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Connection capacity maps
Interpretation guide and methodology

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1 Introduction

This document describes the methodology and assumptions used to determine the absorption capacities of Swissgrid's transmission grid. It presents the results in the form of maps covering various time horizons, along with an interpretation of these results. It also indicates the limitations and caveats associated with the figures provided.

2 Guidelines for determining connection capacities

2.1 Grid capacity

(1) The available connection capacities are determined on the basis of market simulations and grid calculations that take into account the (n-1) security principle and the grid's operating borders.

(2) The system is analysed for every hour of the year to reflect the variability in electricity demand and generation. The grid developments planned for the relevant time horizon are incorporated into the analyses.

(3) The indicative available connection capacities are specified for various time horizons, taking into account planned grid developments:

- Current situation (2026)
- Time horizon: +3 to 5 years (2030)
- Time horizon: +8 to 12 years (2035)
- Time horizon: +15 to 20 years (2040)

(4) The following methodology is used to determine the connection capacity to each substation in the Swiss transmission grid:

(5) The analyses are based on a model that reflects the grid configuration envisaged for the specific time horizon, assuming that all the grid elements that make up the Swiss system are in operation. This provides a dynamic view of the system, taking into account new developments, enhancements and modernisations. In the event of outages of grid elements, the absorption capacity is generally lower than that shown on the maps.

(6) A market simulation is carried out for the entire year covered by the relevant time horizon. This determines the expected consumption, generation and cross-border electricity exchange for each European market area on an hourly basis. Once the results have been integrated into the grid model, the outgoing load flows in the electricity grid can be calculated prior to the connection of the new plant.

(7) Load flows are analysed for every hour of the year in question. This approach makes it possible to identify critical periods, potential congestion and the available power reserves for additional loads and/or generation.

(8) A specific observation zone is defined for each feed-in or feed-out allocated to a grid node. The limitation of this zone is based on sensitivity analyses and load flow simulations. An observation zone comprises those grid elements whose load flow could be significantly affected by a variation in power output at the relevant node.

(9) Connection capacities are calculated on an hourly basis for the entire year by linearising the load flows on the basis of sensitivity factors (Power Transfer Distribution Factor, PTDF). The analyses take into account the seasonal thermal limits of all grid elements within the observation zone, as well as the (n-1) security criterion. The maximum power that can be fed into or out of a node is reached when the load flow on one of the monitored elements reaches its seasonal capacity limit.

(10) Statistics on the connection capacities of the Swiss grid make it possible to quantify the system's flexibility and robustness with a view to integrating new feed-ins or feed-outs. They indicate a minimum value that guarantees connection capacity throughout the year without any constraints, as well as flexibility values representing the available capacity 90% or 80% of the time – depending on the grid connected party's operating conditions (ability to modulate the new feed-in or feed-out power during grid overloads).

(11) The already allocated capacity, existing capacity and reserved capacity at each grid node in the Swiss grid are deducted from the figures calculated. This allows the feed-in and feed-out volumes that are actually still available to be calculated for each node.

(12) An indicative assessment of the connection feasibility at the substations is provided on the basis of the existing plants and the available space.

These connection capacities are then shown on a map and listed in an Excel table along with additional information.

3 Capacity maps

The following capacity maps can be found in the annex.

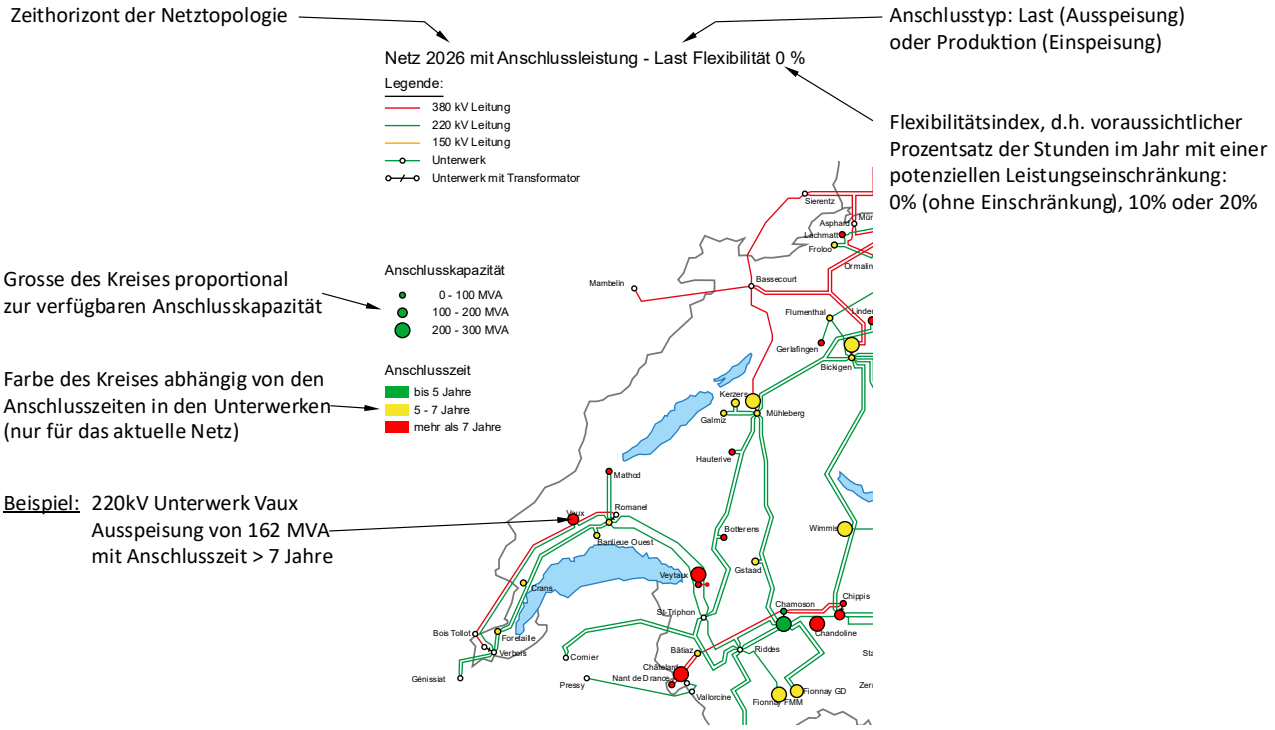
Time horizon / grid topology	Feed-out (load)			Feed-in (production)		
	Base (flex. 0%)	Flex. 10%	Flex. 20%	Base (flex. 0%)	Flex. 10%	Flex. 20%
2026	Capacity & substation con-nection	Capacity & substation con-nection	Capacity & substation con-nection	Capacity & substation con-nection	Capacity & substation con-nection	Capacity & substation con-nection
2030	Capacity	Capacity	Capacity	Capacity	Capacity	Capacity
2035	Capacity	Capacity	Capacity	Capacity	Capacity	Capacity
2040	Capacity	Capacity	Capacity	Capacity	Capacity	Capacity

3.1 Map interpretation

Information on interpreting the capacity maps is given in the following sections.

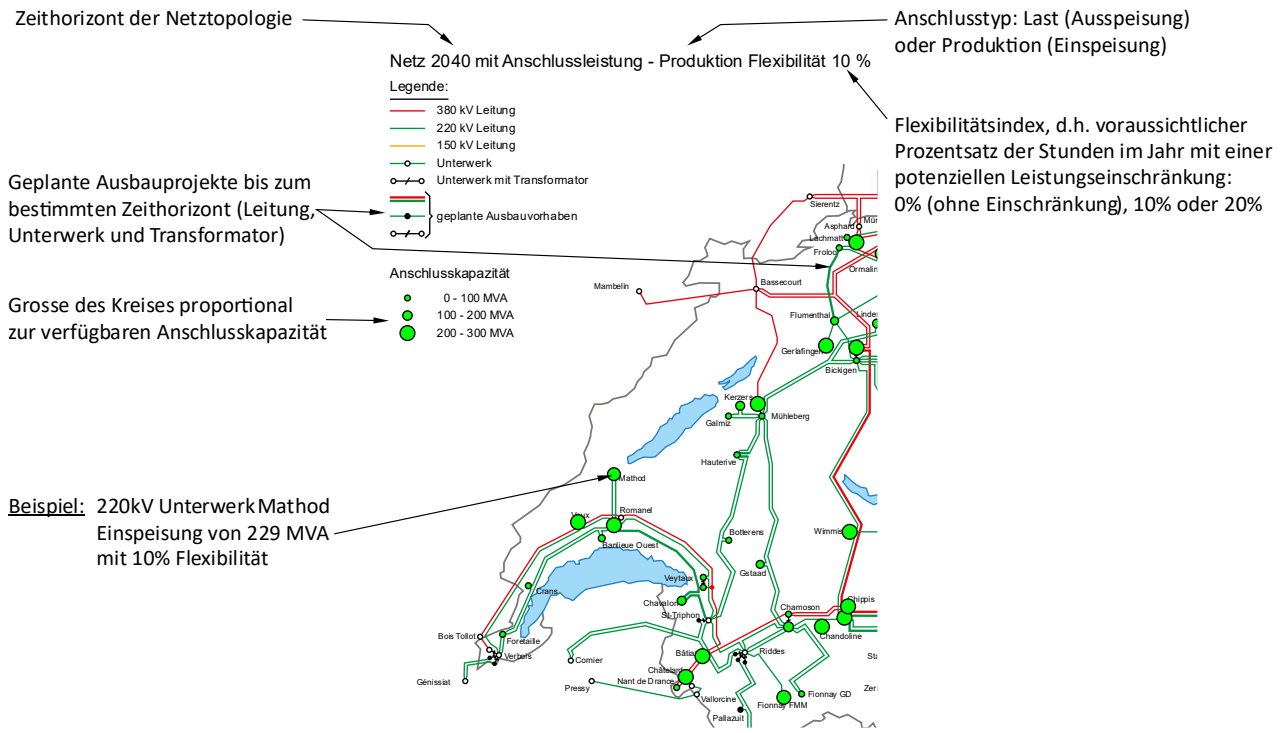
3.1.1 Current grid

The maps show the absorption capacity of the current grid and the estimated time needed to modify the sub-station systems.



The current grid would allow an additional load of 162 MVA to be connected to the 220 kV Vaux substation without any constraints. It is estimated that it would take more than seven years to adapt the substation to allow the connection.

3.1.2 Future grid



With the planned grid in 2040, an additional feed-in of 229 MVA could be connected to the 220 kV Mathod substation, subject to potential constraints during 10% of the hours of the year.

