ASAP

Advanced System protection schemes Applied in the Power grid

By
Kjell Petter Myhren
- Senior Adviser Technology & Innovation, System operation
- Project manager in the ASAP –project

Statnett

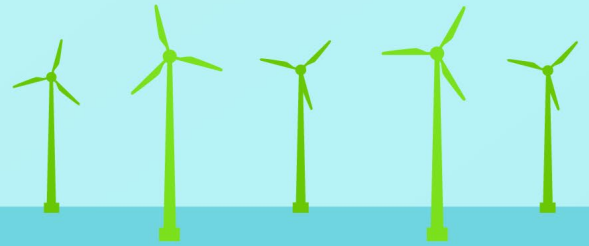
ASAP
Advanced System protection schemes Applied in the Power grid

Project period

- From date 15th October 2021
- To date 31th December 2023

Partly funded by The Research Council of Norway

Contractors
- DNV organized as consortium with RI.SE, NTNU and ENERYIELD



Project Structure

SP0: Project management
- Coordination of sub-projects & reference groups

Statnett, DNV·GL

Project reference group

DNV·GL, NTNU – Trondheim Norwegian University of Science and Technology, RISE, Statnett

SP1: Effective communication of SPS status to operators

RISE

- WP1: Situation analysis
- WP2: Specification of HMI
- WP3: Testing

SP2: Optimized setting of System Protection Schemes

RISE

- WP1: Situation analysis
- WP2: Method for automatic activation status
- WP3: Method for automatic adjustment of disconnected volume
- WP4: Evaluation of method application to existing SPSs
- WP5: Impact on operators' overview from automated SPS solutions

SP3: Model dependency between SPS

DNV·GL, ENERYIELD

- WP1: Area selection and Data collection
- WP2: Development of simulation approach and tool
- WP3: Simulation
- WP4: Testing off-line data
- WP5: Reporting

SP4: Future solutions for optimal use of grid capacity

DNV·GL

- WP1: Screening of methods for optimizing grid utilization
- WP2: Methods for increased grid capacity through adapted grid capacity limit
- WP3: Methods for increased grid capacity through curtailment
- WP4: Alternative methods for increased grid utilization
- WP5: Development of protection and control solutions for optimal grid utilization

Reference group SP1

DNV·GL, RISE, Statnett

Reference group SP2

DNV·GL, Statnett

Reference group SP3

RISE, Statnett

Reference group SP4

RISE, Statnett

ASAP

Advanced System protection schemes Applied in the Power grid

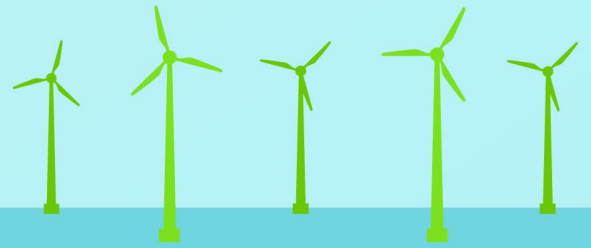
Short Introduction to System Protection Schemes (SPS)

Event-based protection solutions

- Automatic disconnection production
- Automatic disconnection load
- Automatic change topology

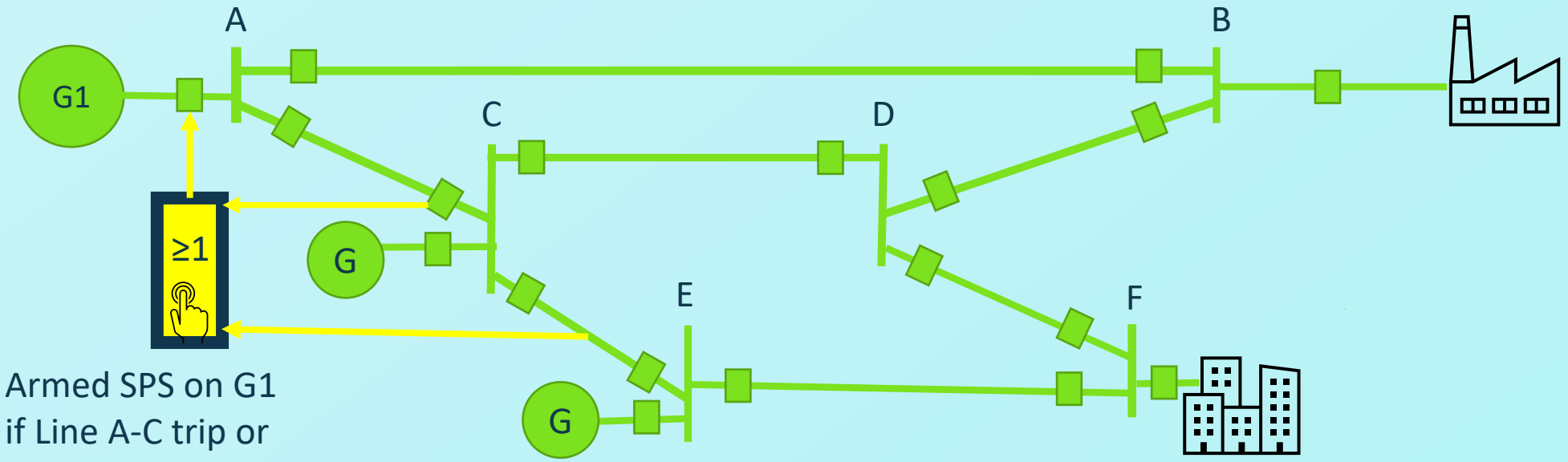
Increase capacity on transfer corridor by use of SPS

