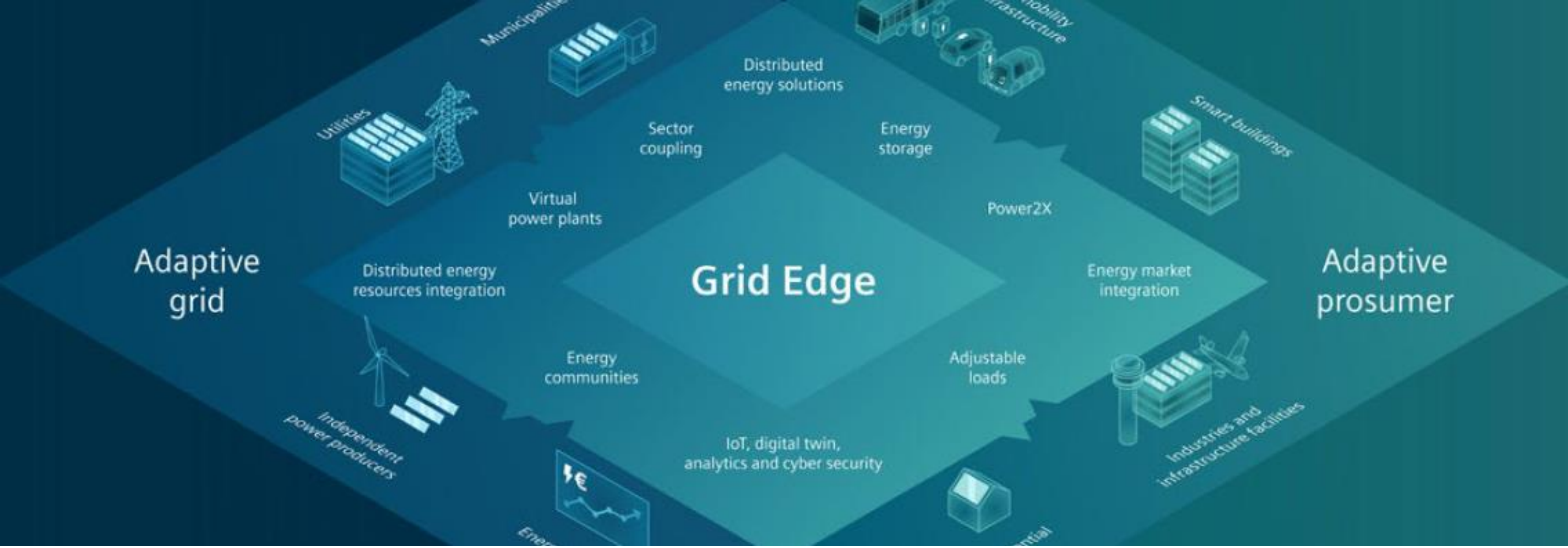
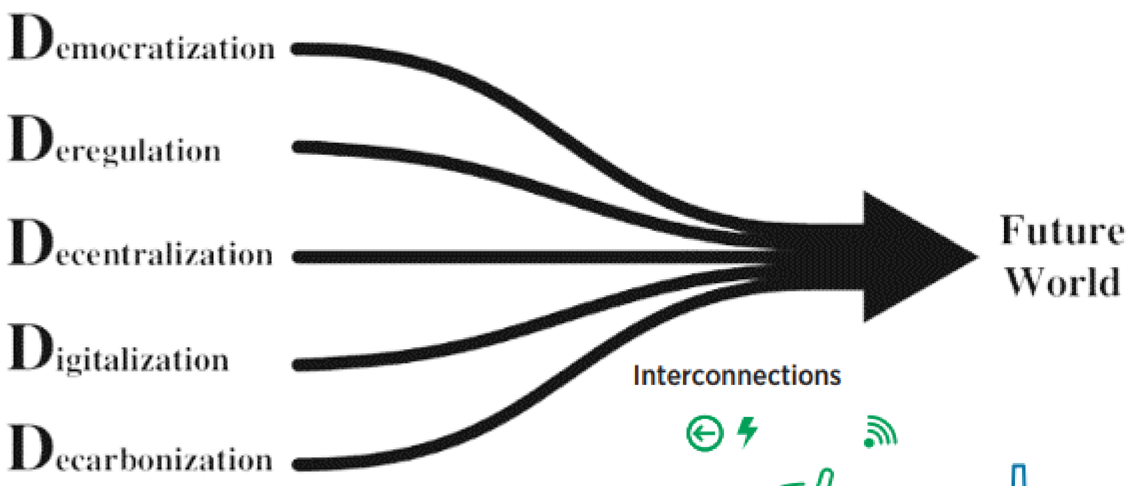


