Model roadmaps

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SINTEF Energy Research
User Meeting 29.11.2023

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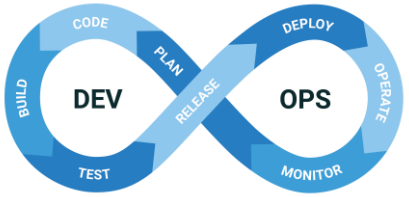
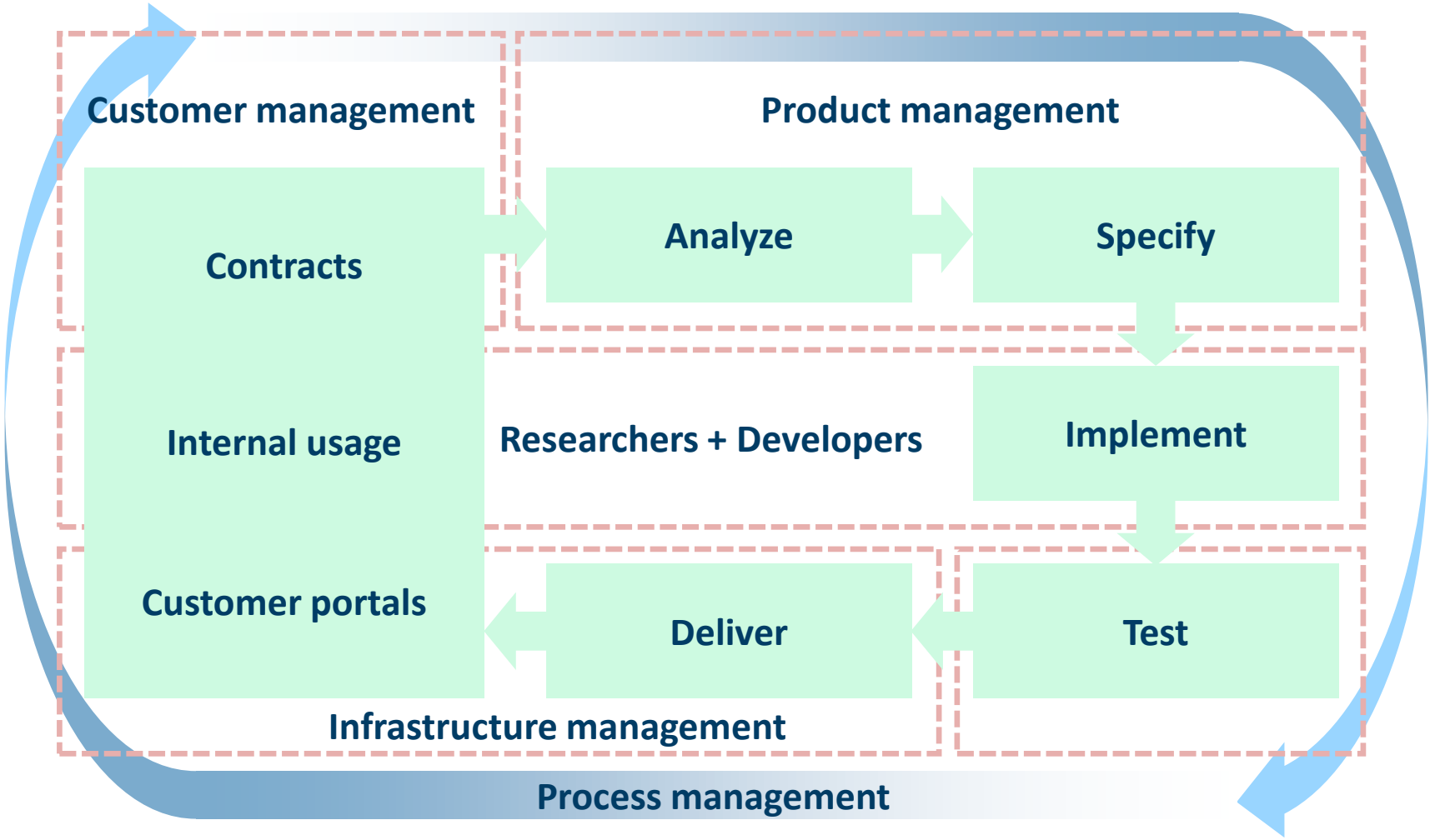
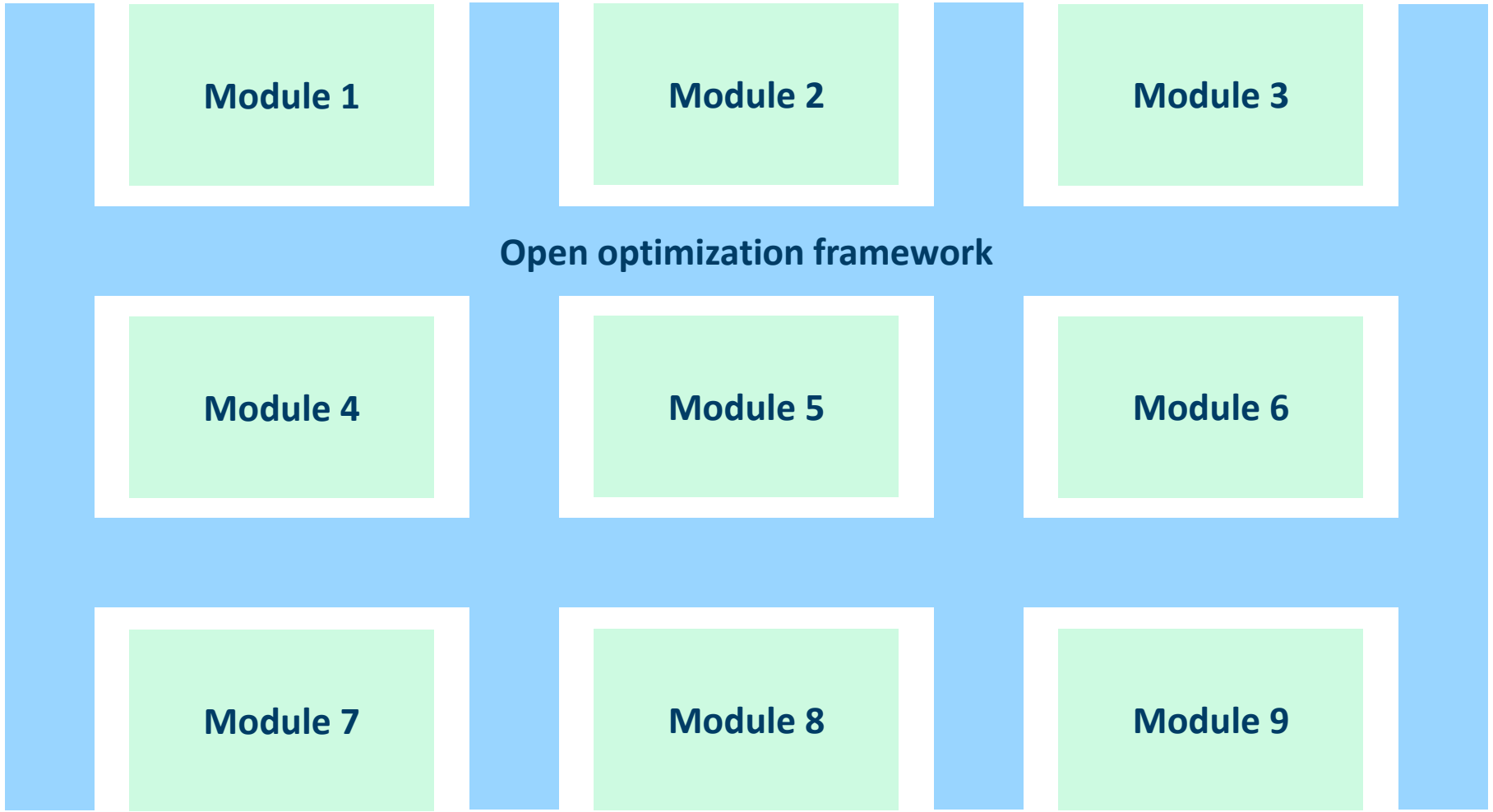
Development cycle and roles



