

The Perfect Storm

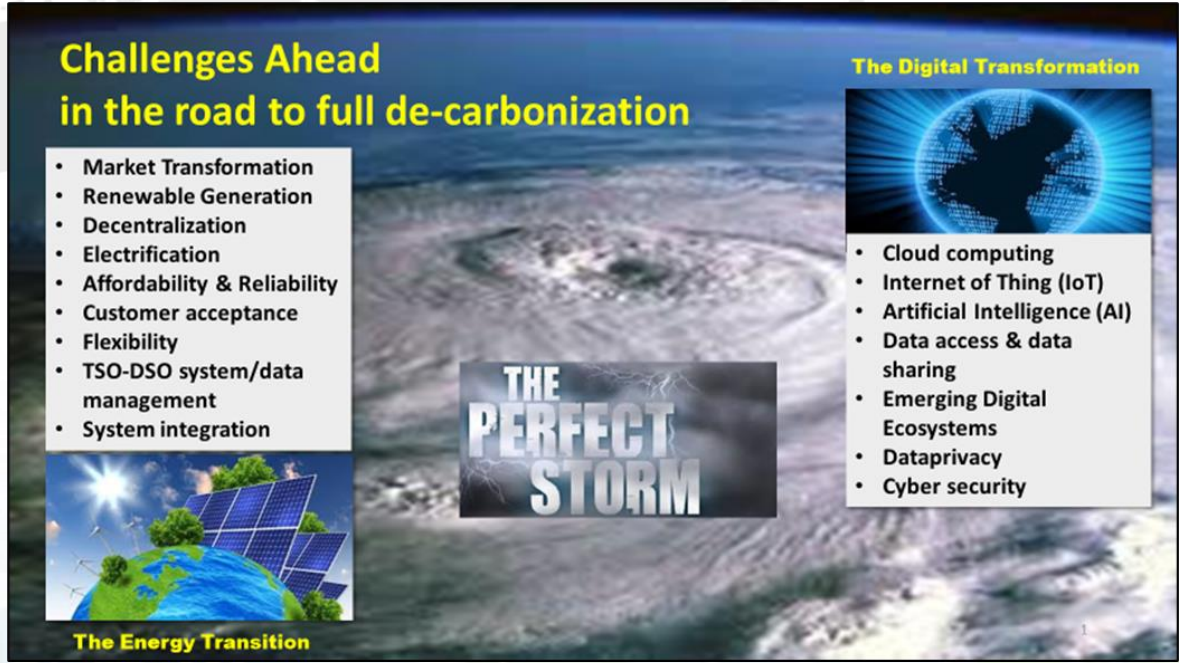
The Energy transition meets the Digital transformation



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Content

- General insights & learnings
- Challenges for the system operators
- The Digital transformation:
 - Smart metering
 - Flexibility
 - Data exchange
 - Local Energy sharing
- The EU action plan on digitalization of the Energy System



Challenges Ahead in the road to full de-carbonization

- Market Transformation
- Renewable Generation
- Decentralization
- Electrification
- Affordability & Reliability
- Customer acceptance
- Flexibility
- TSO-DSO system/data management
- System integration

The Digital Transformation

- Cloud computing
- Internet of Thing (IoT)
- Artificial Intelligence (AI)
- Data access & data sharing
- Emerging Digital Ecosystems
- Dataprivacy
- Cyber security

The Energy Transition



General insights & learnings

Effectiveness = Quality X Acceptance



New connections are needed

“The Energy System of the future will not be built on the silo’s of the past”

“Technology, markets and regulation are strongly intertwined. We will be only successful if their vision & strategies are consistently aligned”

“Systems will only work together, if the people who built them do”

Access to Energy is a basic human right

“The market works for society and its citizens and not they other way around”

Focus on transition strategies & change management (HR) is needed

“Living in the world of A (today) we will only arrive in the world of B (tomorrow) if we apply the principles of the world of B”

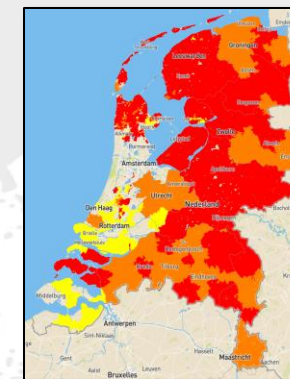
“The creation of the world of B next to the world of A, is a more effective route then trying to modify the world of A”

“If you want to change the course of a river, you have to intervene at the top of the mountain where it originates”

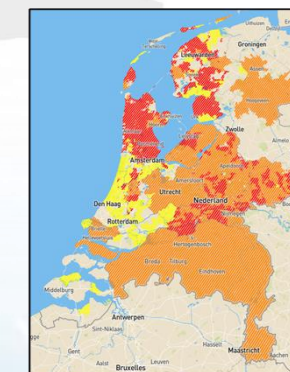


Challenges System Operators

- Shortage of grid capacity (due to misalignment between national subsidy schemes and grid expansion programmes)
 - DER integration in LV grids, originally not designed & engineered for bi directional energy flows, create PQ issues
 - Low voltage grid LV with a low level of digitalization
 - Lacking adequate Day Ahead load forecasting and predictive loadflow analysis capabilities on all grid levels
- ↓
- Lack of grid capacity 37% (cables, transformers, space)
 - Lack of capital (>100 Billion euro CAPEX up to 2050)
 - Lack of technical staff (17.500 fte)
 - Lack of time....