3.1.3 Table

Figures indicating the available connection capacities are shown in the tables for all substations, for the various time horizons and for each type of connection.

4 Caveats

The following points must be taken into account:

(1) All the information and estimates are provided solely for guidance. They are based on hourly analysis results, taking into account physical constraints and operational safety regulations.

(2) The figures shown on the maps are purely indicative and are not binding. They are recalculated for each connection application, taking into account the latest assumptions and topological measures designed to maximise the feed-in or feed-out at the relevant grid node.

(3) The calculations are based on market simulations that include assumptions associated with both Swiss and European energy scenarios. These scenarios may need to be adapted to new framework conditions, which could result in changes to the available capacities.

(4) The absorption capacity is specified up to a value of 300 MVA. Applications for connections using this capacity require a detailed analysis. This also applies to connections that would feed power into or out of grid-critical elements in relation to Switzerland's cross-border capacities with neighbouring countries.

(5) Applications for connections to substations that are directly linked via international interconnection lines require coordination with the relevant neighbouring grid operators. Consequently, no figures are shown on the maps in these cases.

(6) Outages due to maintenance work or other periods of non-availability are not taken into account and may result in lower figures during these periods of constraint.

The analyses and maps do not take into account the simultaneous submission of connection applications for neighbouring grid nodes.

(7) Capacity reserved for a nearby site can have a significant impact on the available capacity at other nodes within the same supply region.

(8) The estimated connection feasibility at the substations is purely indicative and does not guarantee connection within the specified timeframes. It refers exclusively to modifications at the substation and not on the connection line.

(9) An evaluation of sites that require the construction of new substations is not included.

(10) The grid topology considered for a specific time horizon is purely indicative. It represents the complete grid and does not take into account any periods of non-availability, temporary topologies or other changes. The project commissioning time horizons are subject to approval processes that are beyond Swissgrid's control. This may result in changes to grid development sequences, which in turn may affect the available grid capacities.

(11) No entitlement to grid connection or access can be inferred from the information given on the capacity maps.

5 Further developments

The available connection capacities are currently evaluated on the basis of the power that can be fed into or out of the grid on an hourly basis over a full year, without taking into account the storage capacity, flexibility or constraints of the plant. A number of further developments are planned in this context:

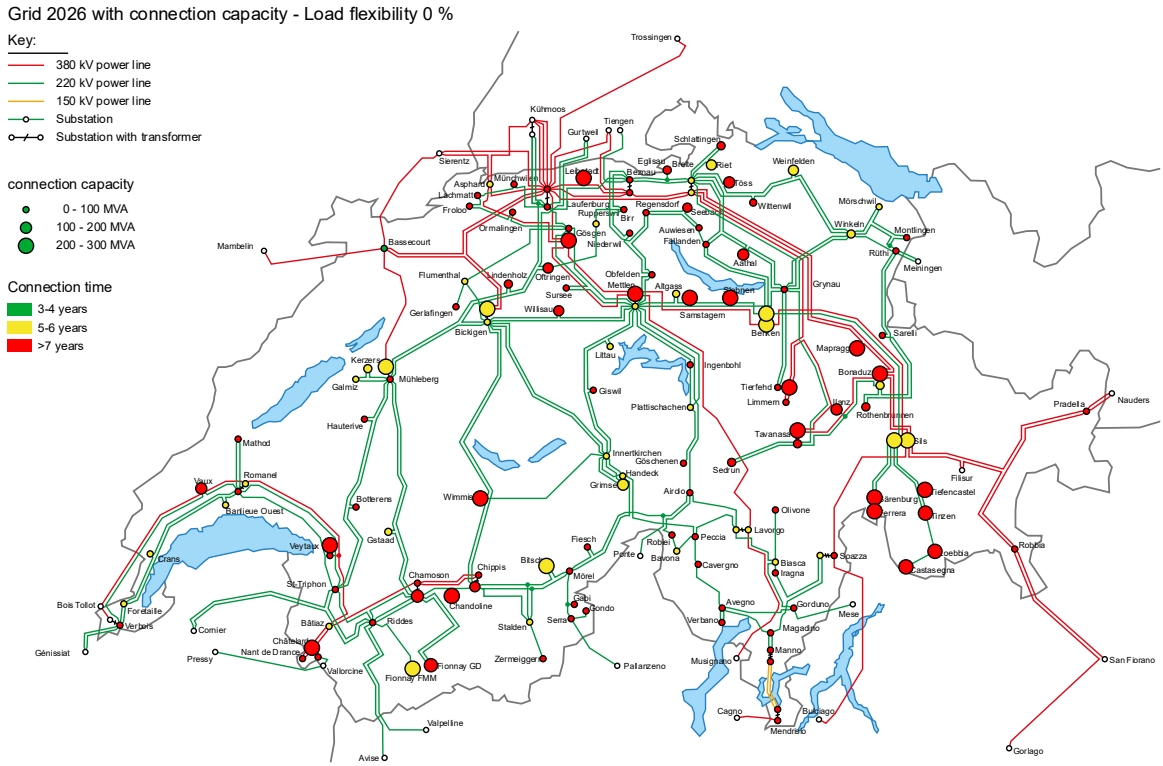
- **Batteries**: consideration of the flexibility associated with their storage capacity and of the potential to provide ancillary services such as imbalance energy or redispatch.
- **Photovoltaics**: limitation in relation to other types of power plant and consideration of the generation profile when evaluating the power that can be fed into the grid.
- **Seasonal variations**: creation of separate maps for summer and winter.

6 Annexes

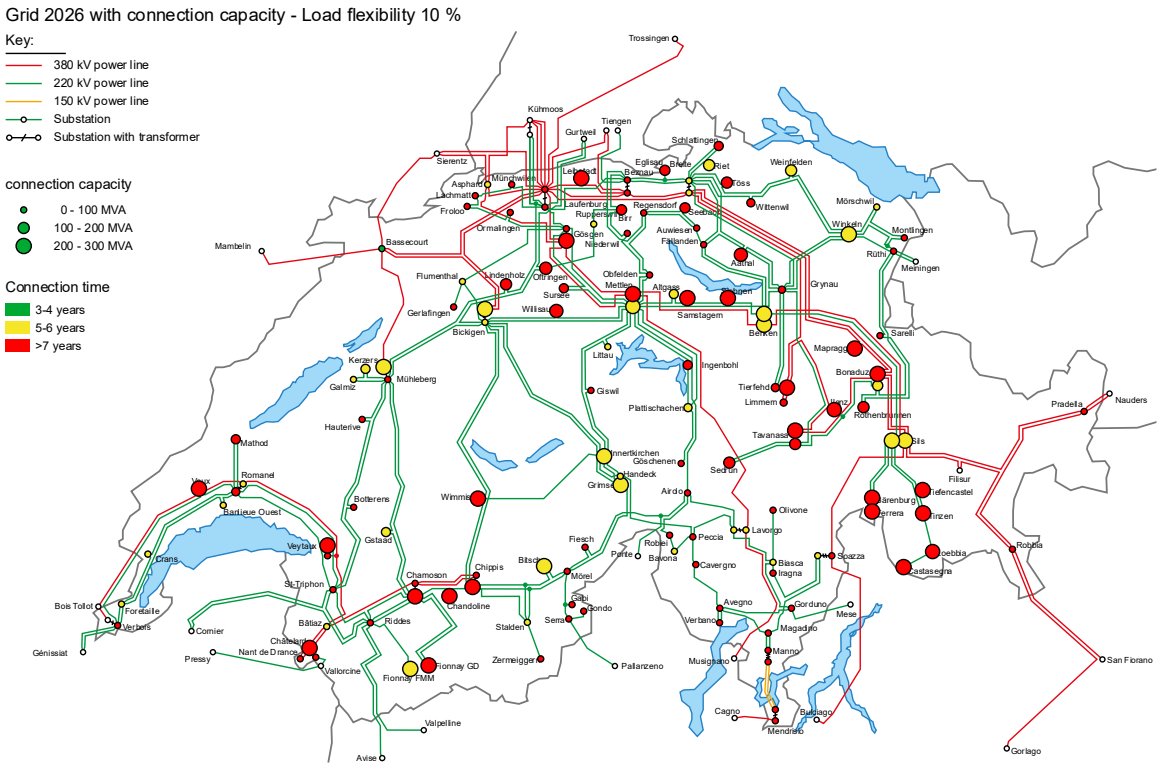
6.1 Current status (2026)

6.1.1 2026 grid topology

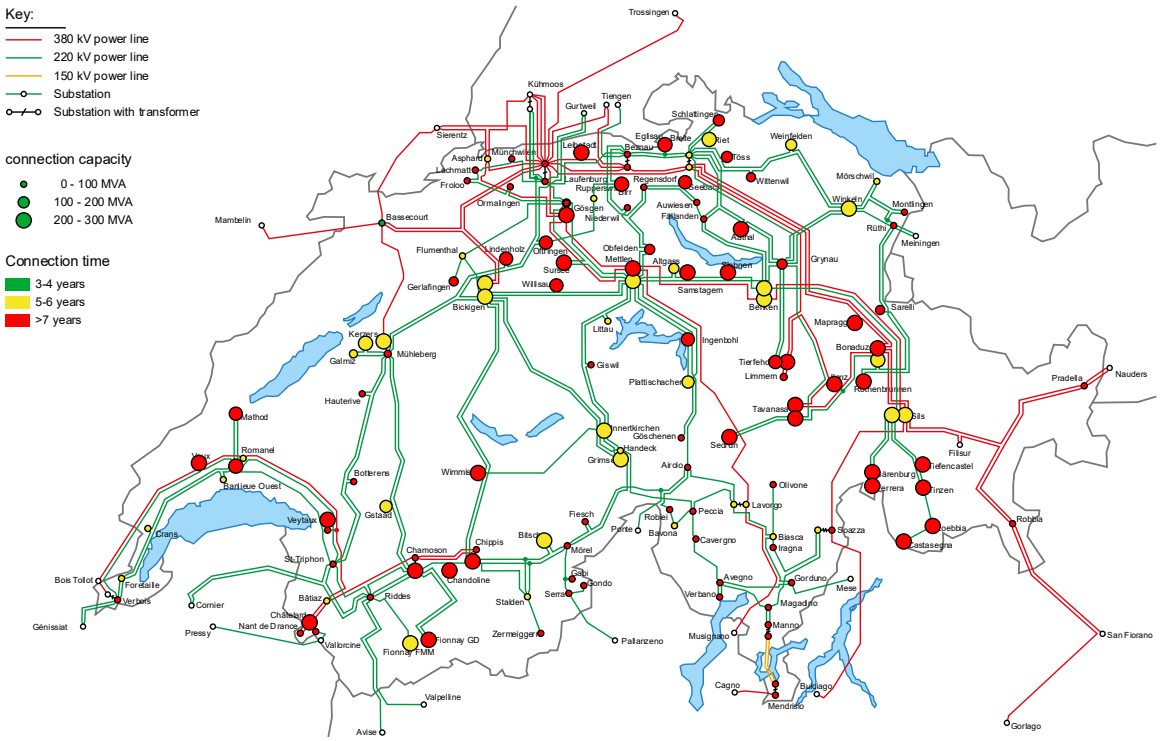
6.1.2 2026 grid, feed-out (load), base (flexibility 0%)



