POWER 2U

HACK THE WIND 2018 WINNER TEAM
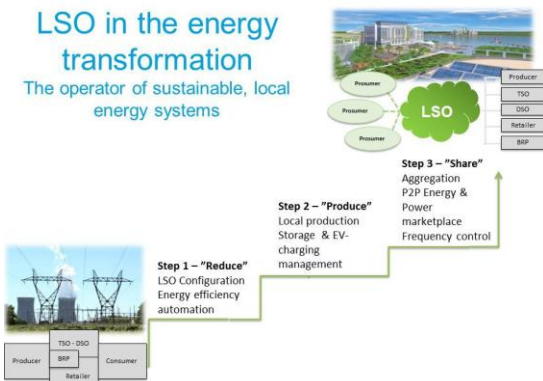
CHALLENGE 2 - HAMBURG HARBOR MICROGRID

TEAM: POWER2U SWEDEN

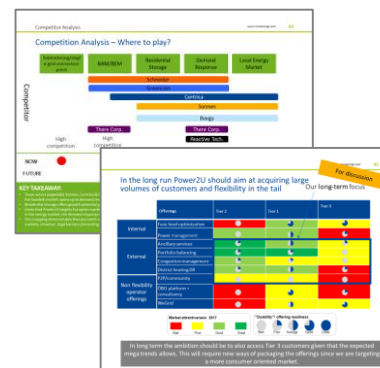PRESENTER: XUE WANG

The initial LSO concept has been detailed and narrowed down to Power 2U – the flexibility operator
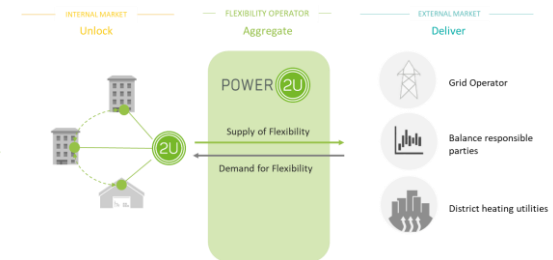
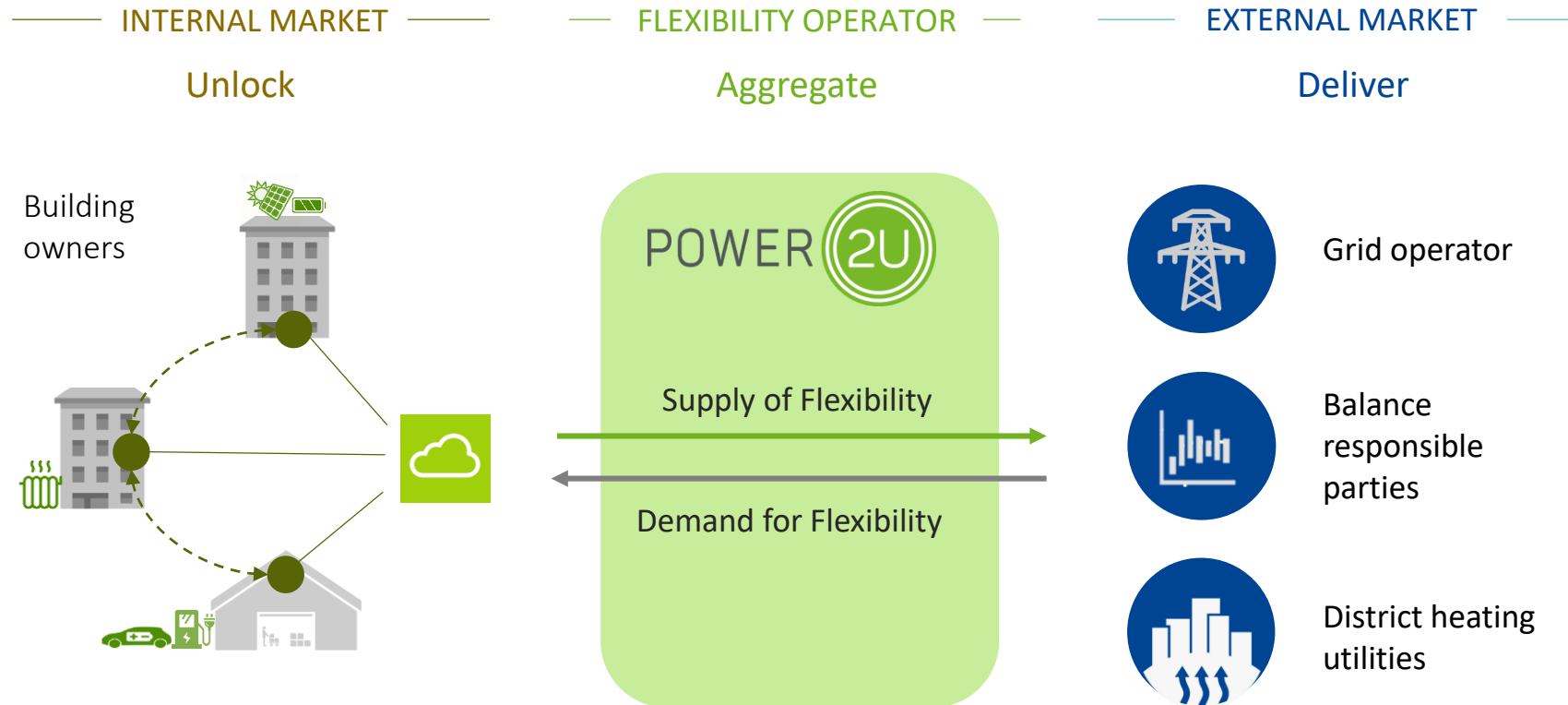LSO – innovative and broad concept

