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# Modern solutions for voltage control in the Romanian transmission grid

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October 2019

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Președinția României la Consiliul Uniunii Europene

# Voltage control in Romanian transmission grid

Main voltage control objectives:

- Maintain an appropriate high voltage profile;
- Increase the system voltage stability margin;
- Minimize the power system losses;
- Optimization of reactive power flow.

Equipments for voltage and reactive power control in transmission grid:

- Synchronous generators;
- Wind power plants;
- On-load Tap changing transformers;
- Shunt reactors;
- Generators in compensator mode;
- Disconnection of transmission OHLs.

# Voltage control in Romanian transmission grid

Equipments for voltage and reactive power control:

- ❑ Synchronous generators:
  - Generators terminal voltage (NPP, most of TPP and HPP);
  - Automatic voltage control on the HV busbars (Brazi Vest 400 kV and 220 kV, Lotru 220 kV);
- ❑ Wind power plants;
  - Automatic voltage control on the HV busbar 400 kV S/S Tariverde, Rahman, Stupina, Gura Ialomtei.

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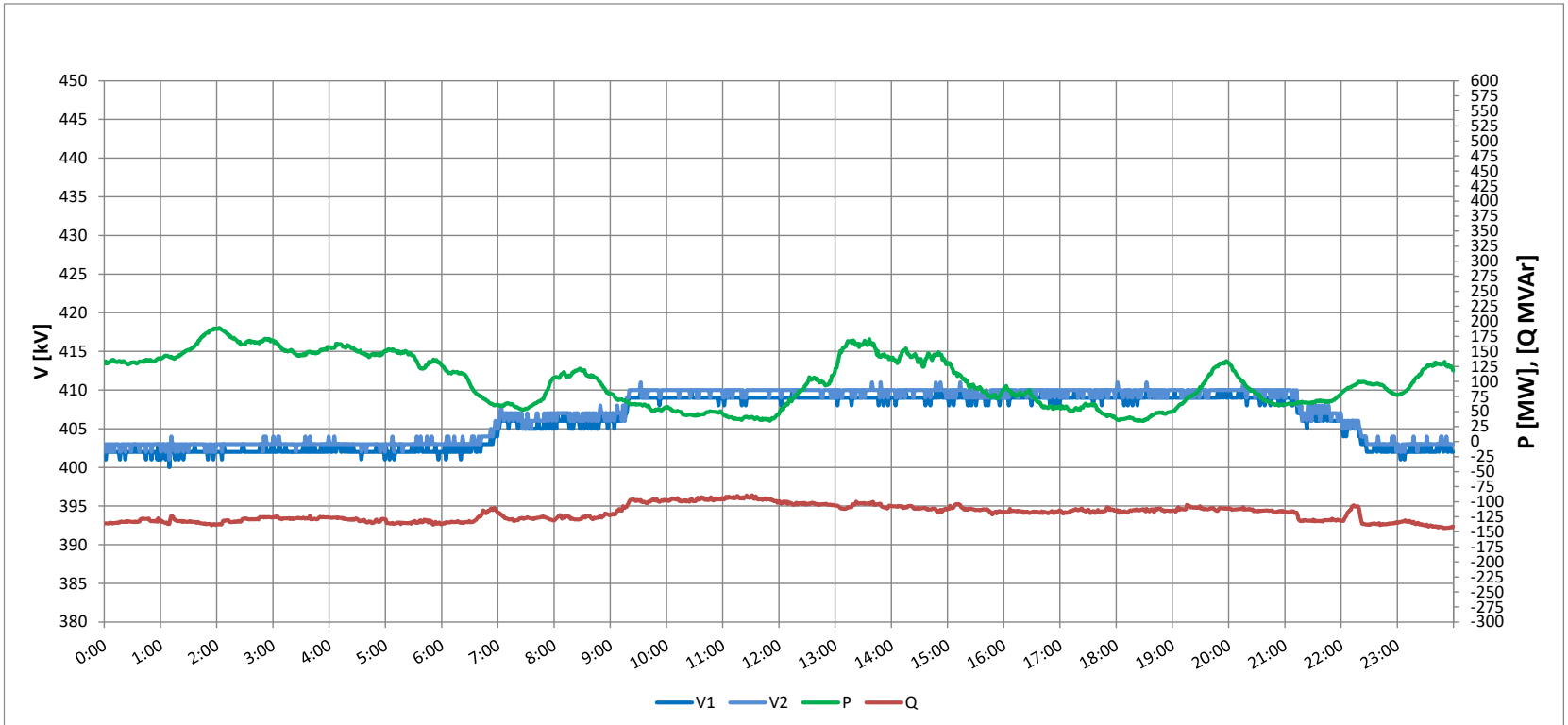
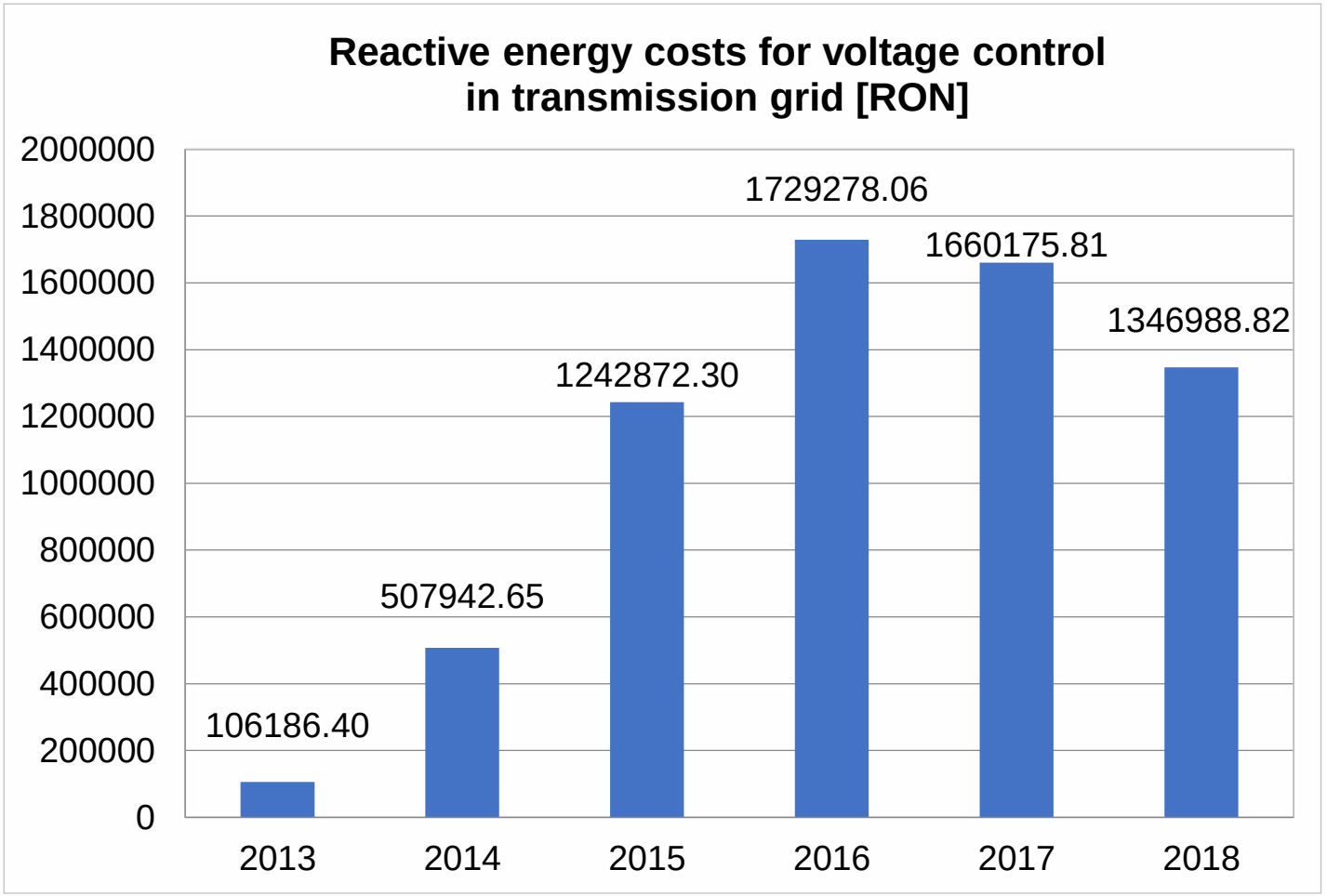


