



Le réseau
de transport
d'électricité

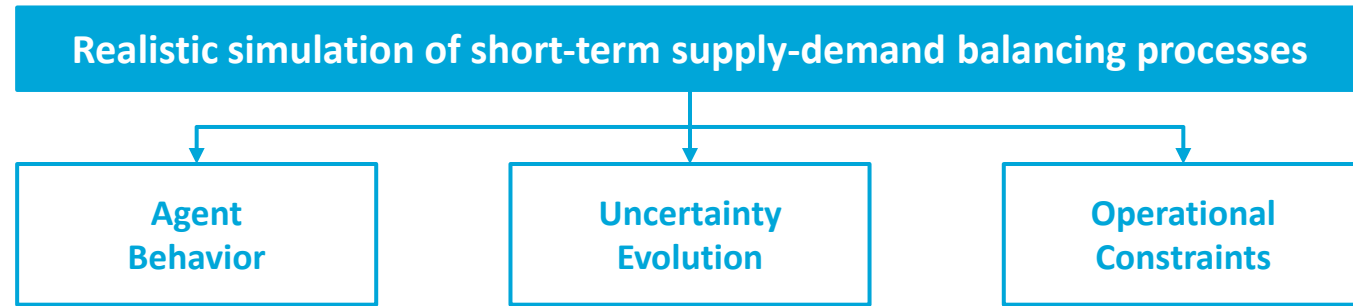
ATLAS: A Model of Short-term European Electricity Market Processes under Uncertainty

March 27, 2024

Emily Little

RTE R&D

ATLAS: A complementary vision to perfect foresight central dispatch models



ATLAS: A complementary vision to perfect foresight central dispatch models

Realistic simulation of short-term supply-demand balancing processes

Agent Behavior

- Market Area
- Portfolio
- Control Block



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Realistic simulation of short-term supply-demand balancing processes

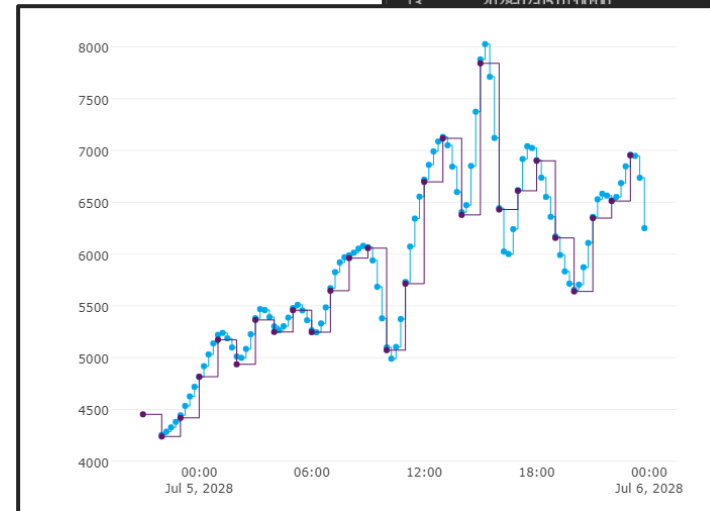
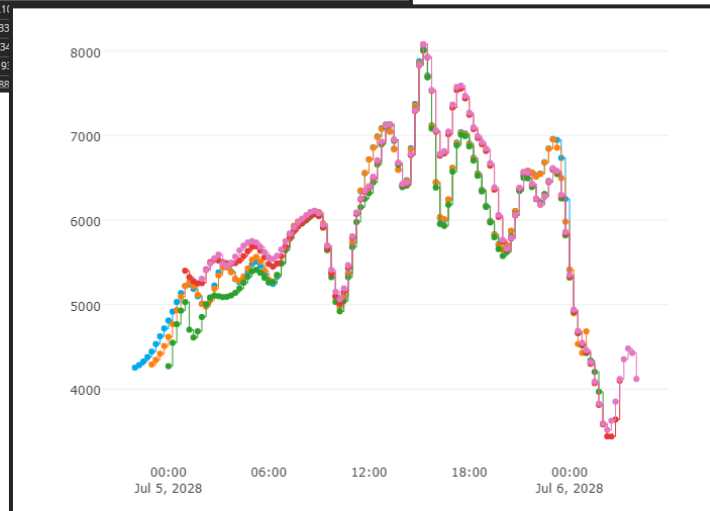
#	Timestamp	C1	C2	C3	C4	C5
0	2028-07-04 21:00:00	0	0	0	0	0
1	2028-07-04 22:00:00	4255	0	0	0	0
2	2028-07-04 22:15:00	4285.375	0	0	0	0
3	2028-07-04 22:30:00	4327	0	0	0	0
4	2028-07-04 22:45:00	4379.875	0	0	0	0
5	2028-07-04 23:00:00	4444	4292	0	0	0
6	2028-07-04 23:15:00	4534.328125	4347.53125	0	0	0
7	2028-07-04 23:30:00	4625.625	4420.375	0	0	0
8	2028-07-04 23:45:00	4718.359375	4510.53125	0	0	0
9	2028-07-05 00:00:00	4813	4618	4272	0	0
10	2028-07-05 00:15:00	4918.03125	4770.2734375	4549.5	0	0
11	2028-07-05 00:30:00	5031.25	4935.8125	4768.5	0	0
12	2028-07-05 00:45:00	5137.09375	5093.1953125	4929	0	0
13	2028-07-05 01:00:00	5220	5221	5031	5401	0
14	2028-07-05 01:15:00	5238.73046875	5265.70703125	4703.70703125	5325.78125	0
15	2028-07-05 01:30:00	5186.28125	5216.59375	4611.46875	5276.375	0
16	2028-07-05 01:45:00	5098.44140625	5116.43359375	4684.74609375	5252.78125	0
17	2028-07-05 02:00:00	5011	5008	4854	5255	0
18	2028-07-05 02:15:00	4998.634765625	4977.080078125	5004.908203125	5416.953125	0
19	2028-07-05 02:30:00	5084.171875	5052.11	5052.11	5416.953125	0
20	2028-07-05 02:45:00	5225.623046875	5189.833	5189.833	5416.953125	0
21	2028-07-05 03:00:00	5381	534	534	5416.953125	0
22	2028-07-05 03:15:00	5468.5615234375	5440.318	5440.318	5416.953125	0
23	2028-07-05 03:30:00	5459.5703125	5439.88	5439.88	5416.953125	0