Future use of SPS



System Protection Schemes (SPS)

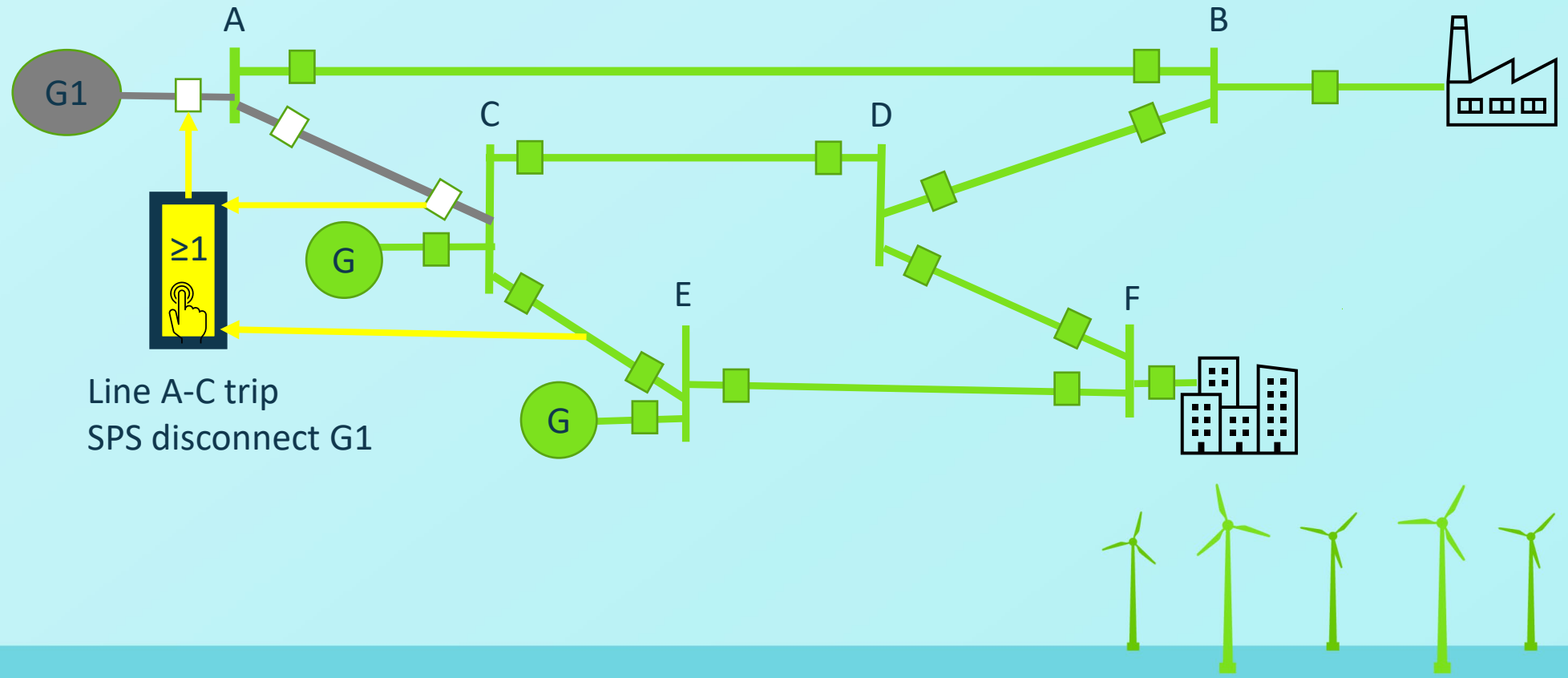
Event-based protection solutions
Disconnection of production (PFK)



Armed SPS on G1
if Line A-C trip or
Overload on Line C-E

System Protection Schemes (SPS)

