Resilience in markets and active distribution systems

C5 – Markets & Regulation and

C6 – Active distribution systems & distributed energy

cigre

For power system expertise

Thijs Slot – C5

Bart Luijckx – C6

Contents

1. Resilience of the electricity market
   - Resilience of market prices
   - Resilience of consumers

2. A new market platform and its resilience challenge: Cybersecurity and GOPACS

cigre
For power system expertise

Resilience in relation to markets is 2-tiered

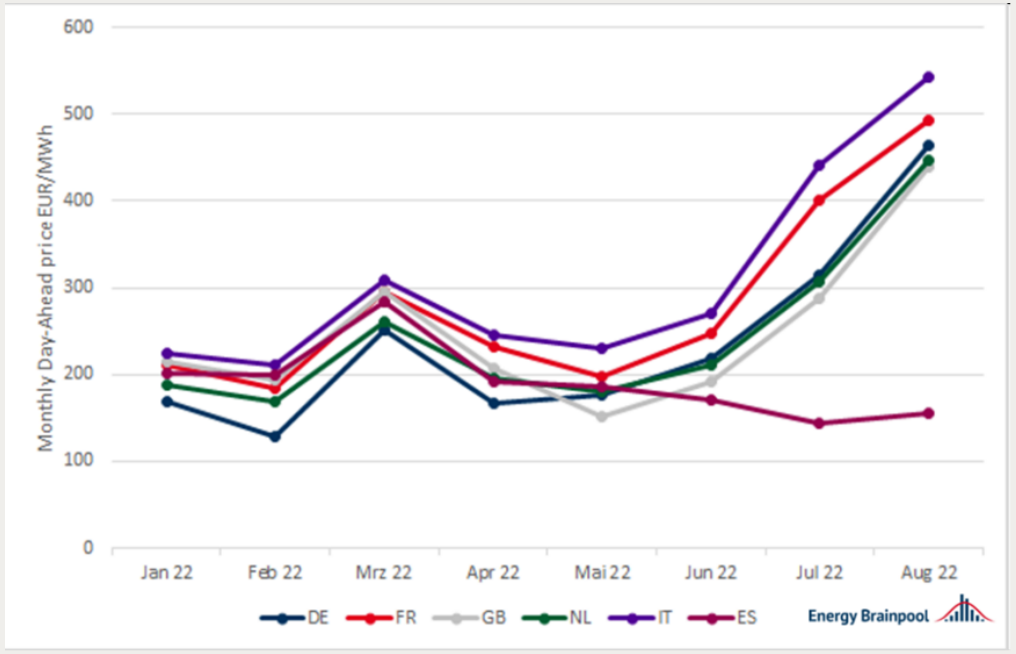
*Resilience is "**The capacity to absorb, adapt, or transform in the face of shocks and stresses**." (USAID)*

- Resilience of market prices
- Resilience of consumers to cope with 'shocks and stresses' caused by markets

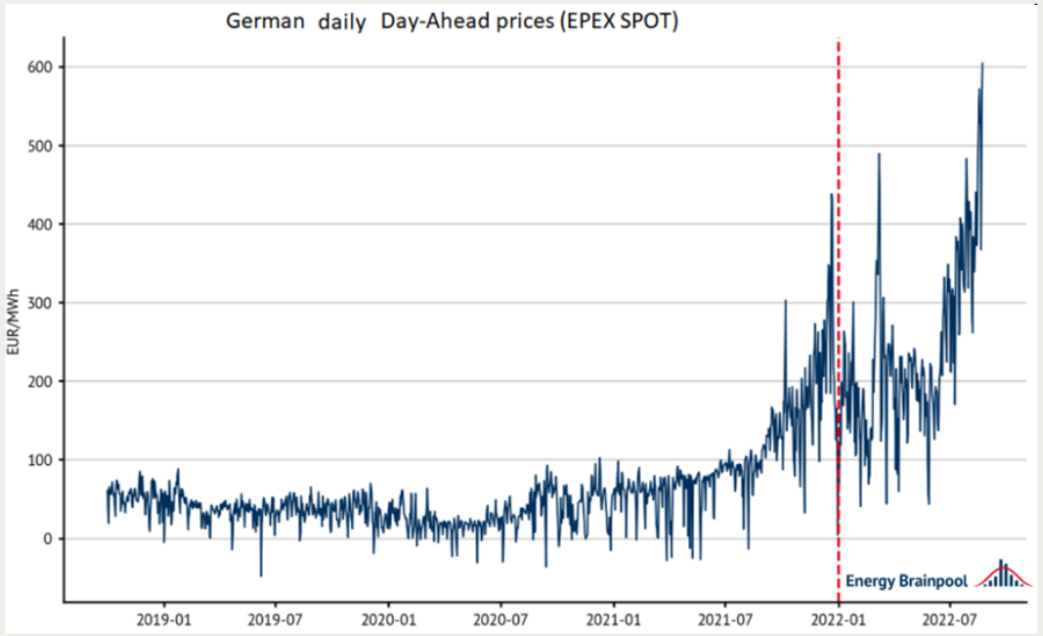
Picture source: msa.com

Market prices (Tier 1)

- Power prices in 2022. “Shocks and stresses”, caused by:
  - Gas price impacts
  - Generation shortages in Nordics and FR



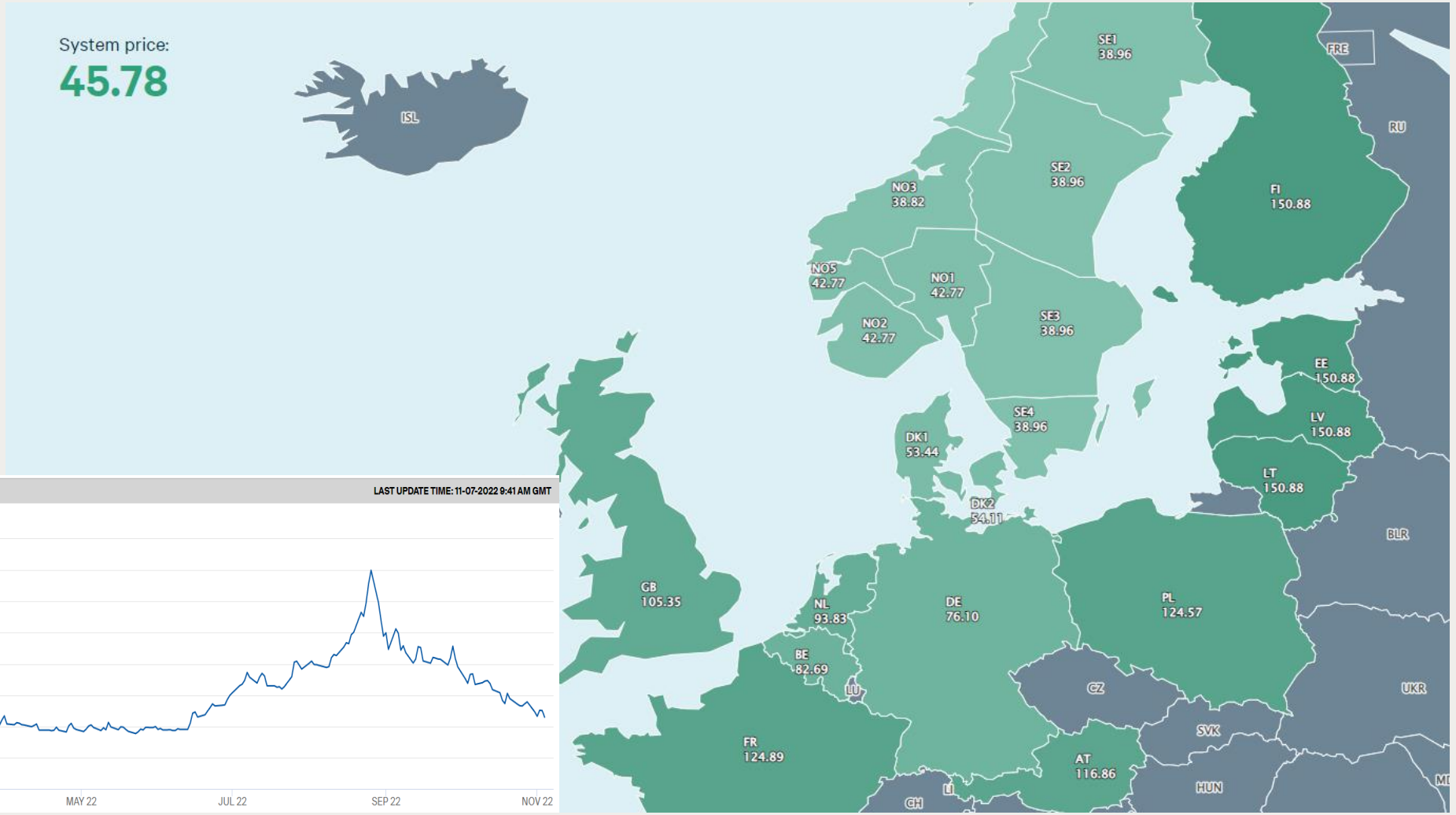
Monthly average price on the day-ahead markets of selected European countries / SOURCE: Energy Brainpool



