SAFER2028-SINARP2024 Deliverable report,

D2.1.2: The 400 kV transmission system model (T2.1)

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1 Introduction

The grid work in 2024 has had a significant upgrade in terms of parametrisation, harnessing the work by The Phong Nguyen [1]. In 2024 the grid model has been brought up to date. Significant improvements in the usability of the model have been implemented, with the aim that one grid model will be able to be used for all scenarios and simulations, using an m-file to set the parameter settings, commented off/on functions for, e.g., determining whether or not voltage sources should be used (for speed) rather than synchronous machines, the load type (PQ, impedance or constant current), etc. This significant overhaul has made the model a lot more configurable, and it would seem that some bugs have been ironed out, as, for example, the steady-stage load flow analyser is now working in Simscape, allowing initial conditions to be set before the slower time-domain simulations are run. The actual grid model is now visually much cleaner, with, by and large, one block for each 400 kV connection point. However reactive power compensation devices are visible in the overall view, so as to easily visualise whether they are connected or not.

Another significant development has been to change the frequency measurement from a PLL-based block to a simple logging of the shaft speed of a synchronous machine, for example one of the Loviisa units. A doctoral student, Tofighi Milani Seyyed, was given the task to sort out why the frequency response was not responsive to inertia in the system. John had felt that the problems must be in the grid model, but Tofighi discovered that the problem was with the frequency measurement, not the grid model. Whew! Fortunately, VTT have been using a generator rotor speed-based frequency measurement, but it does mean that Grid-only frequency plots produced by Aalto are erroneous up until this report. It should be noted that funding finishes for the SINARP project this year, but that does not preclude applying to enter the SAFER project in the next round with a transmission model that is fit for purpose, fully configurable with more credible frequency logging, and not such a burden on any future funding!

2 The Blocks

Each turquoise box in Fig. 1 contains the various generation types and demand lumped to each connection point.

For example, behind the block shown in Fig. 2 for Olkiluoto 3, is the generation type, nuclear, then a block or subsystem with the two generator units, labelled as A and B, and an alternative voltage source for both A and B for faster simulations that do not require transient behaviour to be modelled, Fig. 3.

Connection points that contain demand as well as generation have separate blocks for each, and further, separate blocks for different generation types (nuclear, wind parks, hydro, urban CHP, industrial CHP) and also 3 possibilities for load modelling (PQ, Impedance, constant current)

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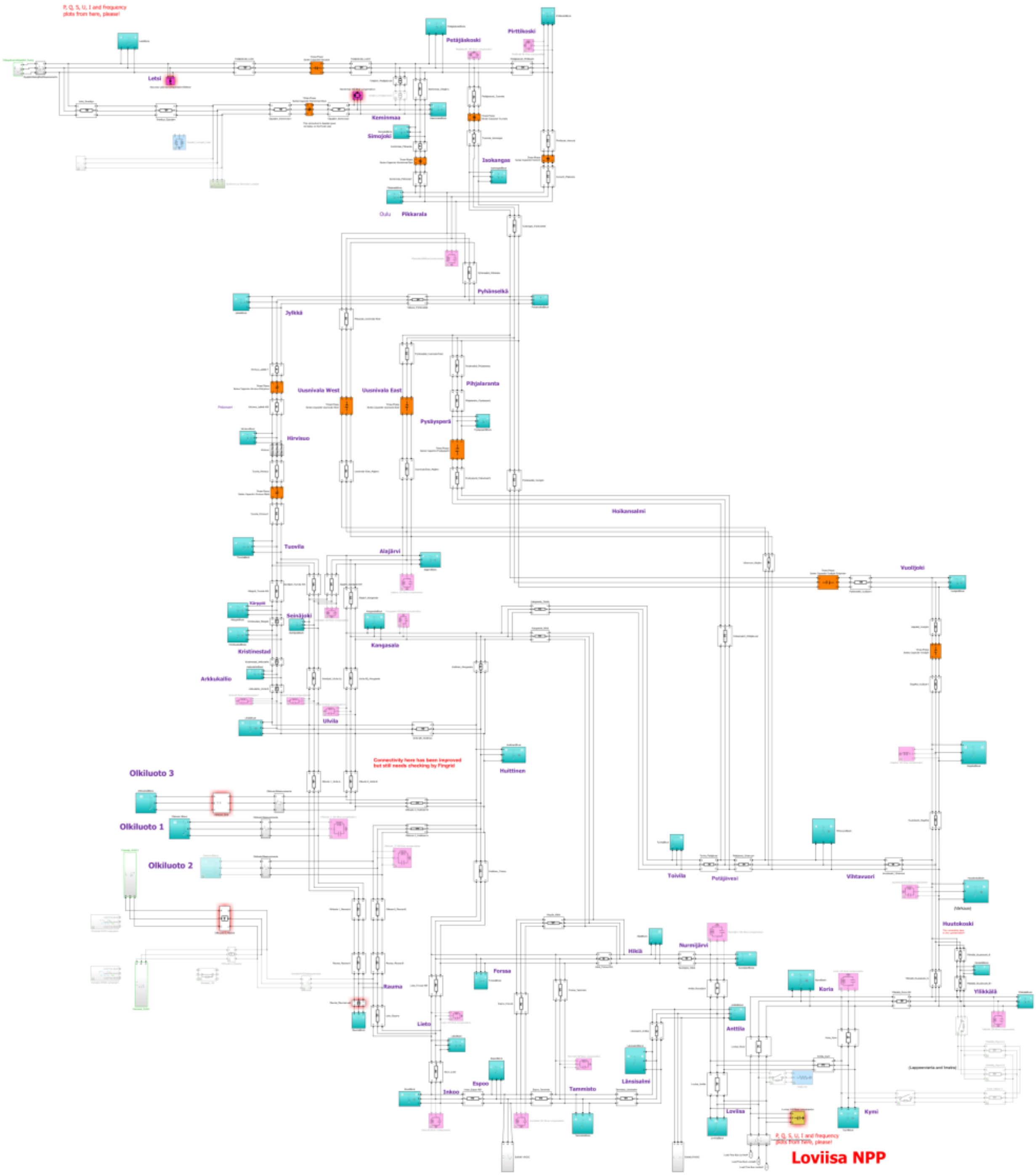

