European Commission

Technology Challenges and Regional Approaches for Integrating Renewables and Energy Security

BRUSSELS • THON HOTEL EU
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What are the local system challenges?

DSO point of view from Belgium

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Introducing Infrax

- Utility in 4 disciplines
  - Electricity distribution (MV & LV)
  - Natural gas distribution
  - Sewerage
  - Cable (TV, internet)

- 126 municipalities in Belgium
- 2.192.000 connections
  (Electricity+gas+sewerage+cable)
- 1.554 employees
- 778 million EUR turnover*
- 250 million EUR investments*

*(2013)

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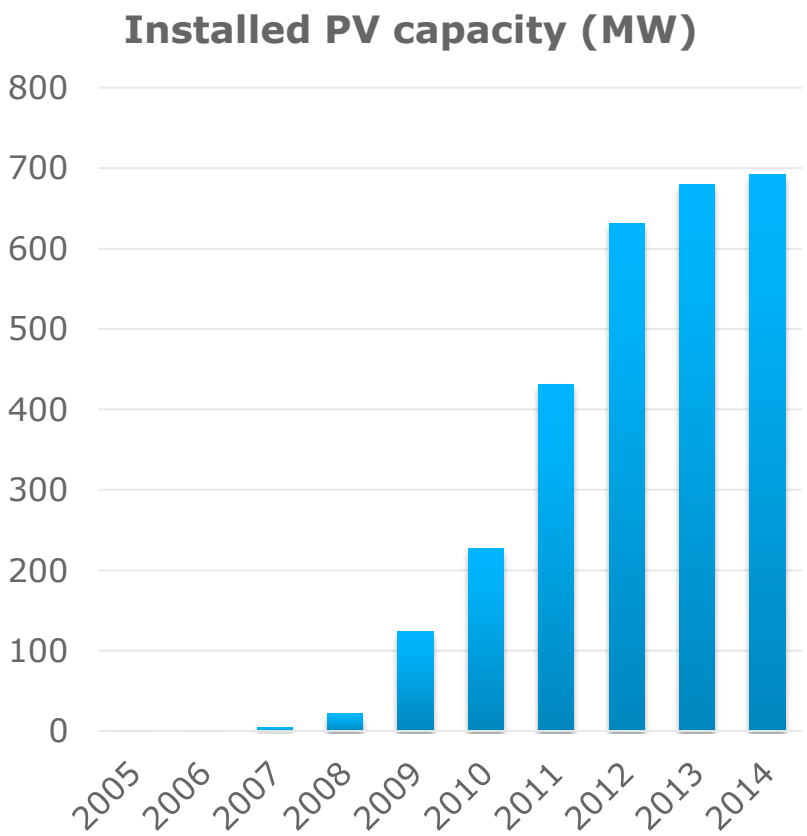
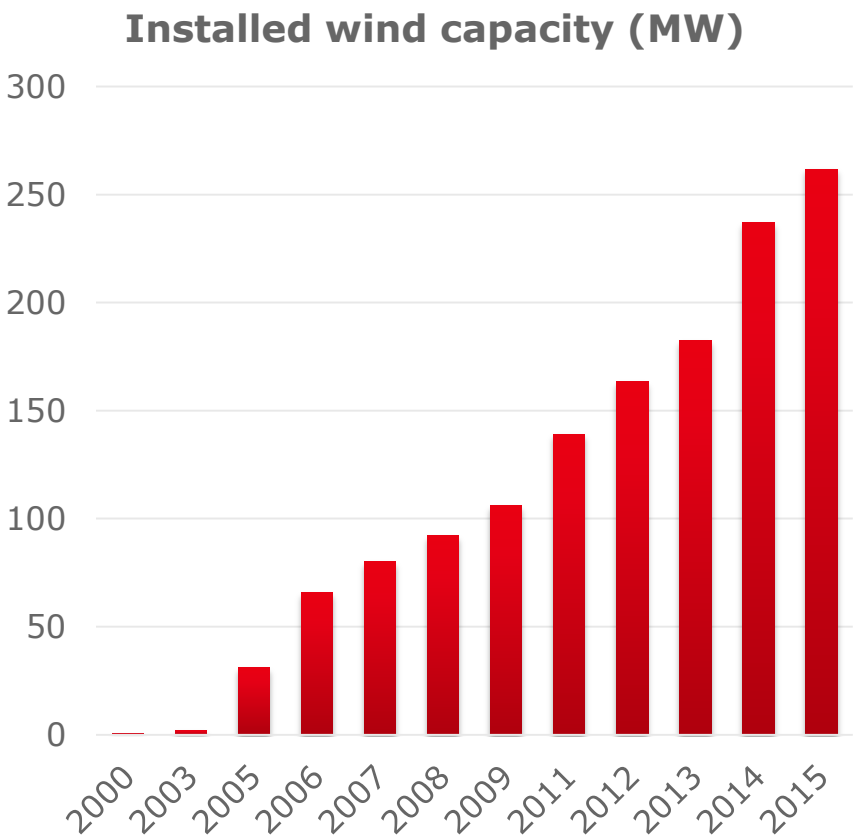
Evolution of wind and PV generation in the Infrax distribution grid