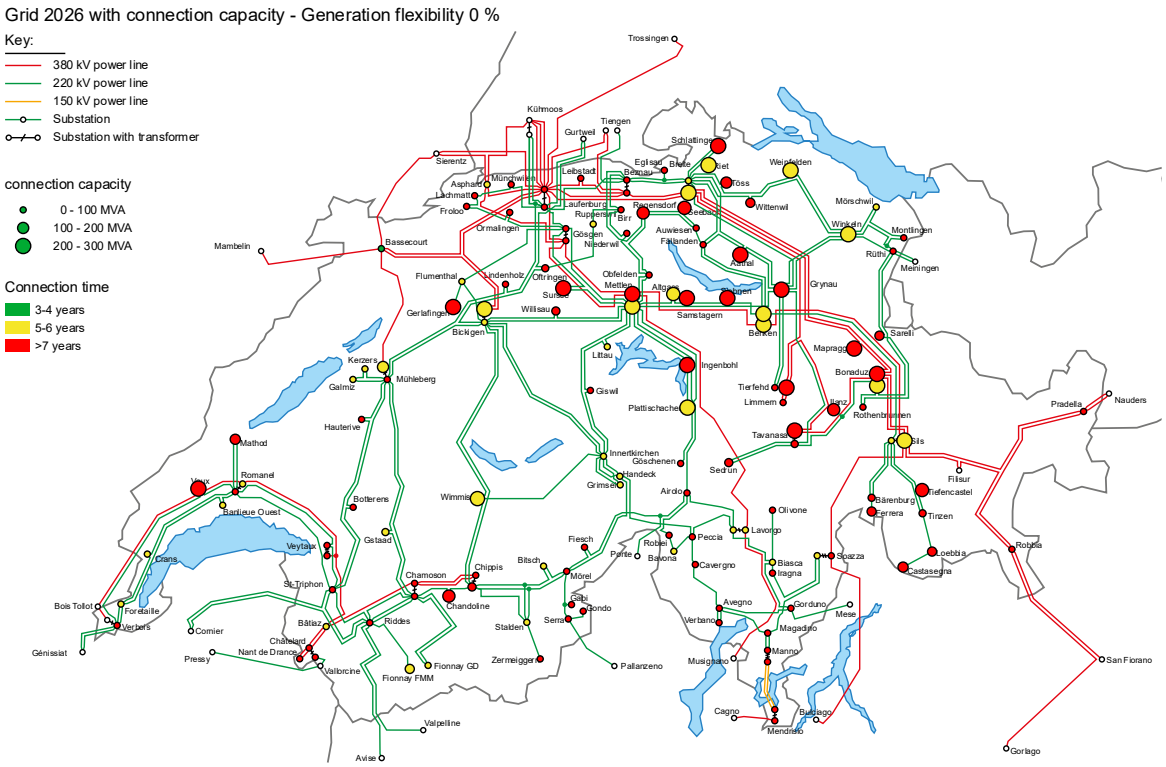
6.1.3 2026 grid, feed-out (load), flexibility 10%



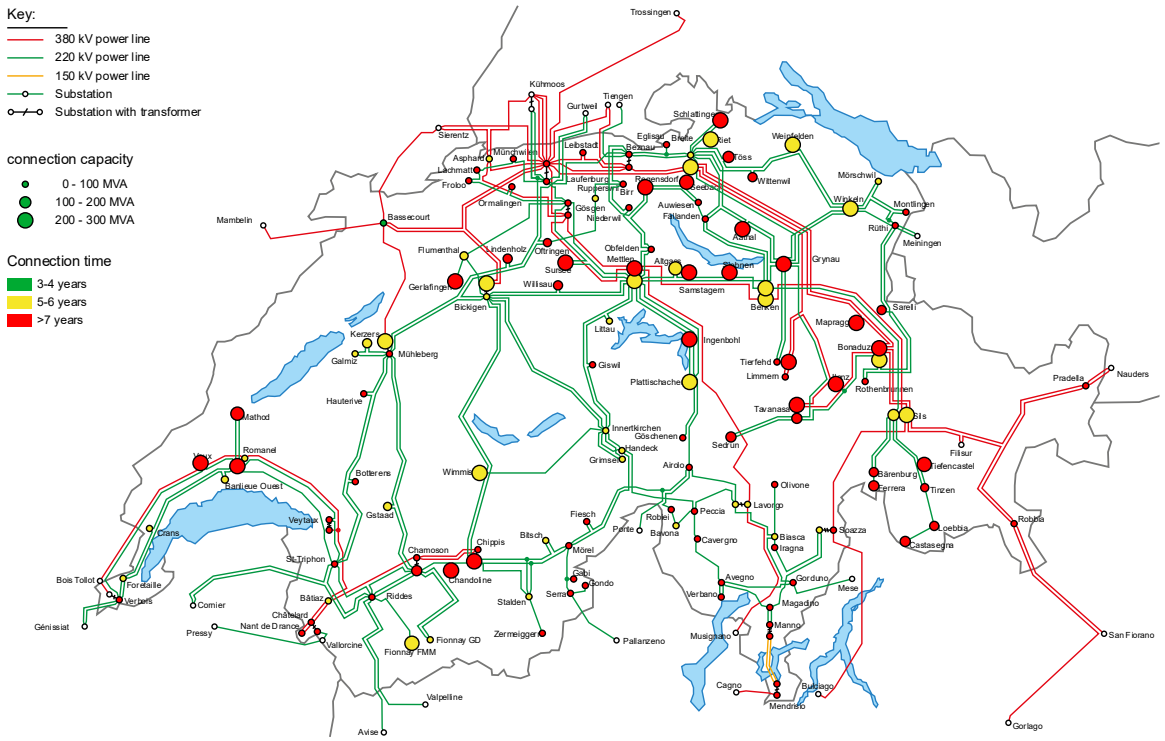
6.1.4 2026 grid, feed-out (load), flexibility 20%



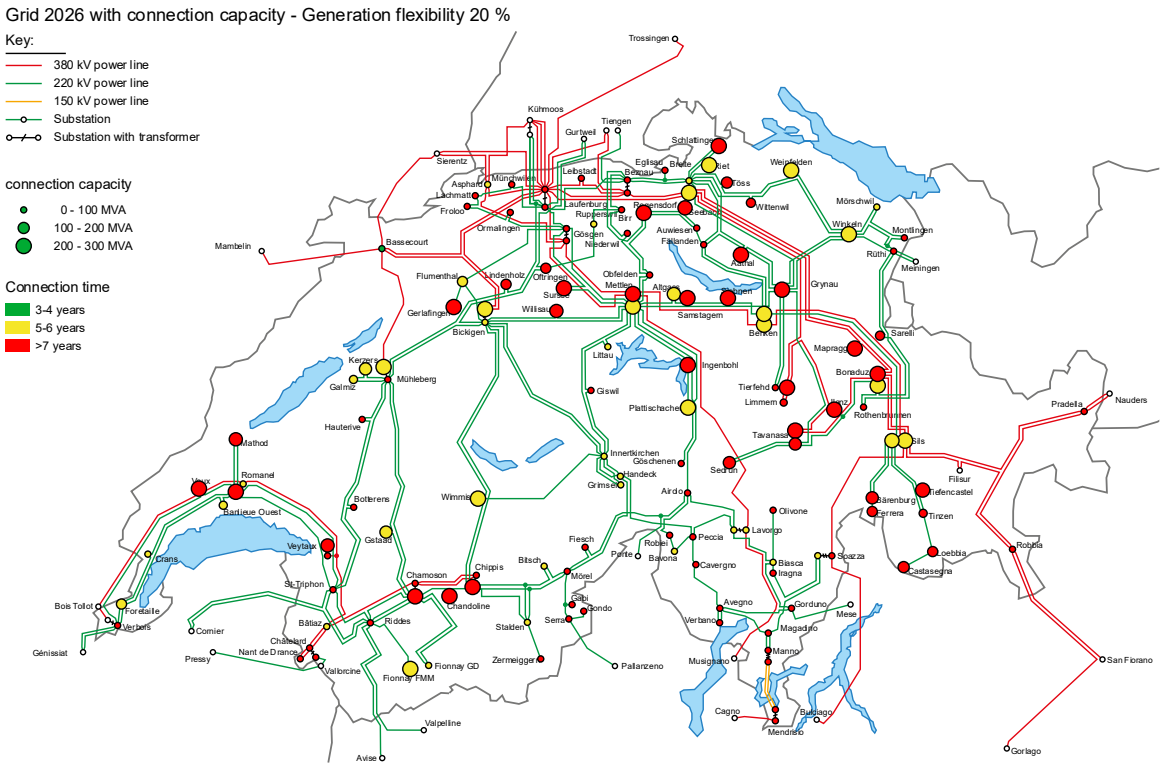
6.1.5 2026 grid, feed-in (production), base (flexibility 0%)