Figure 1 Overall view of grid model in Simscape, where turquoise blocks represent 400 kV connection points

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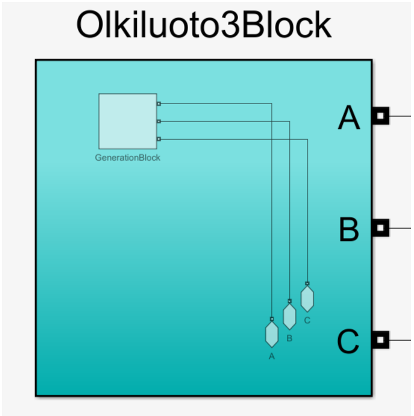

Figure 2 Block for Olkiluoto 3

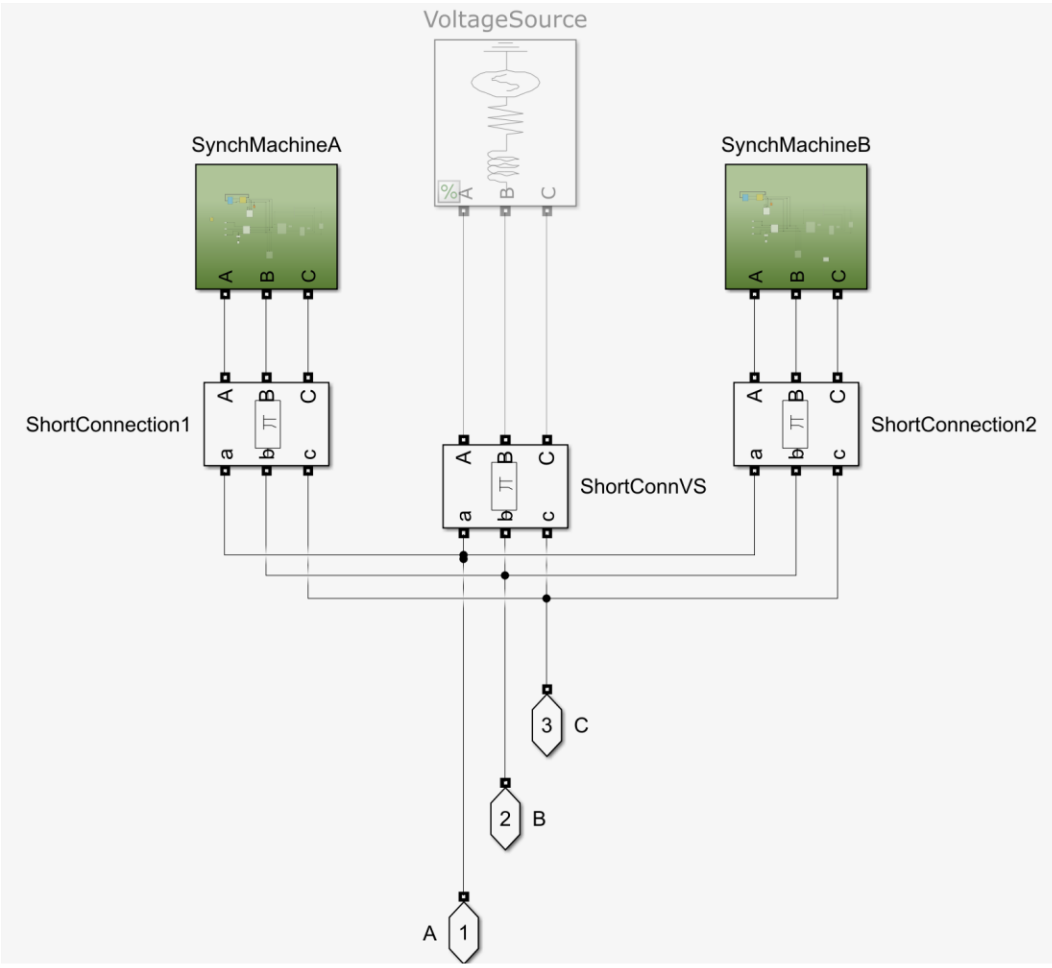

Figure 3 Nuclear Block for Olkiluoto 3

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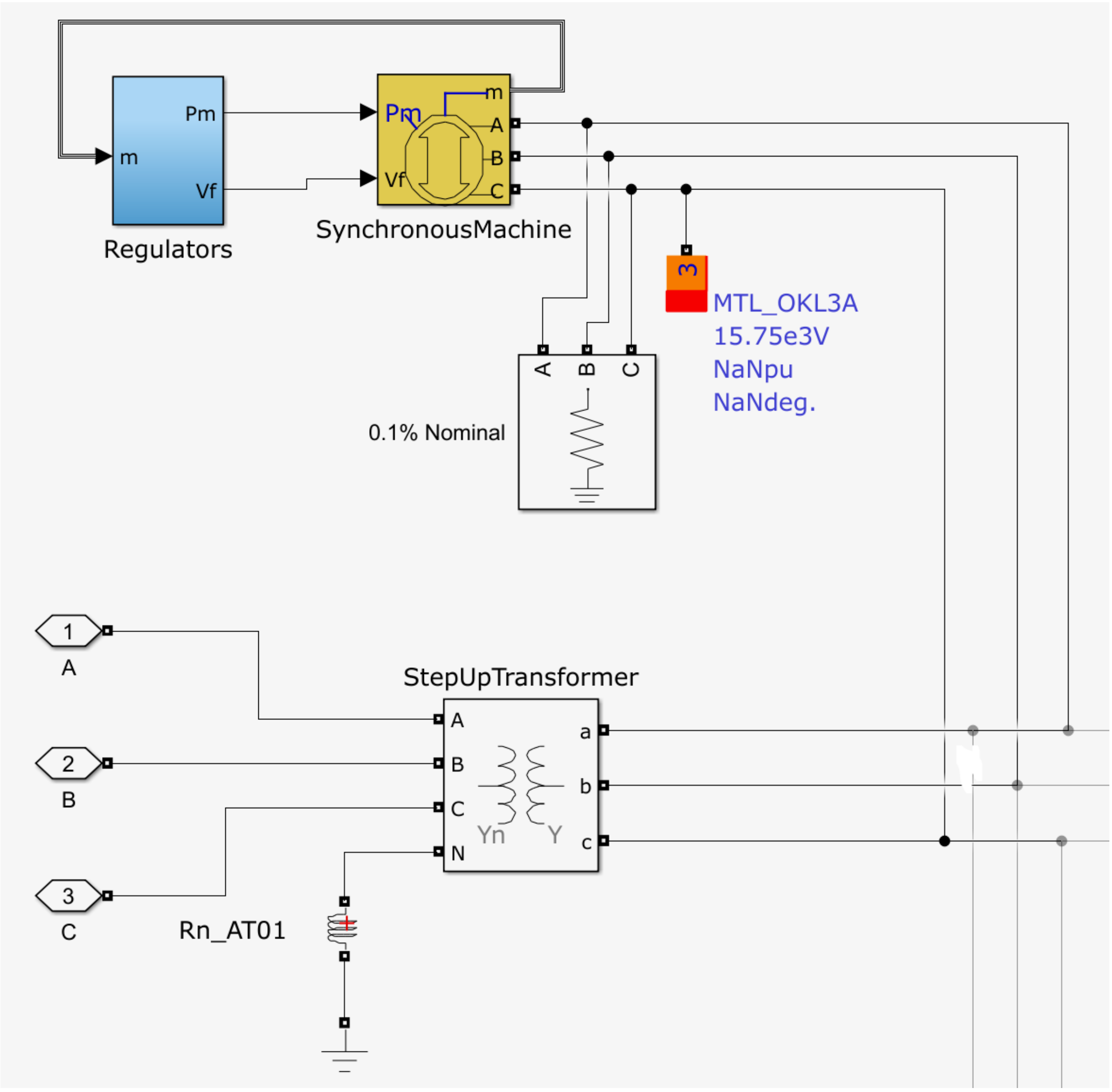

