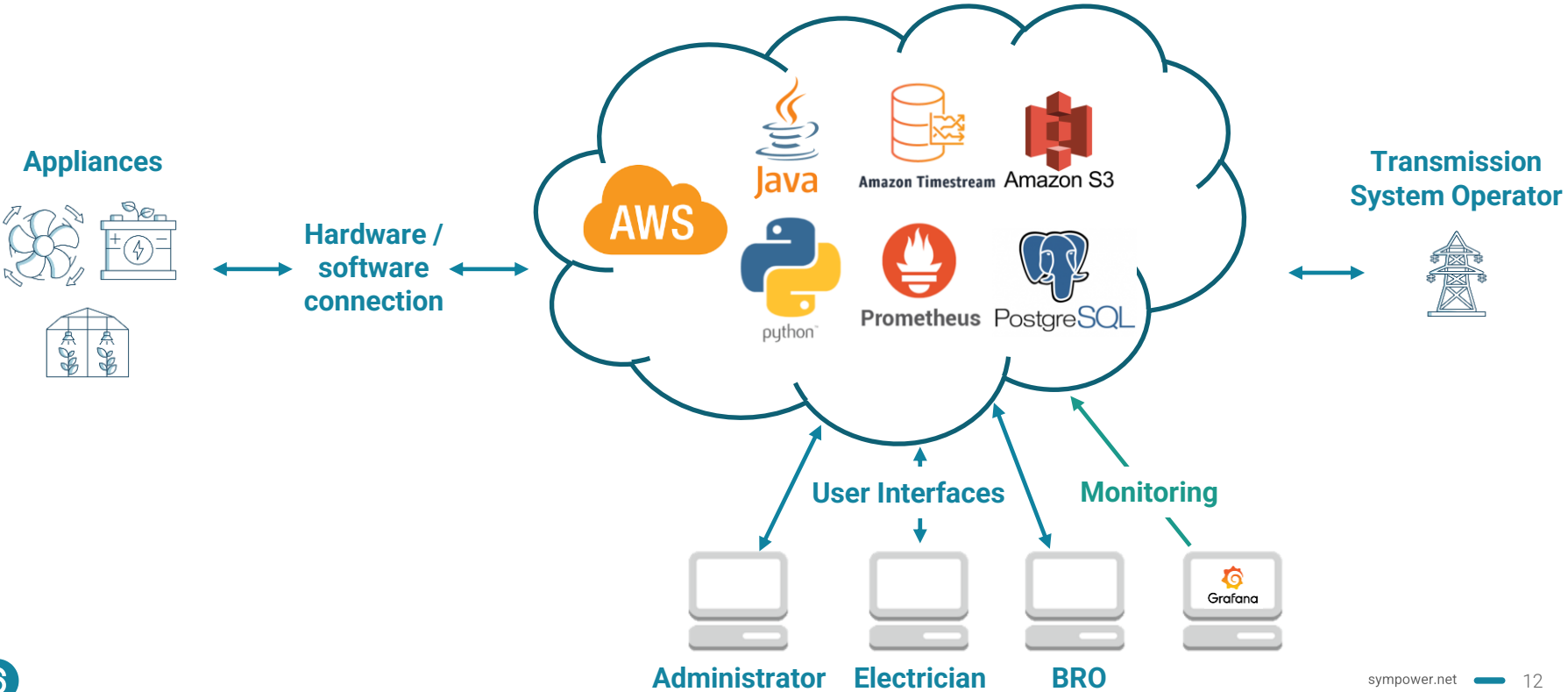
- Revenue cut from balancing services
- Stay in charge of customer experience with our white-label service
- Accelerate the shift from fossil fuels to renewables

## Grid Operators



- Reduce costs
- Security of supply
- More sustainable grid

# Sympower platform



# Sympower platform - Data



Country



Energy Market



Partner (BRO/BRP)



