

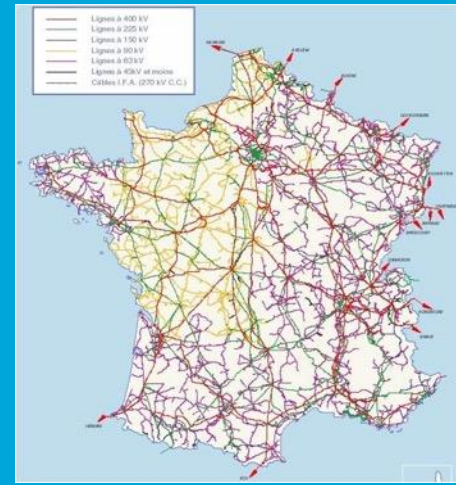


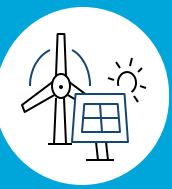
Le réseau
de transport
d'électricité

New Zonal Adaptive Automaton (NAZA) Innovative solutions for system operations at RTE

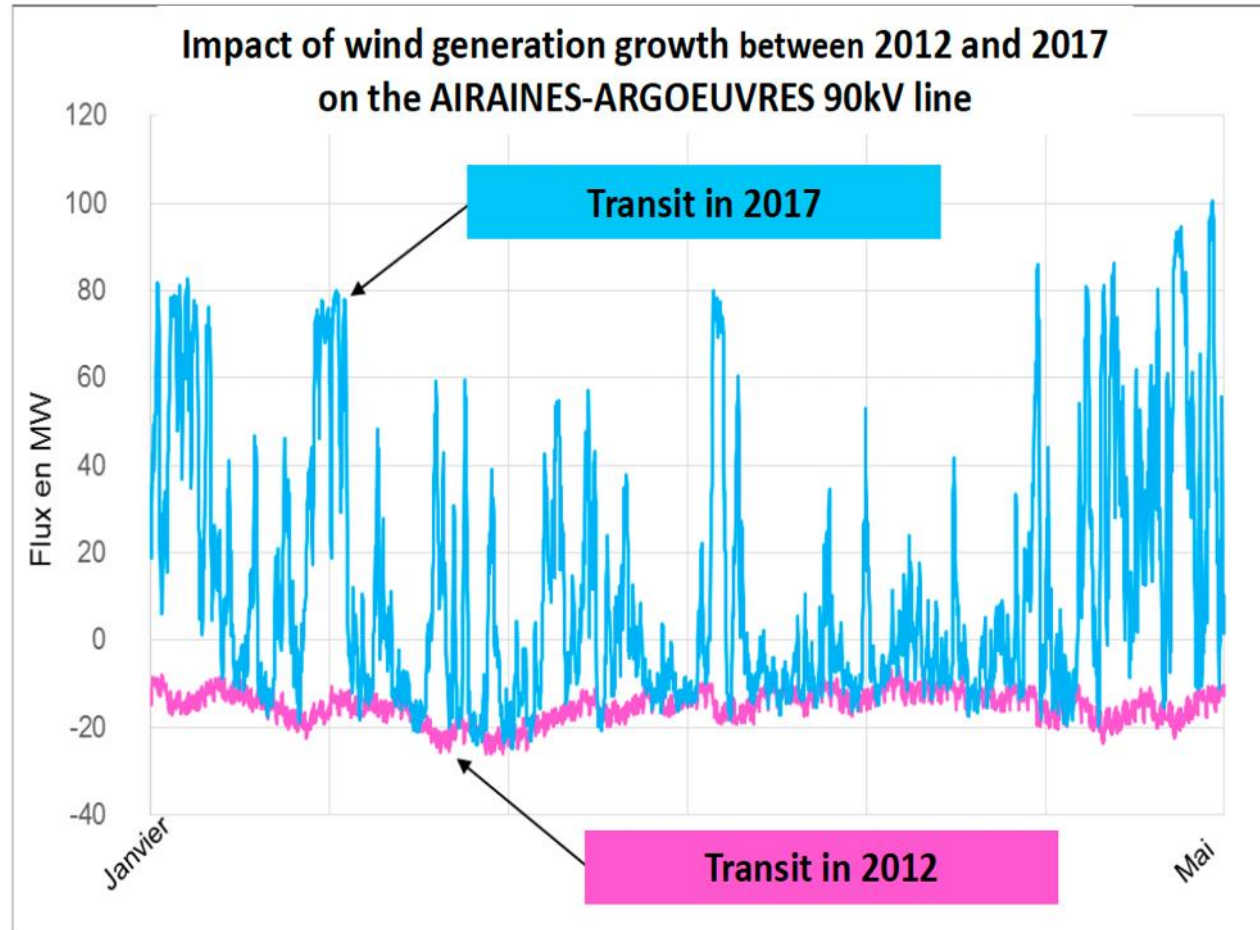
ESIG Technical Workshop Oct 2025

Alexandre Parisot





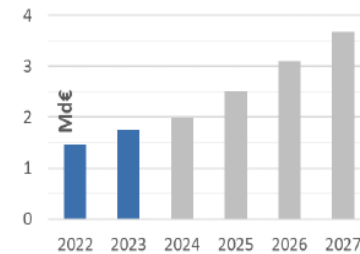
Integrating renewables in subtransmission (63/90 kV)



Renewable energies increase the variability and uncertainty of flows

RTE aims for an optimum cost/quality for the community

Optimal sizing



Strengthening the network

About 1/3 of RTE's investments concern the HTB1 network (less than or equal to 90kV)