# Voltage control in Romanian transmission grid

Equipments for voltage and reactive power control:

- Generators in compensator mode in Lotru and Vidraru HPP.

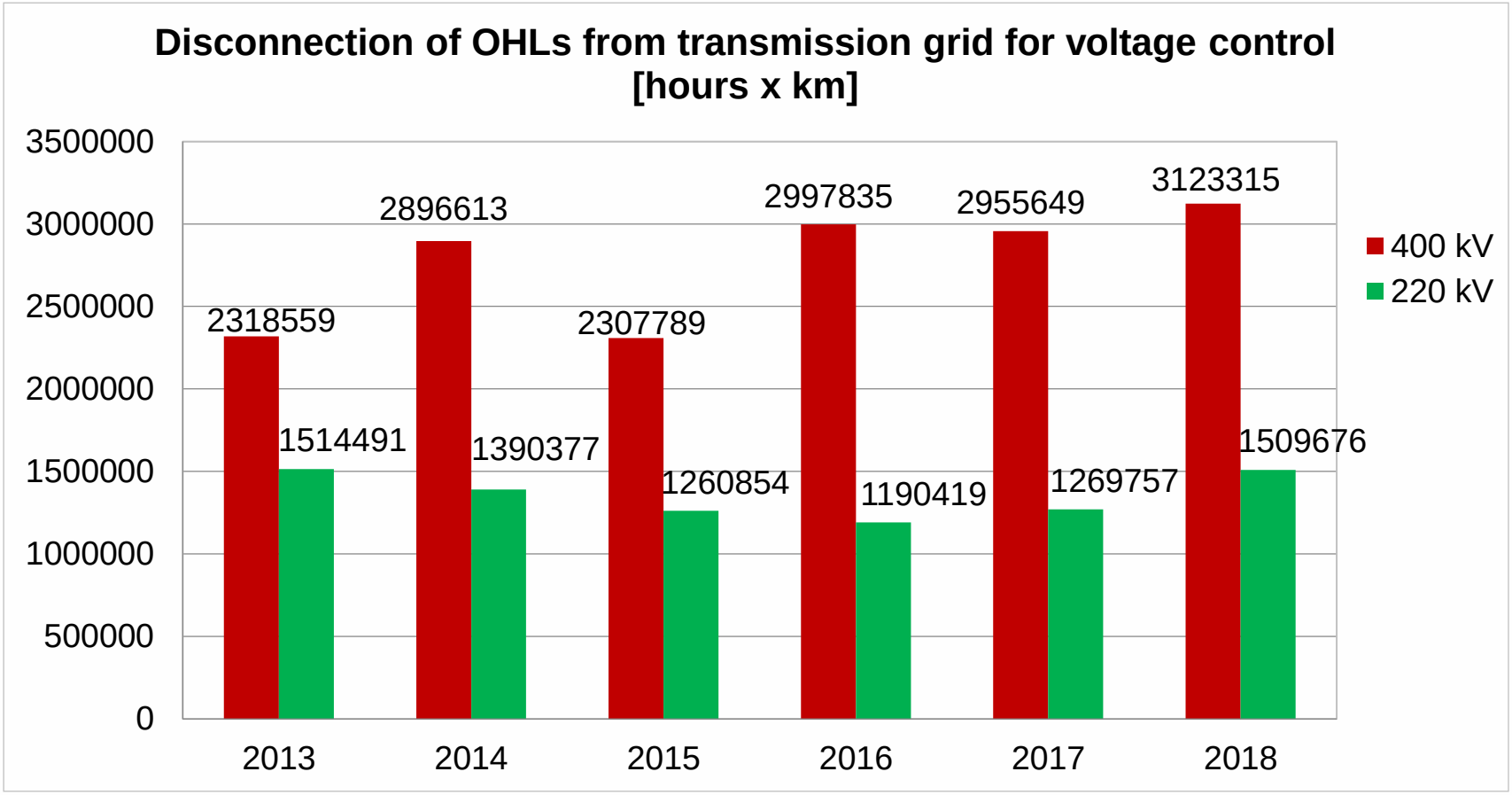


# Voltage control in Romanian transmission grid



Equipments for voltage and reactive power control:

- Disconnection of transmission OHLs.



# Modern solutions for voltage control

Location of FACTS devices:

- ❑ Sibiu Sud 400 kV;
- ❑ Bradu 400 kV.

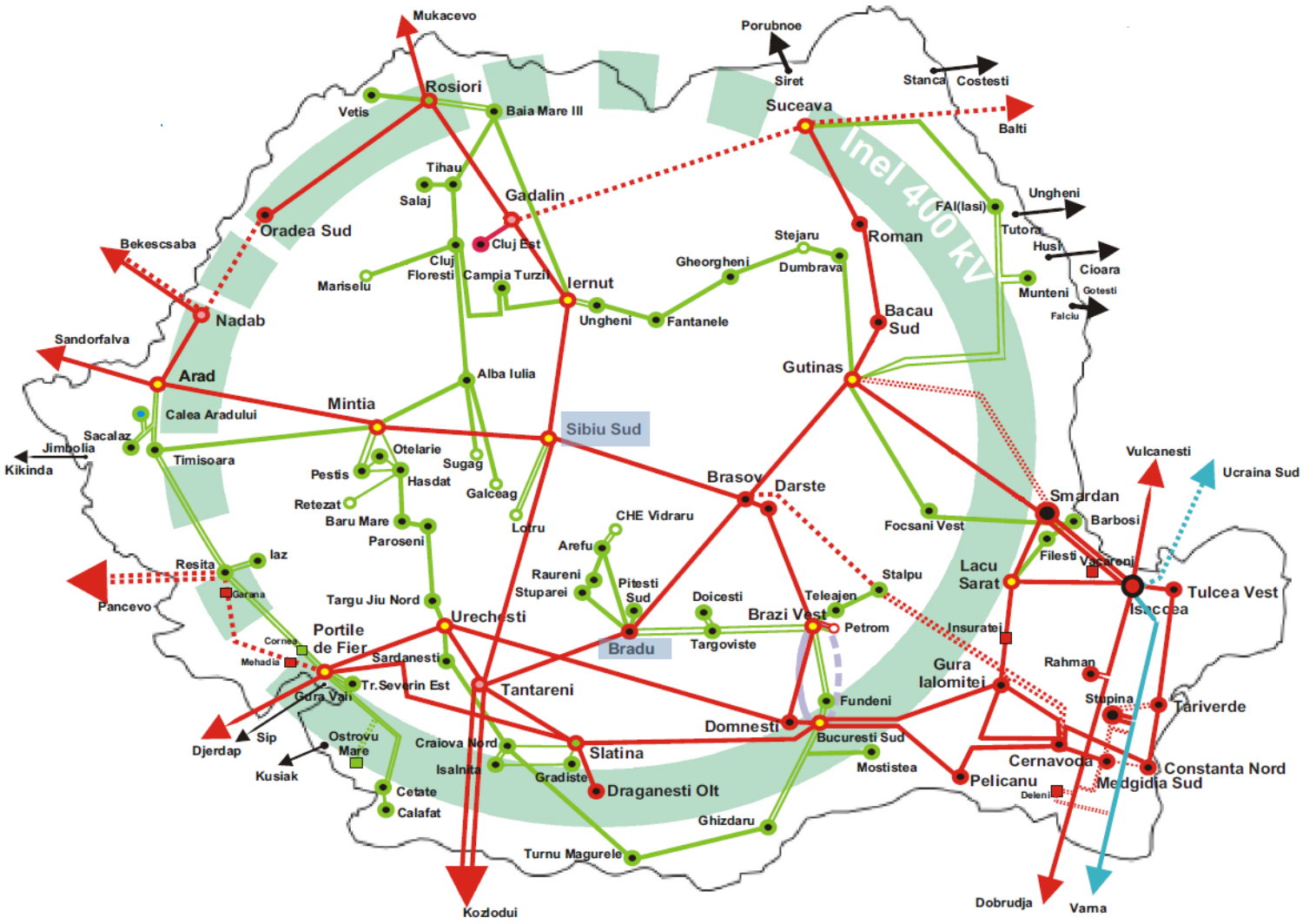
Sistem studies:

- ➢ Steady-state;
- ➢ Stability analysis;
- ➢ Power losses study;
- ➢ Harmonics analysis.