Hourly day-ahead prices on EPEX SPOT for Germany (2015 to Jul 2022) / SOURCE: Energy Brainpool

Current situation (Nov ’22)

- Significantly lower DA prices
- Gas price down to 1/3 of peak end august
- For how long??



Impacts on large consumers and households (Tier 2)

- 23 Aug: Bloomberg: 70% of Europe's fertiliser production halted
- 16 Sept: European Aluminium Association: Half of Europe's aluminium smelters have been forced to halt or curtail their production of aluminium
- 19 Sept: Bundesbank: German recession in the winter – inflation above 10%
- 30 Sept: Reuters: Dutch inflation leaps to 17%, boosted by high energy prices

Picture source: CNN.com

Proposed measures

- Demand reduction – ‘market measure’ to reduce load and peak prices
- Price cap – ‘market interference’ to reduce profits
- Solidarity fund – for impact alleviation on consumers

Demand reduction – all Member States to reduce consumption by at least **5%** in peak hours

Windfall profit collection – set a limiting electricity price for inframarginal technologies (RES, bio, lignite and nuclear) at **180 EUR/MWh**.

Solidarity fund - collected on energy firms’ 2022 profits, which are above 20% increase of the average profits for the past three years at a rate of at least **33%**.

Source: https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_22_5521 (14th September, 2022)

Conclusions Market Resilience

- Markets can increase resilience to price shocks by decreasing (foreign) fuel dependency, and by ensuring the availability of sufficient sources of generation
  - Requires more long-term planning and processes
- Consumers can increase their resilience to energy price shocks through centralized consumer compensation funds and redistribution of (windfall) profits, long(er) term contracts;
  - Can be implemented on short notice
  - Direct market price cap undesirable because of market disruptions that impact investment climate

Any thoughts on how to improve market resilience?

GOPACS; a new market platform and its cyber security challenges

GOPACS

- An important part of resilience concerns securing a system against ’shocks and stresses’, caused by cyber threats
- To illustrate these, we take the example of Dutch Grid operators who are working together on GOPACS
- GOPACS allows market-based mitigation of grid congestion and offers large and small market parties an easy way to generate revenues with their available flexibility and contribute to solving congestion situations.
- For GOPACS the grid operators collaborate with the energy market platforms of ETPA and EPEX SPOT

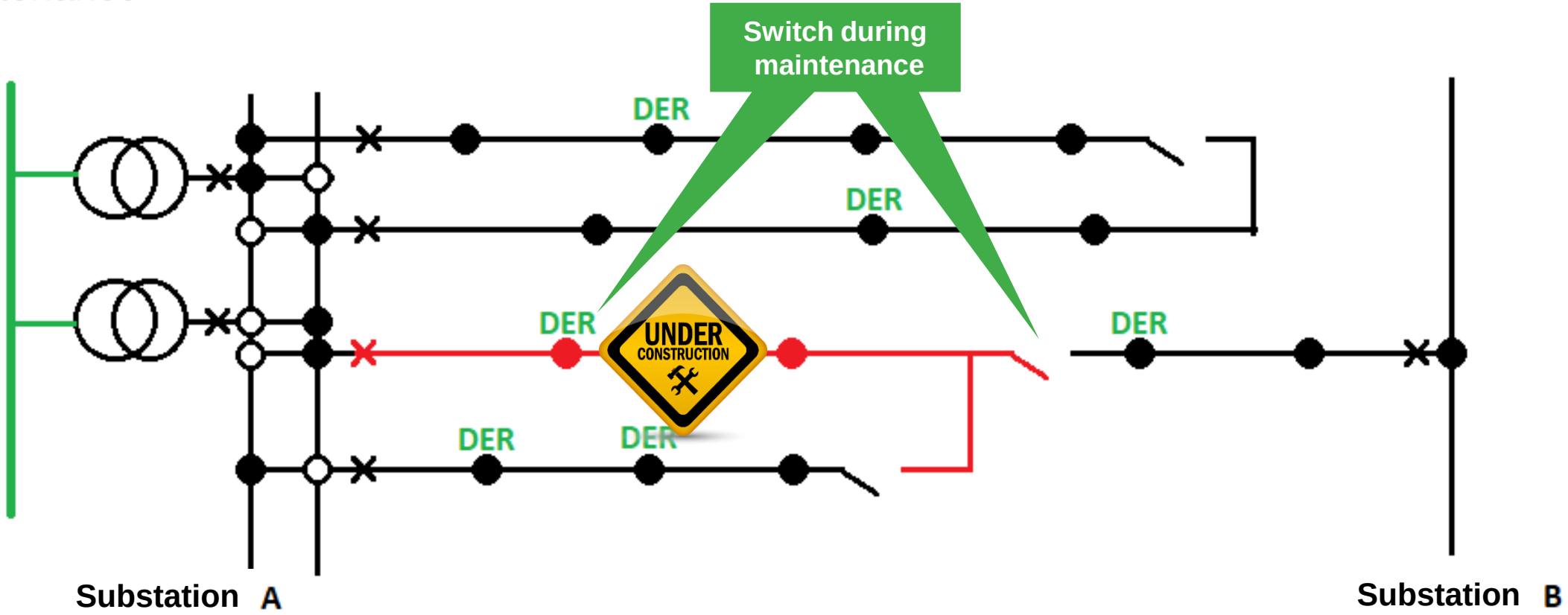
Securing the decentralized energy resources connected to the grid

