Network Services in a Smart City

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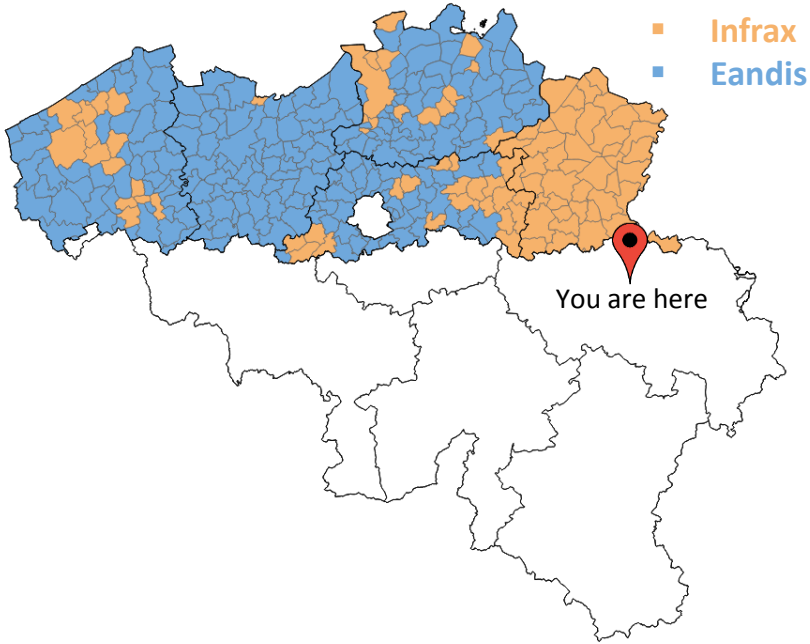
Introducing infrax and eandis ("FLUVIUS" as from 1/7/2018)

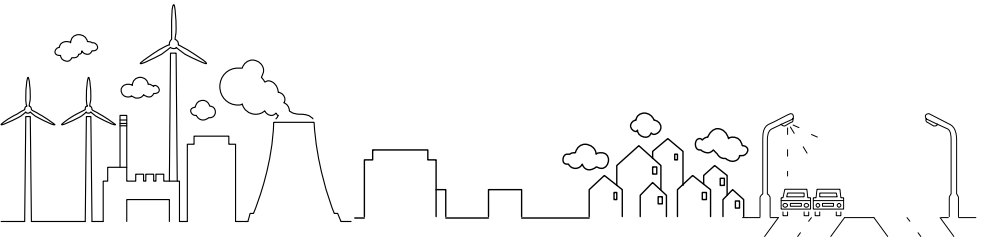
We are a multi-utility in Flanders

- Electricity distribution
- Natural Gas distribution
- Heat networks
- Telecommunication networks (Fiber/Coax)
- Sewerage
- Public lighting



Mission : Sustainably connecting society with our **multi-utility** solutions

#Overview



- Smart grids at the heart of smart cities
- Energy trends and evolutions
- Challenges: System balancing and congestion management
- Flexibility: A more active role for the end-consumer
- Enablers
  - Tariff design
  - Market models
  - Smart metering

Smart grids at the heart of smart cities

- Wikipedia: *"A **smart city** uses digital technologies and ICT to improve the quality of urban services, reduce the costs and consumption of raw materials and **energy**, and to interact more actively with its citizens."*

- The energy infrastructure is arguably the single most important feature in a smart city. Without energy, all activity stops.
- The widespread, high-quality grids of Eandis/Infrax connect all Flemish cities, municipalities and their inhabitants with each other.

To facilitate the energy transition, we are developing our grids into more reliable, sustainable and resilient "Smart grids"