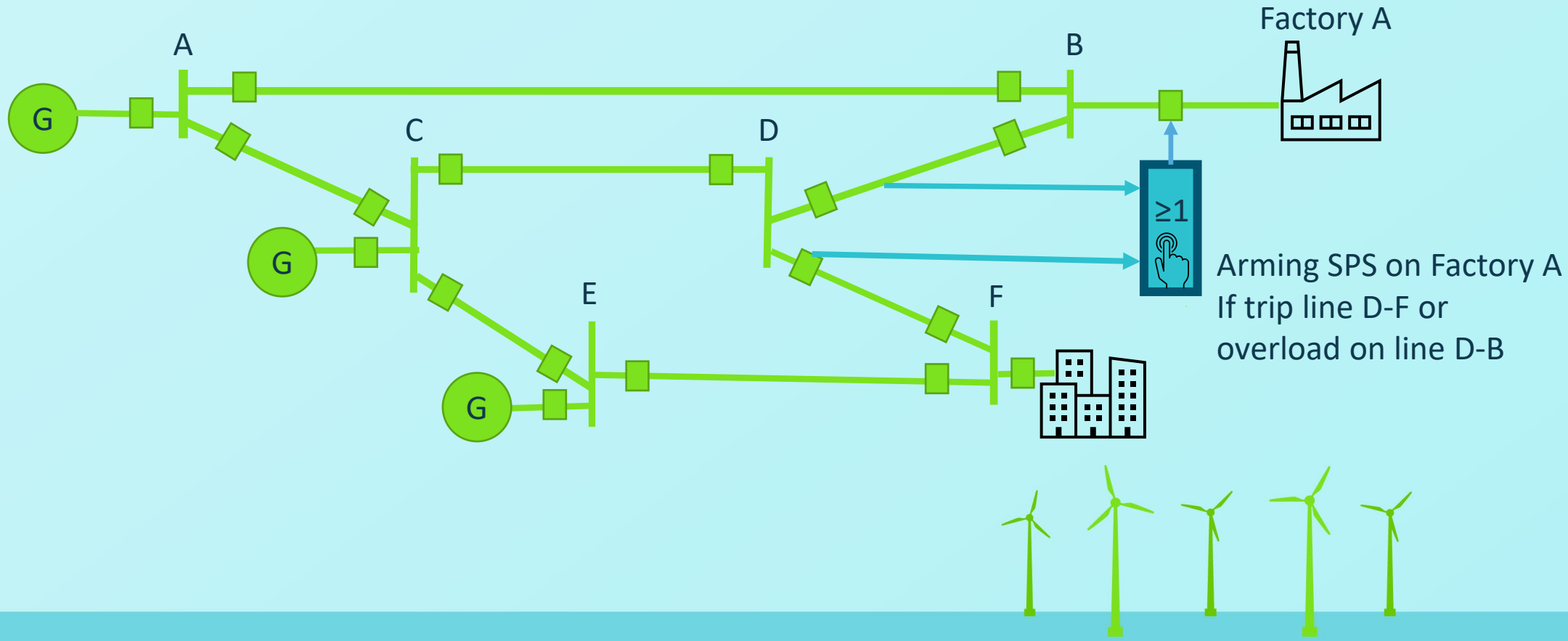
Event-based protection solutions
Disconnection of production (PFK)



Line A-C trip
SPS disconnect G1

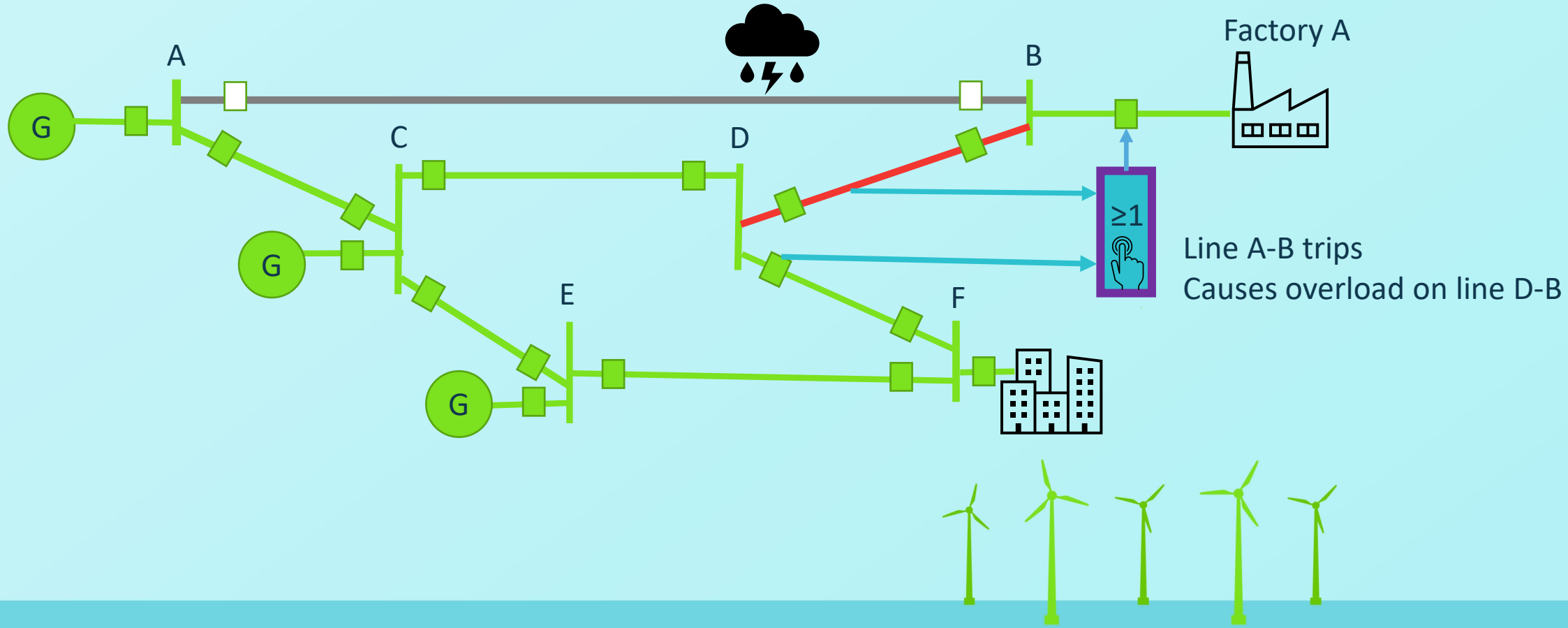
System Protection Schemes (SPS)

