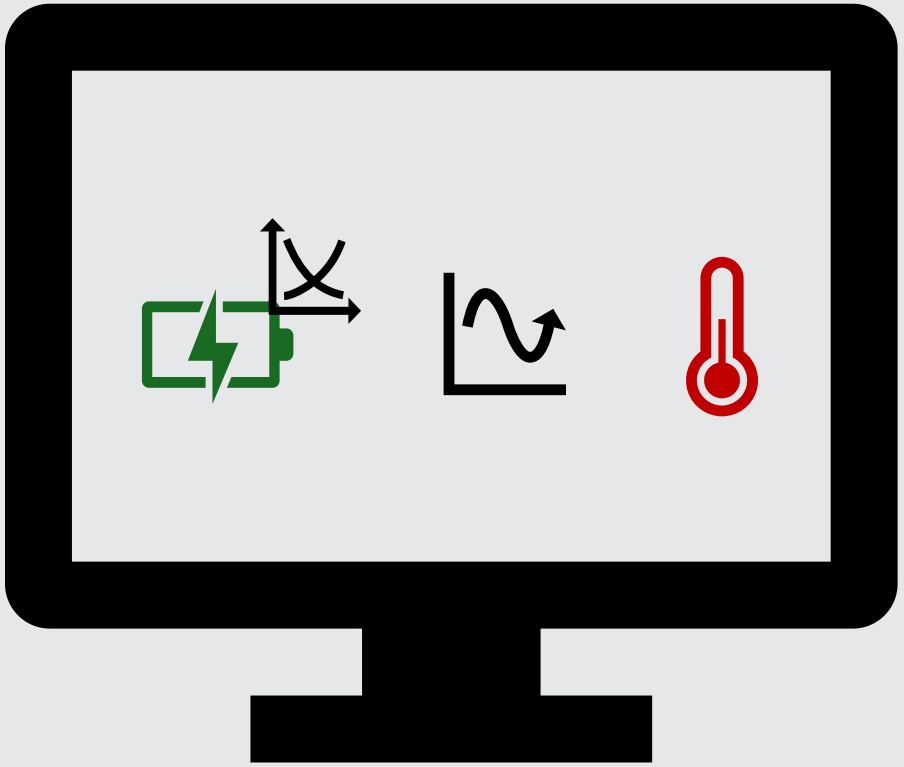

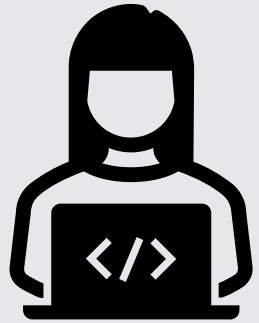

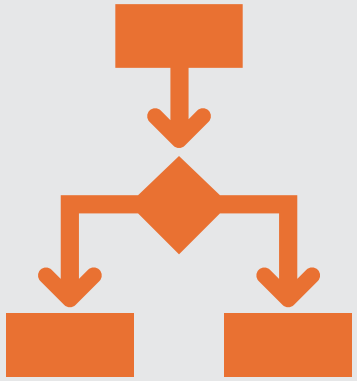

Session 3

Technology that supports operational planning

NextGrid

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Some definitions…

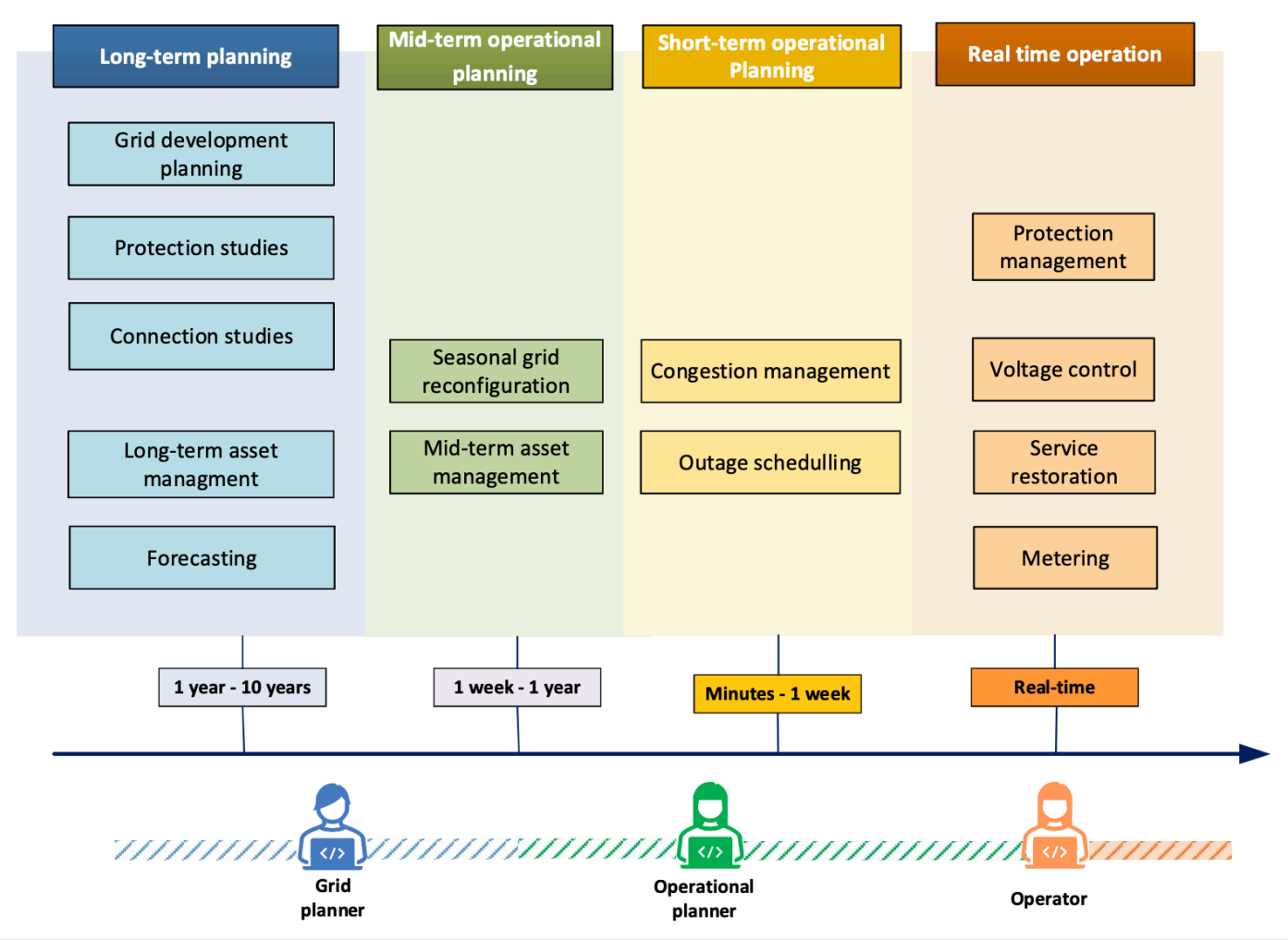
Proactive grid operation

Handling grid challenges before they occur. As opposed to *reactive operation.*

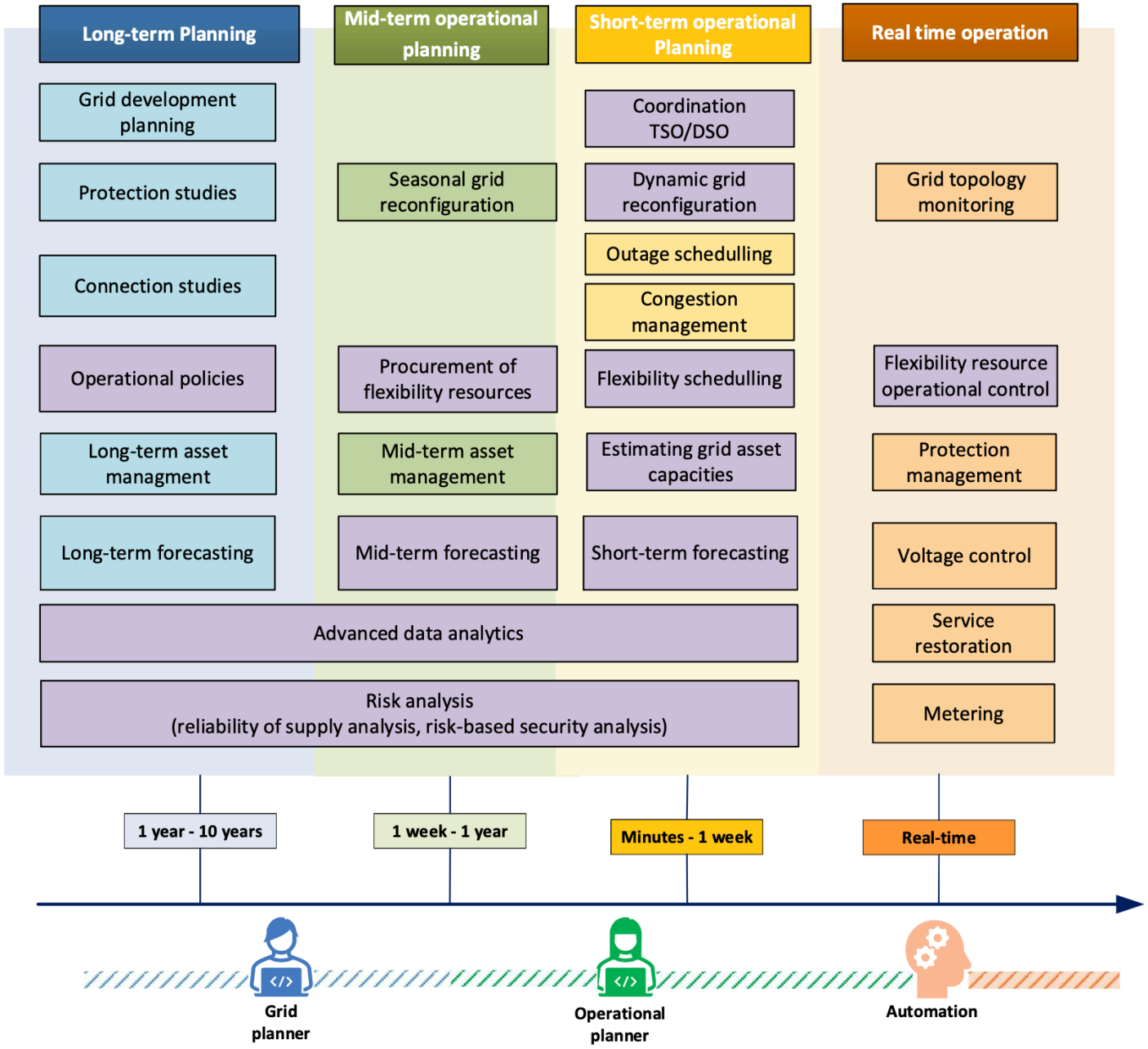
Operational planning

Proposed method for organizing proactive operation: Planning and scheduling of operation ahead of time.

Distribution Grid Operational Planning

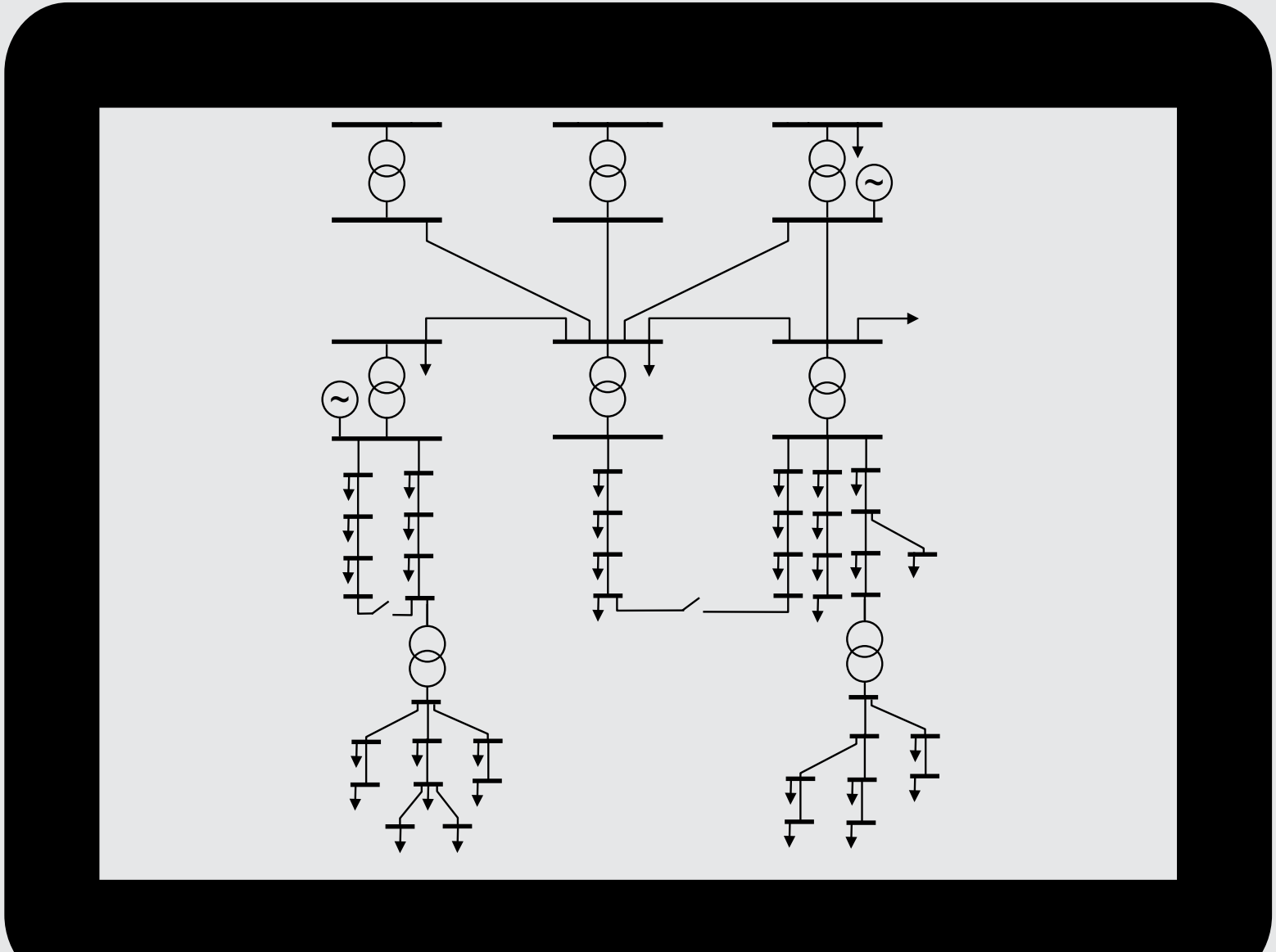


Traditional DSO planning process and activities on different time horizons.



Proposed change to planning process

- Operational policies
- Procurement of flexibility resources
- Mid-term forecasting
- Coordination TSO/DSO
- Dynamic grid reconfiguration
- Flexibility scheduling
- Estimating grid assets capacities
- Short-term forecasting
- Flexibility resource operational control
- Advanced data analytics
- Risk analyses