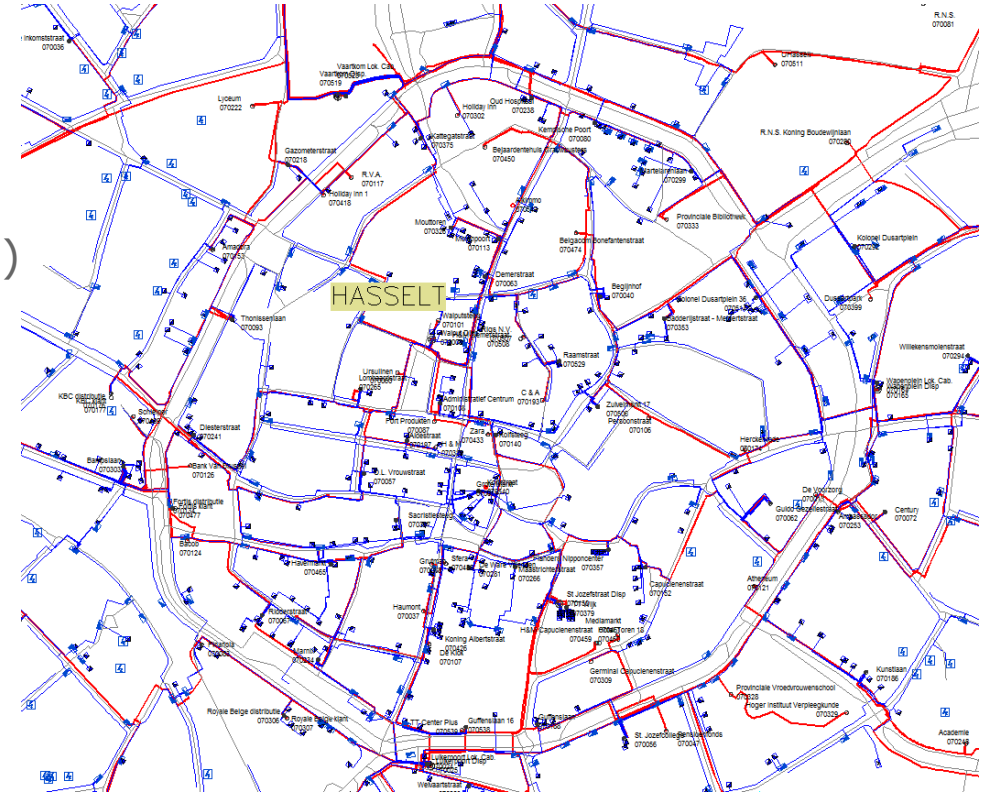
The rise of RES and new technologies is changing the grid's loading pattern

- Wind and PV generation
  - Direct: Infeed to the local grid (reverse power flows)
  - Indirect: Load follows production => demand peaks during "happy hour"
- Electric vehicles (EV)
- Heat pumps and airconditioning

Risk = Local grid congestion

Conventional design rules for distribution grids

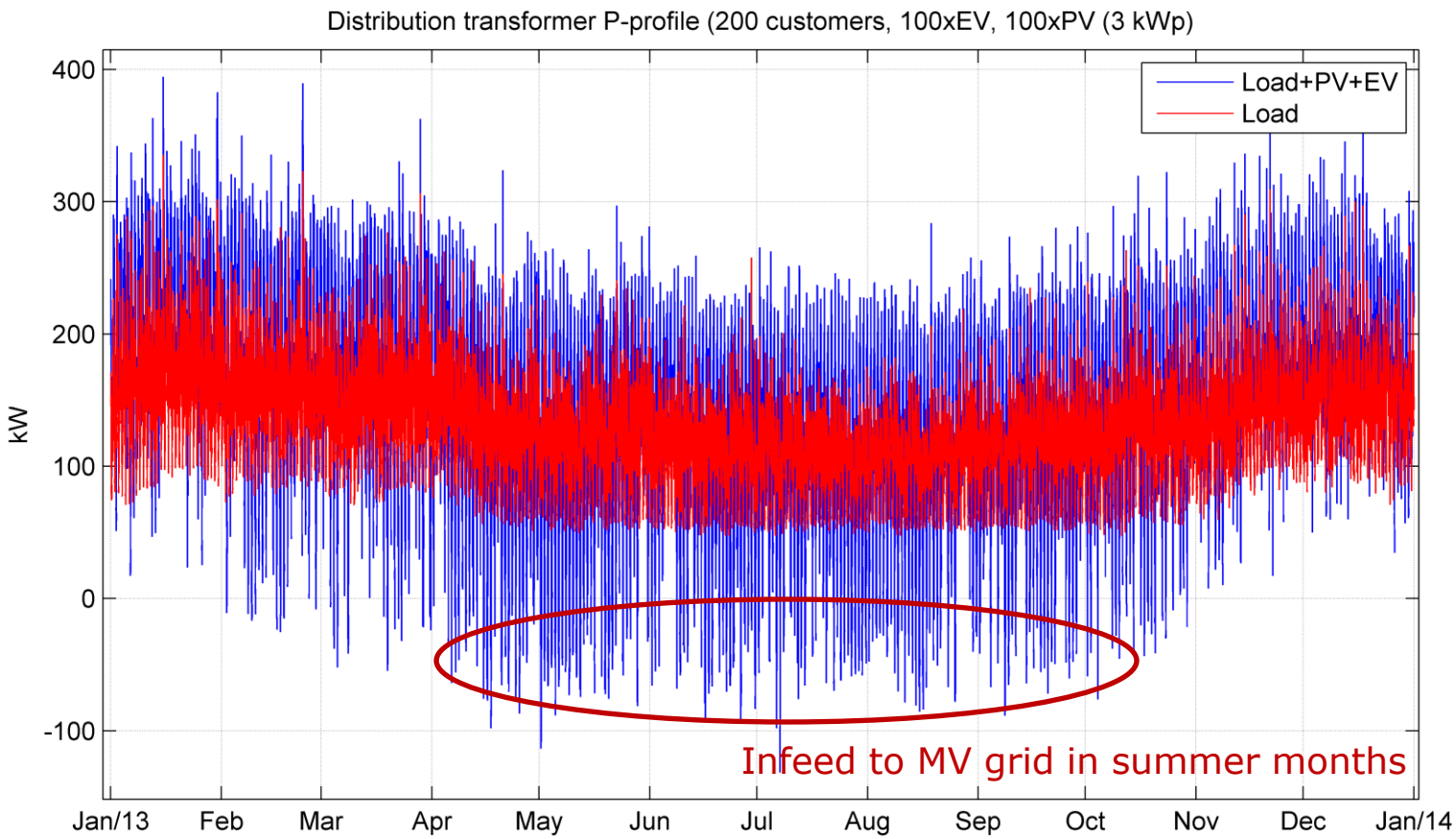
- **MV grid**
  - n-1 (switching required)
  - Simultaneity = **0.8**
  - Constraint = Overload ($S>S_{nom}$)
- **LV grid**
  - No redundancy
  - Simultaneity = **0.2–0.3**
  - Constraint = Over- and undervoltage



Preconditions (not valid anymore…)

- Only load - no generation
- Stochastic distribution of loads in time and place (low simultaneity)