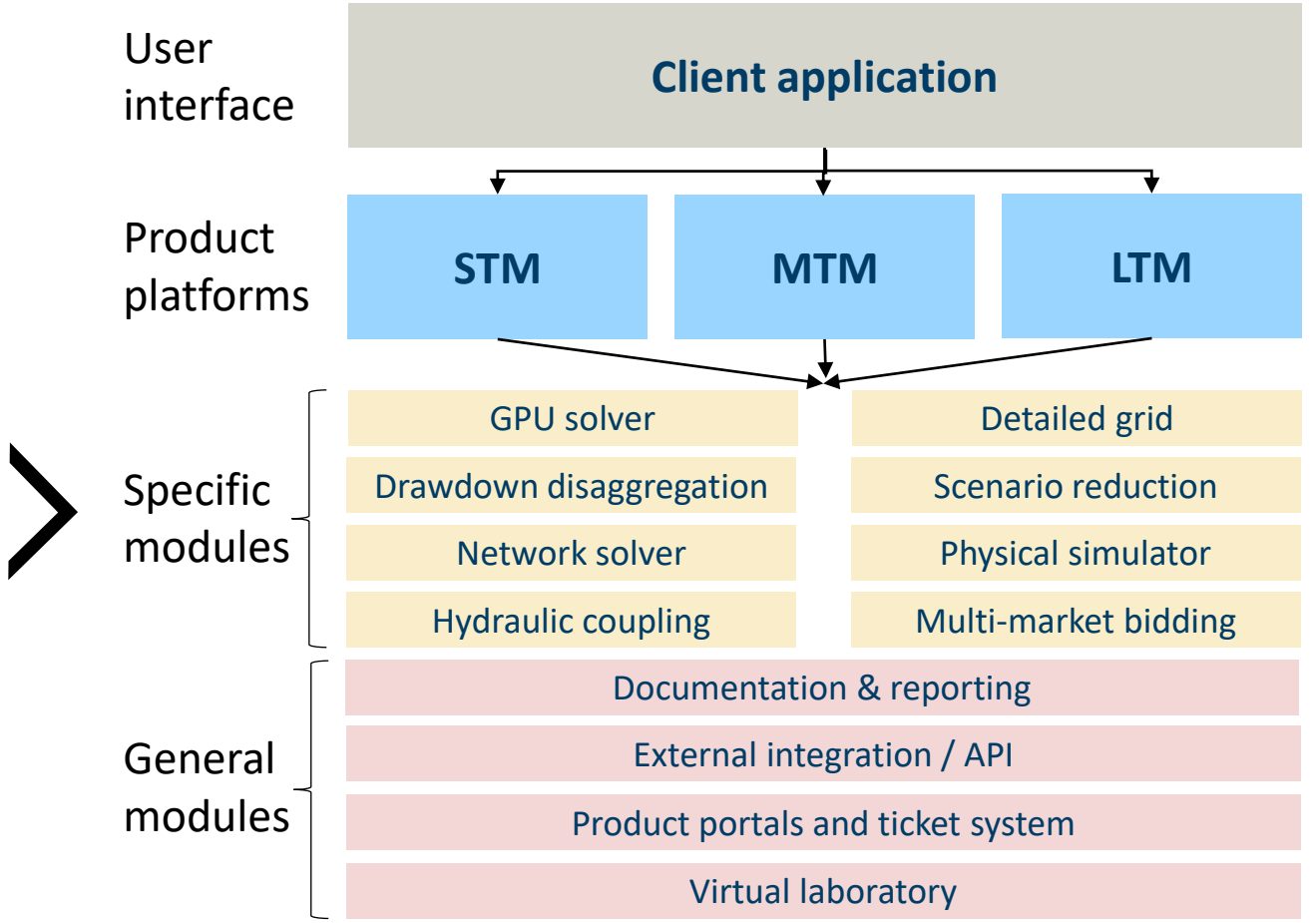


Framework overview from LTM days 2023

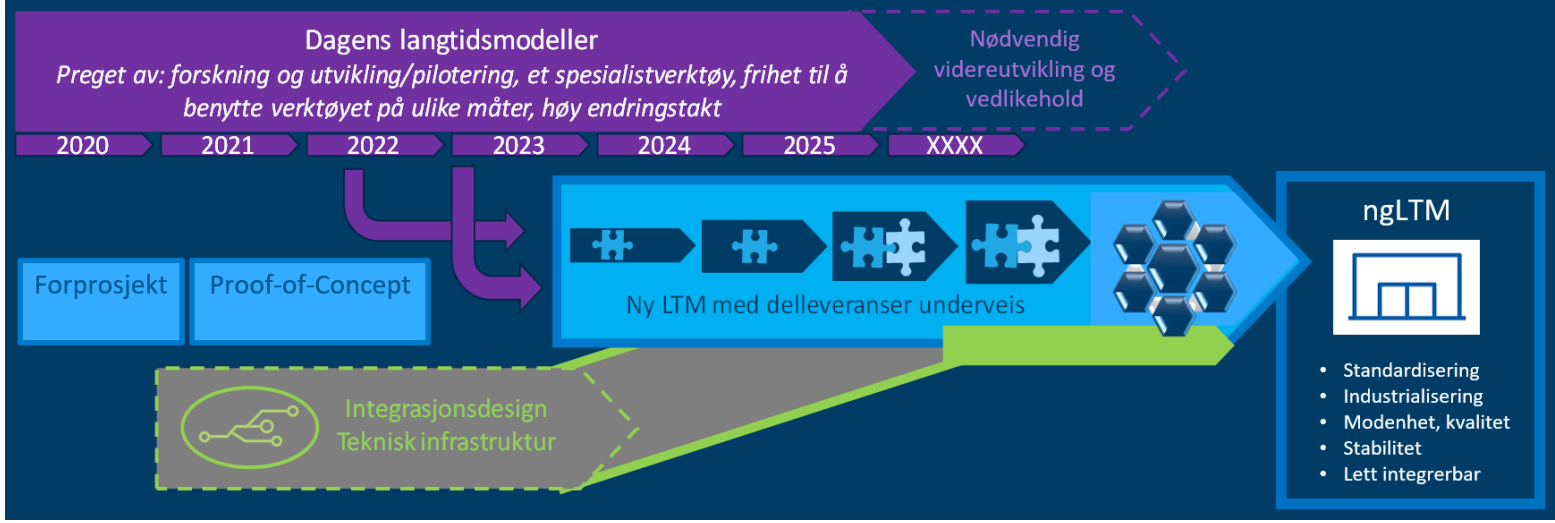


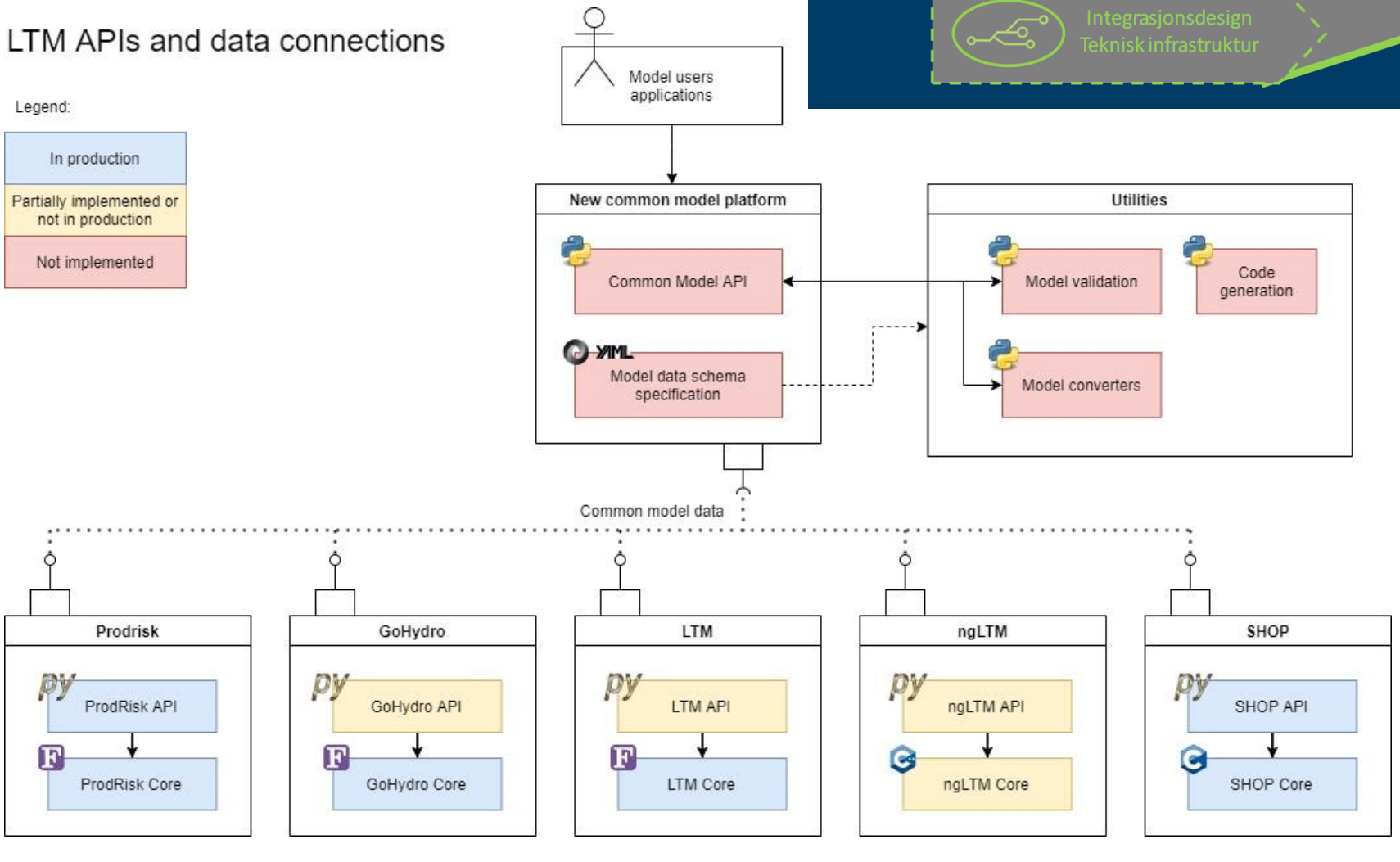
Model platform

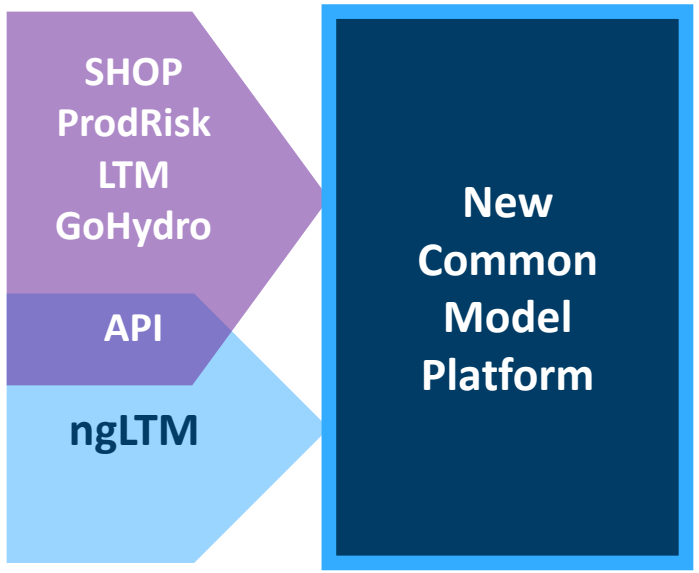
Customer 1	Customer 2	Customer 3	Customer 4	Customer 5	Customer 6
Module 1	Module 1	Module 1	Module 1	Module 1	Module 1
Module 2	Module 2	Module 2	Module 2	Module 2	Module 2