NextGrid
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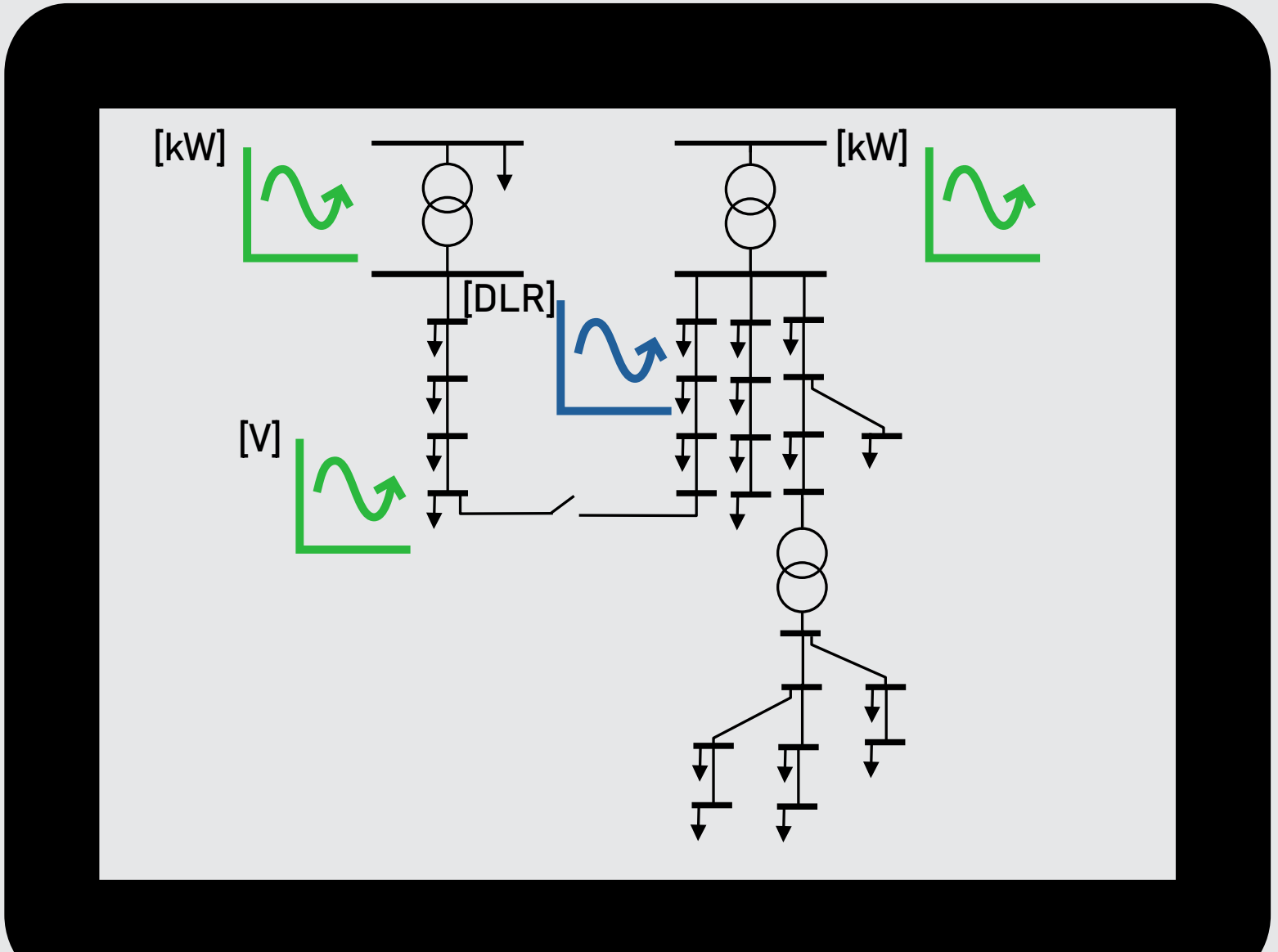
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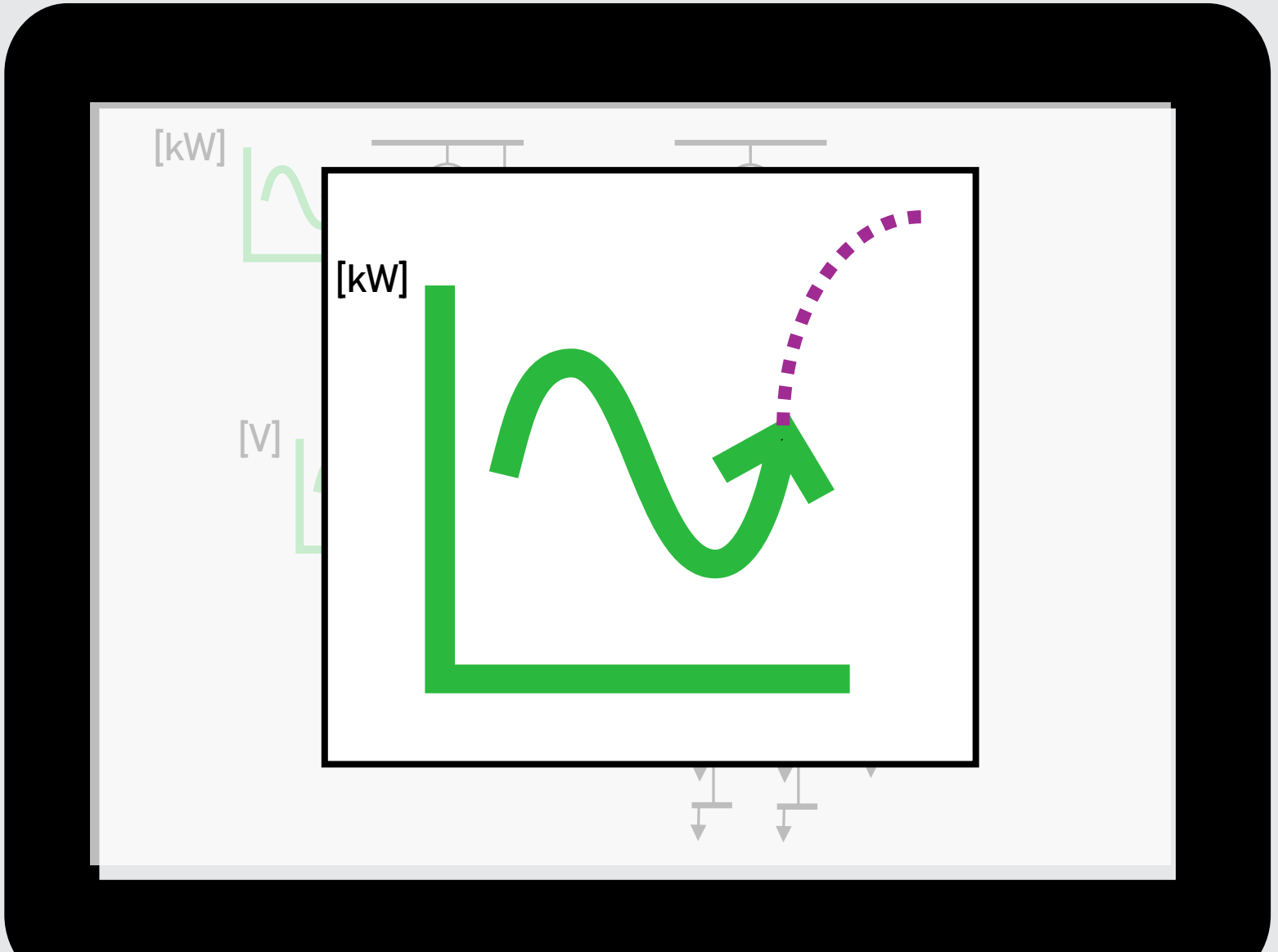
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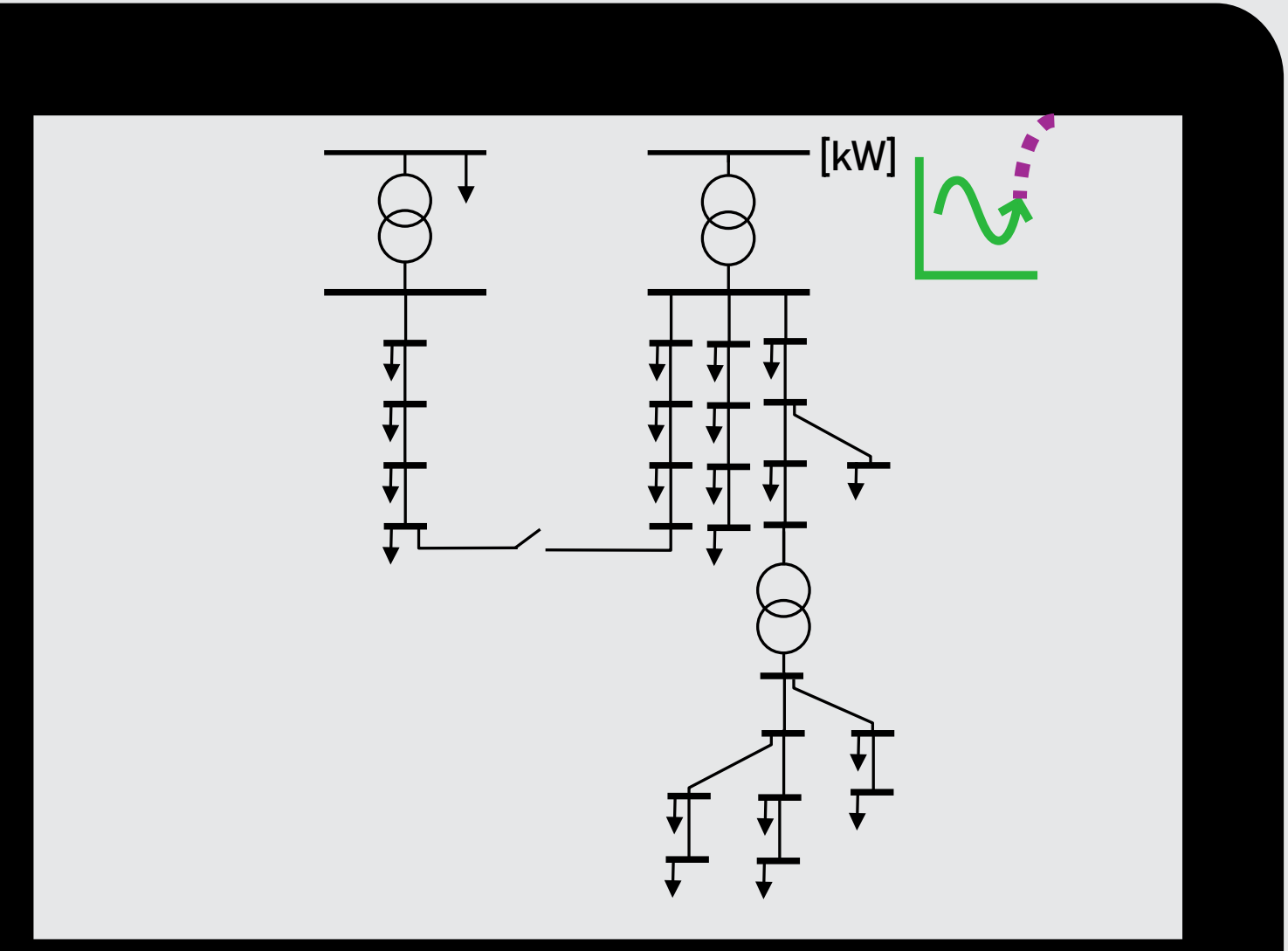
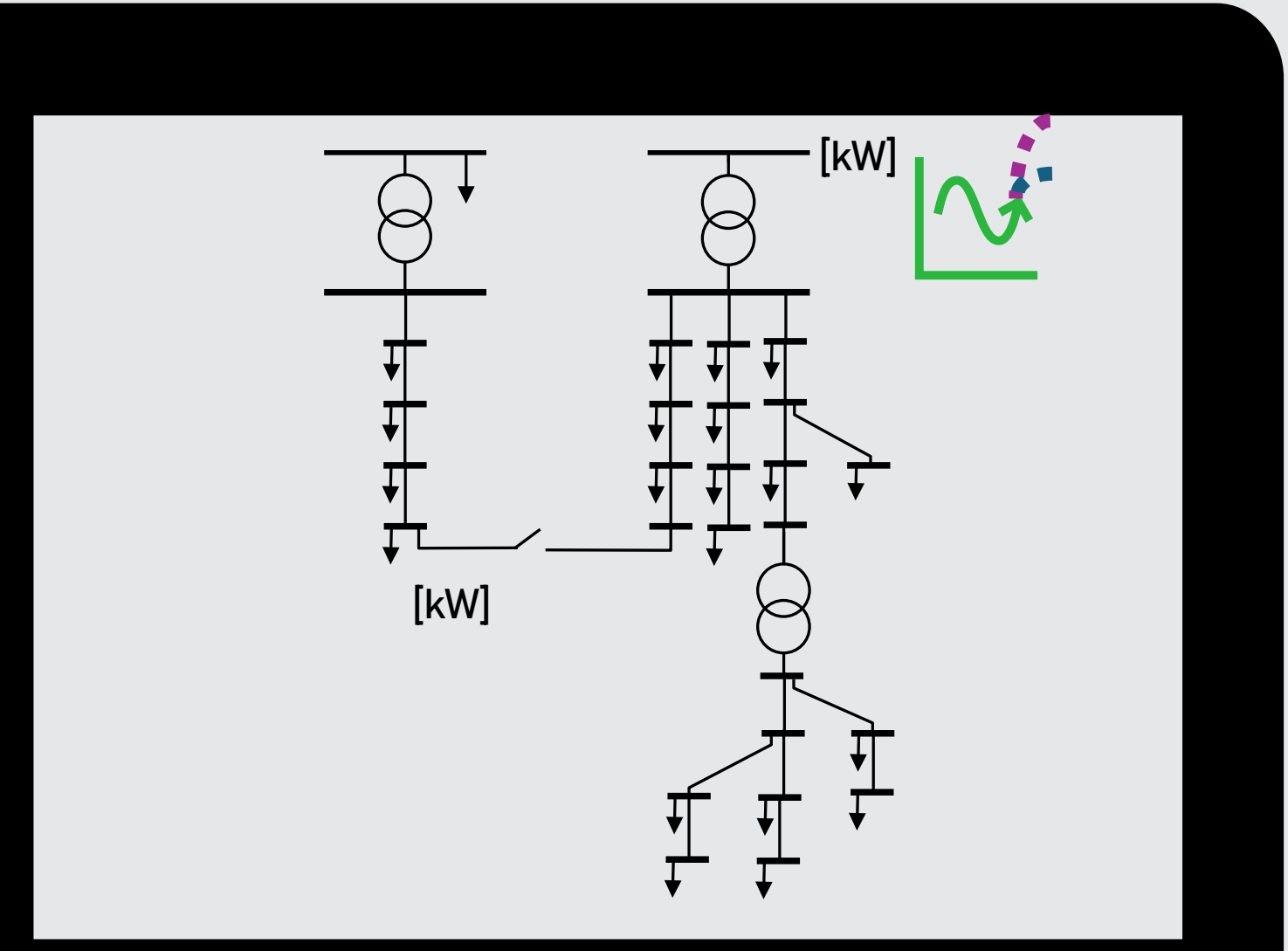
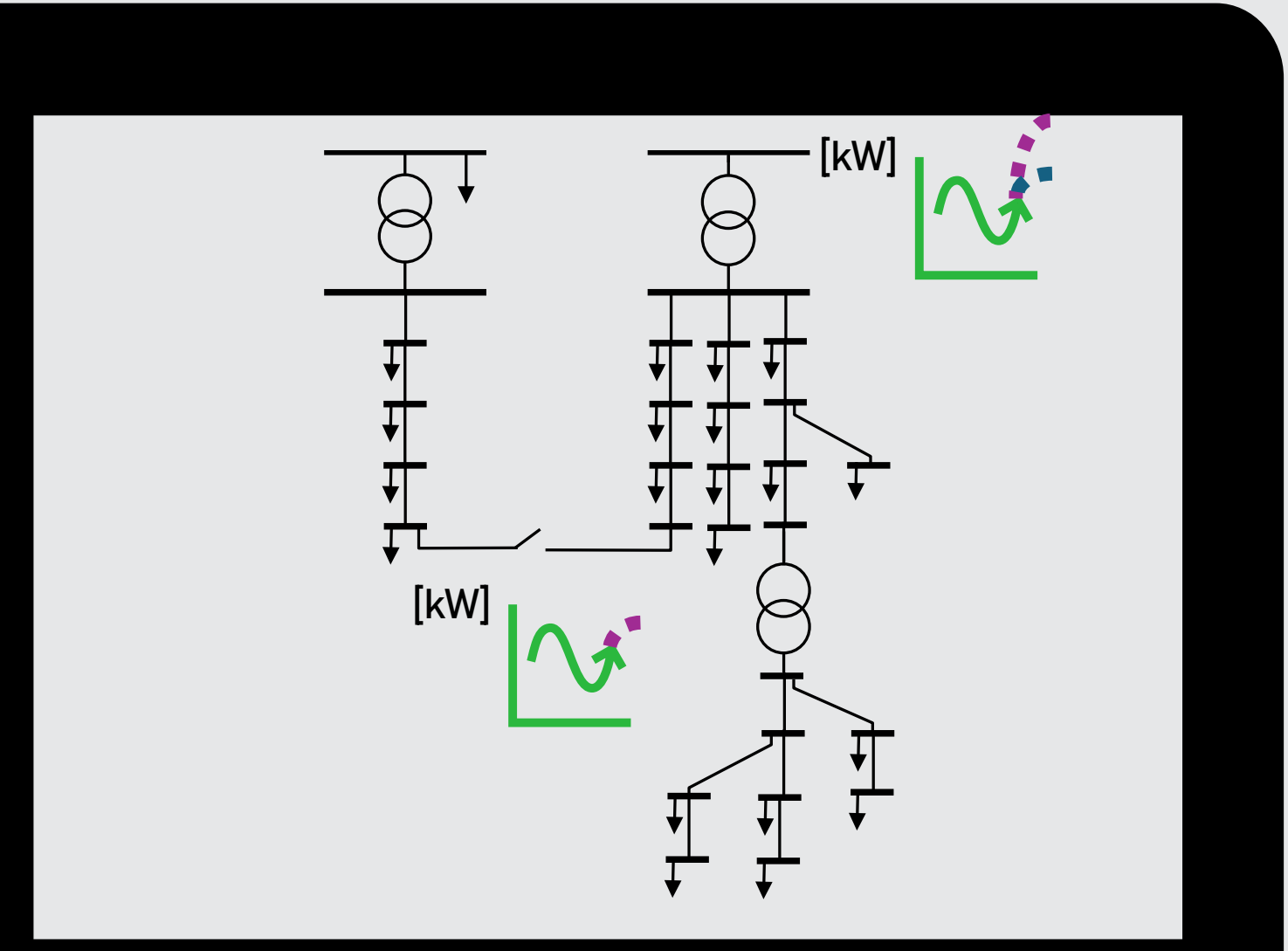


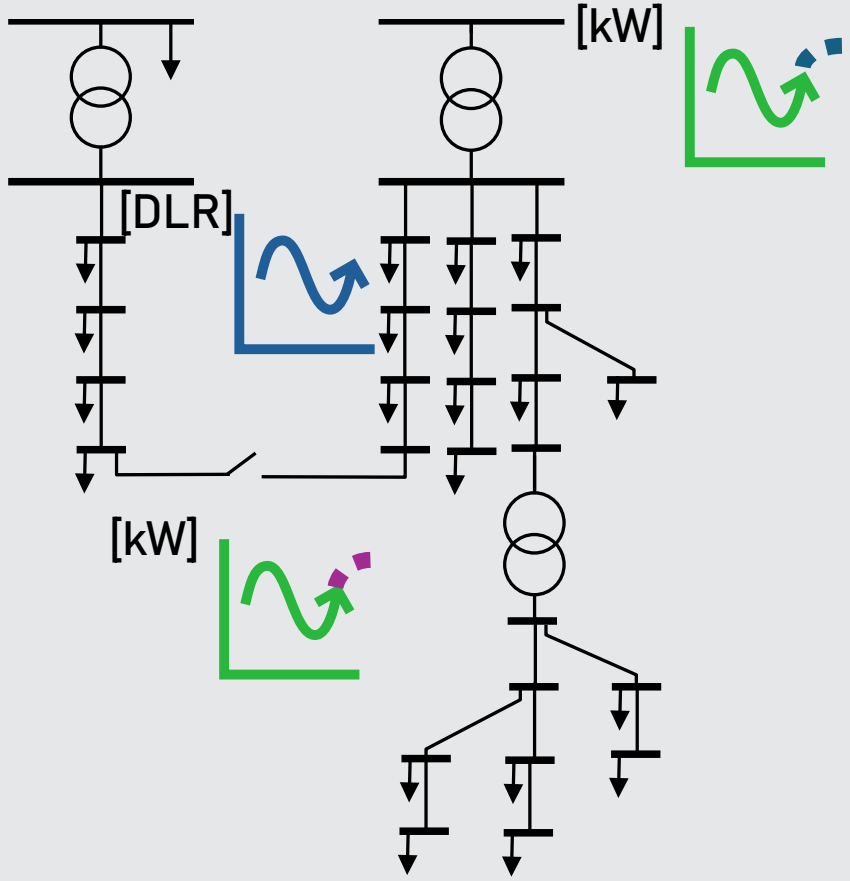
Time	Expected grid state	Planned action	Cost estimate
T-0	Nominal	-	
T+1	Nominal	-	
T+2	Nominal	-	
T+3	T2 overloaded	-	$$$$