cigre

For power system expertise

Use Case 1: maintenance

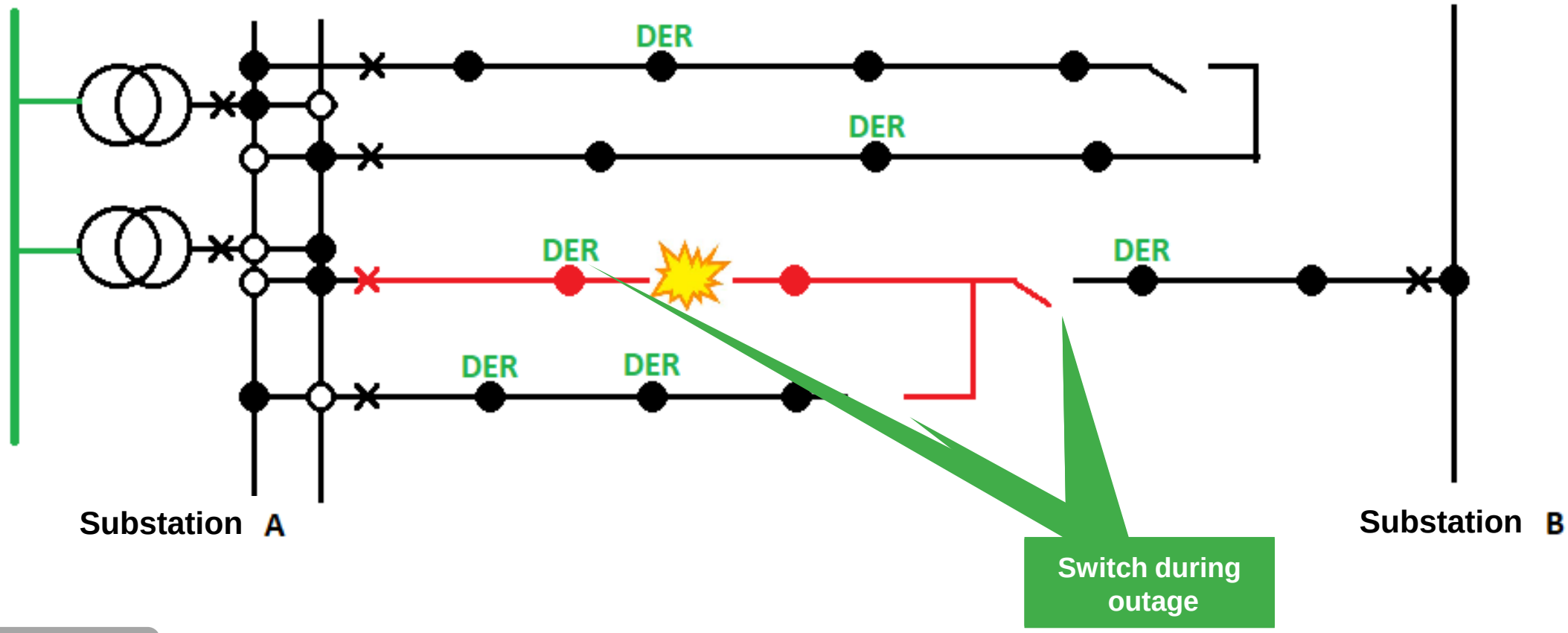
Shedding DER generation in case of maintenance. From N-1 to N, to utilise all (limited) grid capacity for (new) customers (e.g., DER) including redundancy for maintenance



Larger DER

Use Case 2: outage

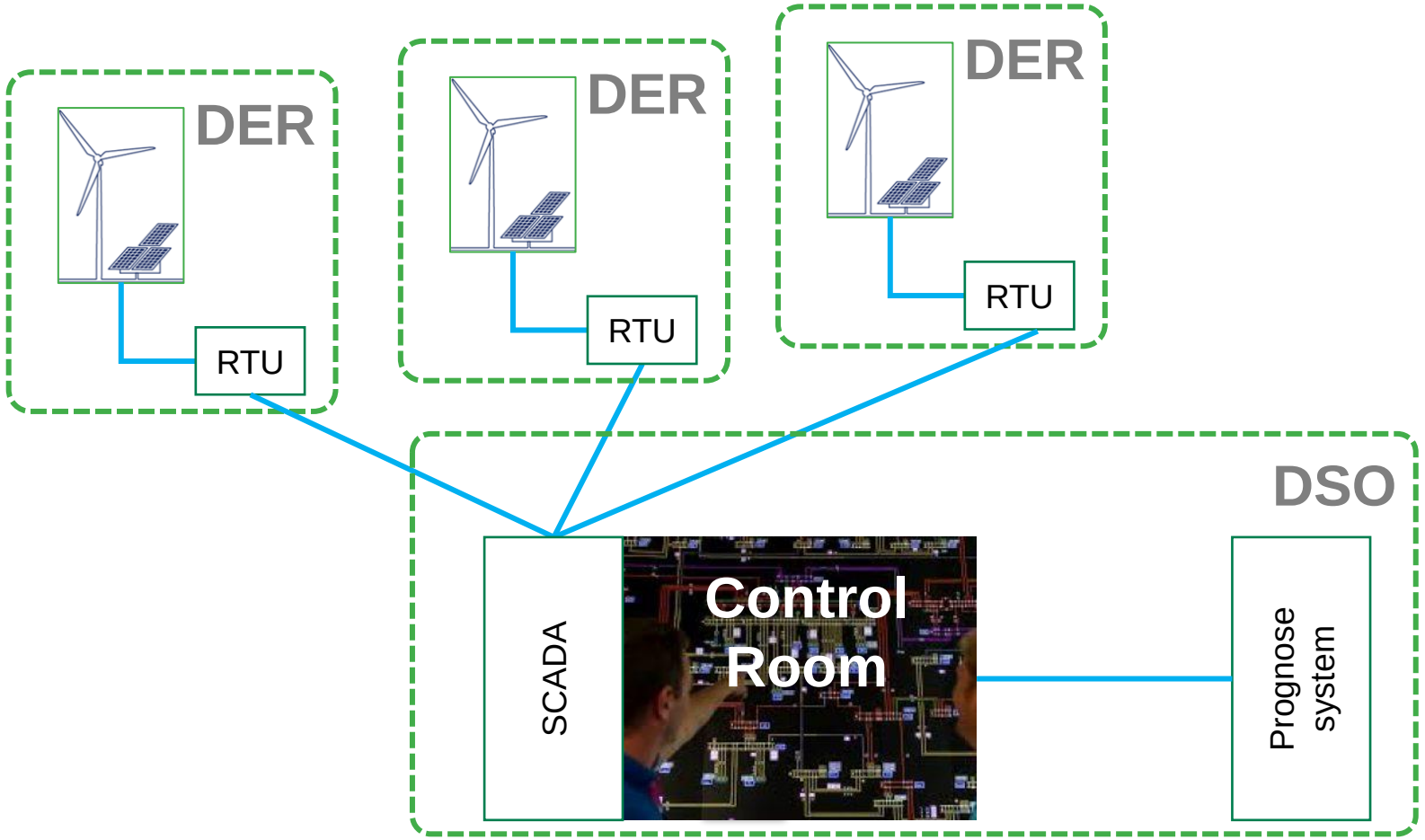
Shedding DER generation in case of an outage. From N-1 to N, to utilise all (limited) grid capacity for (new) customers (e.g., DER) including redundancy for grid interruption



Larger DER

Use Case 3a: Manual peak shaving as 'normal operation'