Uncertainty Evolution

Different forecast horizons

Different time granularity

#	Timestamp	C1	C2
0	2028-07-04 21:00:00	4453	0
1	2028-07-04 22:00:00	4239	4255
2	2028-07-04 22:15:00	4239	4285.375
3	2028-07-04 22:30:00	4239	4327
4	2028-07-04 22:45:00	4239	4379.875
5	2028-07-04 23:00:00	4419	4444
6	2028-07-04 23:15:00	4419	4534.328125
7	2028-07-04 23:30:00	4419	4625.625
8	2028-07-04 23:45:00	4419	4718.359375
9	2028-07-05 00:00:00	4816	4813
10	2028-07-05 00:15:00	4816	4918.03125
11	2028-07-05 00:30:00	4816	5031.25
12	2028-07-05 00:45:00	4816	5137.09375
13	2028-07-05 01:00:00	5173	5220
14	2028-07-05 01:15:00	5173	5238.73046875
15	2028-07-05 01:30:00	5173	5186.28125
16	2028-07-05 01:45:00	5173	5098.44140625
17	2028-07-05 02:00:00	4936	5011
18	2028-07-05 02:15:00	4936	4998.634765625
19	2028-07-05 02:30:00	4936	5084.171875
20	2028-07-05 02:45:00	4936	5225.623046875
21	2028-07-05 03:00:00	5364	5381
22	2028-07-05 03:15:00	5364	5468.5615234375
23	2028-07-05 03:30:00	5364	5459.5703125
24	2028-07-05 03:45:00	5364	5391.5439453125
25	2028-07-05 04:00:00	5248	5302
26	2028-07-05 04:15:00	5248	5264.18798828125
27	2028-07-05 04:30:00	5248	5303.71484375



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Realistic simulation of short-term supply-demand balancing processes

Operational Constraints

Unit technical constraints

Economic Constraints(2)