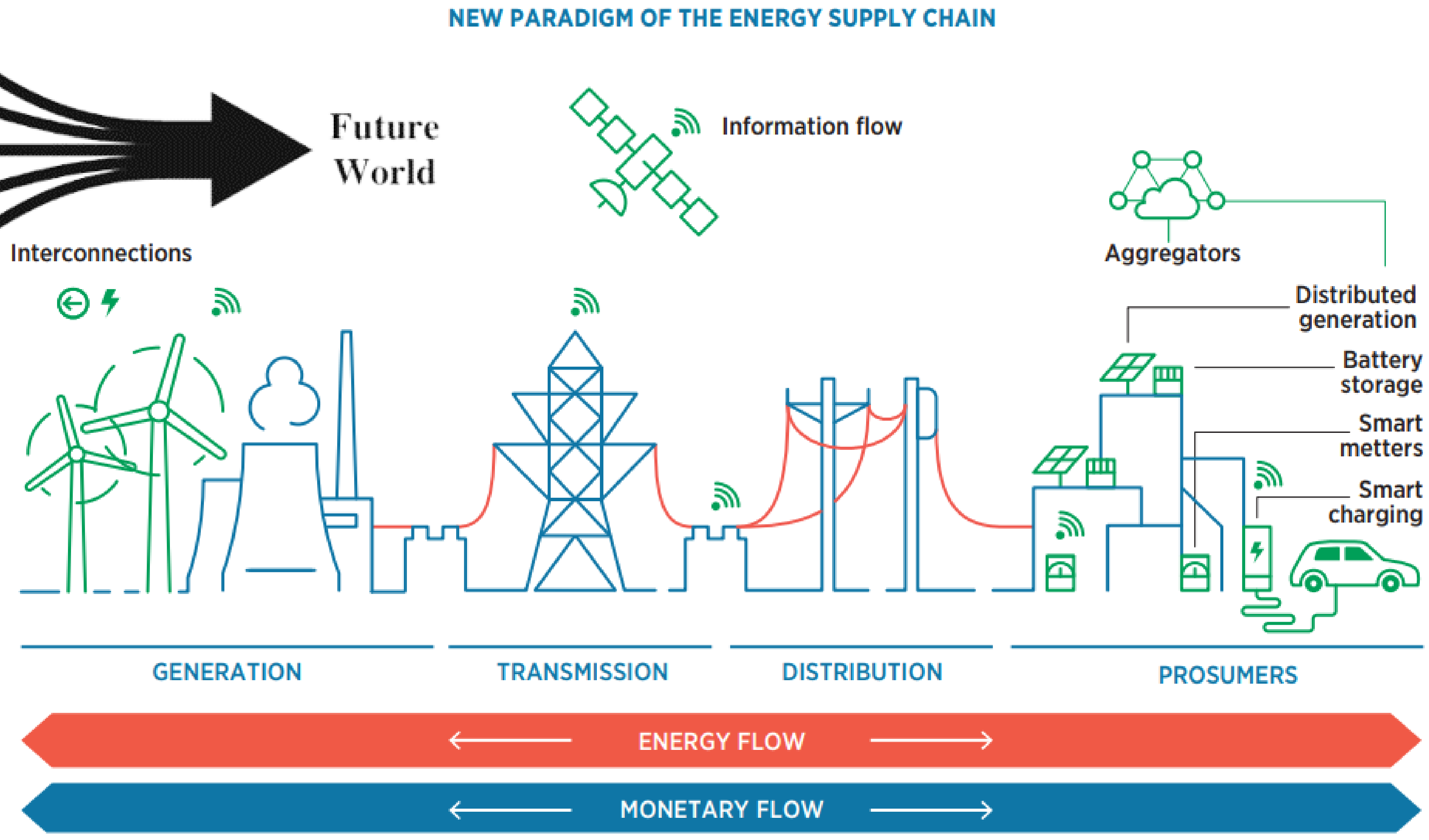
Grid adaptive integration of distributed energy resources