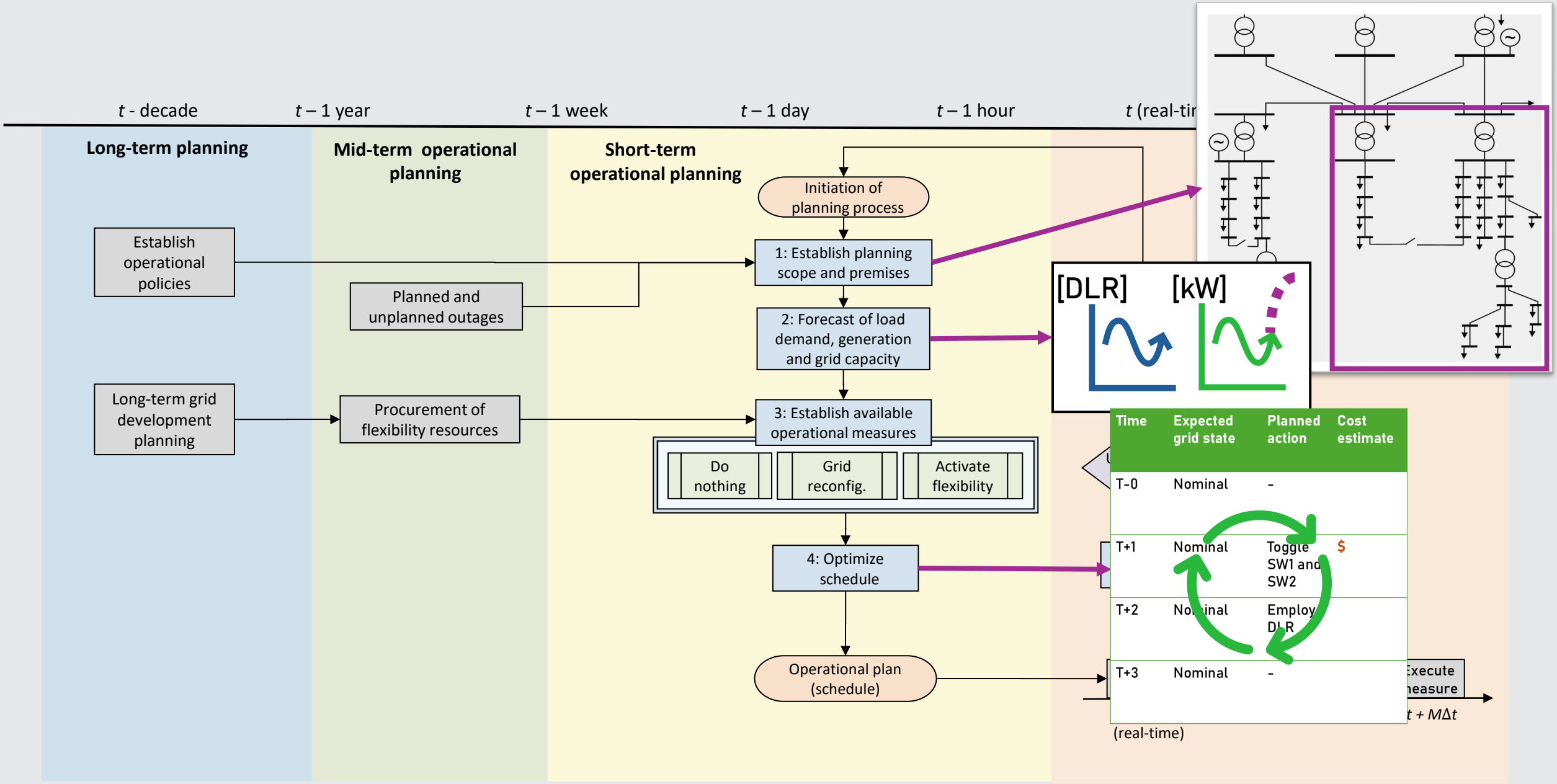
Time	Expected grid state	Planned action	Cost estimate
T-0	Nominal	-	
T+1	Nominal	-	
T+2	Nominal	-	
T+3	T2 overloaded	-	$$$$



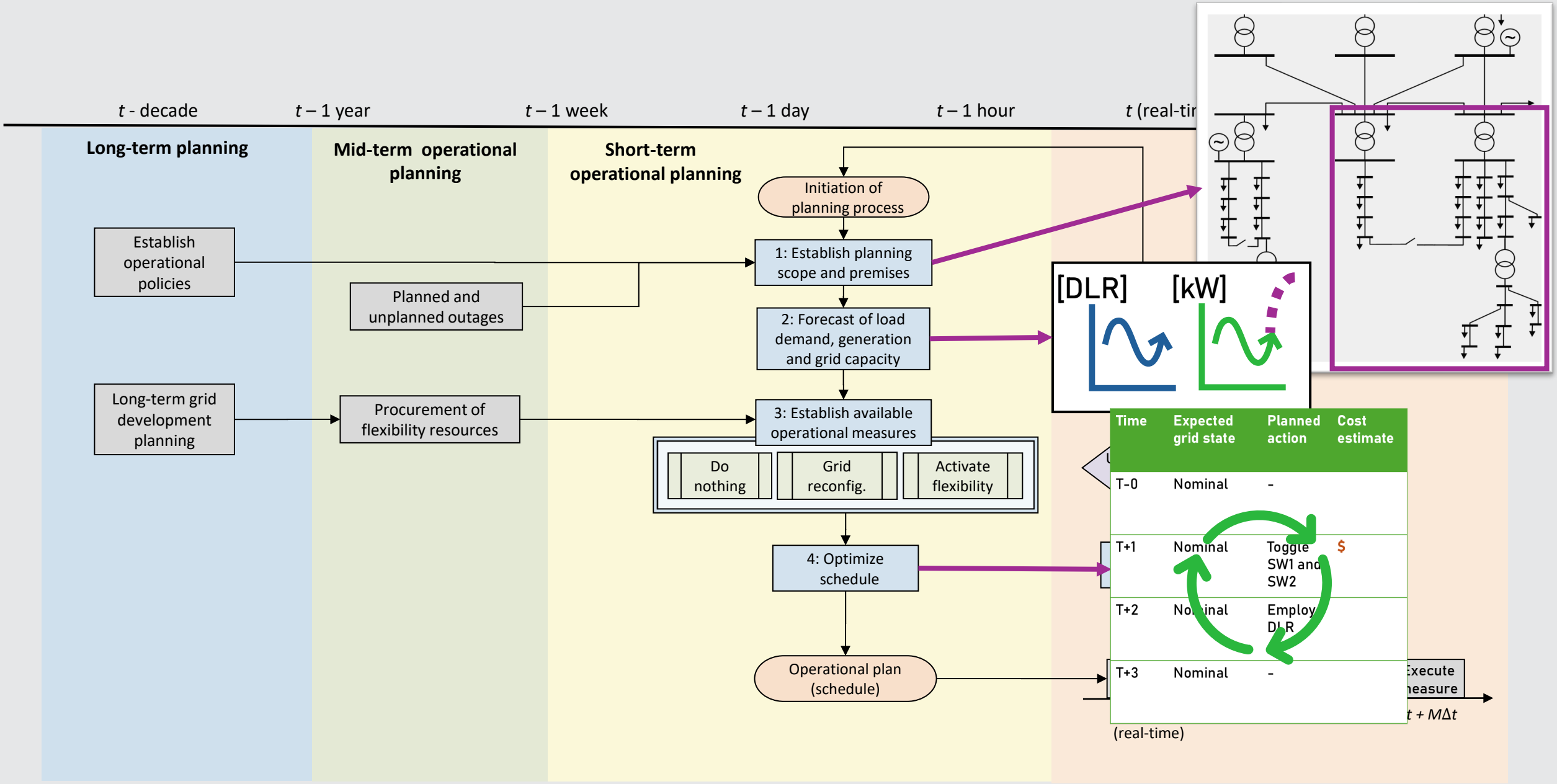
Time	Expected grid state	Planned action	Cost estimate
T-0	Nominal	-	
T+1	Nominal	Toggle SW1 and SW2	$
T+2	L12 slightly overloaded	-	$$
T+3	Nominal	-	



Time	Expected grid state	Planned action	Cost estimate
T-0	Nominal	-	
T+1	Nominal	Toggle SW1 and SW2	$
T+2	Nominal	Employ DLR	
T+3	Nominal	-	



Raymundo E. Torres-Olguin, m.fl.: *Rethinking Distribution Network Operational Planning with Flexibility Resources,* CIGRE Session proceedin



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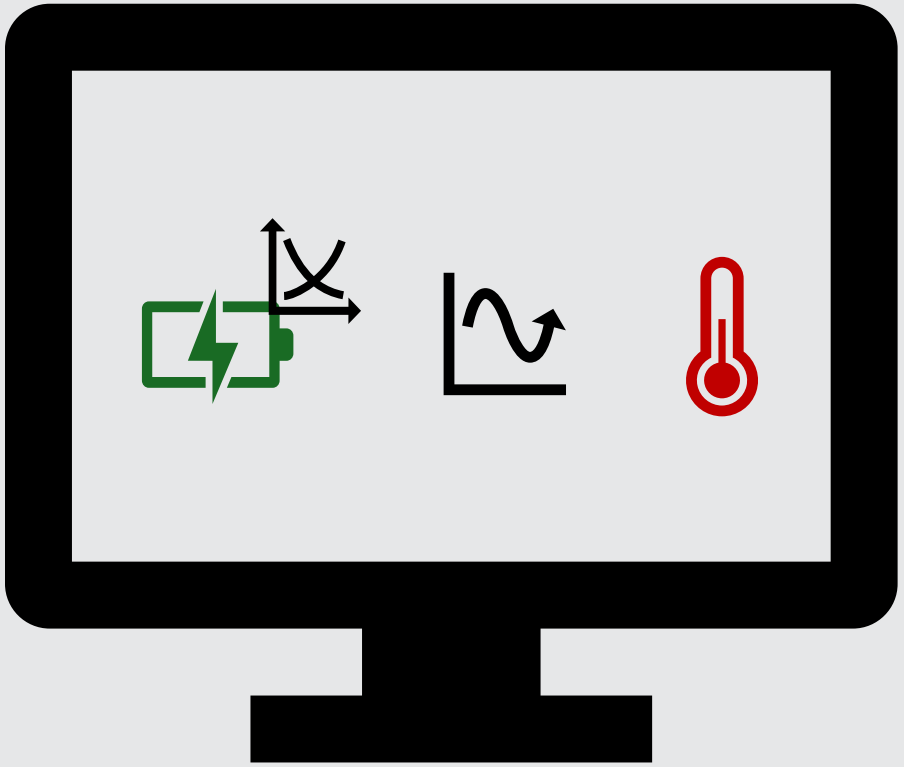
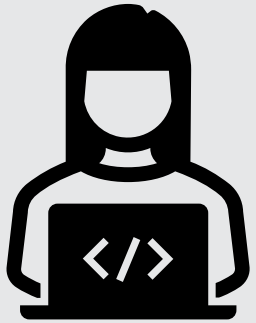
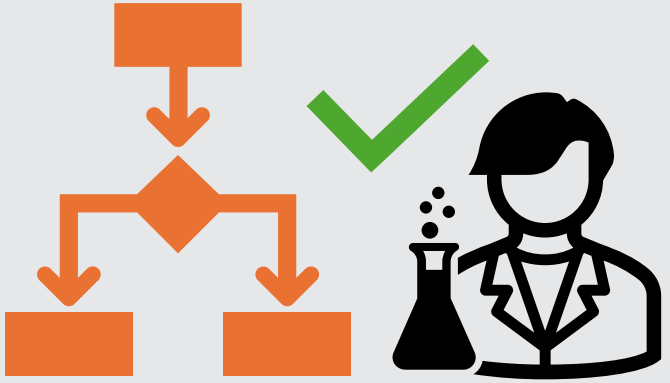






Ways of working

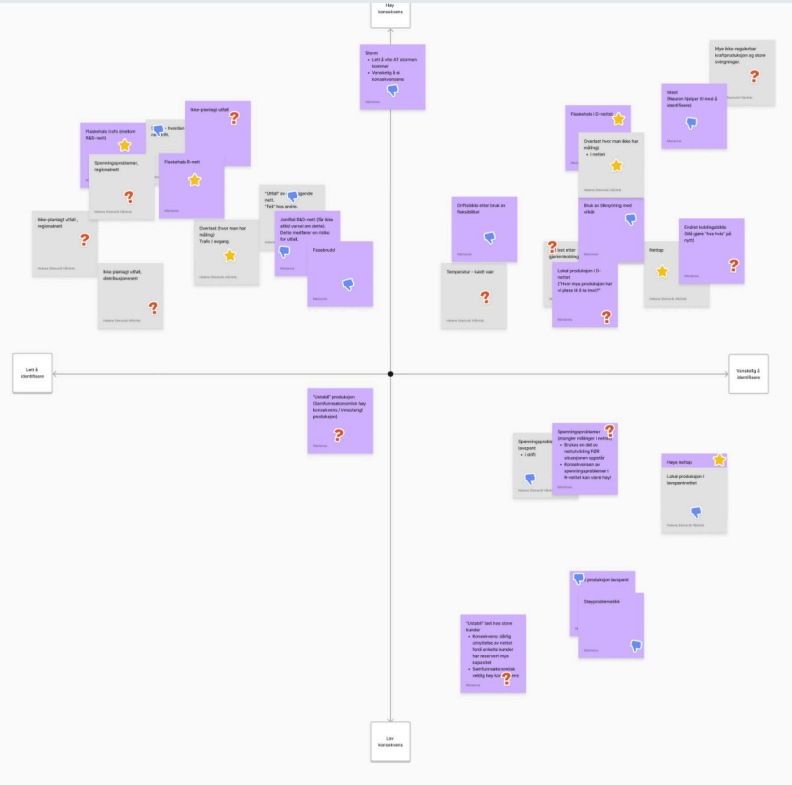
We conducted different workshops with the partners in the project:

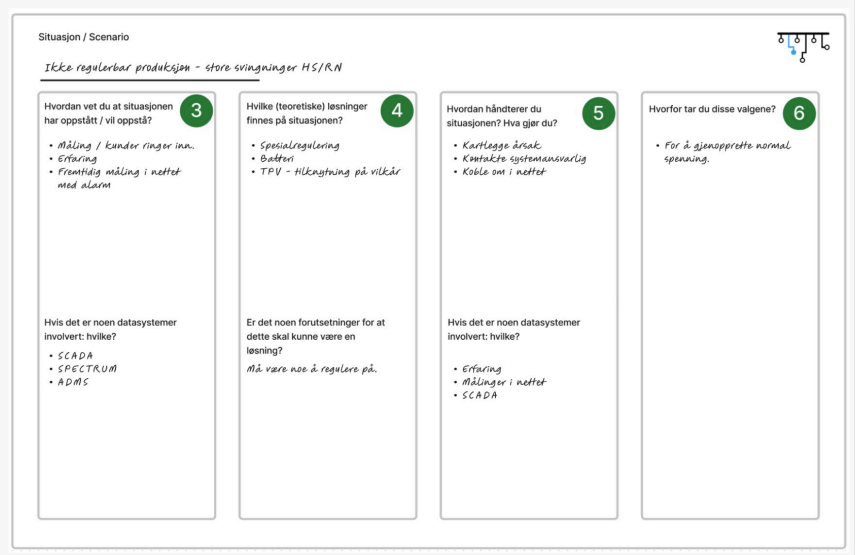
In these workshops we had one question as the main topic:

"Describe a situation that may occur in your work environment, where you need help from active/pro-active grid support."