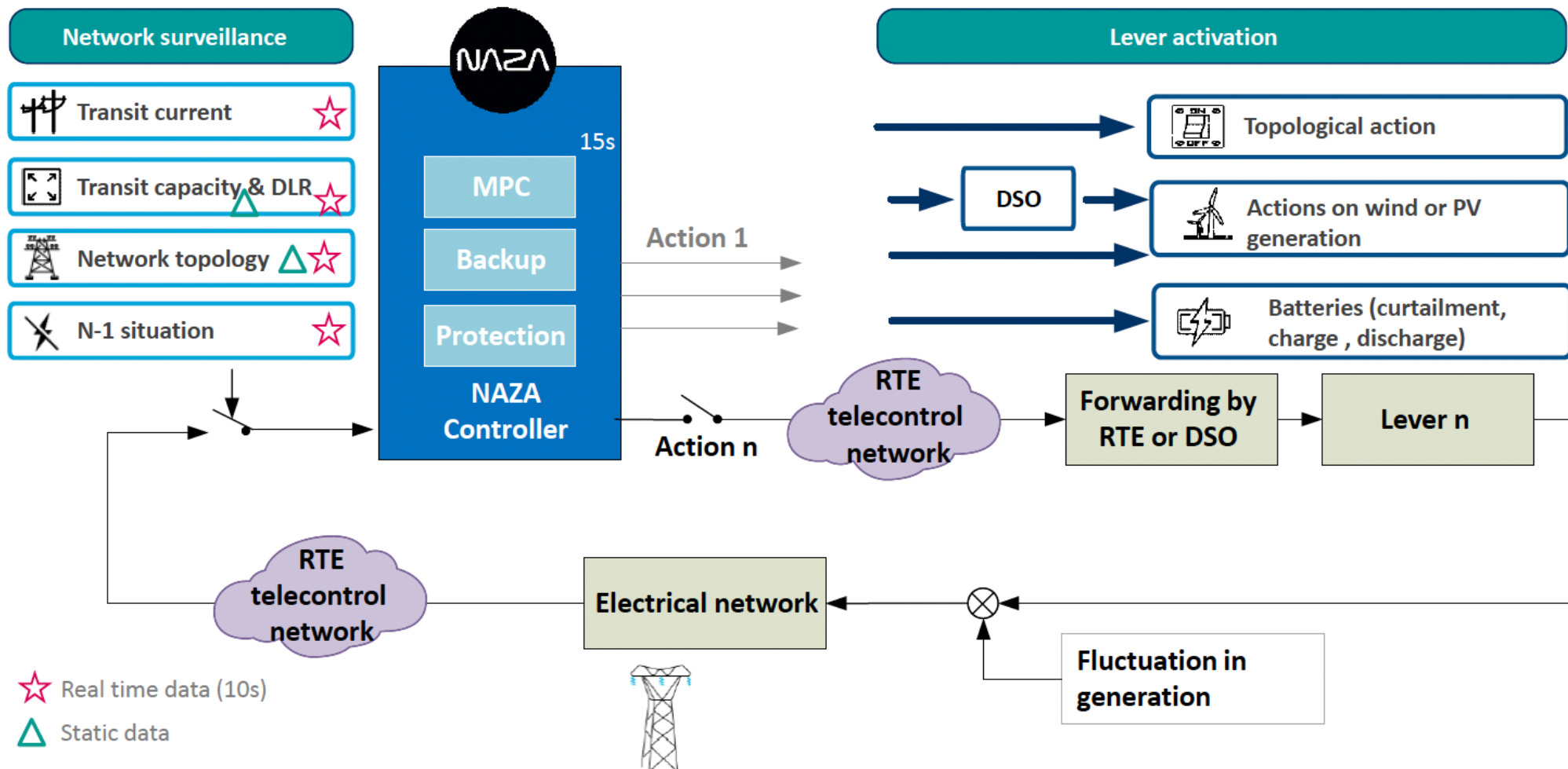


Occasional curtailment of renewable energy production a few hours a year

The network needs generated by the arrival of renewable energies are concentrated on the HTB1 network (< 90 kV)

New automatic controller : zonal & closed loop

NAZA is an innovative software platform with an optimization algorithm (Model Predictive Control) to detect and process transit constraints in a specific zone





Implementation of Model Predictive Control (MPC)

An innovative approach that introduces **predictive control** for real-time network management.

- Supervision line by line is replaced by **management by zone**.
- The meshed network, the changes in topology and the multiplicity of levers do not allow effective remedial actions (flowchart like) to be defined in advance: a **network model** and an **optimization algorithm** are necessary.
- To minimize **margins**, it is necessary to decide at the last moment, depending on the **dynamics of the flows** and **how long** it takes to activate the **levers**.
- Taking these deadlines into account corresponds to the framework of **predictive control**, with a **closed-loop** operation to manage errors.