Krista Pētersone

Contents

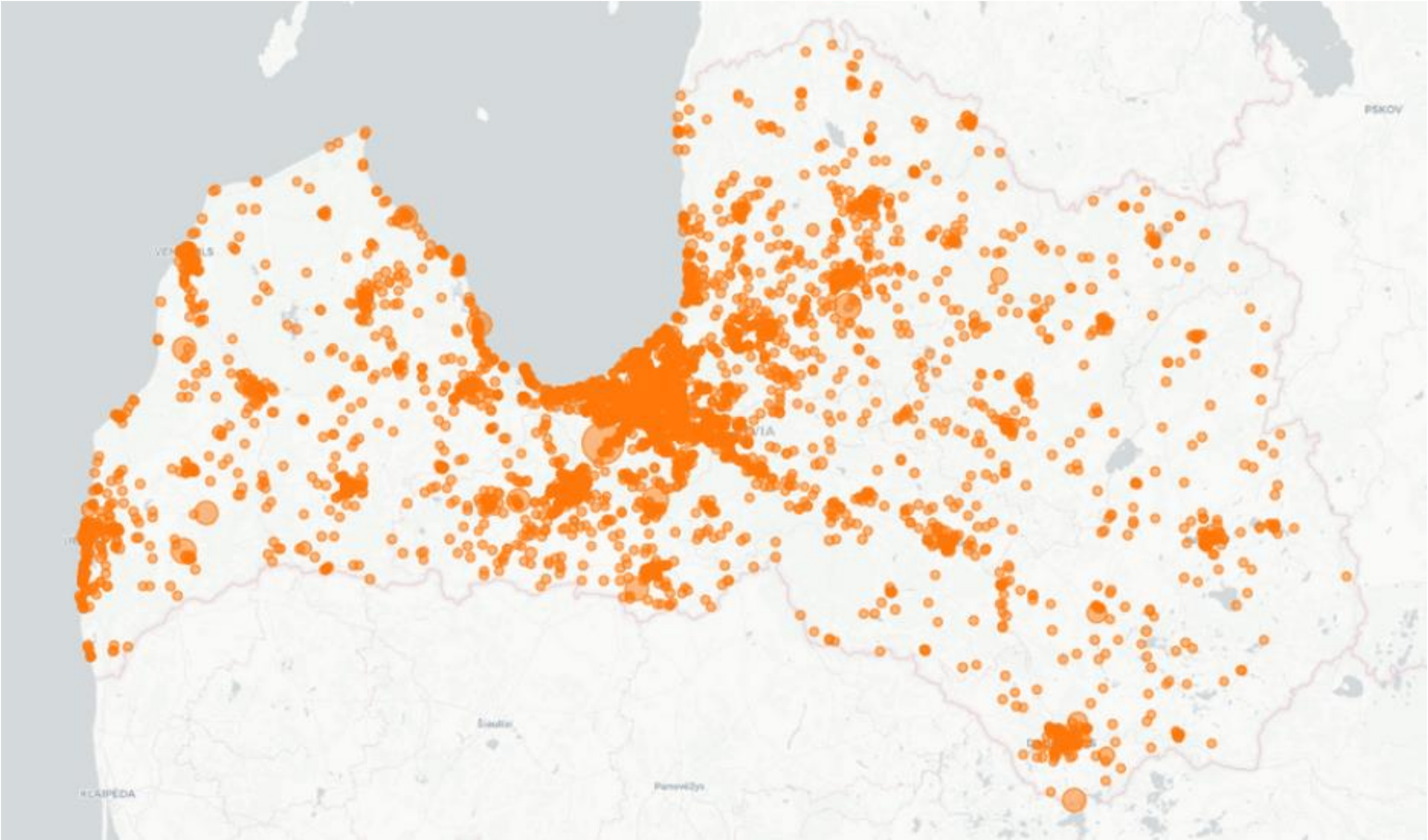
Context – 5D of energy transformation





Sources: IRENA, Moghaddam et al. 2022

Context – rise of prosumers in LV



Source: sadalestikls.lv

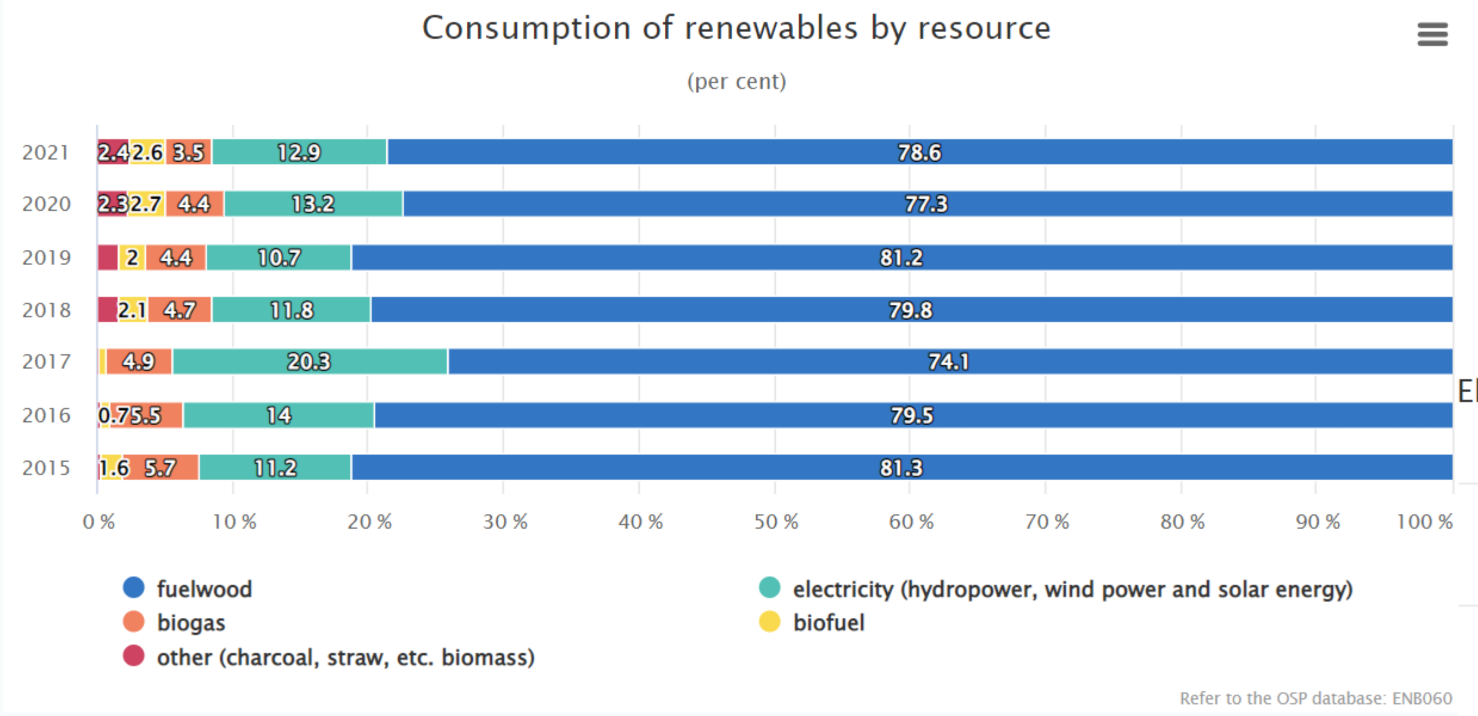
Solar PV microgeneration – up to 11.1 kW