Module 3	Module 3	Module 3	Module 3	Module 3	Module 3
Module 4	Module 5	Module 5		Module 4	



Common framework







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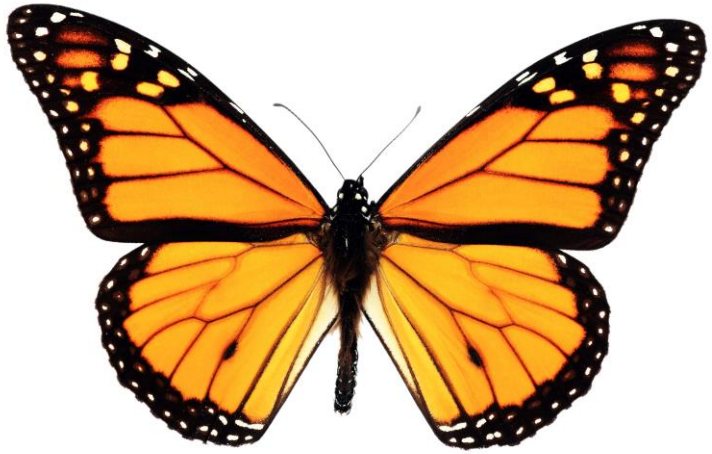
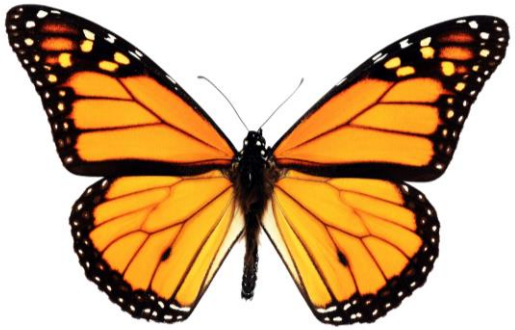
Model platform financing





- Based on increased user ambitions
- In addition to normal index adjustments
- Scaled with average yearly TWh production