Energy trends and evolutions

Electric vehicles

PV generation

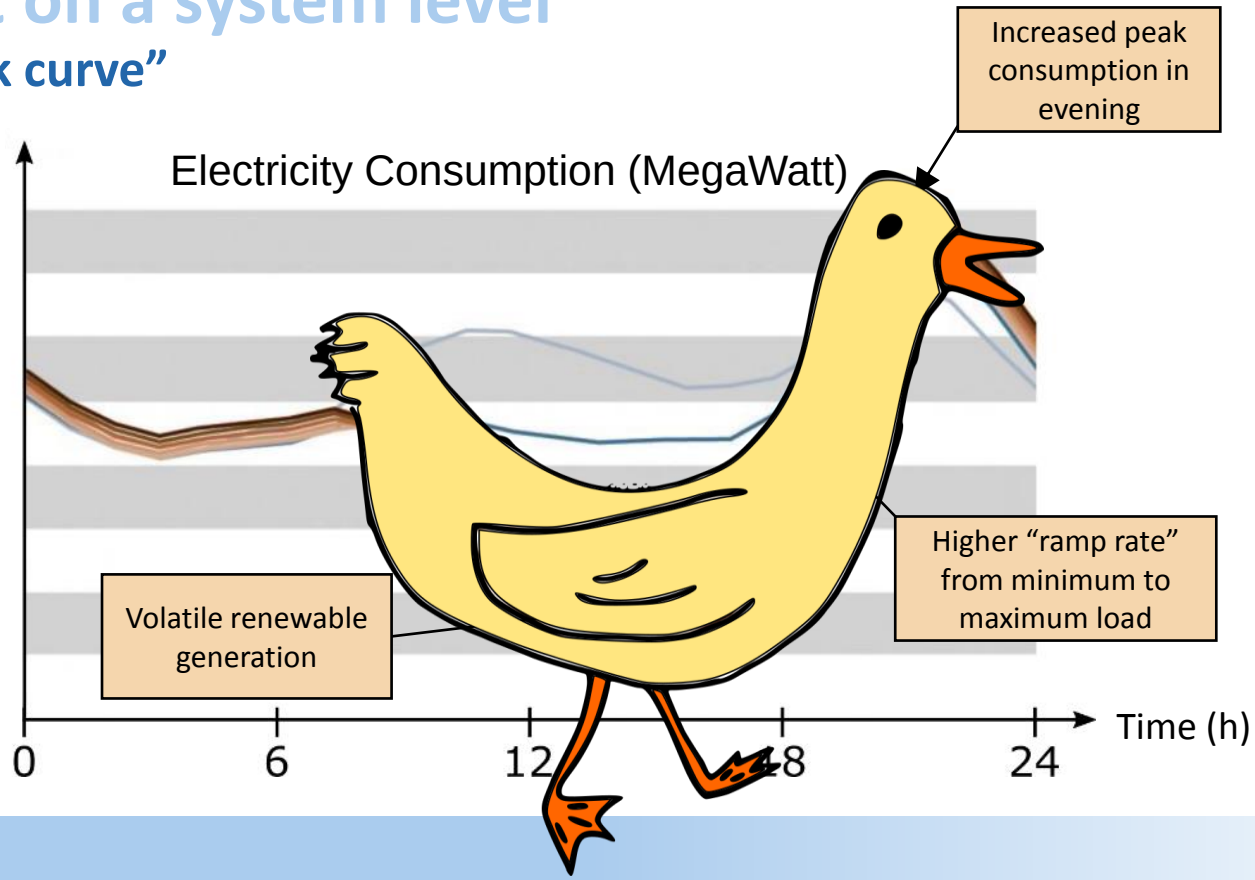
Heatpumps

Wind generation

- Increase of **decentralized, renewable and intermittent generation**
- **Electrification**: Shift from fossil fuels to electricity for **transport & heating**
  - Estimated by 2050:
    - 30% more electricity consumption
    - 40% less natural gas consumption

Impact on a system level

The “duck curve”



Global challenge: **Balancing demand and supply**

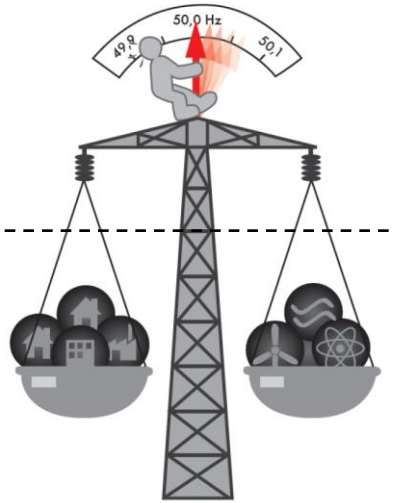
Before: Supply side management

Future: Demand side management

Demand
- Not flexible

Demand
- More flexible

Flow of flexibility



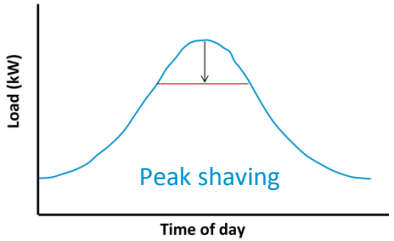
Flow of flexibility

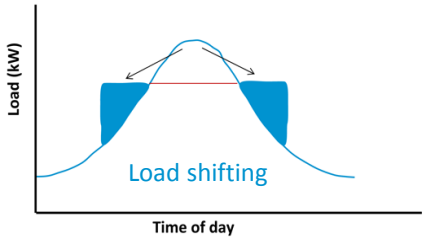
Generation
- Centralised
- Dispatchable
- Predictable