TSO



Financial



Electricity prices



Electricity load



Assets / Resources



Contract



Grid frequency



Date & Time



Electricity generation



Weather



Software



Hardware Inventory



Power consumption

milliseconds

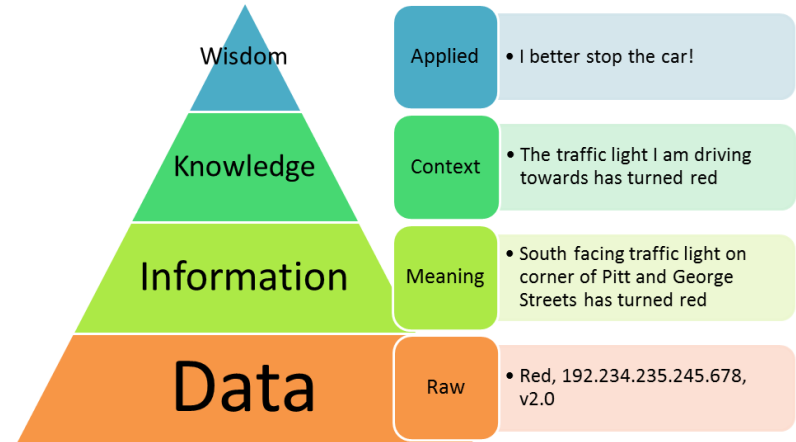


month



# Data as machine oil

- Sympower's platform collects and stores various types and large amounts of data relevant to the balancing process.
- We want to make these data easily accessible and turn these into useful information, knowledge, and insights, that our employees and customers can use to perform their work and run their operations.
- We see these data as the machine oil that keeps business processes running smoothly and efficiently.



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# Data Team

- Data Product Owner, Data Scientists, Data Engineers, Business Intelligence Engineers, Master/PhD students.
- Create information, knowledge and insights from data collected on the platform, to
  - Open new revenue streams
  - Refine existing revenue streams
  - Support, improve, and optimize decision making and other business operations
  - Help Sympower's employees fulfil their daily tasks and make their work easier and more efficient
  - Make data available to Sympower's customers and partners when and where needed
- Use Data Engineering, Business Intelligence (BI), and Data Science in order to achieve these goals.

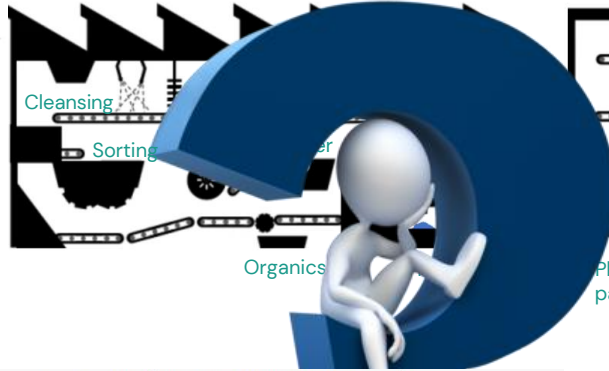


# Data as plastic

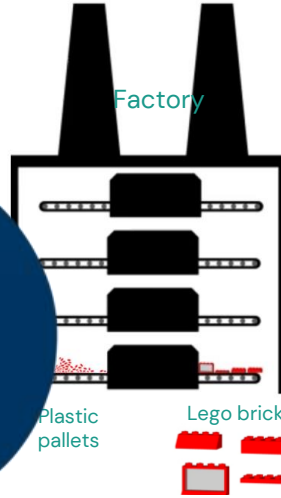
Garbage dump



Recycle plant



Factory



Lego car

Extract data from sources to a Staging Area

#	id	Name	Birthday	Gender	IsTeacher?	#Students	Country	City
1	111	John	3/12/1990	M	0	0	Ireland	Dublin
2	222	Mery	15/10/1978	F	1	15	Iceland	Madrid
3	333	Alice	19/04/2000	F	0	0	Spain	Madrid
4	444	Mark	01/11/1997	M	0	0	France	Paris
5	555	Alex	15/03/2000	A	1	23	Germany	Berlin
6	555	Peter	1983-12-01	M	1	10	Italy	Rome
7	777	Carvin	05/05/1995	M	0	0	Italy	Italy
8	888	Roxane	03/06/1948	F	0	0	Portugal	Lisbon
9	999	Arcne	05/09/1992	F	0	1	Switzerland	Geneva
10	101010	Paul	14/11/1992	M	1	26	Italy	Rome

Uniqueness      Formats      Attribute dependencies      Misspellings

Missing values  
Invalid values  
Misfiled values  
Misspellings

Transform the data  
(clean, sort, combine, standardize,  
new columns, conform dimensions,  
etc...)