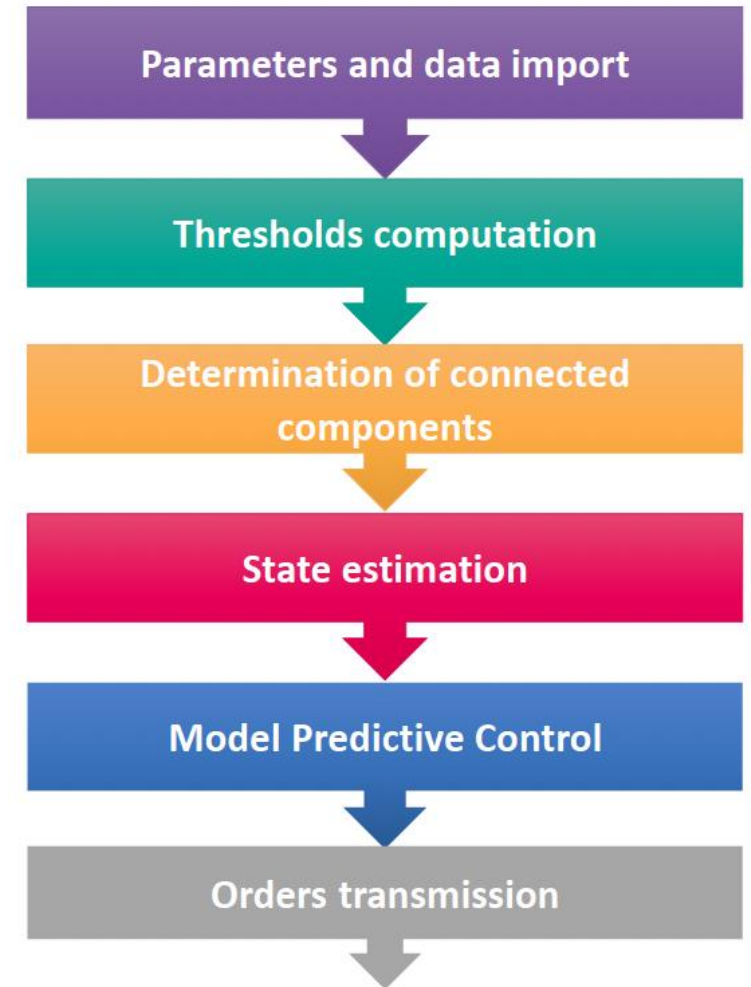
