How to face the grid capacity challenges

Electrification of transport

Interreg Europe — Co-funded by the European Union — ZCI

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Transition manager Fluvius

Interreg Europe Zero Carbon Infrastructure

Tuesday 14th of May

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2. Specifics on EV
3. No regret investment plan
4. Next steps and conclusions

Fluvius in the energy landscape:

→ Multi-utility System operator

Electricity & gas distribution

206.000 km distribution grid

6,6 M customers

5500 Employees

2,5 B Turnover

1,2 B Investmen

Regulator

In Vlaanderen is de VREG de regulator (Vlaamse Regulator van de Elektriciteits- en Gasmarkt). De medewerkers adviseren de gewestelijke overheid en controleren de toepassing van decreten en besluiten.

Production

elektriciteit onder andere in kerncentrales of klassieke centrales met fossiele brandstoffen. Voor groene elektriciteit worden hernieuwbare energiebronnen zoals wind en zon gebruikt.

Import

In België zijn er geen aardgasbronnen. Het aardgas wordt voornamelijk ingevoerd uit Noorwegen, Nederland en Qatar (vloeibaar aardgas = LNG), en in mindere mate uit Rusland en Groot-Brittannië. LNG wordt aangevoerd per methaanschip, via Zeebrugge.

Transport

Transport

Fluxys

Fluxys vervoert aardgas vanuit de gasterminals via het hogedruknet, naar de Fluvius-netten e naar grote industriële verbruikers.

Fluvius

In Vlaanderen brengt Fluvius als distributienetbeheerder aardgas en elektriciteit naar de klanten (tot in woningen en kleinere bedrijven).

Klanten

Public lighting

Metering company

3,5 M Smart Meters

Supply, services

Data Management

Market facilitator

Supply, Flex/ EC

Bron: www.creg.be

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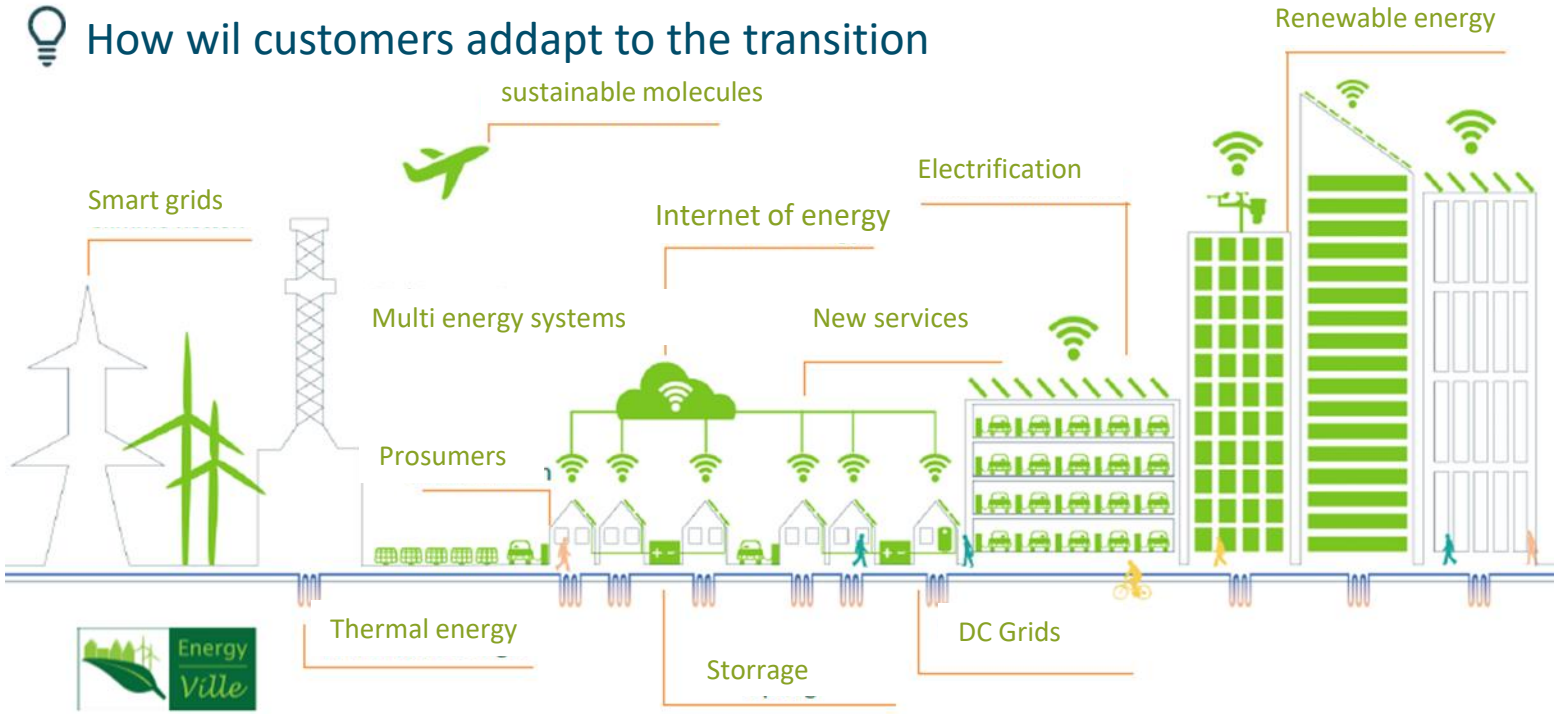
Energy transition: challenges for the grid

- **A more complex energy landscape**.
  - New needs and expectations,
  - New customers and market parties,
  - New products and services, ...
  - New energy carriers

- **New challenges**
  - Electrification and capacity
  - Acces and operational security
  - Balancing and congestion
  - Market facilitation

Our world in 2030 ? Less energy, more electricity, data driven

How wil customers addapt to the transition



The distribution network is an important enabler for the energy transition

System Challenges!

Introduction of production and storage

- More renewable,
- More decentralized,
- Less predictable
- Less controll

Change of consumption behaviour

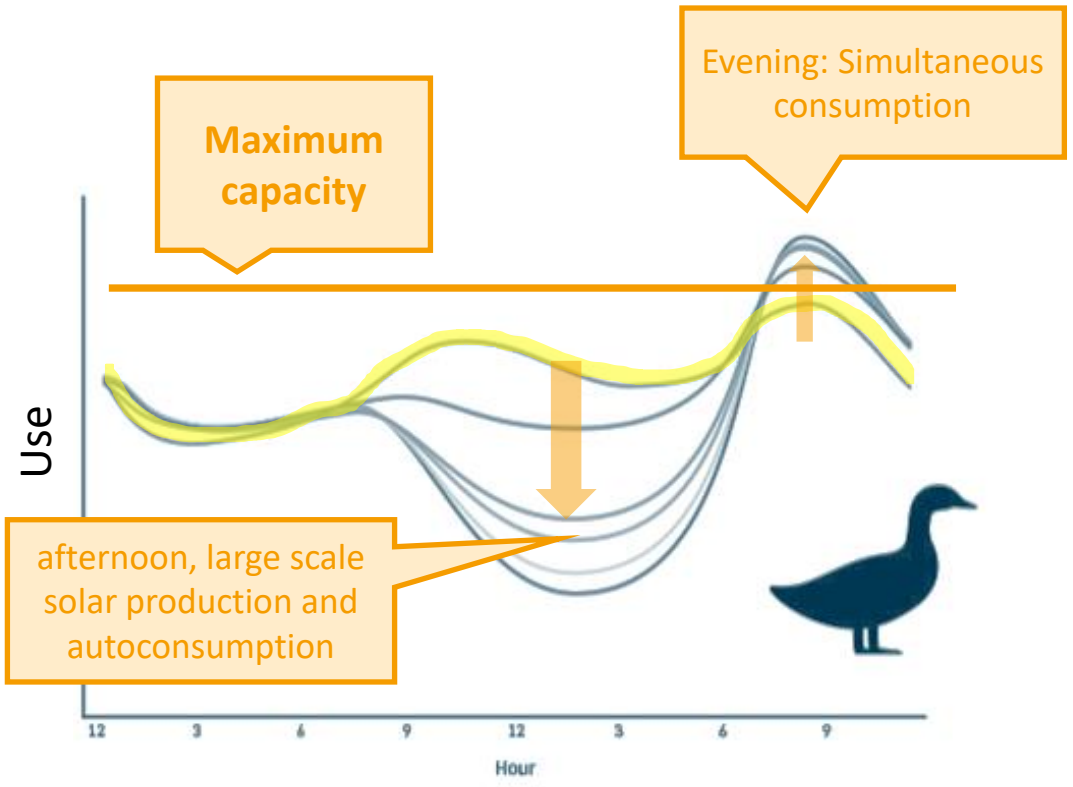
- Electrification of transportation
- Electrification of Heating
- Electrification of proces industry
- Simultanious behaviour

New products and services in the market

- Energy sharing / communities
- Flexibility and dynamic tariffs
- Local and global balancing
- Digitalisation and HEMS

Availability and reliability of the grid capacity in a less predictable, fast changing environment

The electricity grid under pressure ?