Evolution of distribution transformer load pattern due to PV and EV



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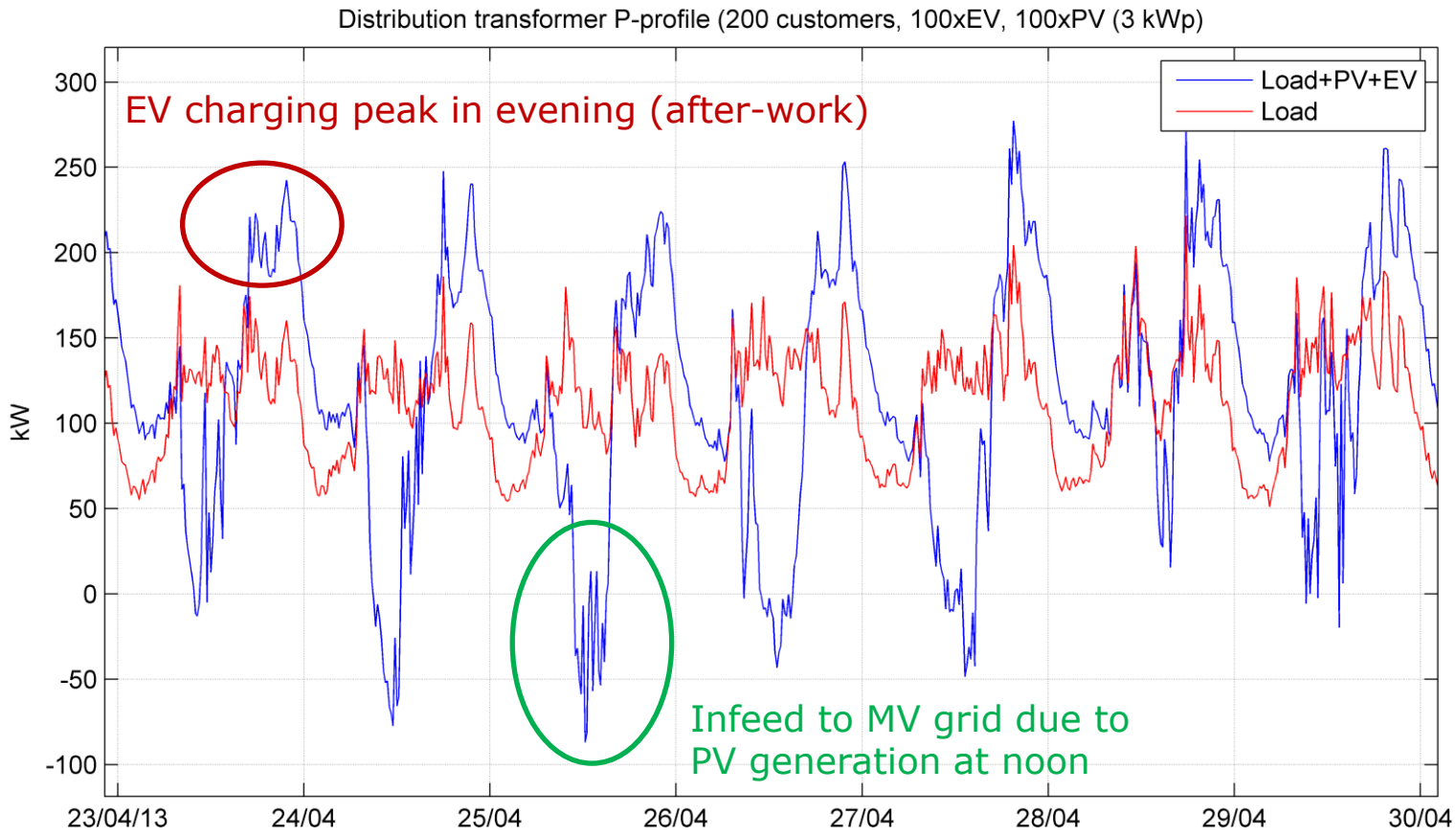
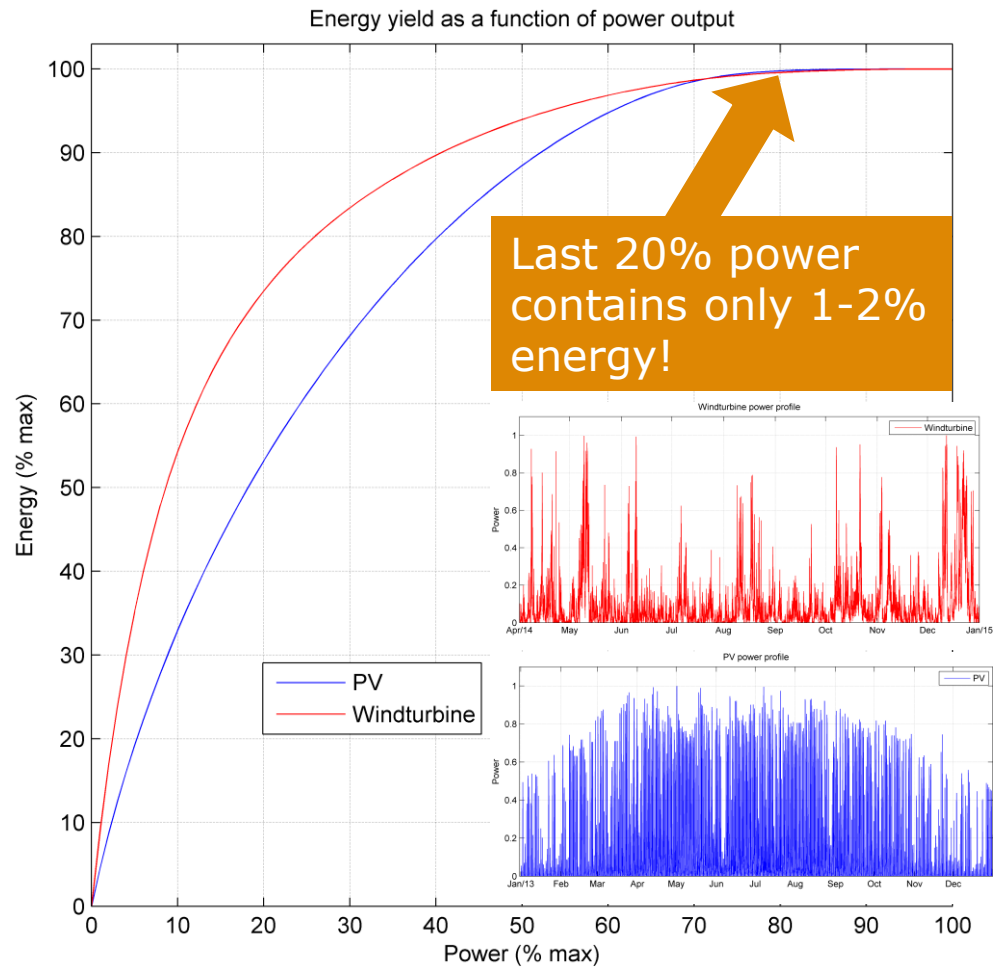
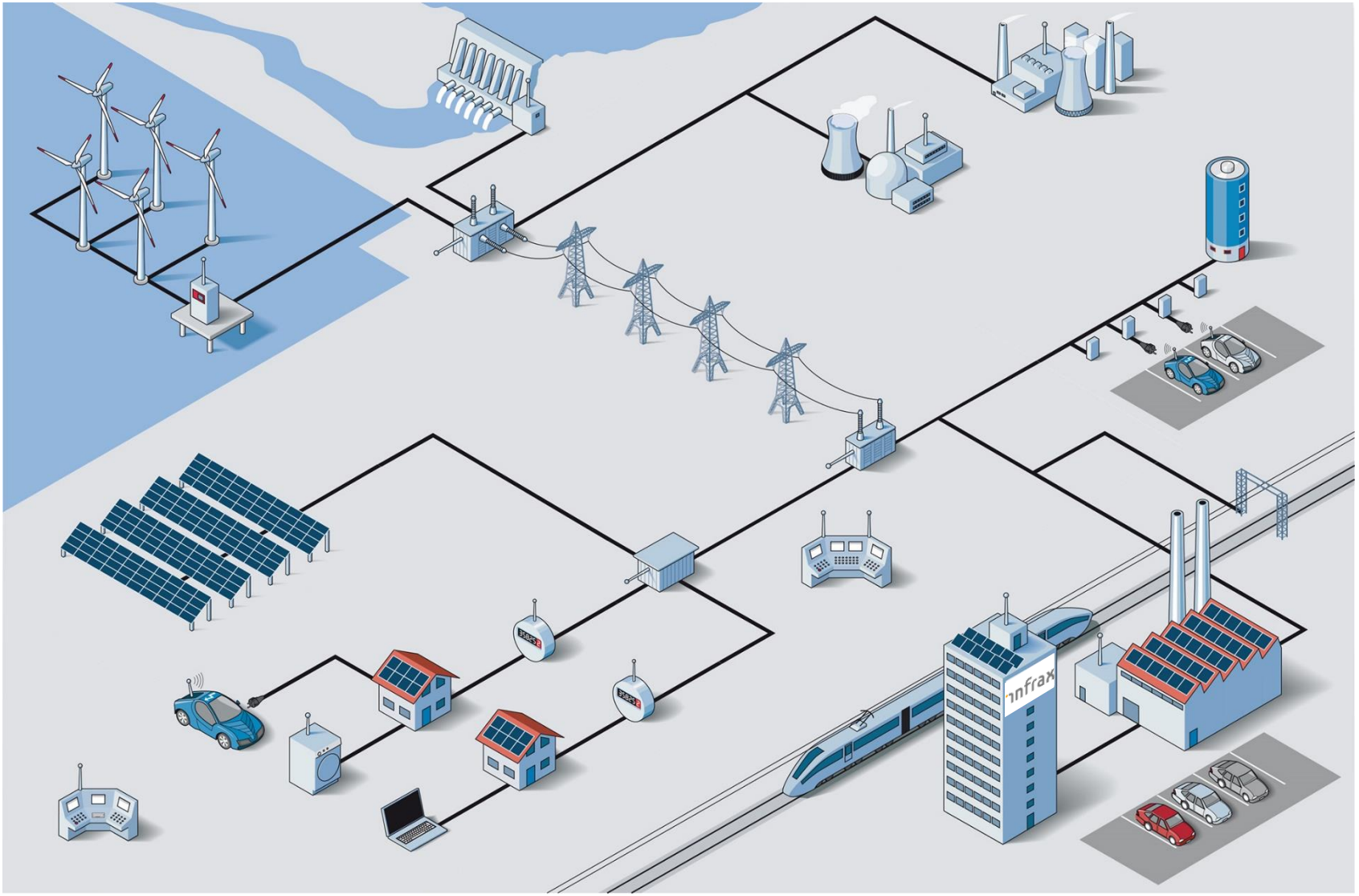


