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LUNCH &LEARN

ENERGY HOLOCRACY

December 14, 2023

WELCOME!

WE WILL START AT 12:15H

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Program

12:15h: Introduction by MiaoMiao Zhou, Associate Professor Smart Fermentation – MNEXT

12:20h: Presentation Jack Doomernik, professor Smart Energy – MNEXT

12:50h: Questions/discussion

13:00h: Closure

- Please ask your questions via the chat
- Presentation slides will be shared afterwards
- This Lunch & Learn will be recorded

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ENERGY HOLACRACY:
RENOVATING OUR ENERGY SYSTEM

Dr. Ir. Jack Doomernik MM

jemj.doomernik@avans.nl

MNEXT Smart Energy

@14-12-2023 Lunch & Learn

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UNIVERSITY OF APPLIED SCIENCES

MNEXT: Centre of Expertise for Material & Energy Transition

ENERGY

MATERIALS

RENEWABLE ENERGY CARRIERS

SMART ENERGY

BIOBASED RESOURCES & ENERGY

BIOBASED TRANSITIONS

BIOBASED BUILDING BLOCKS & PRODUCTS

BIOBASED BUILDING

MARINE BIOBASED CHEMISTRY

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The **Smart Energy Research Group** is focussed on technical developments to built smart grids that balance supply from renewable sources with energy demand and supports energy saving.

The Smart Energy Team









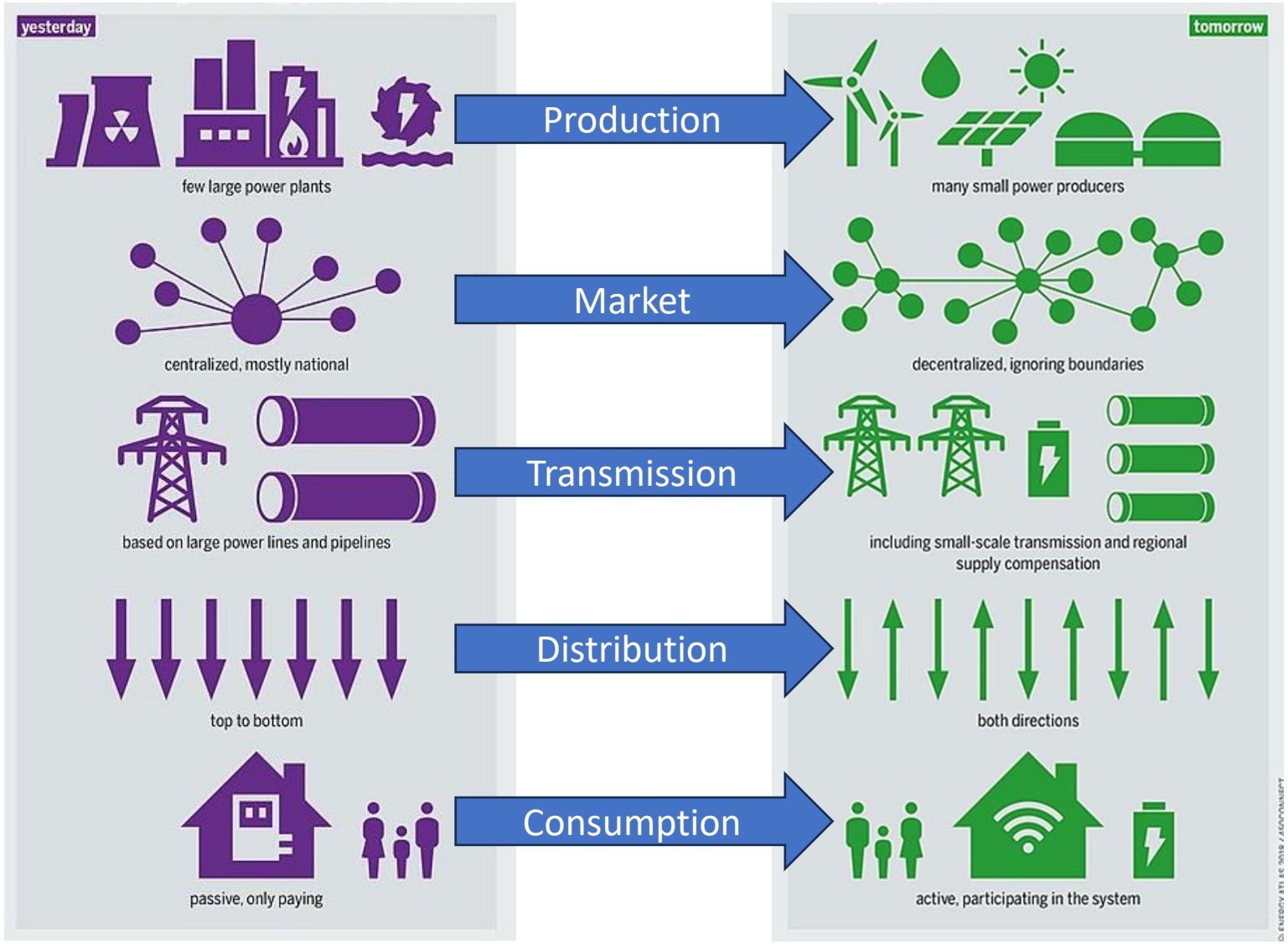



Agenda

- What is the problem?
- Smart Energy research
- Holon approach
- Practical application

A new energy mix: less fossil, more renewables

Renovation of our energy system



Gradually building a different kind of energy system

Today

Supply:
- Fossil fuels
- Few large central generators
- Planned production

Demand:
- Consumers
- Petrol and diesel cars
- Oil and gas boilers

Grid:
- Balance in supply and demand
- Independent electricity network
- AC
- Standard meters
- Centrally controlled billing
- Fixed tarifs
- One direction delivery to consumer
- Contractual congestion
- Data for billing