Production



Consumption

General insights & learnings on digitalization

Business IT integration

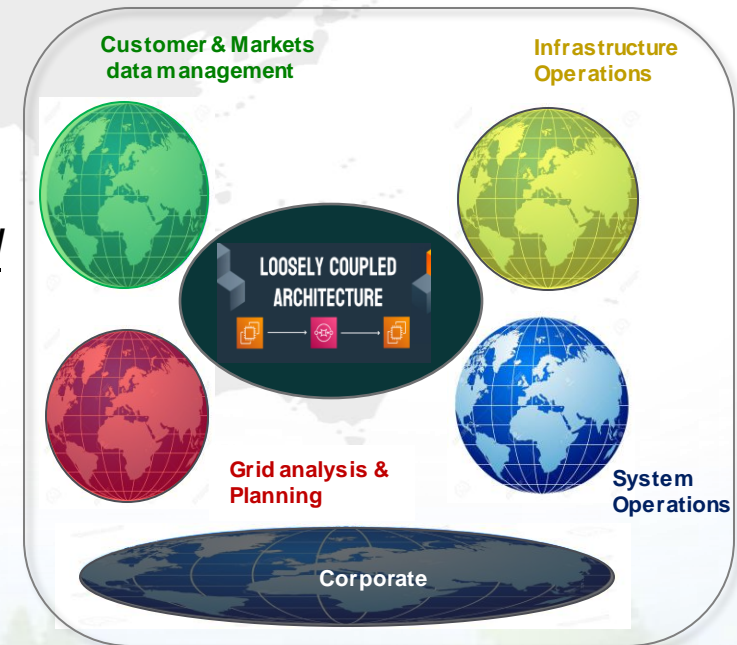
“Transforming a business ecosystem into a digital business ecosystem requires the adoption of an outside-in mindset and integration of the IT function in the business”

Data exchange is a Business transaction

“Exchange of data is more than defining a data format & protocol. In the digital business ecosystem it is a business transaction, defined by business, legal, technical and operational parameters”

Business agility through a loosely coupled IT architecture

“The speed and direction of change of the 4 core functions of a DSO (planning, infra-operations, system-operations, market facilitation) differ, which requires a loosely coupled IT architecture, to accommodate business agility in the business digital ecosystem”





Smart metering: insights & learnings

Definition of a smart meter

“a real smart meter is more than a dumb meter with software in it. It is a smart component (sensor & computing platform) in the business digital ecosystem”

Rolling out smart meters \neq Operating smart meters

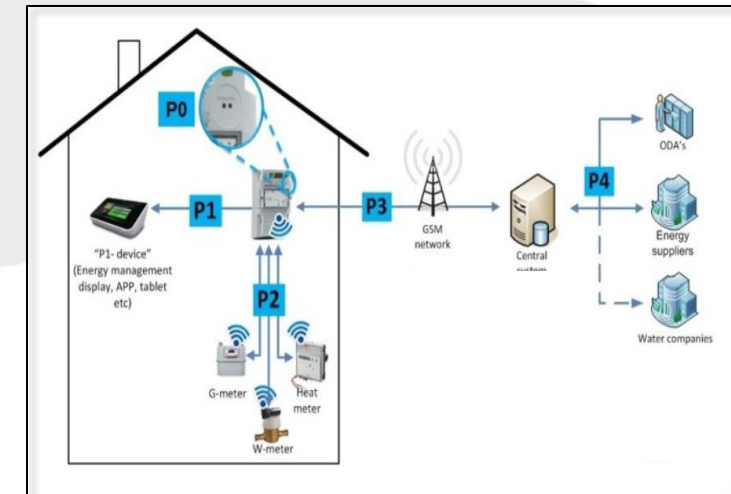
“a data collection performance of 99% still equals 84.000 meters in failure (installed base = 8.4 Mio smart meters, = 90%)

Privacy

“Smart meter data reflects personal behaviours. This requires data handling which respects privacy (GDPR). To earn trust from citizens this should be safeguarded in an independent way”

Decentralizing data processing

“To accommodate processes using massive data, originating at the grid edge”, data processing is also needed in the edge (IoT edge computing),.