PV and wind characteristics

- Required grid capacity is determined by peak consumption/generation
- PV/wind power peaks have short duration
  - Low value in terms of energy content
  - High societal cost in terms of required grid capacity
- Low utilization factor of grid assets = cost inefficient

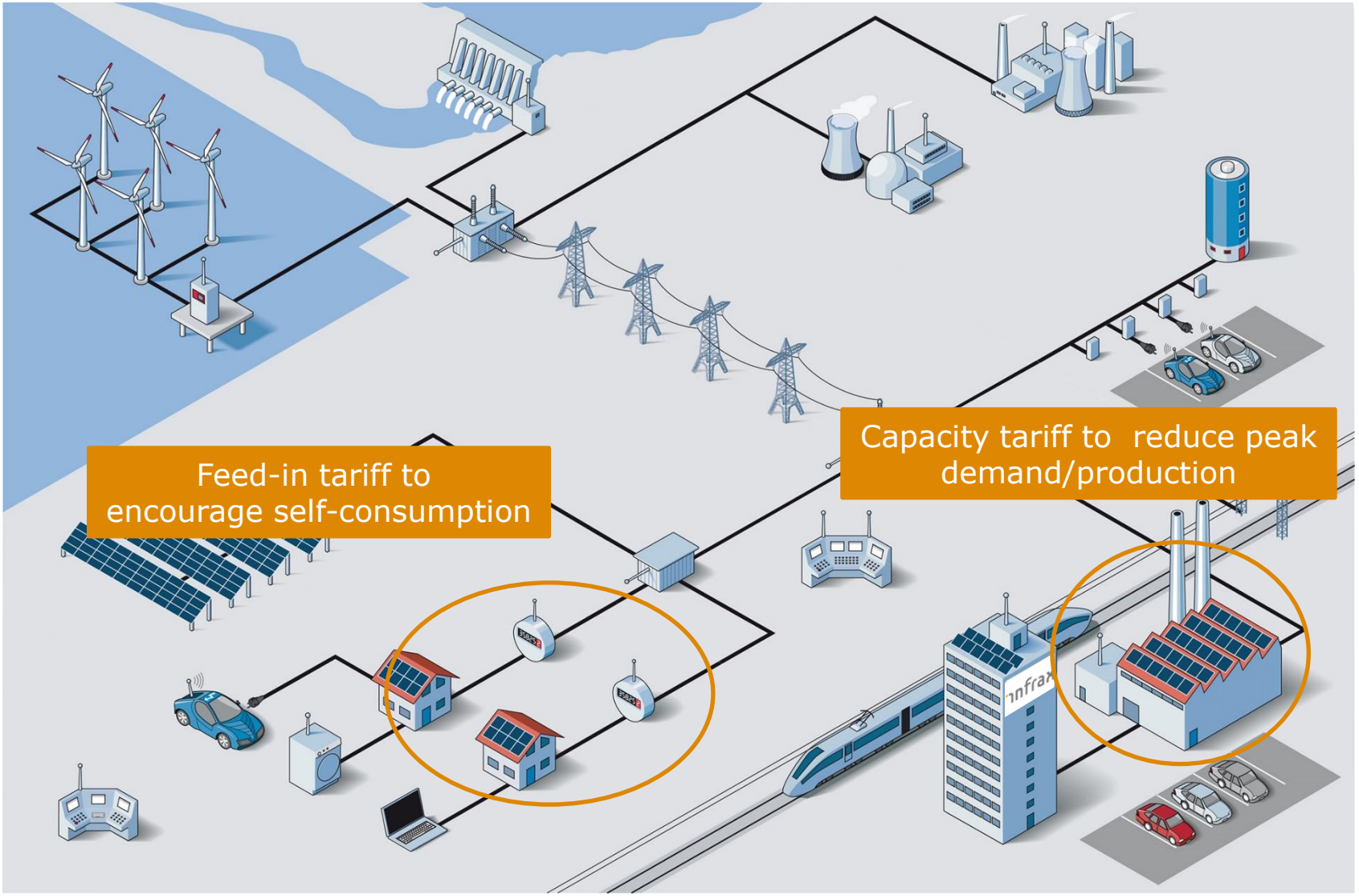


Different solutions…

