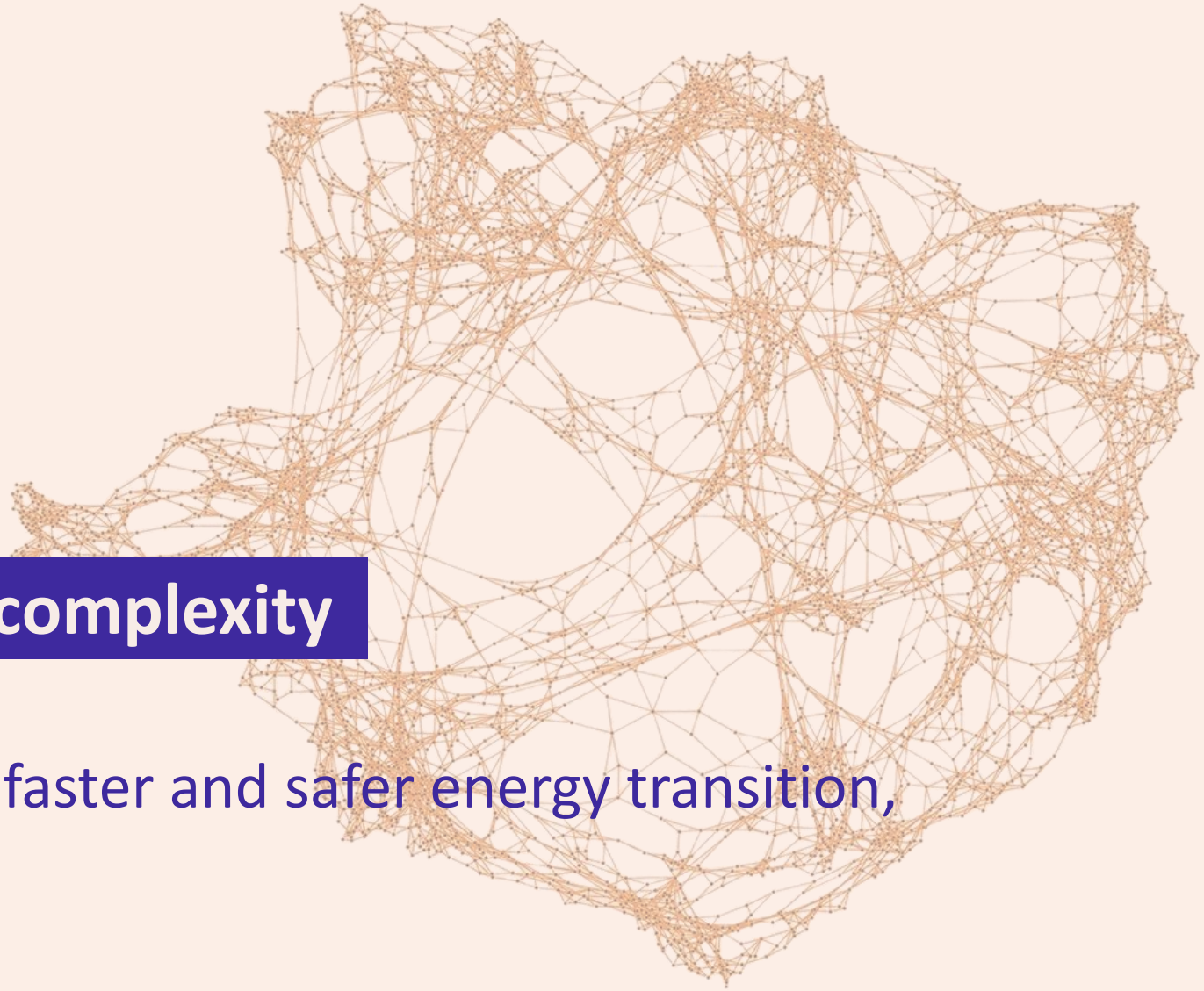
Infinigrid



Seeing through the grid complexity

Removing the blindfold, for a faster and safer energy transition,
& billions in savings

Robert Nyiredy [robert@infinigrid.ai]