Figure 4 Olkiluto 3A generator, transformer and regulator block, which also allows a choice of two or no power system stabilizers

Configurability means that comment functions set up in the ScenarioChooser and ParameterSettings m-files automatically select how the generation should be modelled, whether or not wind park converter harmonics should be injected, how load should be modelled (this will be further refined to apportion how much of the load behind a connection point should be modelled as PQ, Z and I loads. There are also two ways wind parks can be modelled, which will be discussed in the next section.

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3 Wind park modelling

Floran and his exchange student Pierre Troussard developed a grid-forming model and digital twin of a wind park [2]. We are still utilizing last year's grid-following model [3] in the grid model, as that best reflects the wind turbines in use at present. A low-inertia, low-short-circuit rated synchronous machine equivalent model is also available as an alternative for simulations that should run faster, as a larger time increment can be used.

The Appendix will list the parameters used in the final simulations, but this report will conclude with Tofighi Milani Seyyed's investigation into why the grid model was not giving realistic frequency responses to major contingencies such as nuclear tripping or HVDC cable failure. This has solved one way to bench-mark the grid model with frequency plots publicly available from Fingrid [4]

4 Frequency measurement aberrations – problem solved!

John gave Tofighi a scaled down grid model representing the south-west of Finland, and Tofighi came to the conclusion that there was nothing wrong with the grid model, either in the grid or with the synchronous generator modelling[1].

However, Tofighi, who had worked earlier on inertia in power systems, quickly realized that the way we were measuring the frequency of the system is responsible for the problem. We were using the PLL (phase lock loop) method to measure the frequency, but we also measure the shaft speed of the generator, as this is a needed parameter in the coupling with the regulator blocks, even though we were not logging this parameter. There turns out to be a difference in the output measurement signal, which comes from the method of measurement, and if time increments are large, say 1 ms, there is a huge discrepancy. Togighi reasons that the PLL is not locked to the phase immediately at the beginning or during transients (such as switching or tripping events). During this locking period, the PLL introduces additional dynamics, which manifest as an overshoot, undershoot, or lag in the frequency estimation. At startup, the PLL starts with a mismatch between its internal oscillator phase and the grid voltage phase. This causes a transient as it adjusts to lock onto the signal. The dynamics of the PLL are governed by its loop filter design (e.g., PI gains or bandwidth). A faster PLL (high bandwidth) locks quicker but may exhibit higher noise sensitivity, while a slower PLL (low bandwidth) takes longer to stabilize. Many PLL implementations include low-pass filters to mitigate noise or harmonics. These filters introduce additional delay and transient behavior. The initial transient dynamics of the PLL are a natural part of its operation and reflect its attempt to estimate the grid frequency accurately under changing conditions.

However, the real system frequency is fundamentally linked to the rotational speed of all synchronized machines. The generator shaft speed is the closest representation of this, especially for studying primary frequency control and system inertia. Therefore, to study the frequency dynamics (RoCoF , nadir point, etc) it is good practice to measure the frequency directly from the shaft to eliminate those additional dynamics introduced by the PLL, because they are coming from PLL, not the inertia of the system.

Accordingly Tofighi added another frequency measurement utilizing the per unit speed of the generator shaft. He ran the model for two cases, 20-second and 2-second inertia, while measuring the frequency by both methods. The results are presented in Figs. 5 and 6. He has circled the

[1] This is not to imply that the synchronous machine models exactly replicate the generation in Finland, but that the models behave rationally!

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RoCoF of the frequency in both cases. When inertia is 2, RoCoF is almost -2,5 Hz/sec, and when H=20 sec, RoCoF =-0,27 Hz/sec. as you can see, when the inertia is multiplied by 10 the RoCoF values are divided by 10, which makes sense.