SHOP team at SINTEF

Management

Hans Ivar Skjelbred

Hans Christian Bolstad

Eline Opdalshei

Research

Christian Øyn Naversen

Jiehong Kong

Per Aaslid

Bjørnar Fjelldal

Kristine Schüller

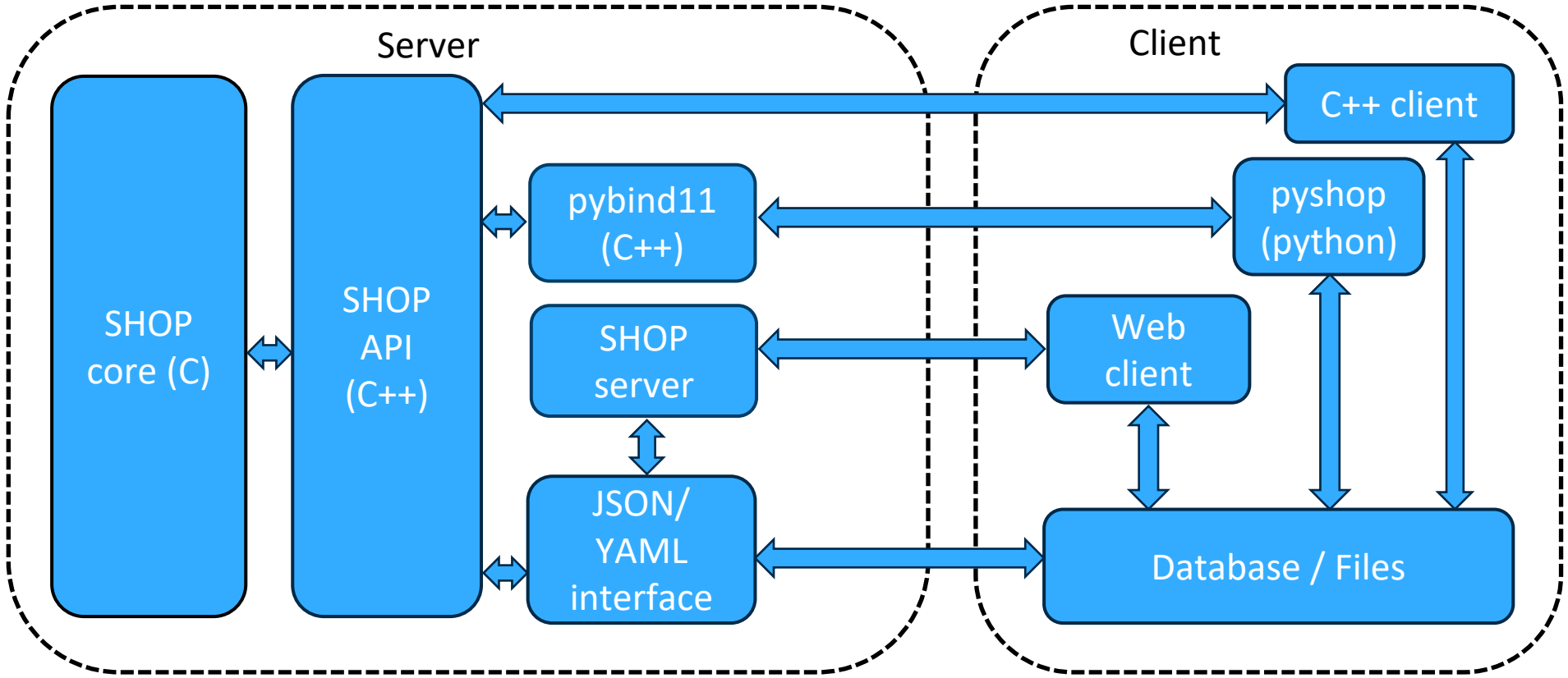
Development

Jonatan Lund

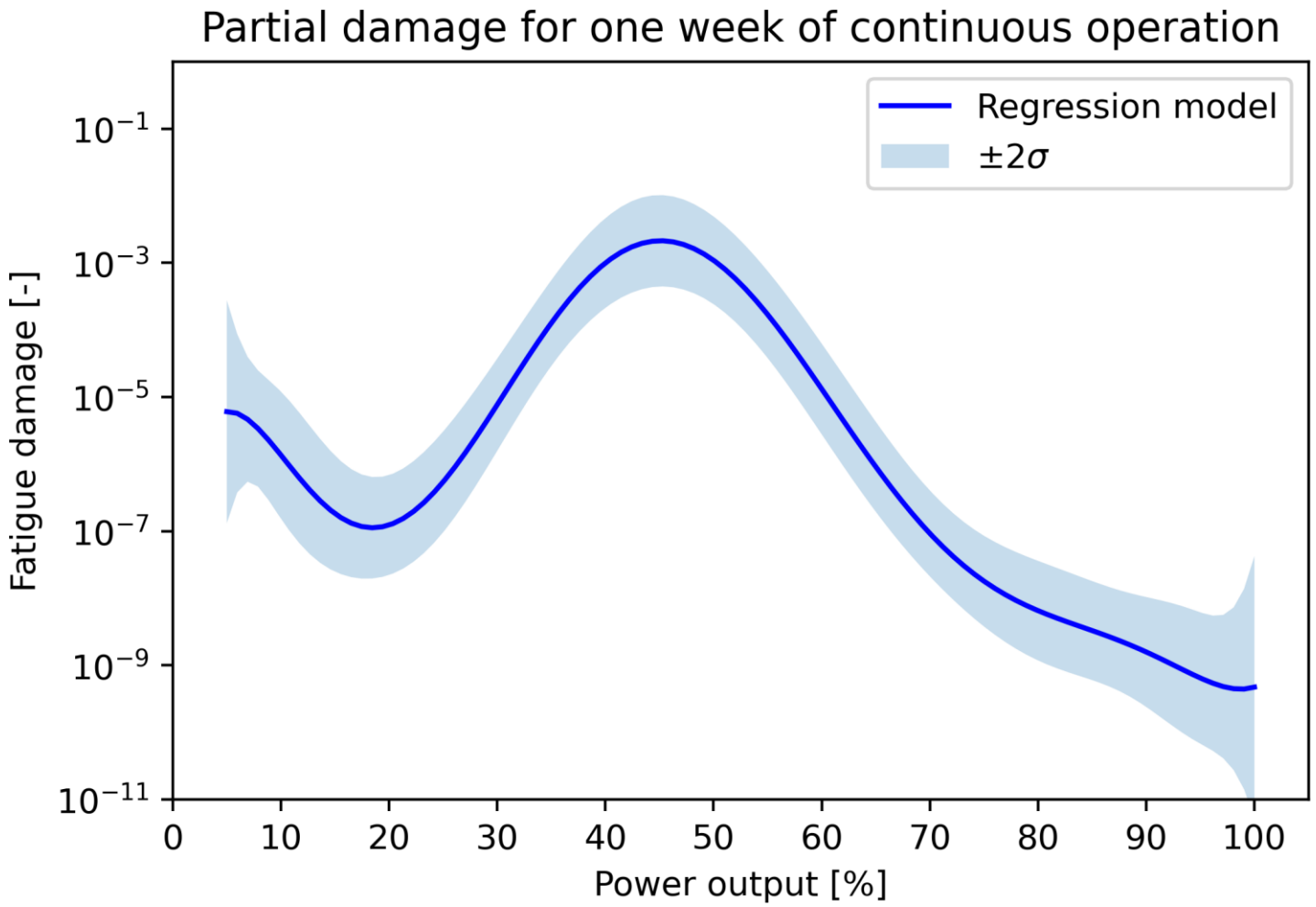
Kent Fagerjord

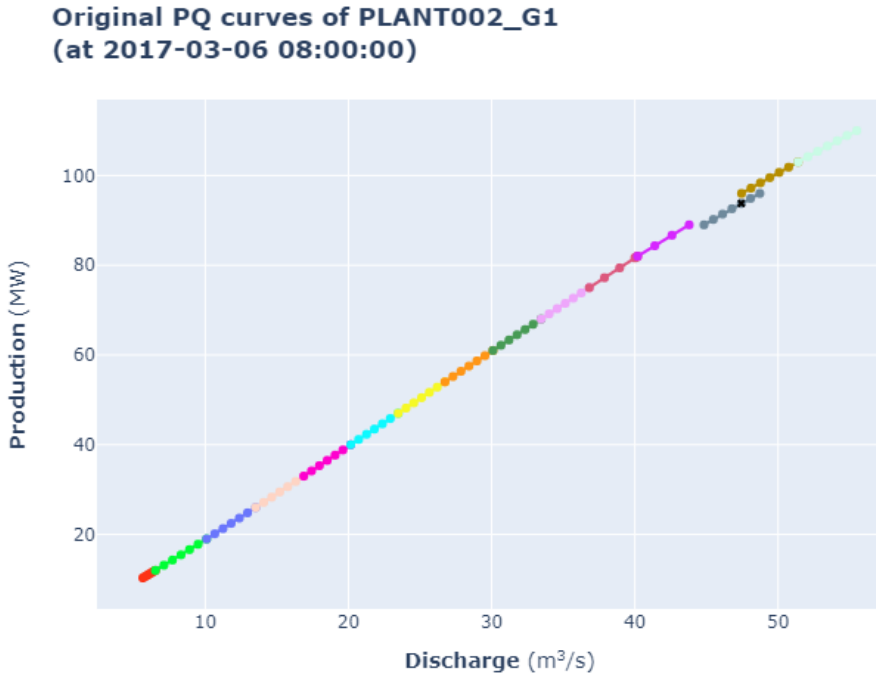
News in SHOP 15.5

- All input to SHOP Core uses low-level API
  - Moved ASCII parsing outside SHOP Core (15.3)
  - Multiprocessing in REST API
  - Unified handling of YAML and JSON
- First version of min up-/downtime for generators
- Improved handling of warnings/errors