End of 2021:
2145 prosumers, 14 MW

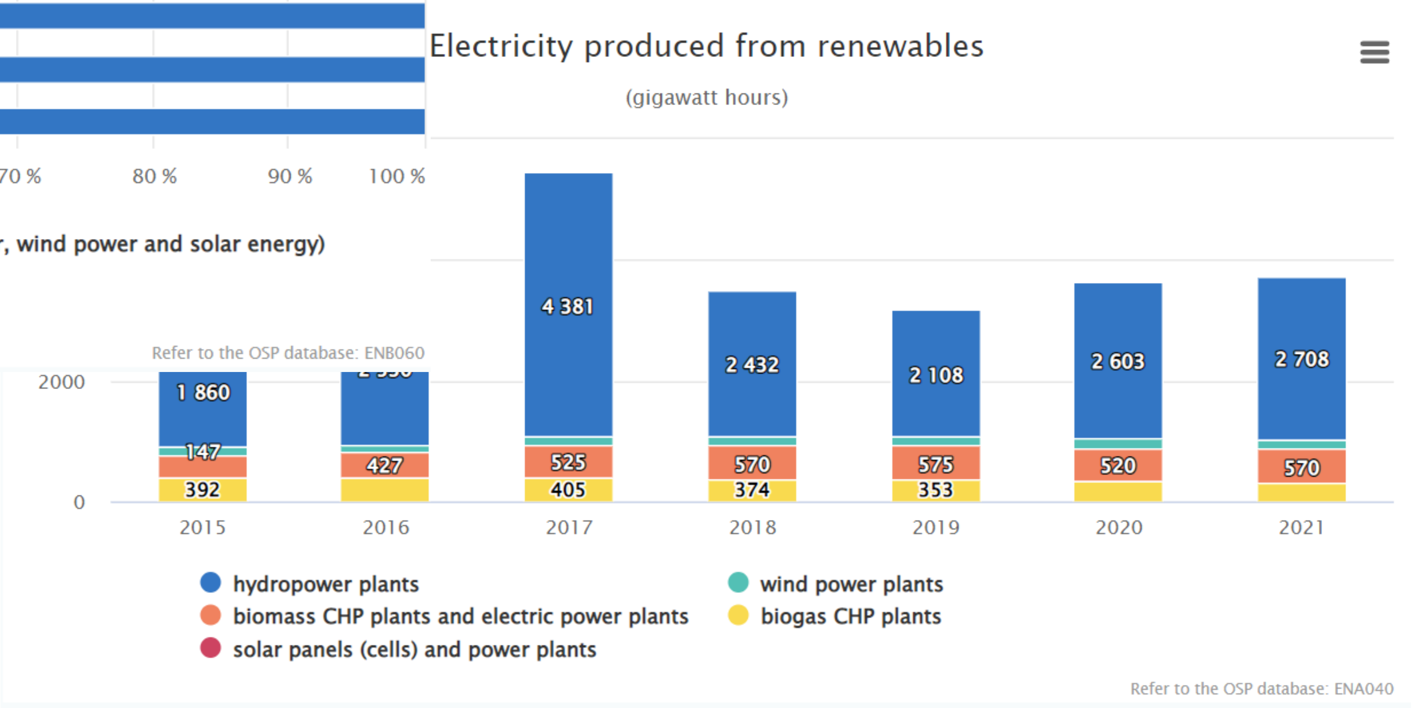
September 2022:
9200 prosumers, 72 MW

Larger solar power plants – application stage

Context – energy transition in LV



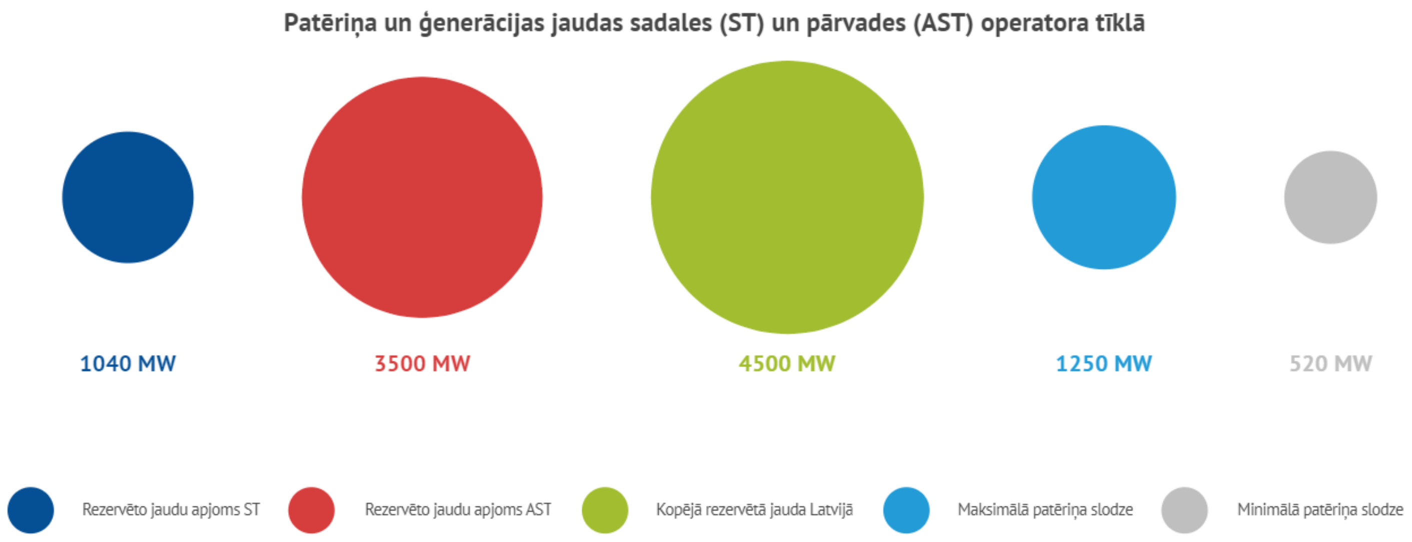
Latvia – 3rd highest share of renewable energy in the EU (42%), but very low deployment of solar and wind power