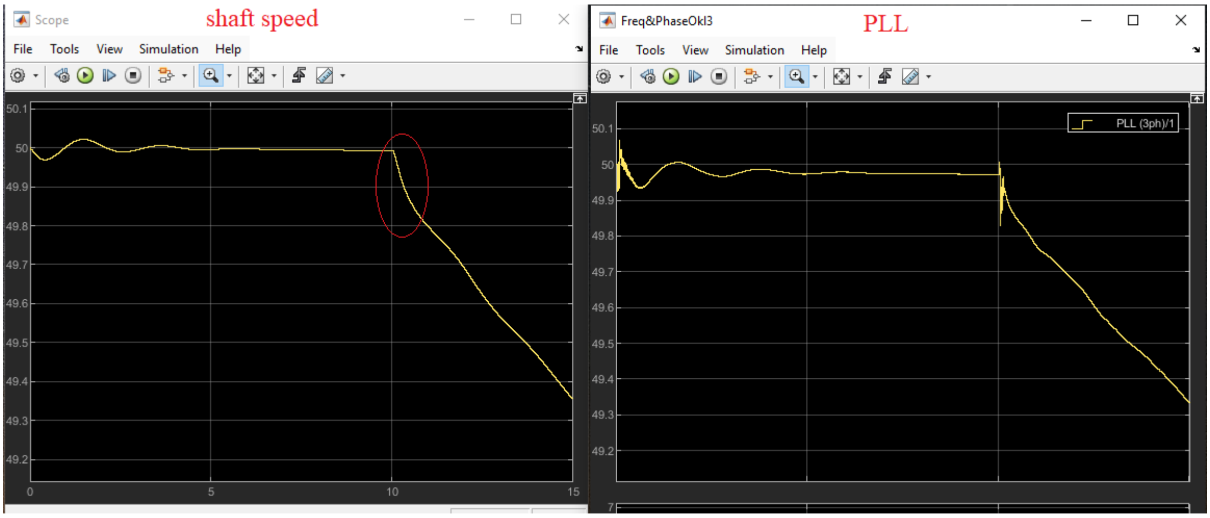

Figure 5 Inertia H = 20 s

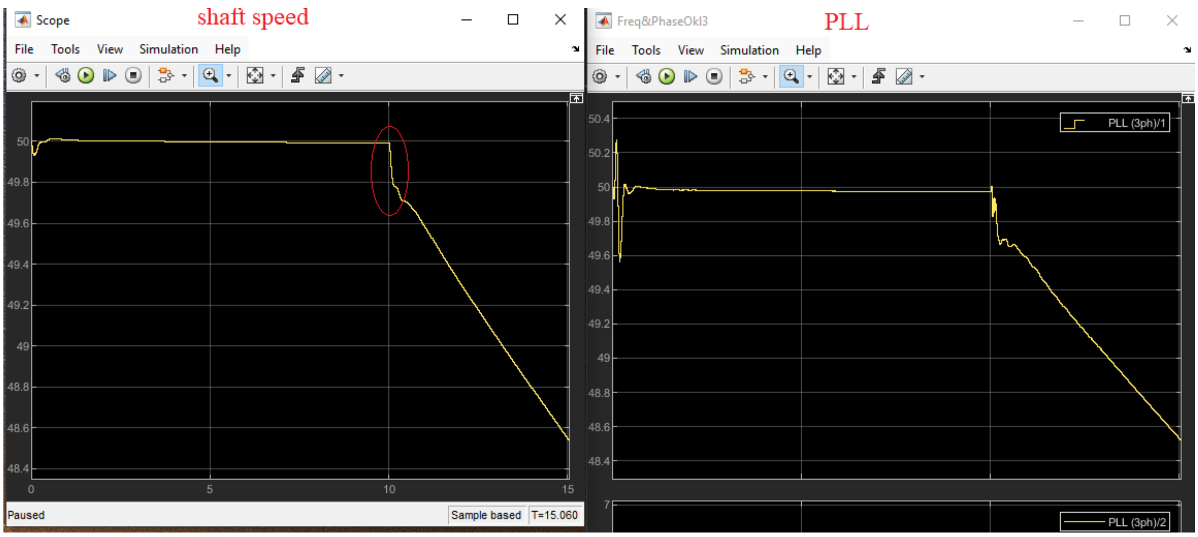

Figure 6 Inertia H = 2 s

Note that these numbers are approximate, and these figures come from a small grid, shown in Fig. 7. In the actual grid and indeed, in our full model of Fingrid's 400 kV grid, the RoCoF is much slower due the much higher system inertia in GWs.

Hence, in order for RoCoF to be calculated accurately, the frequency should be measured by the shaft speed sensing to remove additional dynamics introduced by the PLL. In fact, we were looking at the wrong place for RoCoF calculation! They were PLL dynamics!

The placement of the rotor speed frequency measurement is illustrated in the top of Fig. 8, which has a gain of 50, to turn per unit into Hz.

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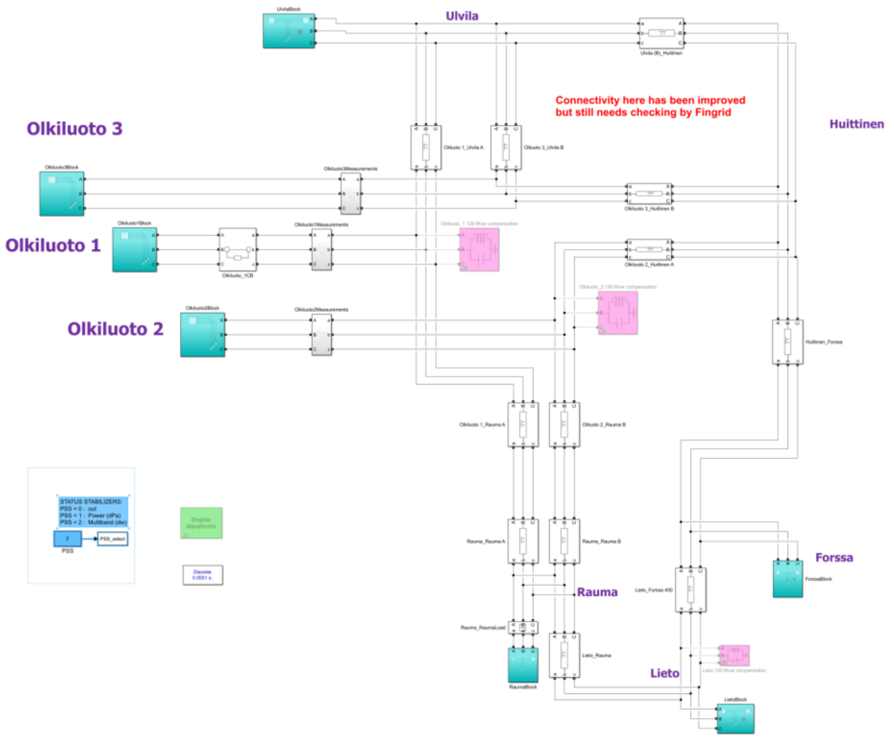

Figure 7 Small grid model given to Tofighi to solve inertia problem, or lack thereof!

