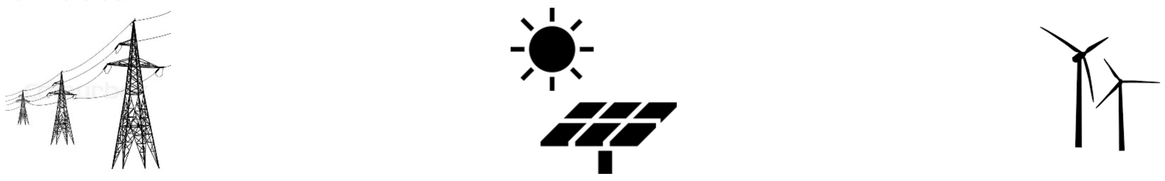
Dynamic frequency stability analysis

WP 2 Task 2.3: Performing short-term dynamic simulations

- Carry out a frequency stability analysis in time domain from a few milliseconds up to a few minutes
- Represent the real transient behaviour of hydraulic turbines within a short time frame as effectively as possible

Challenges in a highly renewable power system

- NORDEL synchronous area - with a not densely meshed grid structure - might be liable to frequency deviations
- Increase of wind and photovoltaic generation units connected via power electronics to the power system have to be adequately modelled with respect to their gradients and reduced stabilizing effects



Can hydropower help stabilising the power system by providing flexibility in electrical energy production in future scenarios?

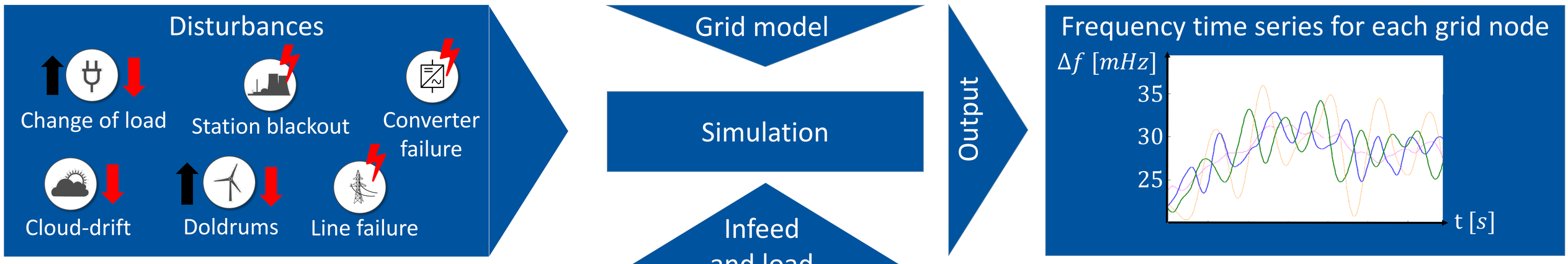
Defining three European energy scenarios

- Deliverable 2.1: Development of three scenarios as a framework embodying a path of different developments

Identifying of resulting power flow

- Perform market simulations and calculate the resulting power flows within the European grid for selected scenarios
- Power flow

Frequency stability analysis representing the transient behavior of hydraulic turbines

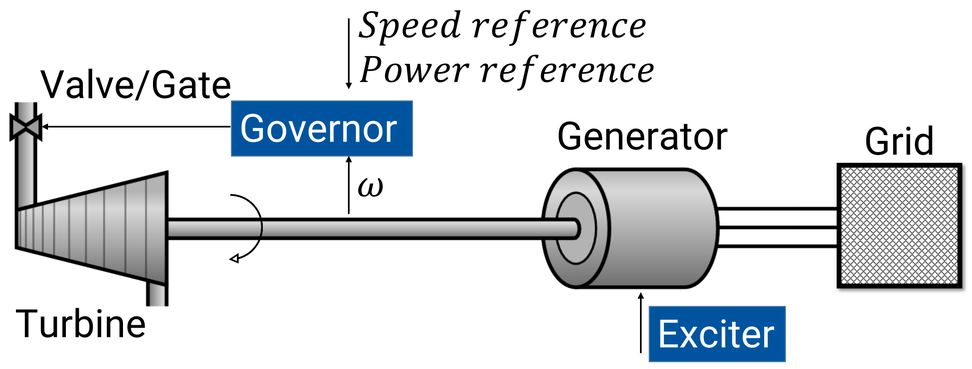


Dynamic models of generators and loads necessary → HydroFlex: Focus on hydropower plant primemover