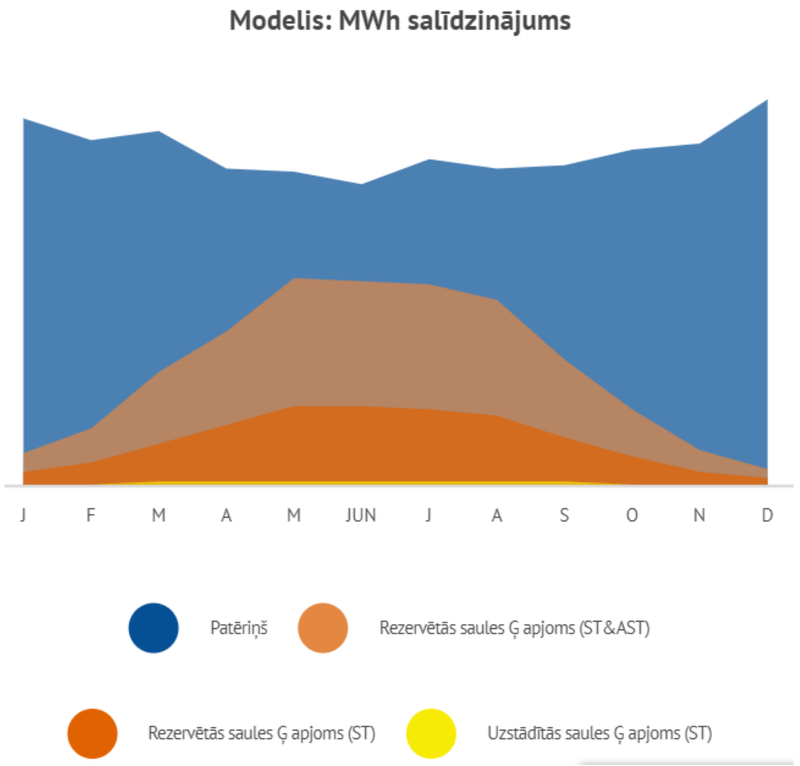


Source: stat.gov.lv

Context – energy transition in LV

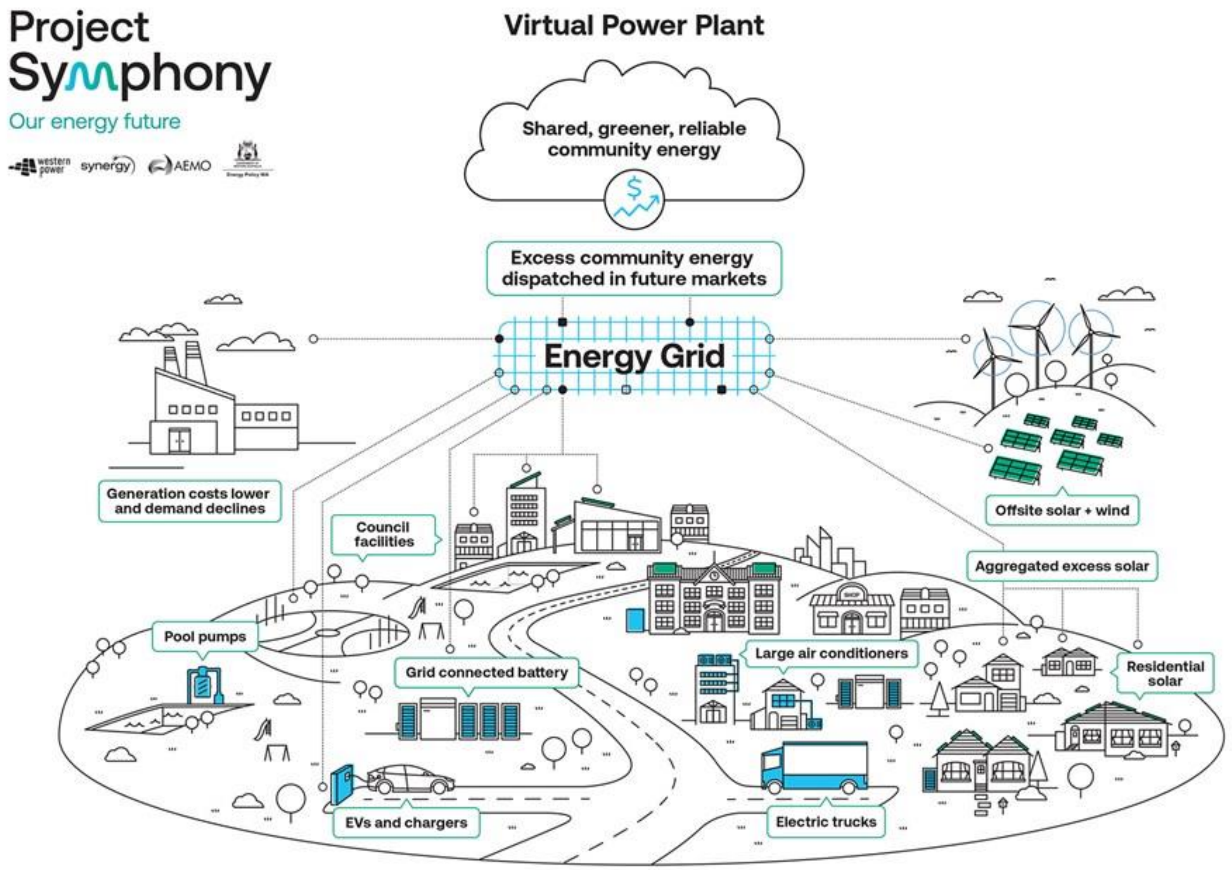
Booming interest from project developers: «reserved capacity» in transmission and distribution systems exceeds consumption