Event-based protection solutions
Disconnection of load (BFK)



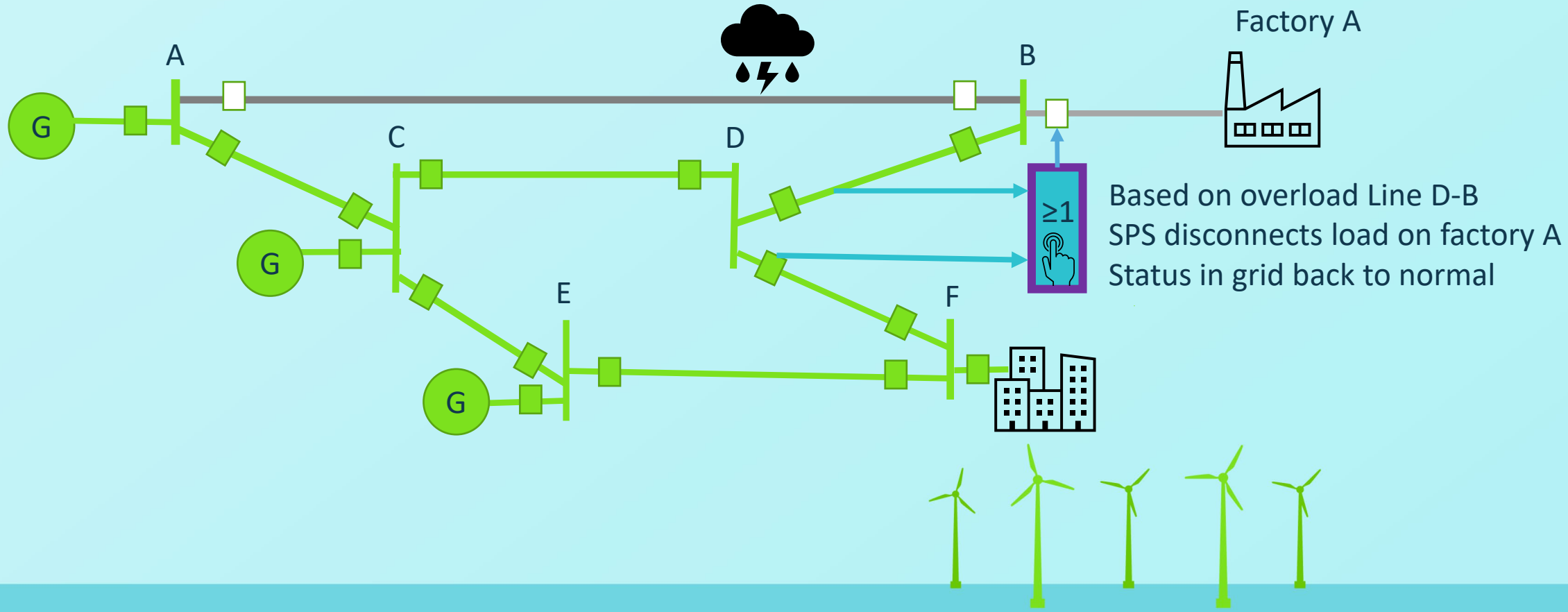
System Protection Schemes (SPS)

Event-based protection solutions
Disconnection of load (BFK)



