FLEXe

Future Energy System

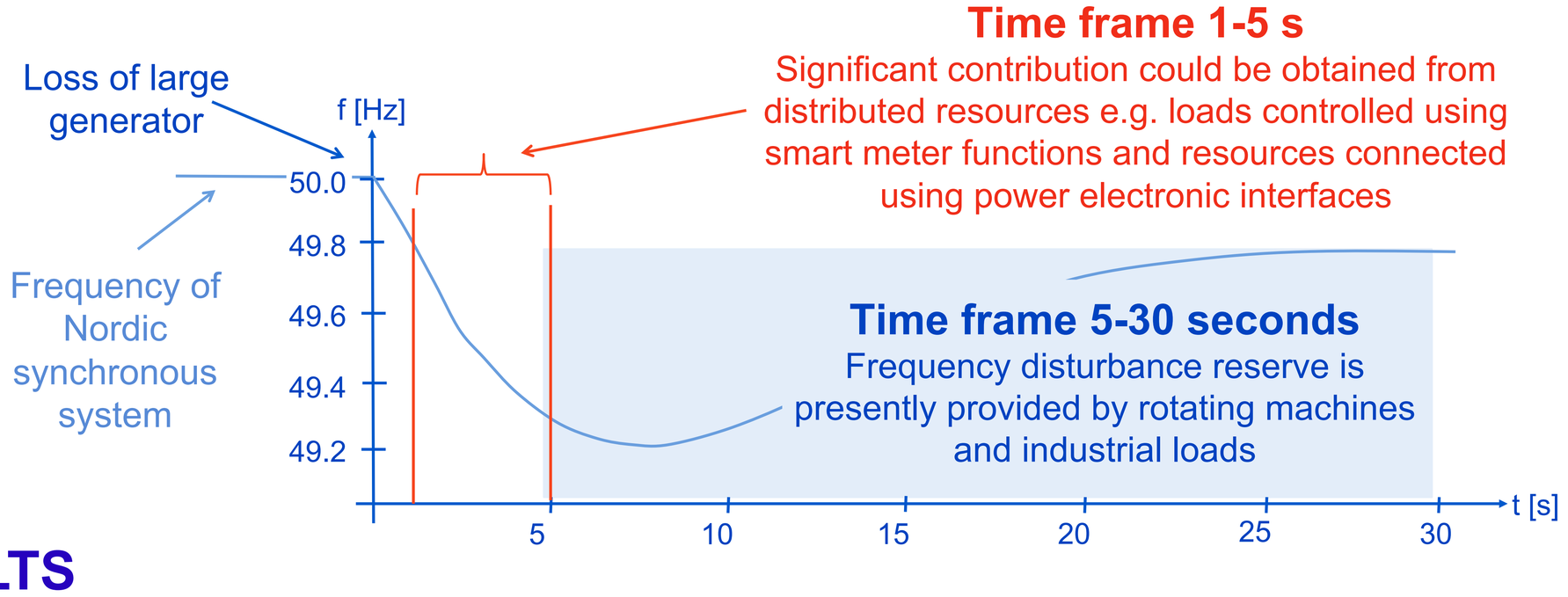
Distributed resources as fast frequency reserve

studied in co-operation with Fingrid Oyj, MX Electrix Oy, TUT, and VTT

SCOPE

Feasibility of small distributed demand response resources as fast frequency reserves was assessed in general.

The research focused on smart meter based implementation issues.