Example: LV grid management & system operations

- Smart meter data for LV grid managing and planning and system operations purposes is needed.
- In 2022 the DUTCH Data Protection Authority approved DSOs code of conduct on privacy on EU GDPR compliancy

Future

- Access to all relevant grid edge data (smart inverters, CHP's, EV CP's): only on a legal basis or customer consent
- Creating a roadmap NEXTGEN smart meter towards an IOT grid edge computing architecture

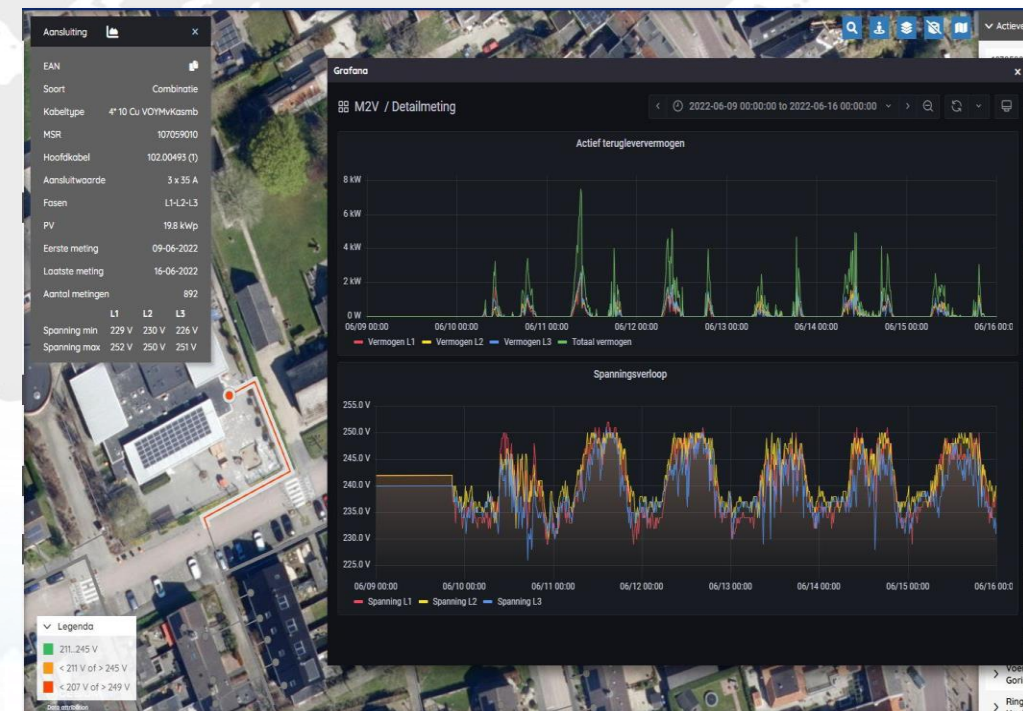
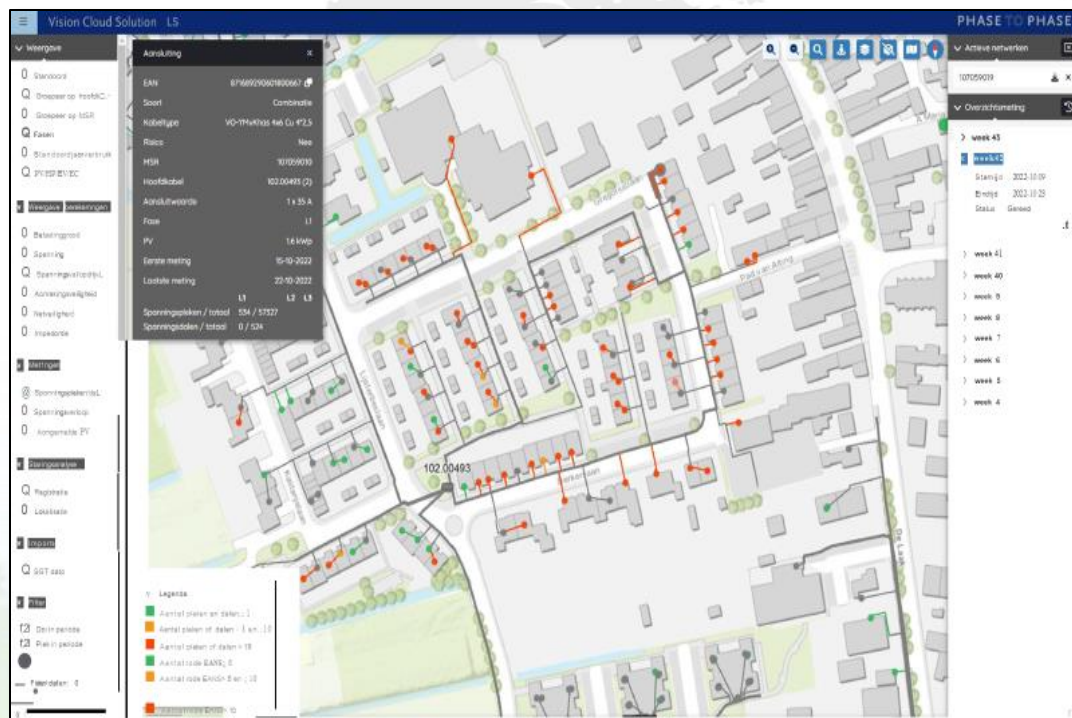
USE CASES	
✓	2021 Voltage level monitoring at LV customers V1
⌚	2022-1 PQ monitoring at LV grid
✓	2022-2 Fault detection and lokalisation
⌚	2022-10 Extreme usage
	2022-3 Customer compensation after outage
	2022-7 Grid Capacity planning
	2022-8 Reducing grid losses
⌚	2022-9 Congestion management icm 2022-7
⌚	2022-11 PV panels
	2022-12 EV charging
	2022-14 Voltage level monitoring at LV customers V2 icm 2022-1
	2022-4 Capacity gas grid