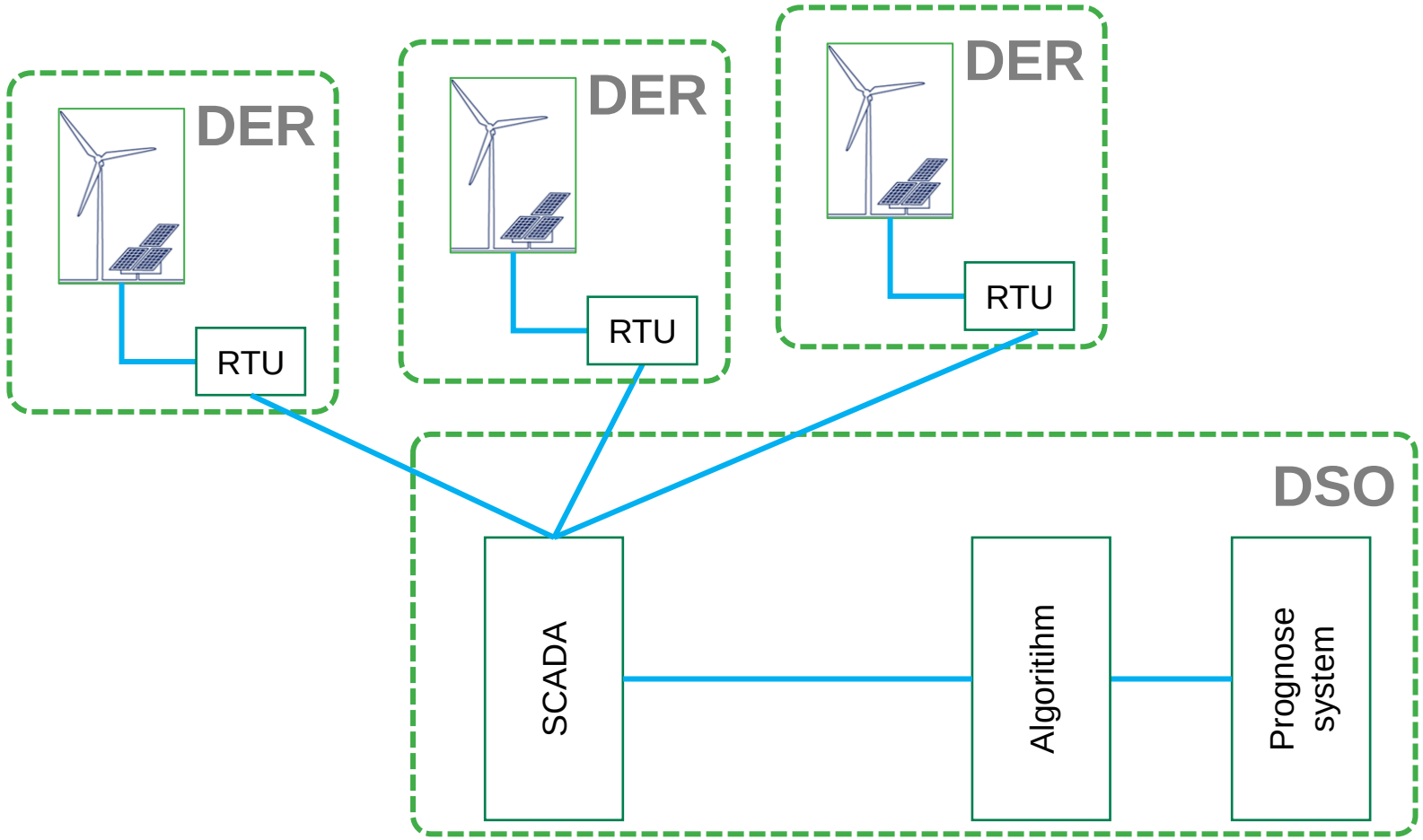
This means shedding DER generation in case of overload ('peaks') during normal operation. The shedding of DER generation is based on prognoses about the grid capacity the next day (or hours etc...). The grid operator will manually switch the DER cabinets of the grid operators.



Larger DER

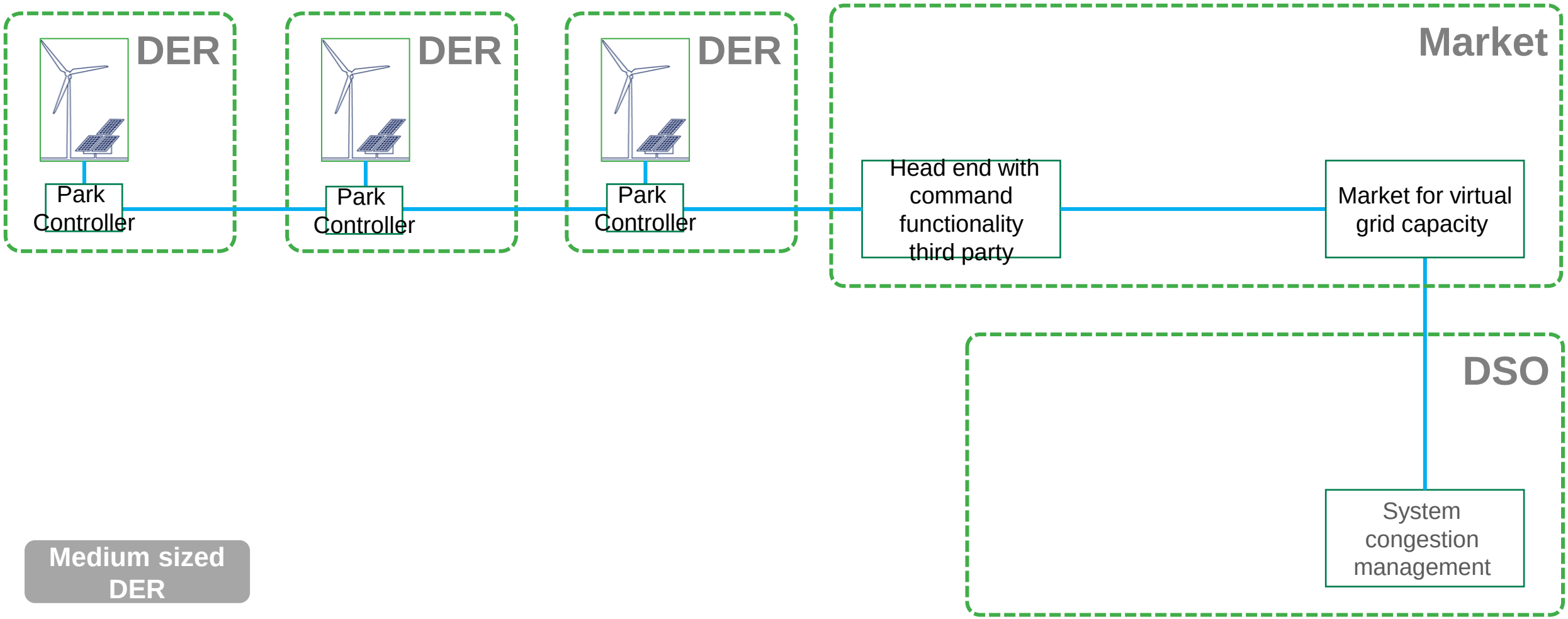
Use Case 3b: Automatic peak shaving as 'normal operation'

Based on an algorithm, automatically SCADA will be shedding DER generation in case of overload ('peaks') during normal operation. The algorithm for shedding DER generation is based on prognoses about the grid capacity the next day (or another interval).