- ✓ **Technology**

  SVC or STATCOM

- ✓ **Rated Power**



# Modern solutions for voltage control

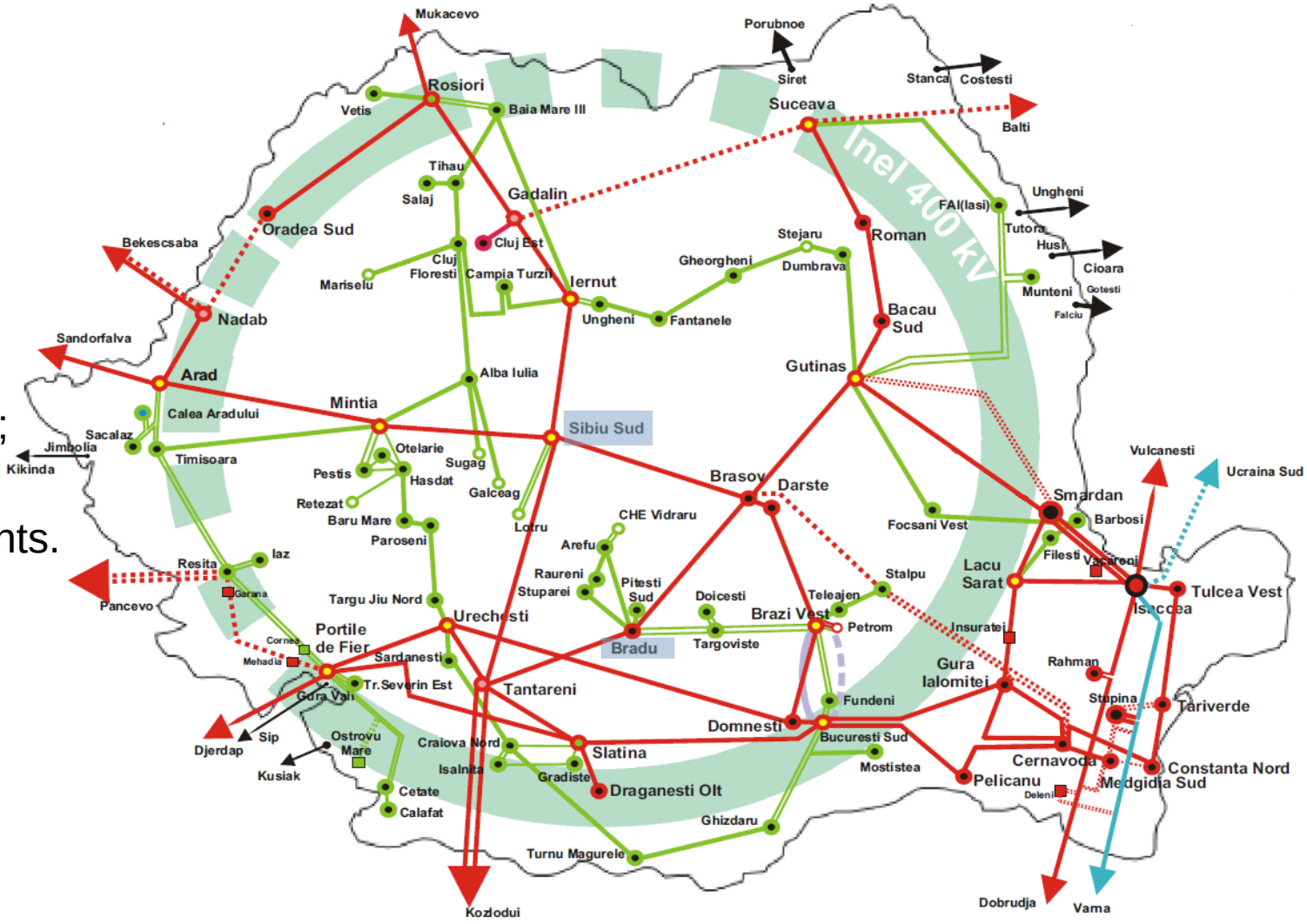
- ✓ **Technology**

  SVC or STATCOM

- ✓ **Rated Power**

**Feasibility study**

- Cost-benefits analysis;
- Economic efficiency indicators of investments.