Ways of working

In the workshops we categorised the different answers and decided to focus on the following main problem areas:





BOTTLENECKS

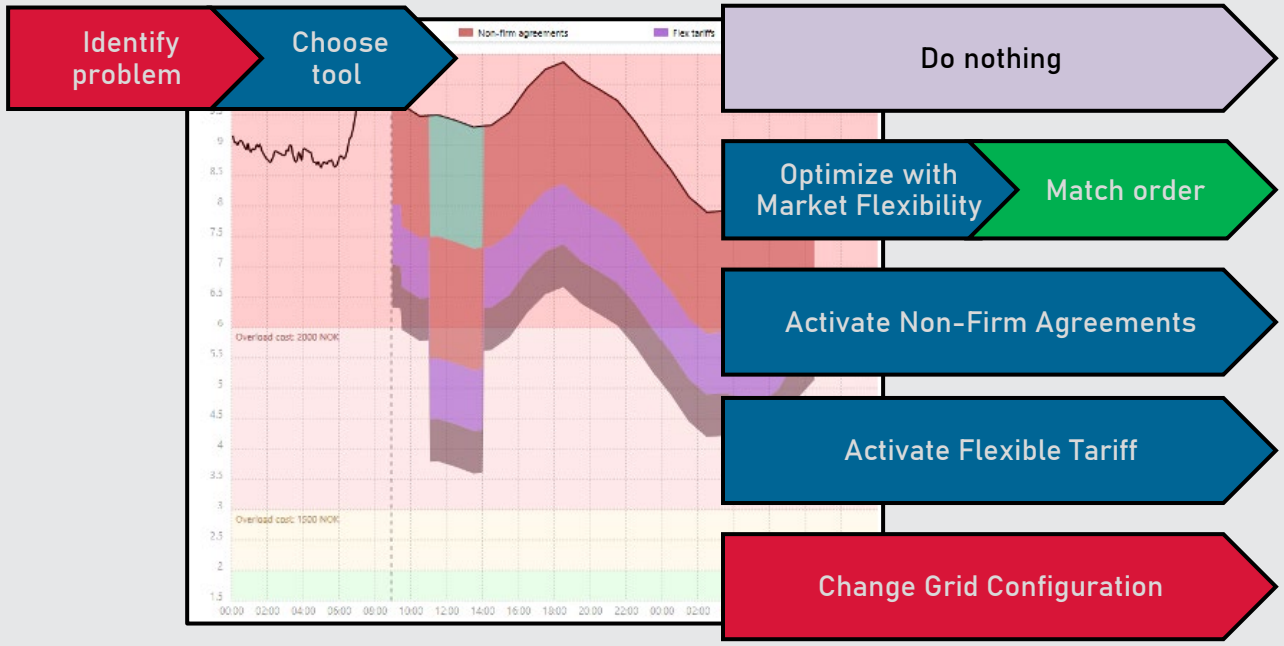
VOLTAGE DEVIATIONS

NextGrid workflow

Medium term planning

Model Use Case (CIM) → Load Flow Analysis → Publish Flexibility Need

Short term planning and proactive decision support



Kognitwin Grid

Apps: knowledge managementand decision support

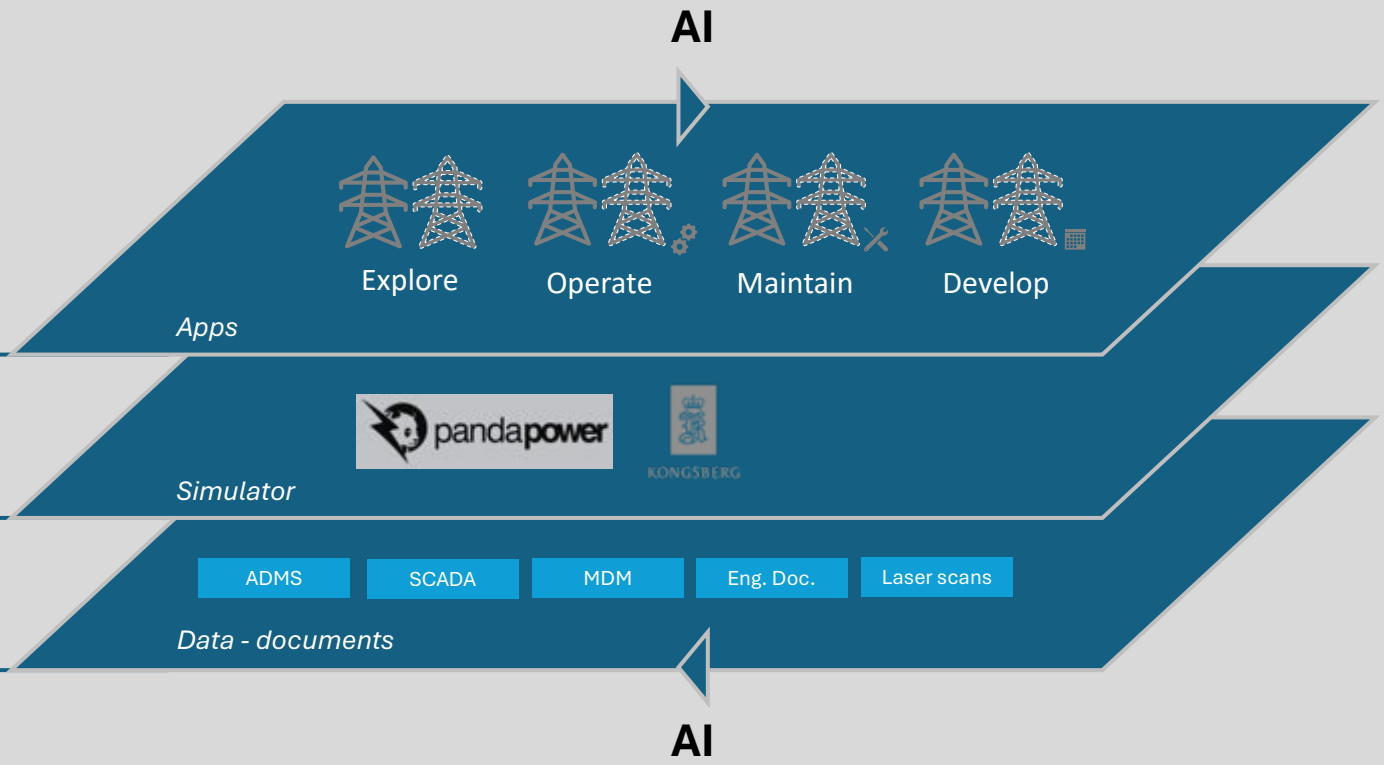
- 4 modules (Explore, Operate, Maintain, Develop)
- Various use cases
- Easy to build new use cases

Simulator

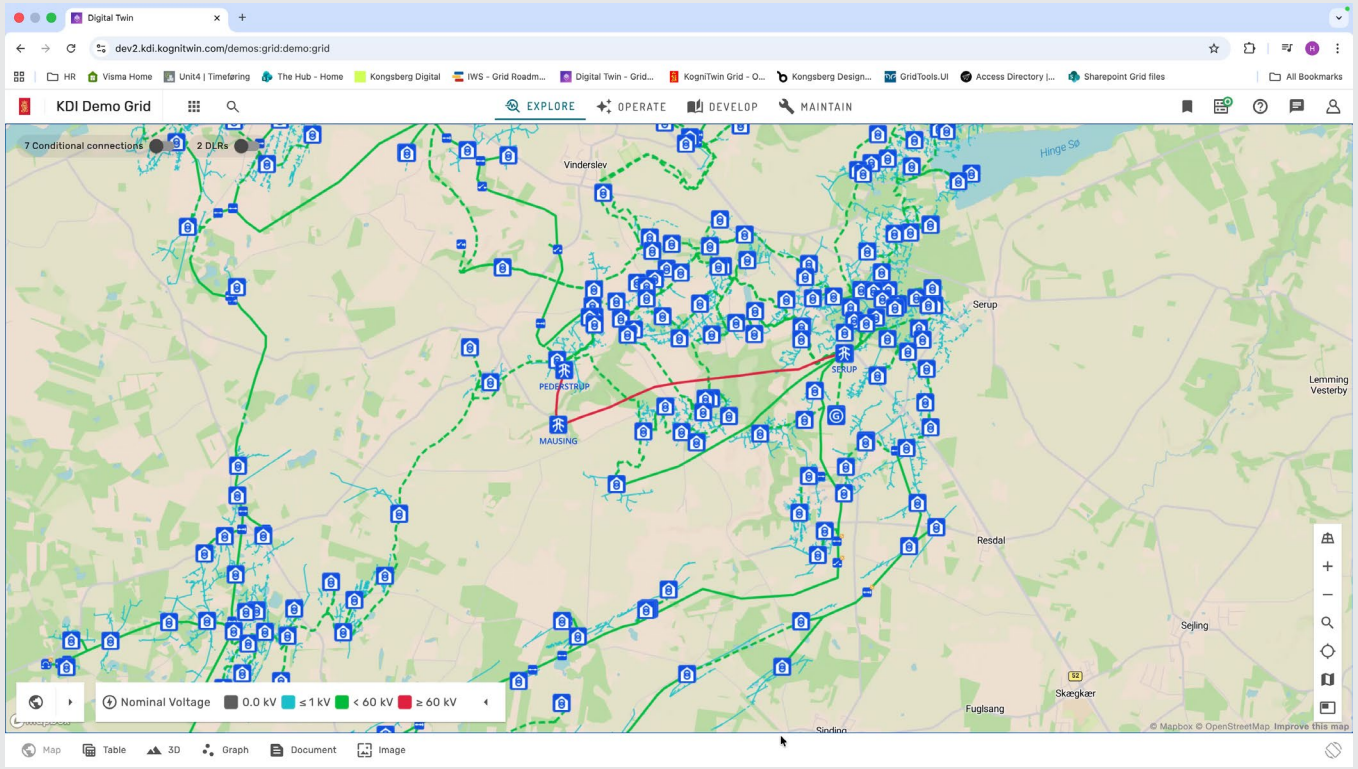
- Built-in (PandaPower) or company-specific
- Short and long term scenarios

Data - documents

- Contextualization engine
- Integration with more Data Platforms (e.g. Databricks)

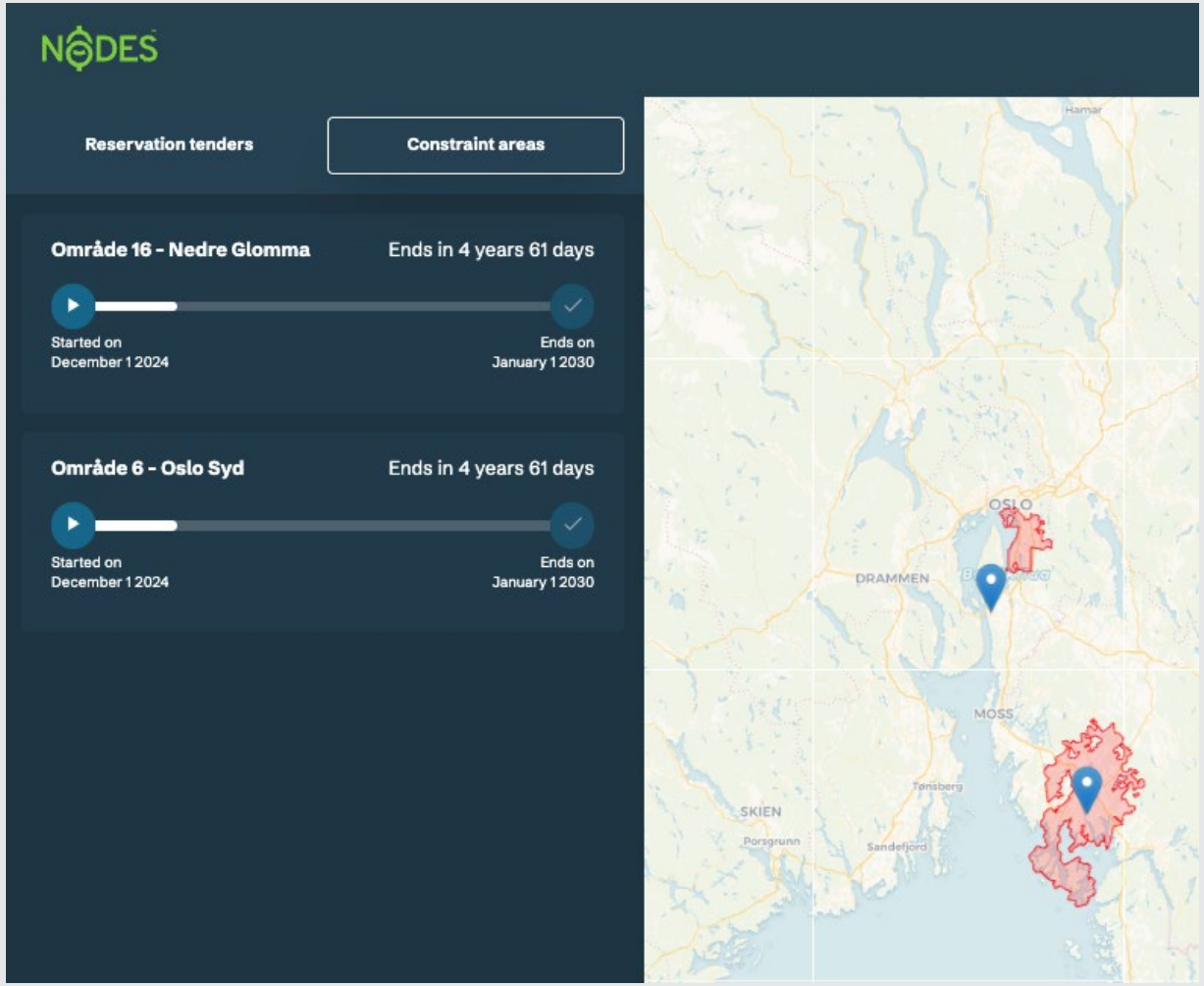


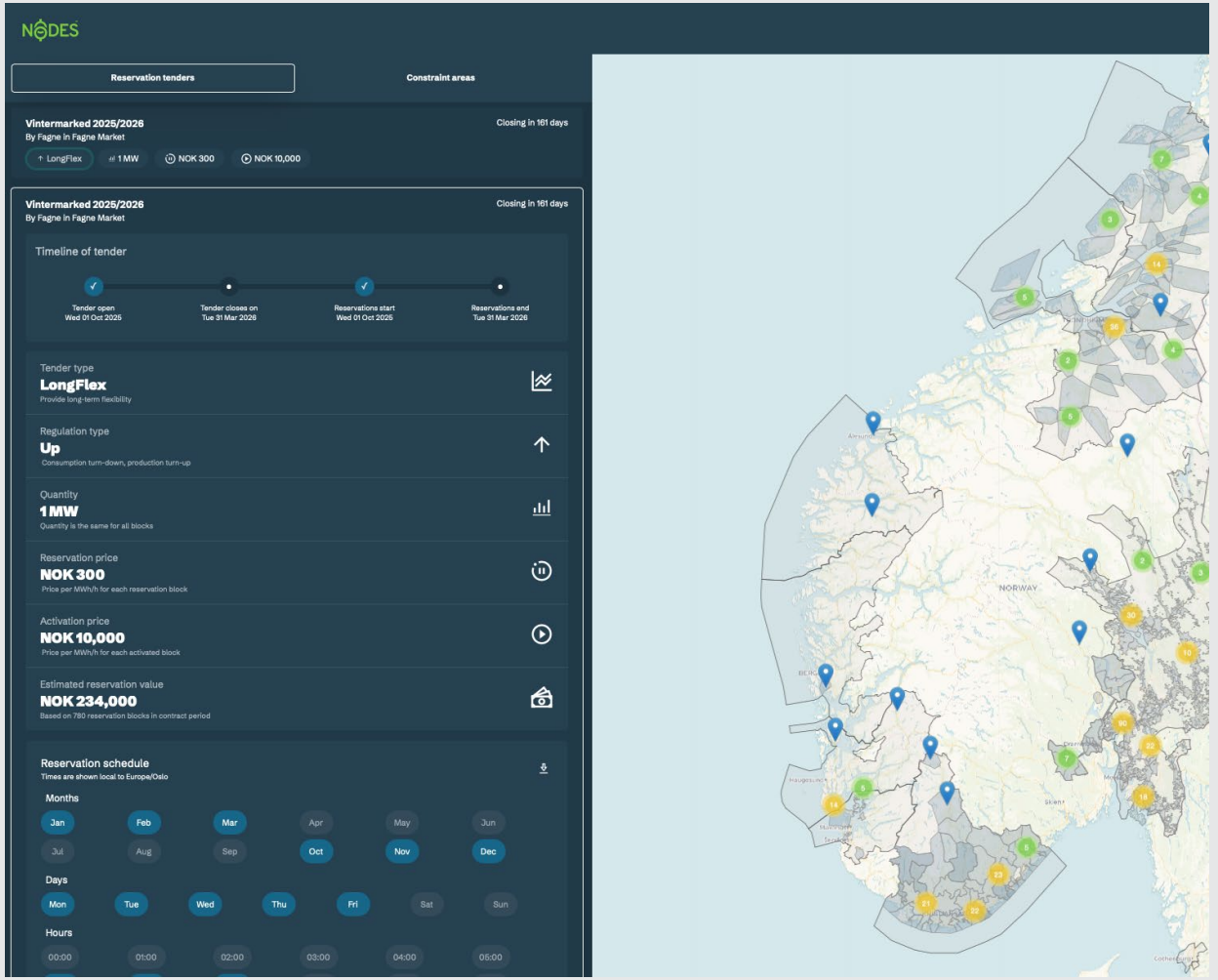
Grid modelling and load flow forecasting



- Grid modelling
- Load forecasting (ML)
  - Weather
- Load flow analysis
- Dynamic line rating
- Output: Problem areas