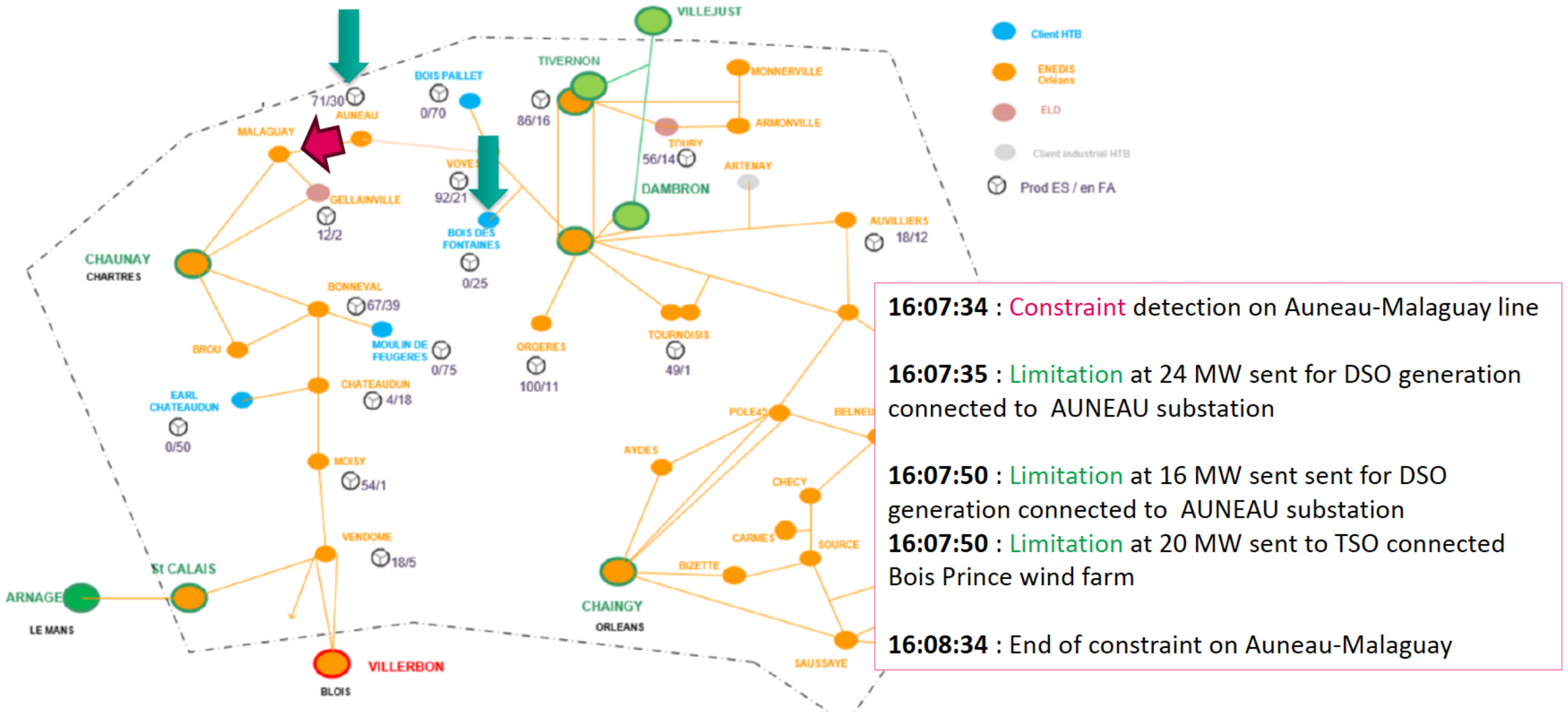