Our power grid - Perfect harmony - Immensely complex

This is the foundation of our society

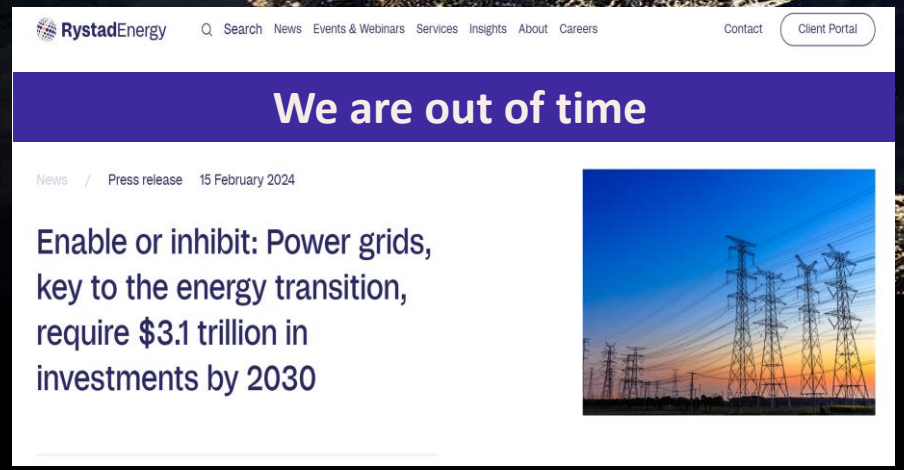
This foundation is now being threatened

No transition without transmission

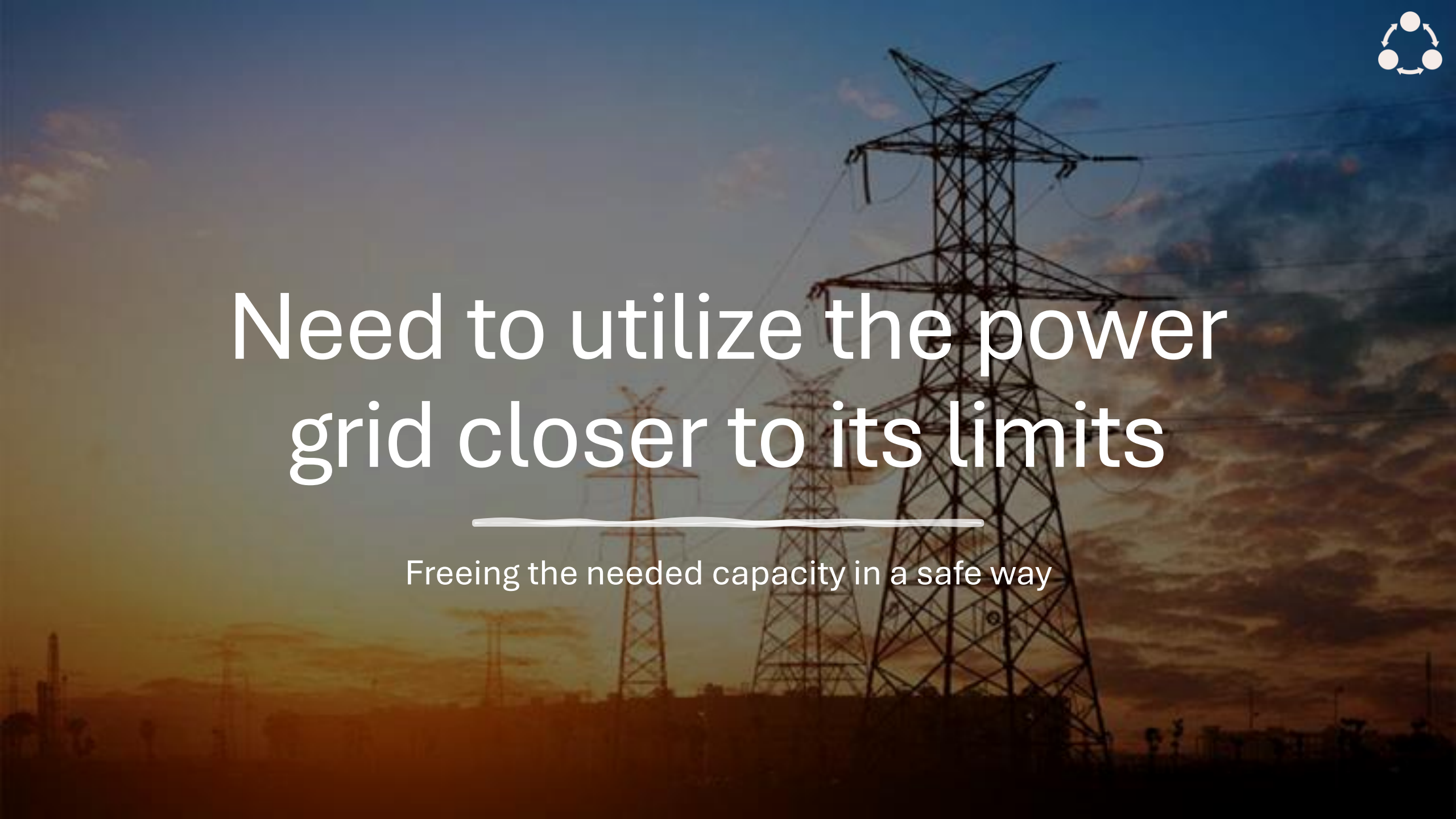
The “music” stops

- Slow down or in worst case -

stop electrification of society and the green transition



By a worldwide GRIDLOCK



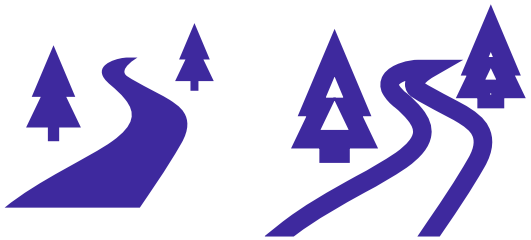
Need to utilize the power grid closer to its limits

Freeing the needed capacity in a safe way

Manual grid operation is being challenged

OPPORTUNITY

Need to use some of the spare grid capacity



By tapping into the existing security constraint in a safe way

Give grid operators more road to handle the increasing traffic

This can only be achieved by analyzing the security of supply in near real-time, understanding the risk and mitigate when needed