6.1.6 2026 grid, feed-in (production), flexibility 10%



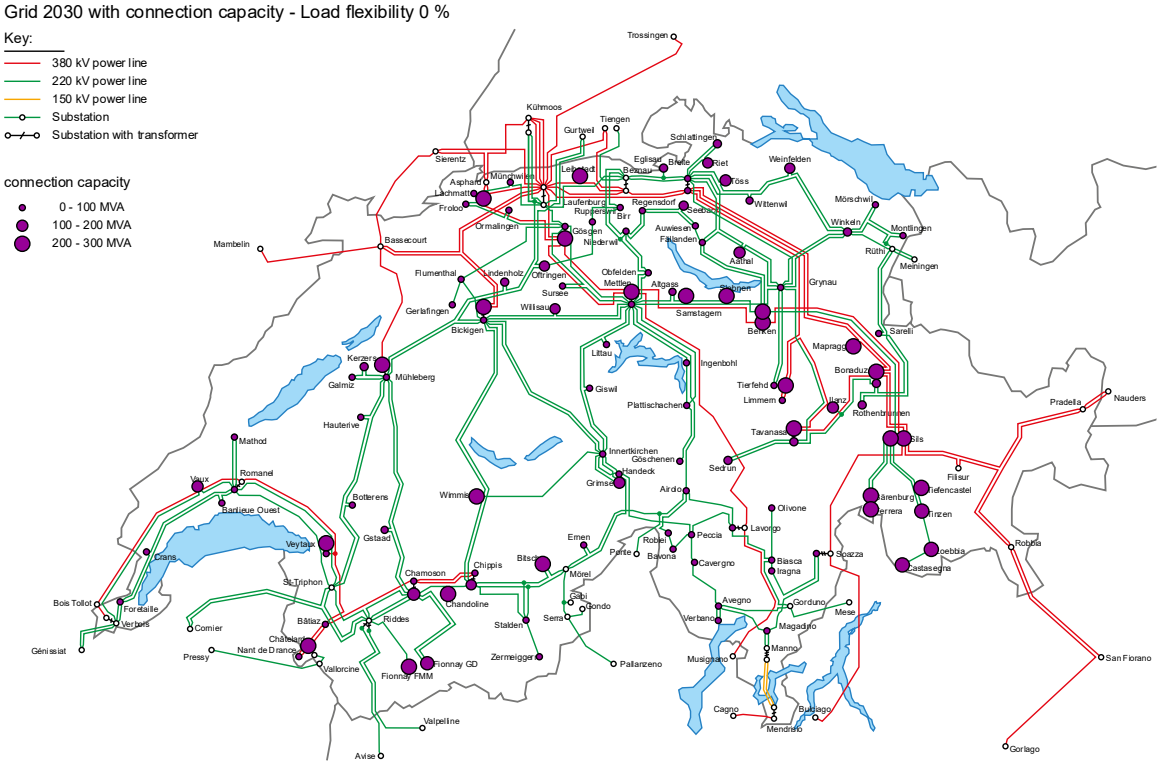
6.1.7 2026 grid, feed-in (production), flexibility 20%



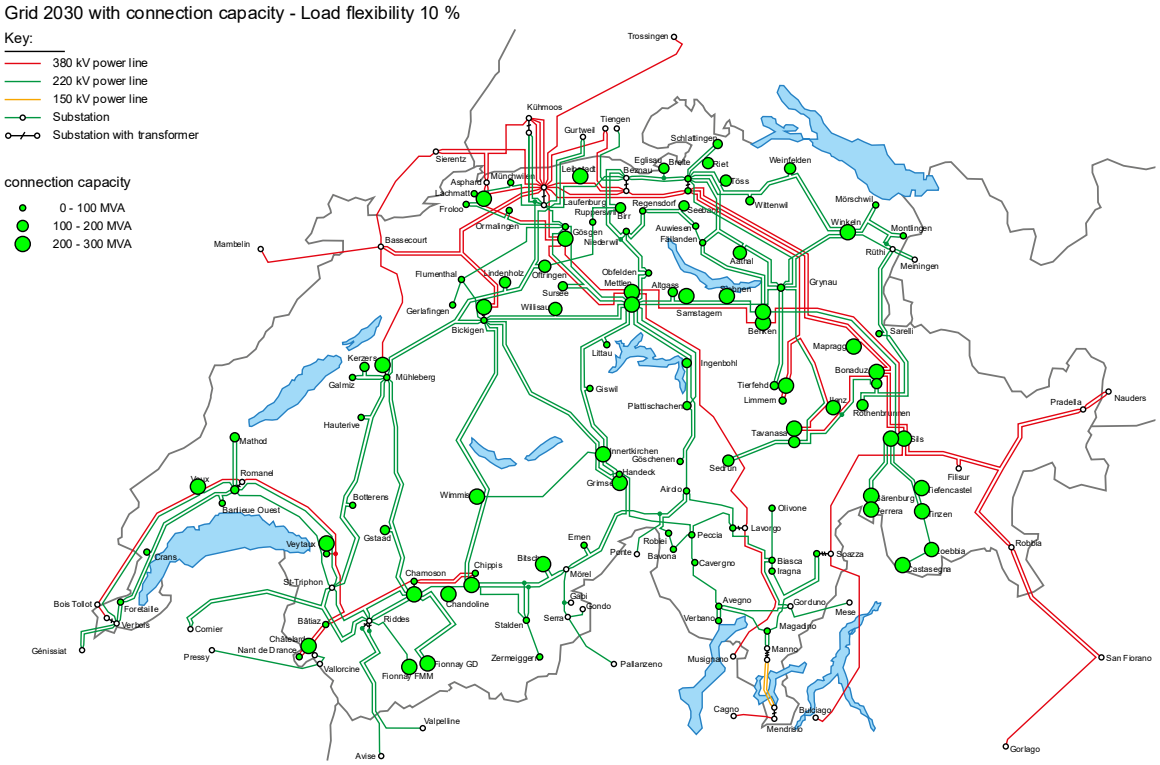
6.2 Time horizon: 2030

6.2.1 2030 grid topology

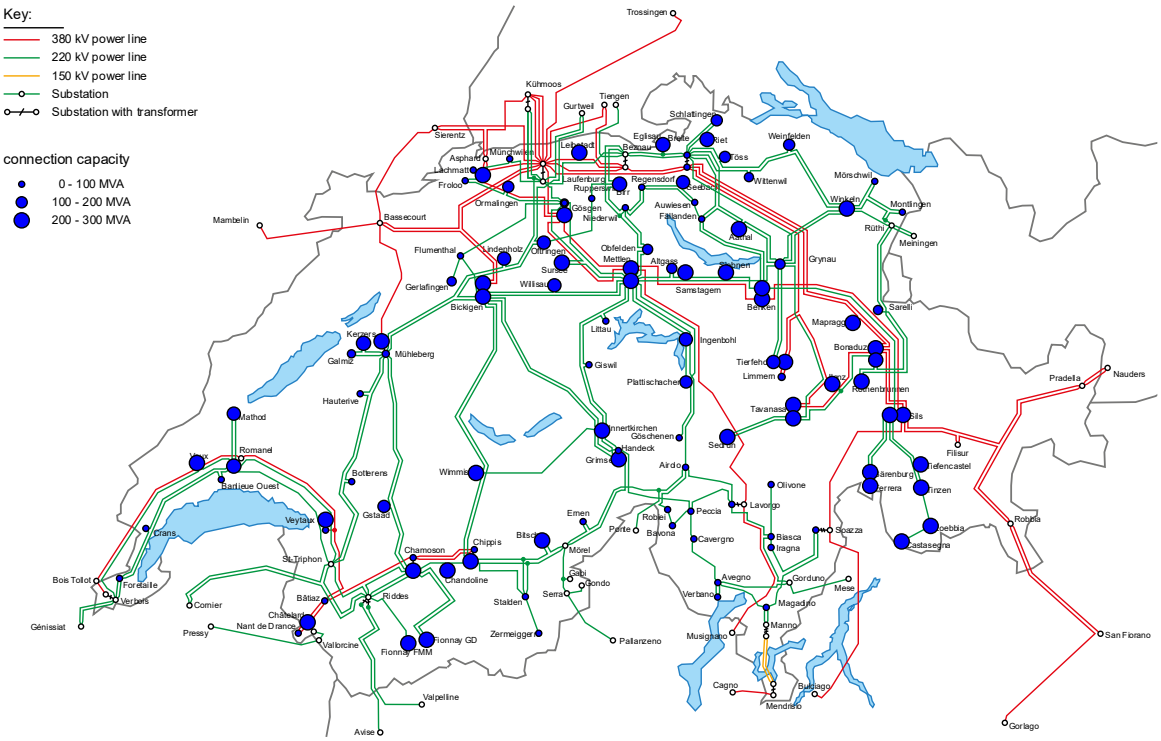
6.2.2 2030 grid, feed-out (load), base (flexibility 0%)



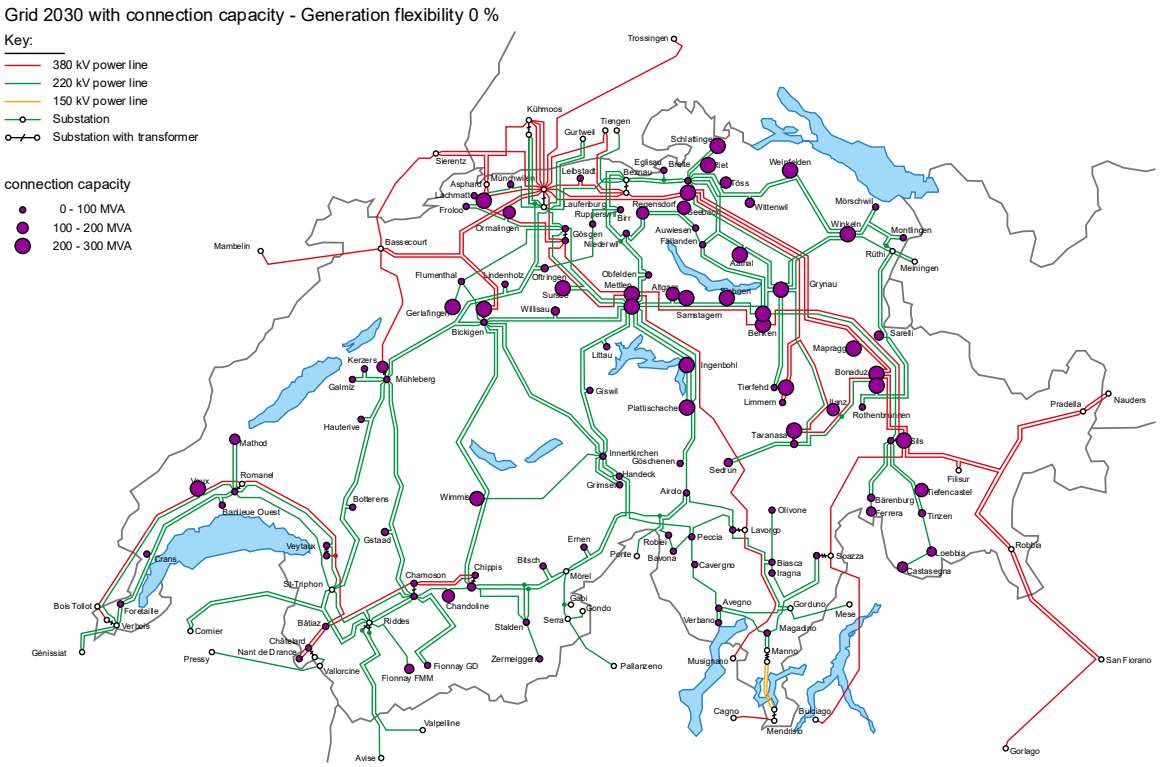
6.2.3 2030 grid, feed-out (load), flexibility 10%