1. Cover the variable costs
2. Cover the start-up costs (if started up)

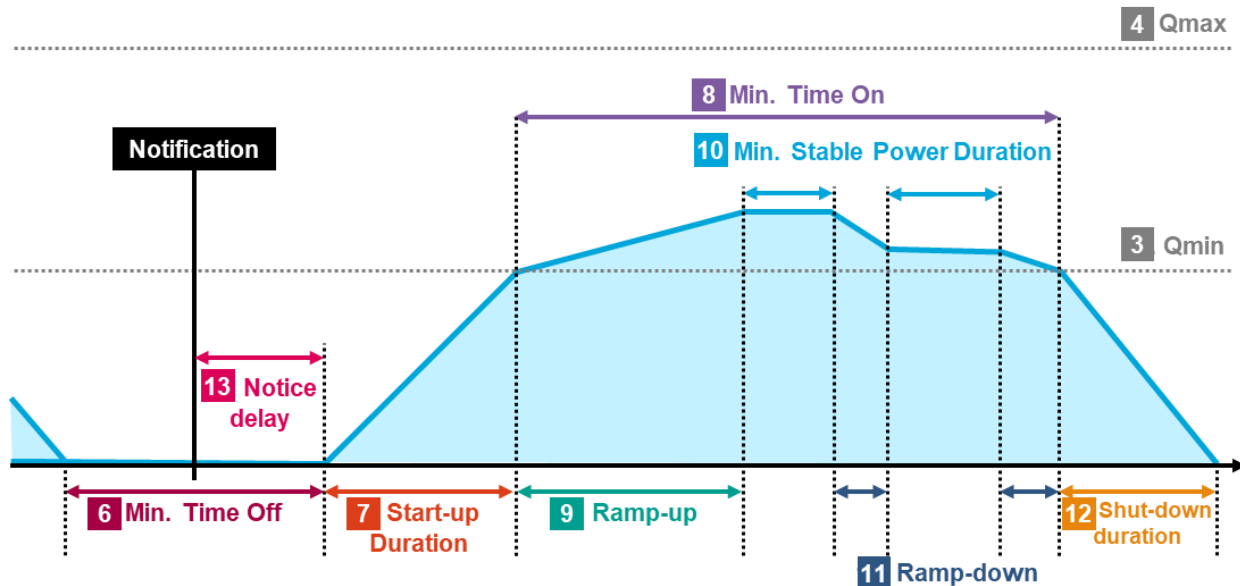
Static technical constraints (3)

3. Respect the minimum power at all time steps*
4. Respect the maximum power at all time steps
5. Respect any previously procured reserve requirements

Dynamic technical constraints (7)

6. Respect the minimum time off duration
7. Respect the start-up duration
8. Respect the minimum time on
9. Respect the ramp-up limits*
10. Respect the minimum stable power duration
11. Respect the ramp-down limits*
12. Respect the shut-down duration
13. Respect the necessary notice delay

*Unless in a start-up or shut-down period



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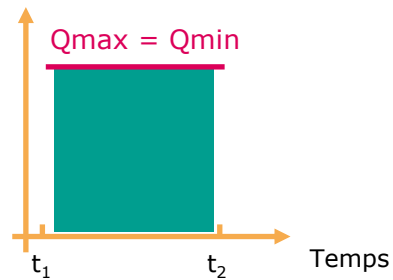
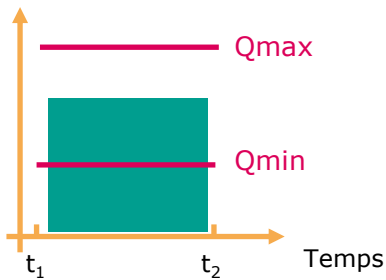
Offer types

Divisible

Indivisible

Volume offre

Volume offre



Operational Constraints

Process constraints

Offer coupling types

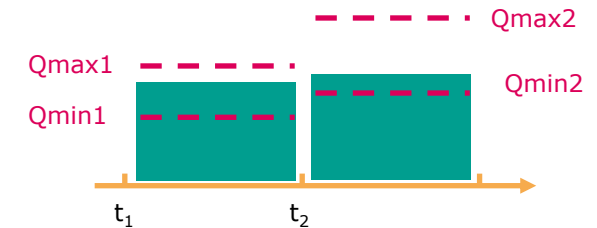
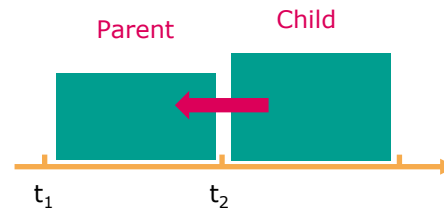
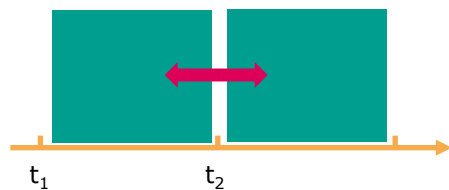
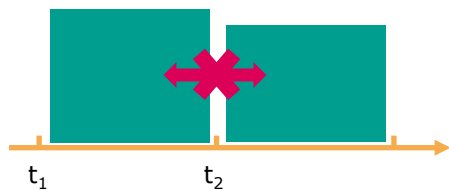
Exclusion