Proprietary mathemathical breakthrough, building on team's 20+ years of power grid risk experience

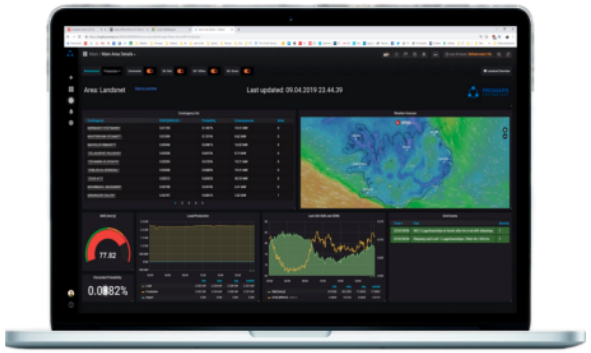
Introducing the solution: Promaps Realtime – probabilistic risk analysis in near Realtime

Data input

- Ambient conditions*
- Consumption Data
- Battery Capacity
- Energy production
- Transmission Capacity

+ Sensor Data
+ Statistics
+++

Solution



Mathematical breakthrough** – solved 4 math problems

Minutes for entire power system vs hours for individual branches

Predict grid failures and optimize grid in real-time

Scalable software, no hardware

Impact

Increased system grid/capacity

Reduced/optimized investment need

Higher reliability and control

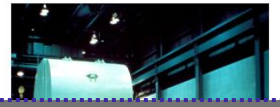
Faster energy transition

Promaps Realtime “the solution”