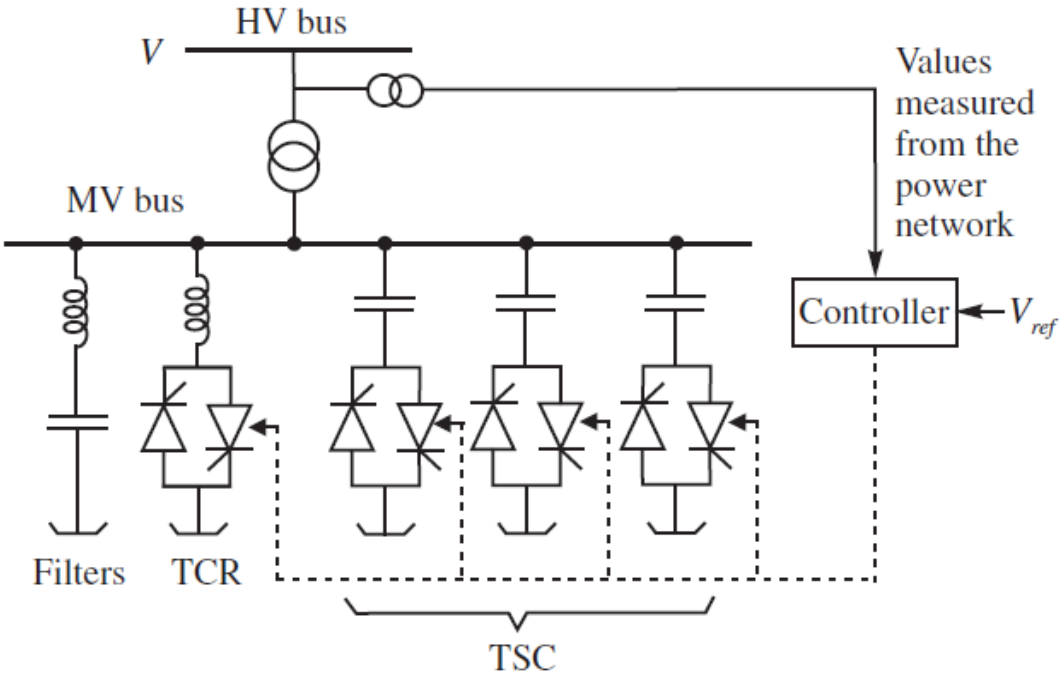


# Shunt FACTS devices



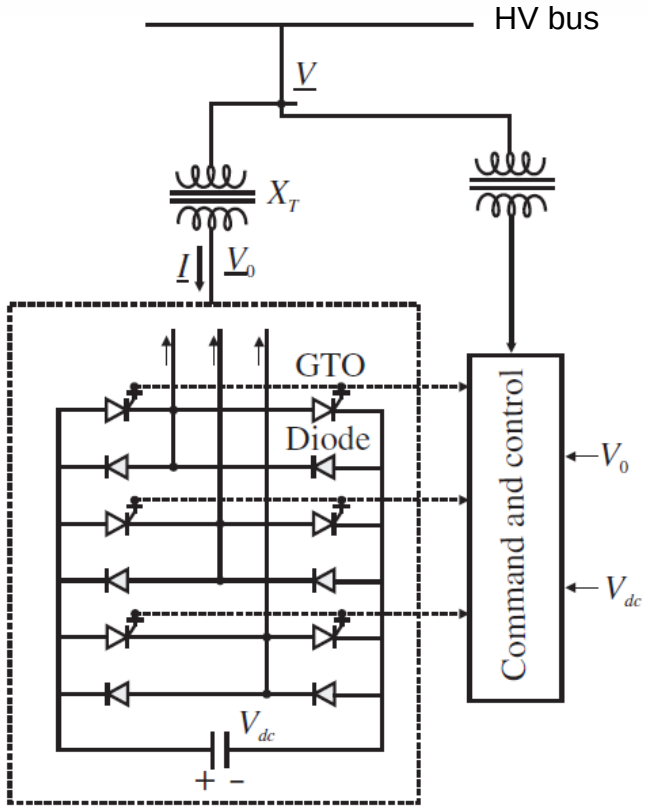
## Static VAr Compensator

- Thyristor controlled reactor (TCR) – continuously controlled inductance;
- Thyristor switched capacitors (TSC) – switched on/off;
- Fixed filters for low order harmonics filtering.