Source: sadalestikls.lv

Context – changing electricity market

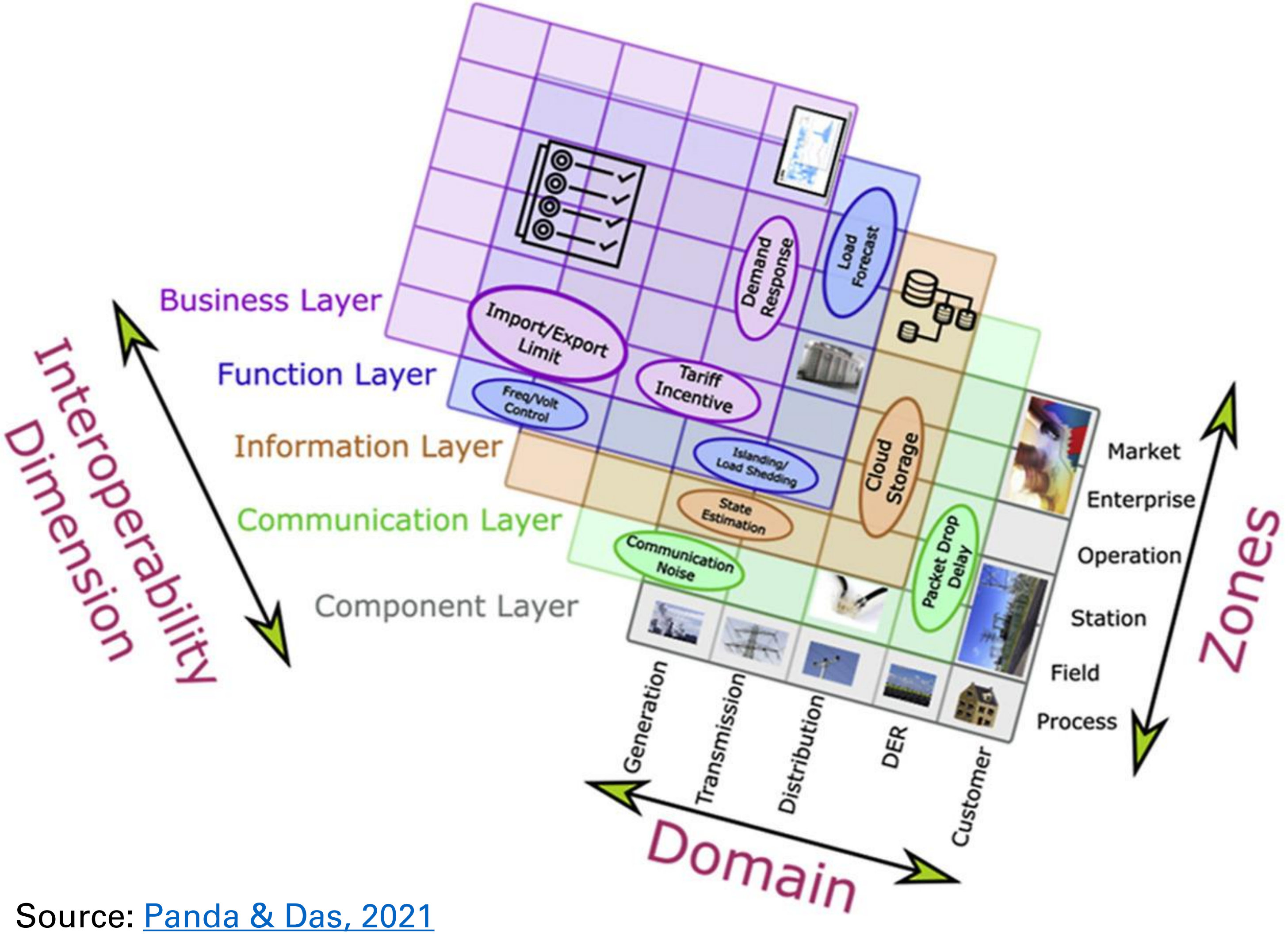


Source: www.westernpower.com.au

Operational concepts

- Active users, collective self-consumption
- Energy communities
- Energy sharing
- Flexibility, demand response
- Aggregators
- Virtual power plants

Context – smart grid paradigm



Smart grid architecture model since 2012

Source: [Panda & Das, 2021]

Theory – demand side flexibility

Definition

"Demand-side flexibility" means the capability of any active customer to react to external signals and adjust their energy generation and consumption in a dynamic time - dependent way, individually as well as through aggregation.

Sources: smarten.eu, iea-shc.org

Enabling factors

- Technical capabilities of the equipment
- Consumer behaviour
- Aggregation for flexibility markets
- Regulative environments
- Data exchange and interoperability