Increase flexibility by knowing what to do and when

Energy Storing System

Spinning Reserve



Load flex

Load Shedding

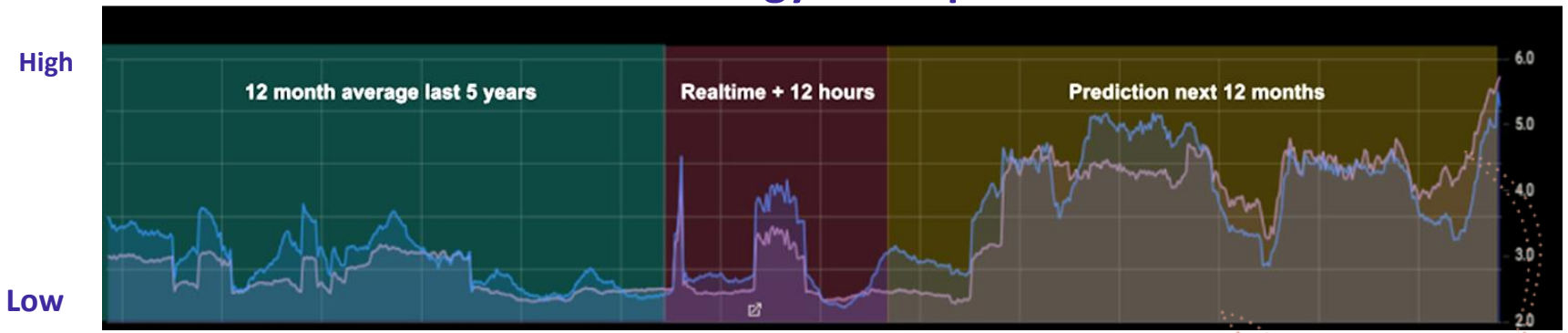
New grid

Production impact

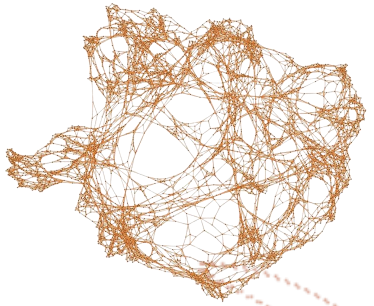
Optimise system operation

Freeing up to 15 - 35% of total grid capacity while ensuring a safe security of supply for the coming decades

Risk of Energy not suplied



Visual representation of Norwegian west coast power grid



Quantified security of power supply

The solution

Deterministic & Probabilistic Reliability Criteria

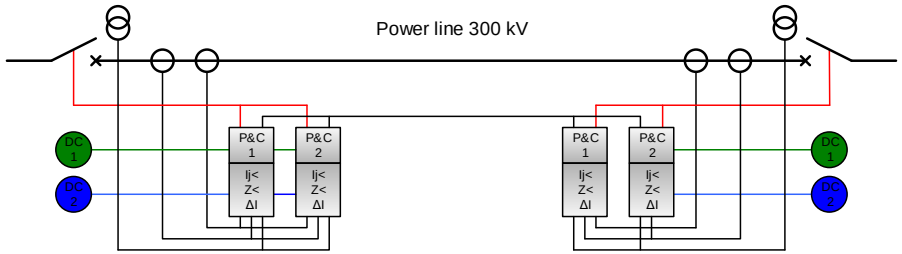
By use of probabilistic quantification of the security of supply – a lot of new tools for gaining flexibility are available

	Deterministic N-1 criterion	Probabilistic criterion
Contingency list	Single outages	-All contingencies up to N-k system states -All contingencies up to a certain cumulative probability of occurrence
Probabilities	Not considered	Failure probability for each component
Consequences	Not considered	Interruptions are valued at Value of loss of load