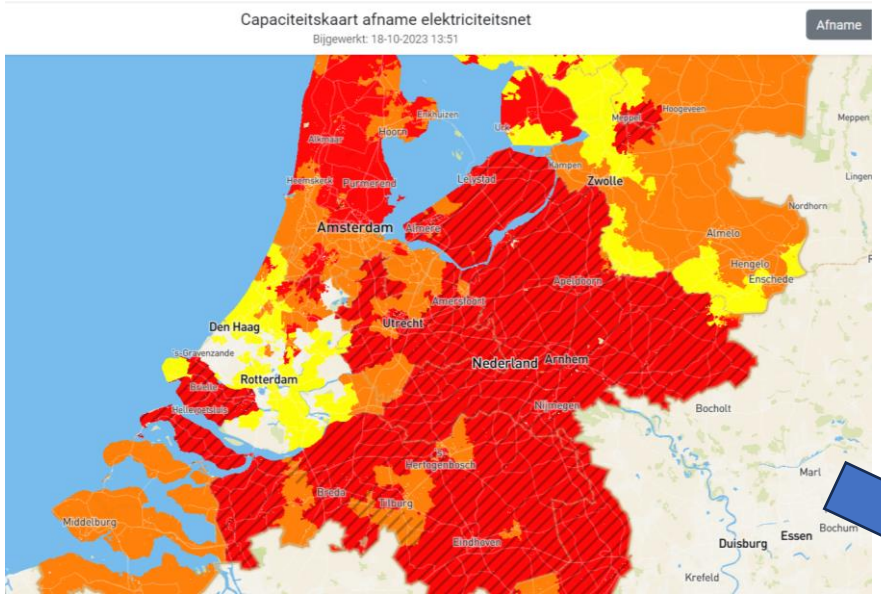
Tomorrow

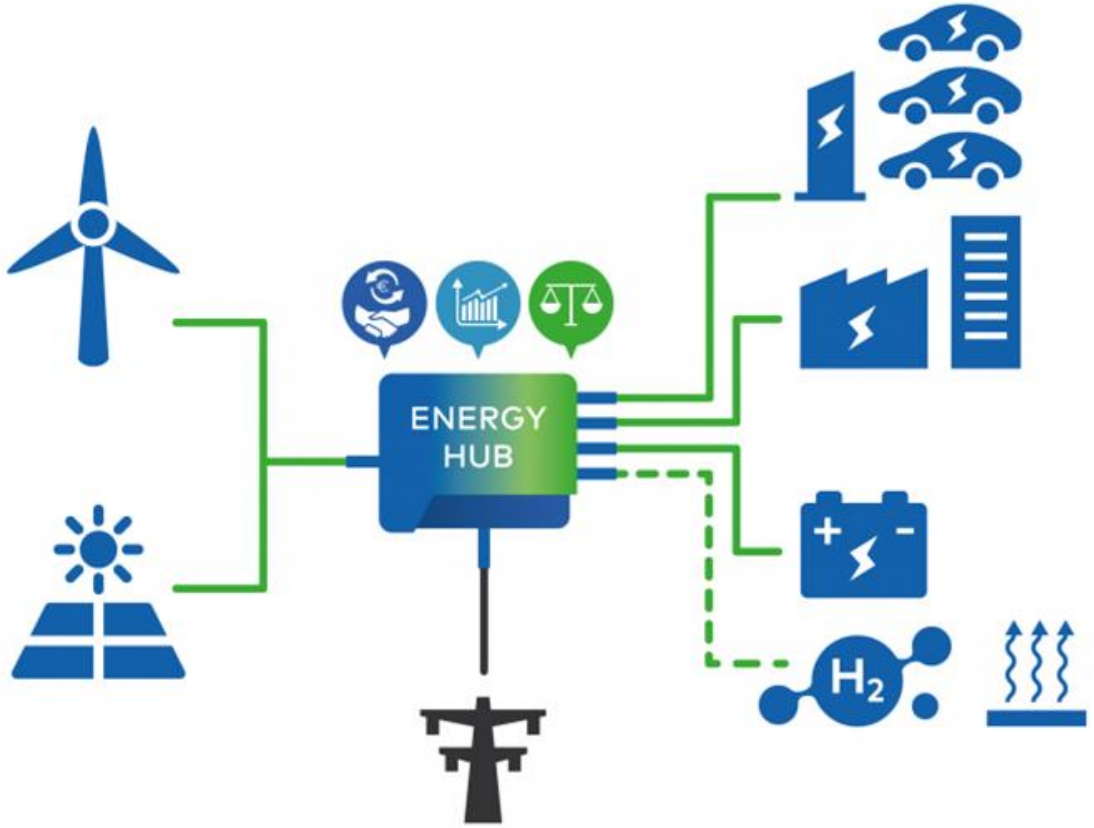
Supply:
- Renewable sources
- Many small local producers
- Volatile and intermittent production

Demand:
- Prosumers
- Electric vehicles
- Heat pumps

Grid:
- Storage solutions
- Multicommodity grids
- AC and DC
- Smart meters
- Blockchain
- Dynamic pricing
- Birectional Peer2Peer trading
- Optimal use of physical infrastructure
- Big data and new digital platforms

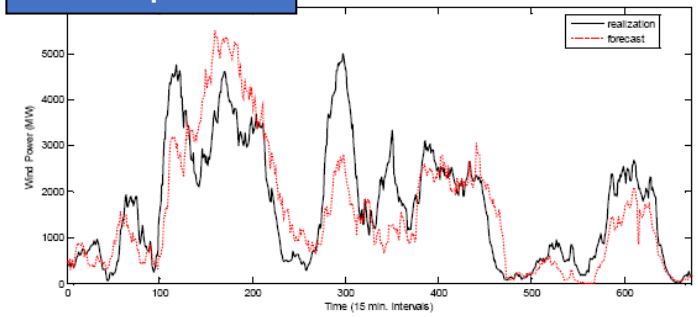
Prevention of grid congestion with Local for Local solutions





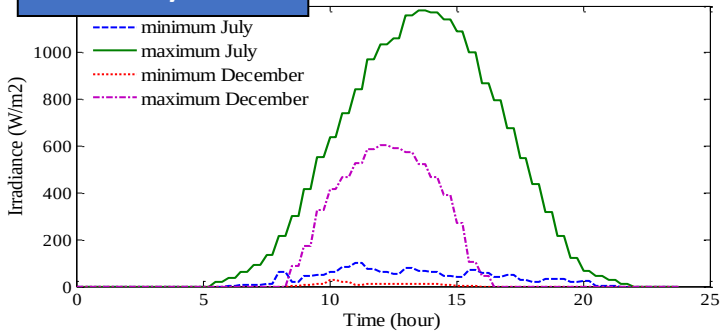
Systems integration of new technologies and energy balancing