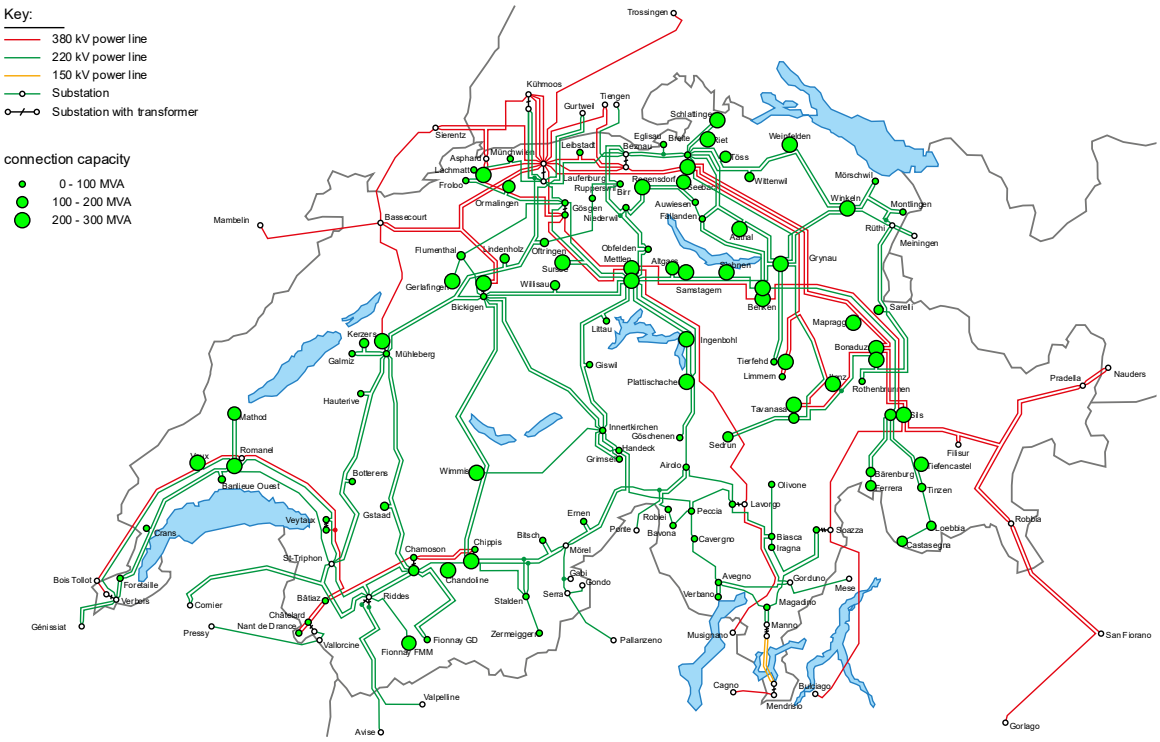
6.2.4 2030 grid, feed-out (load), flexibility 20%



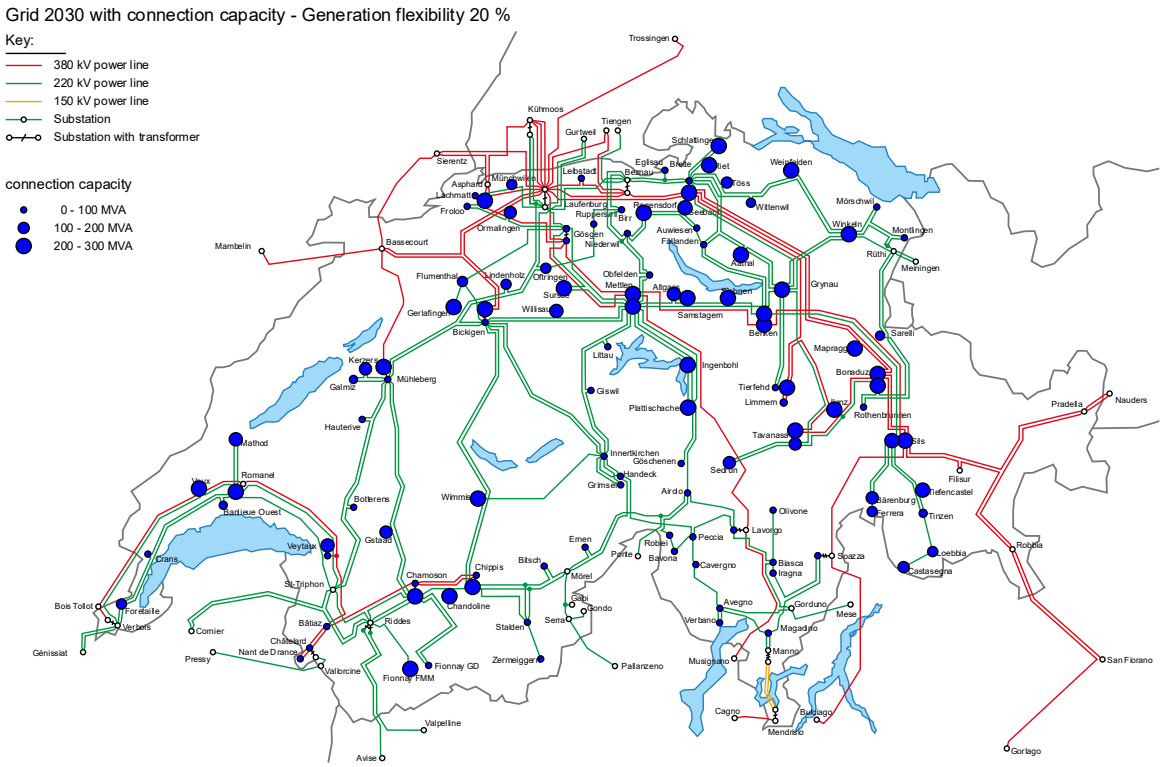
6.2.5 2030 grid, feed-in (production), base (flexibility 0%)



6.2.6 2030 grid, feed-in (production), flexibility 10%



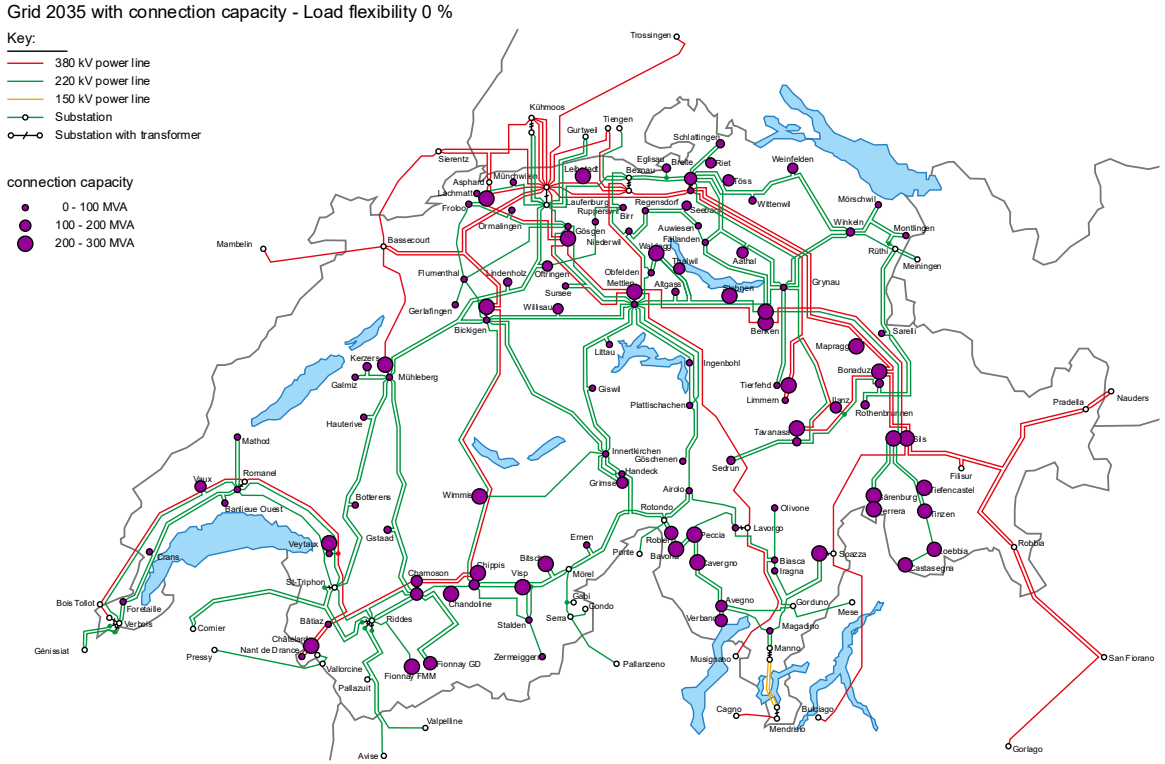
6.2.7 2030 grid, feed-in (production), flexibility 20%