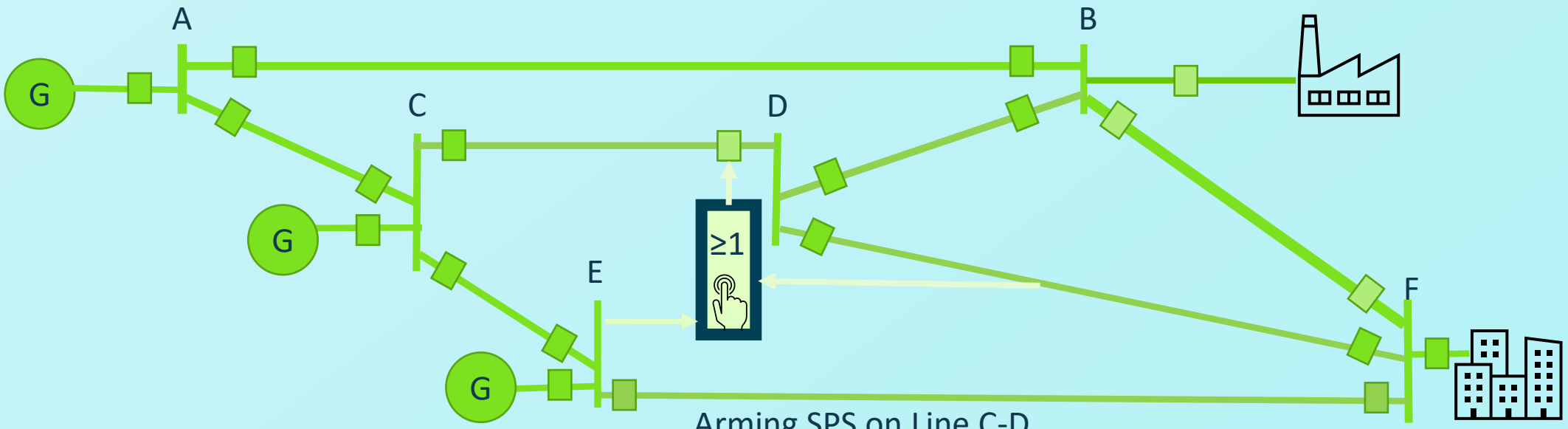
System Protection Schemes (SPS)

Event-based protection solutions
Disconnection of load (BFK)

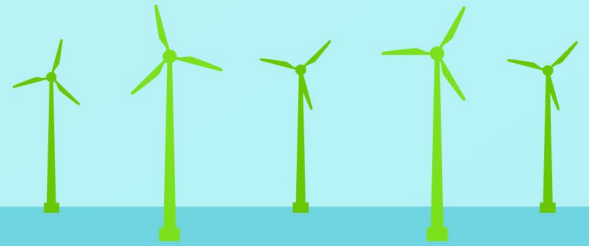


System Protection Schemes (SPS)

Event-based protection solutions
Change topology (Nettsplitt)



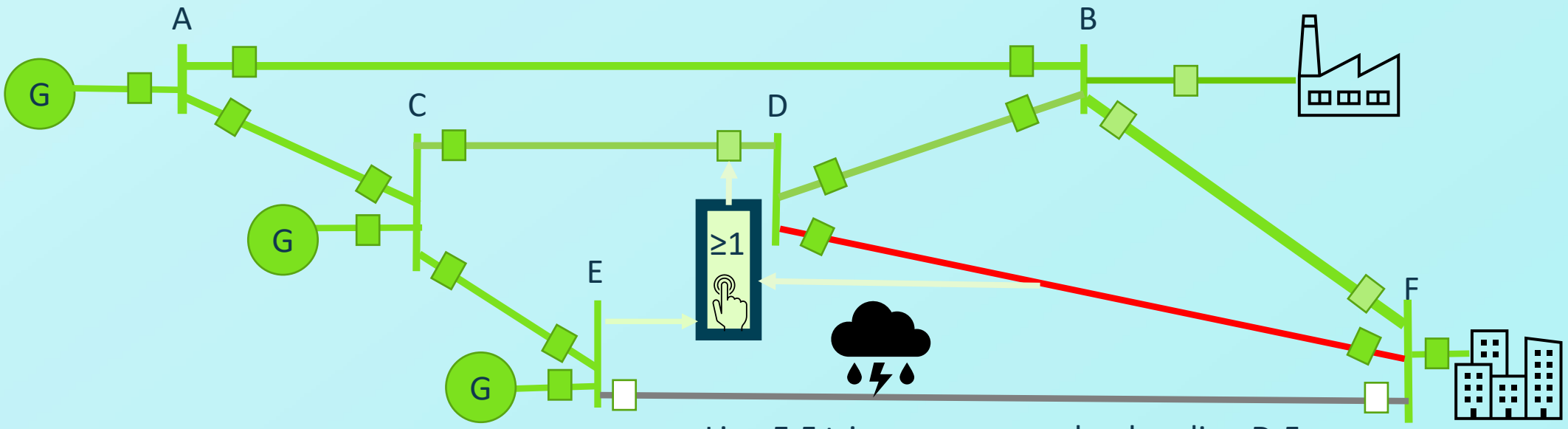
Arming SPS on Line C-D
If overload on line D-F or
trip on busbar E