Wind park



Real and Forecasted Wind Power Profile for One Week, 6000+1800 MW Wind

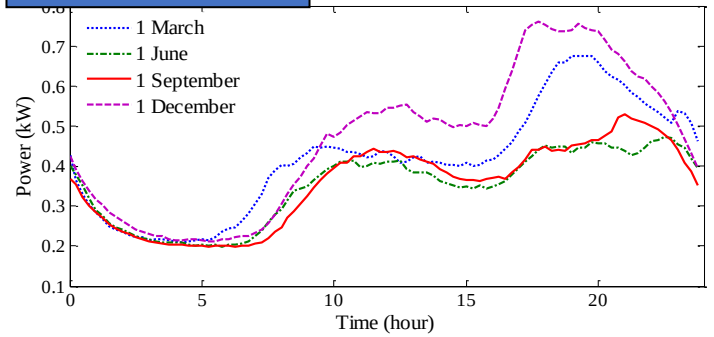
Solar system



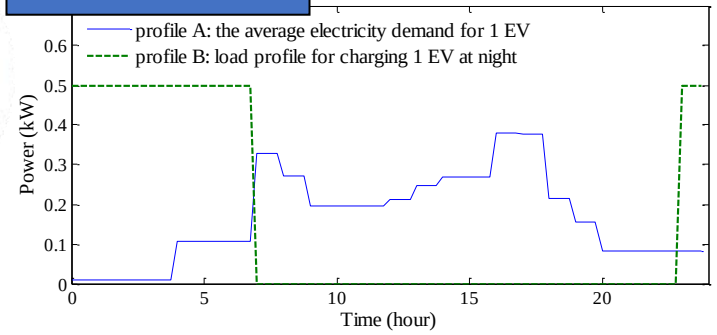
Smart Grid capabilities:

- Better grid utilization
- Prevention of grid congestion and expansion
- Enables more local production
- Flexibility for end-users
- Dynamic load control
- Multi-vector solutions
- Supports direct and indirect electrification
- Integration of storage and back-up solutions

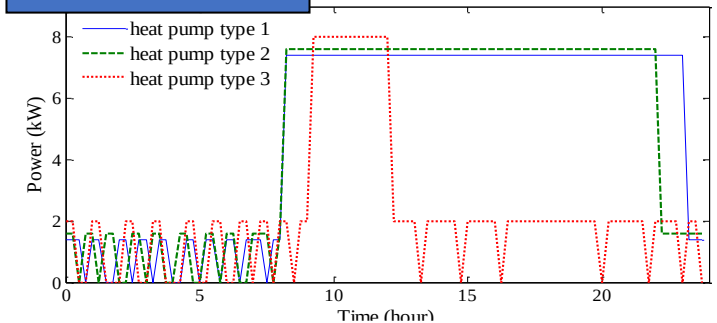
Household



Electric car



Heat pump



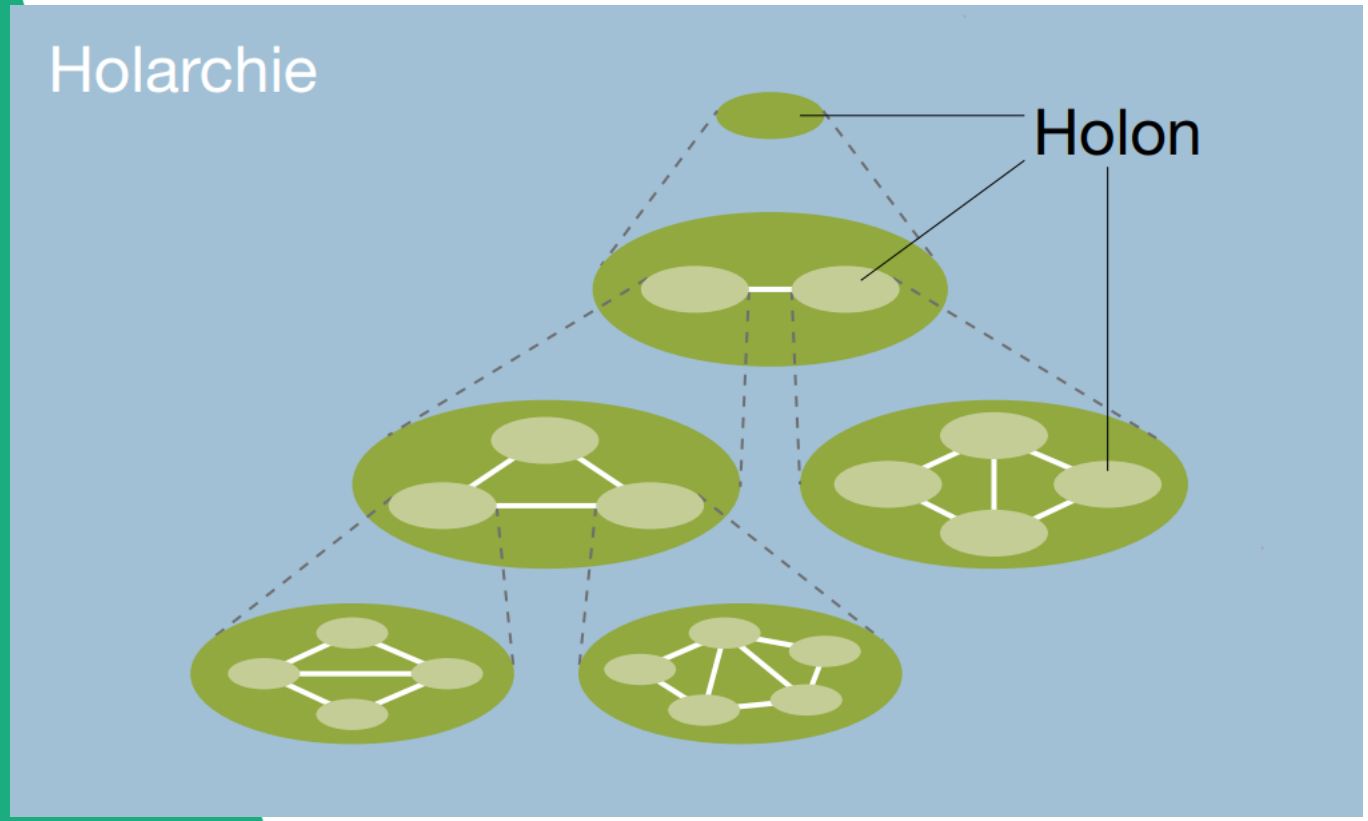
What is Holarchy?