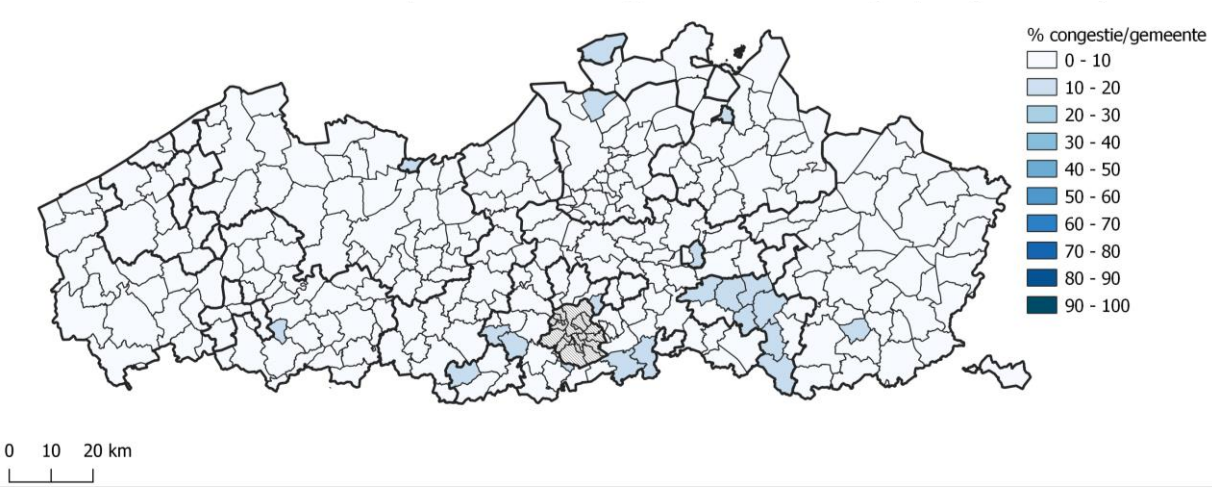


- Electrification:
  - Higher consumption (volume)
  - Higher simultaneous behaviour
  - Higher system peak
  - Higher impact on the grid

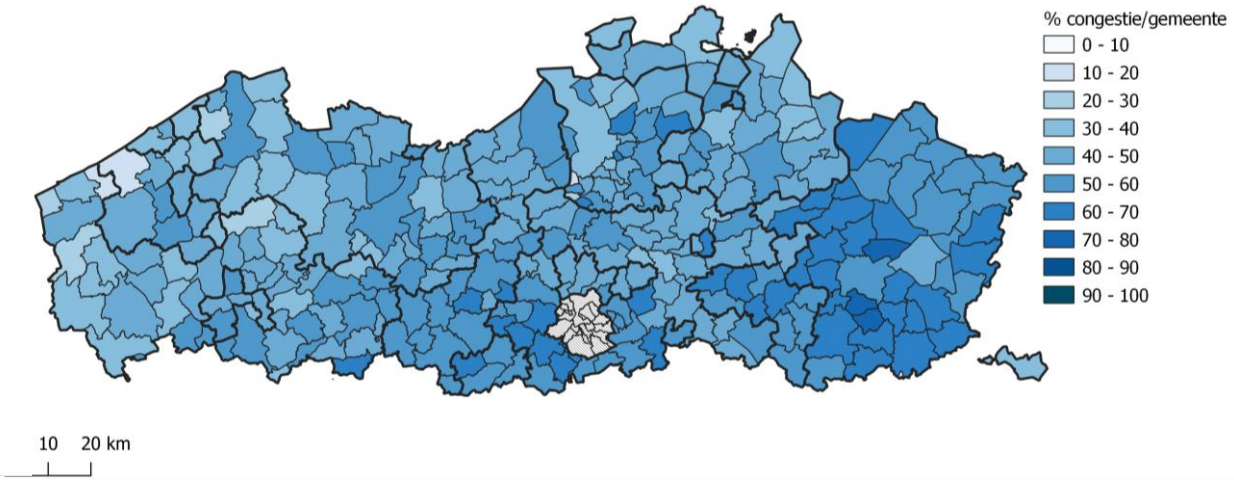
→ Investments in grid infrastructure and smart use of available grid capacity

Actual and future grid conditions

Actual amount of networks with congestion risk



Estimated amount of networks with congestion risk



Preparing our grids for the future in order to facilitate the energy transition

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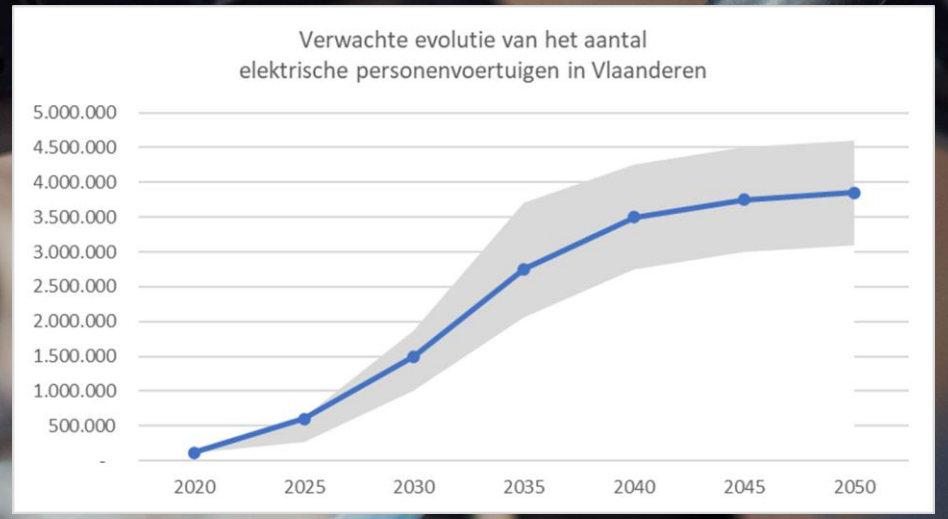
4 types Electric Vehicles and impact on our Grid

Private car	Van	Heavy Duty Truck	Public Transportation
			

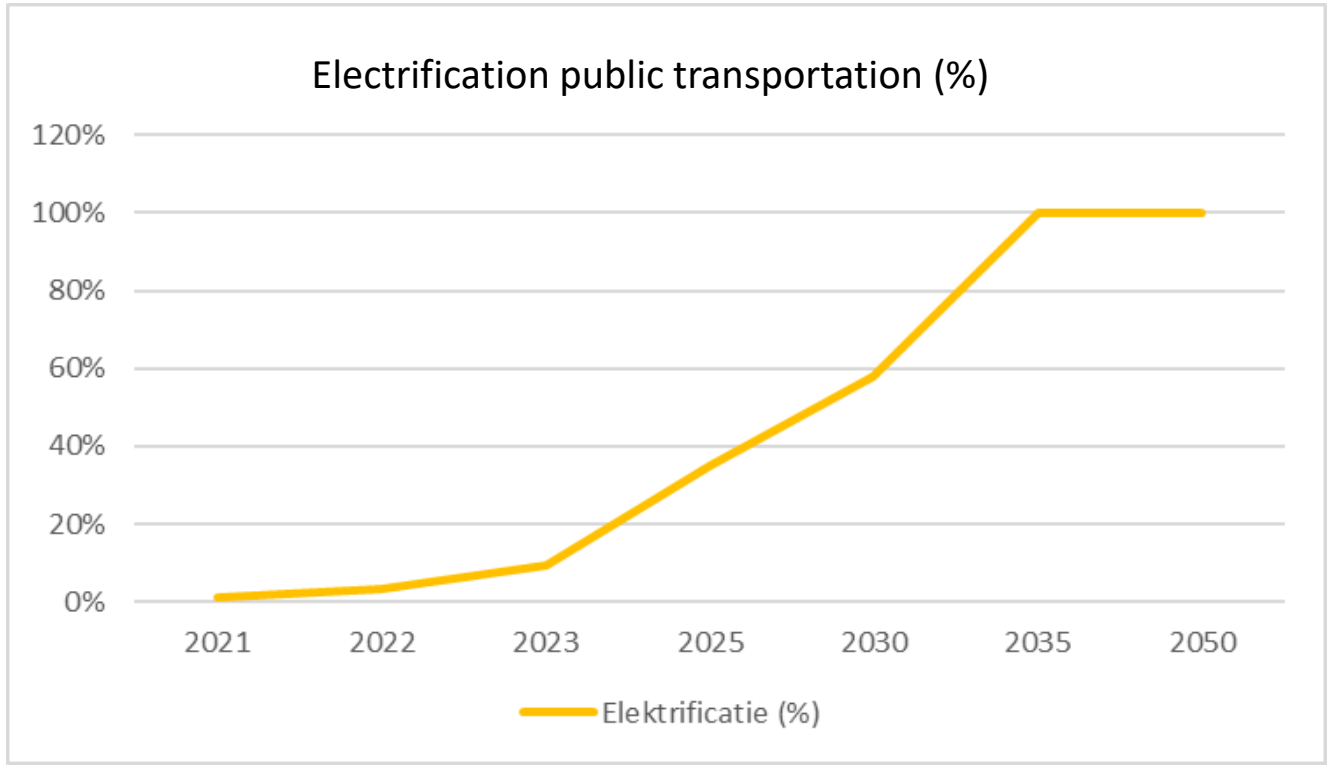
Private car and small van

- Significant quantities
  - 3,6 million in 2021 → 3,85 million in 2050
  - Best estimate: 1,5 million EV's in 2030 !
- Importance of charging combinations:
  - **Home charging (slow)**
  - **Charging at the office (slow and Fast)**
  - **Public charging (slow and fast)**
- Charging capacity: We asume
  - Average charging power of 7,5 kW
  - Simultaneaty of 60 %
- Large impact on the LV distribution grid between 17h and 20h(peak hours)