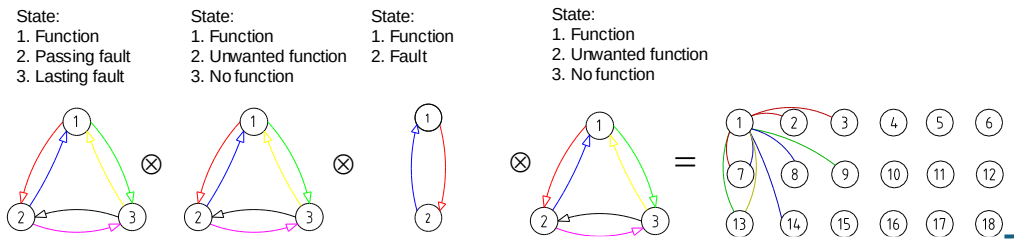
Power system complexity

Power system branch

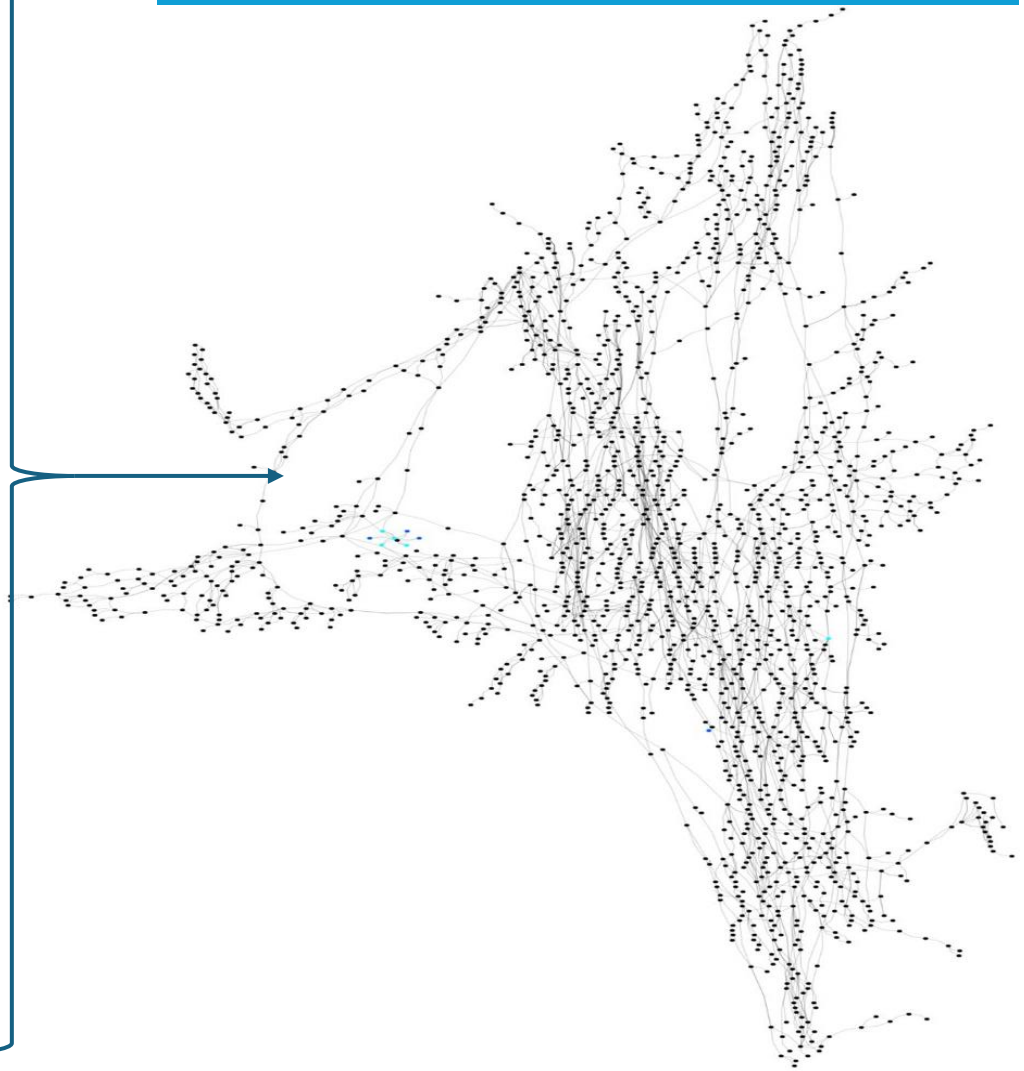
Consist of many component



With many potential many failure states



Power system consist of thousands of branches



Production

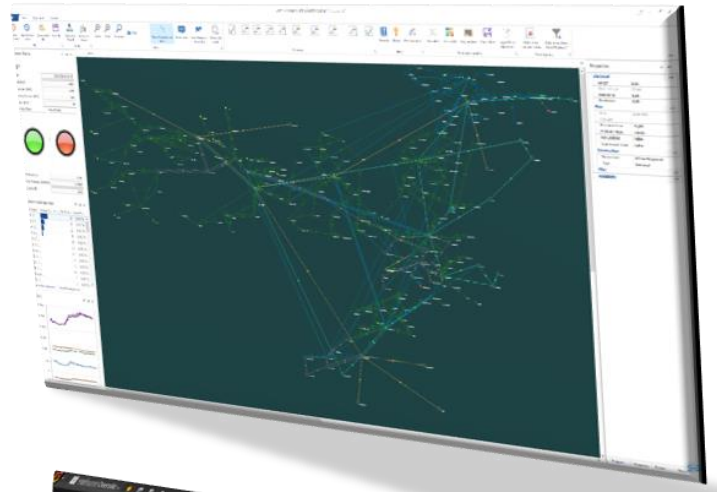
Capacity

Load

Promaps Realtime Dashboard installed in the control room