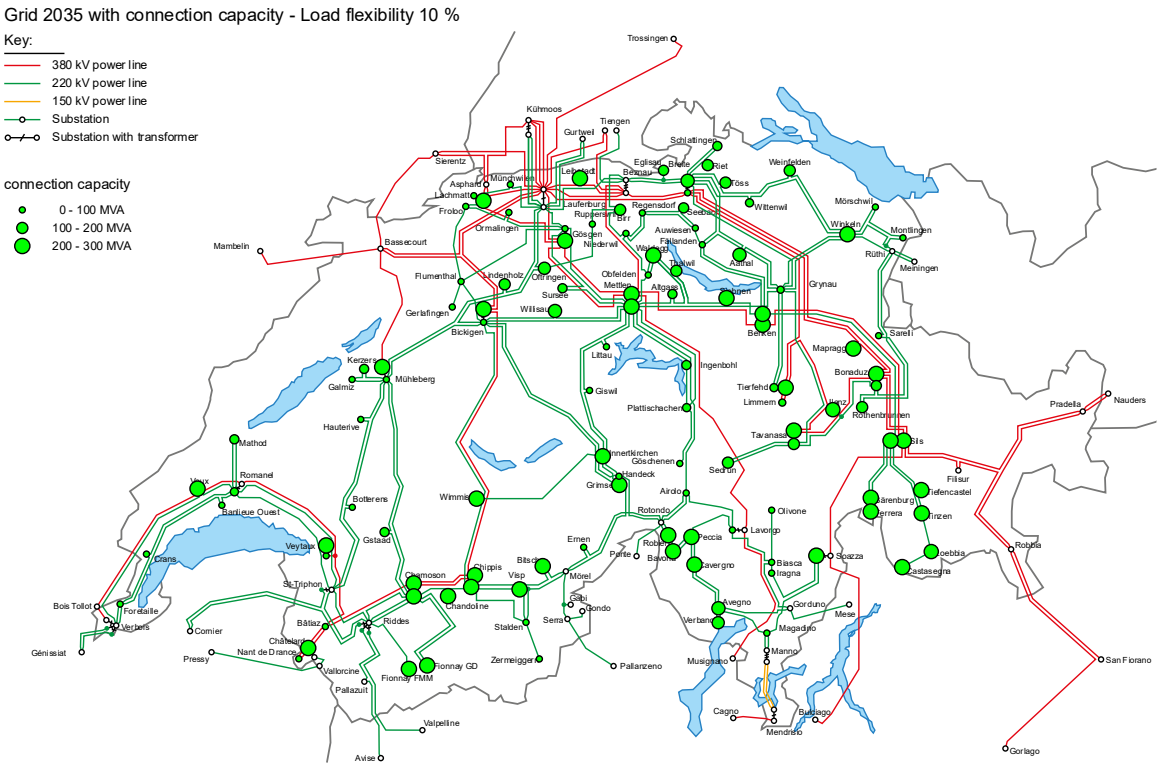
6.3 Time horizon: 2035

6.3.1 2035 grid topology

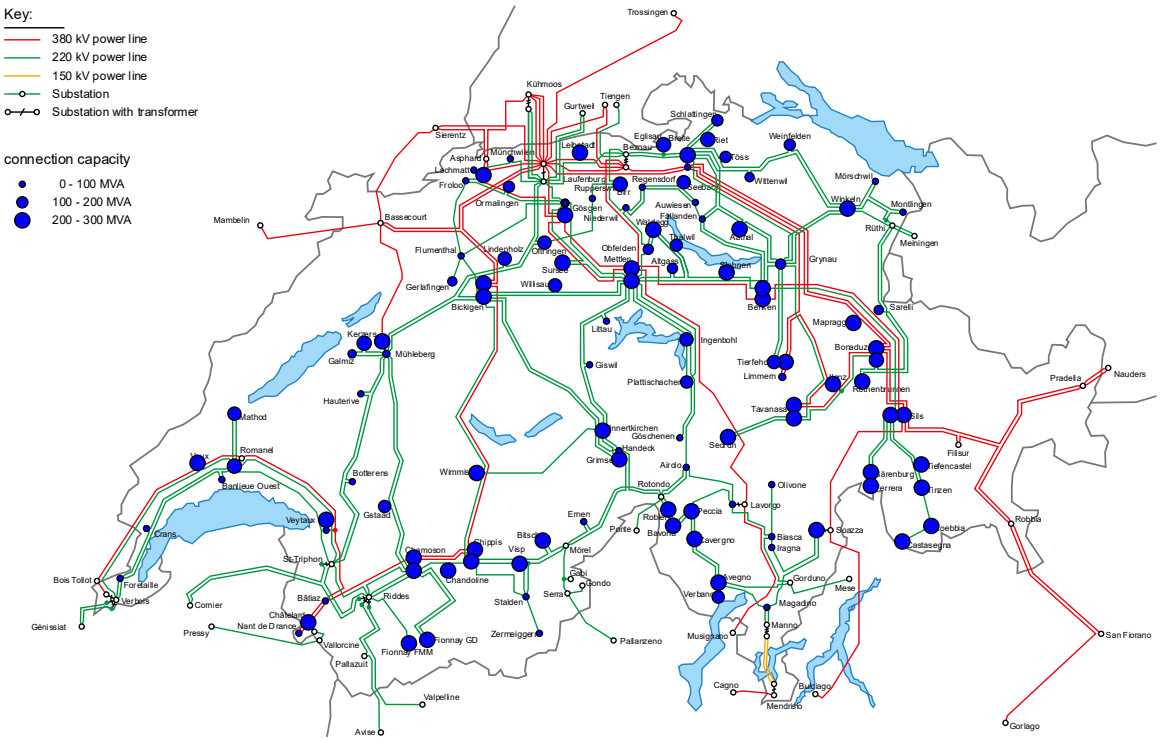
6.3.2 2035 grid, feed-out (load), base (flexibility 0%)



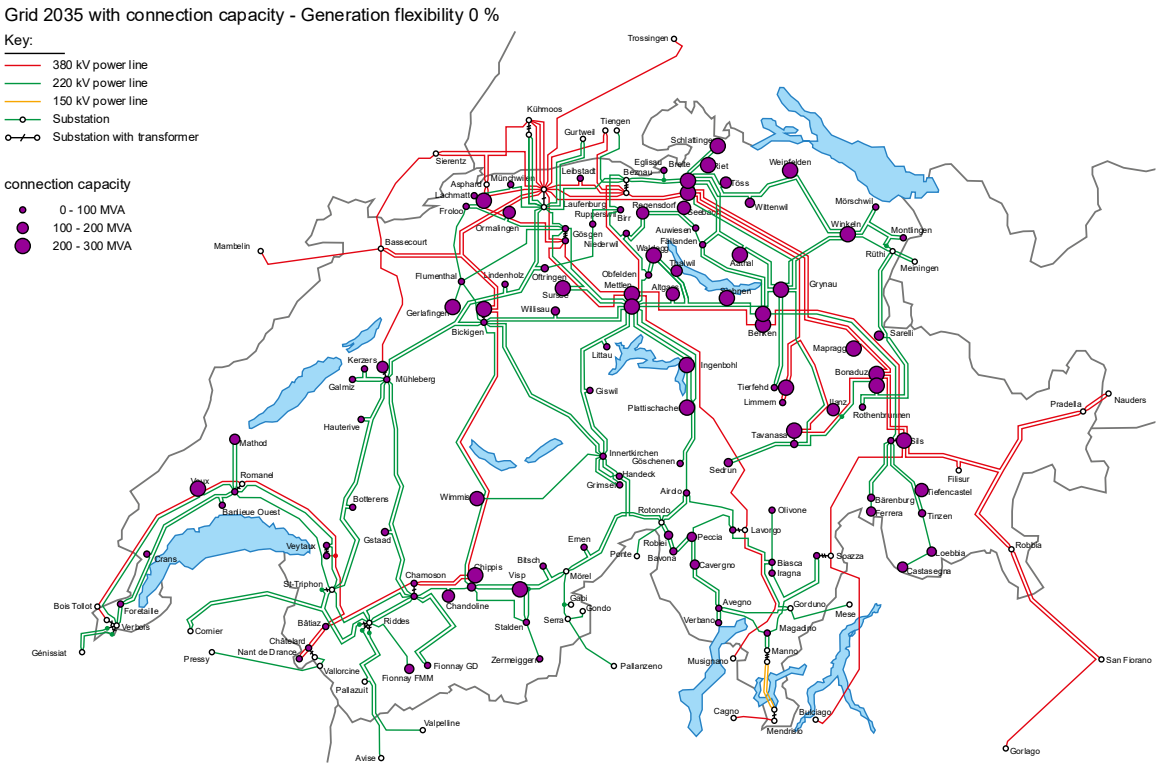
6.3.3 2035 grid, feed-out (load), flexibility 10%



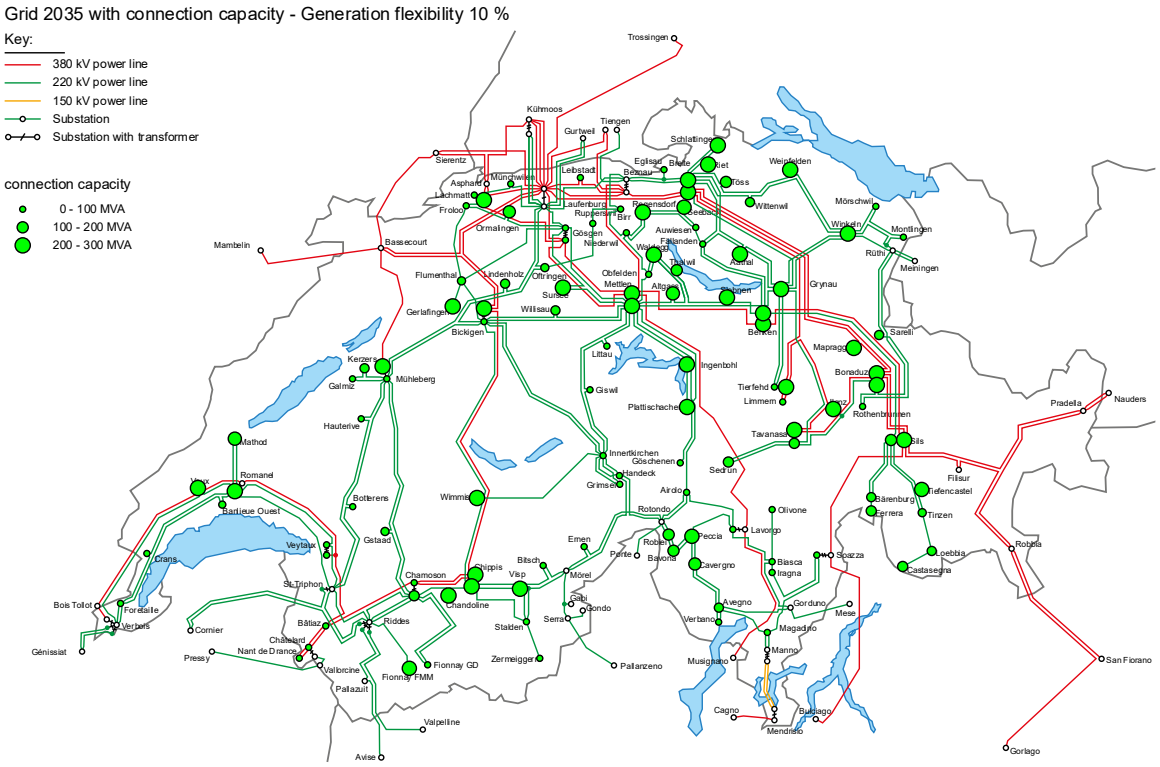
6.3.4 2035 grid, feed-out (load), flexibility 20%