Clarified strategic direction

Power 2U – The flexibility operator

Understanding the customer journey

How to monetize this?

A double-sided business model

Power 2U unlocks, aggregates and delivers flexibility

INTERNAL MARKET

Unlock

FLEXIBILITY OPERATOR

Aggregate

EXTERNAL MARKET

Deliver

Building owners

Supply of Flexibility

Demand for Flexibility

Grid operator

Balance responsible parties

District heating utilities

The Goal

- Hamburg Harbour Microgrid is a decentralised energy system enabled by Power2U

- **Secure** the energy supply to the consumer

- Ensure the **stability** of the grid

- Maximise the **self-sufficiency** of the Microgrid

- We believe that with the help of Smart Contract, different types of customers will be empowered to trade energy services via a **reliable**, **traceable** and **sustainable** system

Industrial consumer

Smart Ledger1

Smart Ledger3

Smart Ledger4

Grid

Electric thermal energy storage

Smart Ledger2

Wind-farm
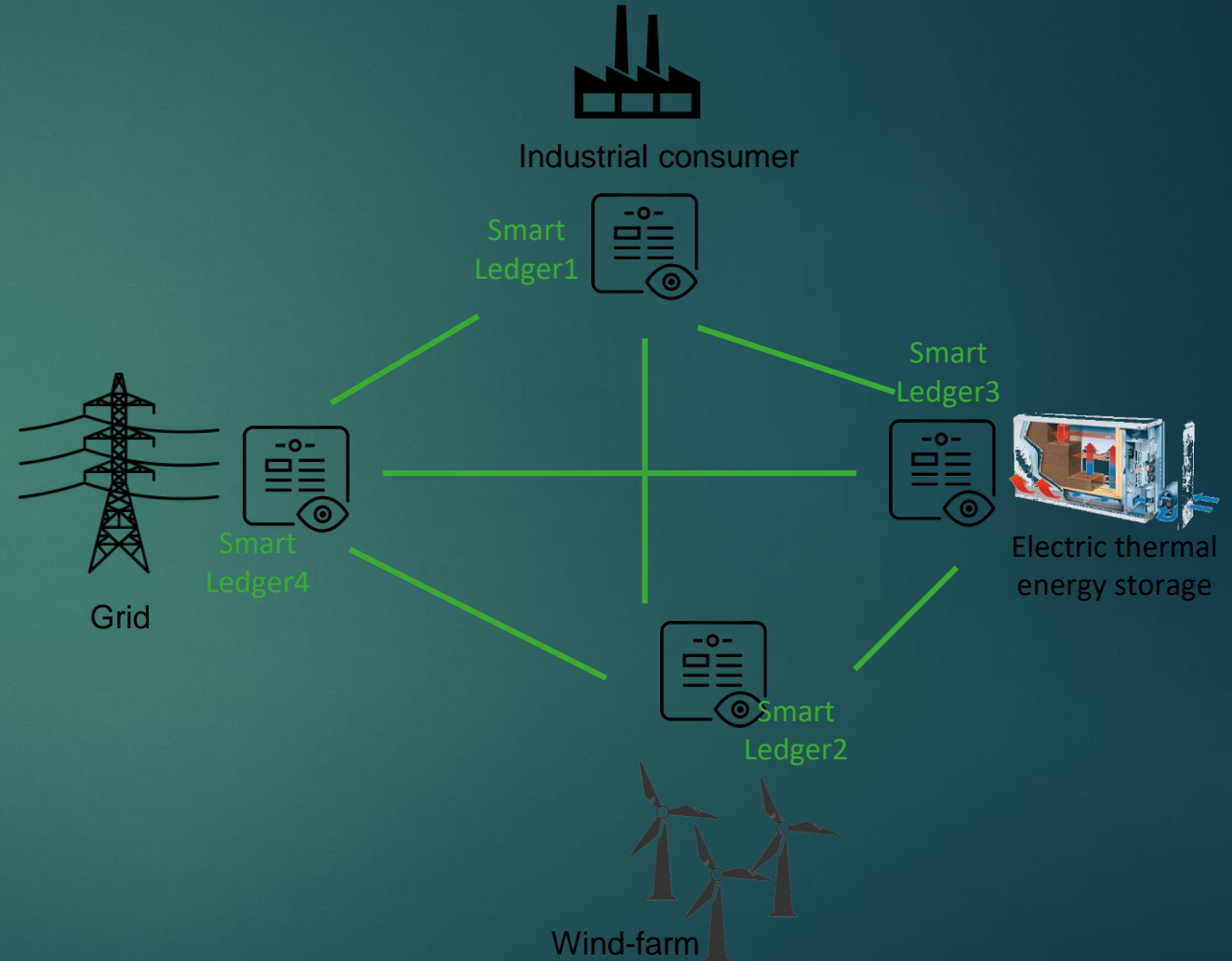
Smart Ledgers — How?

Industrial consumer

Requirement: Industrial consumer is the energy buyer to fulfil the consumption profile
- Read el. price (euro/kW.h) from SPOT Market
- Publish the **following 24h** consumption prediction (hourly time-step)
- Prioritise the use of wind generation
- When the wind is not sufficient, go for ES first, and the last resort is to buy from the grid (secure the demand)

Windfarm

Requirement: Windfarm is the energy supplier in the microgrid
- Read el. price (euro/kW.h) from SPOT Market
- Publish the **following 24h** generation prediction (hourly time-step)
- Provide el. generation to the consumer
- Make decisions according to the '**logic flow**'

Electric thermal energy storage

Requirement: ETES is the storage service provider of the microgrid
- Read el. price (euro/kW.h) from SPOT Market
- Make decisions according to the '**logic flow**'
- Publish the following 24h **predicted flexibility profile** (hourly time-step)
- Provide discharge/charge flexibility to the industrial consumer or the windfarm