Publish Flexibility Need





NextGrid workflow

Medium term planning

Model Use Case (CIM) → Load Flow Analysis → Publish Flexibility Need

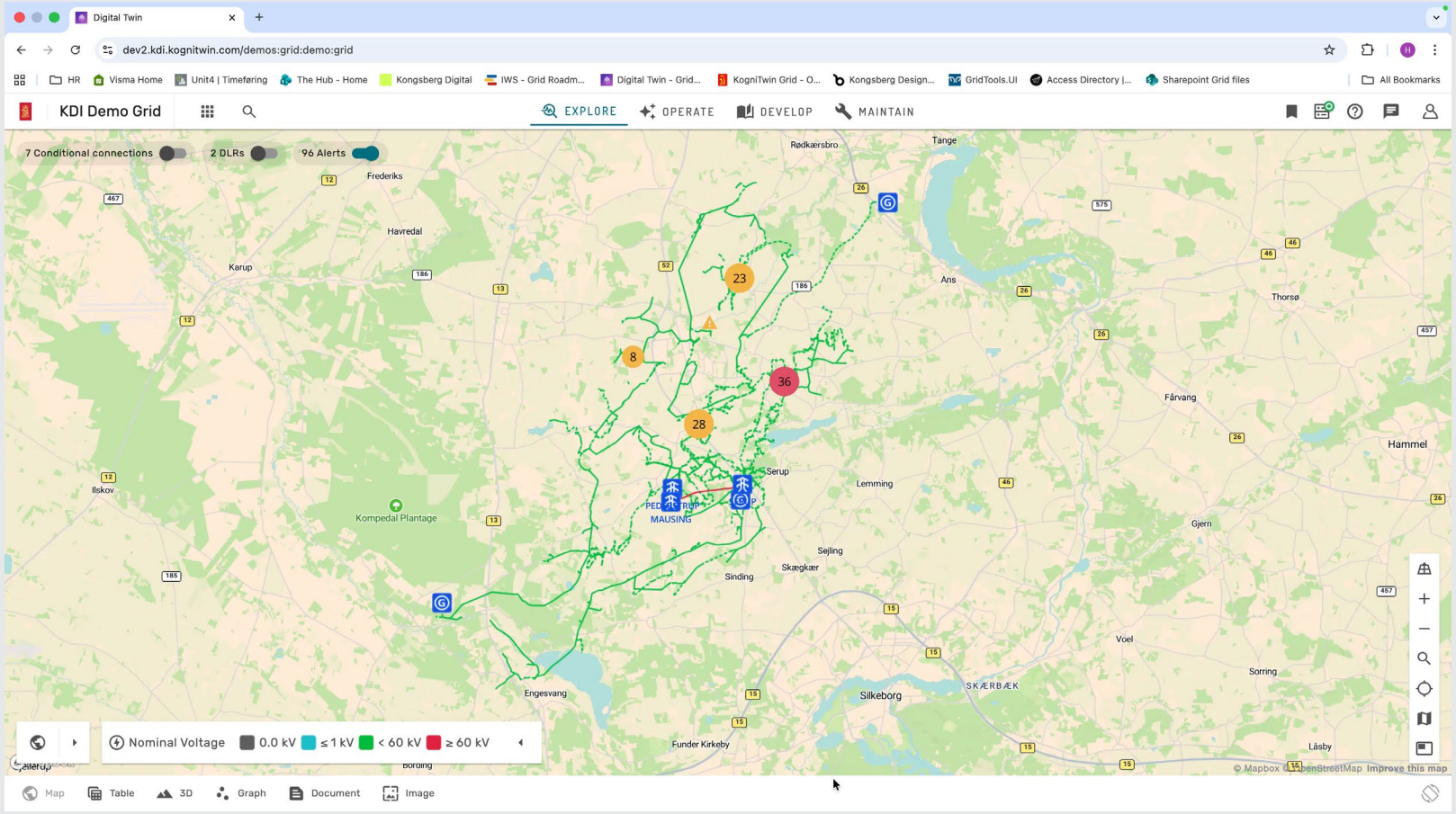
Short term planning and proactive decision support

Identify problem → Choose tool

- Do nothing
- Optimize with Market Flexibility → Match order
- Activate Non-Firm Agreements
- Activate Flexible Tariff
- Change Grid Configuration

Identify

ALERT LIST
FILTERING
SORTING

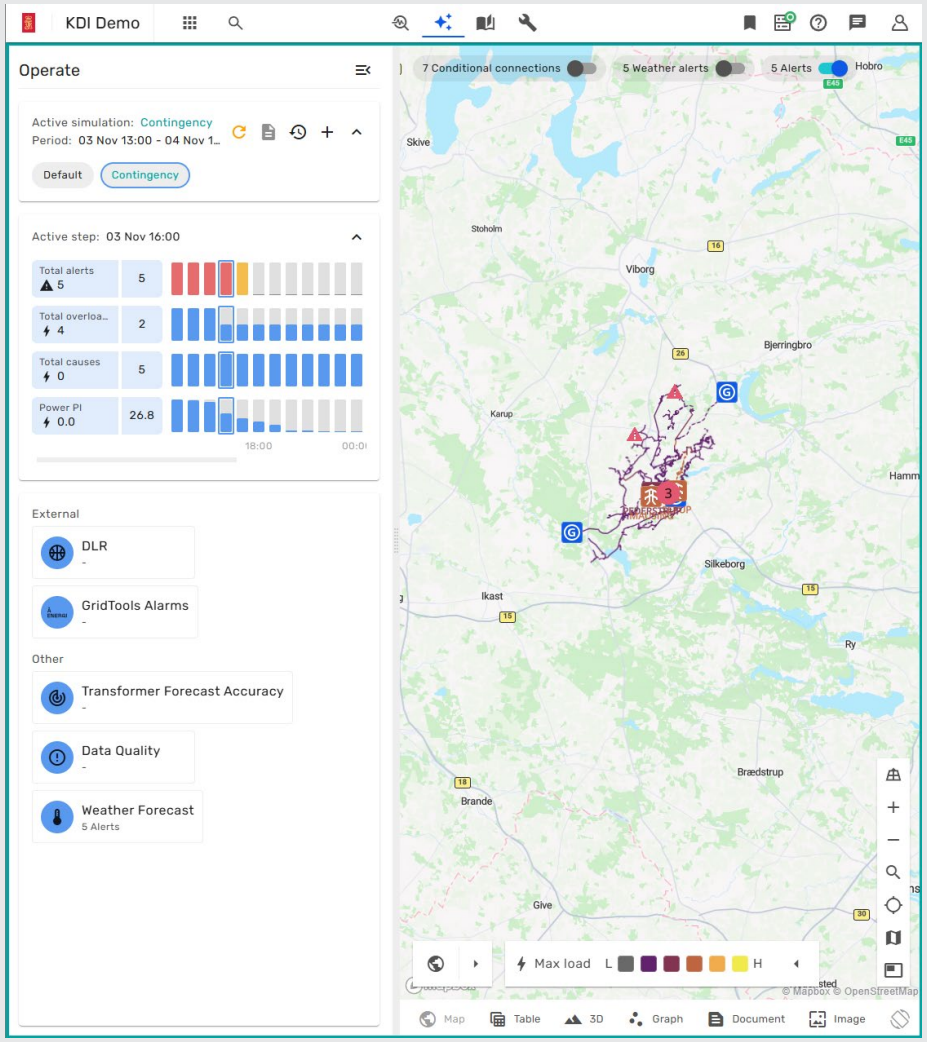


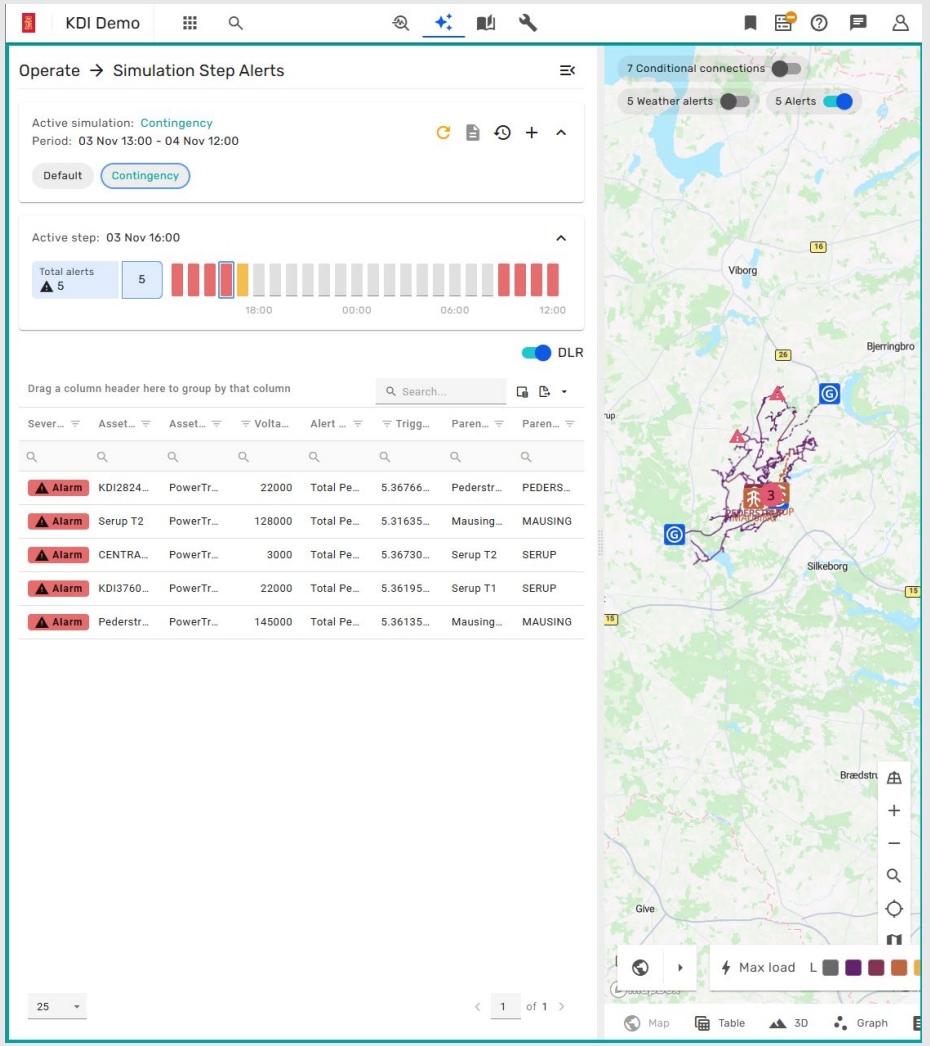
Enhancing the filtering, sorting and general design on alert list.

Analyze

N-1

CONTINGENCY ANALYSIS





How to best show the result in an N-1 situation.

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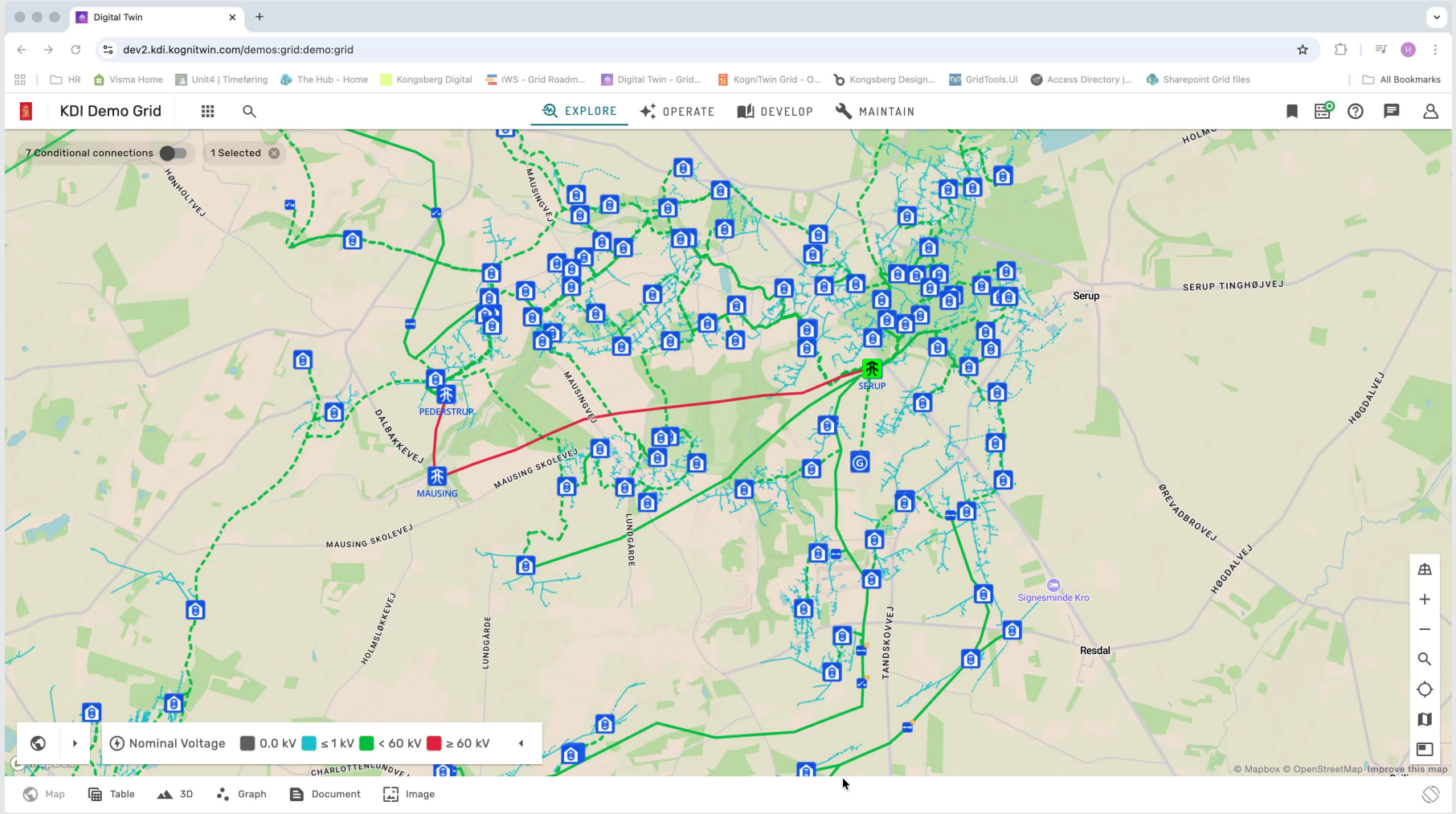
Build Scenario

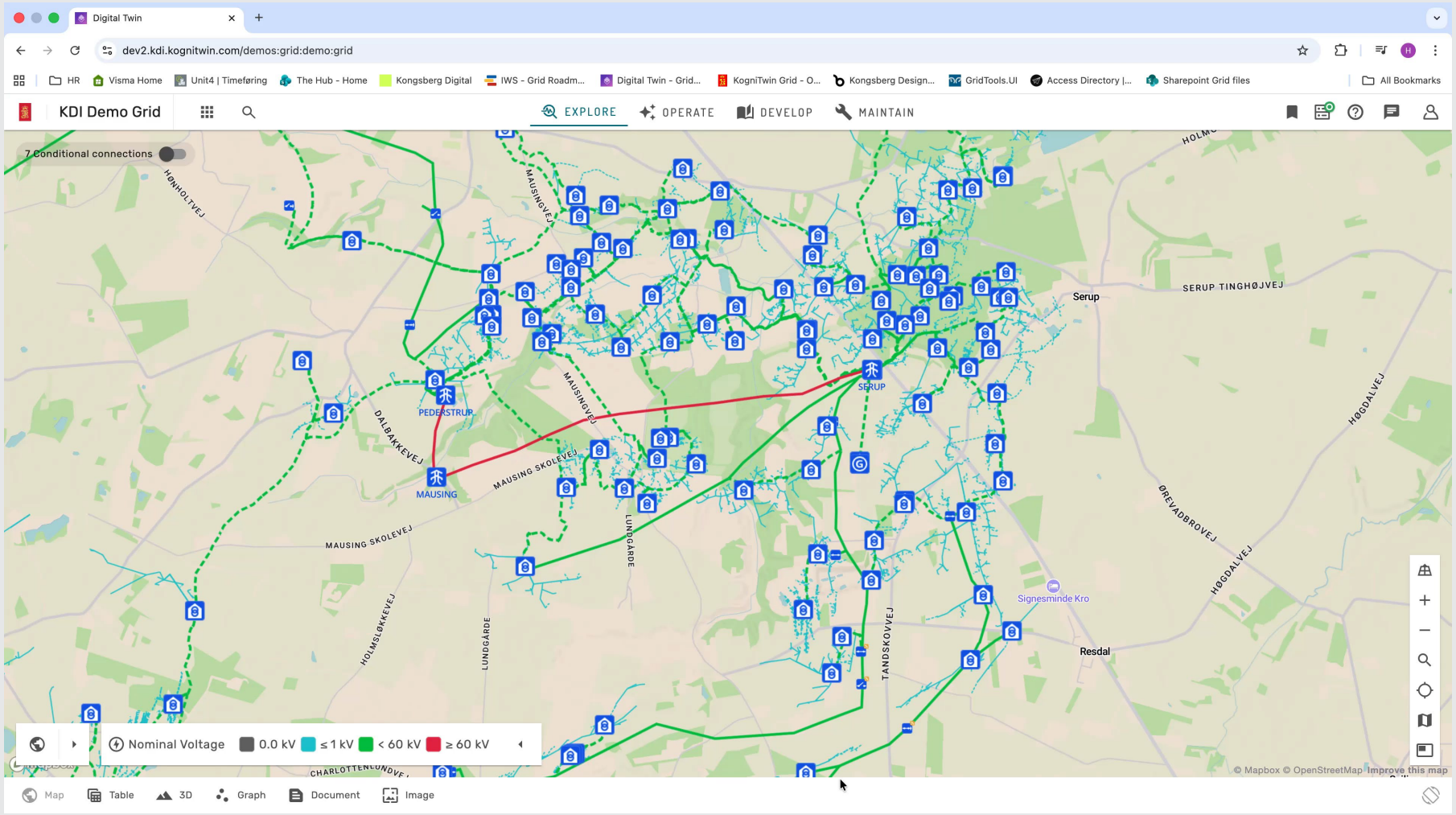
SCENARIO BUILDER



Simplicity of adding assets to the scenario in order to simulation a possible situation.

Connect and compare

CONNECTING KOGNITWIN GRID AND GRIDTOOLS



Created a link between Kognitwin Grid and Gridtools.