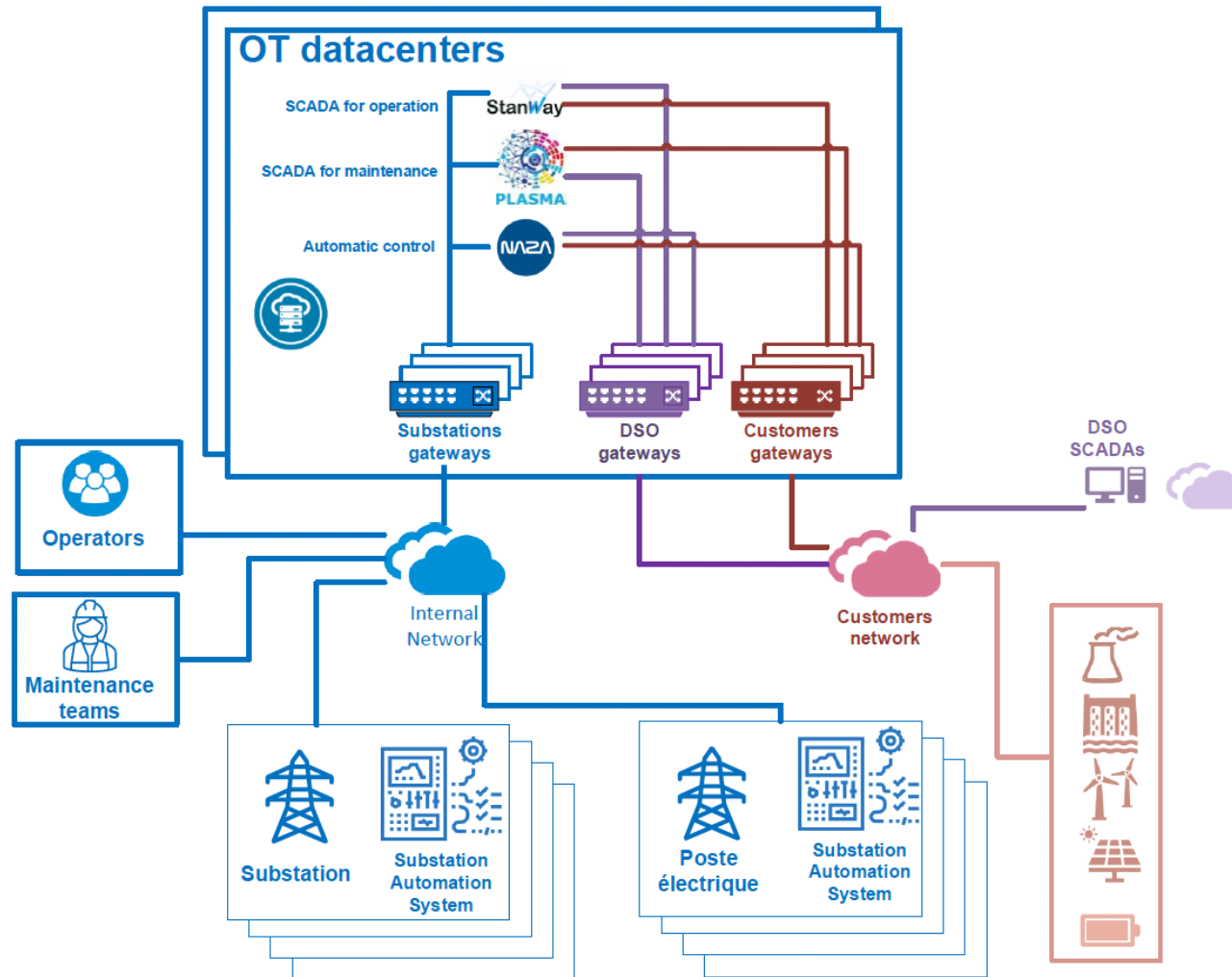


Illustration of actual operation





ICT Implementation and HMI in the control room



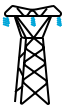
Operation HMI

Operation HMI

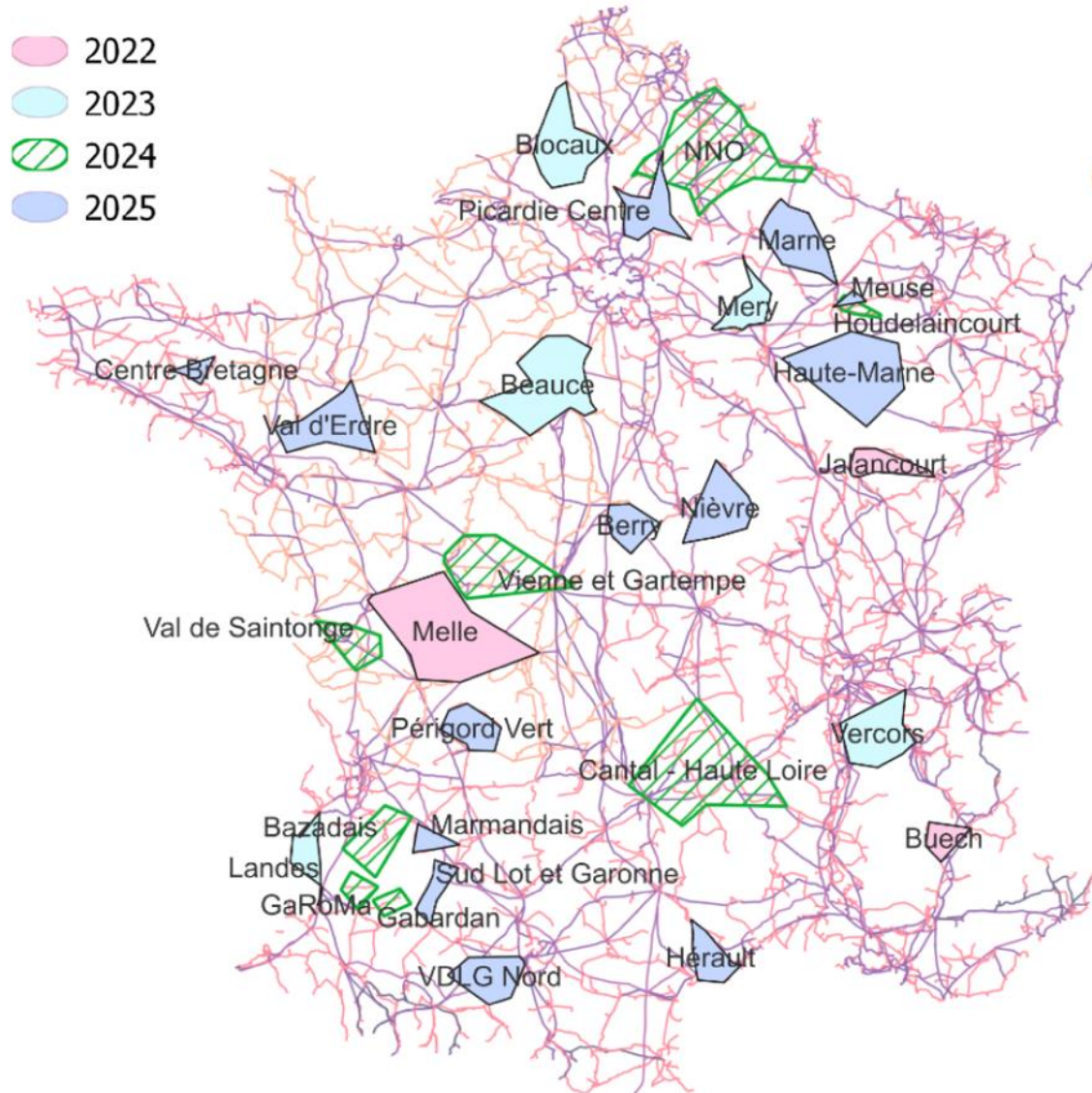
Activations

Généralités		Contexte		Contrainte		Lien	
N...	Z...	Date de début	État	Co...	Ouvrage	Inte...	Type
REX...	MLO...	28-05-2025 11:40:55	N		BELLA41MA...	Non	Écrêtement TVC, Batterie
REX...	MLO...	20-05-2025 12:25:17	N		FLEAC41PA...	Non	Écrêtement TVC
REX...	MLO...	06-05-2025 13:02:48	N		FLEAC41PA...	-	Écrêtement TVC