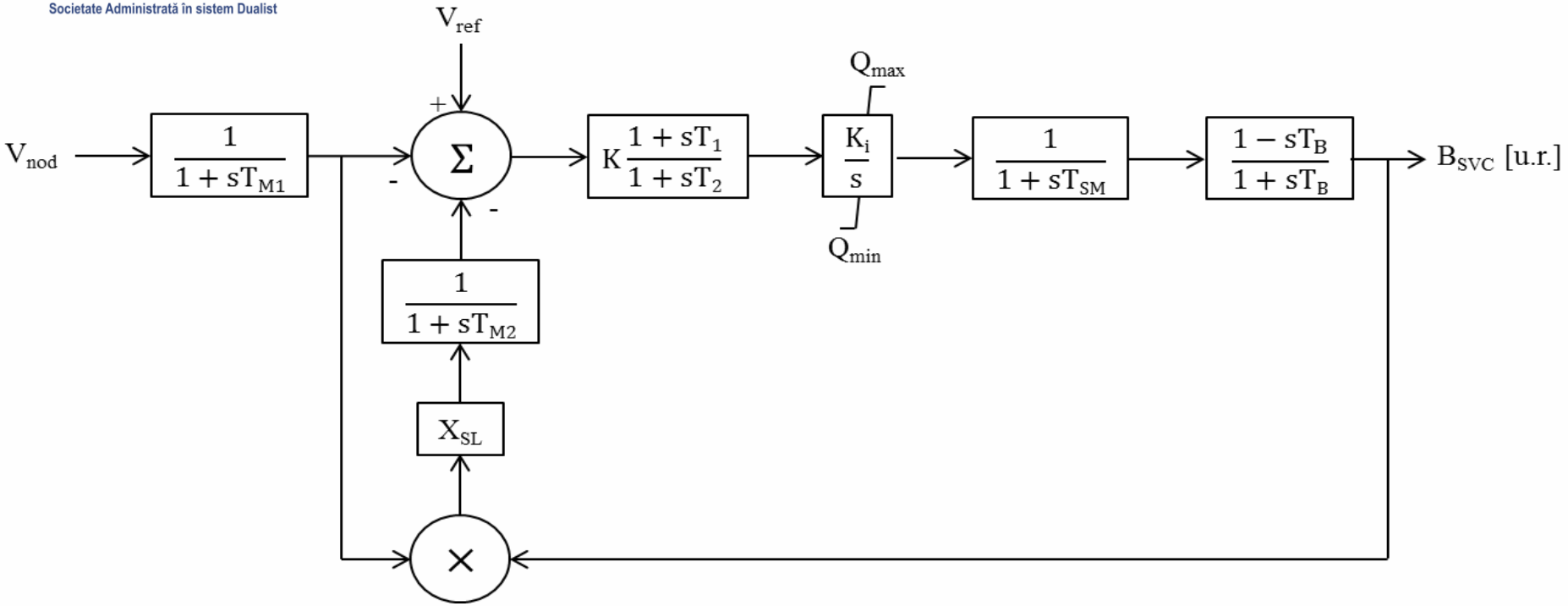



## Static Synchronous Compensator

- DC voltage source;
- Voltage source converter;
- Shunt coupling transformer;