Comment by John: This shows what a fresh set of eyes can reveal, and fancy ex-mechanical engineer (among other things!) John not utilizing the mechanical shaft-speed for measuring the frequency!

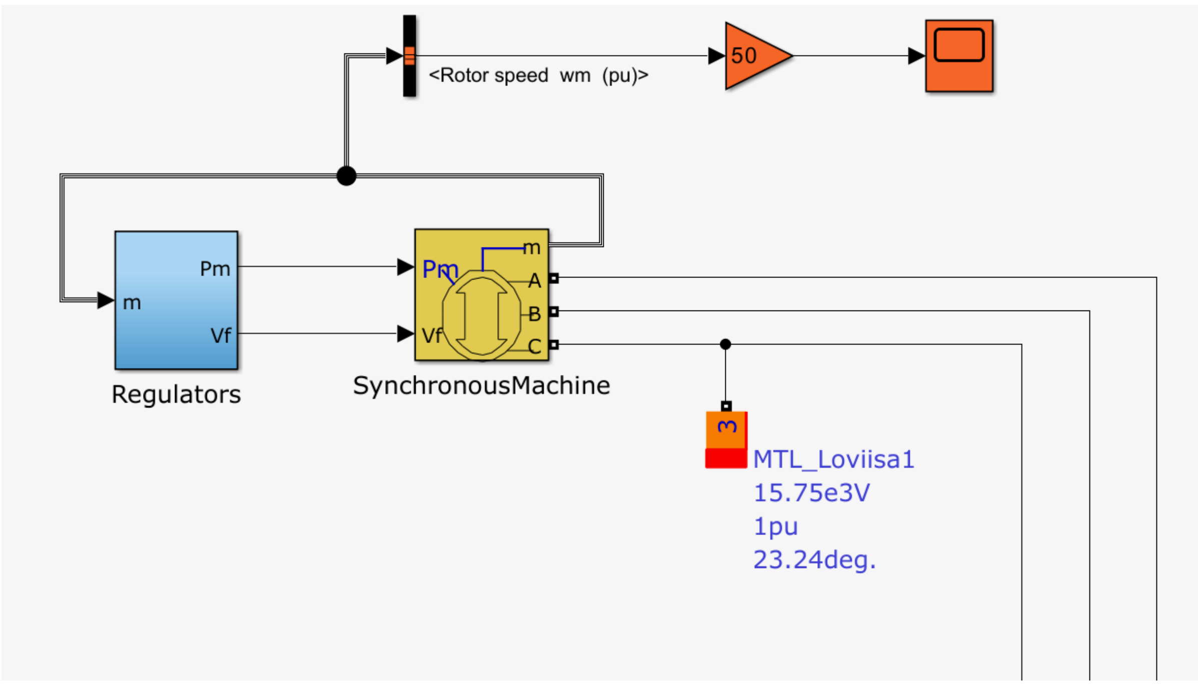

Figure 8 Measurement of frequency based on generator rotor speed of Loviisa 1

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Fig. 8 shows the frequency response that the full grid model (Fig. 1) exhibits when 1.3 GW of generation trips at 10 seconds. This matches quite well with the RoCoF illustrated in Fig. 4.14 in [4].

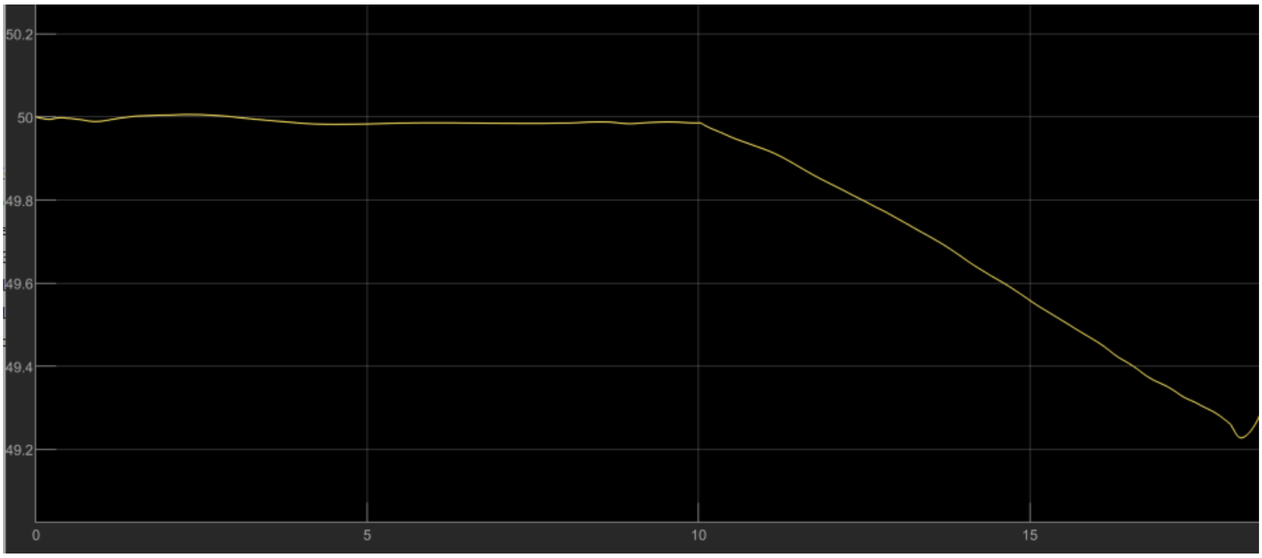

Figure 9 A frequency plot where 1.3 GW of generation trips at 10 seconds with full grid model with system inertia at 193 GWs

5 Discussion

The grid model has been duly updated and made more configurable in 2024, and represents topologically, and in terms of both generation and loads, the situation at the end of 2024. It is most pleasing, and about time, that we have now solved the inertia problem, which was due to an erroneous frequency measurement subsystem, not the grid model itself. This has delayed this delivery by one month, but it was an outstanding problem worth solving. There is no end to potential further developments. We are thankful that we have been able to develop the grid model to the point is at now, but apologetic about the time it has taken and that the work has always been squeezed into the end of the year, in turn squeezing the time available for VTT to perform co-simulations with the APROS model of the Loviisa NPP.