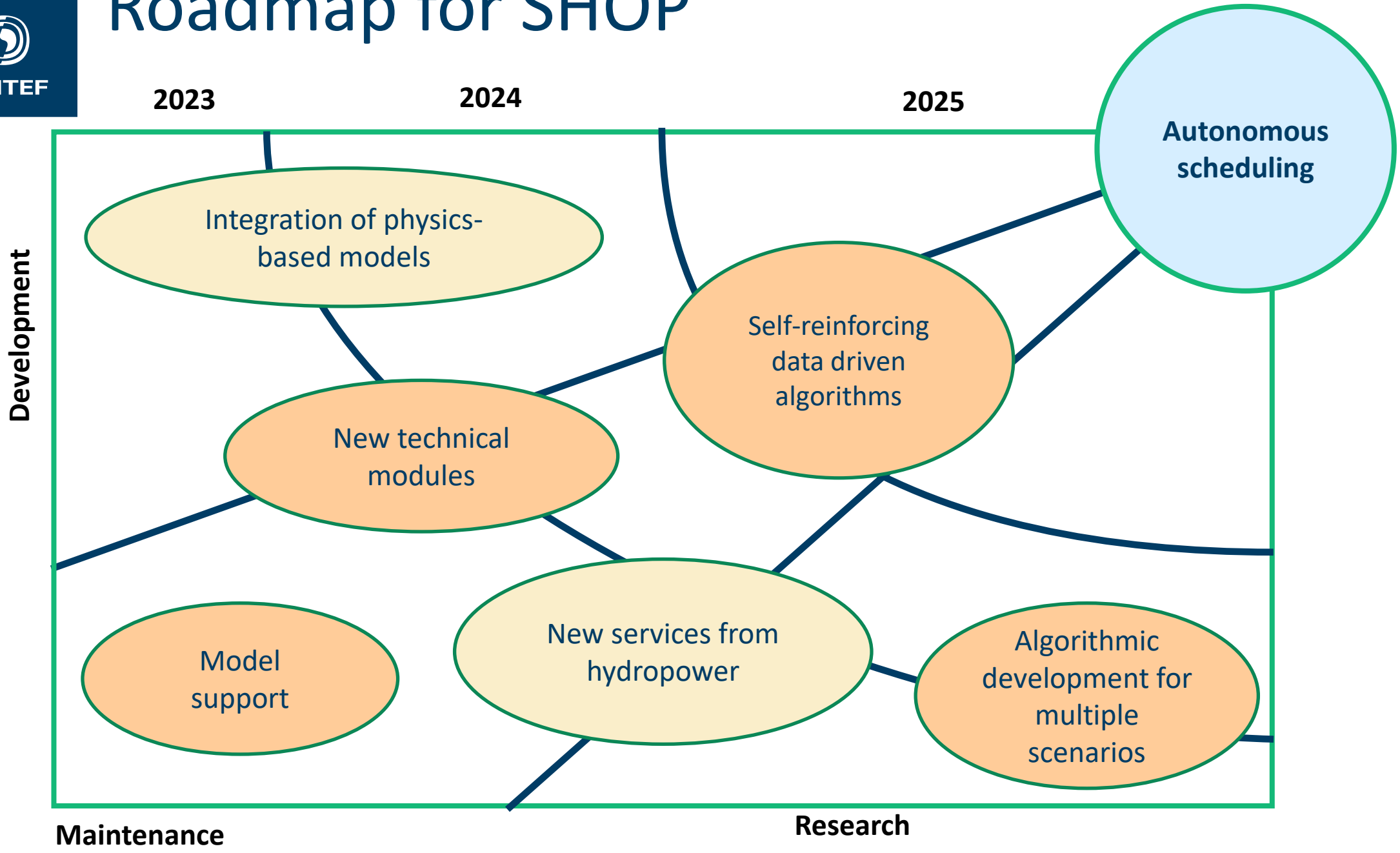


Correct pricing of reserves

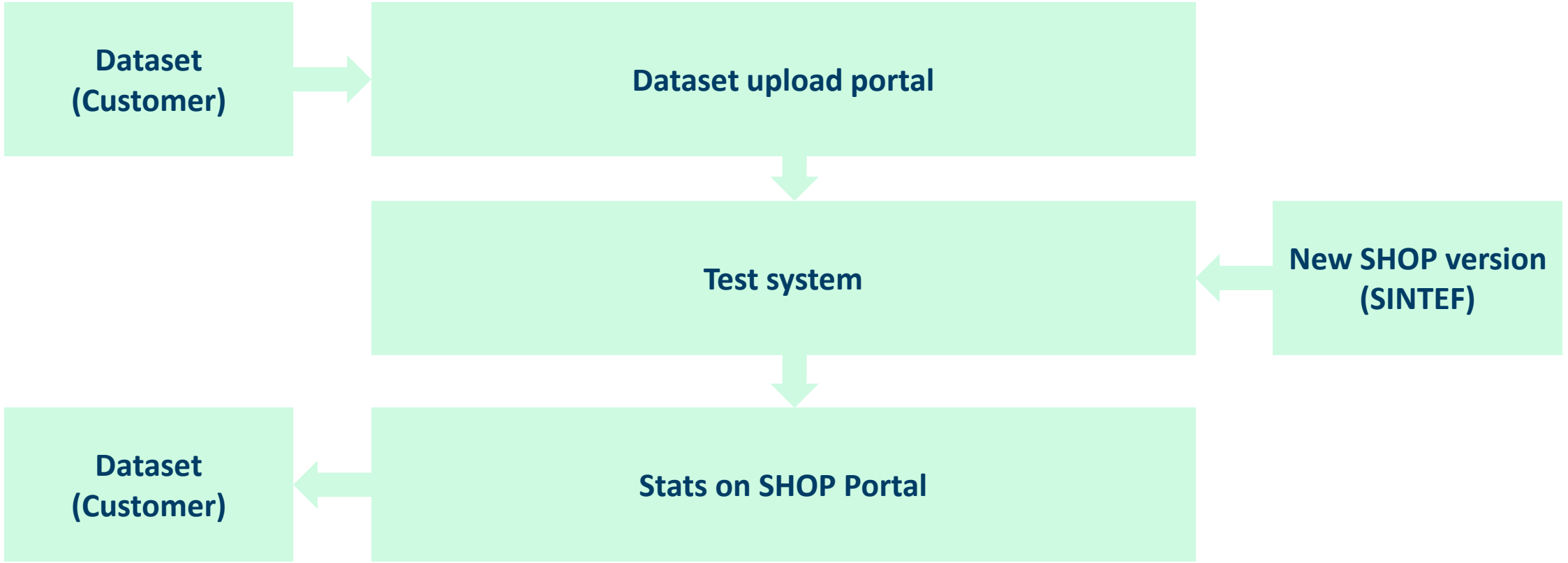




Roadmap for SHOP

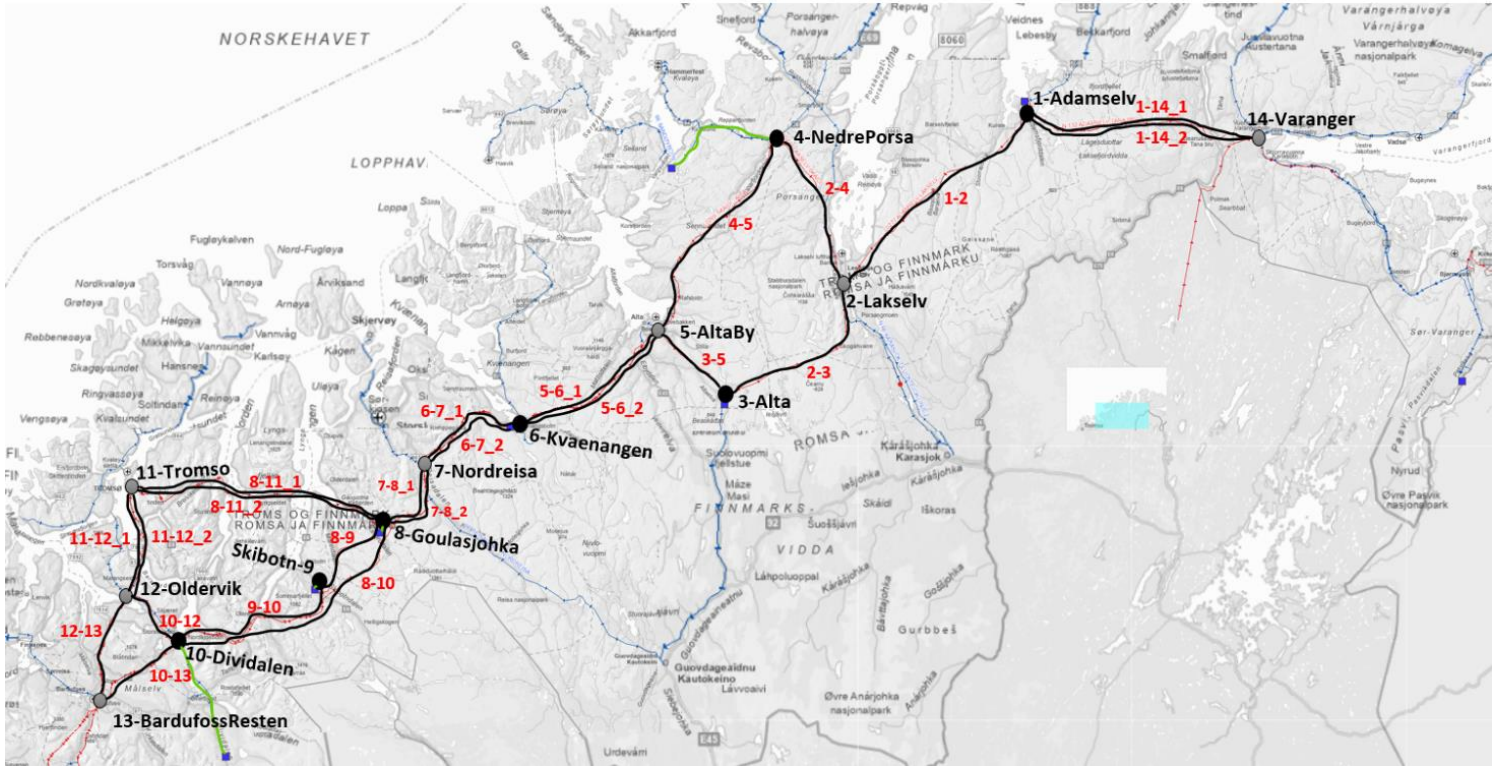


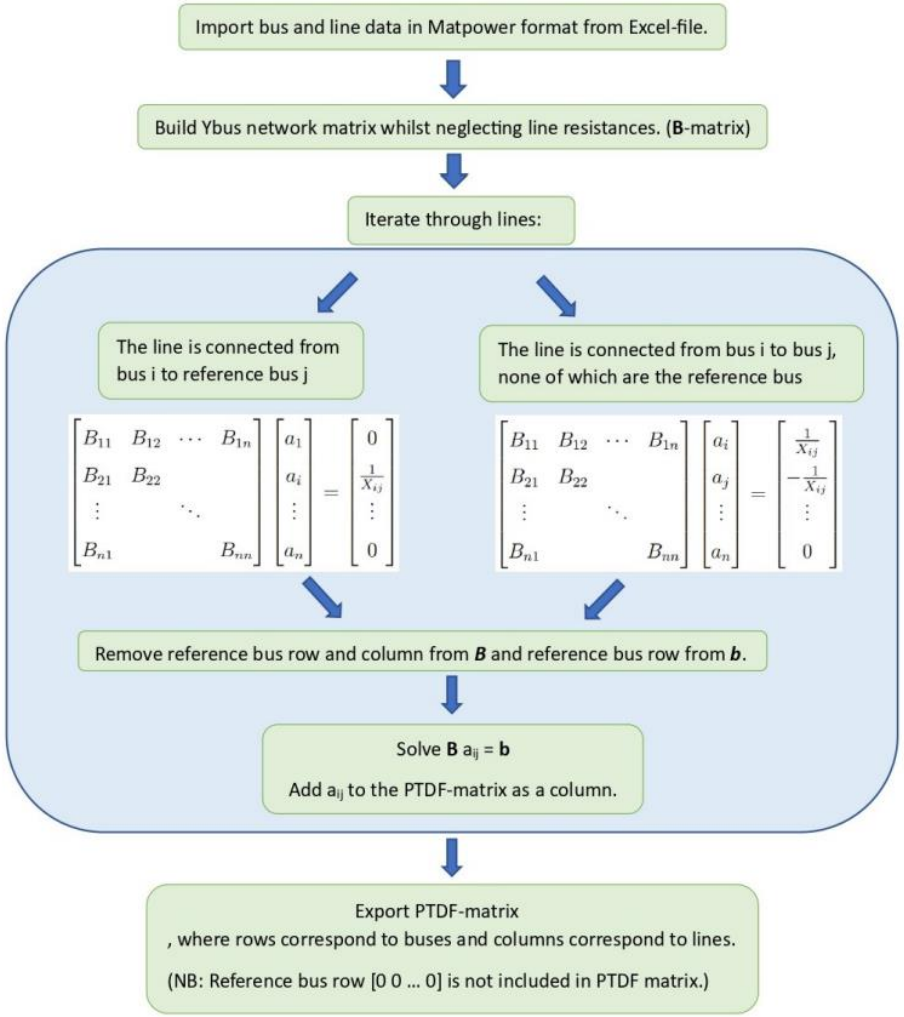
User datasets in test system for SHOP



Master NTNU via vLab

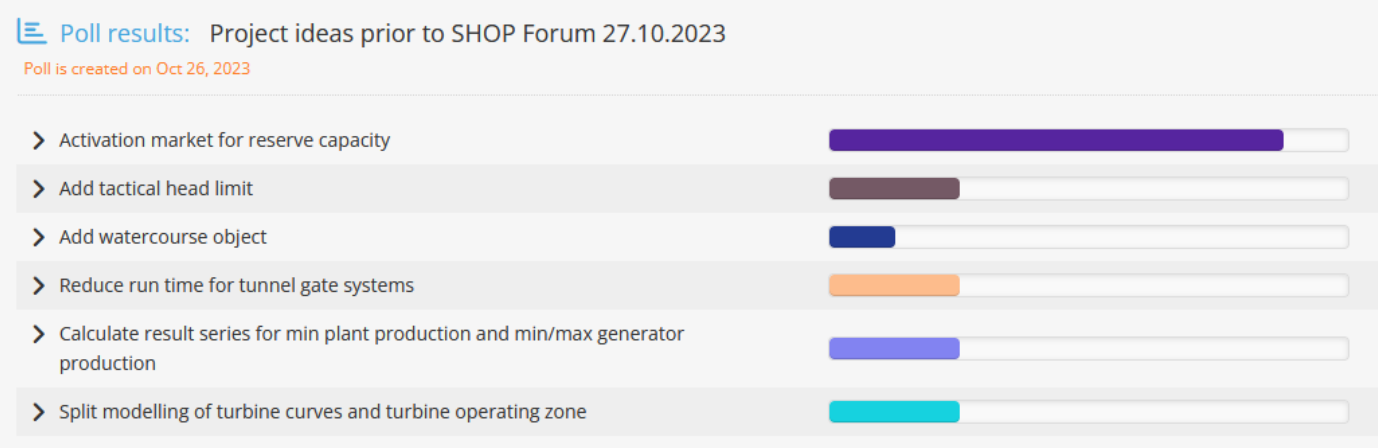
- Integration of Power Transfer Distribution Factors and Internal Grid Constraints in Short-Term Hydropower Scheduling, June 2023, (Forbord, Sivert; Sølberg, Håkon)
- Supervisor Olaf Fosso + Per Aaslid/Hans Ivar Skjelbred