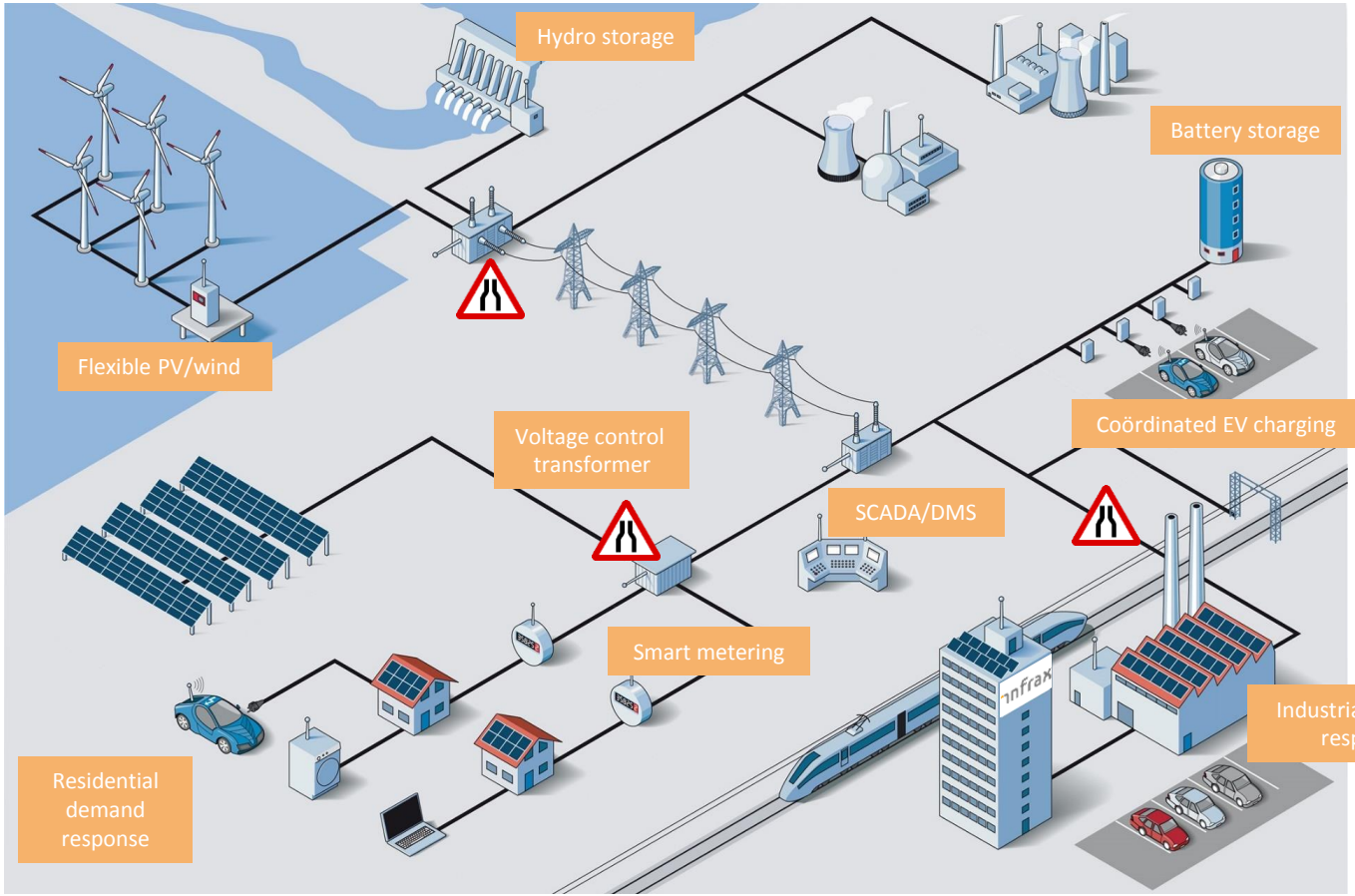
Generation
- Decentralised
- Less dispatchable
- Less predictable