METHODS AND RESULTS

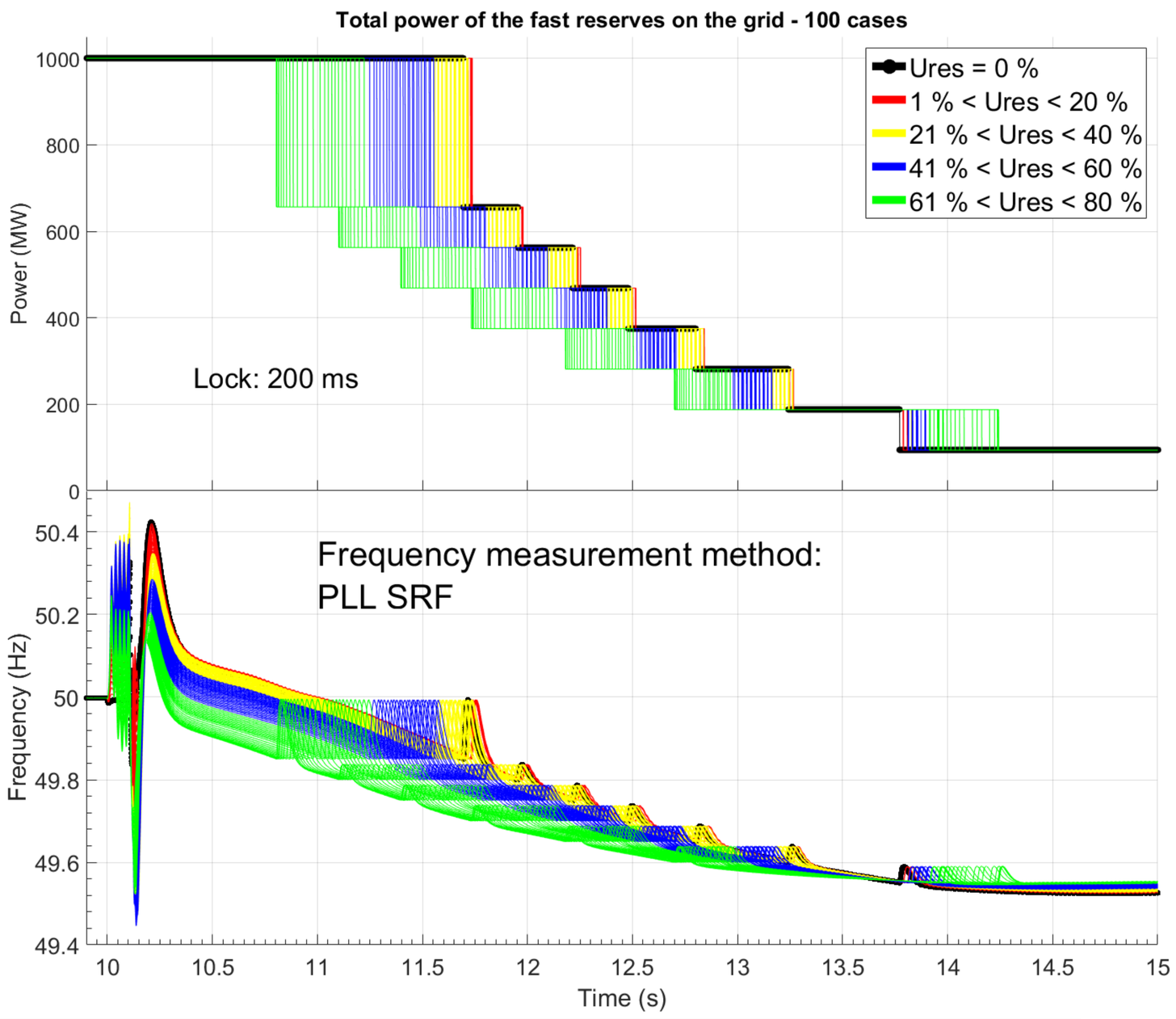
A compact power system simulation model based on the structure and data provided by Fingrid Oyj was developed in the project for PSCAD and RTDS (real time digital simulator) transient simulation software, and used in various simulation studies such as frequency measurement techniques, fault situations and system electromechanical response and especially short term stability issues.

Many frequency measurement techniques presented in literature were studied and compared by simulations and with real measurement devices in RTDS laboratory environment. Robust frequency measurement method was developed in the project and implemented in a prototype smart meter by MX Electrix Oy.

The measurement performance of the smart meter was verified in the RTDS environment and compared with PMU (Phasor Measurement Unit) and the simulated measurement techniques.

In the fault simulations different fault types and locations in the power system were varied (e.g. remaining voltage, fault inception angle), and their impact on frequency measurement located at the customer connection point in the distribution network was studied in the above comparison of frequency measurement techniques.

Large scale use of small distributed resources as fast frequency reserves was assessed in system performance studies by varying amount of reserve loads and their response time (i.e. fast and very fast) with different rotational kinetic reserves of power generation participating in frequency control.



Solution Architect for Global Bioeconomy & Cleantech Opportunities