# Dynamic model of SVC for stability studies



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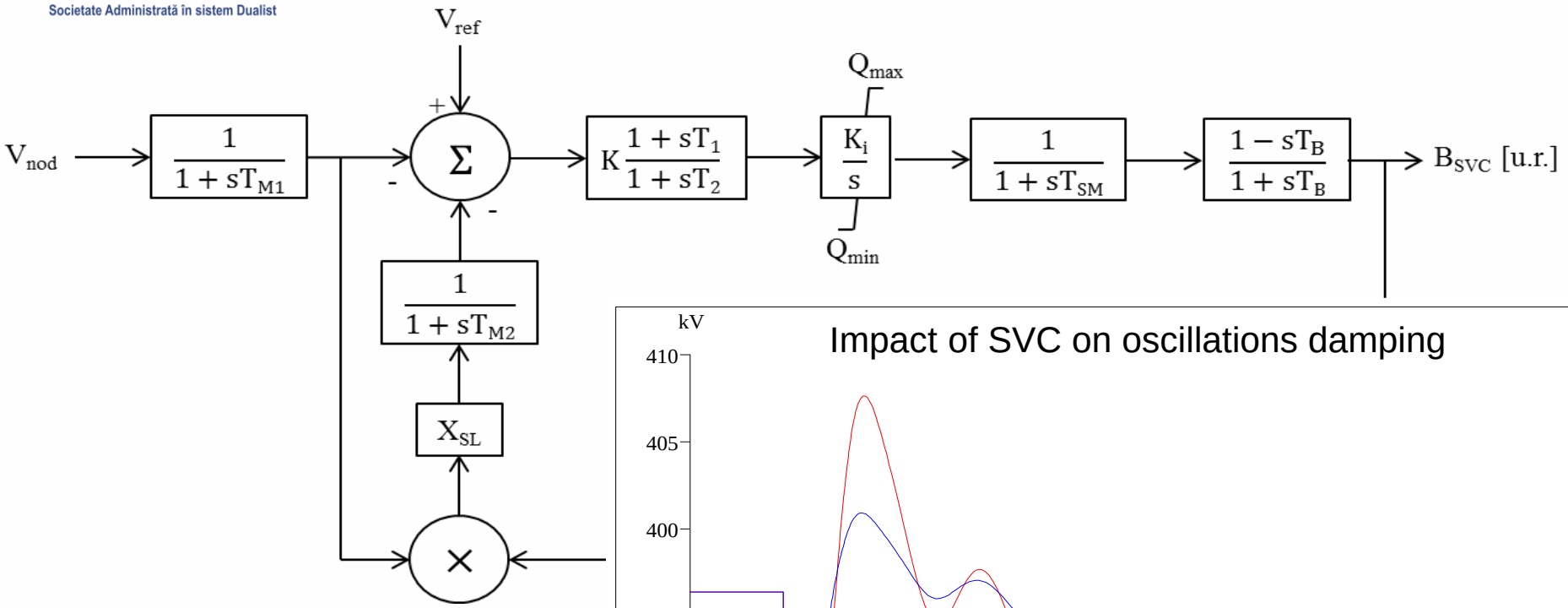
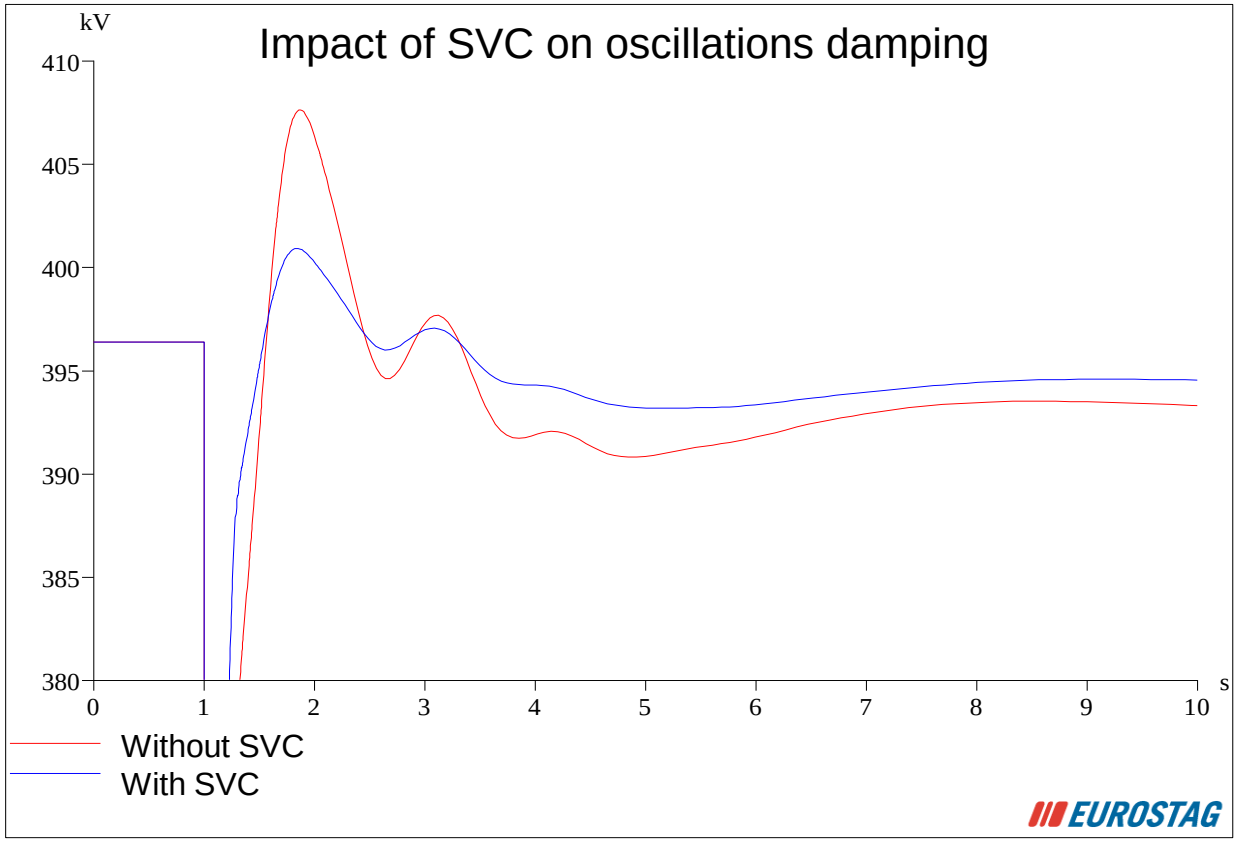
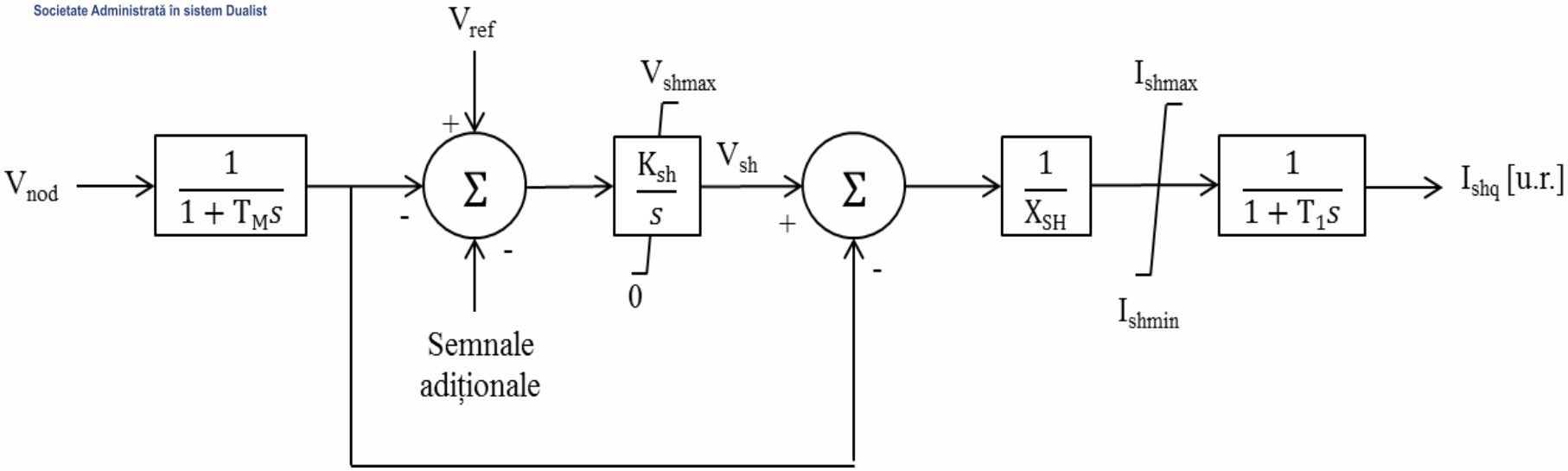