Local challenge: **Congestion management**

- Distribution grids were designed "**Fit and forget"** based on typical load statistics of the past
  - No generation, only offtake
  - Low simultaneity factor => stochastic load distribution
- Electrification (EV, HP) and Renewables cause peak loads on the grid
- Conventional solution = Grid reinforcement => €€€€
- **Smart approach** = Do more with existing grid capacity by unlocking the available flexibility of grid assets, grid users and renewable generation






Hydro storage
Battery storage
Flexible PV/wind
Voltage control transformer
Coördinated EV charging
SCADA/DMS
Smart metering
Industrial demand response
Residential demand response

Digitalisation of the distribution grid

- More (real time) measurements allows more situational awareness
- SCADA/DMS – More remote control
- From grid operator to **system operator**

Passive distribution networks

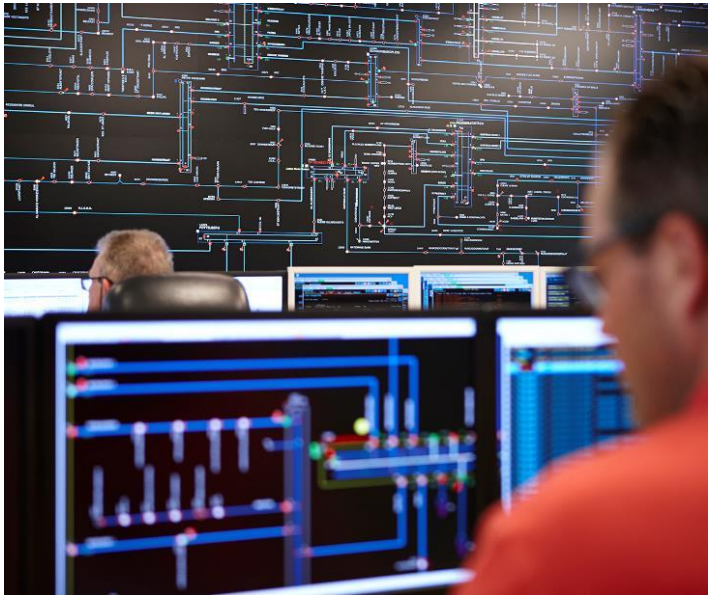
"Fit-and-Forget"

Reactive renewables integration

"Operation only"-approach

Active system management

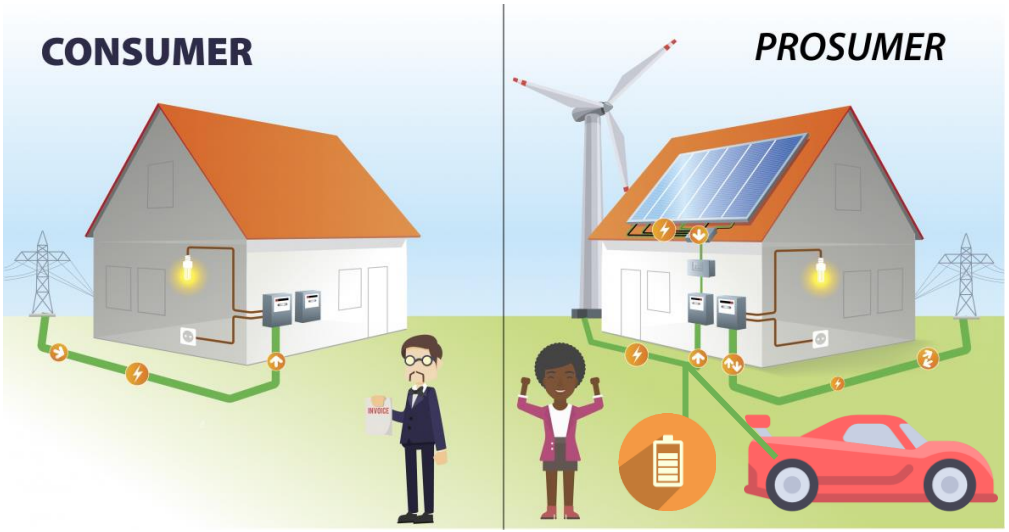
"Real system operator"