REX...	MLO...	29-04-2025 11:03:43	N			Non	Écrêtement ASR, Éc...
REX...	MLO...	28-04-2025 12:22:56	N			Non	Écrêtement TVC
REX...	MLO...	25-04-2025 12:22:34	N		CYRAL41ZD...	-	Écrêtement TVC

Post-mortem analysis HMI



New automatic controller : deployment



Generation connected to NAZA in February 2025

Nb of NAZA zones	Nb of lines in the areas	Nb of sub-stations in the areas	Total RES generation in the areas (MW)	Total RES generation connected to NAZA (MW)
19	324	513	8 849	4 535

Energy Regulation Commission targets

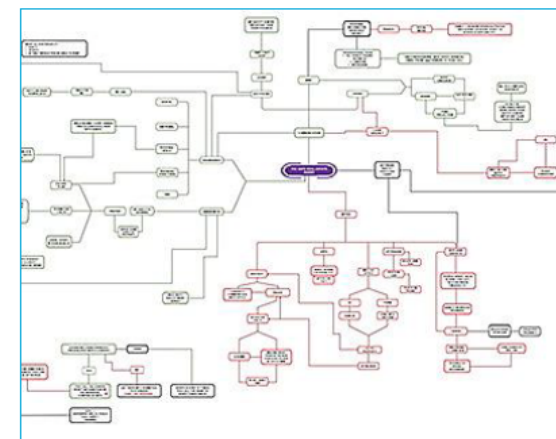
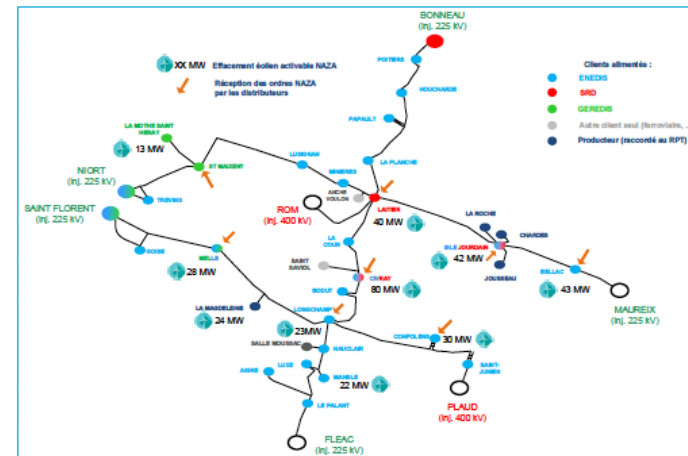
2025	2026	2027	2028
10	10	15	15



How NAZA differs from traditional RAS or SPS

Remedial Action Scheme or **Special Protection Schemes** are not the answer:

- Sub-transmission networks are **meshed** and their **topology** may **change** due to operator or other automaton actions.
- The availability of the **levers** (production curtailment, battery state of charge) also **vary** in time.
- These levers have very **different action delays** (from circuit breaker opening to wind farm curtailment through distribution SO).
- Even sophisticated **flowcharts** lack the capacity to adapt to those constraints.