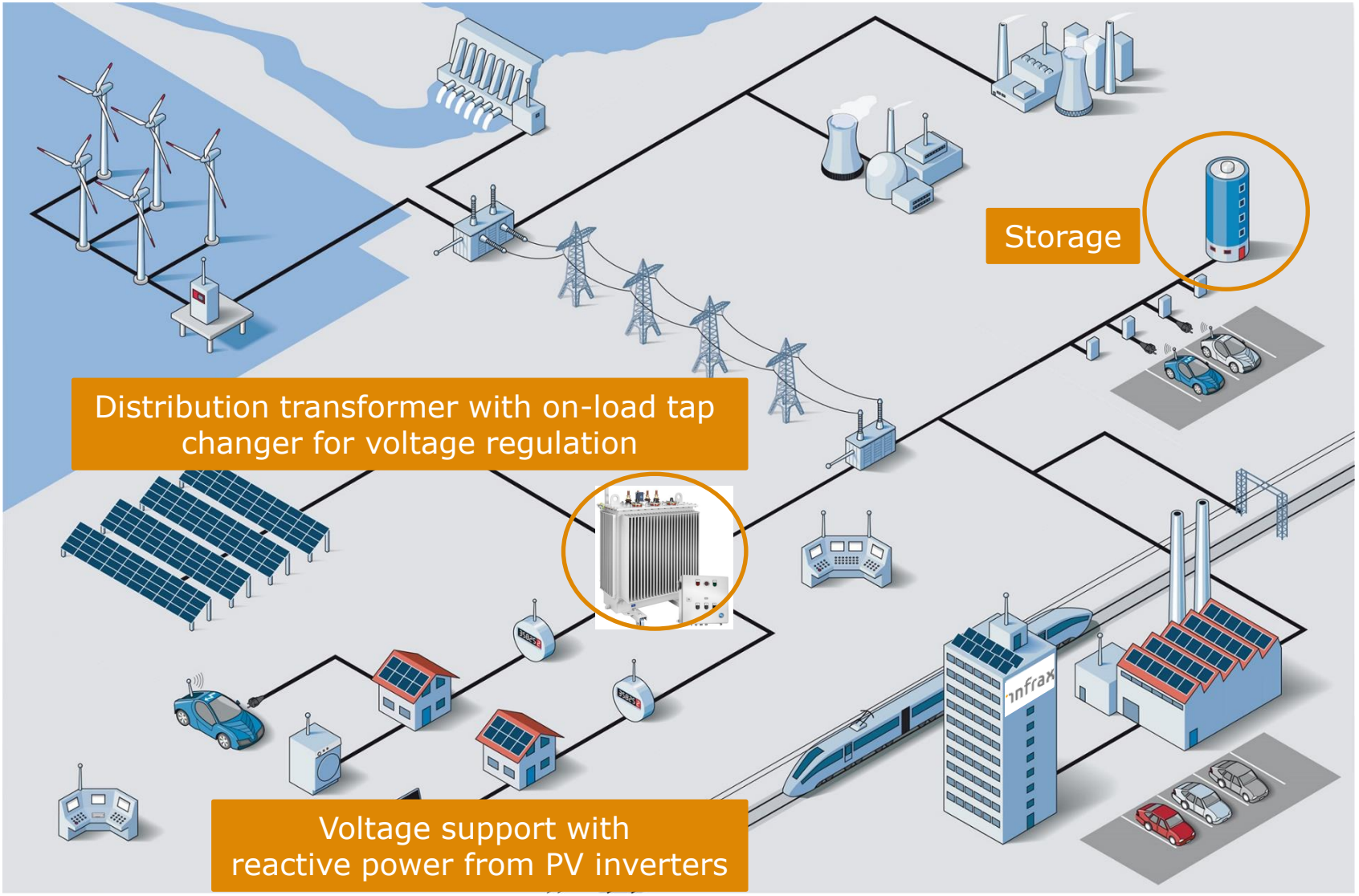


Conventional investments

Incentives

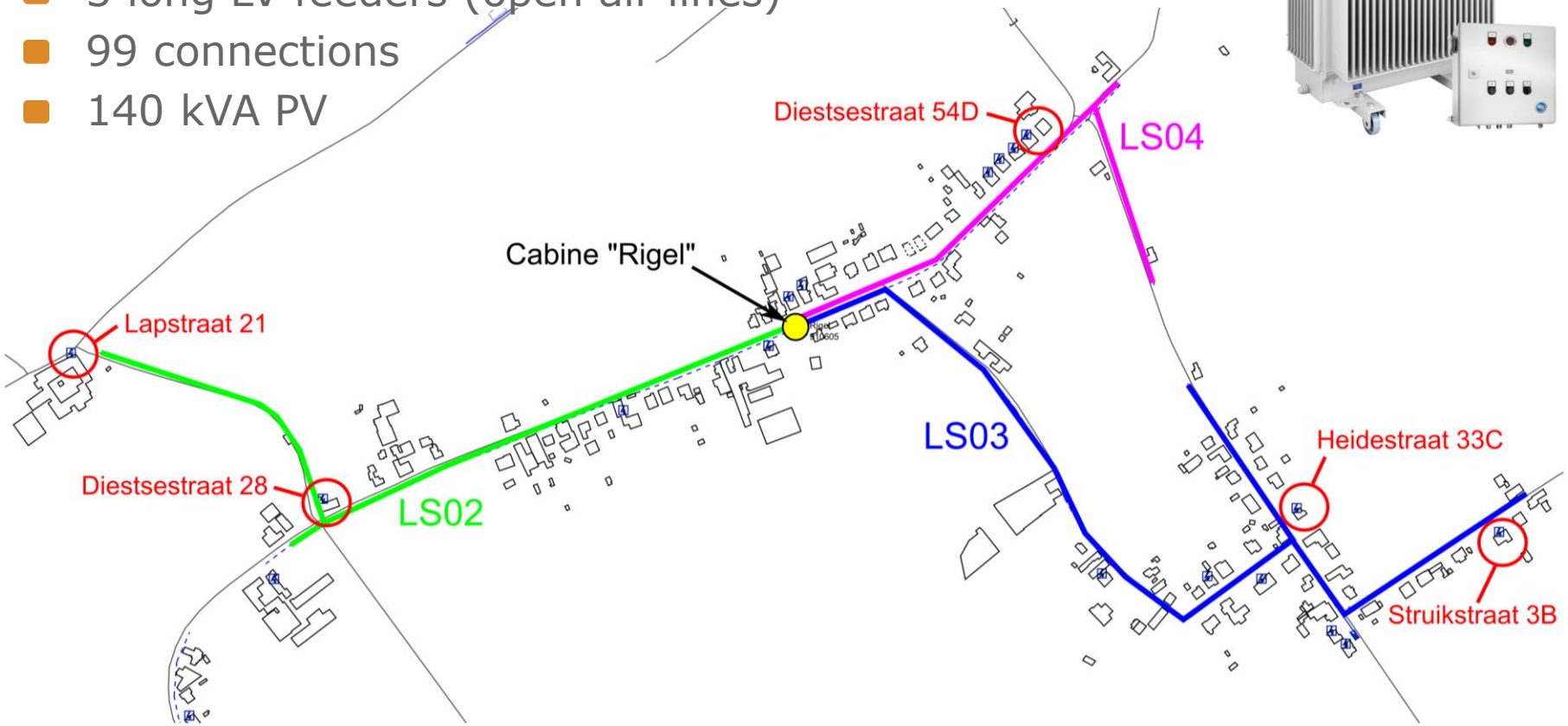

Feed-in tariff to encourage self-consumption
Capacity tariff to reduce peak demand/production

Controllable grid assets



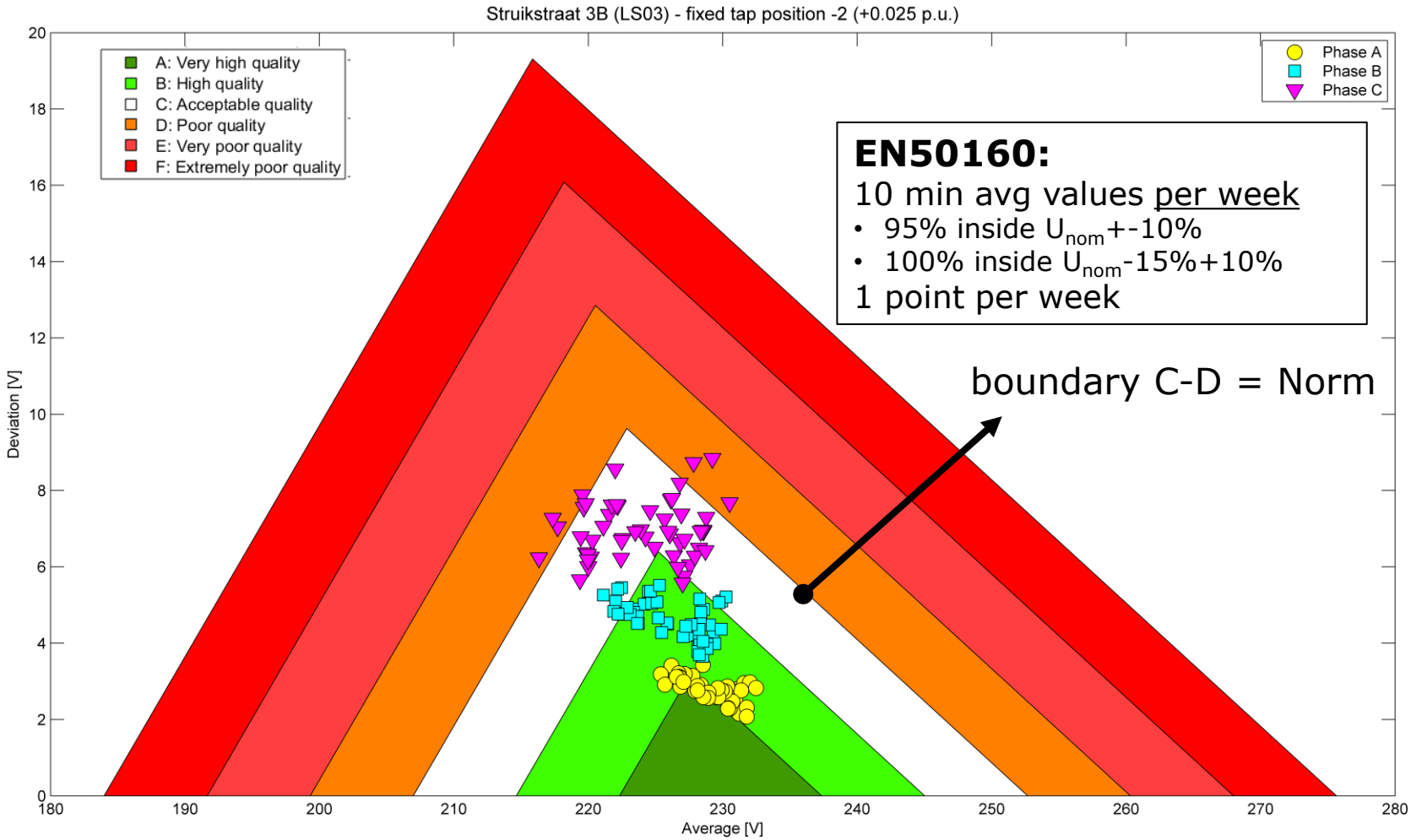
Example: Solving voltage problems in a rural LV grid with an OLTC