Load into  
Data Warehouse  
*star schemas* for  
easy report  
building

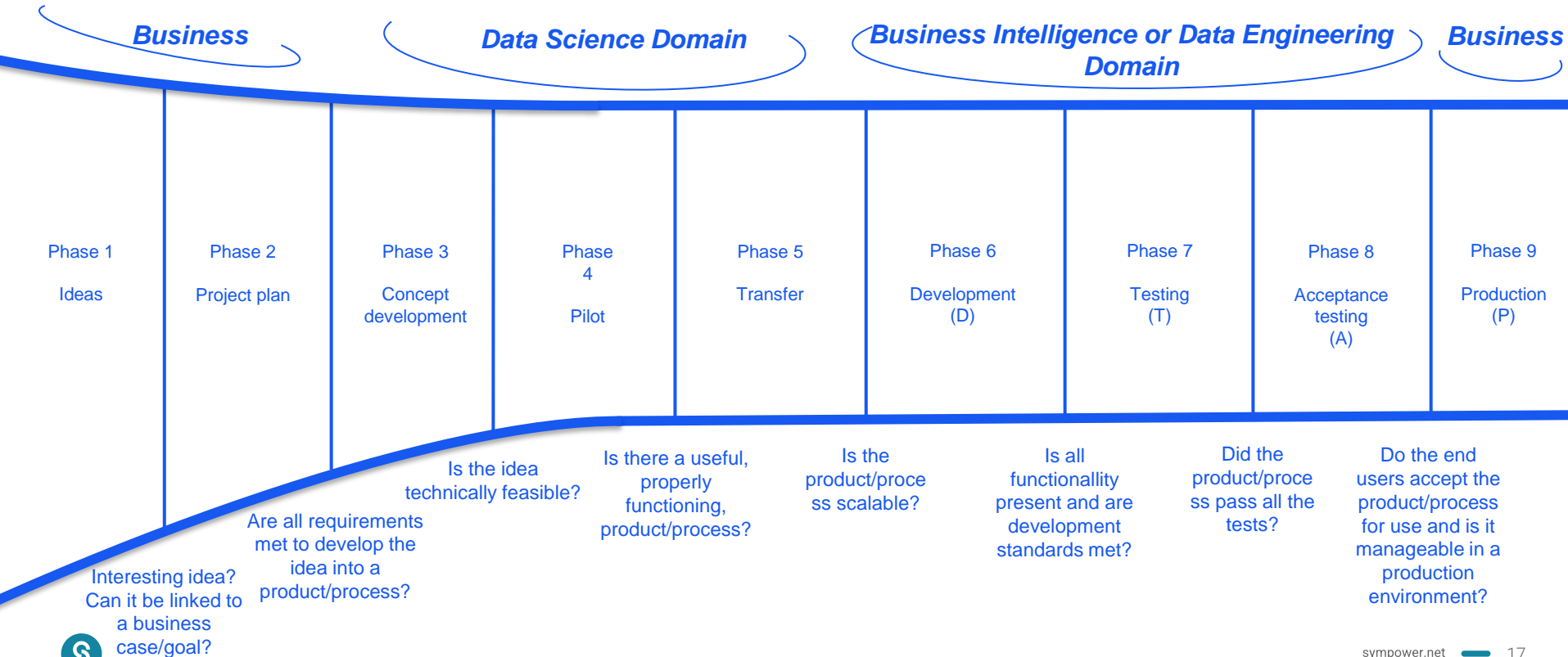


Report





# Data process - Implementation funnel

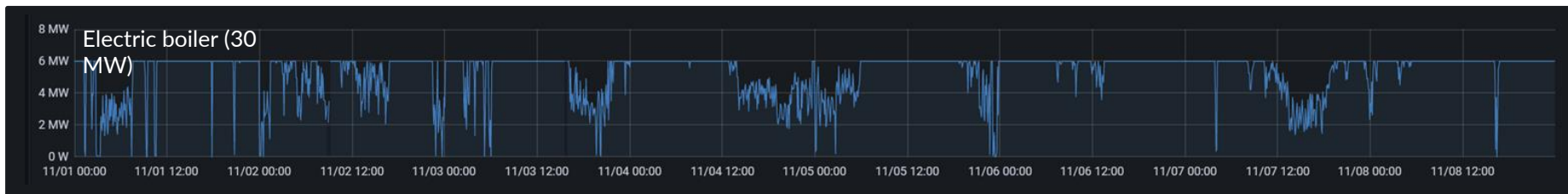


# Data - Types of analysis

- Descriptive analytics – What happened?
  - How much controllable power did an asset have yesterday?
- Diagnostic analytics – Why did this happen?
  - Why did the amount of controllable power of the asset decrease yesterday?
- Predictive analytics – What will happen?
  - How much controllable power will be available for the asset tomorrow at every hour?
- Prescriptive analytics – What action should we taken?
  - How much controllable power of the asset should we bid to the TSO tomorrow at every hour?
- Real time monitoring

# Forecasting controllable power for balancing market

Controllable power



Date and time (UTC) (year = 2021)