System model based on 'holons'

Holons are independent units that have a possess a certain degree of autonomy, but at the same time are subject to control from one or more higher levels

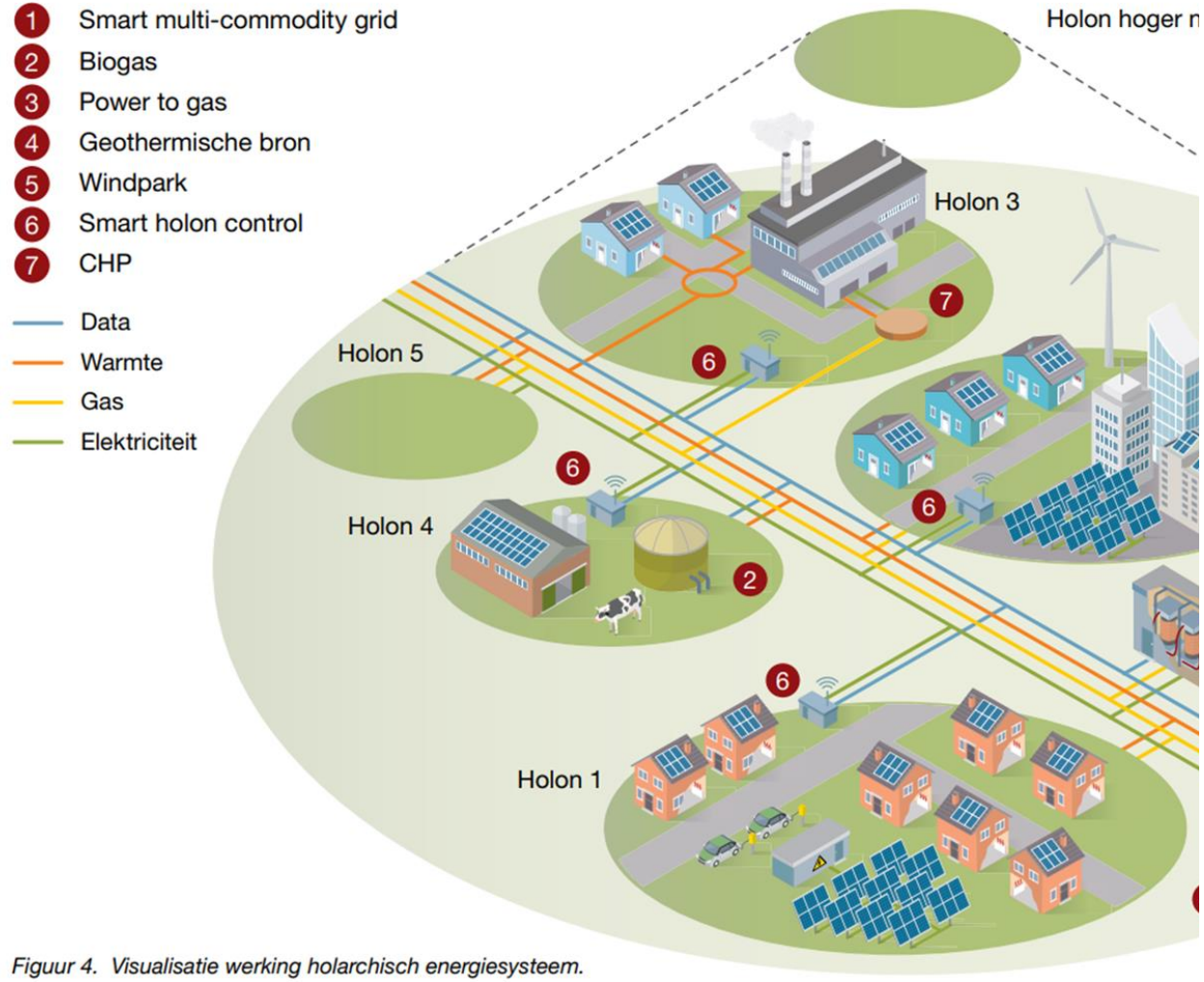
A holarchy is a hierarchy of self-regulating holons that function:

- autonomous (possibly controlling subordinate holons)
- are submitted to higher level holon controls and
- act in coordination with their local environment