A more active role for the end-consumer

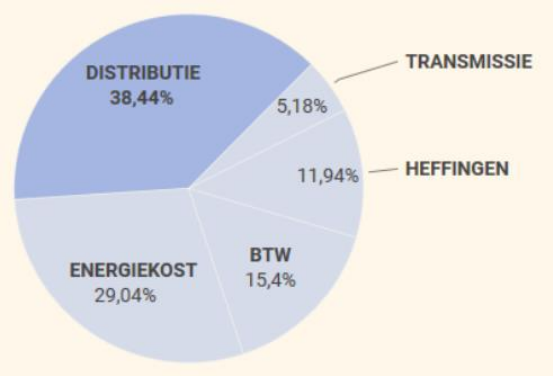
- From passive consumer to active prosumer
- User flexibility as solution for the balancing and congestion challenge

- **Enablers to unlock and valorise the available user flexibility**
  - New tariff designs
  - New market designs
  - New market players / business models
  - Regulatory framework
  - Smart/Digital metering



New tariff design

Towards a (more) capacity-based grid fee?

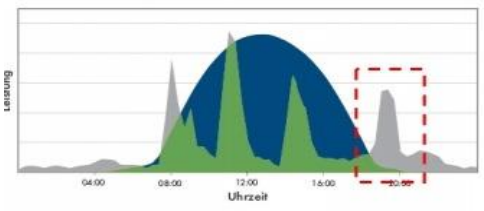


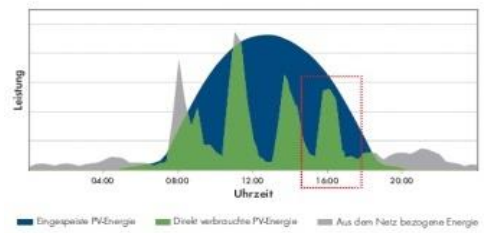
- Current distribution grid fee is based on kwh/year
- Distribution Grid Fee represents **38,3% of electricity invoice** for a houshold with a consumption of 3500 kwh/year

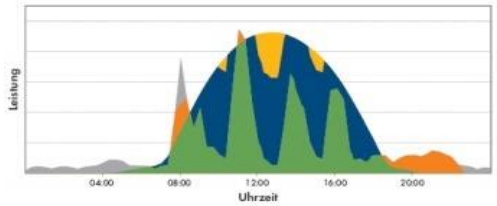
- **A capacity-based grid fee (kW instead of kWh)**
  - Is more cost-reflective => Customers invoking costs pay more
  - Makes EVs and heat pumps more interesting
  - Gives an incentive for **“rational grid use” =>** reward customers who help the system with their flexibility (avoid peak offtake/injection)
  - Replaces “prosumer tariff” (euro/kVA PV converter)
  - Discourages customers to go entirely off-grid

Incentivizing self-consumption of solar energy

Feed-in tariff vs. net-metering?







Natural Self-consumption

30% of the locally generated solar power is directly consumed behind the meter

CEMS (Customer enery management systems)