- Goal: Forecast controllable power of assets to generate and send bids for the balancing market.
- Country: Sweden / TSO: Svenska kraftnät / BRP: Vattenfall (BRP)
- Customer: Paper mill of forest management company. Asset: 30 MW electric boiler.
- Controllable power: 6 MW.
- Note: Need to predict when the drops below 6 MW occur and how long and deep these drops will be.

# Forecasting controllable power for balancing market

Controllable power

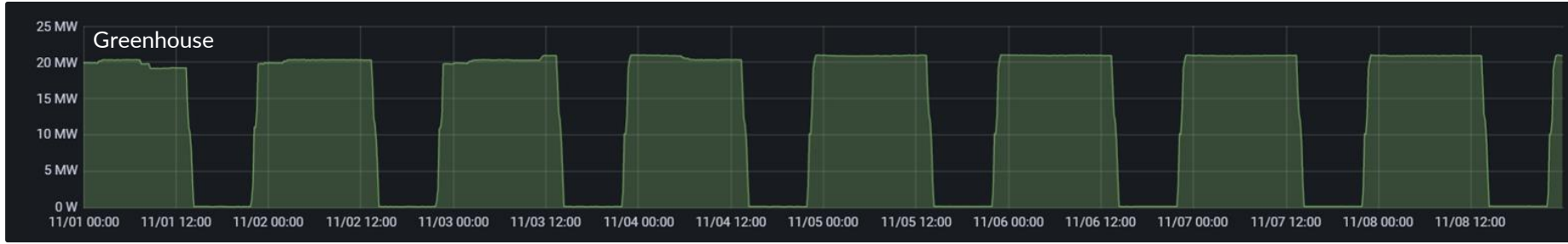


Date and time (UTC) (year = 2021)

- Goal: Forecast controllable power of assets to generate and send bids for the balancing market.
- Country: Sweden / TSO: Svenska kraftnät / BRP: Vattenfall (BRP).
- Customer: Car manufacturer. Asset: 450 kW heat pump.
- Controllable power: 450 kW.
- Note: Full range of power available, i.e. no threshold. Dependency on outside temperature.