References

[1] T. P. Nguyen, "Power system modeling to aid the planning and operation of the Finnish transmission grid in 2035 scenarios," Master's thesis, 31.07.2024, in Master's Programme in Advanced Energy Solutions, https://aaltodoc.aalto.fi/server/api/core/bitstreams/1faa8626-1a00-4f14-951e-c67c1d872610/content

[2] P. Troussard, F. Martin, A. Belahcen, Y. Diab, "Control grid following, grid forming and fault testing of Wind Farm Equipped with Type IV Generator" Internship report for work carried out from May 20 to October 4, 2024. Aalto University and Université Nantes

[3] SAFER2028-SINARP deliverable D1.2.1, Digital twin of a wind farm equipped with type IV generator and a grid following controller, Floran Martin, Robert John Millar, and Janne Seppänen

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[4] Frequency quality analysis 2022. Fingrid, https://www.fingrid.fi/globalassets/dokumentit/fi/kantaverkko/suomen-sahkojarjestelma/frequency_quality_analysis_2022_public.pdf

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Appendix A Generation and demand parameters

Table A1 Generation parameters. Note the more targeted scale factors to enable scenarios to be more nuanced

```
%% HVDC
    % HVDC links from Sweden, usually modelled as generation into Finland
    CoSim.HVDC.Pmax.Finnbole = 800e6;
    CoSim.HVDC.Qind.Finnbole = 0;
    CoSim.HVDC.Qcap.Finnbole = 0;

    CoSim.HVDC.Pmax.Dannebo = 400e6;
    CoSim.HVDC.Qind.Dannebo = 0;
    CoSim.HVDC.Qcap.Dannebo = 0;

    % HVDC links to Estonia, usually modelled as demand from Finland's
    % perspective
    CoSim.HVDC.Pmax.Estlink1 = 350e6;
    CoSim.HVDC.Qind.Estlink1 = 0;
    CoSim.HVDC.Qcap.Estlink1 = 0;

    CoSim.HVDC.Pmax.Estlink2 = 650e6;
    CoSim.HVDC.Qind.Estlink2 = 0;
    CoSim.HVDC.Qcap.Estlink2 = 0;

%% Nuclear
    CoSim.GenPower.Nuclear.Loviisa_1 = 507e6; %280e6;
    CoSim.GenPower.Nuclear.Loviisa_2 = 507e6; %280e6;

    CoSim.GenPower.Nuclear.Olkiluoto1 = 890e6;
    CoSim.GenPower.Nuclear.Olkiluoto2 = 890e6;
    CoSim.GenPower.Nuclear.Olkiluoto3 = 1389e6; %1600e6 - (0 * 350e6);


    % New Hydro lumped to connection points
    CoSim.GenPower.Hydro.Letsi = hydroSynchScaleFactor * 483e6;
    CoSim.GenPower.Hydro.Petajaskoski = hydroSynchScaleFactor * 381e6;
    CoSim.GenPower.Hydro.Pirttikoski = hydroSynchScaleFactor * 554.7e6;
    CoSim.GenPower.Hydro.Simojoki = hydroSynchScaleFactor * 226e6;
    CoSim.GenPower.Hydro.Isokangas = hydroSynchScaleFactor * 344.3e6;
    CoSim.GenPower.Hydro.Pikkarala = hydroSynchScaleFactor * 42e6;
    CoSim.GenPower.Hydro.Petajaskoski = hydroSynchScaleFactor * 381e6;
    CoSim.GenPower.Hydro.Keminmaa = hydroSynchScaleFactor * 106e6;
    CoSim.GenPower.Hydro.Pirttikoski = hydroSynchScaleFactor * 554.7e6;
    CoSim.GenPower.Hydro.Pyhanselka = hydroSynchScaleFactor * 354.7e6;
    CoSim.GenPower.Hydro.Hirvisuo = hydroSynchScaleFactor * 12.3e6;
    CoSim.GenPower.Hydro.Ulvila = hydroSynchScaleFactor * 150e6;
    CoSim.GenPower.Hydro.Kangasala = hydroSynchScaleFactor * 107.5e6;
    CoSim.GenPower.Hydro.Huittinen = hydroSynchScaleFactor * 79.4e6;
    CoSim.GenPower.Hydro.Lieto = hydroSynchScaleFactor * 4.5e6;
    CoSim.GenPower.Hydro.Forssa = hydroSynchScaleFactor * 8.5e6;
    CoSim.GenPower.Hydro.Vuolijoki = hydroSynchScaleFactor * 353.9e6;
    CoSim.GenPower.Hydro.Vihtavuori = hydroSynchScaleFactor * 30.4e6;
    CoSim.GenPower.Hydro.Alapitka = hydroSynchScaleFactor * 27.1e6;
    CoSim.GenPower.Hydro.Huutokoski = hydroSynchScaleFactor * 192.9e6;
    CoSim.GenPower.Hydro.Yllikkala = hydroSynchScaleFactor * 257.5e6;
    CoSim.GenPower.Hydro.Koria = hydroSynchScaleFactor * 288.6e6;
    CoSim.GenPower.Hydro.Kymi = hydroSynchScaleFactor * 87.43e6;
    % CoSim.GenPower.Hydro.Tammisto = hydroSynchScaleFactor * 3e6; % Too small to
    % include!
    CoSim.GenPower.Hydro.Inkoo = hydroSynchScaleFactor * 6.9e6;
    CoSim.GenPower.Hydro.Arkkukallio = hydroSynchScaleFactor * 1e6;
    CoSim.GenPower.Hydro.Seinajoki = hydroSynchScaleFactor * 43.52e6;
```