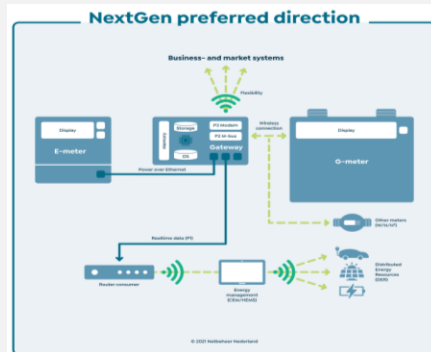
Example: LV grid management using smart meter data

Use Case: Monitoring voltage levels at all grid connection points



Next generation smart meters development

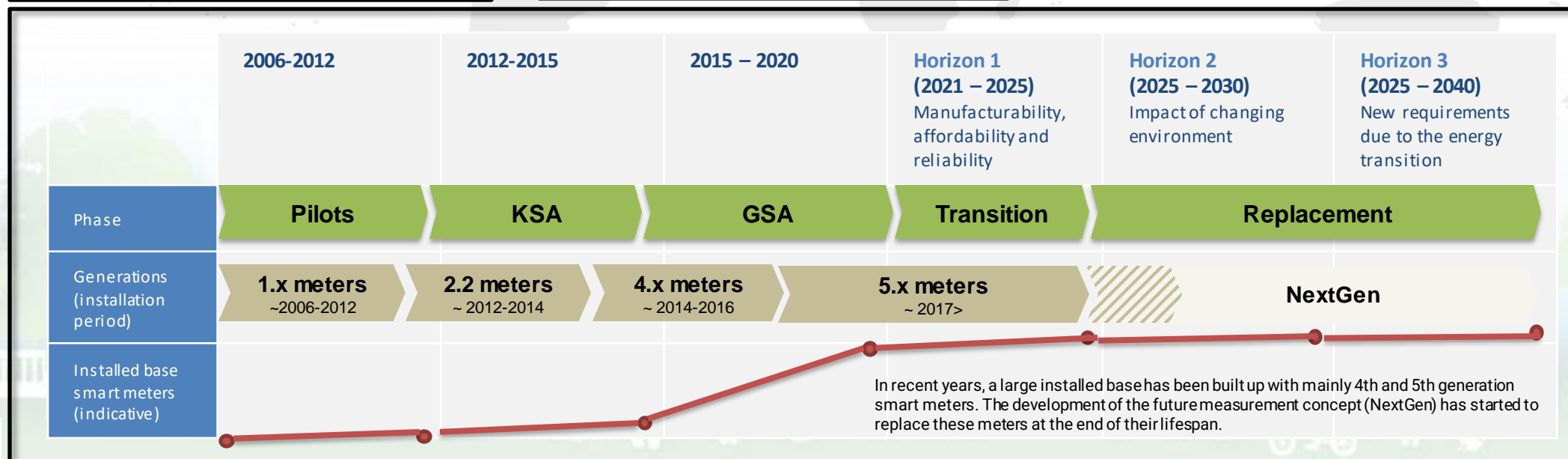
NextGen architecture



Features

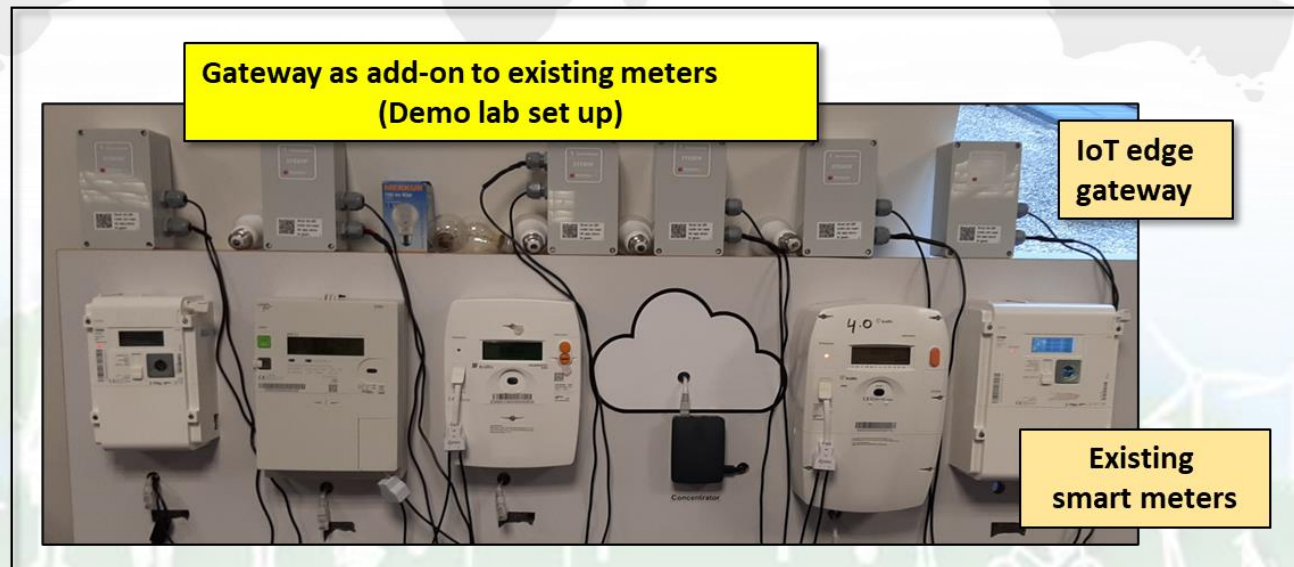
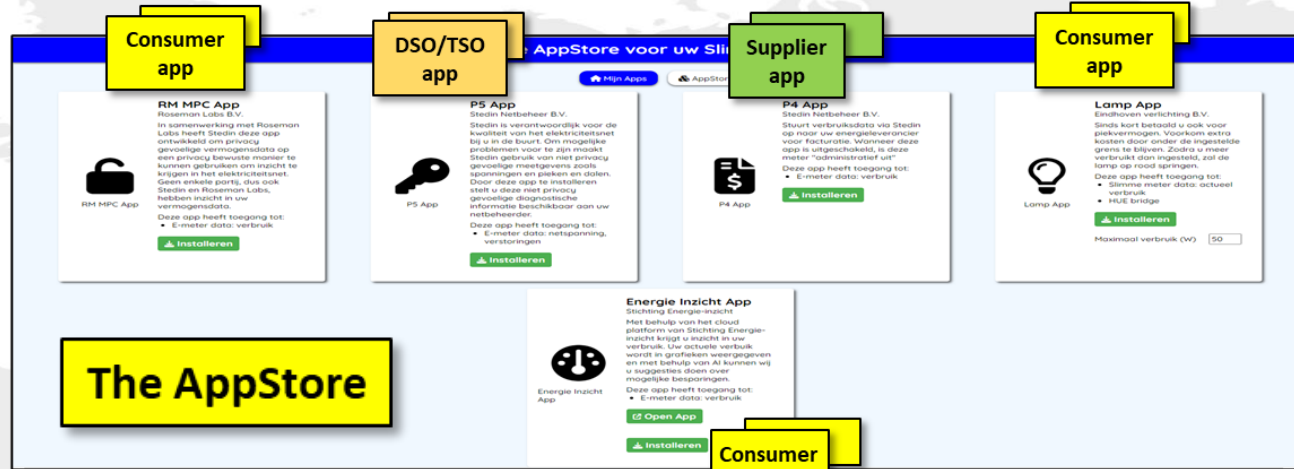
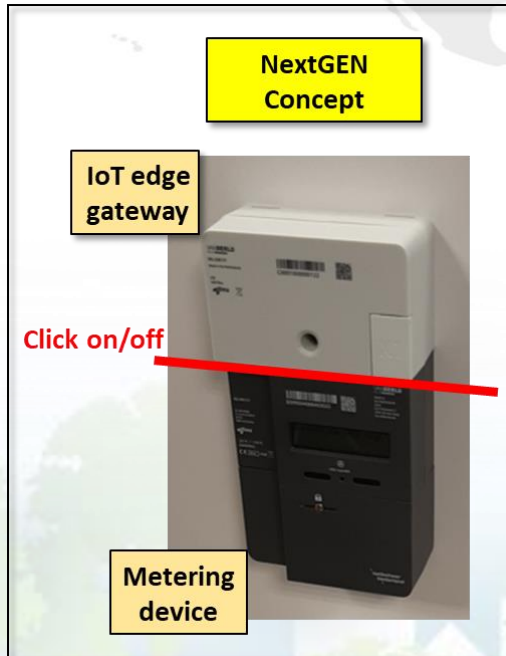
- **Basic meters with long lifetime**
- **IoT Edge Gateway (low cost) with open API's**
- **Applications to be downloaded from an AppStore**
- **Enhanced local consumer interface**
- **Roll out only when needed**

Modular design





Example: Demonstrator project





Flexibility: insights & learnings

A toolbox with instruments



A different mindset is required operating the system

“ We transform from ‘Supply follows Demand’ system to a system in which ‘ Demand follows Supply’ : the last mile is turning into the first mile’.