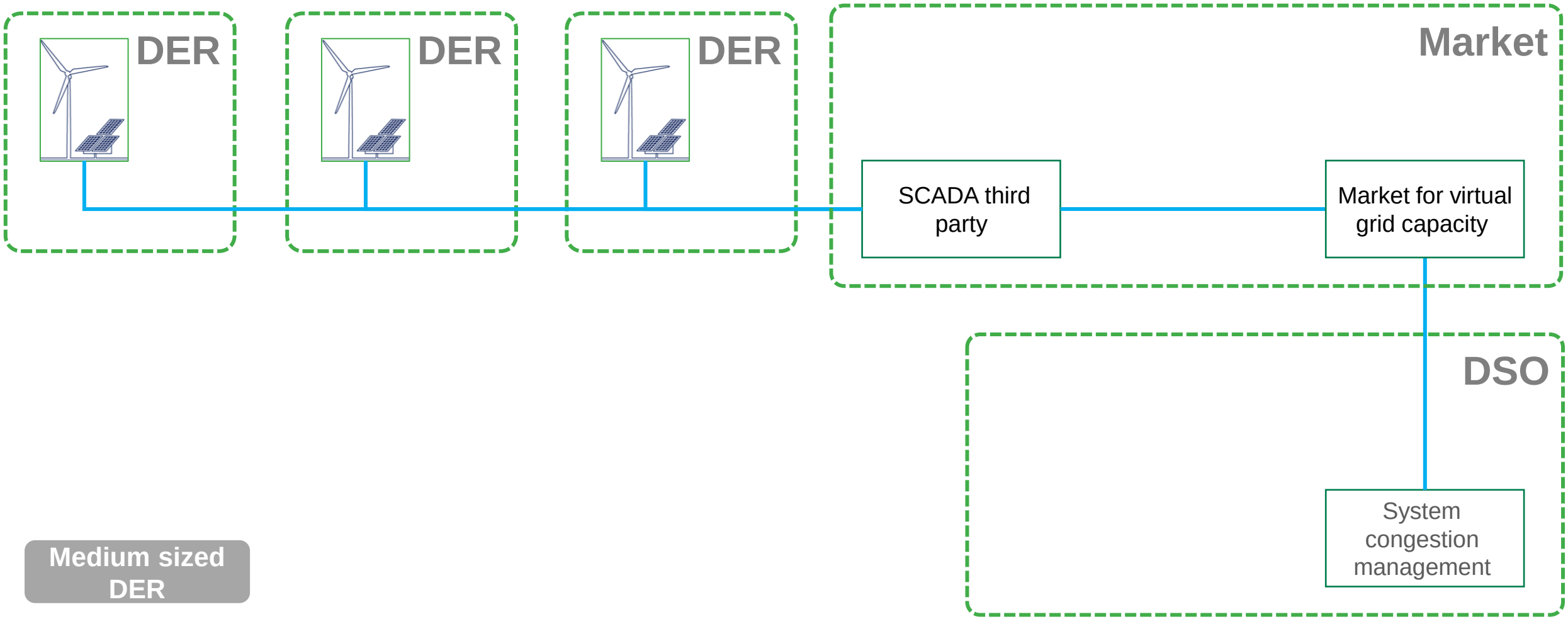
Larger DER

Use Case 3cI: peak shaving by market incentives (RTU's)

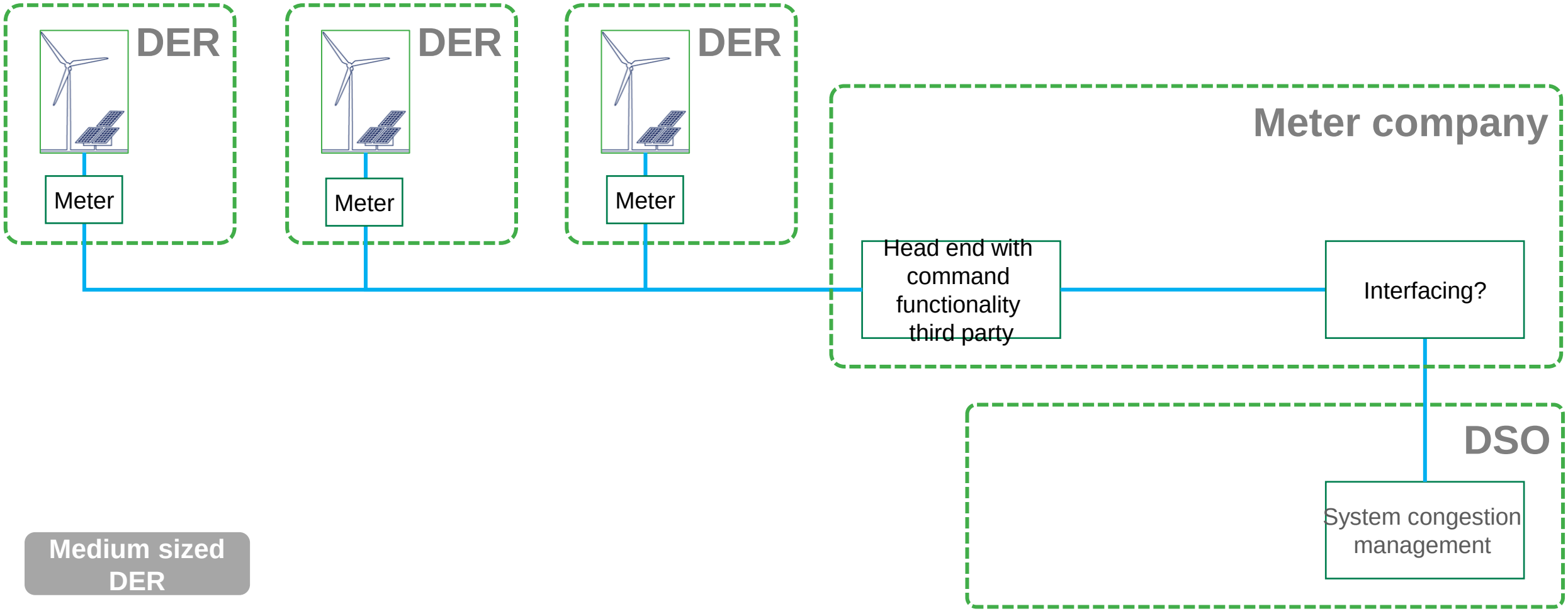


Medium sized DER

Use Case 3cII: peak shaving by market incentives (interface)