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```
%% Wind Parks
    CoSim.Genpower.Wind.Petajaskoski = windScaleFactor * 117.25e6;
    CoSim.Genpower.Wind.Pirttikoski = windScaleFactor * 222.9e6;
    CoSim.Genpower.Wind.Keminmaa = windScaleFactor * 155.95e6;
    CoSim.Genpower.Wind.Simojoki = windScaleFactor * 475e6;
    CoSim.Genpower.Wind.Pikkarala = windScaleFactor * 396.1e6;
    CoSim.Genpower.Wind.Jylkka = windScaleFactor * 914.8e6;
    CoSim.Genpower.Wind.Pysayspera = windScaleFactor * 399.8e6;
    CoSim.Genpower.Wind.Hirvisuo = windScaleFactor * 372.45e6;
    CoSim.Genpower.Wind.Isokangas = windScaleFactor * 146.5e6;
    CoSim.Genpower.Wind.Tuovila = windScaleFactor * 224.3e6;
    CoSim.Genpower.Wind.Karppio = windScaleFactor * 514.7e6;
    CoSim.Genpower.Wind.Kristinestad = windScaleFactor * 643e6;
    CoSim.Genpower.Wind.Seinajoki = windScaleFactor * 189.1e6;
    CoSim.Genpower.Wind.Alajarvi = windScaleFactor * 386.2e6;
    CoSim.Genpower.Wind.Ulvila = windScaleFactor * 293.5e6;
    CoSim.Genpower.Wind.Huittinen = windScaleFactor * 3.6e6;
    CoSim.Genpower.Wind.Lieto = windScaleFactor * 34.9e6;
    CoSim.Genpower.Wind.Forssa = windScaleFactor * 55.3e6;
    CoSim.Genpower.Wind.Vuolijoki = windScaleFactor * 534.1e6;
    CoSim.Genpower.Wind.Vihtavuori = windScaleFactor * 69e6;
    CoSim.Genpower.Wind.Huutokoski = windScaleFactor * 64.5e6;
    CoSim.Genpower.Wind.Yllikkala = windScaleFactor * 257.5e6;
    CoSim.Genpower.Wind.Koria = windScaleFactor * 33e6;
    CoSim.Genpower.Wind.Kymi = windScaleFactor * 31.9e6;
    CoSim.Genpower.Wind.Inkoo = windScaleFactor * 10e6;
    CoSim.Genpower.Wind.Arkkukallio = windScaleFactor * 279e6;
    CoSim.Genpower.Wind.Valkeus = windScaleFactor * 625.8e6;

%% Industrial CHP (Bio etc)
    GenPowerIndCHPAnjalankoski = 160.5e6;
    GenPowerKuusaanniemiInd = 87e6;
    GenPowerKuusankoskiInd = 76e6;
    GenPowerKotkaInd = 72e6;
    % Lumped IndCHP
    CoSim.GenPower.IndCHP.Vihtavuori = hydroSynchScaleFactor * 280e6;  % Äänekoski
    CoSim.GenPower.IndCHP.Hirvisuo = industrialSynchScaleFactor * 95e6;
    CoSim.GenPower.IndCHP.Pikkarala = industrialSynchScaleFactor * 100e6;
    CoSim.GenPower.IndCHP.Yllikkala = industrialSynchScaleFactor * 111.1e6;
    CoSim.GenPower.IndCHP.Koria = (GenPowerIndCHPAnjalankoski + GenPowerKuusankoskiInd ...
        + GenPowerKuusaanniemiInd) * industrialSynchScaleFactor;
    CoSim.GenPower.IndCHP.Kymi = GenPowerKotkaInd * industrialSynchScaleFactor;

    %% Urban CHP
    GenPowerVuosaariAandB = 648e6;
    GenPowerSalmisaari = 163e6;
    GenPowerVantaanJatevoimala = 81.4e6;
    GenPowerSuomenoja = 358e6;

    % Urban CHP and other lumped to 400 kV connection points
    CoSim.GenPower.UrbanCHP.Lansisalmi = urbanCHPscaleFactor * GenPowerVuosaariAandB;
    CoSim.GenPower.UrbanCHP.Tammisto = urbanCHPscaleFactor * GenPowerSalmisaari;
    CoSim.GenPower.UrbanCHP.TammistoJatevoima = urbanCHPscaleFactor * GenPowerVantaanJatevoimala;
    CoSim.GenPower.UrbanCHP.Espoo = urbanCHPscaleFactor * GenPowerSuomenoja;
```


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Table A2 Demand Parameters

```
%% Demand Nodes
    CoSim.Pdemand.Forssa = loadScaleFactor * 134e6;
    CoSim.QindDemand.Forssa = 0;
    CoSim.QcapDemand.Forssa = 0;

    CoSim.Pdemand.Isokangas = loadScaleFactor * 42e6;
    CoSim.QindDemand.Isokangas = 0;
    CoSim.QcapDemand.Isokangas = 0;

    CoSim.Pdemand.Jylkka = loadScaleFactor * 45e6;
    CoSim.QindDemand.Jylkka = 0;
    CoSim.QcapDemand.Jylkka = 0;

    CoSim.Pdemand.Keminmaa = loadScaleFactor * 812e6;
    CoSim.QindDemand.Keminmaa = 0;
    CoSim.QcapDemand.Keminmaa = 0;

    CoSim.Pdemand.Letsi = loadScaleFactor * 160e6;
    CoSim.QindDemand.Letsi = 0;
    CoSim.QcapDemand.Letsi = 0;

    CoSim.Pdemand.Loviisa = loadScaleFactor * 50e6;
    CoSim.QindDemand.Loviisa = 0;
    CoSim.QcapDemand.Loviisa = 0;

    CoSim.Pdemand.Petajaskoski = loadScaleFactor * 222e6;
    CoSim.QindDemand.Petajaskoski = 0;
    CoSim.QcapDemand.Petajaskoski = 0;

    CoSim.Pdemand.Pikkarala = loadScaleFactor * 550e6;
    CoSim.QindDemand.Pikkarala = 0;
    CoSim.QcapDemand.Pikkarala = 0;

    CoSim.Pdemand.Pirttikoski = loadScaleFactor * 224e6;
    CoSim.QindDemand.Pirttikoski = 0;
    CoSim.QcapDemand.Pirttikoski = 0;