Grid

Requirement: Grid provides connection between the main EPS and the microgrid
- Read el. price (euro/kW.h) from SPOT Market
- Publish the signal of **System Balance Deviation** (on/off)
- When there's no sufficient energy supply inside the microgrid, provide el. to the industrial consumer
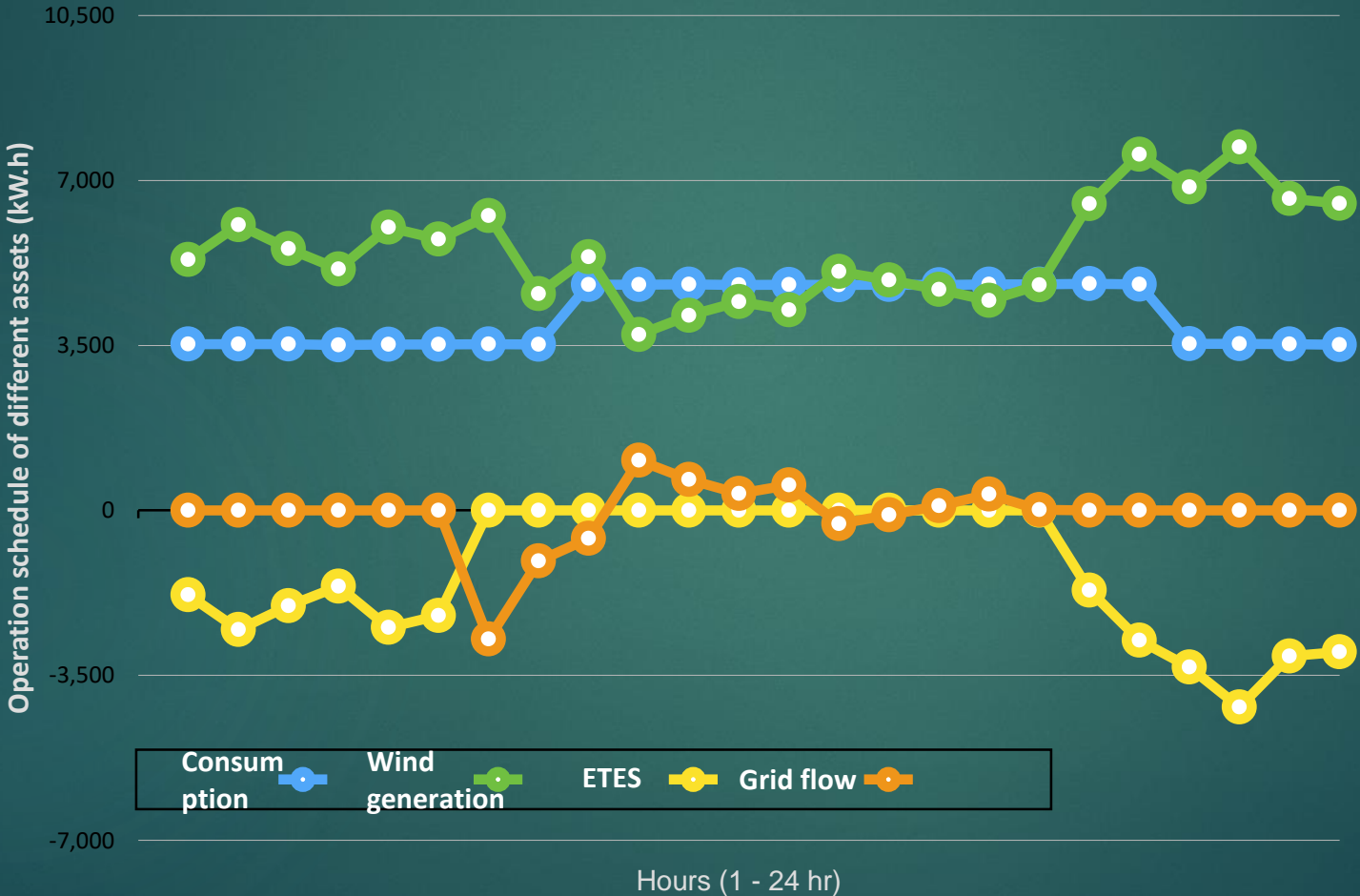- When there's residual from the windfarm, take the 'feed-in' if its **stability** is ensured

Simulation Result

Sample schedule based on (given data 26 October 2017), representing the schedule for 27 September 2018

Choose application accounts

Industrial Consumer

- Factory COO

- Security of energy supply
- Maximise the use of wind production
- Take the price index into consideration

Windfarm

- Wind farm generation manager

- The generation is consumed by the consumer(s)
- Reduce the impact of volatile generation profile

ETES (electro-thermal energy storage)