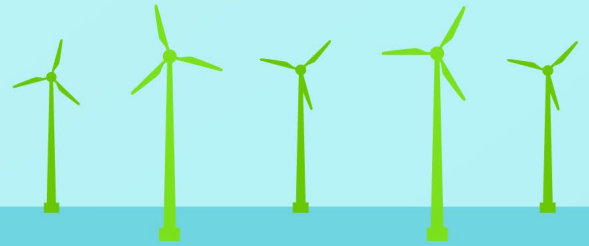
System Protection Schemes (SPS)

Event-based protection solutions

Disconnection of load (BFK) and change topology (Nettsplitt)



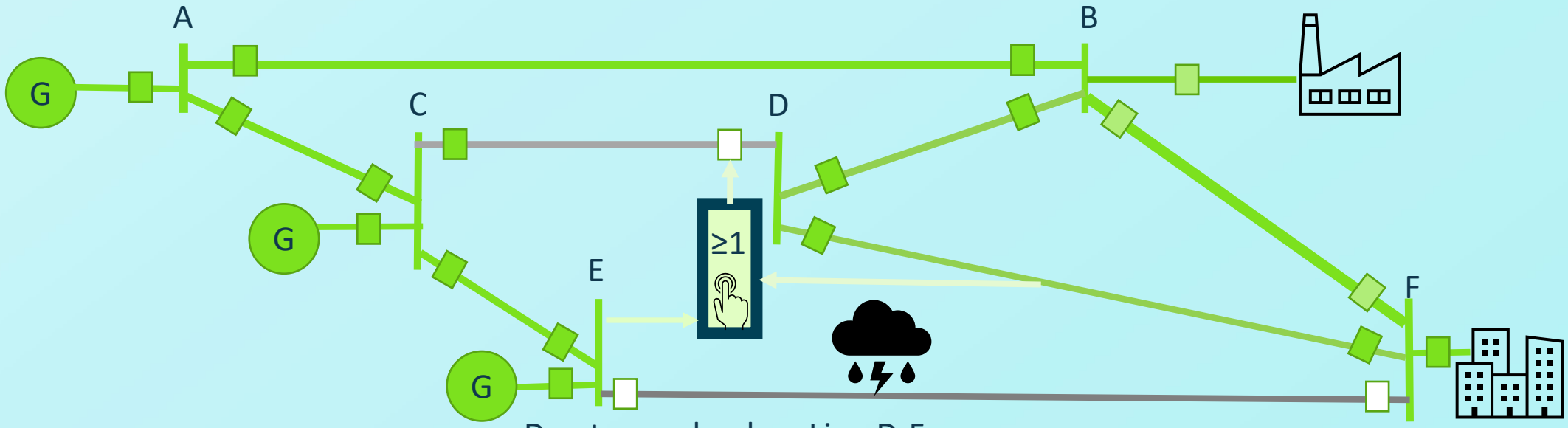
Line E-F trips, causes overload on line D-F



System Protection Schemes (SPS)

Event-based protection solutions

Disconnection of load (BFK) and change topology (Nettsplitt)

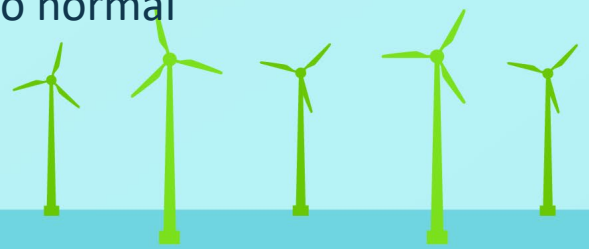


Due to overload on Line D-F

SPS disconnects Line C-D

The powerflow changes, due to change in topology. More powerflow on line B-F

Situation in the grid goes back to normal



More than 350 SPS functions in the Norwegian power system.