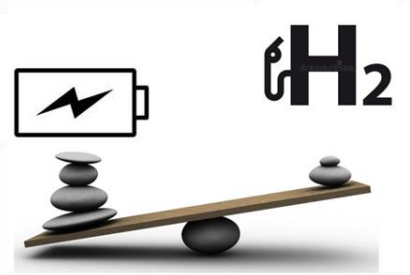


Public transportation

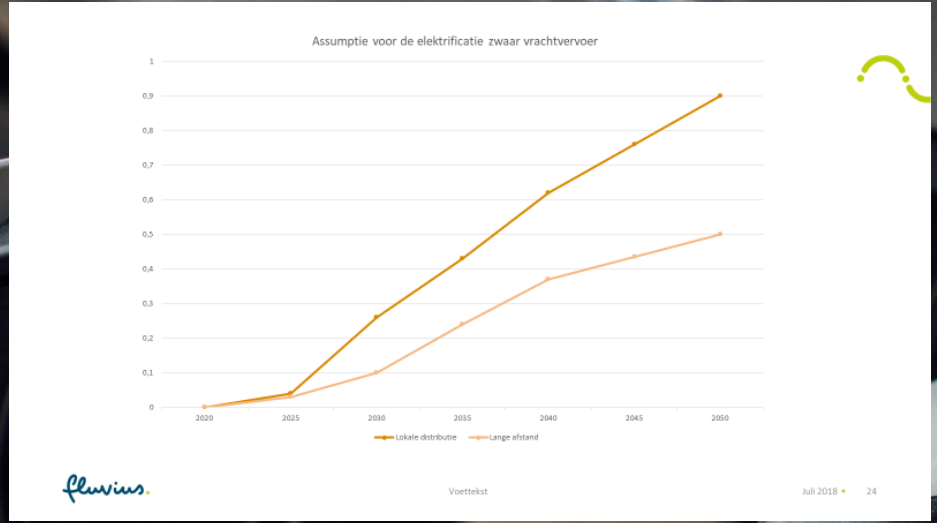
- **Full electric in 2035**

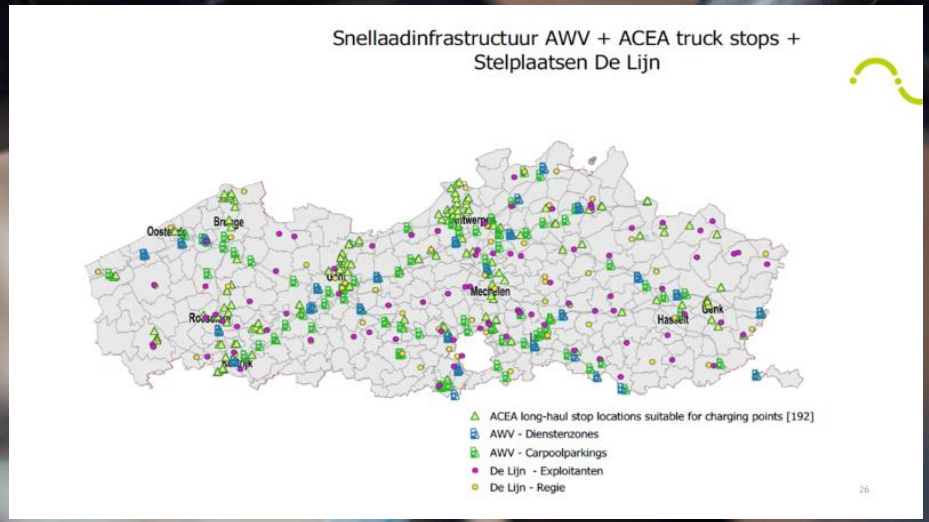


Heavy duty transport (+ 32 ton)



- Electrification will (most probably) be the standard
- Alternatives (Hydrogen, bio CNG, HVO) can't be excluded
- For now there are no electric offer for most market segments
- **Sector expectations: 20 % of the new trucks will be electric in 2030 (= 5% op total fleet)**
- 130 charging stations on the main roads
- Status, innovative pilot projects





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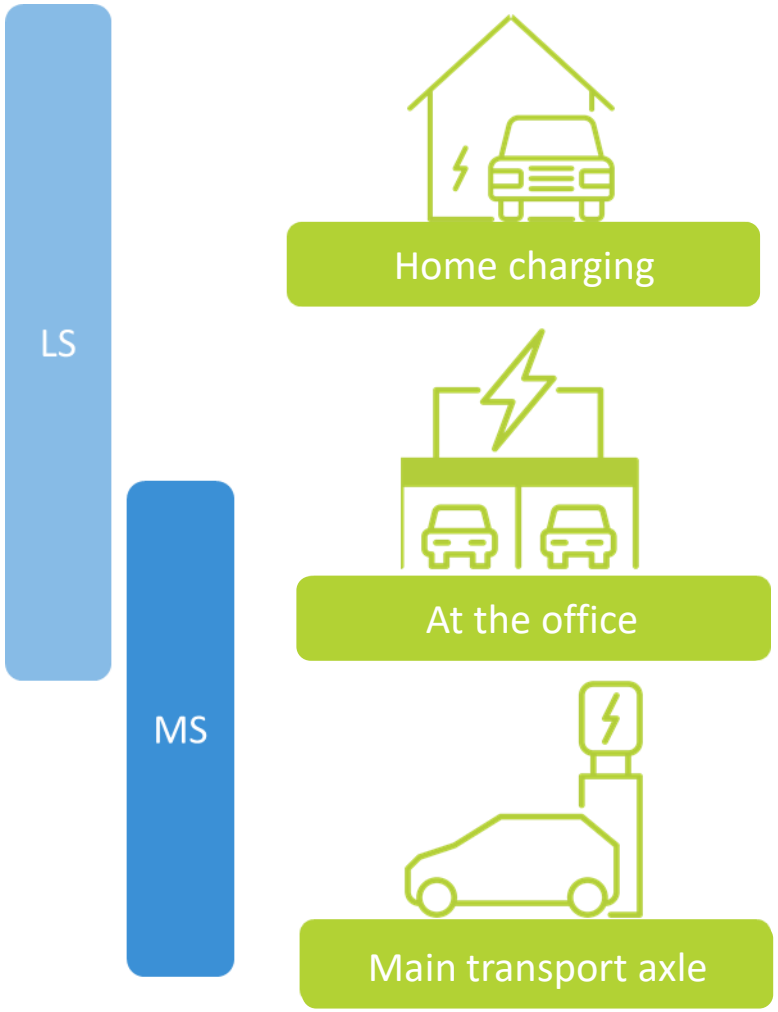
Charging infrastructure



- 2016 – 2021: 5.000 public charging points by Fluvius
- 2022 - …: New RFP Flanders with ambitious goal:
- 35.000 CPE (Charge Point Equivalent) by 2025
- 100.000 CPE by 2030

➔ Assumptions Fluvius: 50% CPE's will be semi-public
➔ Behind existing connection points

- Fast charging (DC):
  - Public charging for cars, van's and trucks
  - Connected to the MV Grid (100 kW to 4,5 MW)
  - Located on strategic places (main roads, highways, truck stops…)
    - Trans-European Transport Netwerk (TEN-T)
    - 121 locations planned , in execution or in service

Specific challenge: 230V-grid in city centers an environment of Brussels

- 230V grid is technicaly equaly performant and so suitable for slow charging at home
- 230V grids have less capacity availability which makes them less appropriate for fast charging of full electric vehicles
- Phasing out of 230V grids since 2007 (20 % less in 2022)
- Easy low cost acces to new additional 400V grids