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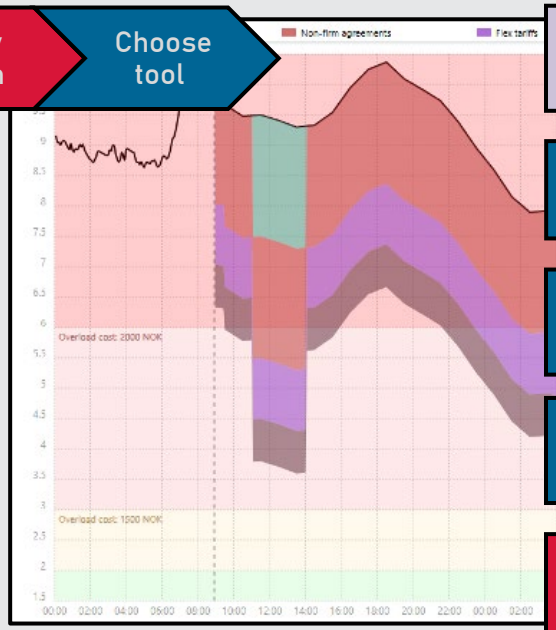
NextGrid workflow

Medium term planning

Model Use Case (CIM) → Load Flow Analysis → Publish Flexibility Need

Short term planning and proactive decision support

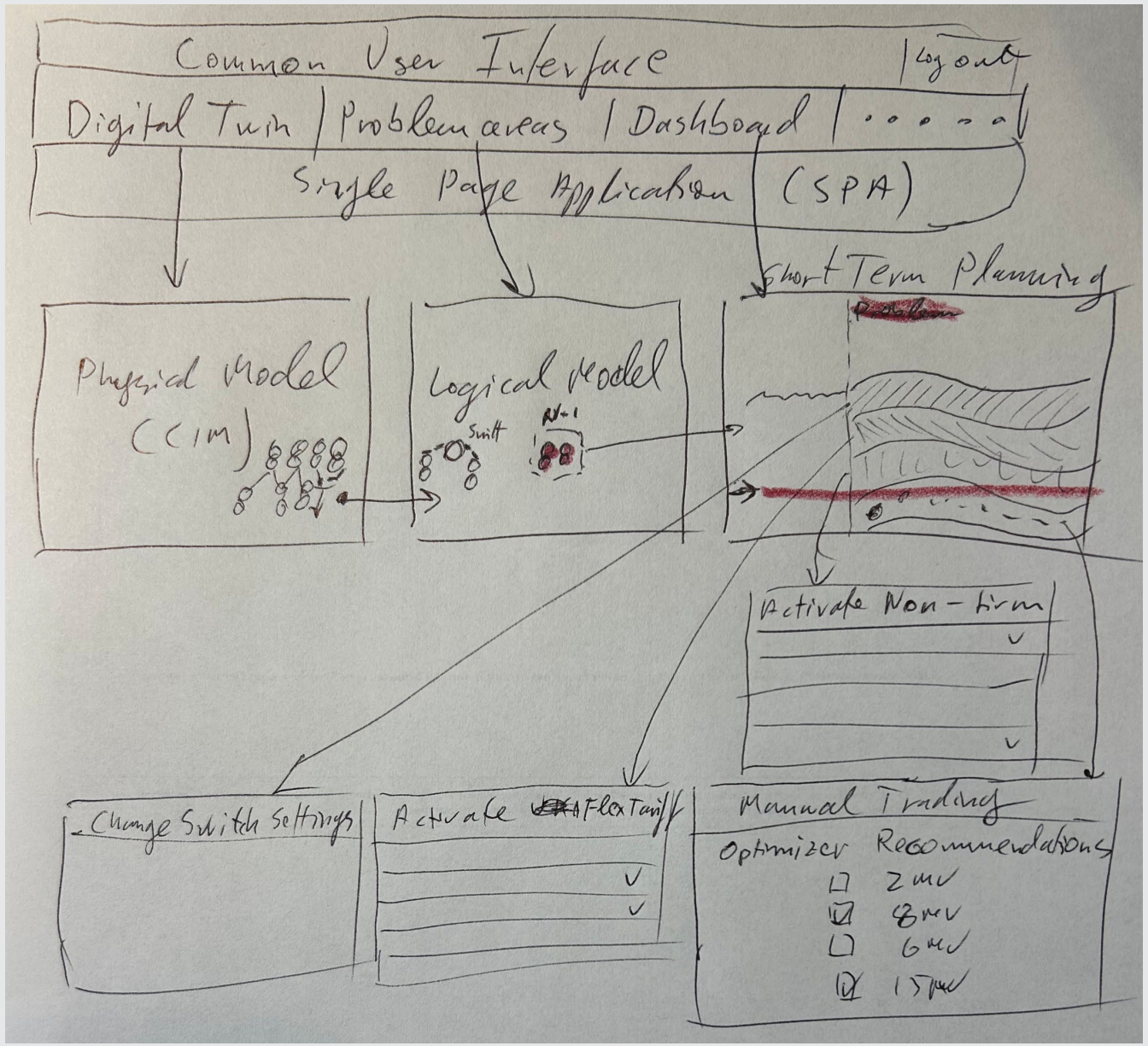


Identify problem → Choose tool

- Do nothing
- Optimize with Market Flexibility → Match order
- Activate Non-Firm Agreements
- Activate Flexible Tariff
- Change Grid Configuration

Common Work Surface

- Future scenarios and workshops
- Grid modeling and integrations
- Decision support and automation
- Demonstration, tests and reports



First sketches

- Single Page Application
- Digital twin (physical model)
- Problem Areas (logical model)
- Dashboard
- 4 tools
  - Change switch settings
  - Market flexibility
  - Flexible Tariff
  - Non-firm agreements

NextGrid

Severity	Asset type	Asset Name	High Level	Time lasted
Alarm	Trafo	T1	7,25 MW	4h
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	
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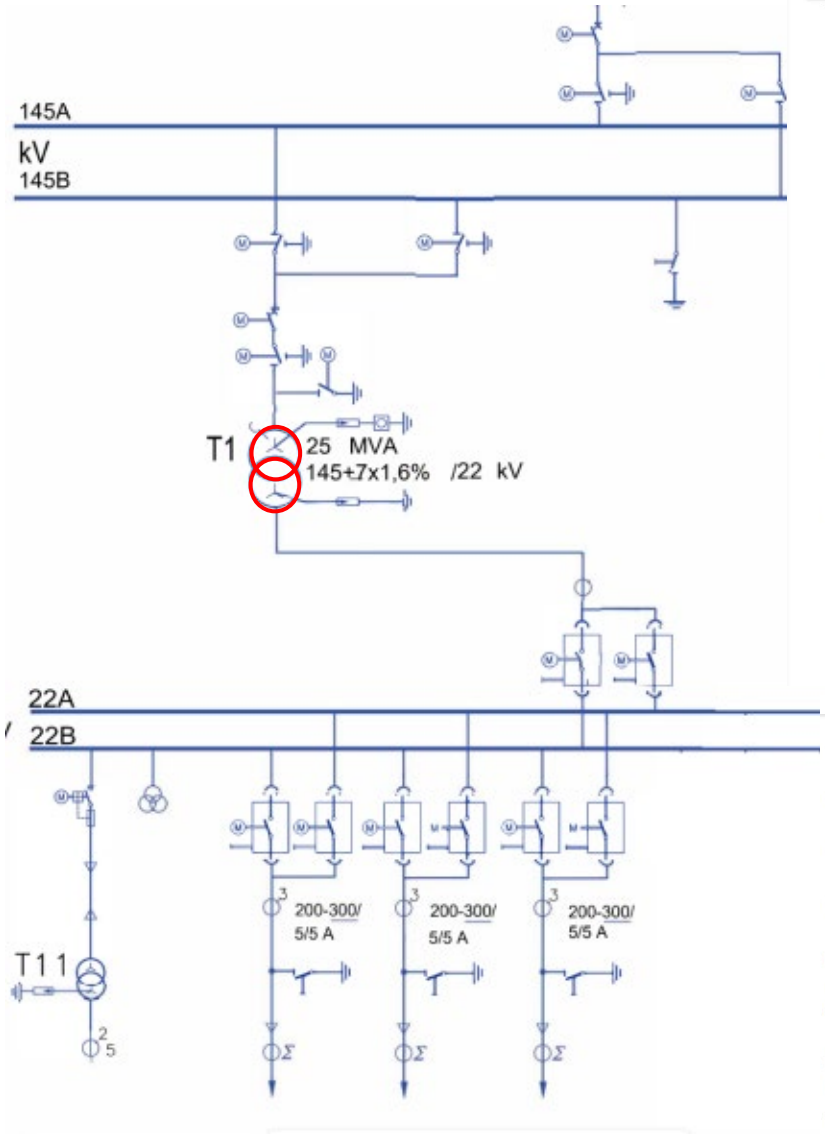
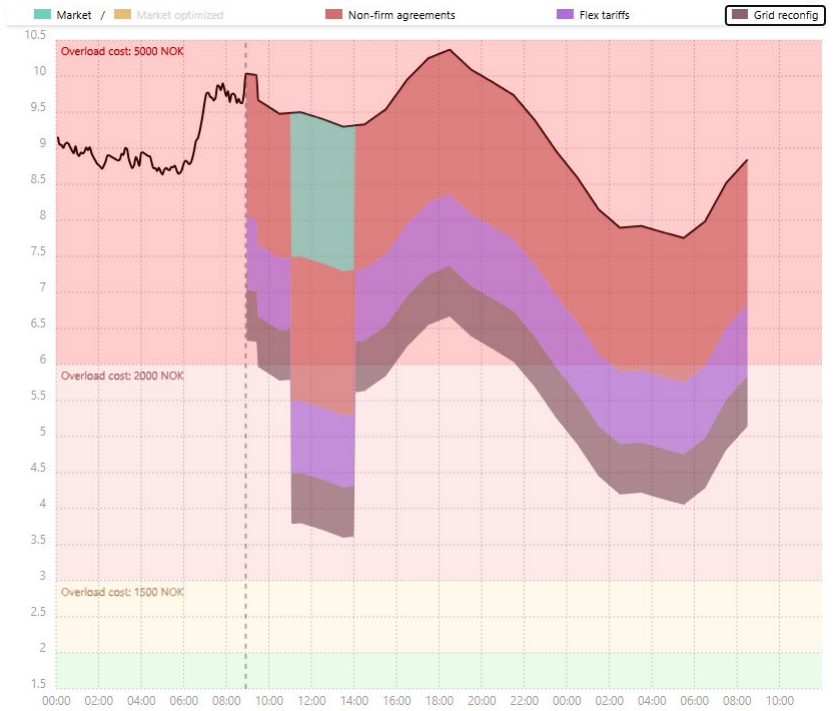
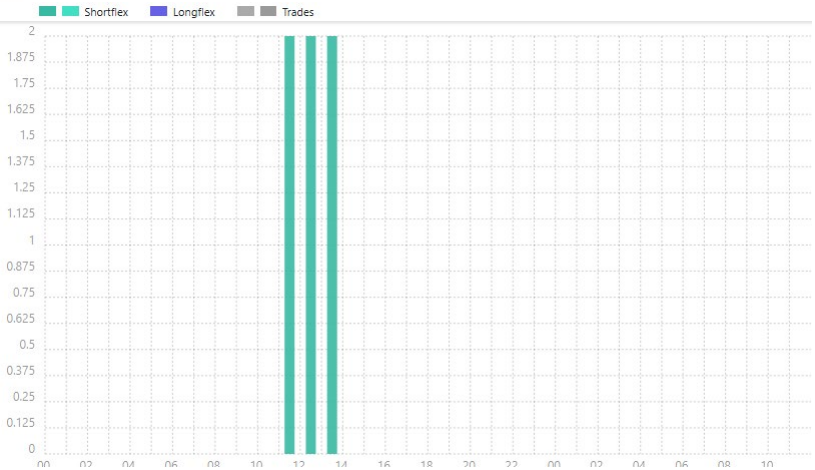
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	







NextGrid

Severity	Asset type	Asset Name	High Level	Time lasted
Alarm	Trafo	T1	7,25 MW	4h
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	Name
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	
Alarm	AC Line Segment	AFG-015BVCPW	Low Voltage	