- 3 long LV feeders (open air lines)
- 99 connections
- 140 kVA PV



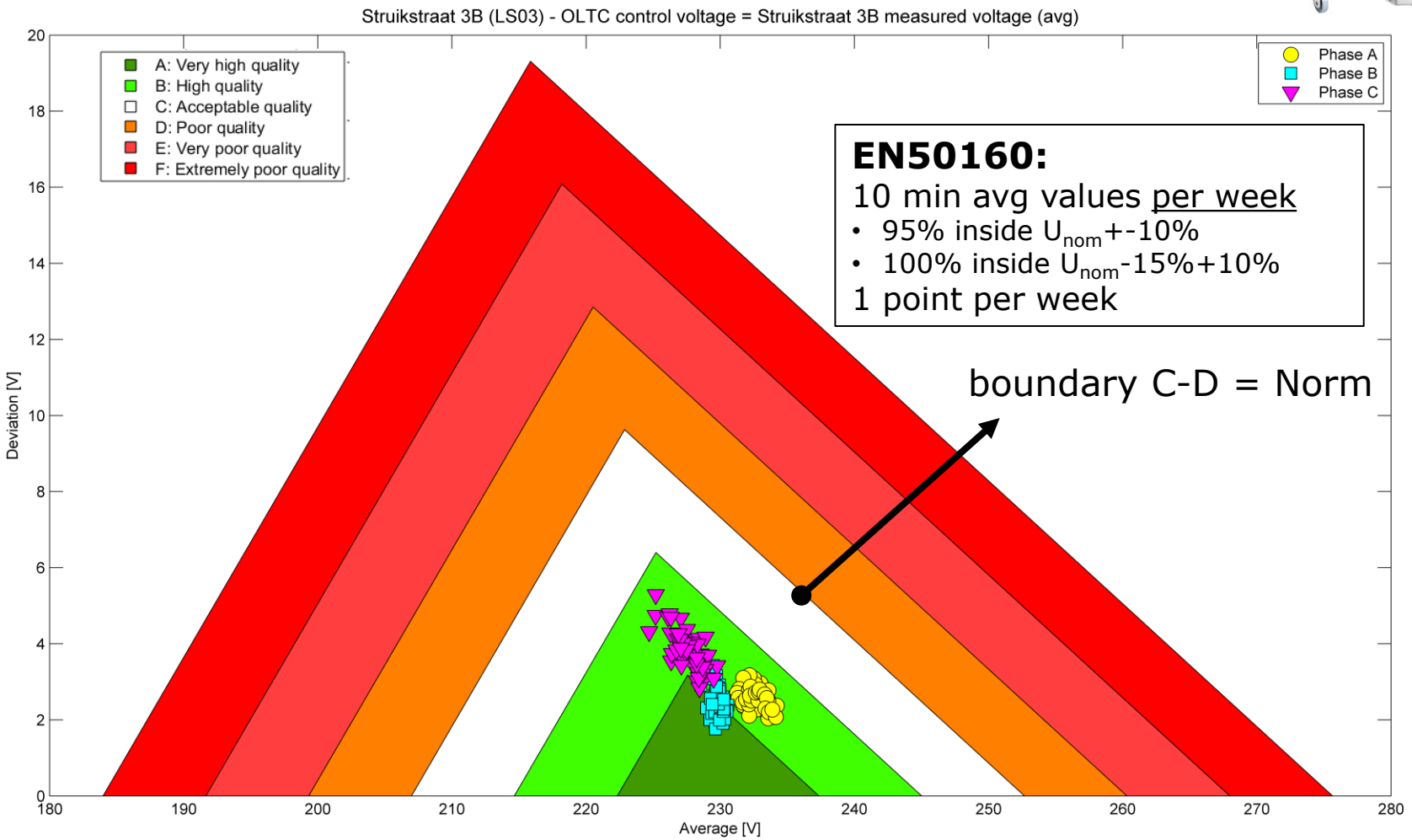
Voltage quality at feeder end

- STAV-method (standard deviation and average per week)