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Creating opportunities

The energy grid is the backbone for the energy transition

System transition at the lowest cost and highest quality

Digital is a must have in the acceleration of the transformation

Guarantee operational security

→ **From grid operator to system operator**

→ **From data manager to market facilitator**

Mobility

Energy Storage

ıstry

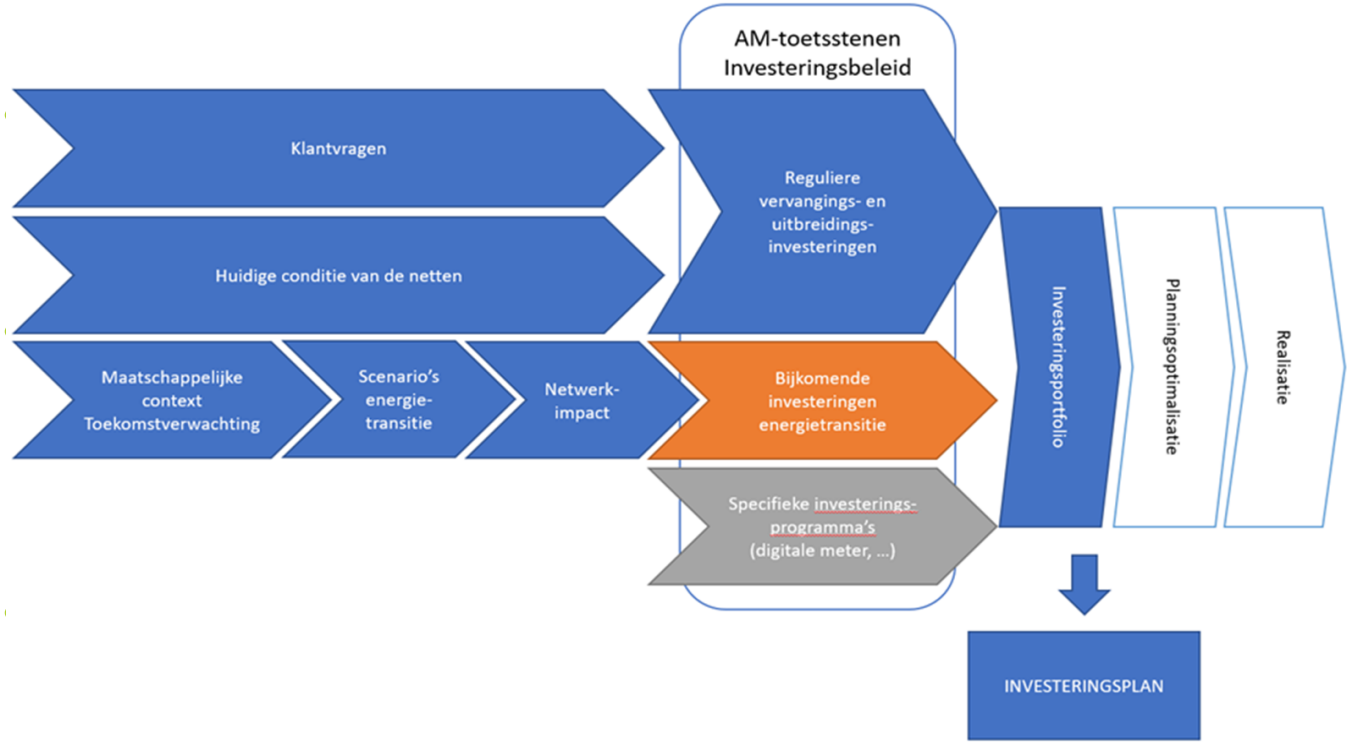
Building heating

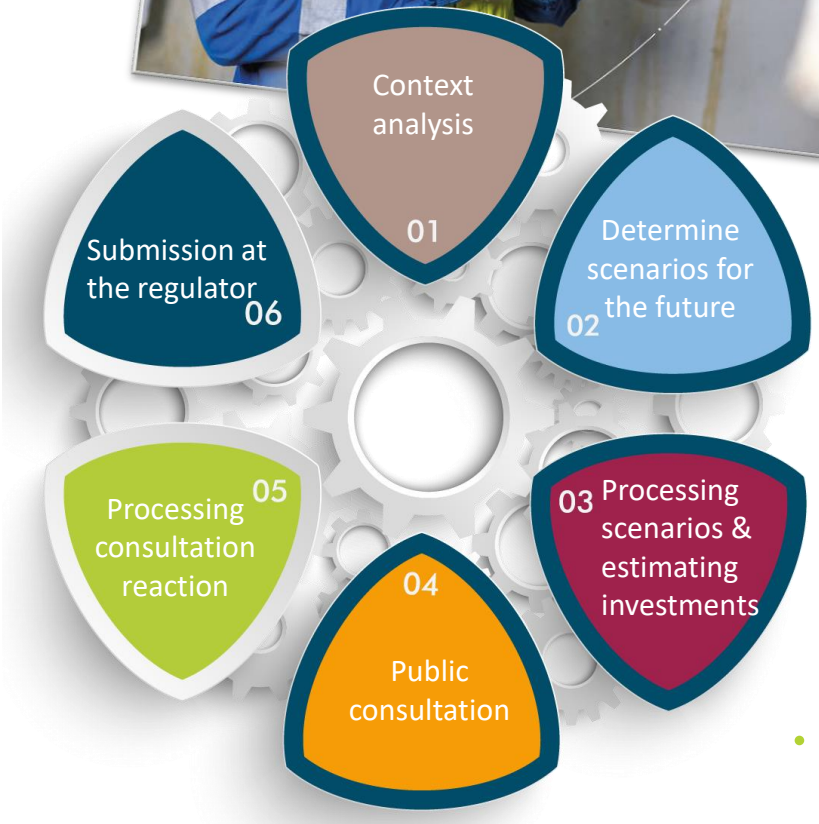
Local challenges

What is the aggregated impact on the distribution grid towards 2034 and 2050?

The DSO Investment Plan?

- Specific plan with regard to the planned investments in the distribution networks of electricity and gas, for the coming 10 years





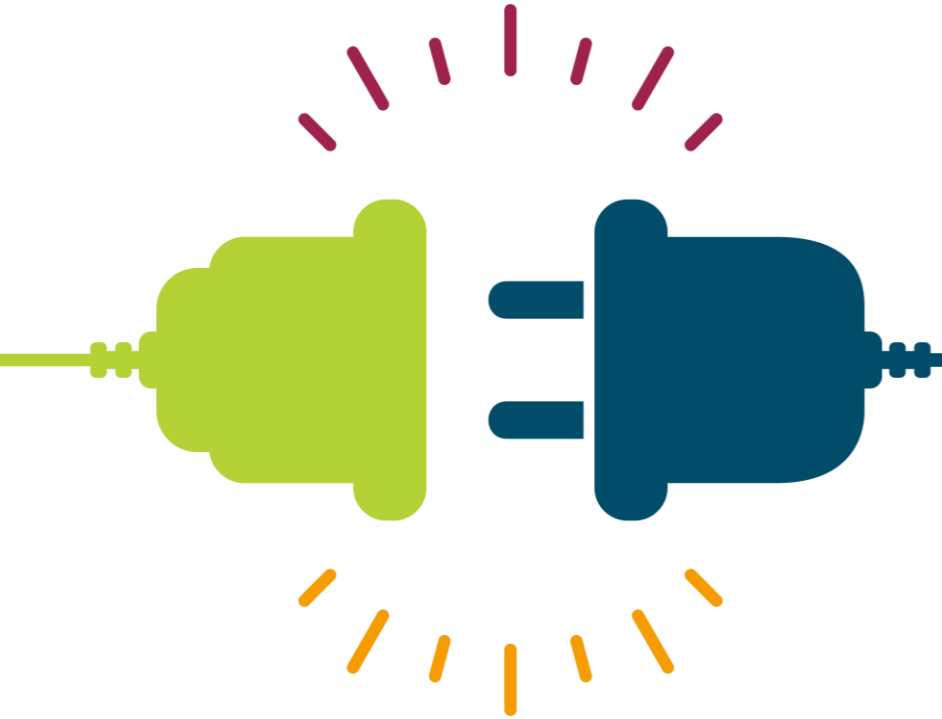
Low voltage: 3 scenarios

High	Medium	Low
1,9 million in 2030 60% simultaneous home-charging at evening peak	**1,5 million in 2030** 60% simultaneous home-charging at evening peak	**1 million in 2030** 40% simultaneous home-charging at evening peak
100% heat pumps	**100% for energy label A** **50% for energy label B/C** **Rest: Hybrid heat pumps**	**25% for energy label A** **Rest: Hybrid heat pumps**

Impact by PV injection is lower than max offtake peak in the evening

2025 2030 2035 2040 2050

“No regret” investment plan



40% of the LV network (30 000 km) to be reinforced

13% of the MV network (6 500 km) to be reinforced

One third of distribution cabinets to be reinforced

- Important to have the networks ready for the energy transition in due time, even in the high scenario
- No overinvestment towards 2050, even in the low scenario (lower transition pace en high impact of mitigating actions)

Electricity investments: our main actions

1. The standard connection for households is evolving from 9,2 to 17,3 kVA
2. Low-voltage grids with insufficient performance are modified more quickly
3. We accelare the deployment of 400V if necessary for electric vehicles
4. We are committed to the further digitization of the electricity grid (cabinets, smart meter)
5. We maximize use of synergy with other utilities to reduce costs