Adopt an “ONE system approach”

“ We have multiple grids, but within a balancing zone only ONE system. So in intervening on system level (balancing & congestion management), TSO’s and DSOs should cooperate: Any action invoked by a system operator on system level should not harm any other system operator”

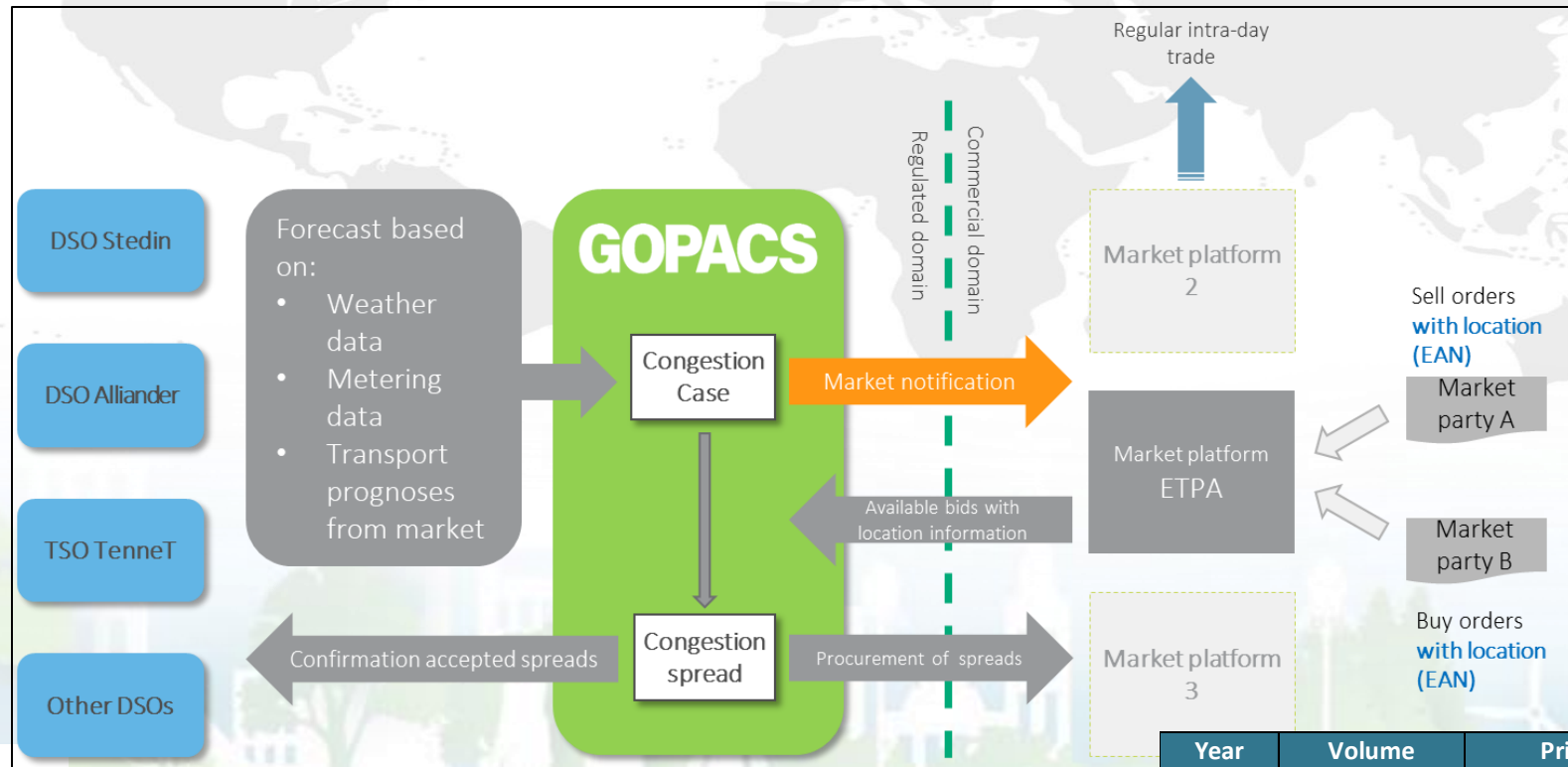
New Capabilities required at distribution level