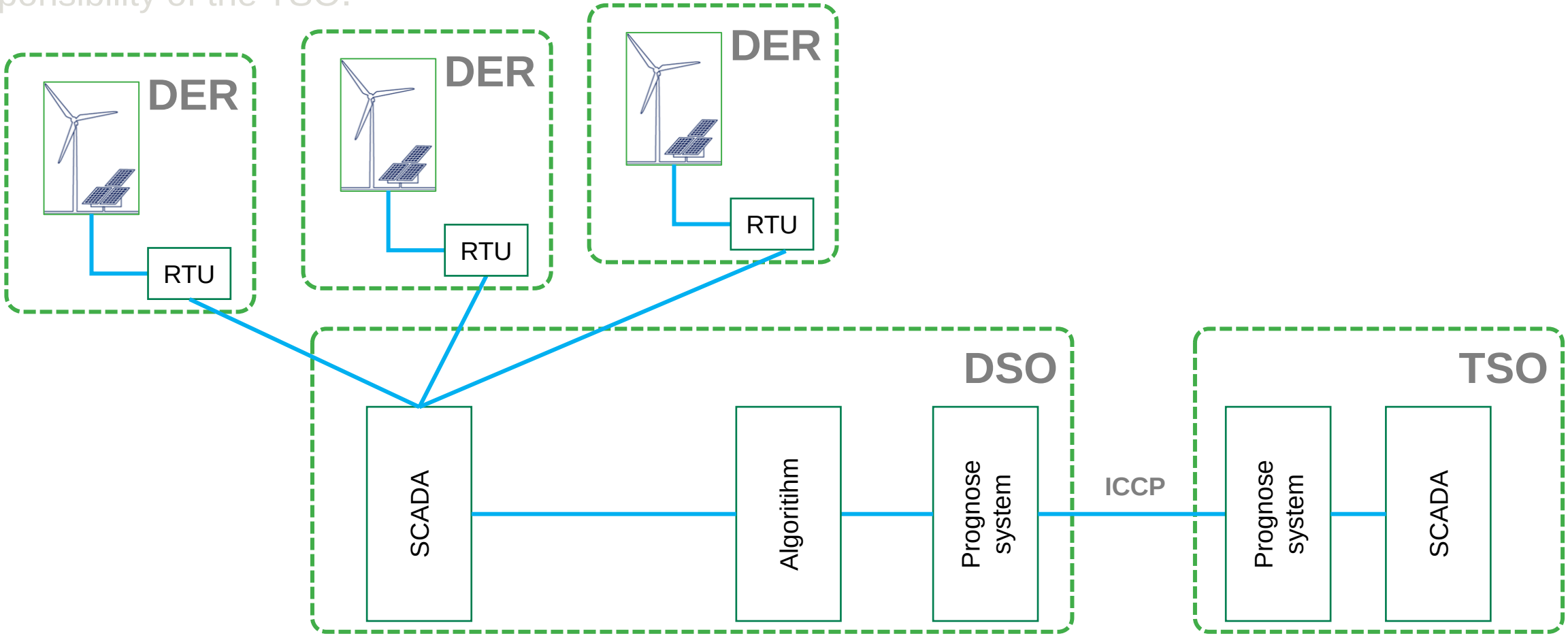
Use Case 3cIII: peak shaving third party (e.g., meter company)



Medium sized DER

Use Case 3d: Peak shaving for TSO (balance responsibility)

On behalf of the TSO the DSO is shedding DER generation to support the balance responsibility of the TSO.



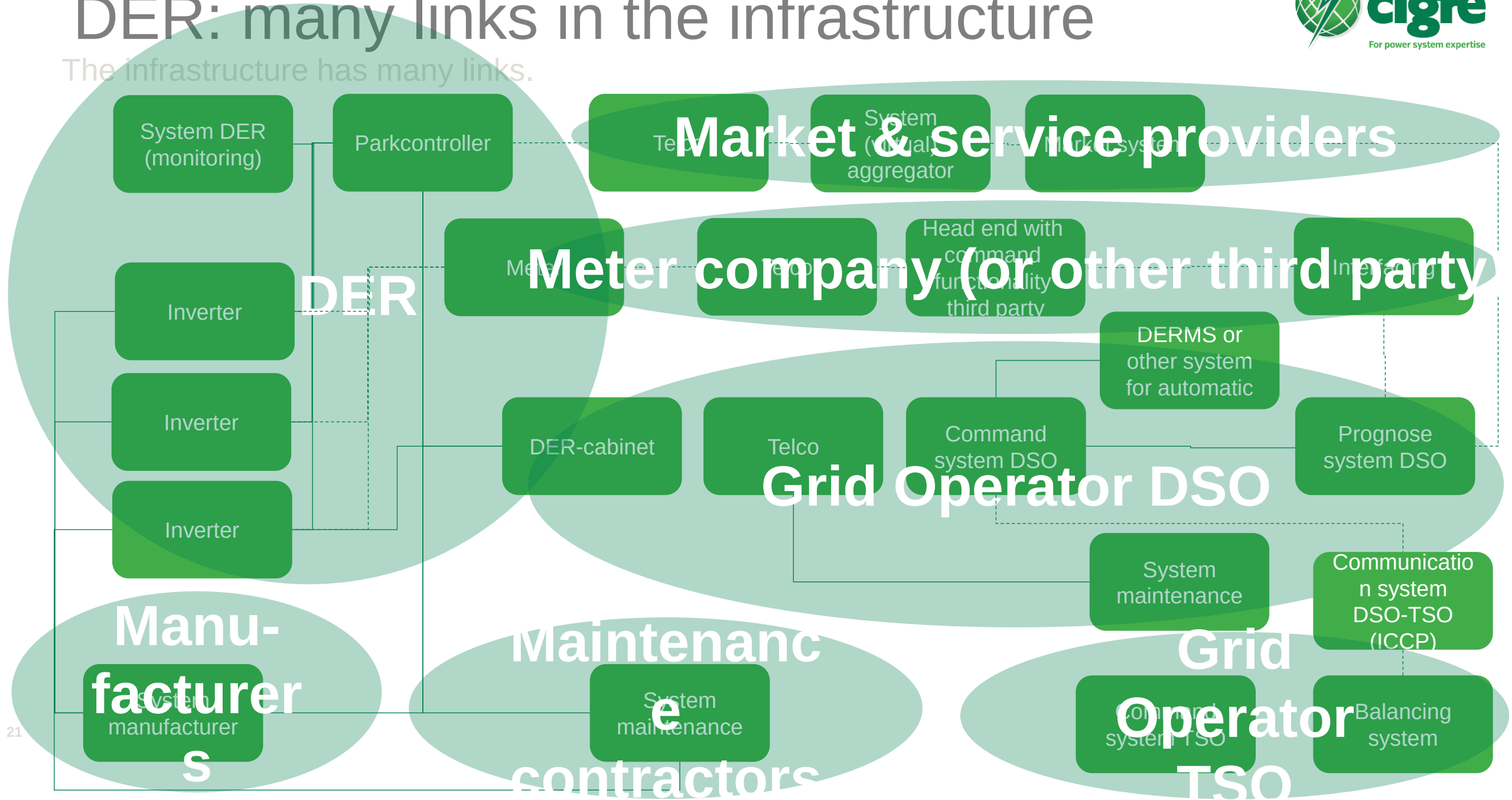
Larger DER

DER: many stakeholders

DER infrastructure has many stakeholders: DER-owners, equipment manufacturers, maintenance contractors, market & service providers (like aggregators) and grid operators.