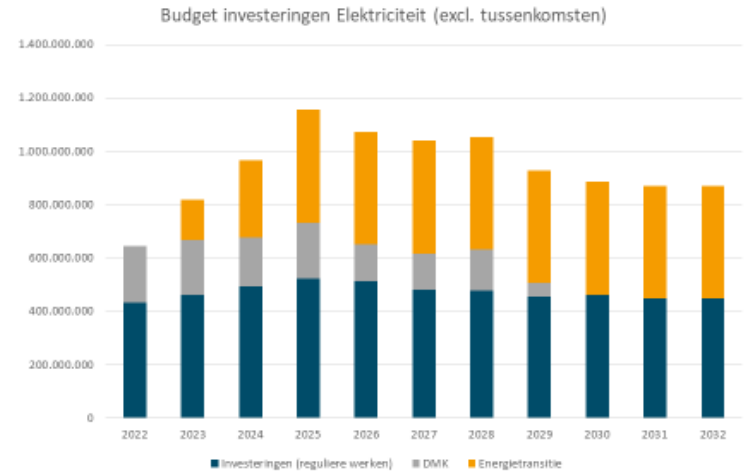
Investments versus flexibility

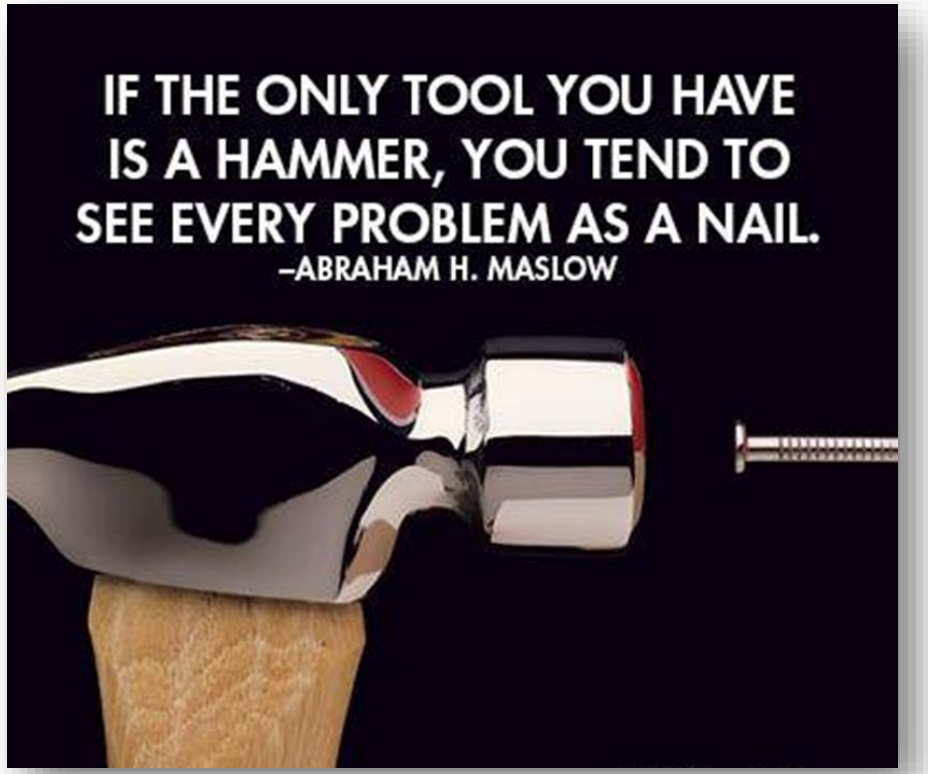
Extra investments in Electricity Grid

Regular investments until 2032
7 Billion €

Aditional investments until 2032
4 Billion €

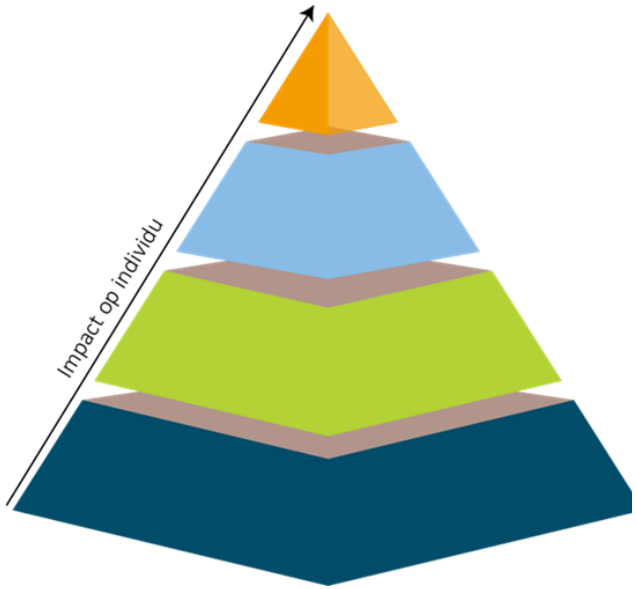
3 Billion Low Voltage
1 Billion Medium Voltage



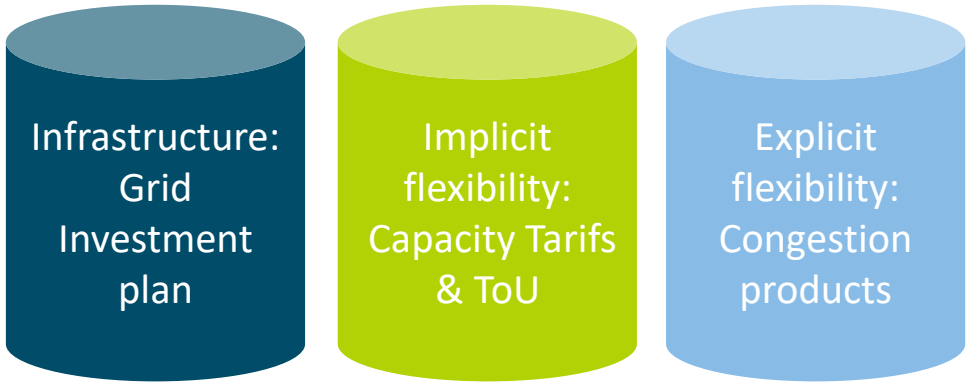


Investment versus flexibility

- System foundation: ‘No-regret’ investments plan
- System optimization: Evolving on every section of the piramid
- Tariff design as implicit flexibility

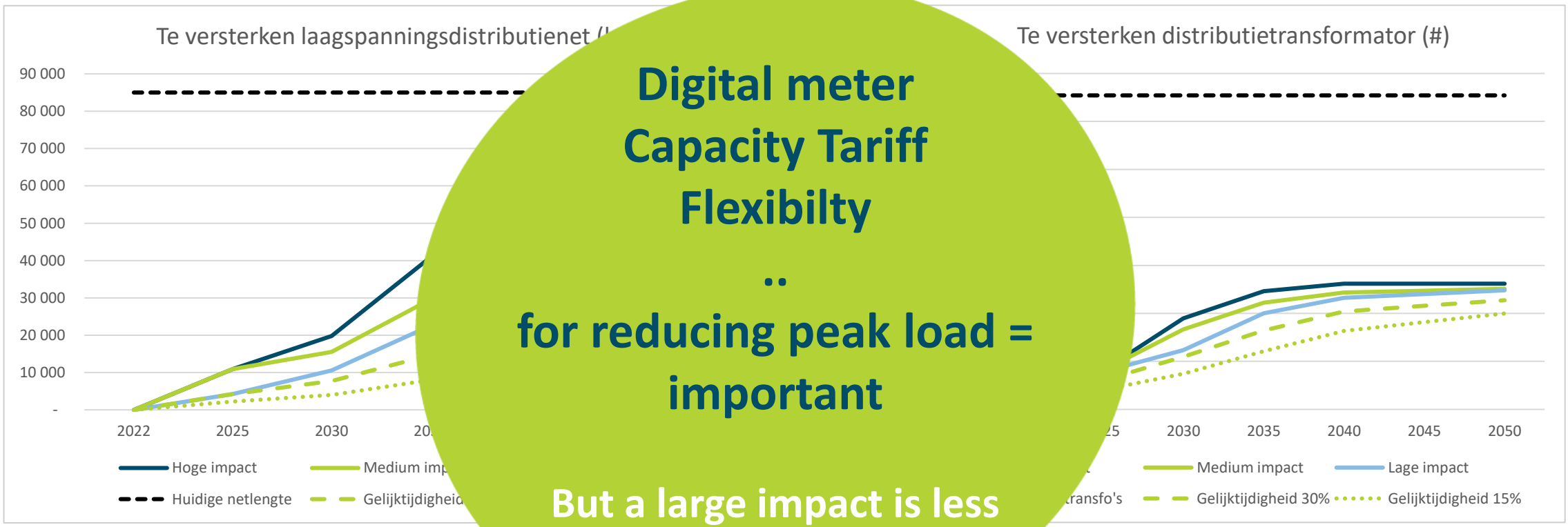


- Regulated solutions
  - Direct control
- Market based solution
  - Flex Procurement
- Tariff design
  - Implicit flexibility
- Infrastructure
  - Smart Grid



Flex challenges DSO’s
System operation → activate
Data management → facilitate

Simultaneous offtake by individual clients: sensitivity analysis



Digital meter
Capacity Tariff
Flexibilty
..
for reducing peak load = important

But a large impact is less realistic the first years

Capacity tariffs

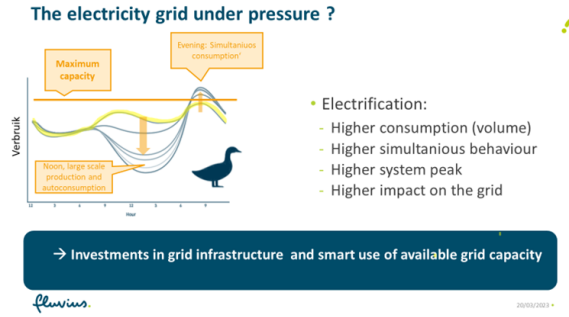
Implicit flexibility

Optimal use of the distribution grid

Introducing capacity component in the grid tariffs

Transparant, Cost reflective grid tariffs

- ✓ *Secure optimal use of the grid*
- ✓ *Reduce system peak, avoid congestion*
- ✓ *Reducing future investments in infrastructure*