Problem to tackle

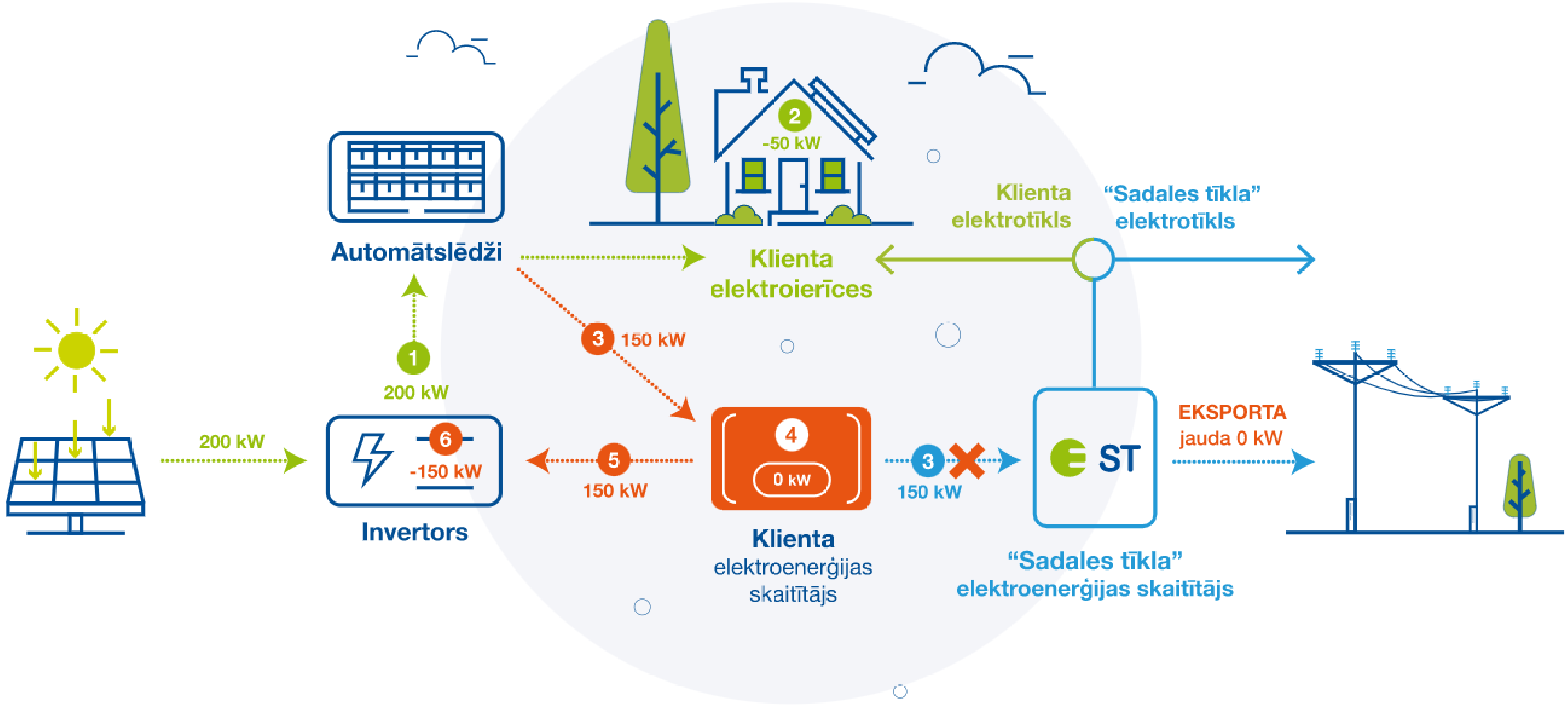
Power grids as open systems

How to coordinate and overcome grid constraints in order to sustainably accommodate increasing power flows from distributed resources?

Overarching goals

- Provide grid services without excessive costs
- Grant equal access to the grid to support fossil phase out
- «Manage the ever-increasing variable generation mix whilst maintaining affordability and security of supply» (smart-en.eu)

Example – zero export limit



Source: sadalestikls.lv

Objective

- Design and test flexible export control schemes for solar power plants without on-site supervisory control and data acquisition systems (SCADA)

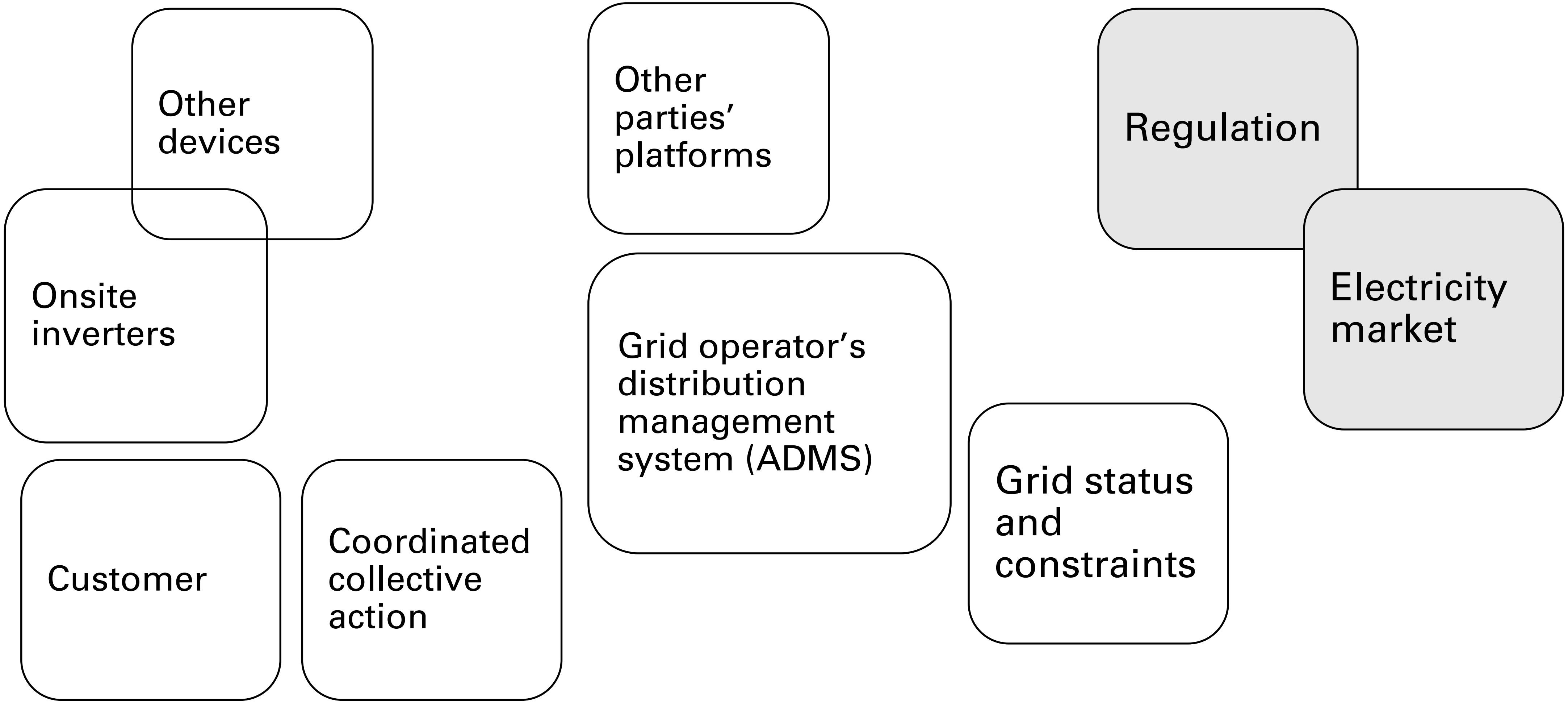
1. Enable inverter – system operator communication
2. Grid monitoring and analysis tools for efficient control
3. Coordination of distributed action