“ Continuing a “copperplate investment strategy” for grids is no longer affordable for society. This requires ‘Day Ahead Load Forecast and Predictive Loadflow Analysis’ capabilities for all grid levels for DSO’s”



Example: Joint TSO/DSO Platform GOPACS in the Netherlands for market based congestion solutions

Operational since 2019



Year	Volume	Price	Price/MWh
2022	181958.4 MWh	€ 59.542.805,62	327
2021	144035.6 MWh	€ 45.221.897,61	314
2020	53965.5 MWh	€ 6.165.575,43	114
2019	36552.1 MWh	€ 4.464.483,75	122

Data exchange: insights & learnings



Data is the new money

“Access to data should accommodate a level playing field in society and the market”

Cross sectoral exchange of Energy Data

“For a successful energy transition, energy data is relevant for also other sectors, such as the building, transportation, financial and public sectors”

A separate Data Exchange layer is needed

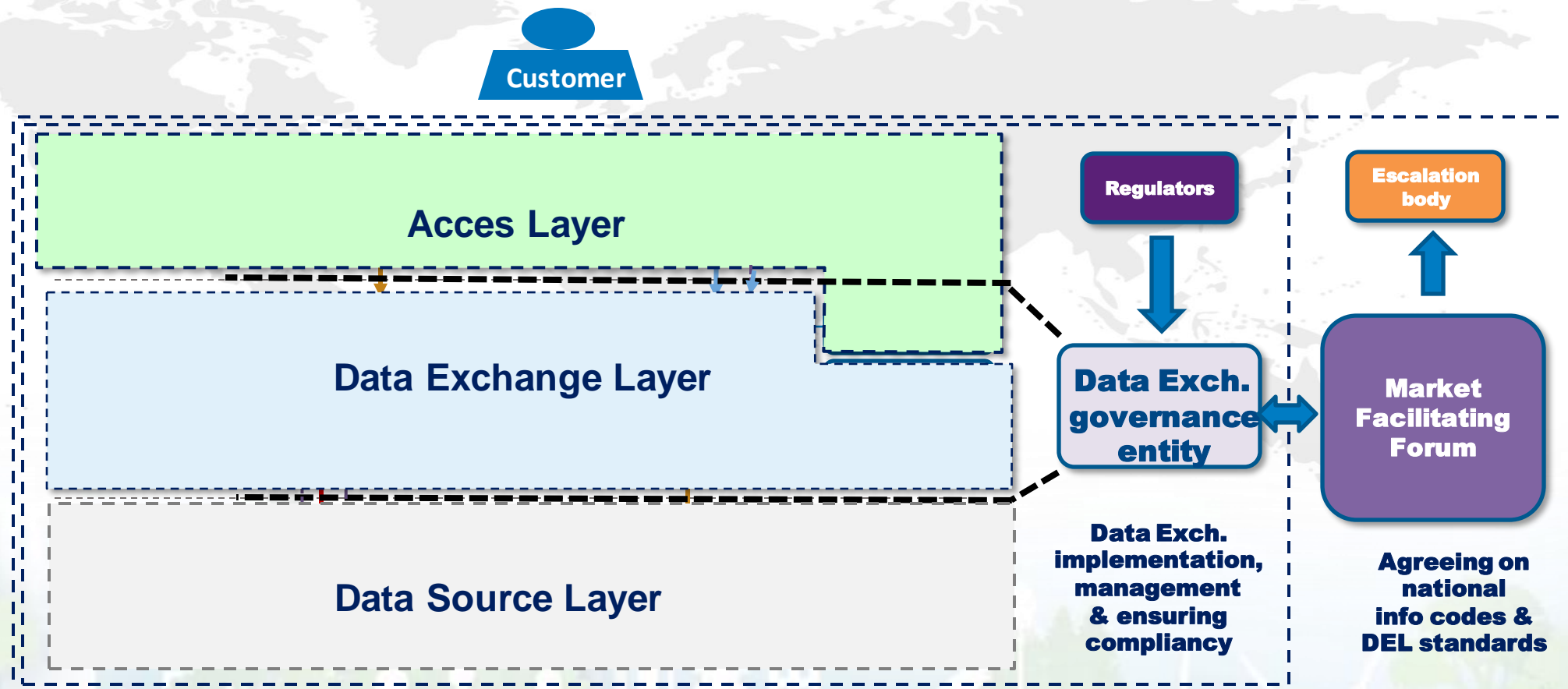
“Implement re-usable functionality (like IAA services) between all data requesters and all data sources”

Start with the governance issue first

With data kept at the source as much as possible, we should strive for interoperable Data Spaces, with each its own governance, including how data can be shared between these Data Spaces”



Example: Implementation Netherlands (2022)





Energy Sharing: insights & learnings

The customer is in the heart of the Energy Transition'

"The commitment of the customer will be essential for success: Statement EU commission"