An intelligent load steering can increase self-consumption with 15 %

Battery Storage

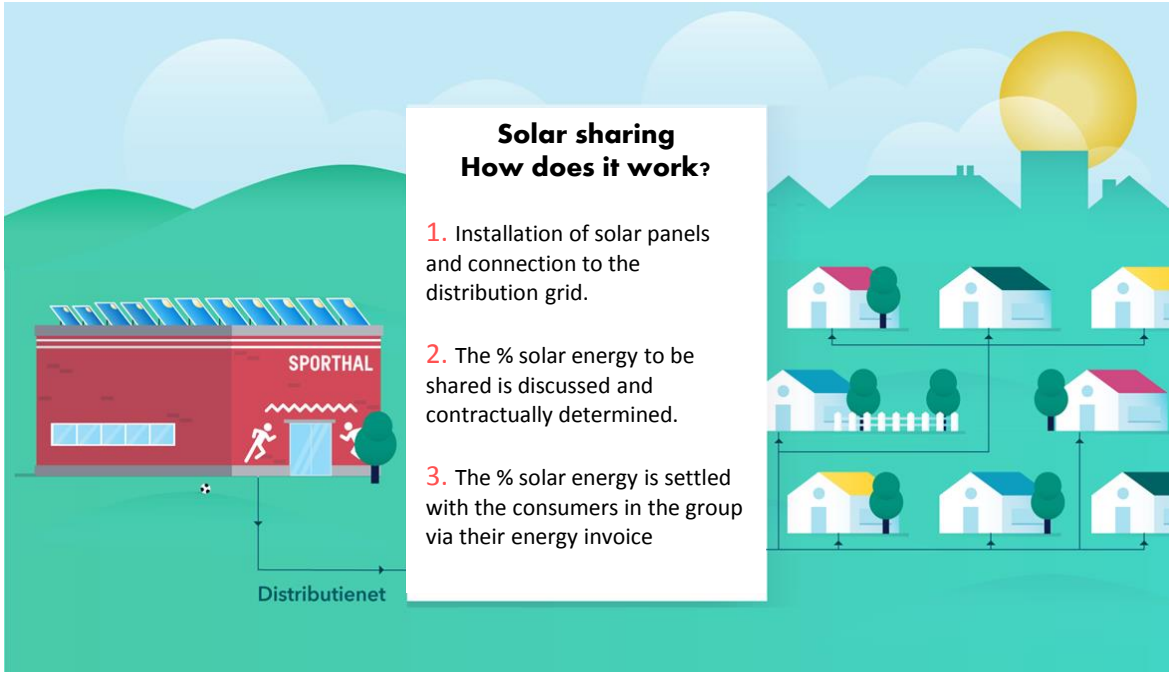
A storage system can increase self-consumption with another 10-15%

New market models

Solar energy sharing – Direct lines - Local Energy Communities

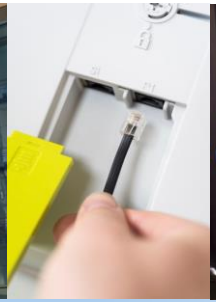
- Locally balancing demand and supply is not incentivized in the current market design and tariffs

- New developments
  - Solar sharing (PoC Zonnedelen)
  - Direct lines
  - Local energy communities



Digital meter: **Enabler to unlock user flexibility**

- Phase-out of old electricity and gas meter technology
- Segmented and gradual roll-out from 1/1/2019
- 3.5 million meters in total
- Supplier = IBM/Sagemcom
- 4G wireless communication to back-end system
- Digital meter = not a smart meter
  - “Smartness” comes from third-party apps (connected via P1 and S1 port)
  - Keep cost as low as possible



Digital meter: **User-interfaces**

P1 / S1 port

In-home display

Dongle / Adapter

KNX
ZigBee SEP 1.1 @ 868MHz
Wavenis
Euridis
Modbus
DECT ULE
ZigBee SEP 1.0
HomePlug AV
UMI
HomePlug GreenPHY
WiFi
IP500
G3
X-10
HomePlug C+C
DSMR 4.0 P1
Zwave
ZigBee SEP 2.0
Bluetooth
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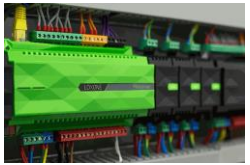
Mobix nD-Net
M-Bus/wM-Bus
Digitalstrom
Watteco
EnOcean
ZigBee HA



Digital meter: **Application roadmap**

Enable end-user to monitor and manage his energy use

Energy-fraud detection

Dynamic energy tariffs to better match supply and demand

New remote energy management services in cooperation with (new) market players

Internet of energy

Data-driven grid operation

Digitalisation

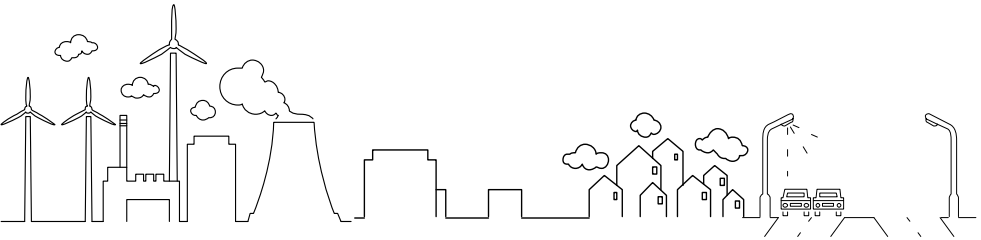
Intelligent markets

Active grid management

Short term

Long term

#Recap



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Thank You

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