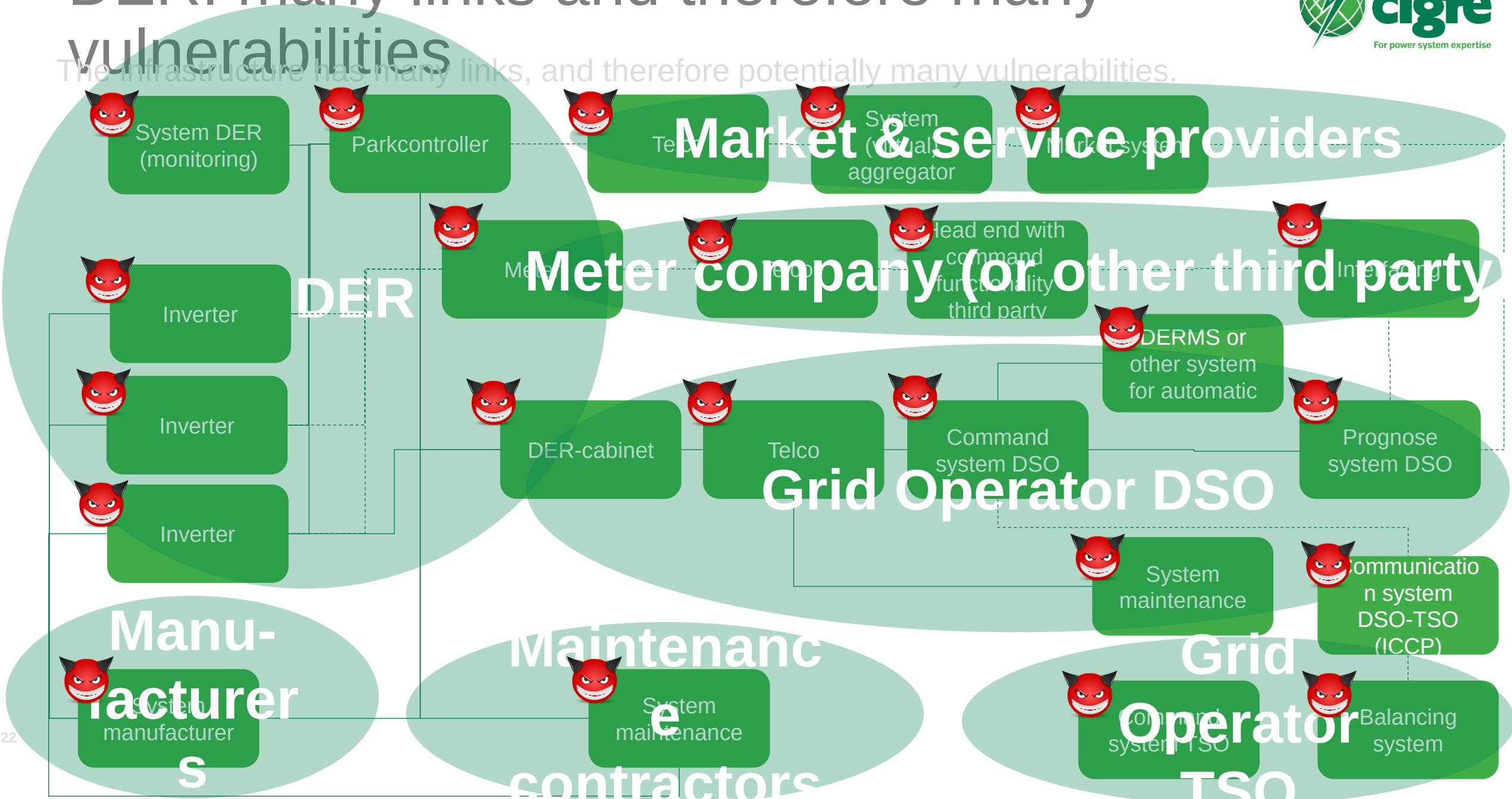
DER: many links in the infrastructure

The infrastructure has many links.



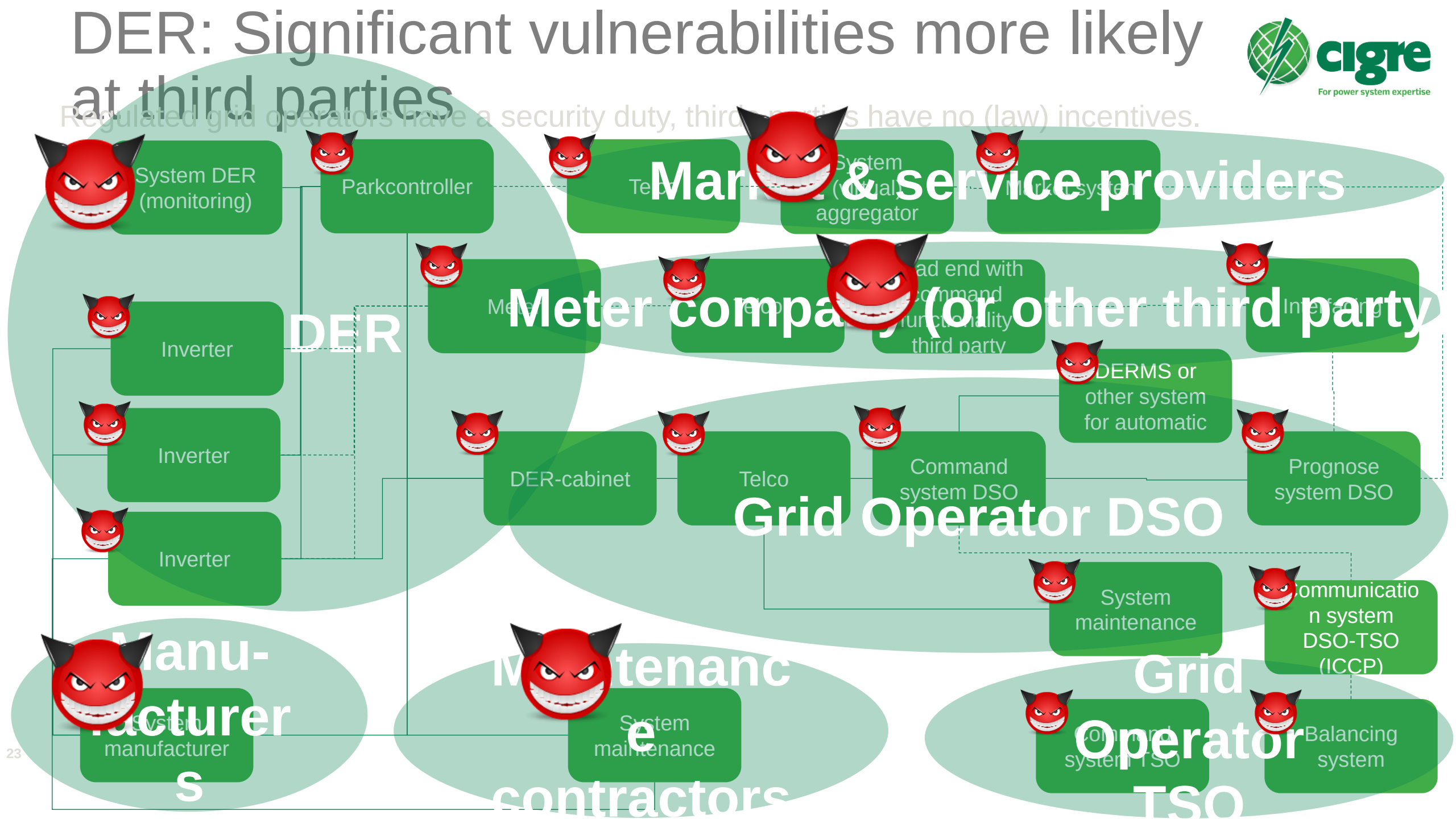
DER: many links and therefore many vulnerabilities

The infrastructure has many links, and therefore potentially many vulnerabilities.