- ✓ *Optimizing individual behaviour*
- ✓ *Reduce individual energy bills by shifting consumption and peak reduction*
- ✓ *Share the available grid capacity*

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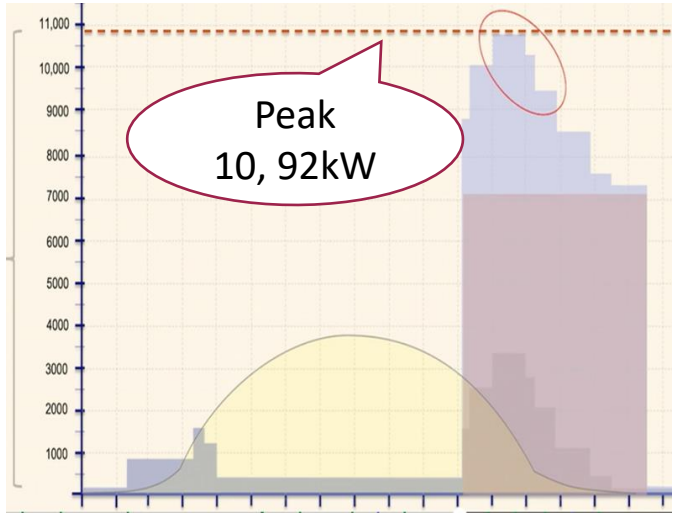
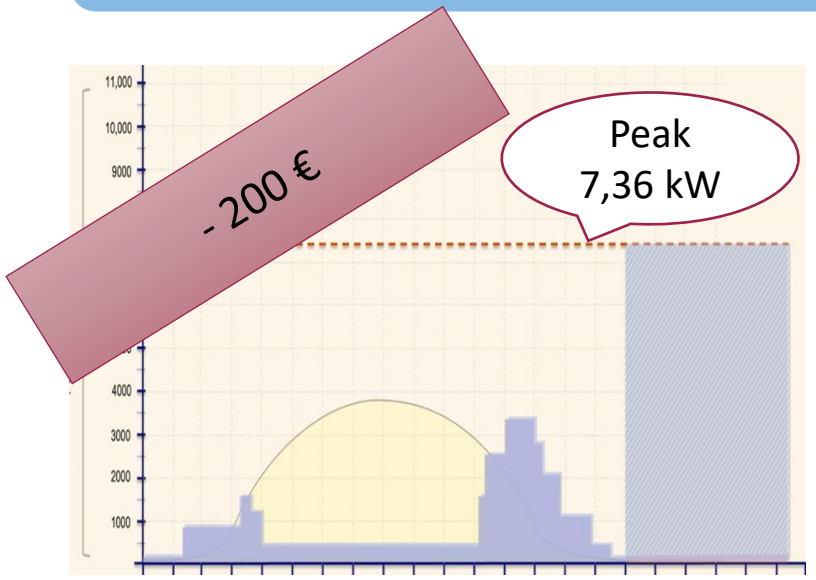
Impact for the customer (ex. EV charging)

No shifting

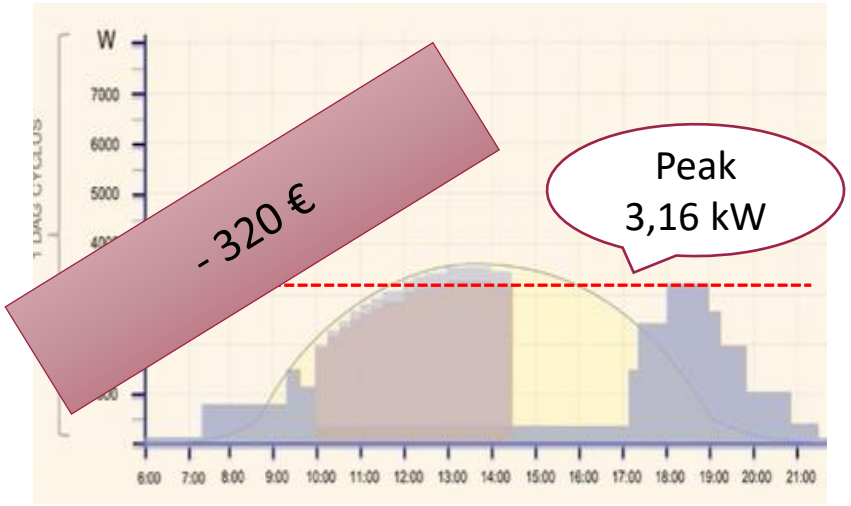


High power charging no shifting of consumption:
➔ Significant peak and billing

Shifting



Charging shifted from normal consumption
➔ Less significant peak and bill savings



Smart charging, low volume and during solar production:
➔ No additional peak and use of own solar production

First results

Impact customer (test on 25,000 LV customers)

- First positive trends are visible
- Customers are reacting to the new tariffs (-8,3 % - 150 W)
- In specific customers with new flexible appliances (- 13,6 % -1,5 kW)
- Positive impact on the energy bill

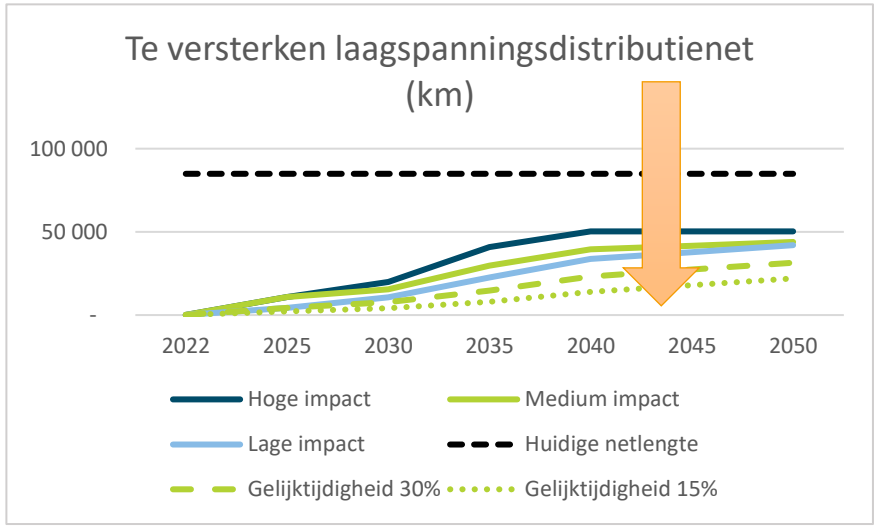
Impact for the DSO

- Lower individual peak leads to lower system peak (1500 kW on substation level)
- Positive outlook on reducing future grid investments

Follow up of results

- On wider population (>100.000 customers)
- On price elasticity and interaction with market

Optimizing individual energy consumption contributes to reduction of the system peak and reduces future investments



Next steps

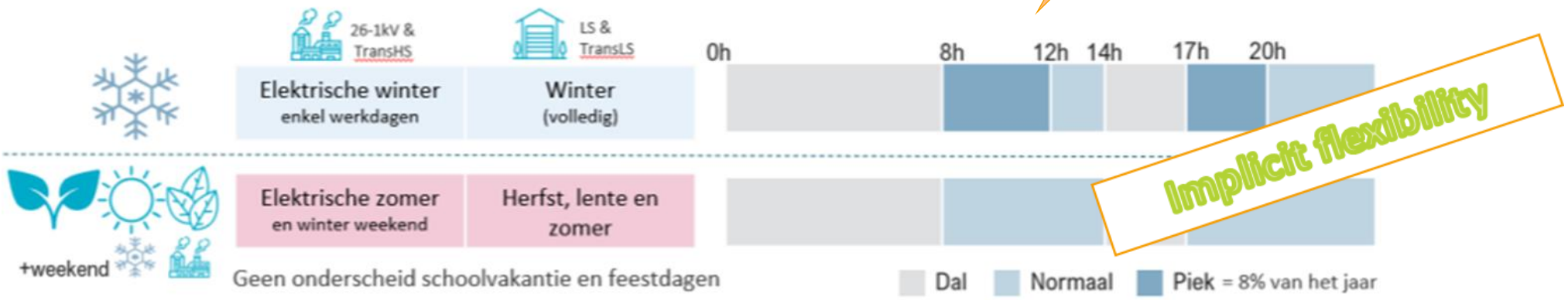
Follow up of first results

- Confirm positive behaviour on wider population
- Translate positive effects in investment plan

Introduction of “Time of Use” tariffs

- Investigate price elasticity
- Investigate further grid optimization opportunities

Additional time frames lead to further optimisation of the individual energy consumption and will contribute to further reduction of the system peak