Market optimized

trade

Non-firm agreements

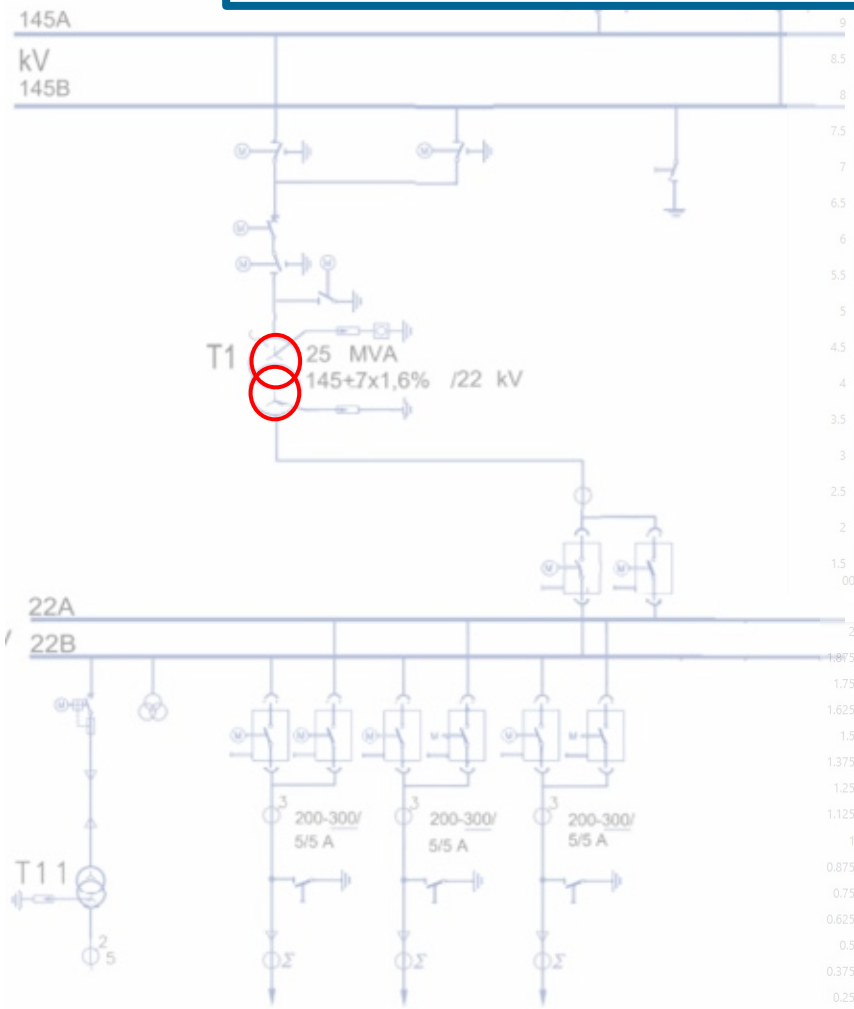
view contracts

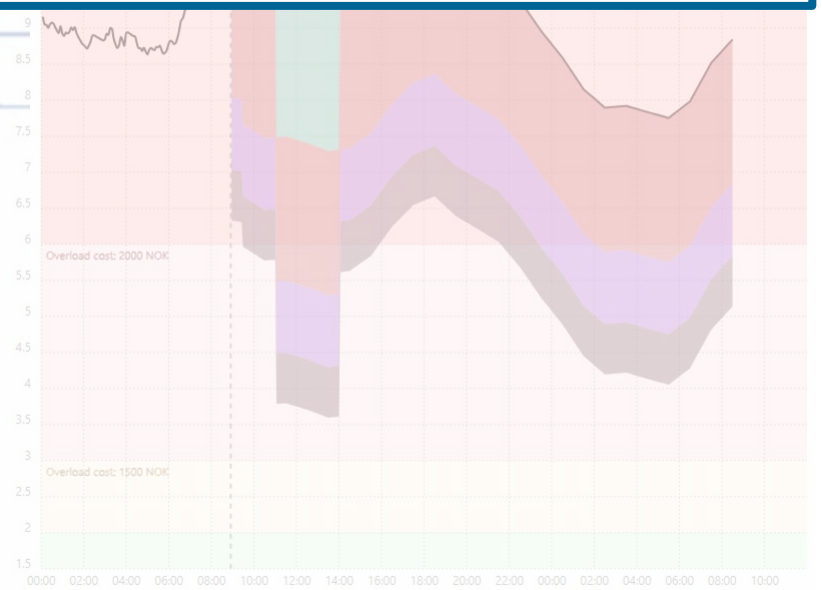
Flex tariffs

view contracts

Grid reconfig

open reconfig

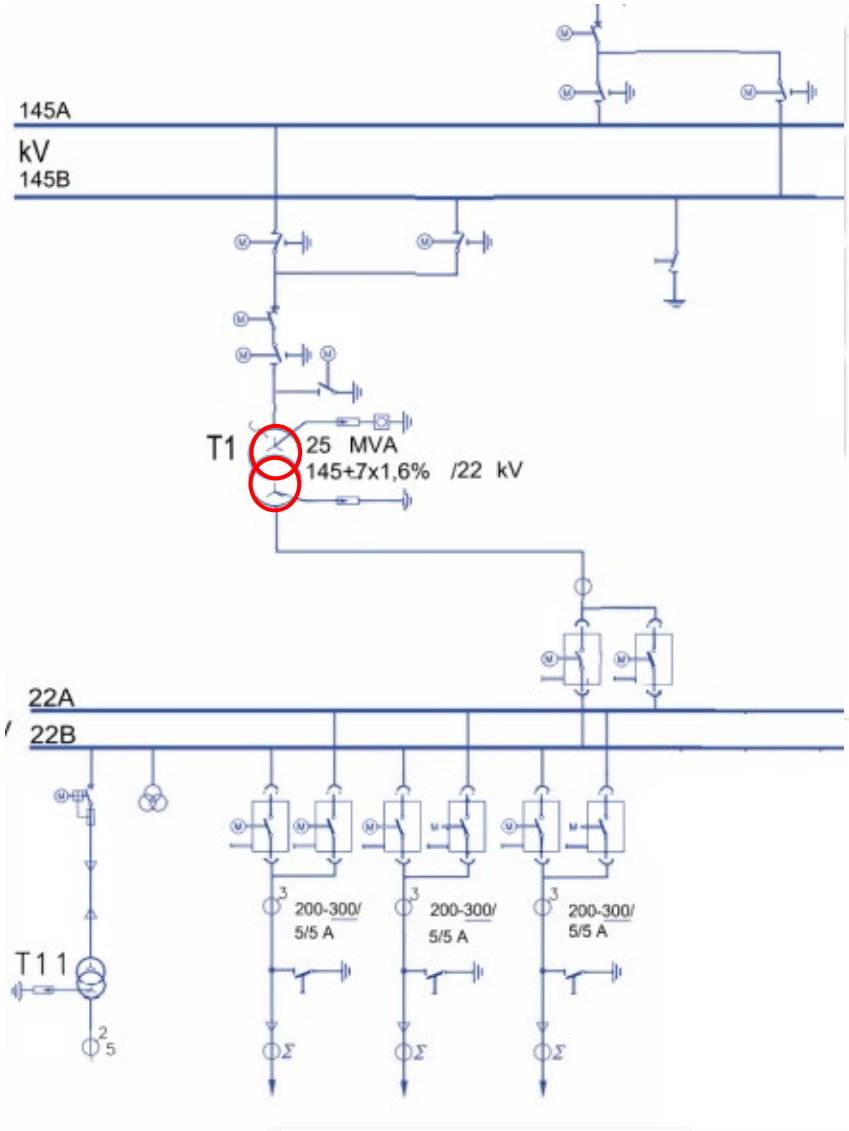


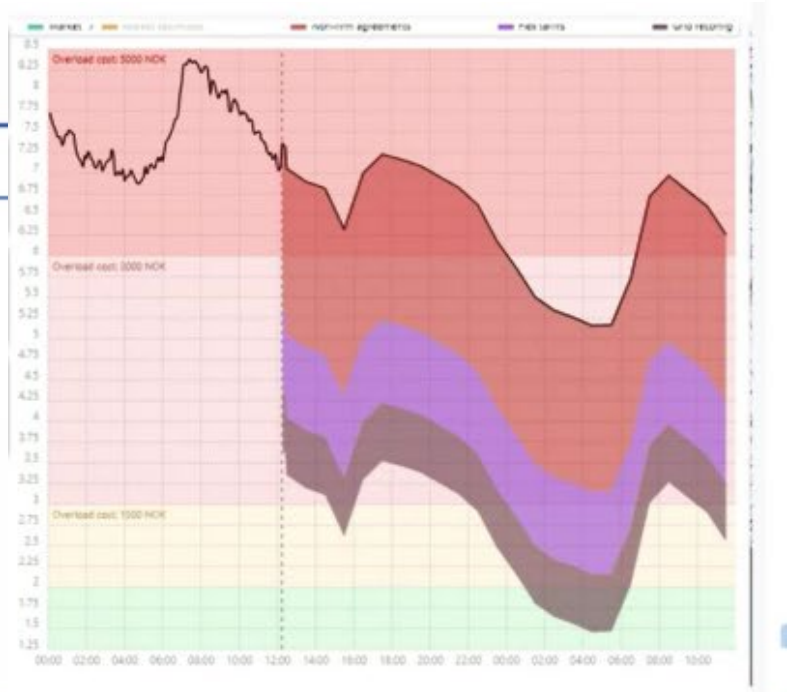


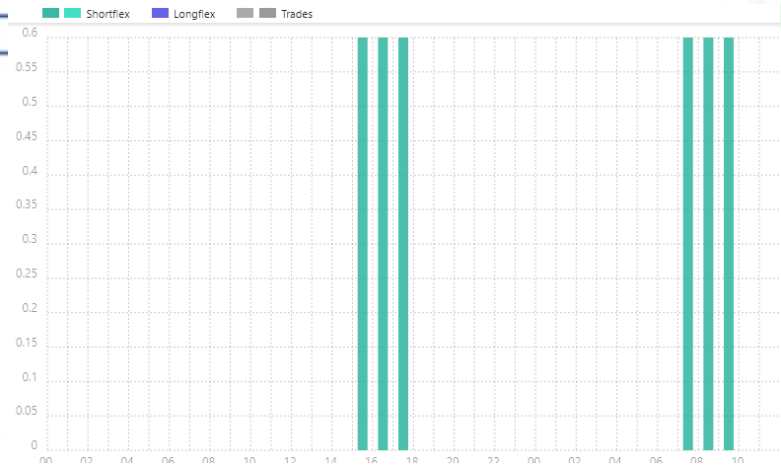
Only one alarm per day pr node (trafo/line)

Preconfigured/persisted filter
- Filter also on overload length

Severity	Asset type	Asset Name	High Level	Length
Alarm	Trafo	T1	7,25 MW	4h





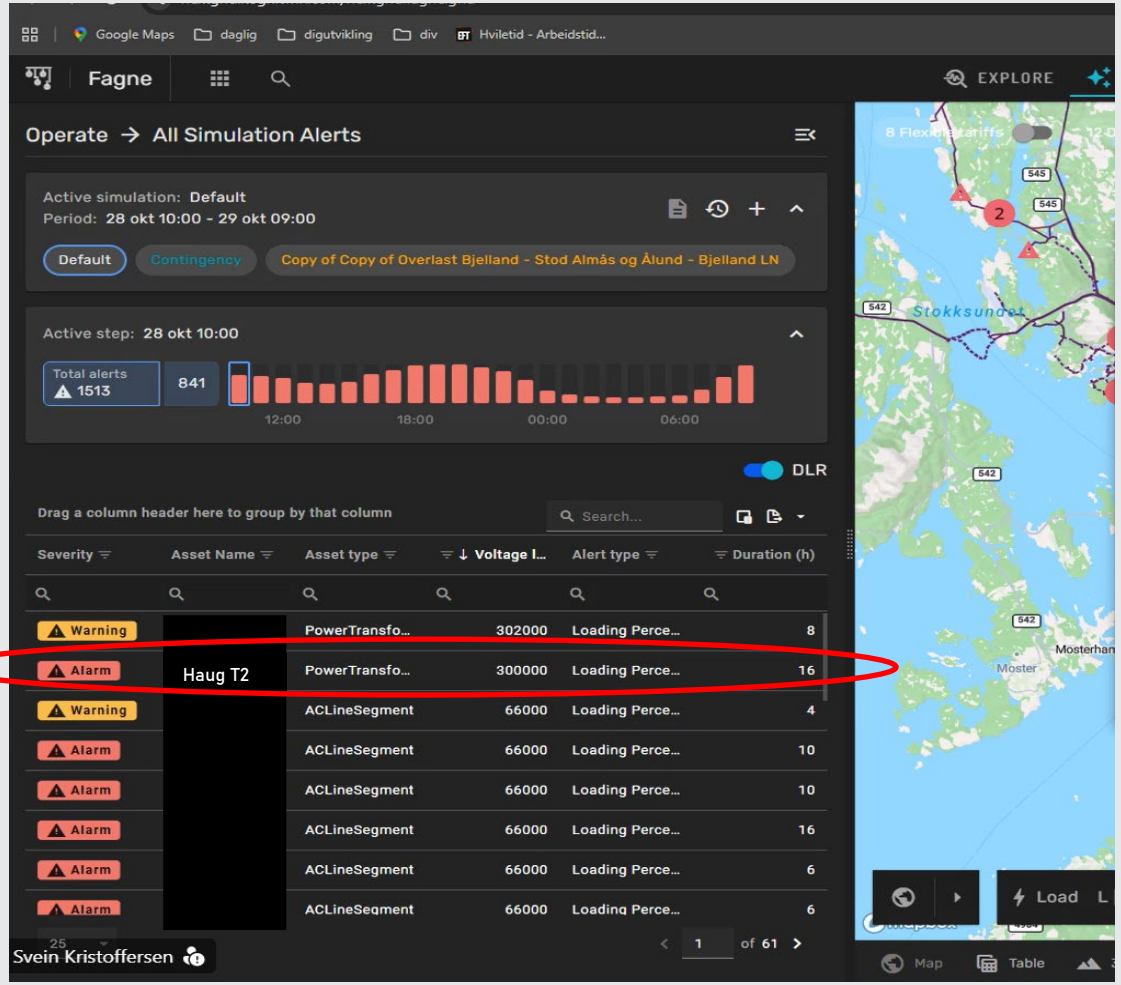


Test with Fagne

Real test with the latest developed software

- Real data, but no real activation
- Case: Overload in «Haug T2»

Alarm list



- Overload in «Haug T2»
- Need operator invention

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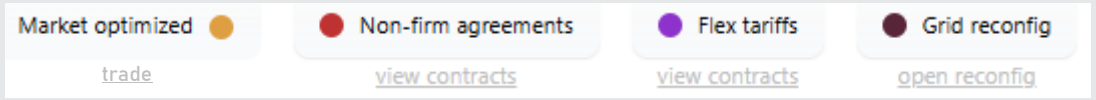
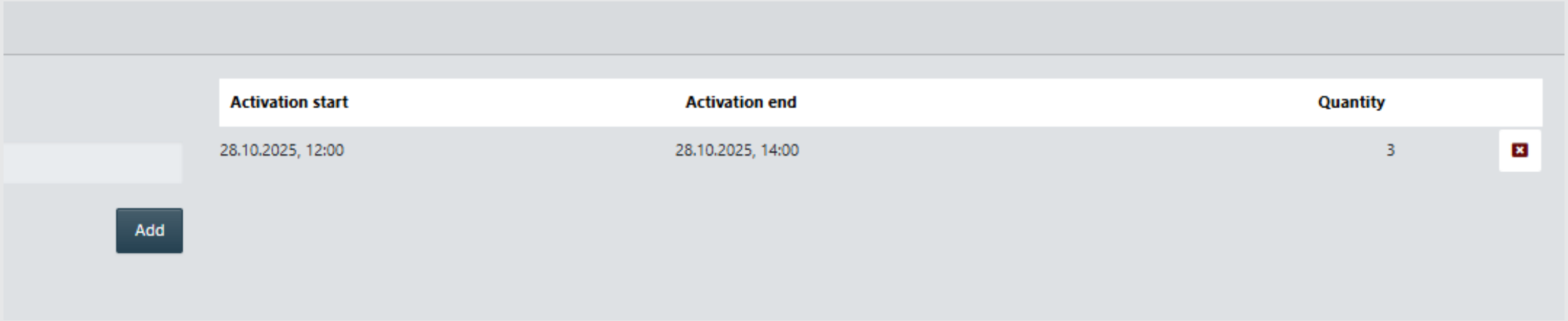
Operational planning dashboard

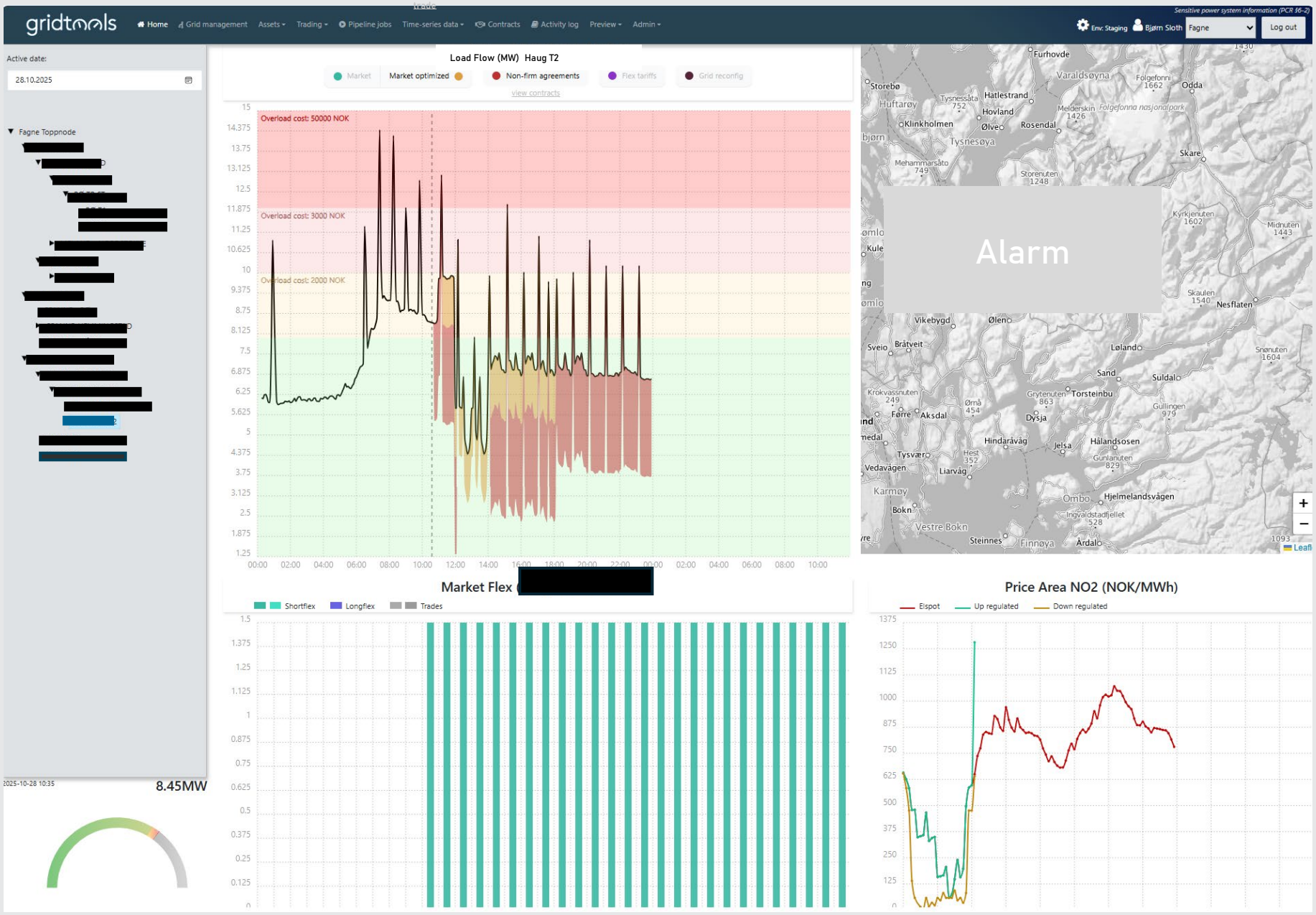
The tools


Market optimized
trade
Non-firm agreements
view contracts
Flex tariffs
view contracts
Grid reconfig
open reconfig