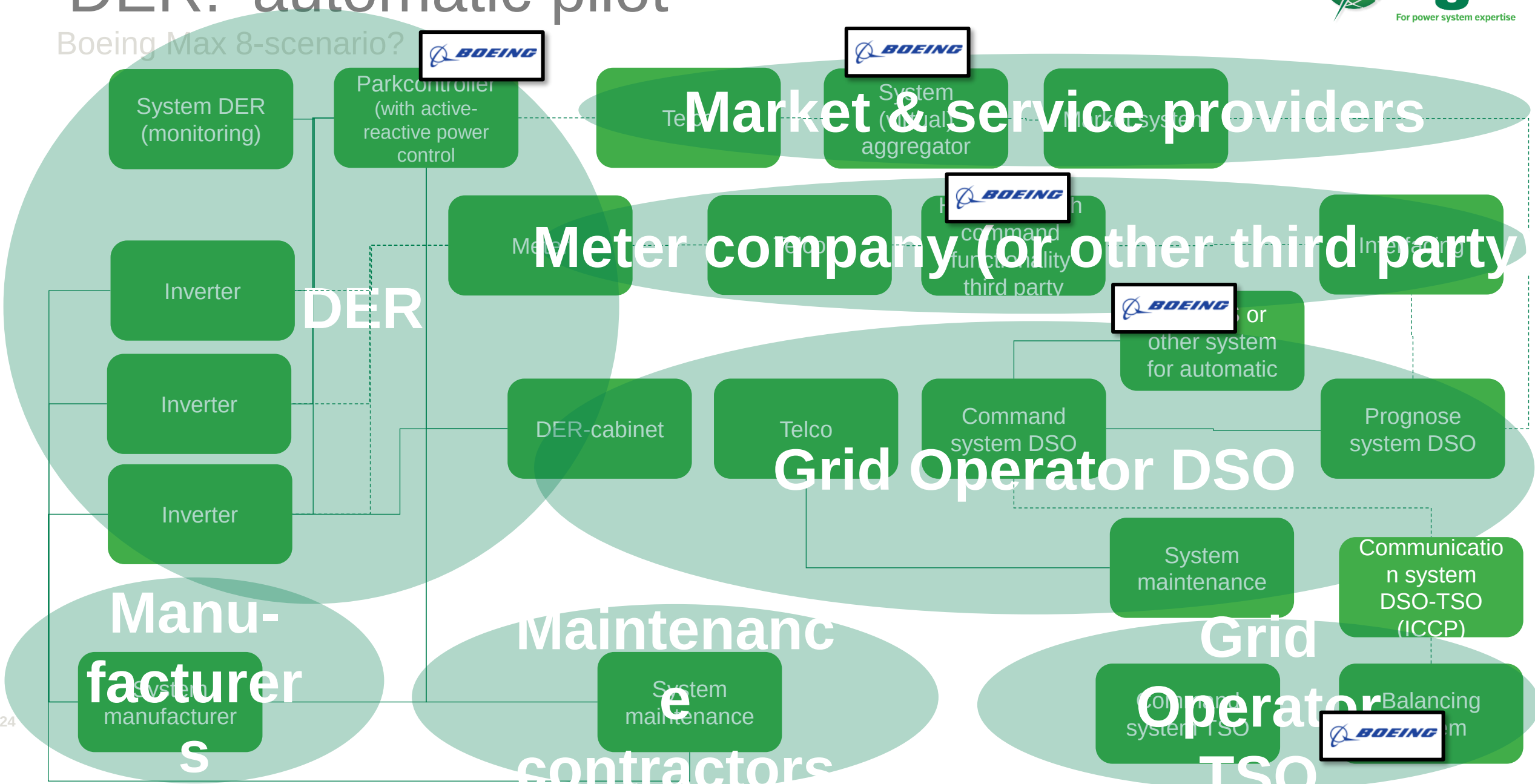
DER: Significant vulnerabilities more likely at third parties

Regulated grid operators have a security duty, third parties have no (law) incentives.



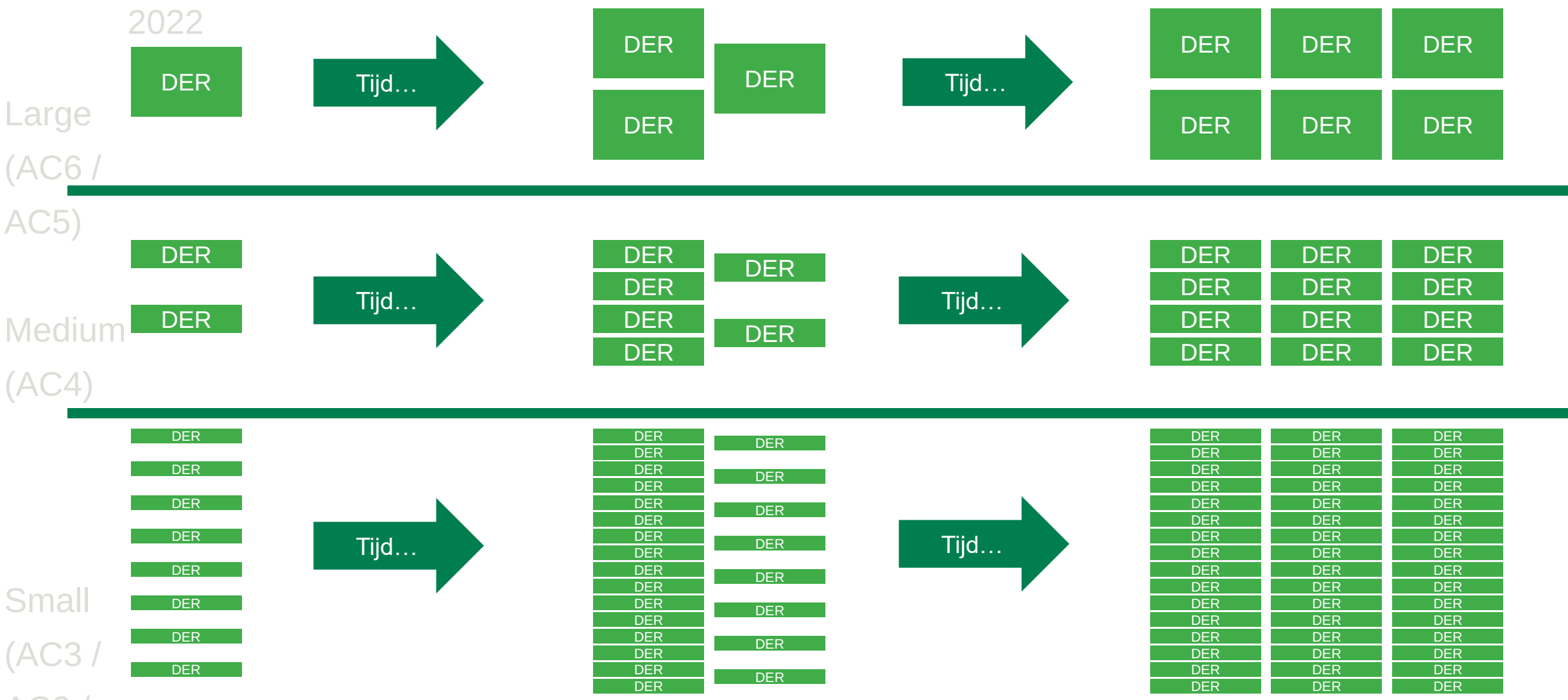
DER: 'automatic pilot'

Boeing Max 8-scenario?



Development DER: impact

Impact of 'all the little ones' is more significant than impact of 'the big ones'?



Development DER: Secure-by-design as a business case…..

The later security is set up, the higher the costs