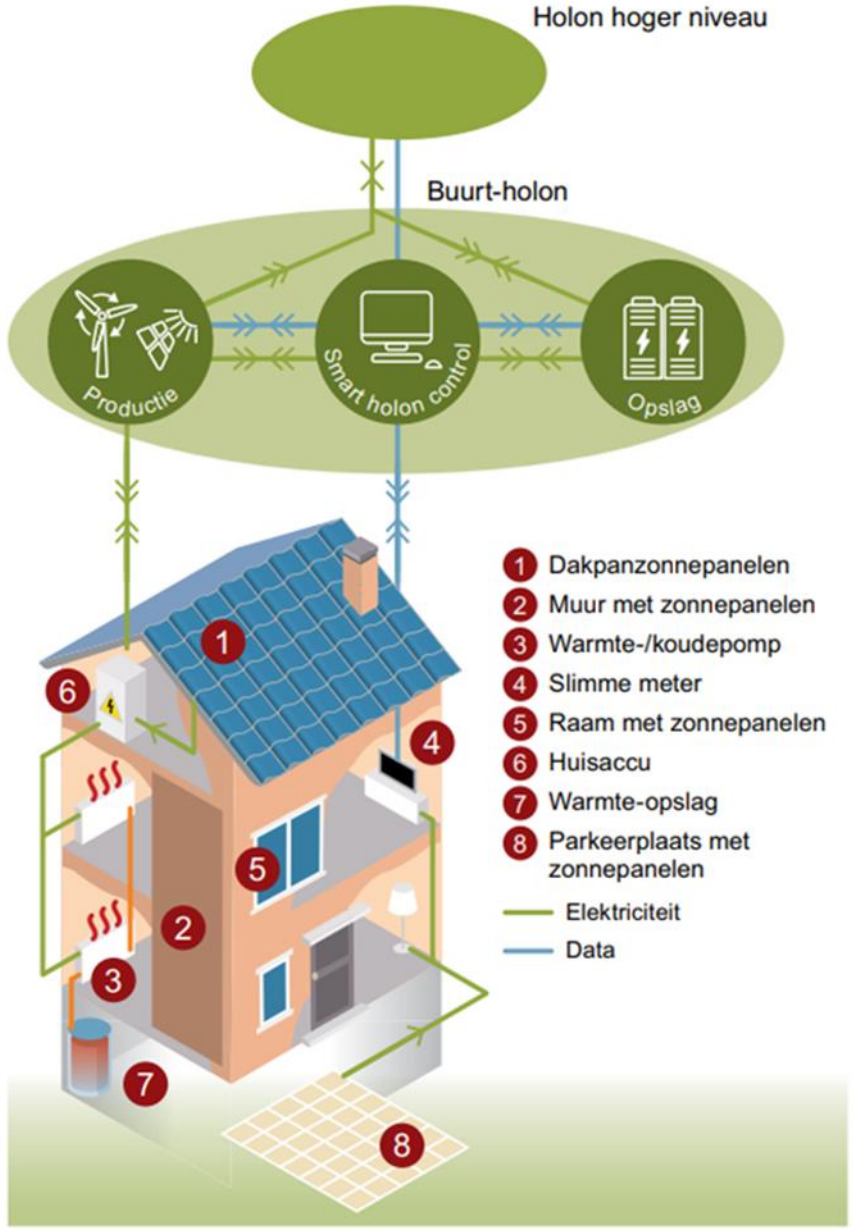


Source: Systeemintegratie, Naar een holarchisch energiesysteem!?, Topsector Energie, 2020

Energy Holarchy



Figuur 4. Visualisatie werking holarchisch energiesysteem.



Figuur 5. Een woning-holon als onderdeel van een buurt-holon.

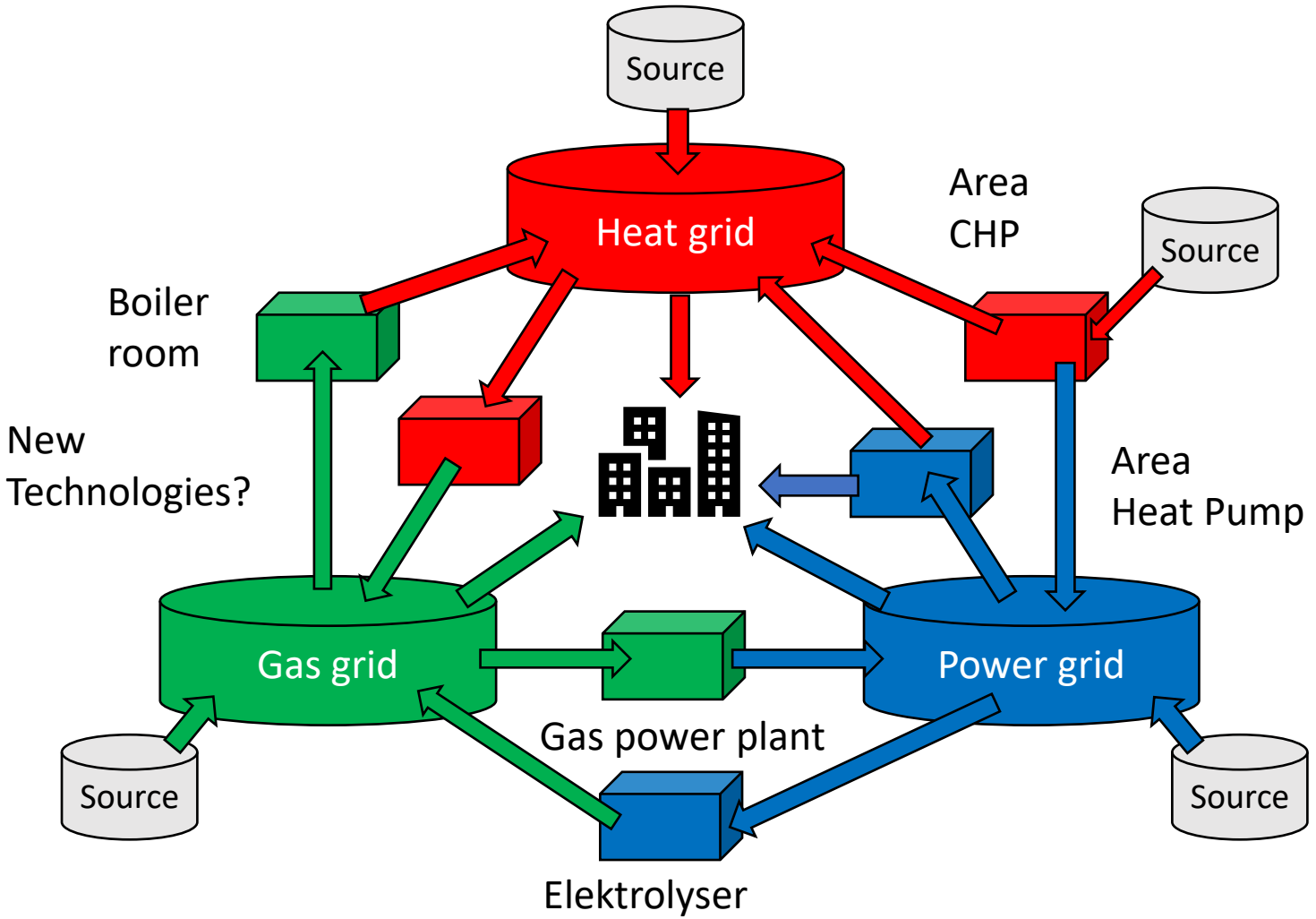
Source: Systeemintegratie, Naar een holarchisch energiesysteem!?, Topsector Energie, 2020

Multi commodity grids to connect and support Energy Holons

Data is the basis for operating energy holons

With this intelligent control, the energy system can be adapted to the possibilities and needs, such as available flexibility, need for balancing or preventing congestion.

