G-PST/ESIG Webinar Series: Developing an EMT Study and Analysis Environment for a 100% Inverter Based Power System	
Question	**Answer**
Do you consider average or switching models of the converters? What's the time step?	our current fixed time step is 10 us, we accept average models as well in case if switching frequency is very high. Of course the average models should be validated against FAT test and so on following our model validation guideline in Energinet.
How is the initialization for different study scenarios performed for EMT? Do you "import" a new power factory case every time you make a change?	if there are significant changes in power flow, then the best way is to adapt the load flow from Power facotry and then export DGS files to import them to PRSIM or PSCAD. There are several different approach for new scenario mapping. Typically you dont need to expand all schematic again if there are no significant changes in network topology.
Is there a process to benchmark/validate model conversion from power factory to PSCAD?	In the system level model wise, we validate power flow in the emt system level simulation by comparing load flow results (Vmag, Vph, P, Q and so on), which are the part of automatic conversion process.
How the loads are modeled in your EMT model? How you can exclude the influence of load models on system oscillations?	In case of very big size load models (e.g. Datacenter, P2X) to be connected to transmission assets, we have vendor specific models. If you are concerning about the load models from DSO. We currently use PQ models to represent their consumption, but dynamic performance and their contribution to transmission wise, this topic is something we need to investigate more via more upcoming studies and projects, where the situation is also the same in RMS enviroment.
How do you perform your real-time stability assessments?	Energinet is not currently using real-time stability assessments. Replication of any critical evvents and incidents only reproduced for analysis.
How do you model IBRs outside your service territory?	I am not sure if i understand this question precisely, but if you mean assets in DSOs, they are currently aggregated depending on regison, where we use our best engineering judgement on how we have to aggregate them. Some dynamic performace from DSO is something we need to improve and think about how to aggregate dynamics to more efficient way.
Did you considered any complex load model? if yes, how do you select and configure such models?	In case of very big size load models (e.g. Datacenter, P2X) to be connected to transmission assets, we have vendor specific models. If you are concerning about the load models from DSO. We currently use PQ models to represent their consumption, but dynamic performance and their contribution to transmission wise, this topic is something we need to investigate more via more upcoming studies and projects, where the situation is also the same in RMS enviroment.
how do you define the boundaries of the network to be modelled in the EMT simulation?	We model automatically entire transmission grid in the Danish power system in EMT tools, but neigbouring countries are aggregated to thevenin source based on assumption, their impact and different approach (frequency dependent impedance, or contain more assets to our models) are something we need to investigate via upcoming projects.

Why reduce the model in PowerFactory and then expand the network in PSCAD?	Power factory is databased tool and PSCAD is graphical coordination based tool. So, of course we can import entire data from Power Factory, but there are unnecessary information (of course depending on type of studies), for instance, terminals, multi-busbars, disconnectors and so on such detail information in station are not necesary and they are reduced or simplifed to have better graphical representation in PSCAD.
There are so many test cases possible at system level EMT studies. How to be sure that we have included all cases, especially when we get all cases stable?	Currently we use external scripts to handle multiple test / study cases and control parameter adaption and so on, which is relatively complicated process then RMS tools using database. Post-processing as well we use external scripts. As mentioned in the webinar, btw, handling big data created by running simulation and so on are something should be improved by software company or 3rd party tools could be also solutions.
Is it correct that PowerFactory can perform EMT modeling and simulation too?	Power Factory officially support EMT as one of their extra tool packages, so user can run EMT simulation, but flexibility wise and numerical stability wise. The package is not matured in our experience compared to typical EMT tools e.g. PSCAD EMTP-RV. In addition to this, We have used PSCAD for many years and as all our models are delivered in PSCAD we will continue to use it even though the conversion is extra work compared to having all in PF
How are the IBR vendor models validated?	We follow our model validation guideline, which can be found in Energinet homepage.
You mention use of SCADA data of actual events to validate the model - are you also deploying high speed measurement devices?	Yes, not all the station, for replication of actual events, we typically involve fault recorder and scada data.
How do you split the full system into small sub-systems for EMT simulation?	We use automatic script, which allows user to split entire Danish network to several sub-systems as user define.
What are the harmonic impedance measurement requirements from vendors EMT model validation. ?	We require harmonic impedance for harmonic studies. If you mean impedance measurement results from vendor specific models, we currently use internal perturbation tool for internal validation, but will require soon measured impedance data and extra models (e.g. state space) soon in upcoming updates in model requirement.