    CoSim.Pdemand.Pyhanselka = loadScaleFactor * 21e6;
    CoSim.QindDemand.Pyhanselka = 0;
    CoSim.QcapDemand.Pyhanselka = 0;

    CoSim.Pdemand.Ulvila = loadScaleFactor * 417e6;
    CoSim.QindDemand.Ulvila = 0;
    CoSim.QcapDemand.Ulvila = 0;

    CoSim.Pdemand.Simojoki = loadScaleFactor * 550e6;
    CoSim.QindDemand.Simojoki = 0;
    CoSim.QcapDemand.Simojoki = 0;

    CoSim.Pdemand.Pysayspera = loadScaleFactor * 78.3e6;
    CoSim.QindDemand.Pysayspera = 0;
    CoSim.QcapDemand.Pysayspera = 0;

    CoSim.Pdemand.Hirvisuo = loadScaleFactor * 553e6;
    CoSim.QindDemand.Hirvisuo = 0;
    CoSim.QcapDemand.Hirvisuo = 0;
```


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```
CoSim.Pdemand.Tuovila = loadScaleFactor * 187e6;
CoSim.QindDemand.Tuovila = 0;
CoSim.QcapDemand.Tuovila = 0;

CoSim.Pdemand.Karppio = loadScaleFactor * 139e6;
CoSim.QindDemand.Karppio = 0;
CoSim.QcapDemand.Karppio = 0;

CoSim.Pdemand.Kristinestad = loadScaleFactor * 117e6;
CoSim.QindDemand.Kristinestad = 0e6;
CoSim.QcapDemand.Kristinestad = 0;

CoSim.Pdemand.Seinajoki = loadScaleFactor * 303.2e6;
CoSim.QindDemand.Seinajoki = 0;
CoSim.QcapDemand.Seinajoki = 0;

CoSim.Pdemand.Alajarvi = loadScaleFactor * 81e6;
CoSim.QindDemand.Alajarvi = 0;
CoSim.QcapDemand.Alajarvi = 0;

CoSim.Pdemand.Kangasala = loadScaleFactor * 690e6;
CoSim.QindDemand.Kangasala = 0;
CoSim.QcapDemand.Kangasala = 0;

CoSim.Pdemand.Huittinen = loadScaleFactor * 254e6;
CoSim.QindDemand.Huittinen = 0;
CoSim.QcapDemand.Huittinen = 0;

CoSim.Pdemand.Lieto = loadScaleFactor * 719.4e6;
CoSim.QindDemand.Lieto = 0;
CoSim.QcapDemand.Lieto = 0;

CoSim.Pdemand.Vuolijoki = loadScaleFactor * 266.4e6;
CoSim.QindDemand.Vuolijoki = 0;
CoSim.QcapDemand.Vuolijoki = 0;

CoSim.Pdemand.Vihtavuori = loadScaleFactor * 591.9e6;
CoSim.QindDemand.Vihtavuori = 0;
CoSim.QcapDemand.Vihtavuori = 0;

CoSim.Pdemand.Alapitka = loadScaleFactor * 532e6;
CoSim.QindDemand.Alapitka = 0;
CoSim.QcapDemand.Alapitka = 0;

CoSim.Pdemand.Huutokoski = loadScaleFactor * 626.1e6;
CoSim.QindDemand.Huutokoski = 0;
CoSim.QcapDemand.Huutokoski = 0;

CoSim.Pdemand.Yllikkala = loadScaleFactor * 1001e6;
CoSim.QindDemand.Yllikkala = 1e6;
CoSim.QcapDemand.Yllikkala = 0;

CoSim.Pdemand.Koria = loadScaleFactor * 575e6;
CoSim.QindDemand.Koria = 0;
CoSim.QcapDemand.Koria = 0;

CoSim.Pdemand.Kymi = loadScaleFactor * 378e6;
CoSim.QindDemand.Kymi = 0;
CoSim.QcapDemand.Kymi = 0;

CoSim.Pdemand.Nurmijarvi = loadScaleFactor * 267.7e6;
CoSim.QindDemand.Nurmijarvi = 0;
CoSim.QcapDemand.Nurmijarvi = 0;
```

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```
CoSim.Pdemand.Anttila = loadScaleFactor * 488.8e6;
CoSim.QindDemand.Anttila = 0;
CoSim.QcapDemand.Anttila = 0;

CoSim.Pdemand.Lansisalmi = loadScaleFactor * 443.3e6;
CoSim.QindDemand.Lansisalmi = 0;
CoSim.QcapDemand.Lansisalmi = 0;

CoSim.Pdemand.Hikia = loadScaleFactor * 614e6;
CoSim.QindDemand.Hikia = 0;
CoSim.QcapDemand.Hikia = 0;

CoSim.Pdemand.Tammisto = loadScaleFactor * 936e6;
CoSim.QindDemand.Tammisto = 0;
CoSim.QcapDemand.Tammisto = 0;

CoSim.Pdemand.Espoo = loadScaleFactor * 530e6;
CoSim.QindDemand.Espoo = 0;
CoSim.QcapDemand.Espoo = 0;

CoSim.Pdemand.Inkoo = loadScaleFactor * 116e6;
CoSim.QindDemand.Inkoo = 0;
CoSim.QcapDemand.Inkoo = 0;

CoSim.Pdemand.Toivila = loadScaleFactor * 187e6;
CoSim.QindDemand.Toivila = 0;
CoSim.QcapDemand.Toivila = 0;

CoSim.Pdemand.Visulahti = loadScaleFactor * 228.1e6;
CoSim.QindDemand.Visulahti = 0;
CoSim.QcapDemand.Visulahti = 0;

CoSim.Pdemand.Rauma = loadScaleFactor * 519.5e6;
CoSim.QindDemand.Rauma = 0;
CoSim.QcapDemand.Rauma = 0;

CoSim.Pdemand.Arkkukallio = loadScaleFactor * 5.54e6;
CoSim.QindDemand.Arkkukallio = 0;
CoSim.QcapDemand.Arkkukallio = 0;

CoSim.Pdemand.Valkeus = loadScaleFactor * 240.9e6;
CoSim.QindDemand.Valkeus = 0;
CoSim.QcapDemand.Valkeus = 0;
```


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