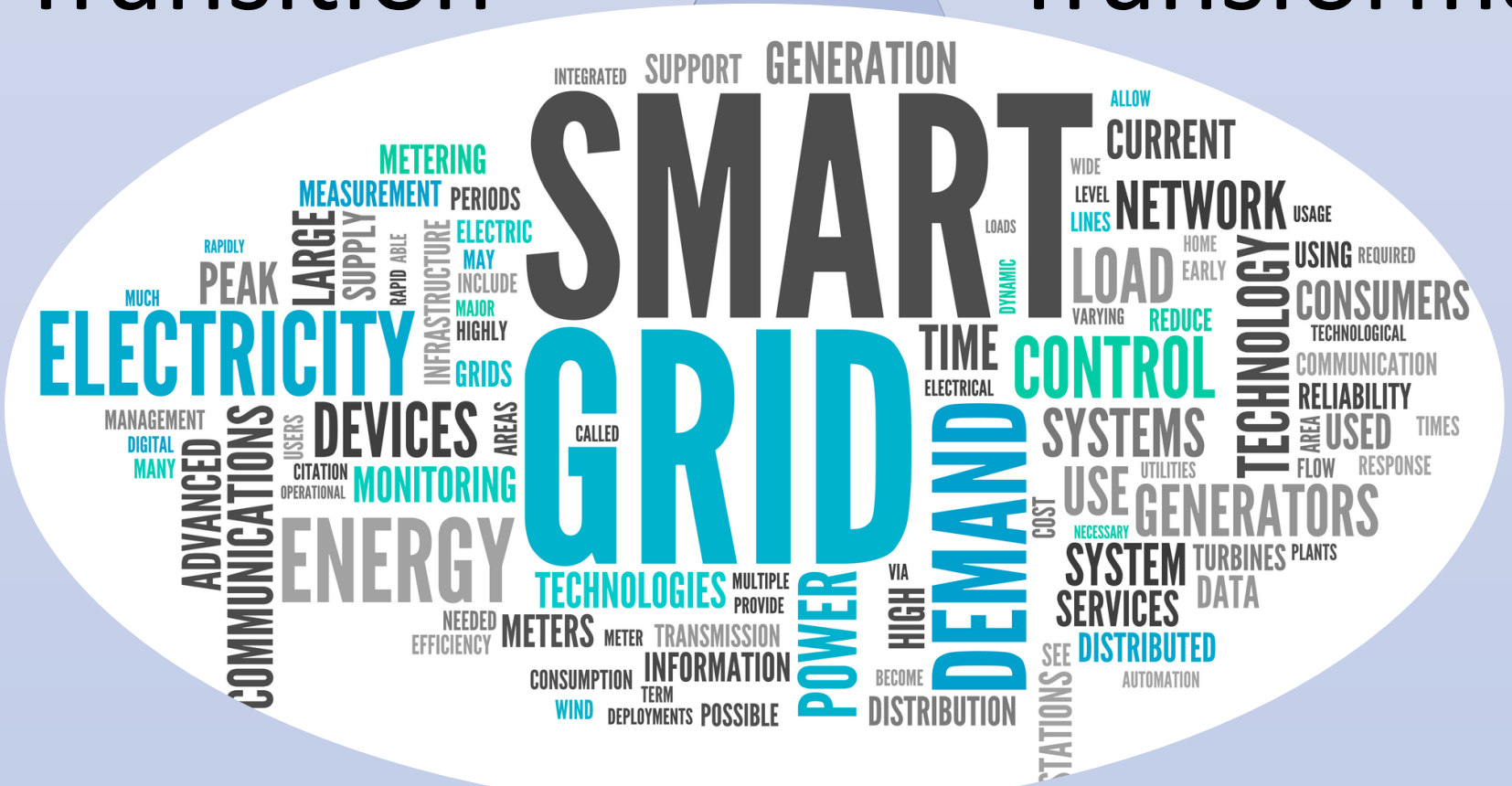
Digitization, including algorithms and AI, play a role in this a crucial role.



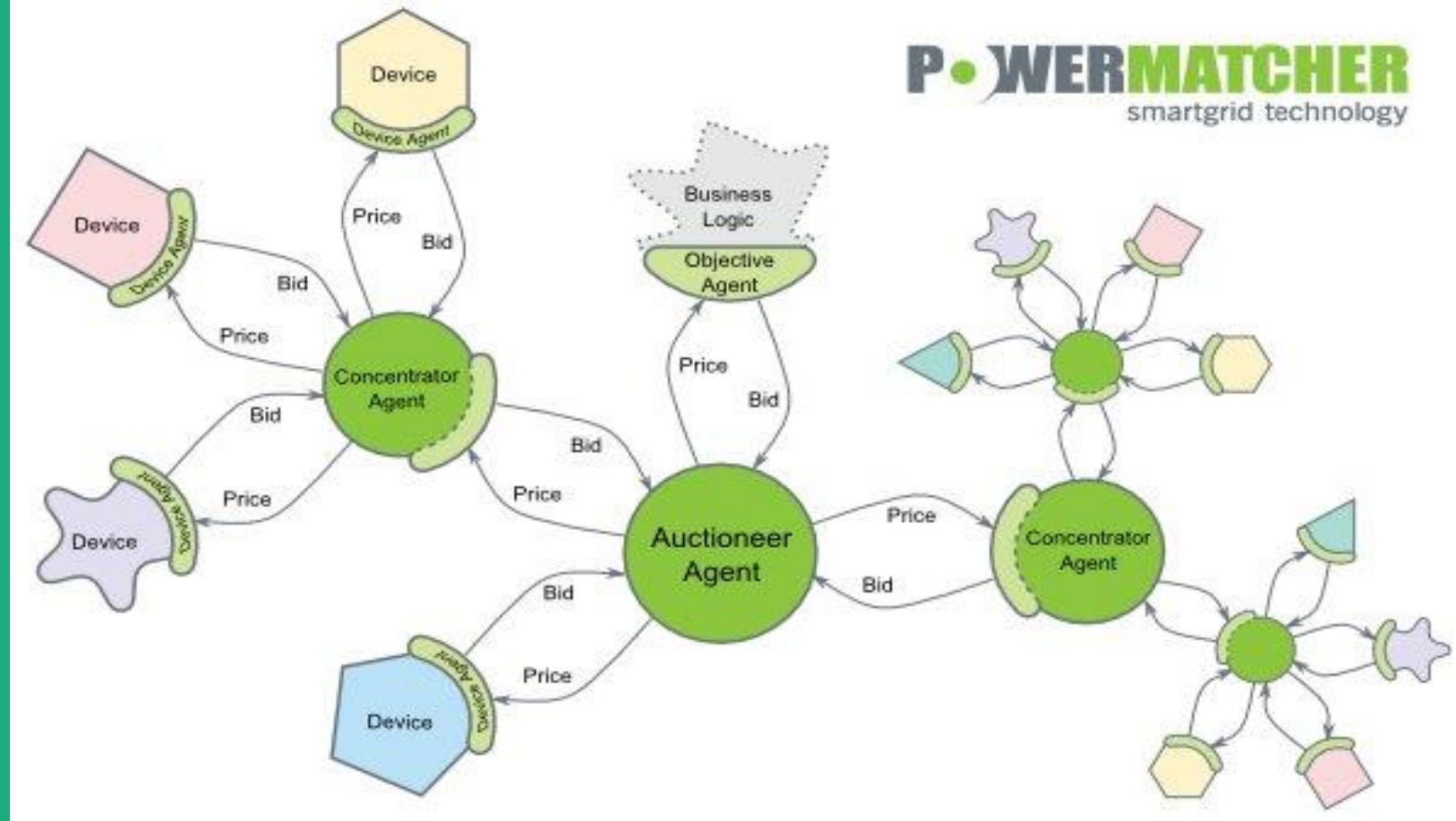
Source: Charlotte Higgins et al, Opportunities for interoperability between different energy networks for remote or island networks, CIGRÉ conference 2018