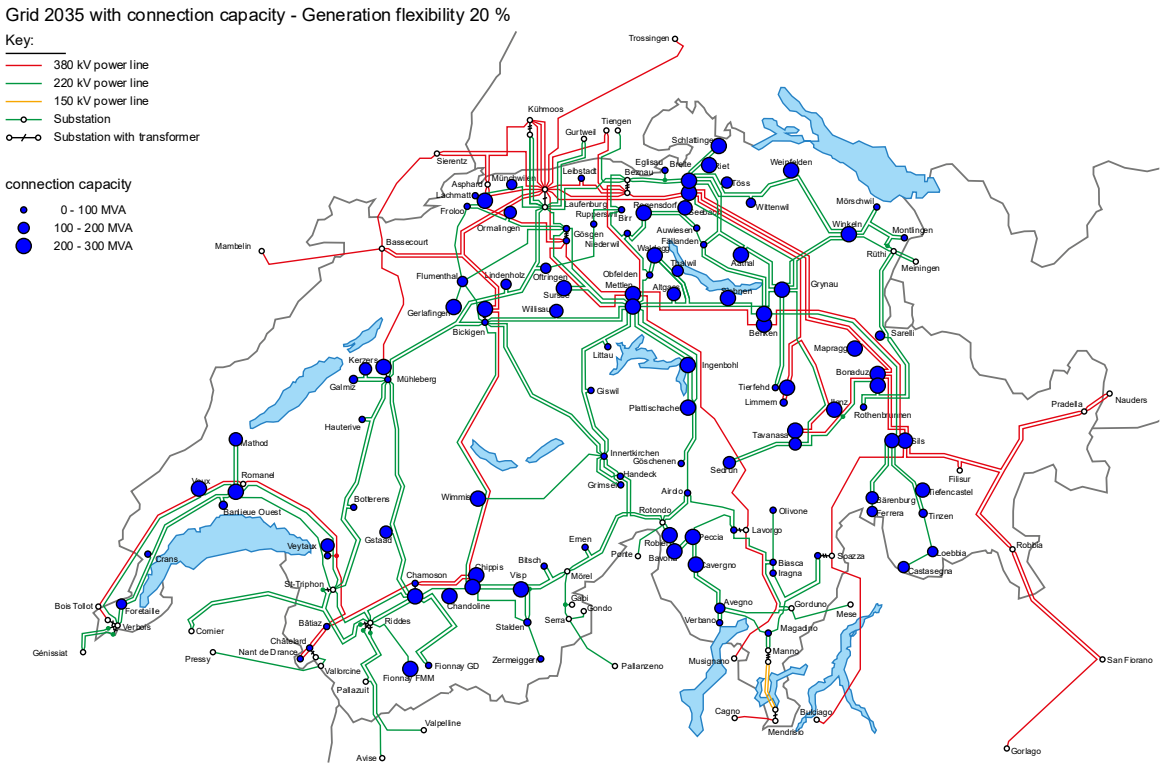
6.3.5 2035 grid, feed-in (production), base (flexibility 0%)



6.3.6 2035 grid, feed-in (production), flexibility 10%



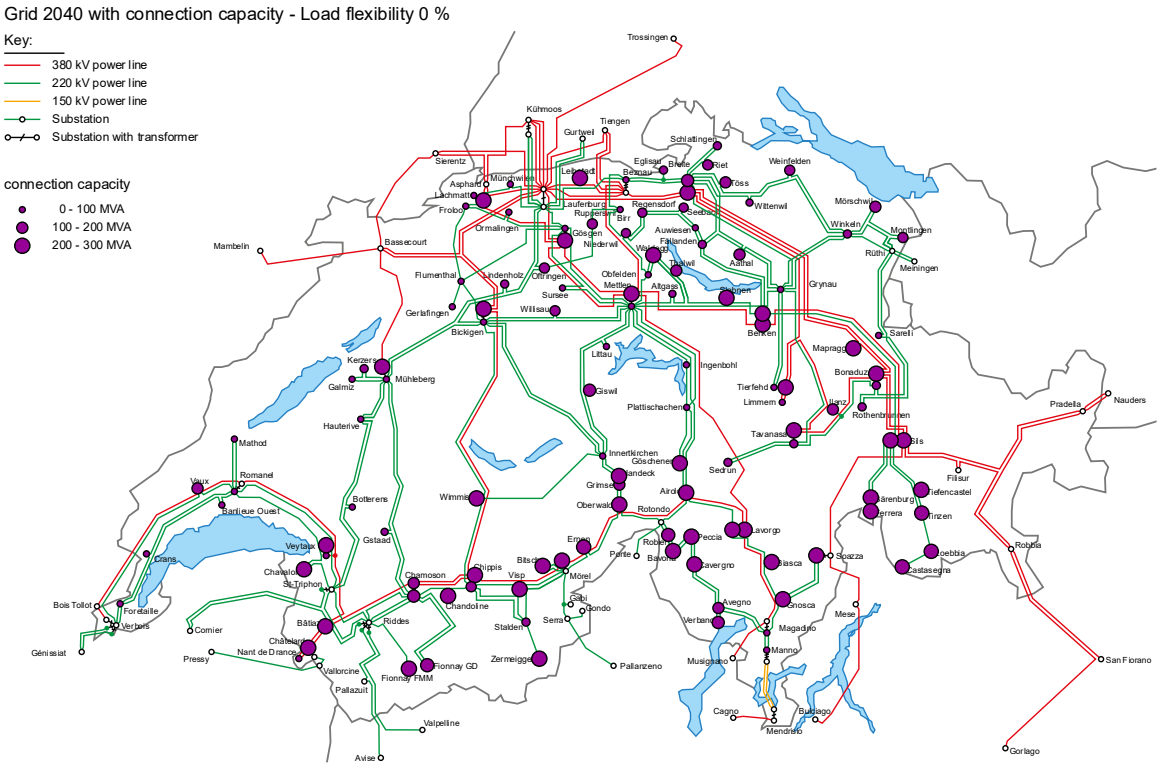
6.3.7 2035 grid, feed-in (production), flexibility 20%



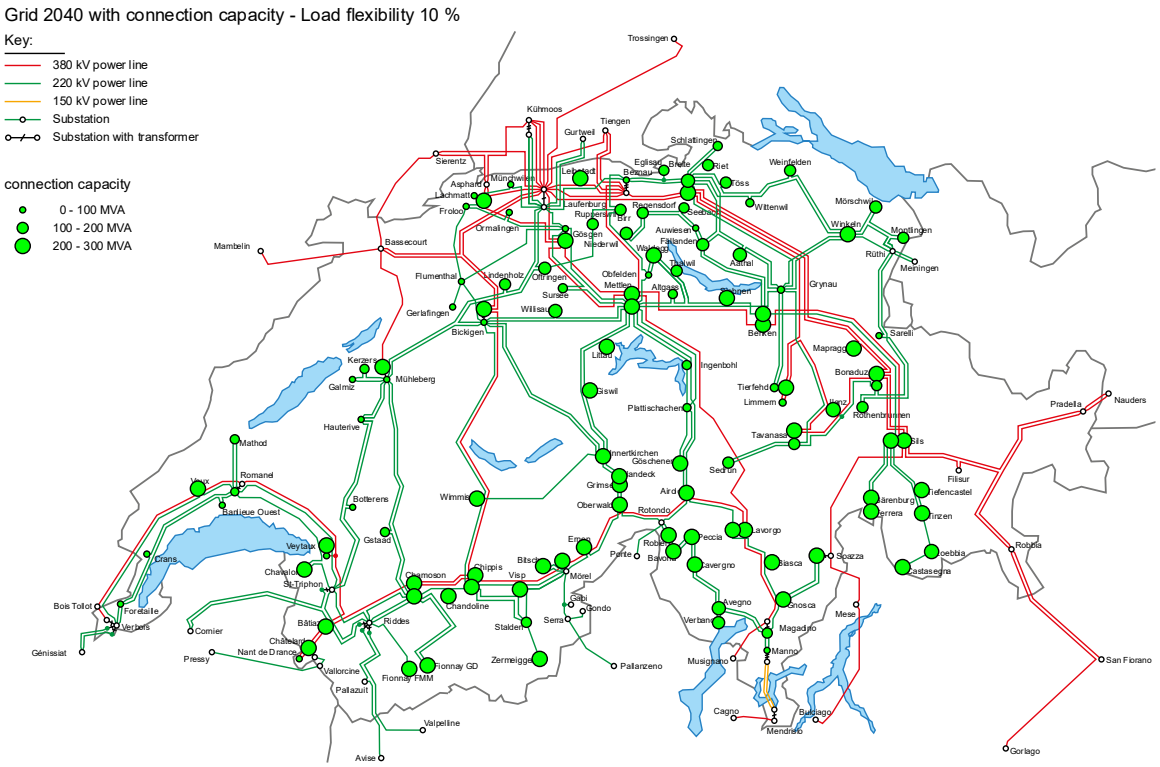
6.4 Time horizon: 2040

6.4.1 2040 grid topology

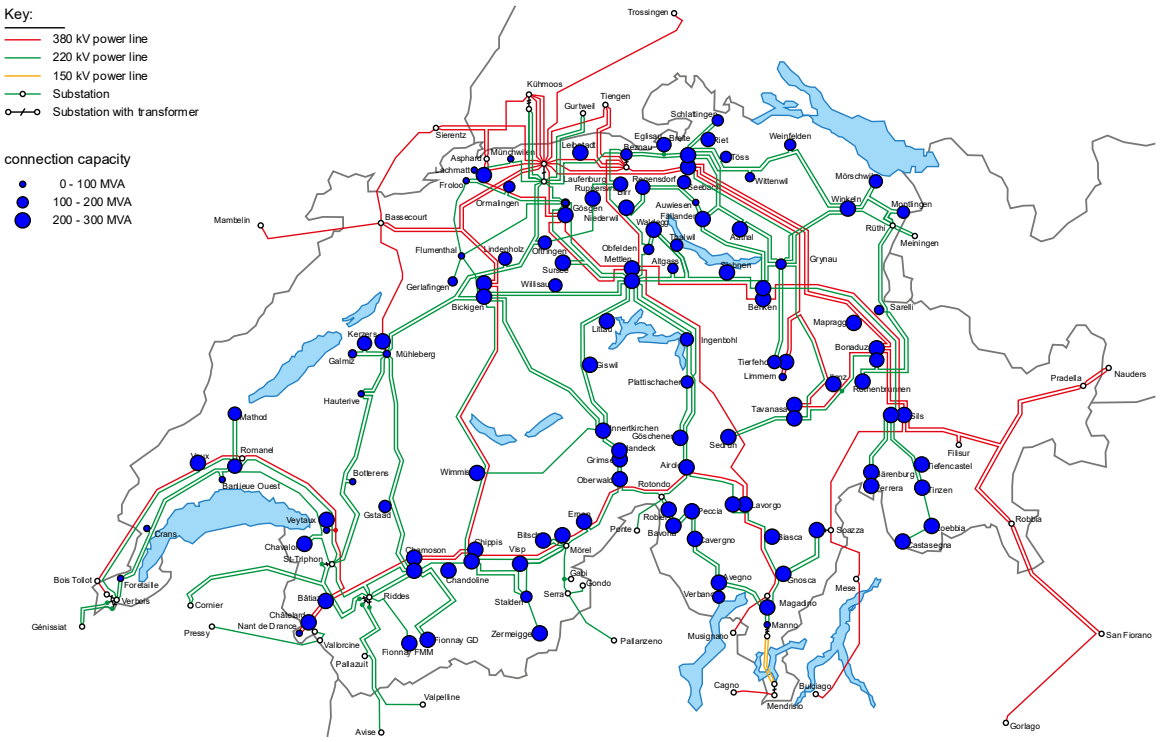
6.4.2 2040 grid, feed-out (load), base (flexibility 0%)