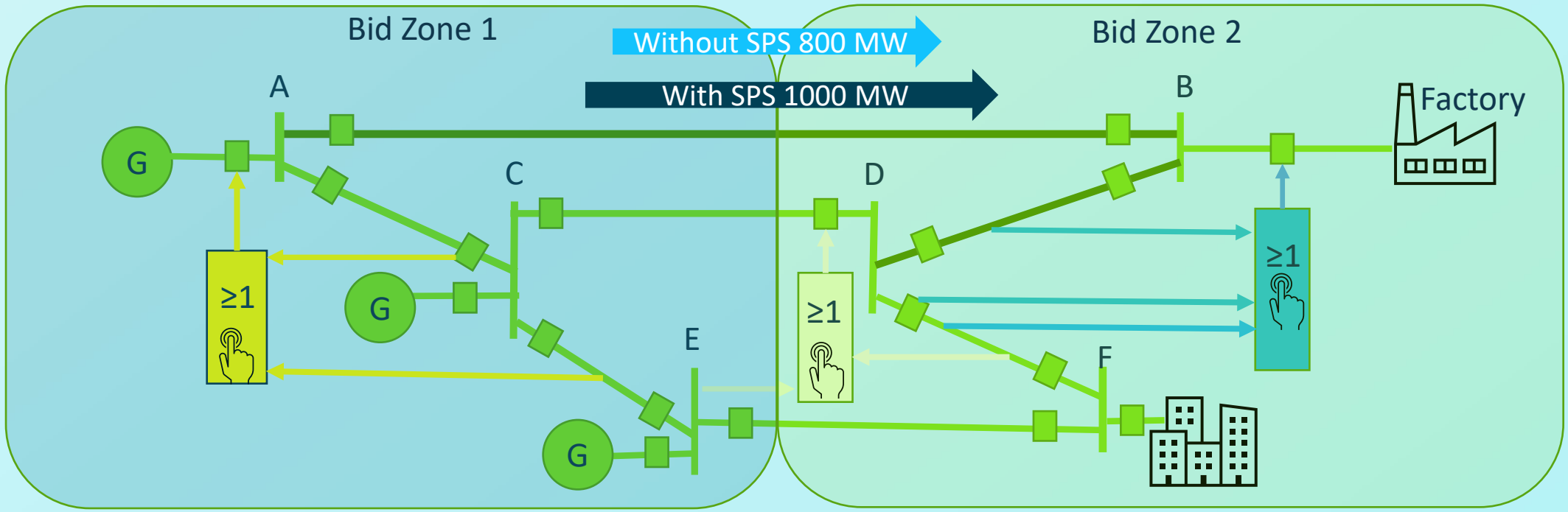
All settings are performed manually by operators

Approximately 2000 change of settings pr year

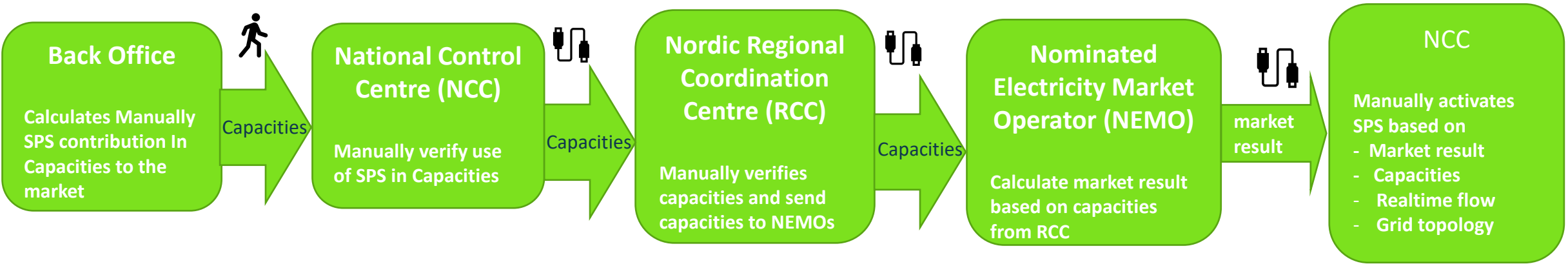
Without a good overview and correct settings,
it could risk making unwanted interventions, with major consequences

System Protection Schemes (SPS)

Increase capacity on transfer by using SPS

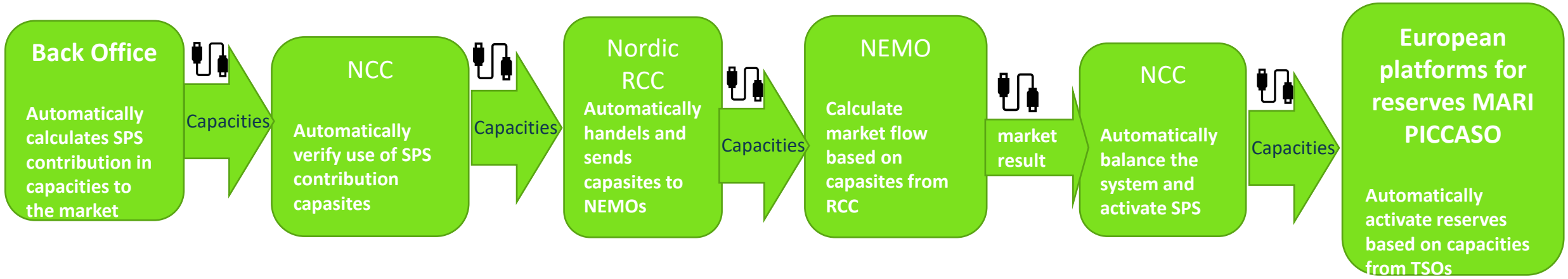


Steps in present use of SPS in market capacity (Today preformed in manually steps)