Promaps realtime- The software

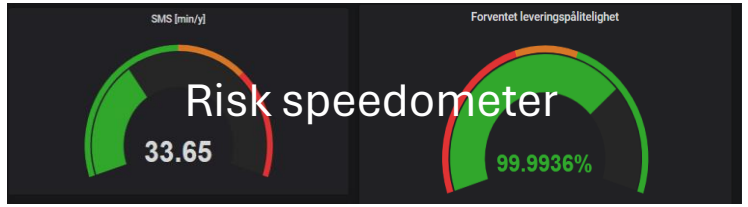
Examples of views in Promaps of flow in grid and its bottlenecks

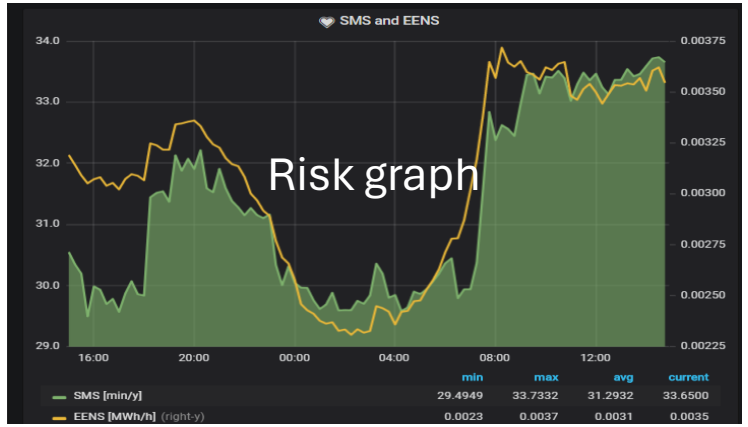


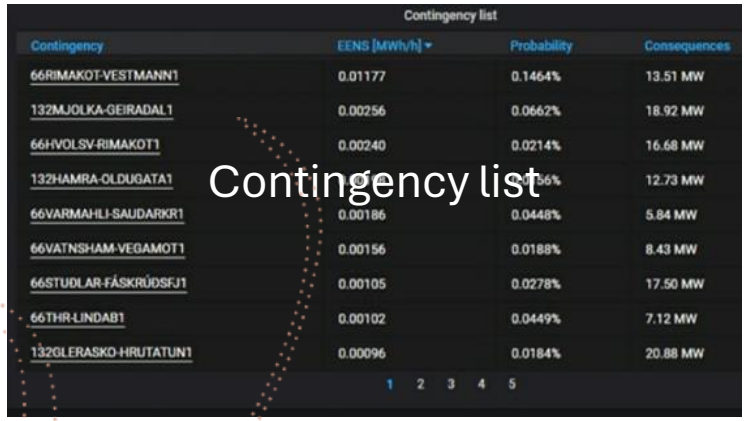
Analysis & calculation result

1. Reliability results:
   - Probability of failure per component
   - Probability of failure per network segment
   - Probability of system failure