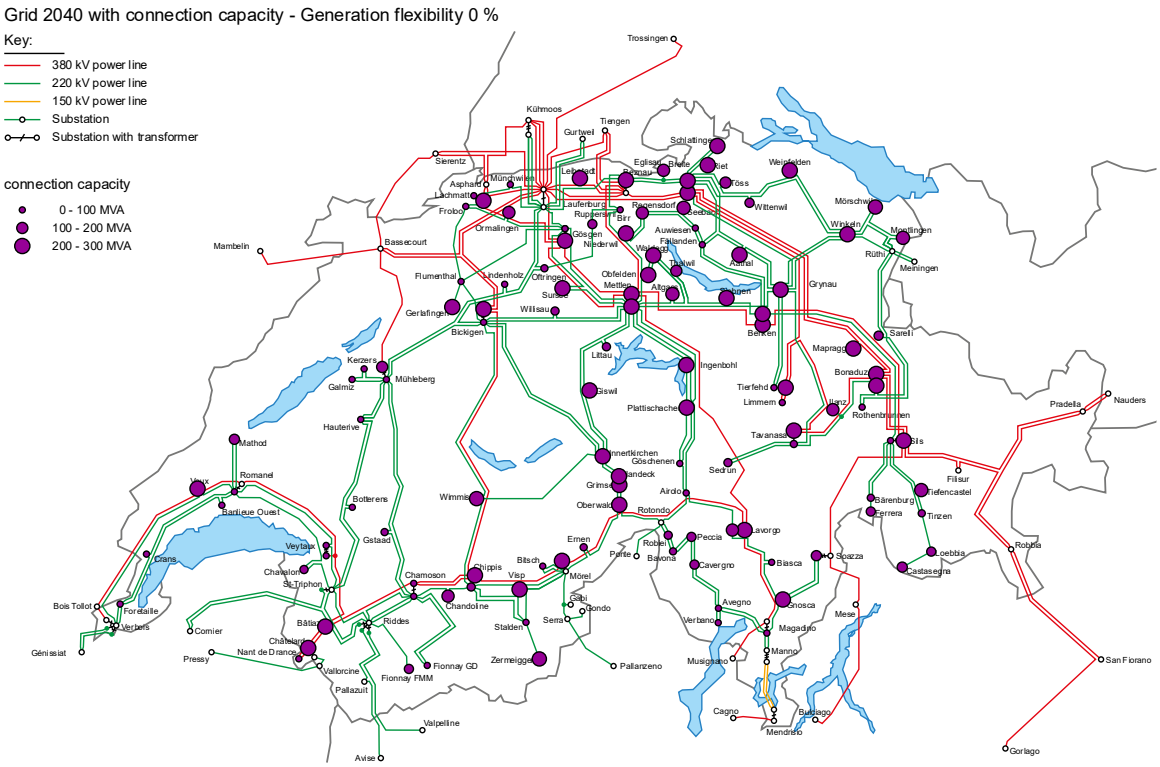
6.4.3 2040 grid, feed-out (load), flexibility 10%



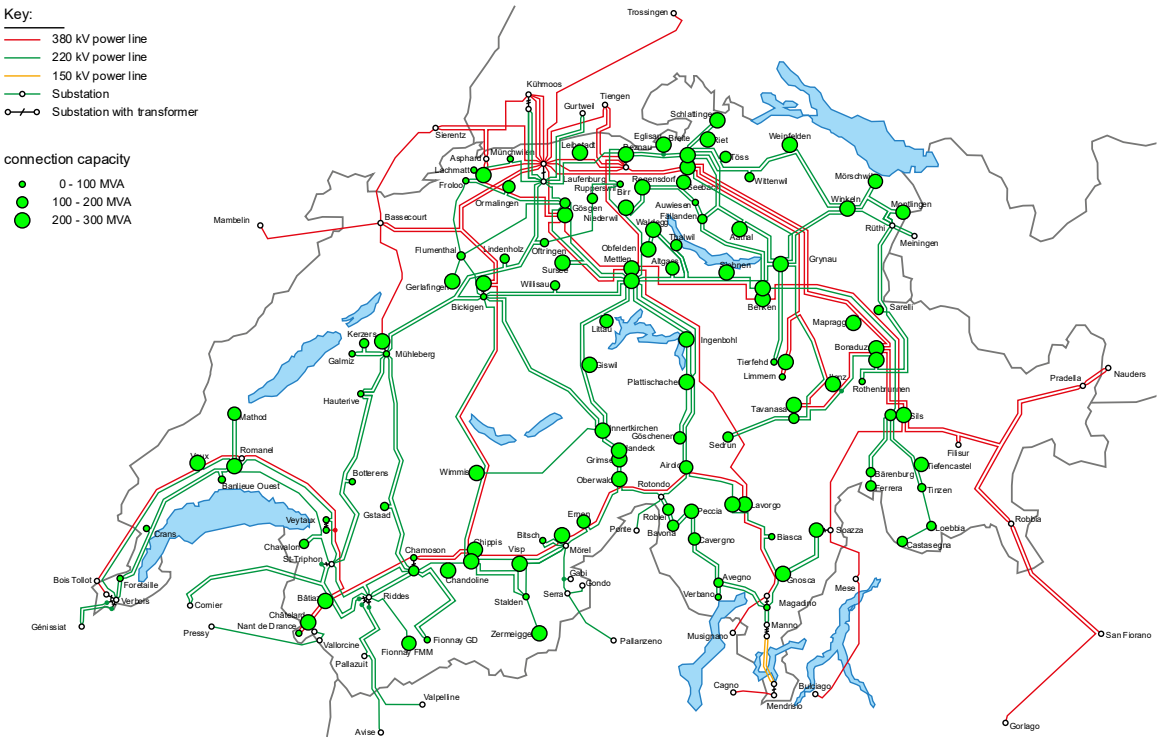
6.4.4 2040 grid, feed-out (load), flexibility 20%



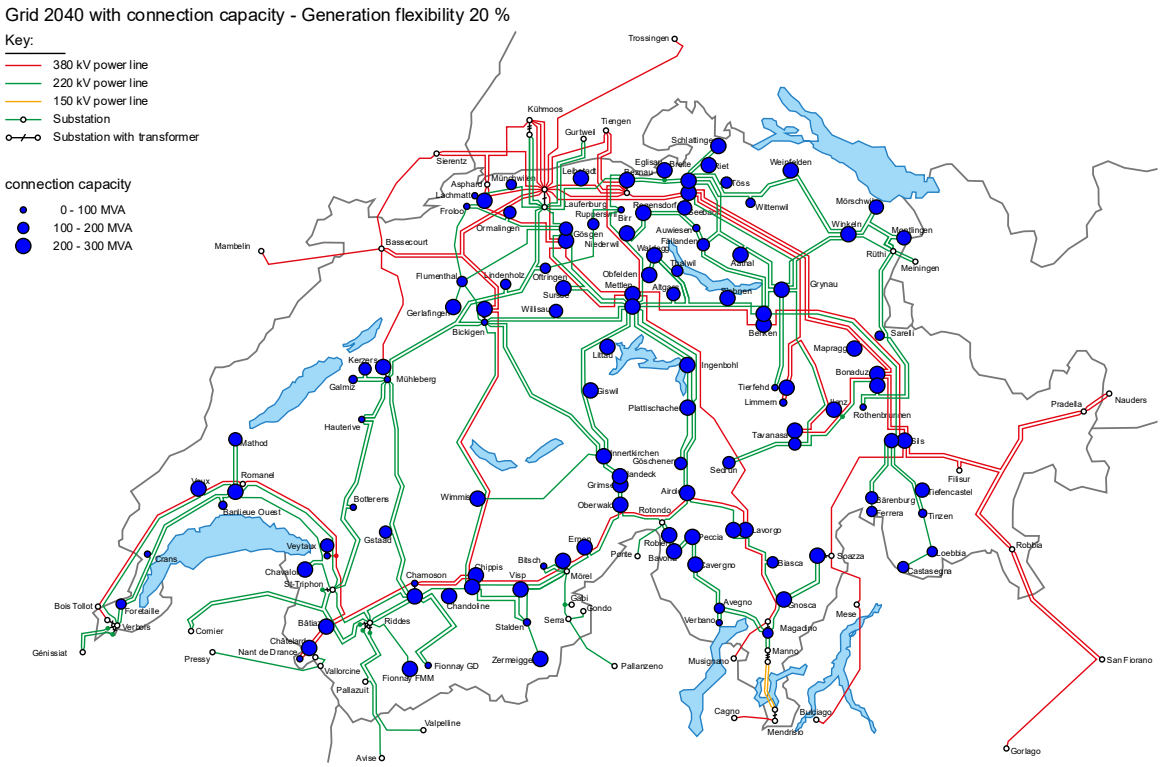
6.4.5 2040 grid, feed-in (production), base (flexibility 0%)



6.4.6 2040 grid, feed-in (production), flexibility 10%



6.4.7 2040 grid, feed-in (production), flexibility 20%



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