Energy Transition

Digital Transformation



Multi agent models can help holons to control and trade their energy



https://www.youtube.com/watch?v=Zz4OpVwYWYE

AI in Energy Systems

Smart grid control

- Smart networks with the application of AI to better control energy flows, make better use of electrical grids and prevent grid congestion.

Grid diagnostics

- With AI we discover the abnormal correlations in the network nodes during operation. Based on the type of “disease” we take different actions. The algorithm is also used in cancer diagnosis.

Transactive energy

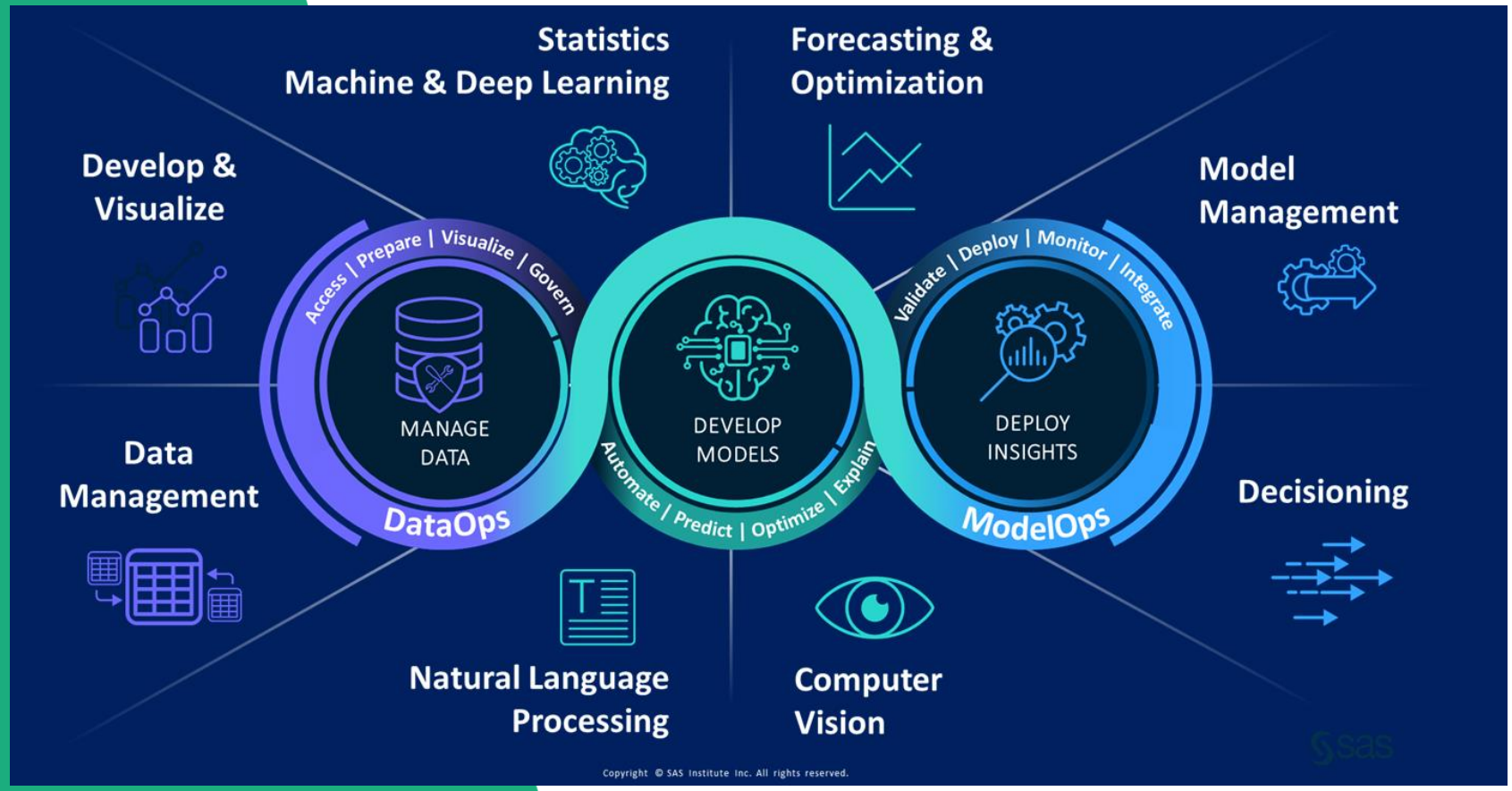
- AI to gain value from flexibility in energy supply and demand in relation to energy markets.