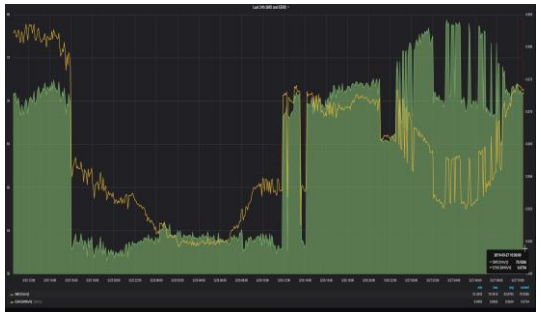
2. Power system risk
   - Expected energy not delivered EENS
   - Contingency list (risk adjusted)
     - Black out list
     - Cascade list
   - Risk indicator in near real time
   - Dynamic risk colour indication
   - Risk graph



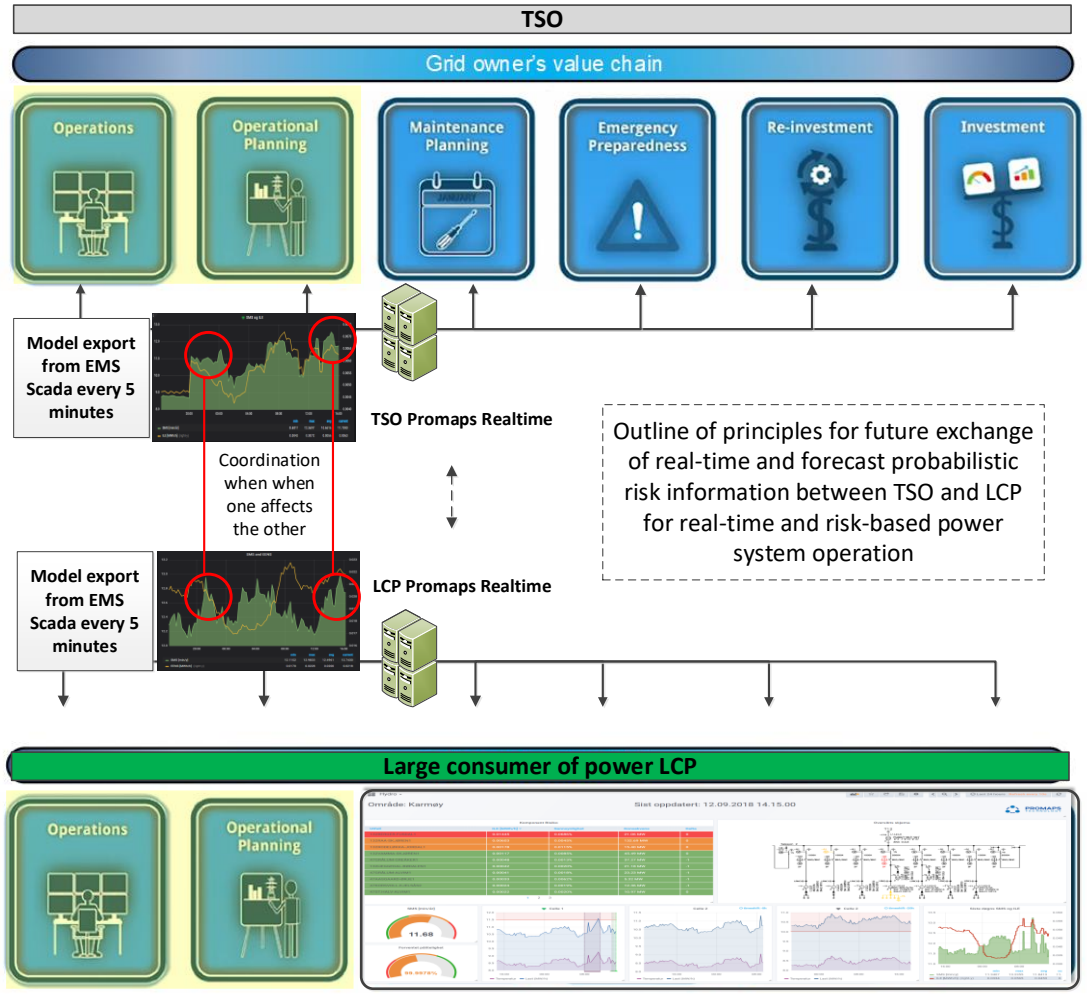




Use case 01 for increase capacity: TSO/DSO - Large prosumer of power

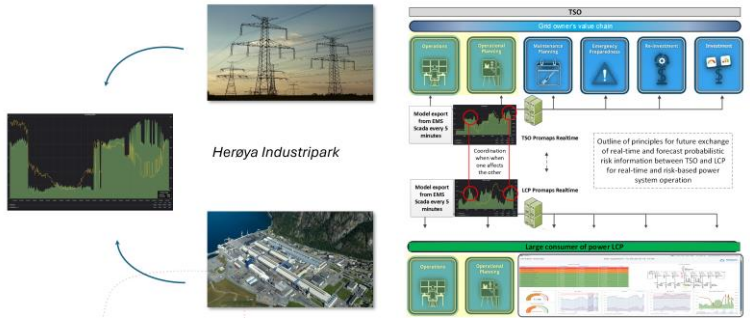


Norsk Hydro consumptions: 12% of Norway's total consumption



Use case 02 for increase internal capacity: Industry park

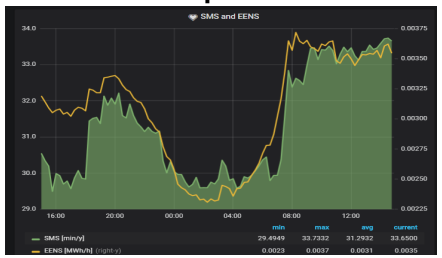
Use case 01: External grid