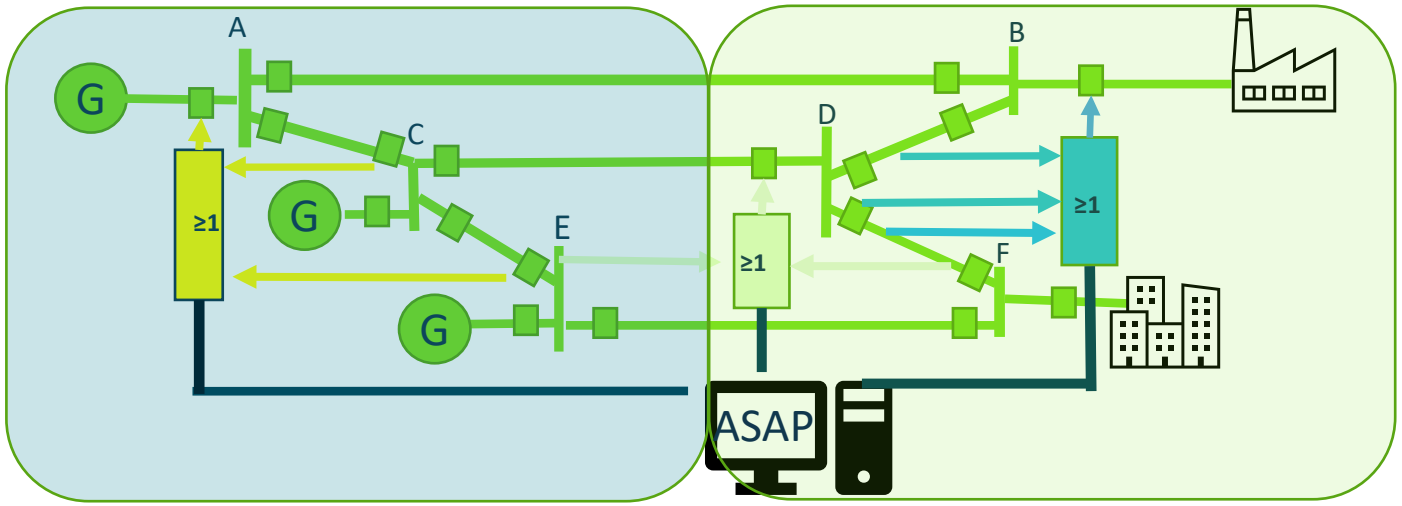
Steps in future use of SPS in market capacity and automatically activation of reserve power in operations.

- Future automation of system operation require automatic method for setting of SPS



The goal

To ensure SPSa role as an important contributor in the power system of the future and the electrification of Norway.
-Find a method for setting of SPS, that can be implemented in future automation for operation of the power system



Design and develop:

- Methods for risk control, optimization and automation
- Intelligent user interface.
- Next generation of system protection.

Future use of SPS

Automatically surveillance of grid and market.

More distributed production with wind, solar, new use of hydro power. Integrated with flexible solutions on the consumer side

How can SPS contribute to:

- More integrated solutions in energy production ?

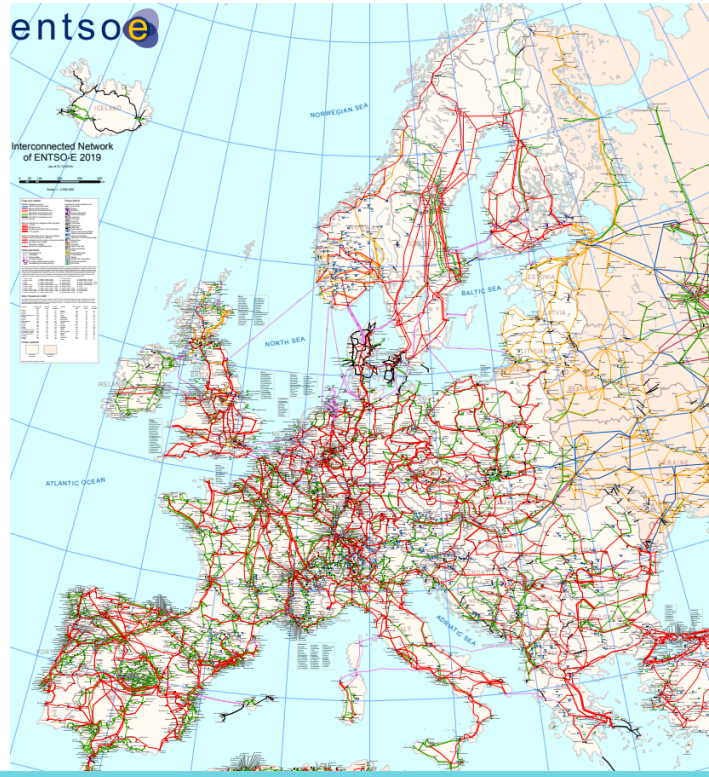
- Safe operation in power systems with small amount of inertia and more converter based production ?

- New markets and products on producer and consumer side ?

- Integrated solutions in Nordic and European activations platforms for reserve power ?

- Use of artificial intelligence (AI) and machine learning to be used to for optimize algorithm for setting of SPSs ?

Integrated European and Nordic solutions for grid monitoring and activation of electric energy reserves




Thank you