Use local what you produce local ("Local4Local")

"With enabling Sharing of energy and Collective Self-Consumption, we will arrive at 3 wins:

- Citizens: *Cheaper and affordable energy, social commitment*
- System Operators: *"reduces stress at DSOs on congested grids, CAPEX expenditure and workforce challenges (needed for grid expansion projects)*
- Government: *it accelerates an affordable energy transition, as citizens become co-investors of parts of the Energy System, and accelerate the uptake of decentralized electricity generation and the decrease of fossil fuel usage"*

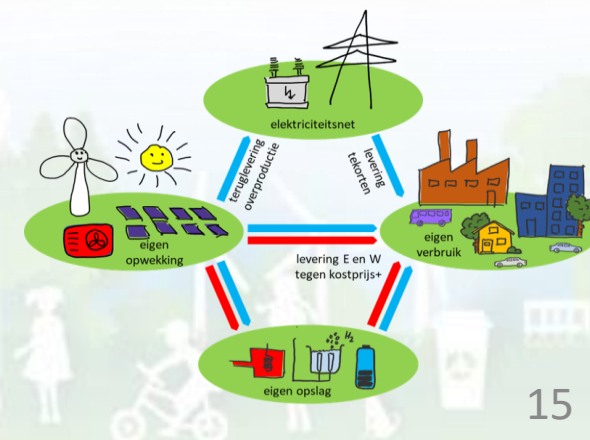
A fundamental market model change is ahead

"From 'Supply of Energy' to facilitating Producer - Consumer energy transactions, in all timeframes"



Energy Sharing & Collective Self Consumption

- Emerging hot topic in Europe and the Netherlands (>600 energy cooperative active)
- Principle first “use Locally what you produce Locally” (Local4Local)
- Perimeter: Municipality or MV grid level
- Local markets (peer2peer trading) connected to the wholesale market
- Local prices decoupled from wholesale market prices
- Multiple market actors active simultaneously on one connection
- Allocation data derived from multiple metering points

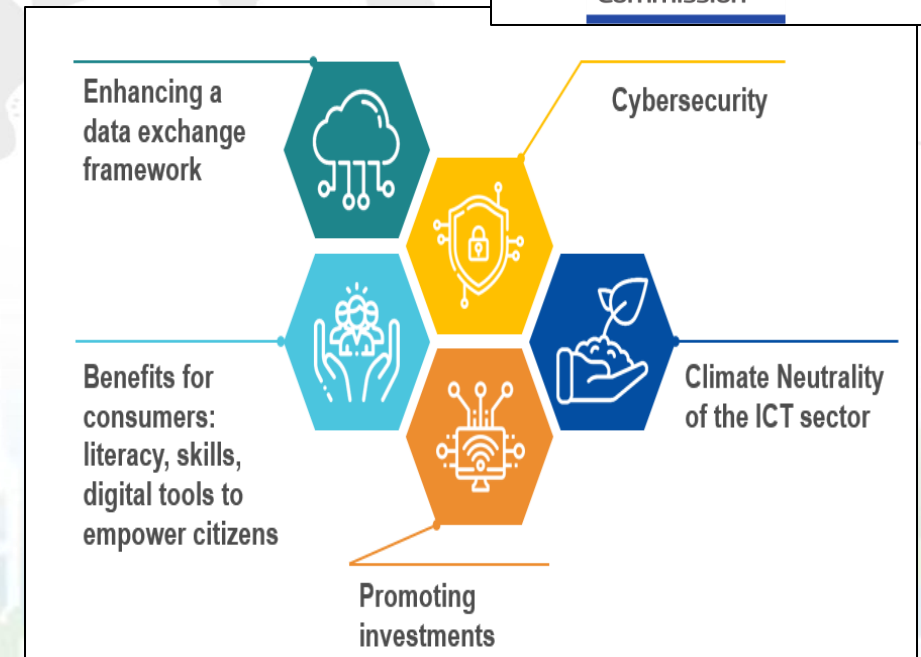




The EU actionplan of digitalisation of the Energy System

Published 18-10-2022

- European and National legislation addressing digitalisation of the Energy System directly
- De European themes:
 1. Data exchange
 2. Empowering citizens
 3. Investments in smart grids
 4. Cyber security
 5. Climate neutrality of the ICT sector
- Consultation on Electricity Market design (EMD) published 23-1-2023
- Publication of draft directive on EMD expected Q2 2023





Thank You

Questions ?

Relevant URL's

- Flexibility: www.gopacs.nl
- Data exchange: www.mffbas.nl
- Energy Sharing: [Energie Samen rapport \(windows.net\)](http://Energie Samen rapport (windows.net))
- EU action plan on digitalisation of the Energy System:
https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_22_6229/QANDA_22_6229_EN.pdf
- Transformation Proces 2022 (Hackaton): <https://vimeo.com/773276307>