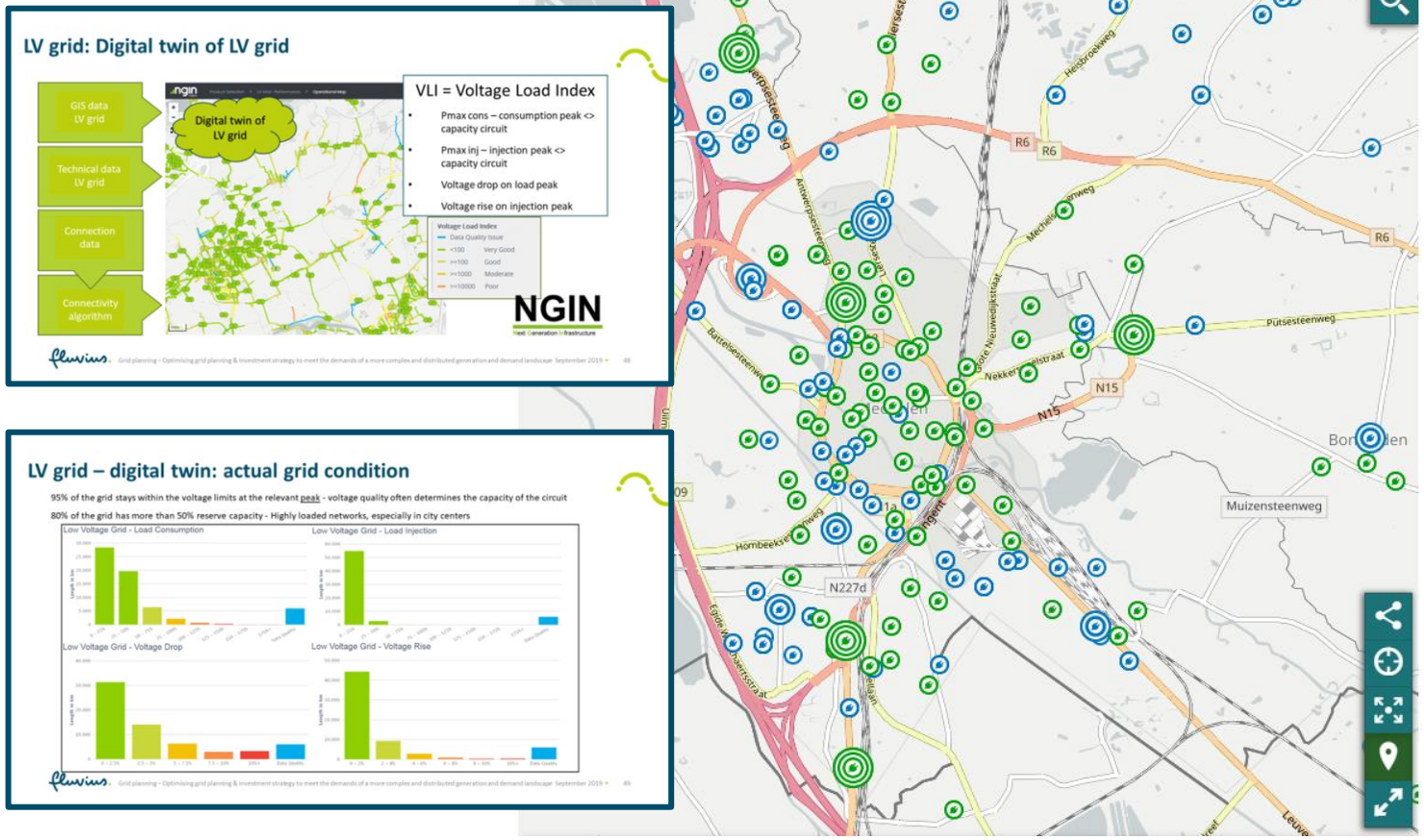


Translation of general investmentplan to the local level

- Enrich IP with local content
  - With public open data
  - With specific locational data
  - With local planning and policy
    - Mobility, Heating, projects, ..

- Load flow calculations
  - More granular time based data
  - Identify grid congestion risk
  - Prioritize grid re-inforcements

Top down → Bottom up



From global to local:

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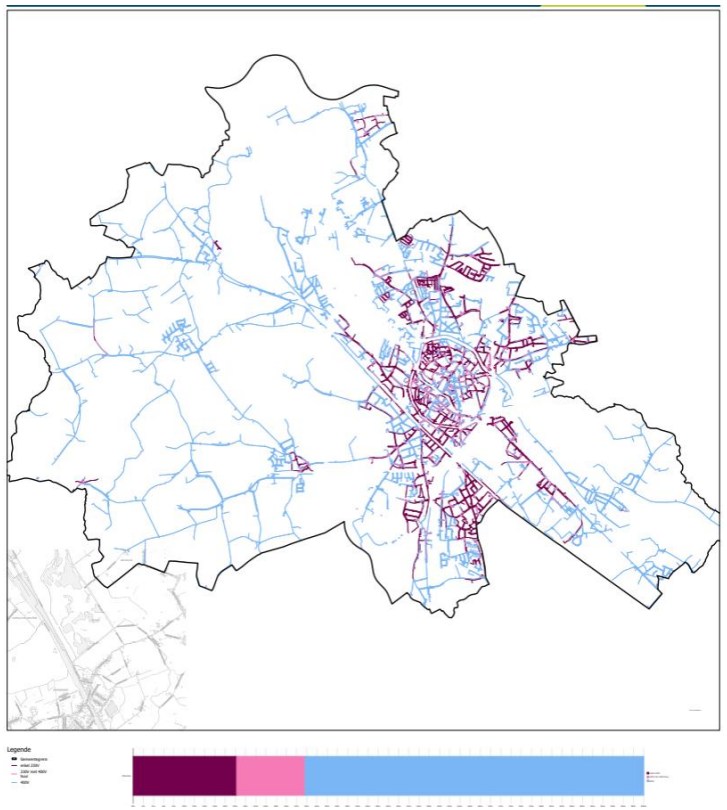
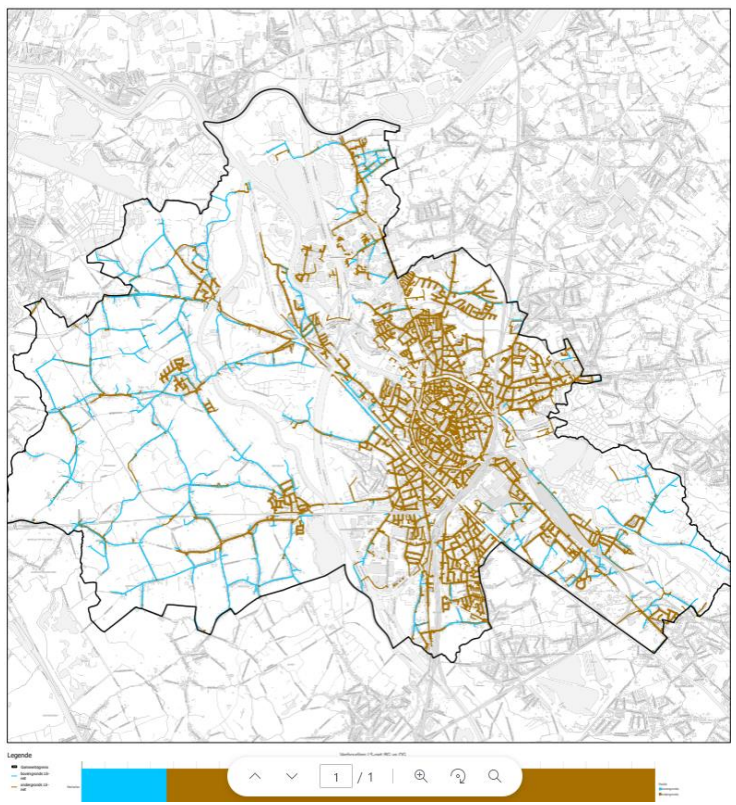
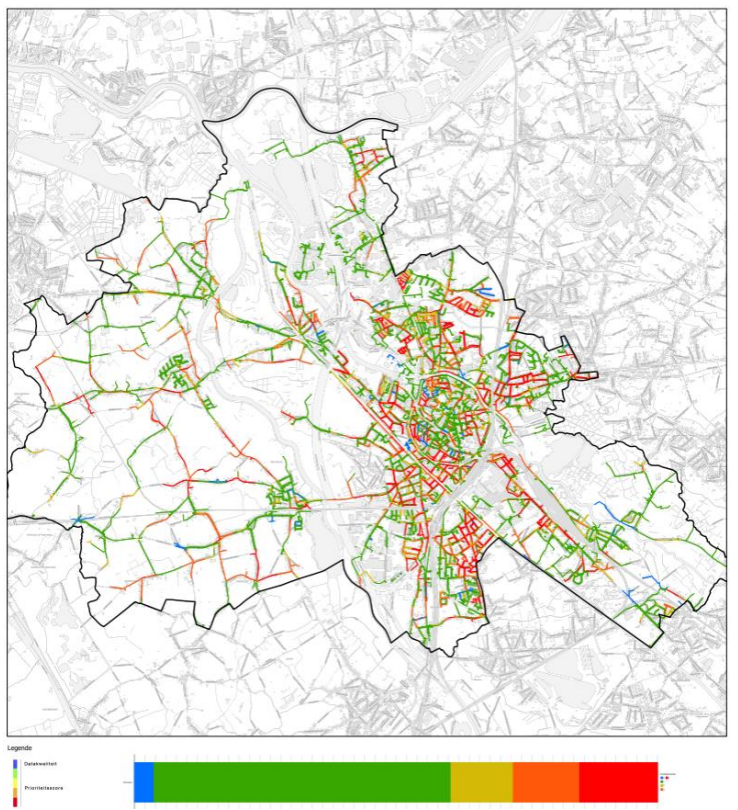
LV 230-400 V grids