SHOP Roadmap 2024

- Split modelling of turbine curves and turbine operating zone
- Activation market for reserve capacity
- Add tactical head limit
- Add watercourse object
- Reduce run time for tunnel gate systems
- Calculate result series for min plant production and min/max generator production



Unlimited - Unlinking discharge limits from turbine efficiency data

Hydropower Production function:

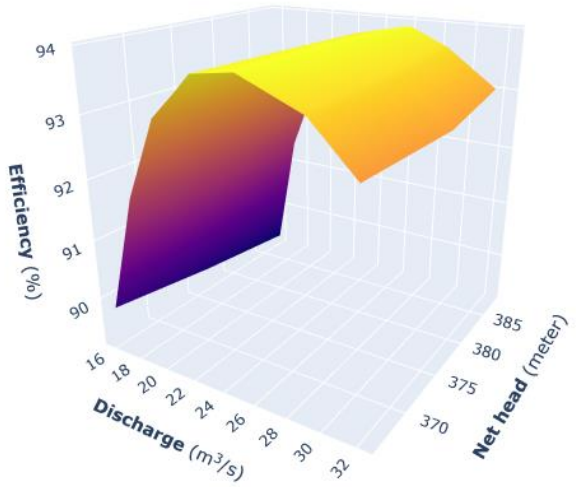
$$p_{i,s,t} = G \cdot \eta_{i,s}^{GEN}(p_{i,s,t}) \cdot \eta_{i,s}^{TURB}(h_{i,s,t}^{NET}, q_{i,s,t}) \cdot h_{i,s,t}^{NET} \cdot q_{i,s,t}$$

Subject to head-dependent discharge limit:

$$Q_{i,s,t}^{MIN}(h_{i,s,t}^{NET}) \cdot \omega_{i,s,t} \leq q_{i,s,t} \leq Q_{i,s,t}^{MAX}(h_{i,s,t}^{NET}) \cdot \omega_{i,s,t}$$
$$\forall i \in I_s, s \in S, t \in T.$$

GENERATOR	min_discharge	PLANT004	4
# id	number	ref	npkt
0	1	0.	3
# x	y		
366	15.80		
377	15.90		
388	15.85		

GENERATOR	max_discharge	PLANT004	4
# id	number	ref	npkt
0	1	377.	3
# x	y		
366	31.20		
377	30.80		
388	30.65		