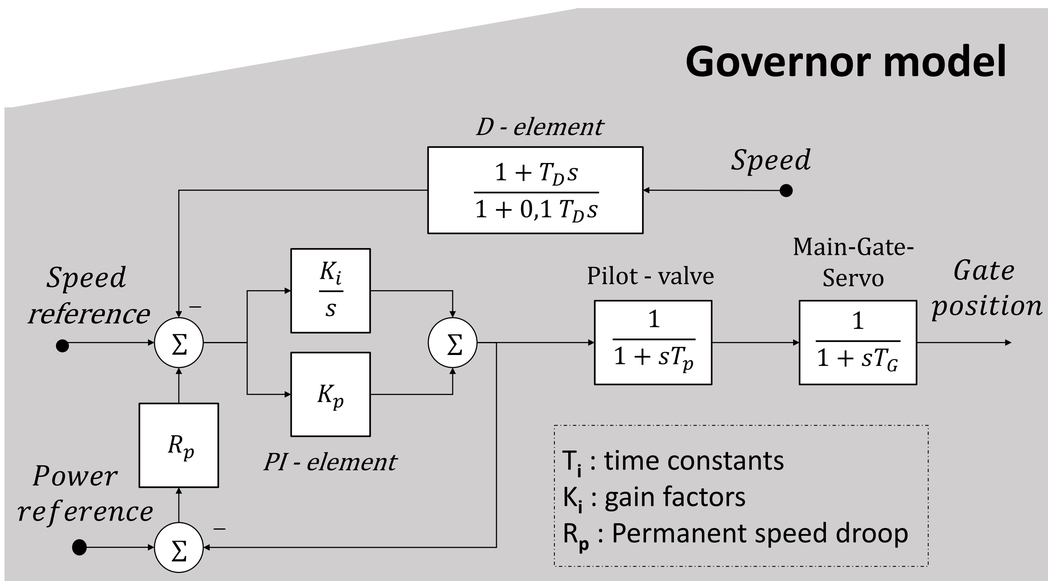
- Dynamic behaviour of hydropower plants defined by controllable governor-characteristics and by physical conditions of power plant setup
- Dynamic models for governor and turbine for HydroFlex' Reference Sites are created and paramatrised with data collected in WP 2.2: Reference Sites

➔ Detailed model of Reference Sites used for investigating frequency stability

Scheme of power plant

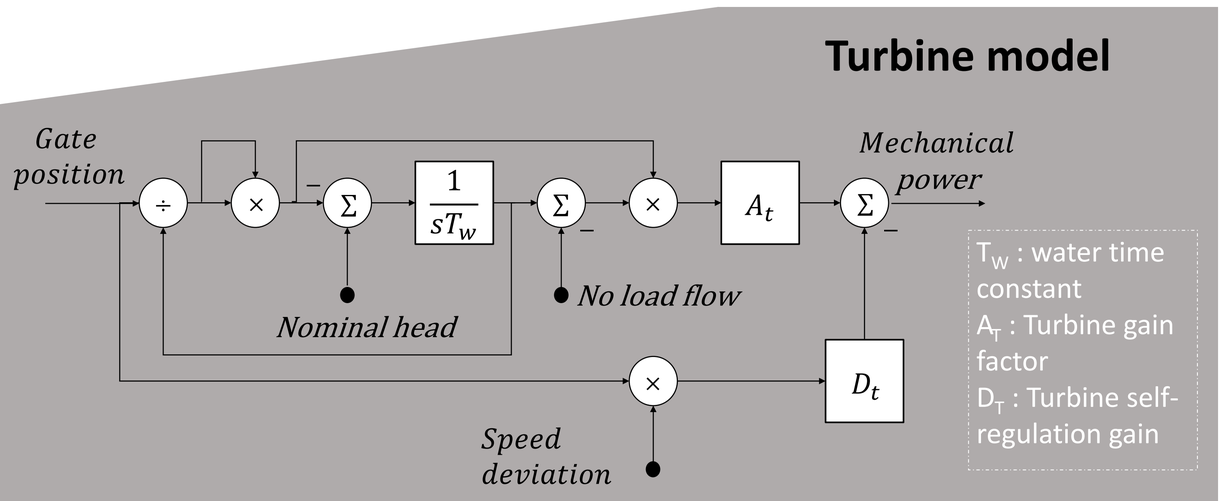


Governor model



- The Governor represents the control system that moves gates or valves
- For frequency regulation the Governor should consist of a PID-element, a Pilot-valve and the Main-Gate-Servo

Turbine model



- The turbine model relates gate or valve position to mechanical power delivered to the generator shaft

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Date: 26/05/2019

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 764011.