Identical Volume

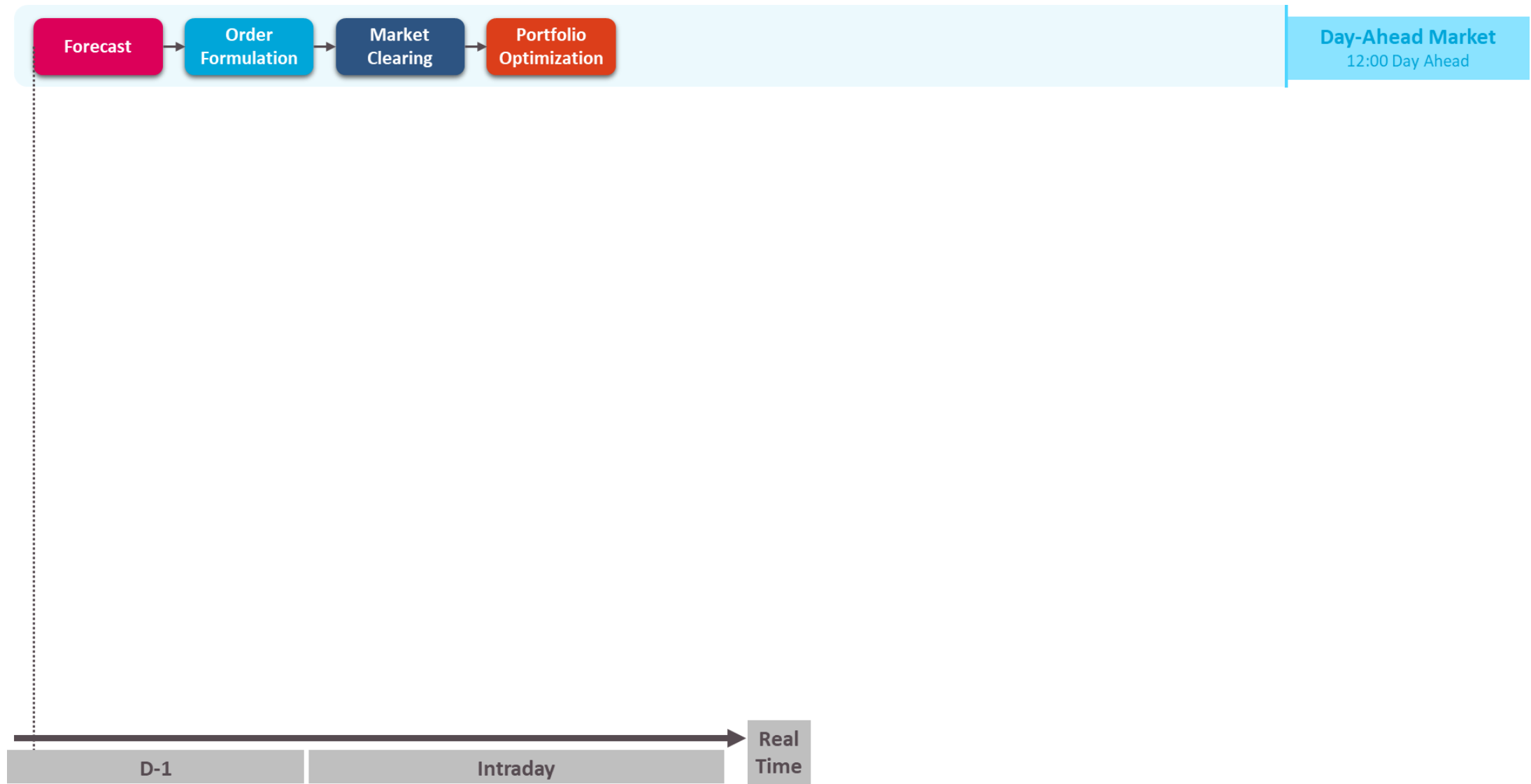
Parent Children

Complement