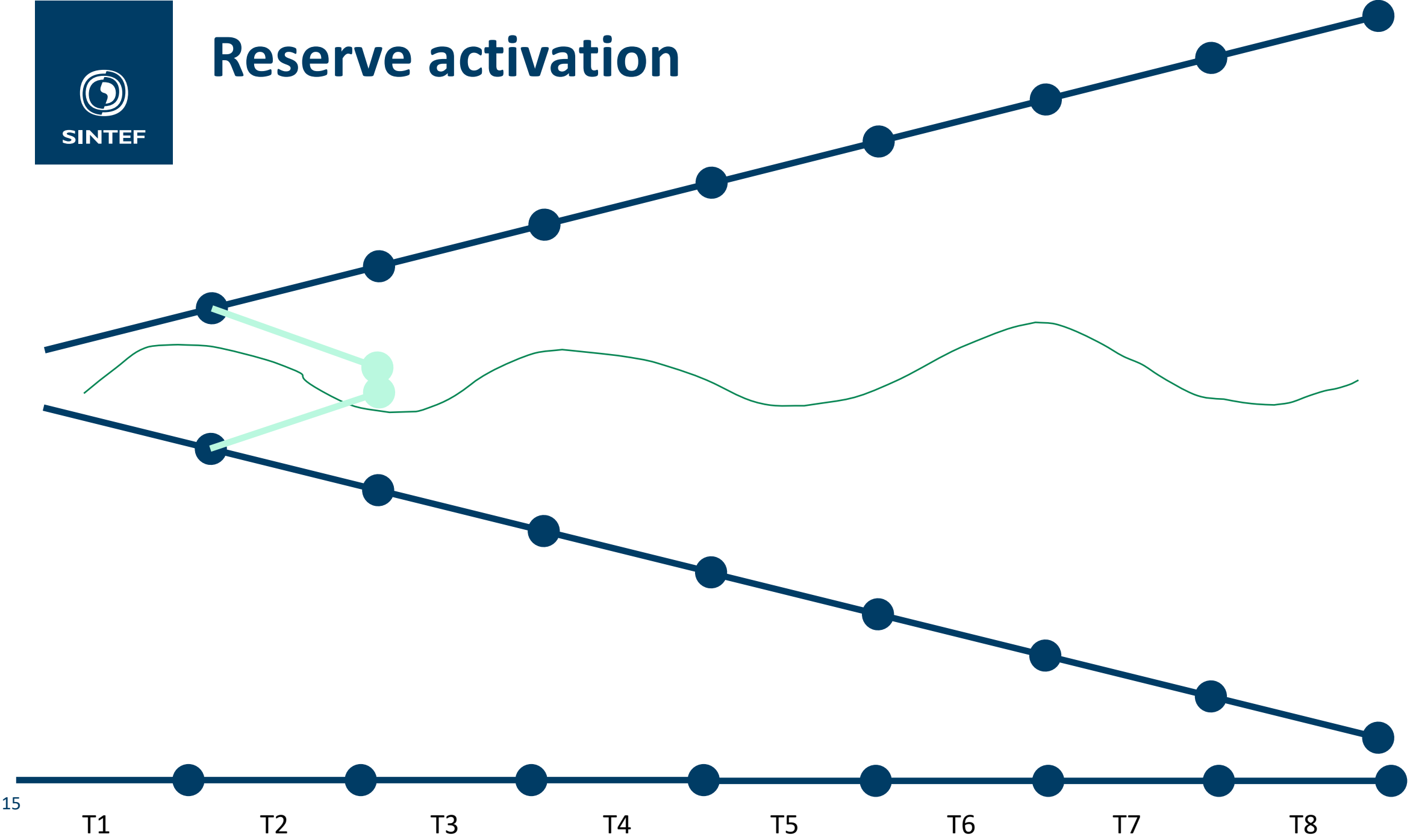


GENERATOR	turb_eff_curves	PLANT004	4		
# id	number	ref	npkt	x_unit	y_unit
0	1	366.	8	m3/s	%
# x	y				
15.72	89.80				
17.74	91.80				
19.79	93.10				
21.32	93.60				
22.40	93.80				
25.04	93.90				
28.87	93.50				
31.58	92.80				

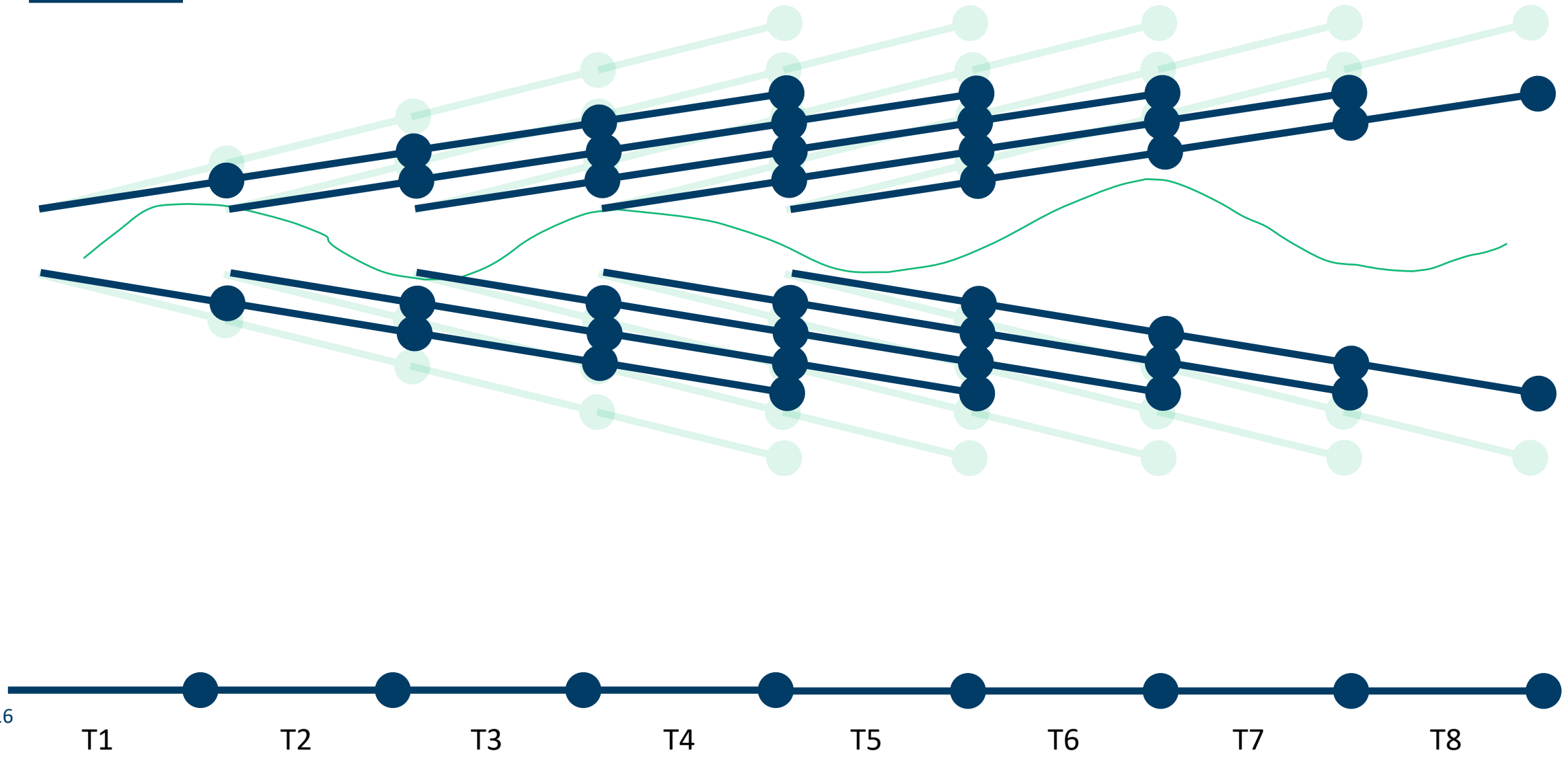
GENERATOR	turb_eff_curves	PLANT004	4		
# id	number	ref	npkt	x_unit	y_unit
0	1	377.	8	m3/s	%
# x	y				
15.69	89.50				
17.70	91.60				
19.77	92.95				
21.38	93.55				
22.48	93.77				
25.04	93.90				
28.89	93.55				
32.34	92.90				

GENERATOR	turb_eff_curves	PLANT004	4		
# id	number	ref	npkt	x_unit	y_unit
0	1	388.	8	m3/s	%
# x	y				
15.83	89.30				
17.23	91.40				
19.48	93.00				
21.90	93.50				
22.23	93.70				
25.90	93.90				
28.49	93.60				
31.67	93.00				

Reserve activation



Activation factor and activation time



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