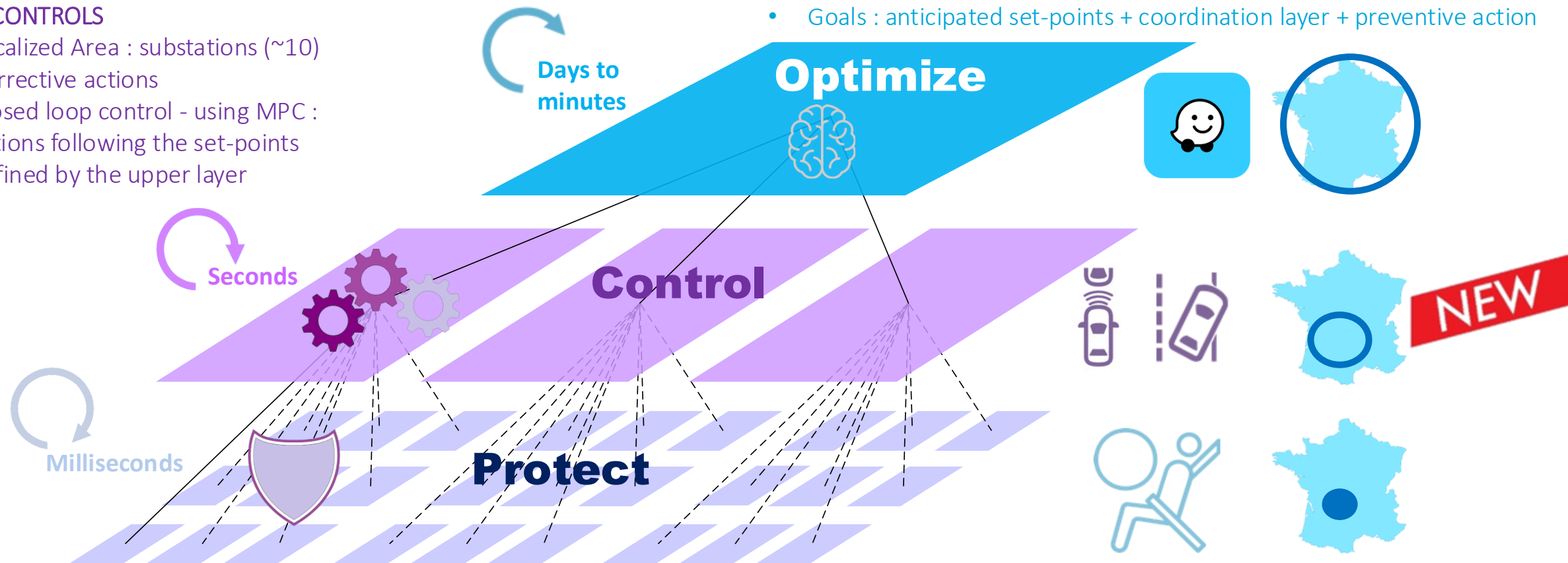
New Architecture for advanced grid solutions

AREA CONTROLS

- Localized Area : substations (~10)
- Corrective actions
- Closed loop control - using MPC : actions following the set-points defined by the upper layer

CENTRALISED CONTROLS – OPTIMIZATION

- View : global & forecasted
- In a control center room
- Goals : anticipated set-points + coordination layer + preventive action



SUBSTATION PROTECTIONS

Ensure last resort equipment and persons protection