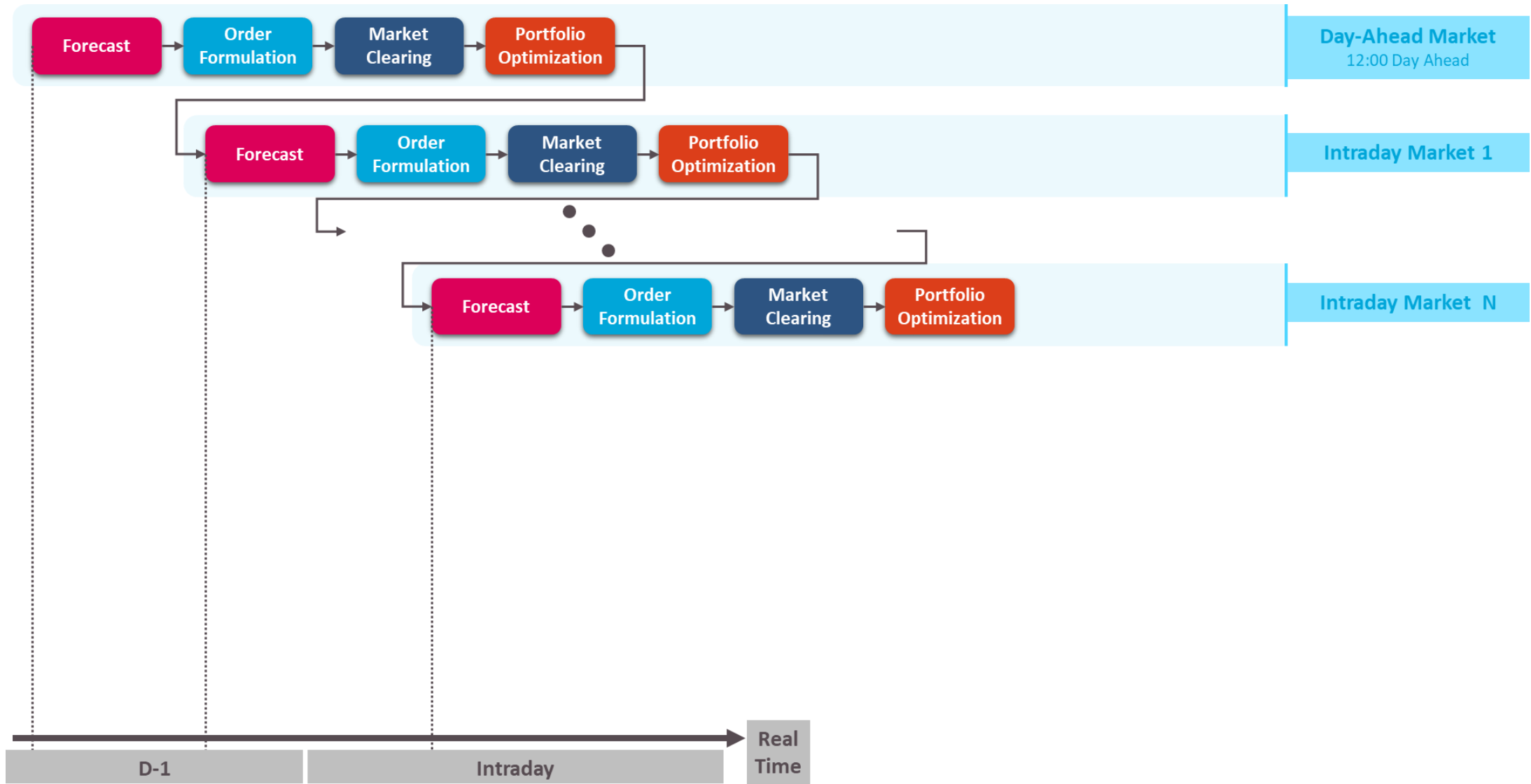
$$\frac{q_1}{q_{max_1}} + \frac{q_2}{q_{max_2}} \leq 1$$