# Forecasting controllable power for balancing market

Controllable power

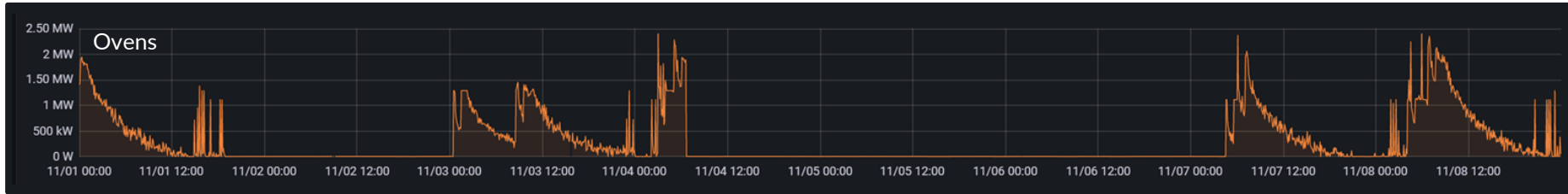


Date and time (UTC) (year = 2021)

- Goal: Forecast controllable power of assets to generate and send bids for the balancing market.
- Country: Finland / TSO: Fingrid.
- Customer: Tomatoes and peppers producer. Asset: ~20 MW greenhouse.
- Controllable power: ~20 MW.
- Note: Controllable power very much dependent on time of day, season, weather, and other local conditions.

# Forecasting controllable power for balancing market

Controllable power

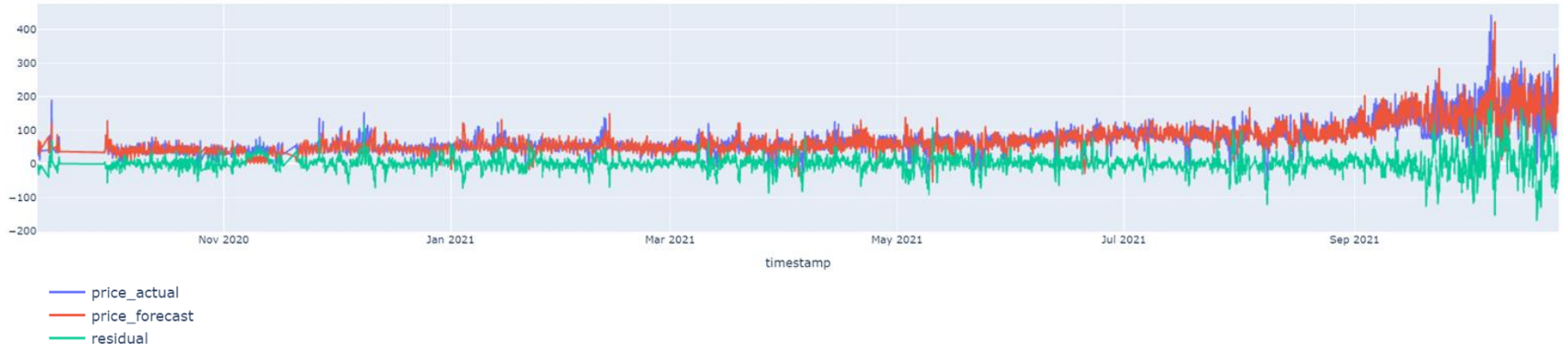


Date and time (UTC) (year = 2021)

- Goal: Forecast controllable power of assets to generate and send bids for the balancing market.
- Country: Sweden / TSO: Svenska kraftnät / BRP: Vattenfall (BRP).
- Customer: Aluminium product developer. Asset: ovens.
- Note: Ovens are characterized by sharp increase in power, followed by a gradual decay. The onset of the sharp rise is difficult to predict.