Activate non-firm agreement

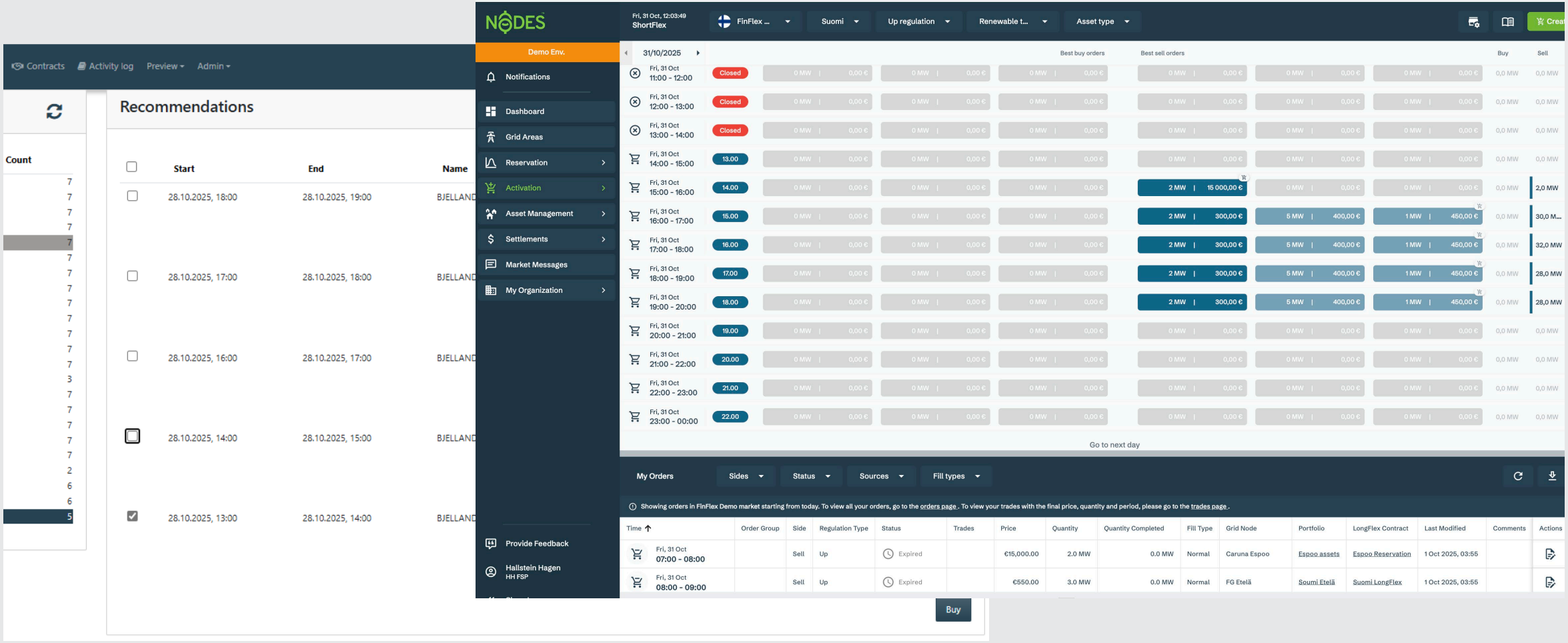


Non-firm agreement activated



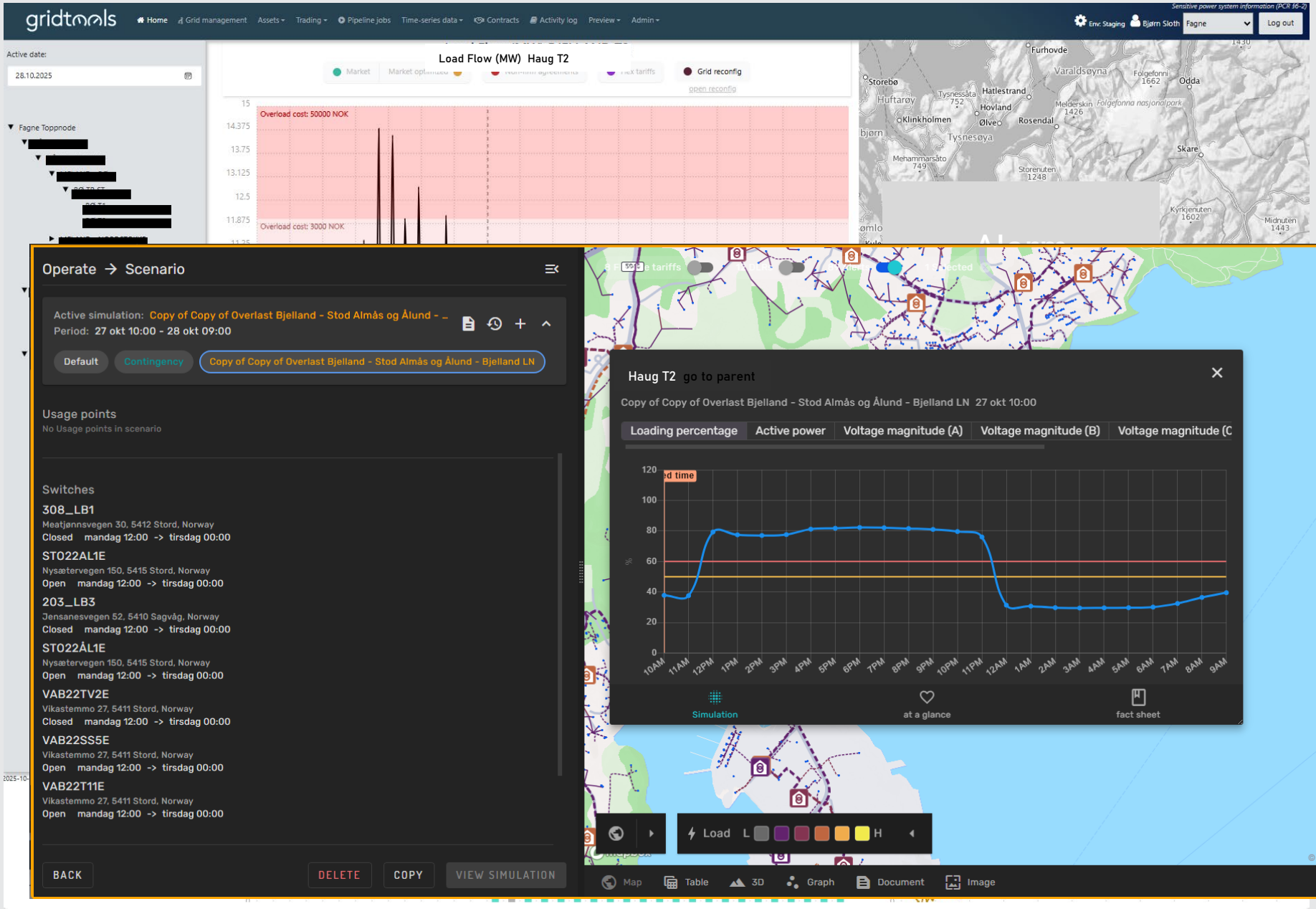
Buy recommended market flex

–match order



Dashboard

Grid reconfiguration



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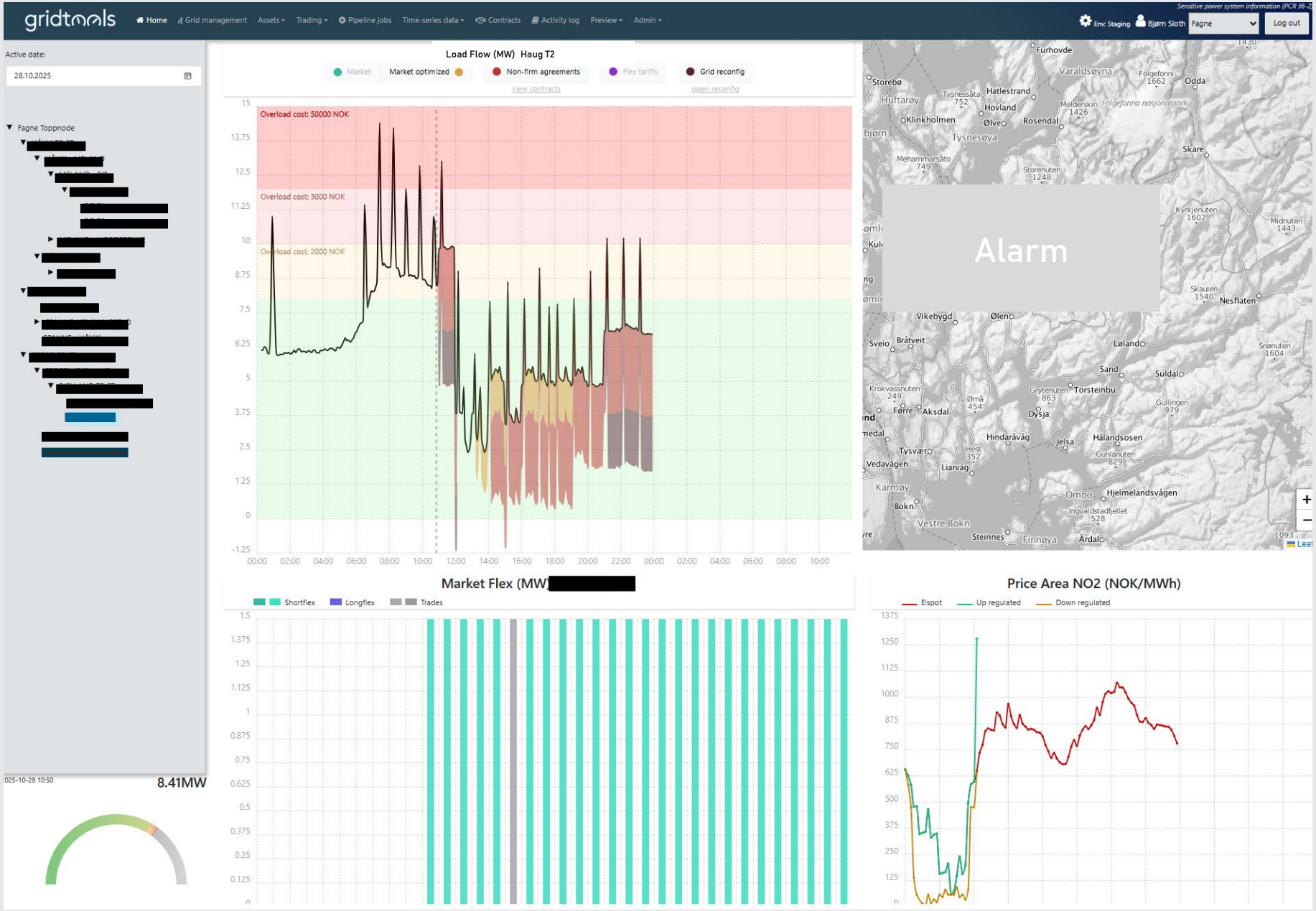
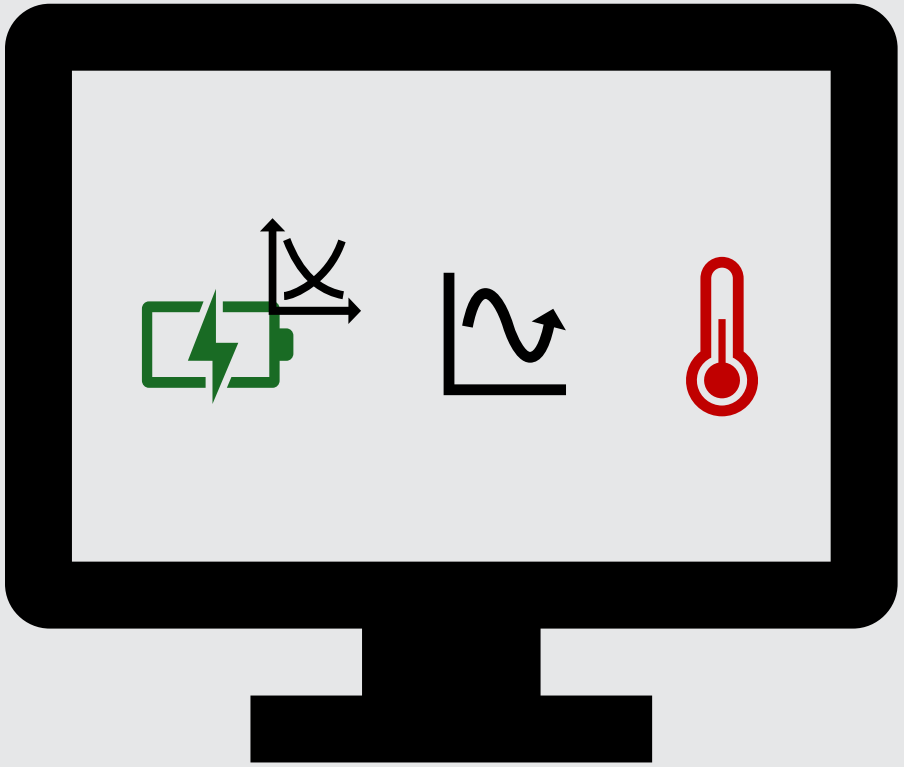
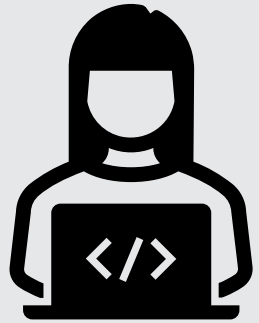
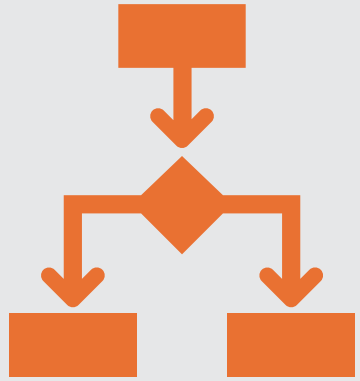
Problem solved

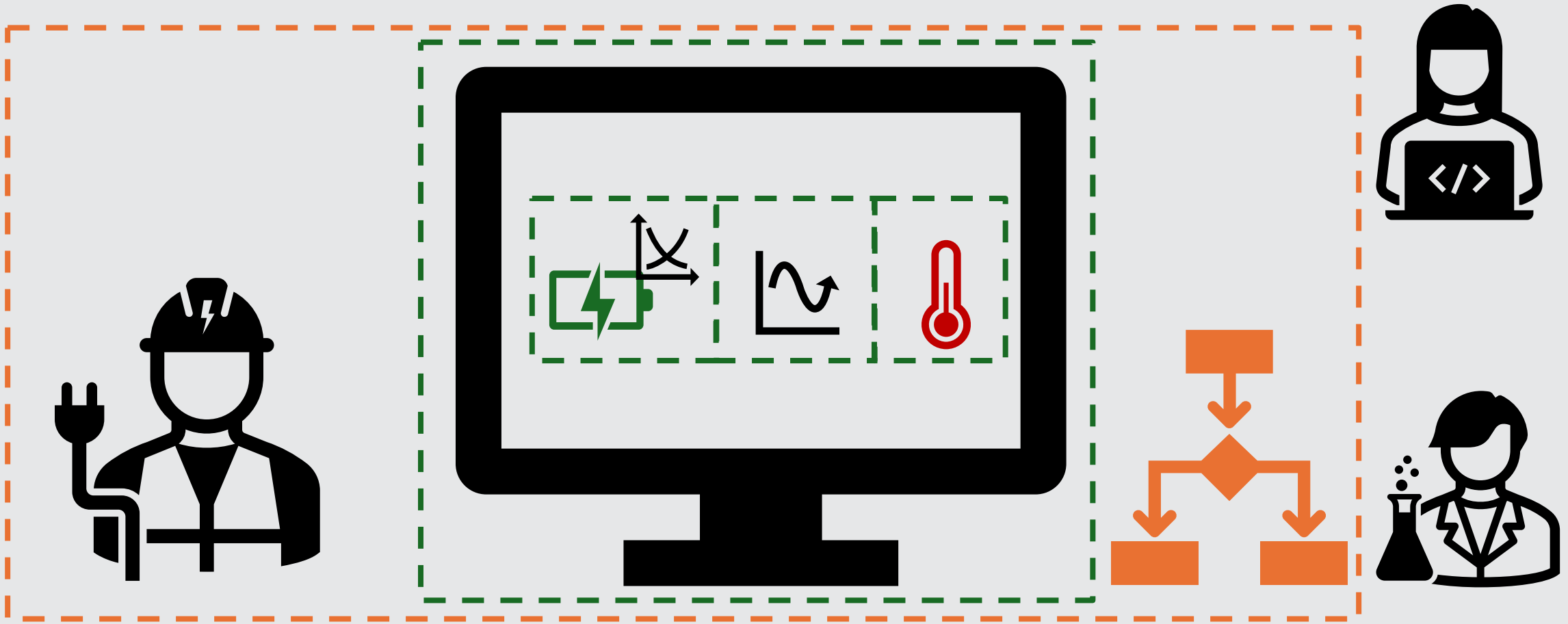
- Non-firm agreement activated
- Market flexibility traded
- Switches reconfigured











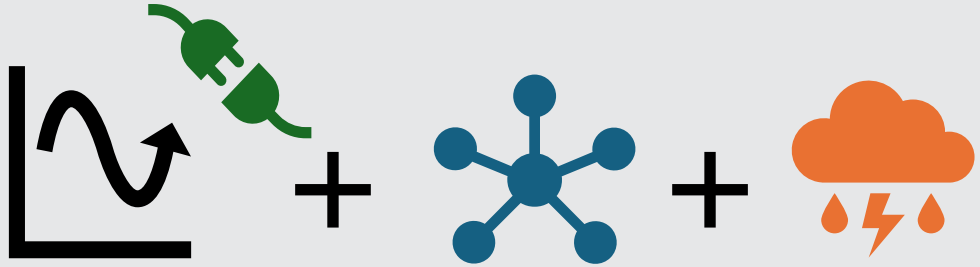
Testing operational planning

How to even test operational planning?

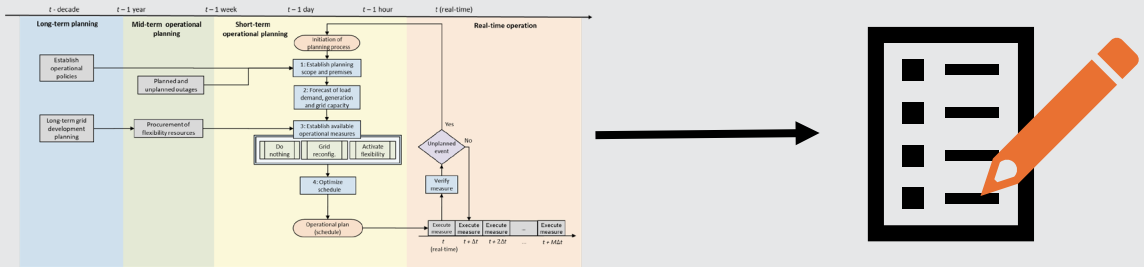
- SoS must be maintained
- Some simulation is required
- Need precise, directive procedure

What we landed on

1. Define operational scenario



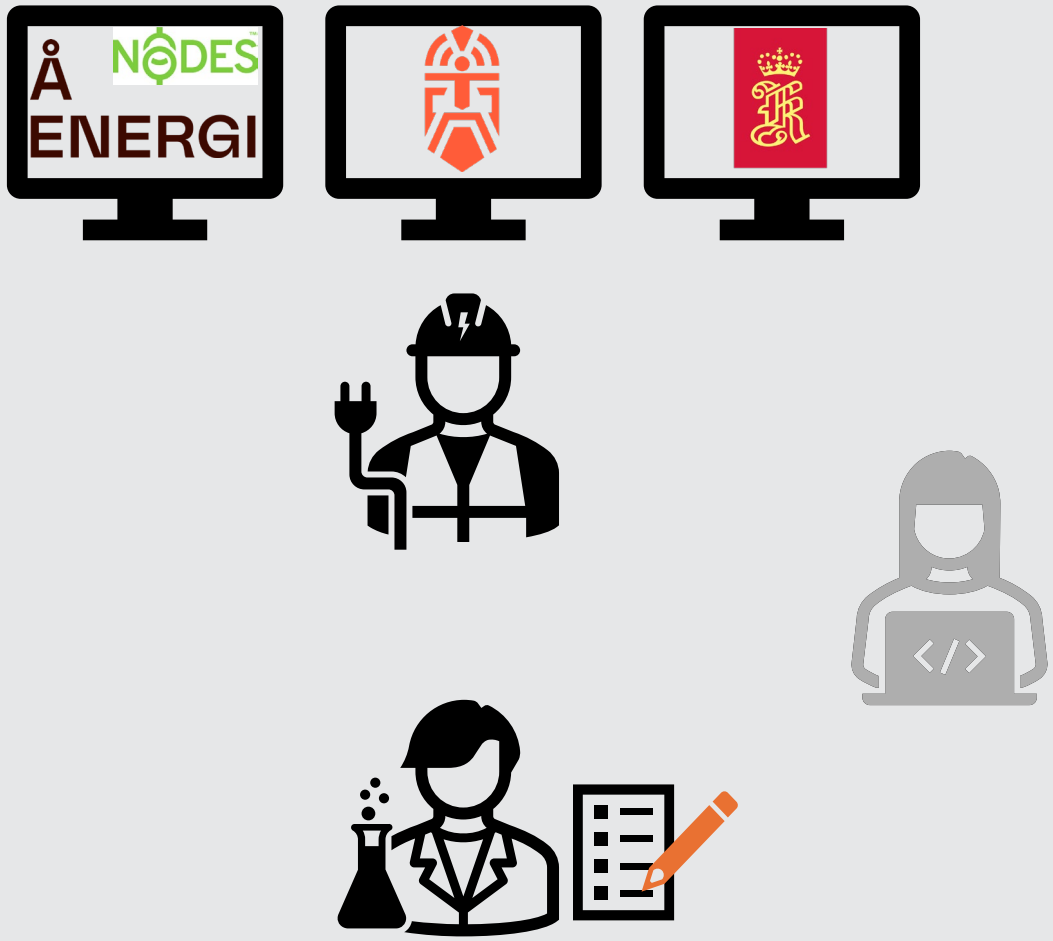
2. Define use of tools of interest



3. Define interview questions

Experimental setup

- Scenarios
  - Congested regional transformer
  - Congested regional lines
  - Planned outage
  - Unplanned outage



Results

- The actions were effective both alone and in combination
- Same decision support can be used both proactively and reactively
- Feedback from operators
  - Difficult manual process -> Automation in the long term
  - How to trust active grid measures?

Foreward for operational planning

- Need for modularity
  - Technologically
  - and methodologically
- Realistic testing
  - Chicken and egg
  - Safety requirements
- Organizational
  - ‘Operational planner’ role

Break