- Asset manager

- Supply storage as a service to absorb local generation surplus and inject to the consumer at certain times
- Arbitrage via the flexibility of energy storage system
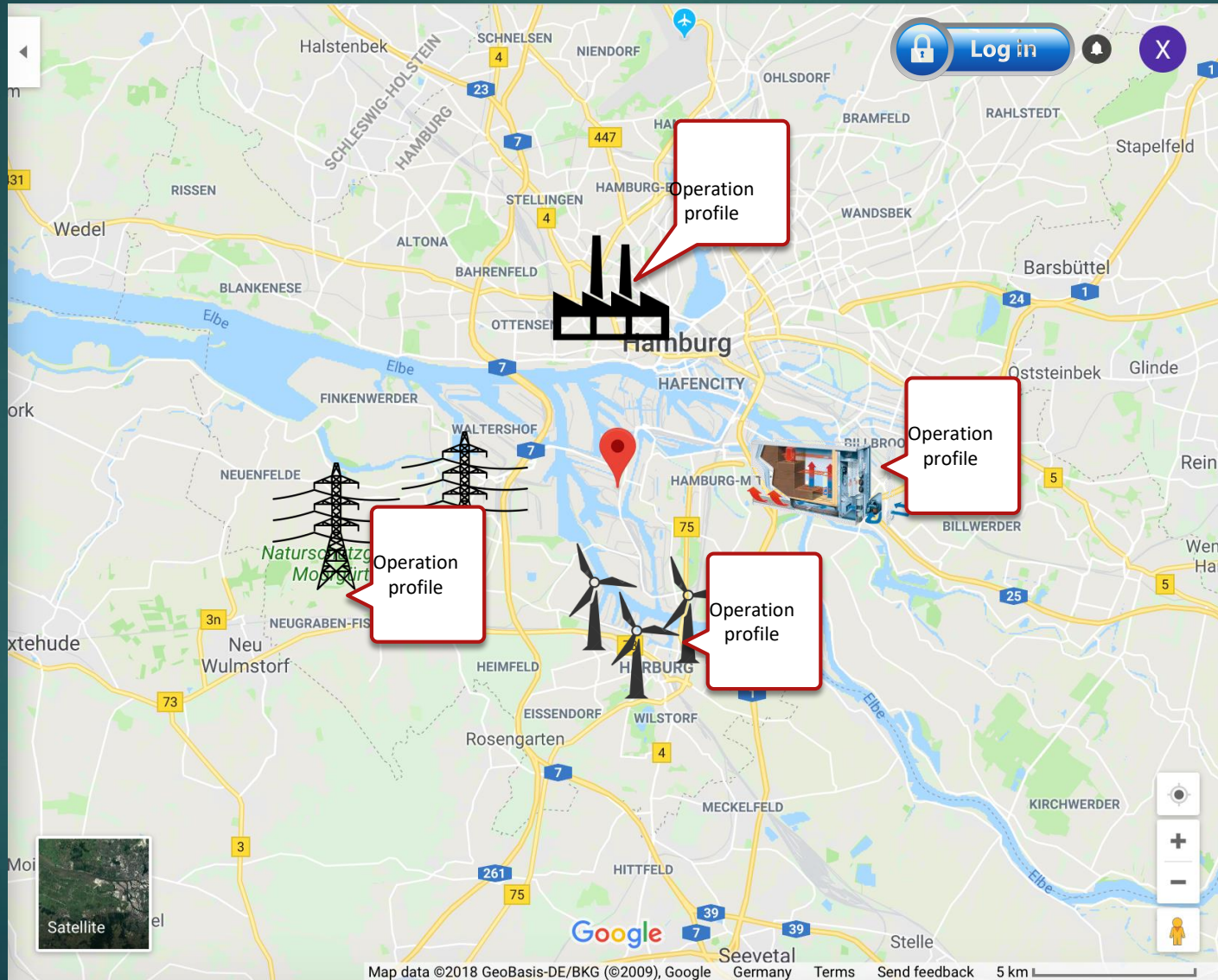
Grid

- TSO coordinator

- Supply the microgrid consumption when local productions are not sufficient
- Allow feed-in when there's residual from the microgrid
- Maintain the grid stability

Log in

Representation of assets on the map

Example of energy trades records, with stakeholder view

After log-in, Transaction records in the application accounts

- Factory COO, i Industrial Consumer

| Account balance | 10 M Euros | Consu. volume |

Transaction with the Windfarm
- Volume bought: 100 kWh
- Price: hourly SPOT price (euro/kWh)

Transaction with the ETES
- Volume bought: 0 kWh
- Price: hourly SPOT price (euro/kWh)

Transaction with the Grid
- Volume bought: 0 kWh
- Price: hourly SPOT price (euro/kWh)

- Wind-farm generation manager

| Account balance | 15 M Euros | Gen. volume |

Transaction with the Industrial consumer
- Volume sold: 100 kWh
- Price: hourly SPOT price (euro/kWh)

Transaction with the ETES
- Volume sold: +20 kWh ('+' means charge the ES)
- Price: hourly SPOT price (euro/kWh)

Transaction with the Grid
- Volume sold: +30 kWh ('+' means feed-in to grid)
- Price: hourly SPOT price (euro/kWh)