# Forecasting electricity prices

Sympower - Actual and forecast prices



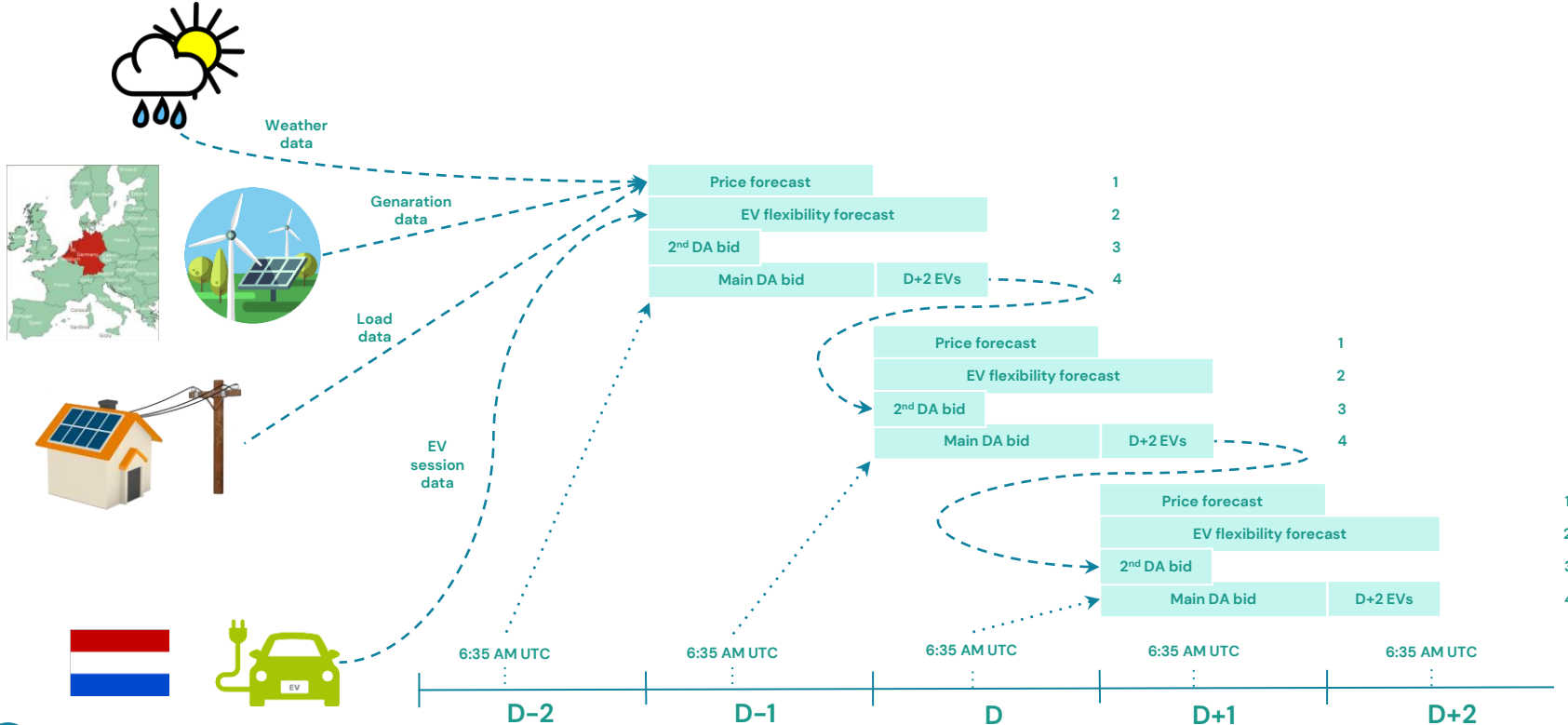
# Smart Charging

- Charging electric vehicles (EVs) at the best possible moments.
  - Passenger cars, e-buses, and e-trucks.
- Shift EV charging peaks away from peaks of other consumption.
- Charge EVs at minimal electricity cost.
- Sympower works with LeasePlan to provide smart charging services in the Netherlands for EV cars.
- Includes optimized bids for buying electricity at the day-ahead market, minimizing total electricity costs and ensuring EVs are charged to required volumes





# Smart Charging



Thank you for  
your interest in  
Sympower

Want to know more?  
**Contact me**



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Thank you for  
your interest in  
Sympower

Want to join the Data Team?

Currently we're looking for a

*Product Manager - Data*

and our team will keep growing next year.

Interested people can keep an eye on our career page:

<https://sympower.net/careers/>