Use case 02: Internal Grid

Monitor the security of supply of the power supply within HIP and to the external surrounding power system

Company 01
Realtime predictions of load



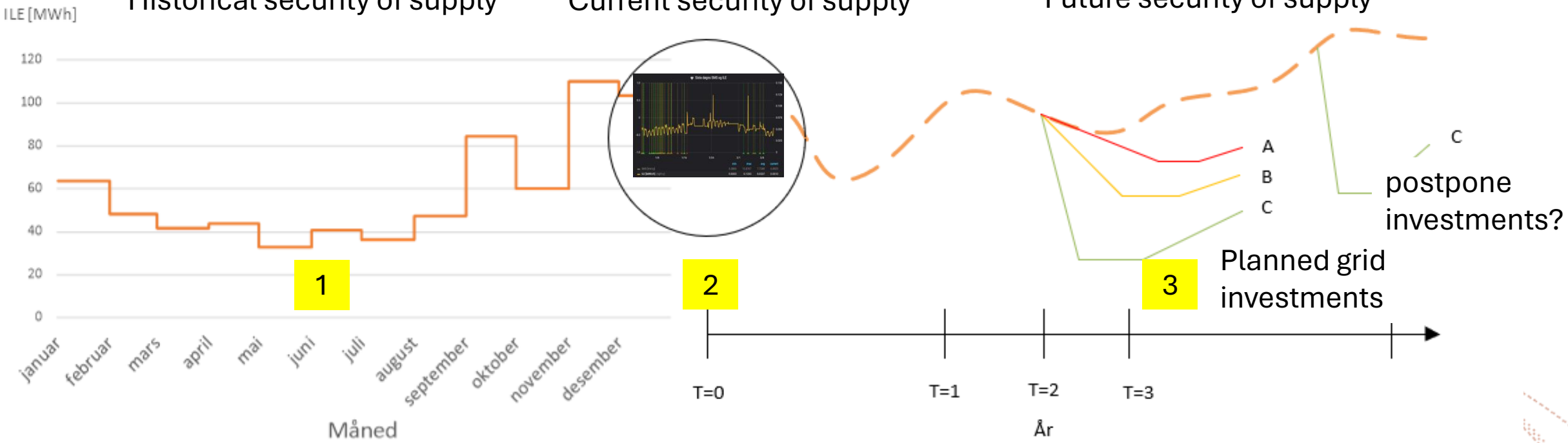
Company 80
Realtime predictions of load

Use case 03 for increase capacity: Investment analysis

Historical security of supply

Current security of supply

Future security of supply



Use cases 04 probabilistic analysis in the value chain

More oversight

Better insight

Top management

Grid owner's value chain

Operations

Operational Planning

Maintenance Planning

Emergency Preparedness

Re-investment

Investment