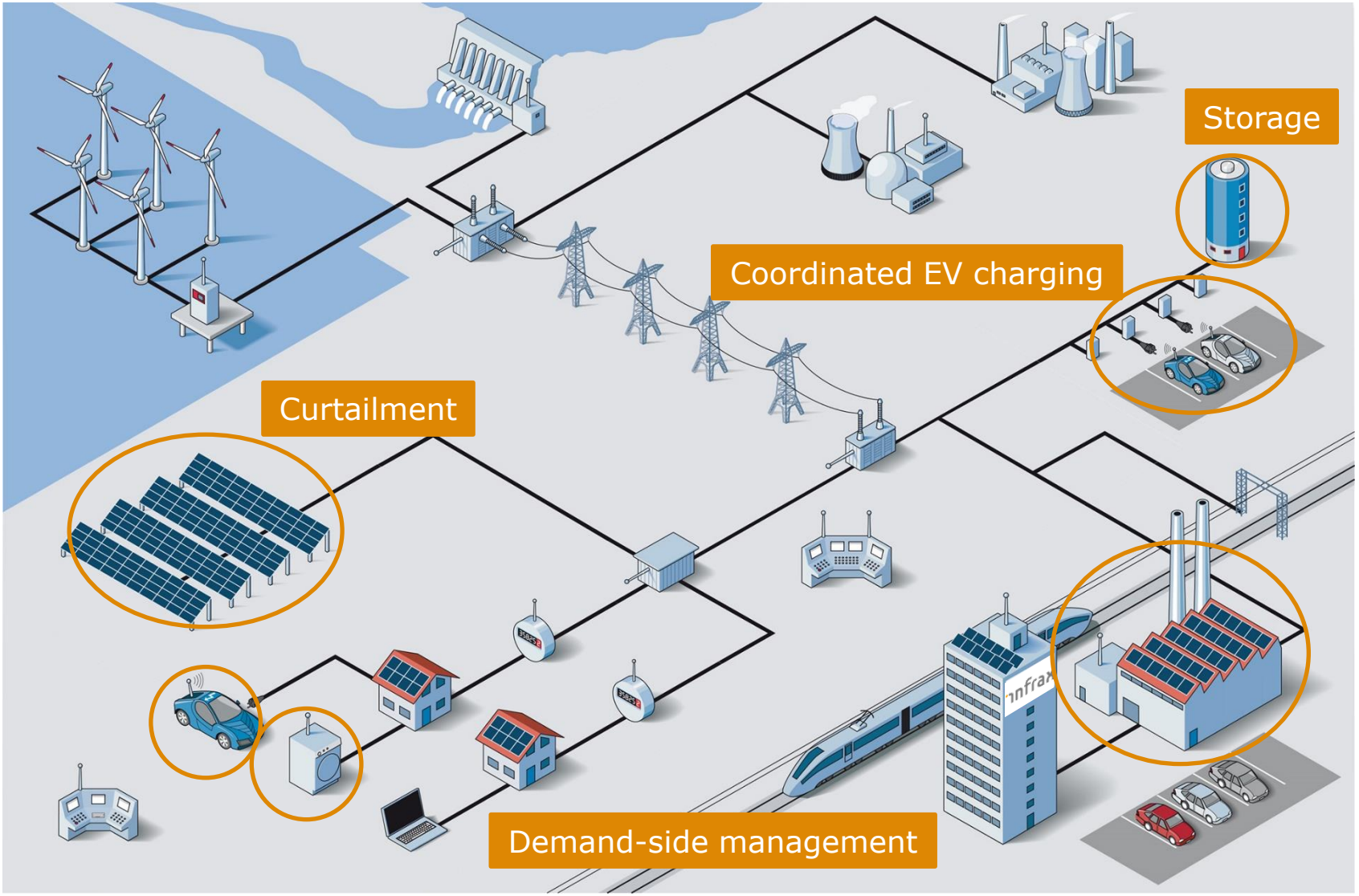


Voltage quality at feeder end

- Significant improvement with OLTC



Flexible loads/generation

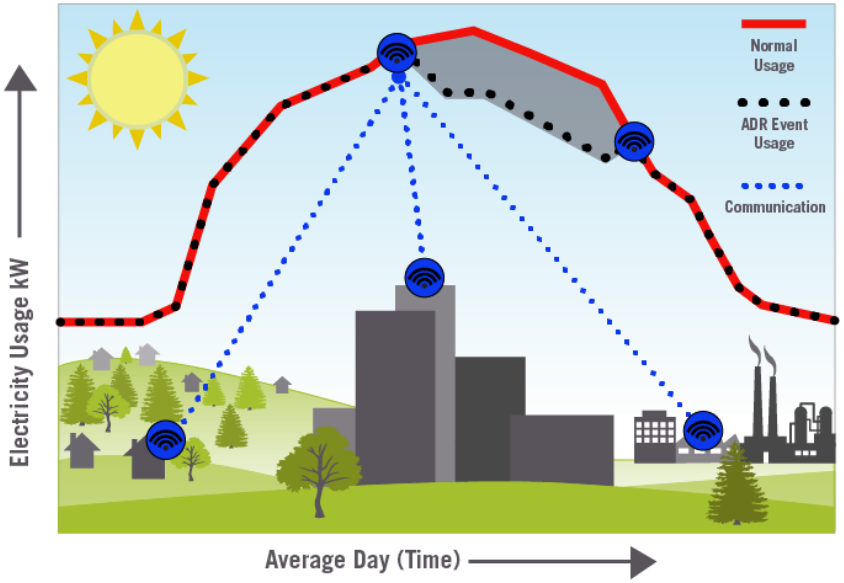


Flexibility: Solution or threat?

- Balancing products R3DP and SDR (Elia)
  - Flex service providers (FSP) contract dispatchable loads and generation in the distribution grid
  - Flexibility services help Elia to keep **global** balance
  - Flexibility services can cause **local** problems due to the high simultaneity factor

Network Flexibility Study (NFS)

- DSO checks if requested flex services cause congestion problems in the distribution grid
- Interval:
  - Now: Every 3 months
  - Future: Towards real-time?



Smart or conventional? Which way to go?

Smart

+ Defer/avoid grid reinforcement

+ Better utilization of the existing grid infrastructure

-Relatively expensive

-More complex

-Uncertainty regarding security, reliability, lifetime,…

Conventional (cable)

+High lifetime

+Relatively cheap

+More copper reduces losses (not negligible!)

-Nuisance of works in public space

-Low utilization of grid capacity

A DSO will only apply smart solutions if they prove to be feasible and cost-effective

Conclusion

- The rise of RES and new technologies has a big impact on the distribution grid's loading pattern
- The distribution grid was not designed for high simulaneity
- At this moment, congestion is not problematic (yet) for the Infrax grids
- Infrax invests in innovative projects to investigate the feasibility of smart solutions

metaPV iMOVE linear Intelligent Networks

- Smart solutions are promissing, but conventional solutions (grid upgrades) have their benefits as well…
- It is key to keep costs for society at an acceptable level

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Thank you for your attention

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