LV under versus above ground



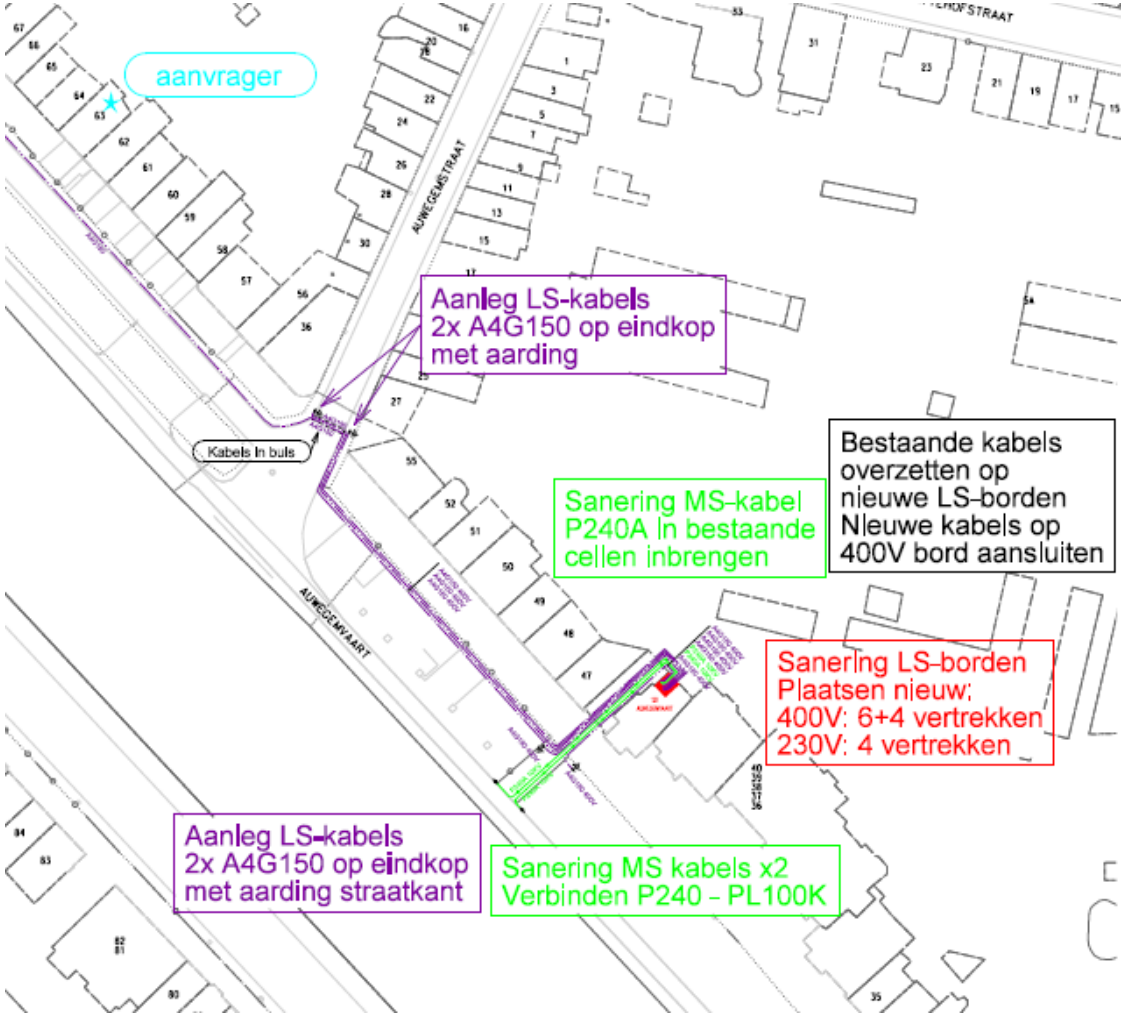
LV priority map



The local level (example)

New charging infrastructure requires local investments

- Reconnecting MV/ LV cubicle on the MV
- Replace MV/ LV transformer tu dual 400/230 V Replace LV cubicle from 230 V only → dual voltage
- New 400 V cables charging equipment
- New 400 V cables next to existing 230 V for future expansion

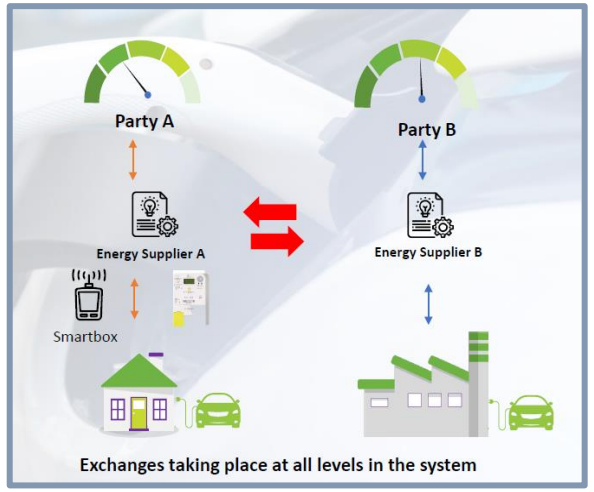


From Gobal to Local: Innovative Projects

- Acces project (Keerdok site)
  - AC and DC charging and superchargers
  - V2G, smart charging and car sharing
  - On site Energy sharing with PV and car batteries

- Co-Charging project (Archie)
  - Public charging
  - Supply split
  - Co-charging from private customers

- EV Experiance
  - Charge anywhere
  - With your own supplier
  - Transfert of energy



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The future of electro mobility is…

- Climat neutral
  - Drive with green energy
  - Enhance system efficienty
  - Data driven
- Attractive
  - Efficient charging, allways ready to go
  - Market conditions to valorise storage and flex capacity of EV's
  - Increase self consumption
- Cost efficient
  - Reduce investment cost
  - Reduce energy bill (towards zero cost charging?)
  - Value stacking, (smart charging, flexibility, energy efficiency)
- Inclusive
  - Social accesible (flex – ability)
  - Remove (technical) barriers
  - Customer protection

Key considerations for a successful transition

Electrification will increase strongly in the coming decades

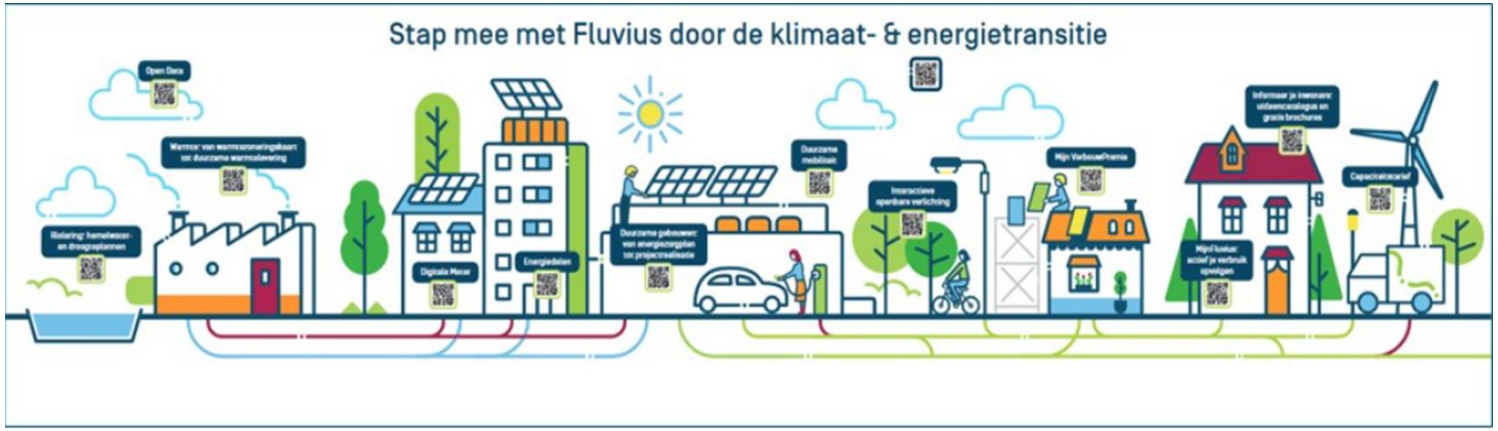
Proactively developing the foundations of the future energy network

Scaling up systems and processes to facilitate complex markets and reduce system cost

Electrification of transport is the main investment driver on the short term

New market services will be made accessible to all our customers and reduce system cost

Electromobility will be driven by local availability of clean affordable renewable decentralized energy



Compelling reason to change !

The energy and climate transition has started

- Changing regulatory framework
- Climate neutrality, carbon neutral
- Energy efficiency first principal
- Electrification, decentralization, storage
- Clean renewable energy, phasing out fossil
- Renewable gasses, circular economy
- …

$$CrC \times V \times Fs > R$$

The local level

MECHELEN

- **Clear motivation**
- **Clear vision and concrete steps**
  - Grid reinforcement plan (in place)
  - Circulation plan & parking spaces (in place)
  - Low emission zone (under investigation)
  - Alternative transportation (stimulated)
  - Mobility sharing solutions (in place)
  - Electrification public transport (ongoing)
  - Public charging opportunities (expanding)
  - Innovative solutions
  - Information and communication
- **Leading towards proven results**
  - Creating opportunities
  - Public acceptance,
  - Customer engagement

Thank you for your attention !

Questions ?

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Tot bij u