# Dynamic model of STATCOM for stability studies



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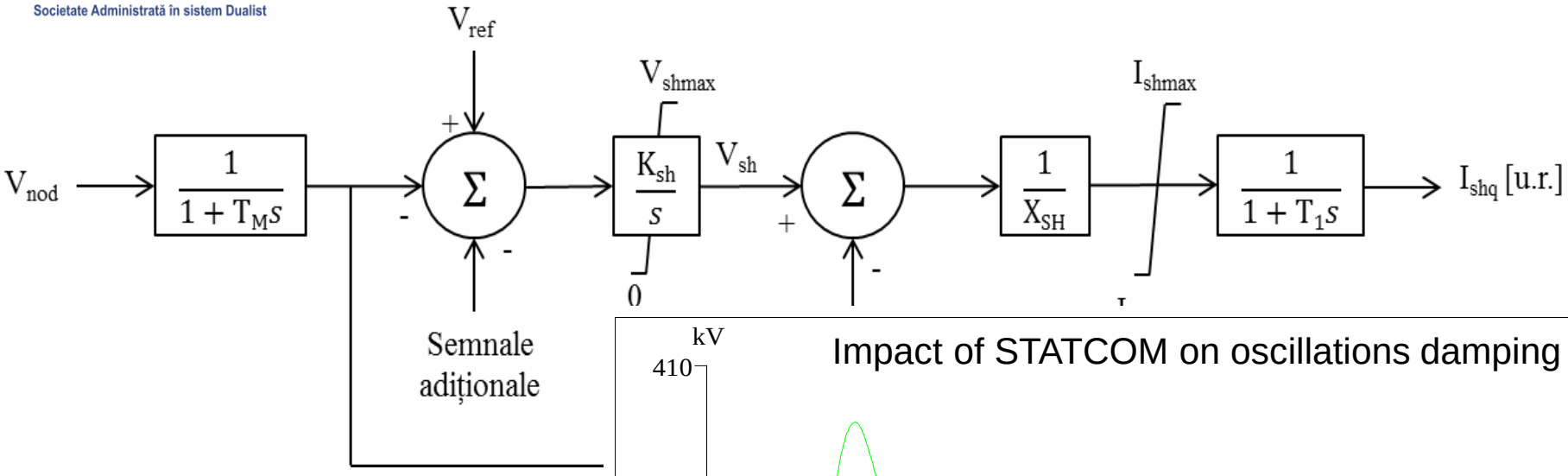


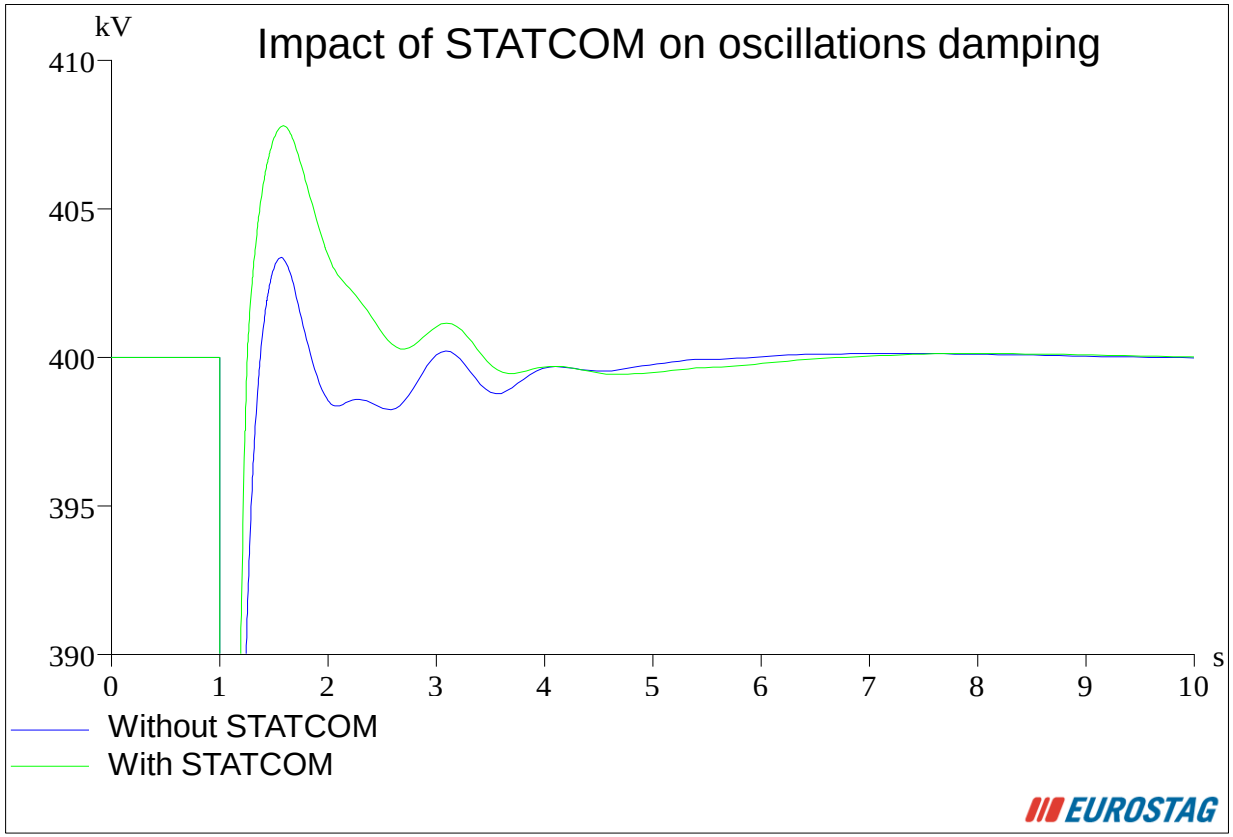

# Applications of shunt FACTS devices in the Romanian transmission grid

- Voltage control in Sibiu Sud and Bradu areas;
- Damping of active power and voltage oscillations;
- Voltage and transient stability margins improvement;
- Optimization of reactive power flow;
- Reduces power losses on transmission lines.