Cooperation with SAS

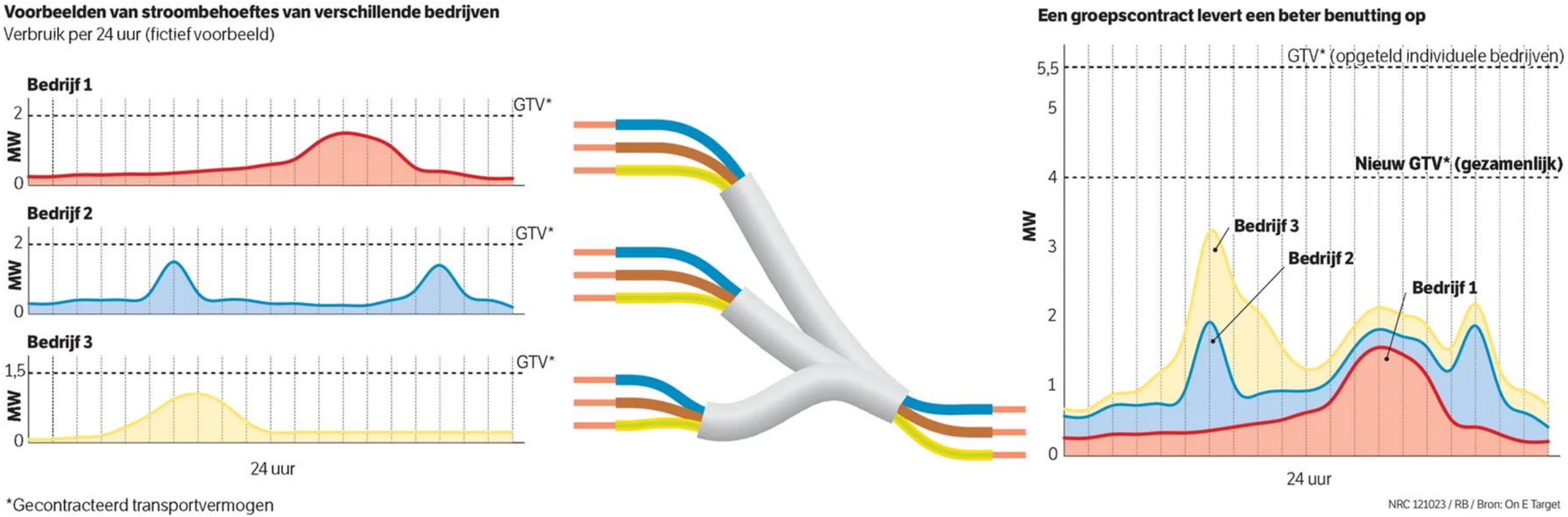
Data collection and acquisitions with smart meters and sensors

Use of AI, analytics and data management platform Viya

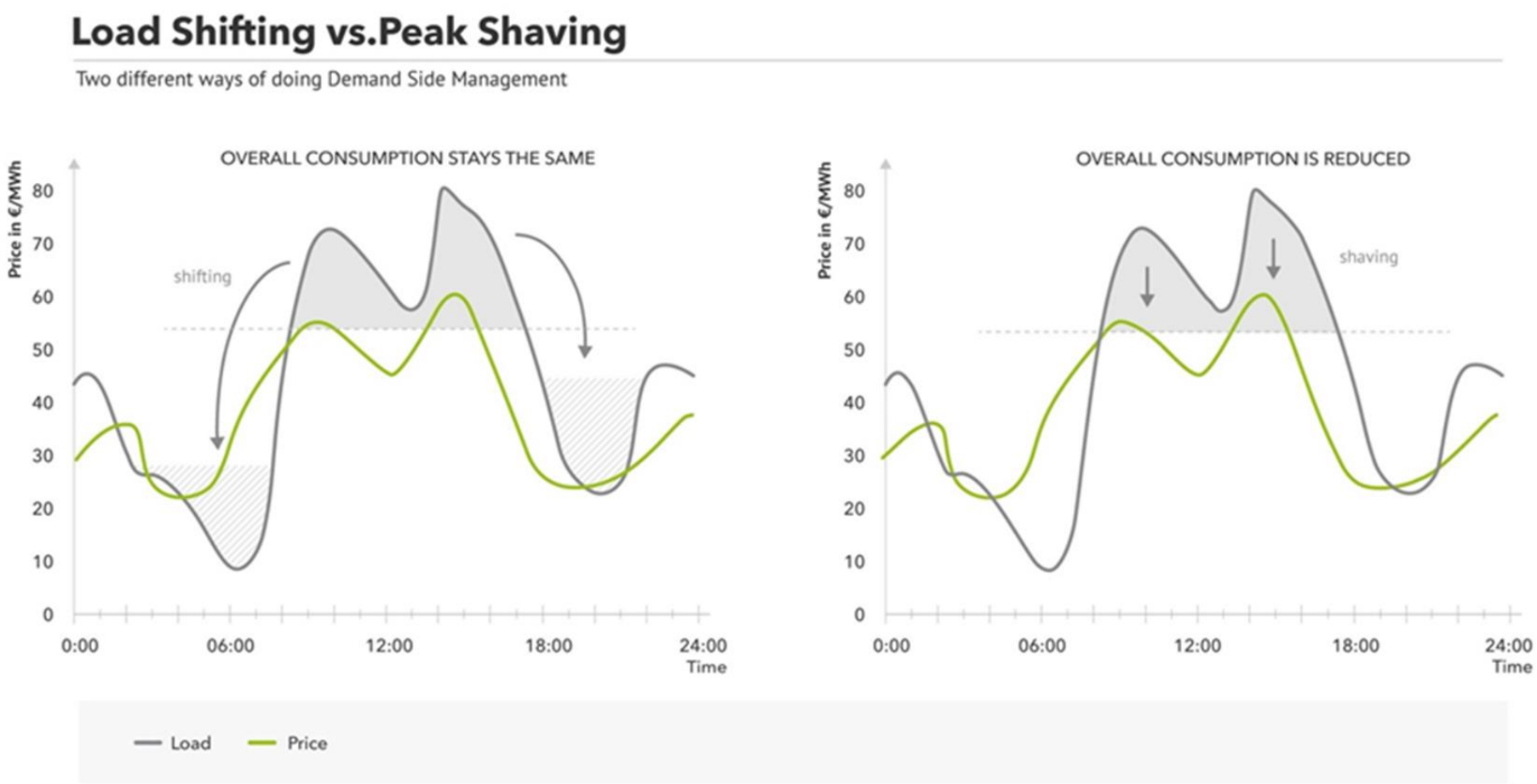
Unlocking the data collected in our Smart Energy Delivery lab from in-house experiments and field labs



Group contracts for business districts?



Demand Side Management



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More information:

Dr. Ir. Jack Doomernik MM

T +31 6 5393 6724
E jemj.doomernik@avans.nl

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Energy Holocracy by Jack Doomernik,
Professor Smart Energy at MNEXT

Thursday December 14, 12:15h

Stay
informed