How different types and gens of inverters can be remotely controlled?

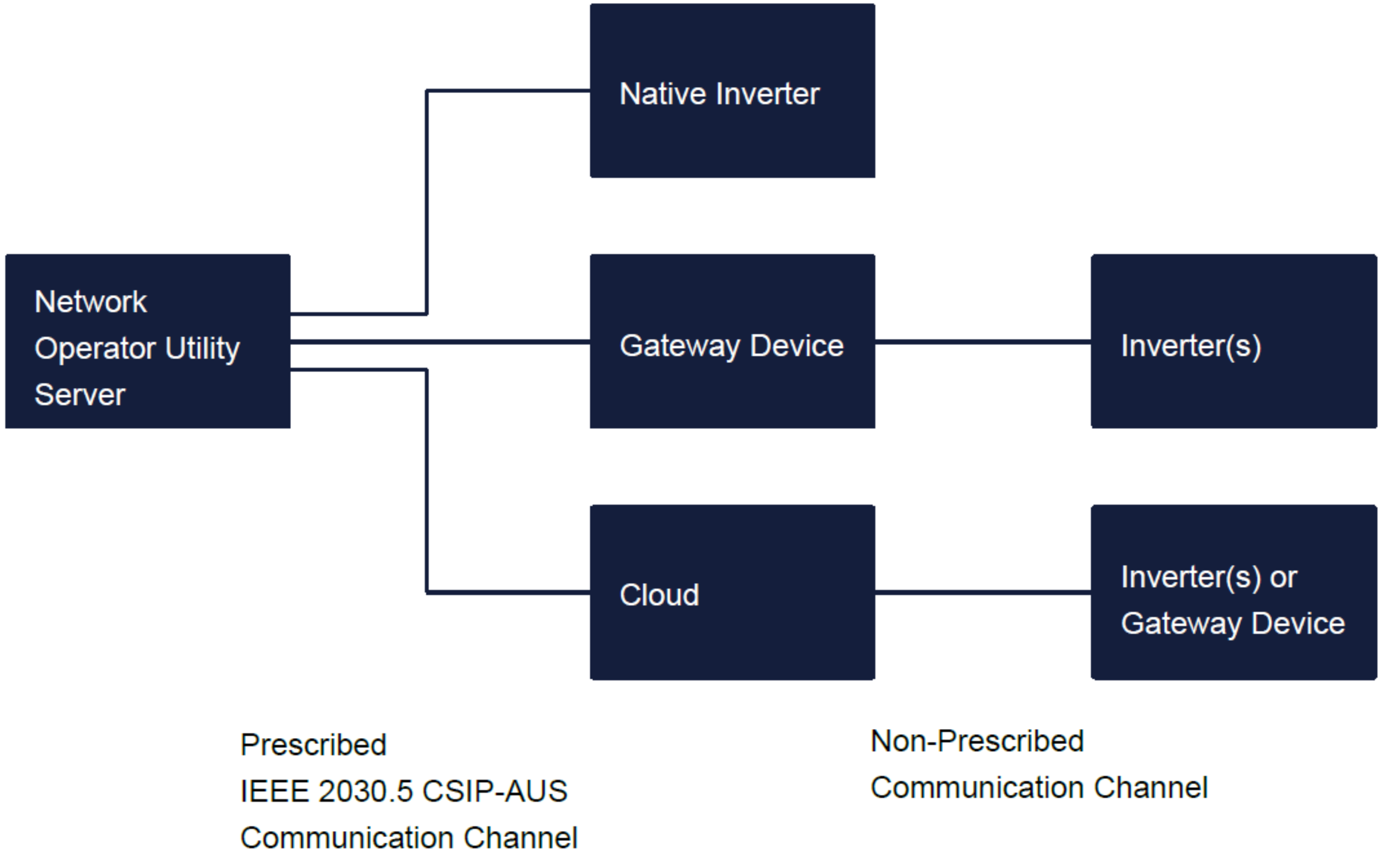
What grid level insights are needed to make conditional control decisions?

How different parties negotiate and cooperate to implement the most sustainable scenario?

Solution – elementary building blocks



Good practice - Australia



Source: www.sapowernetworks.com.au

New fail-safe mechanism - Latvia

Future Hub challenge

«Sadales tīkls» cooperation project with start-ups

Ensure that preset export limits are not breached

Propose a low-cost hardware solution with automated remote control

Options

- Circuit breakers
- Loggers
- Smart-meter functionality

Source: solarimpulse.com

Next steps

- **Study**
- **Collaborate**
  - DSO +
- **Accomplish**

Thank you!

kripete@students.lu.lv