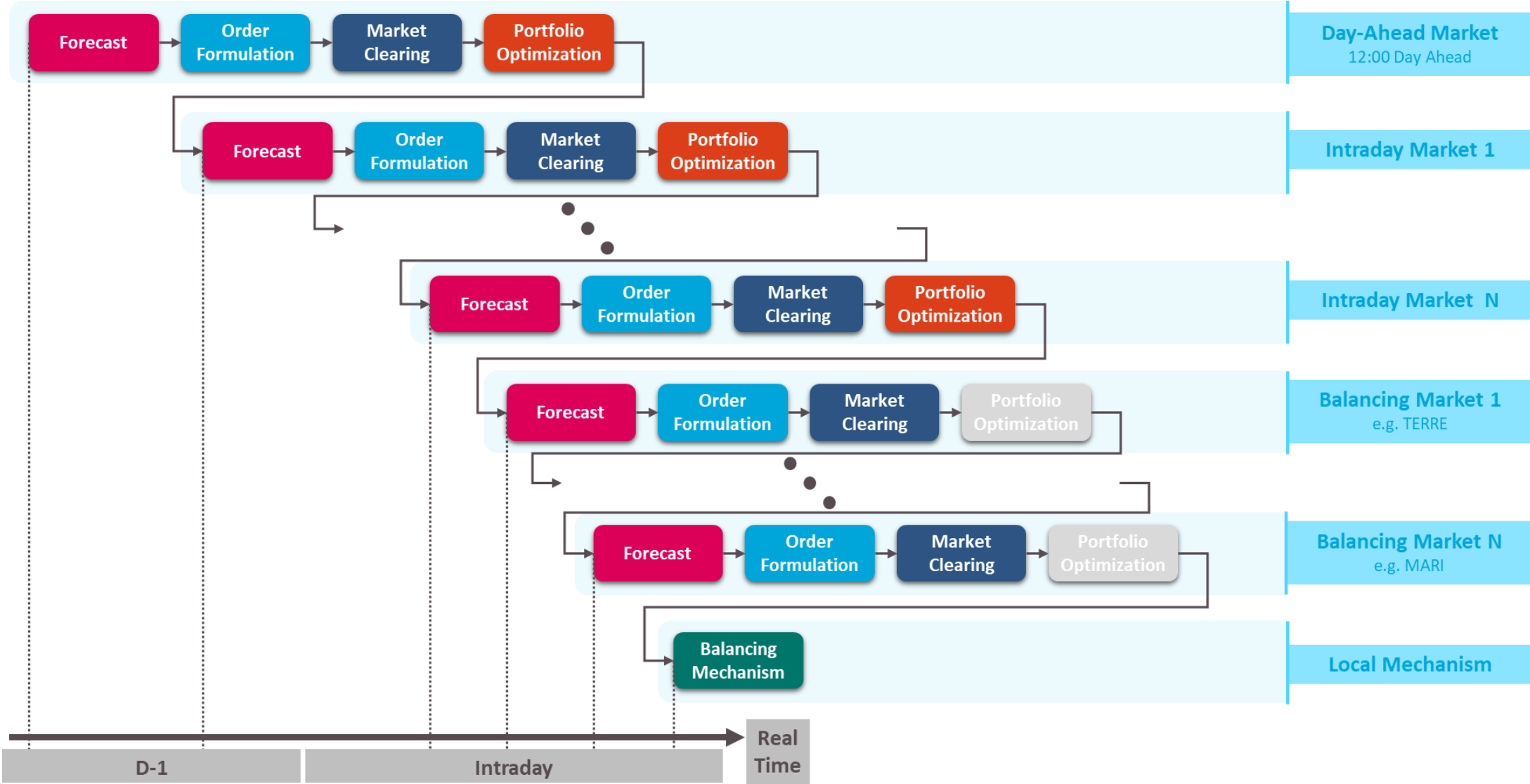
Chain of ATLAS modules



Chain of ATLAS modules



Chain of ATLAS modules





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de transport
d'électricité

Thanks!

More info on ATLAS :

ATLAS: A Model of Short-Term European Electricity Market Processes under Uncertainty

Little, Emily, Florent Cogen, Quentin Bustarret, Virginie Dussartre, Maxime Lâasri, Gabriel Kasmi, Marie Girod, Frederic Bienvenu, Maxime Fortin, and Jean-Yves Bourmaud. <http://arxiv.org/abs/2402.12848>.

ATLAS: A Model of Short-Term European Electricity Market Processes under Uncertainty – Balancing Modules

Cogen, Florent, Emily Little, Virginie Dussartre, and Quentin Bustarret. <https://arxiv.org/abs/2402.12859>