ESIG Webinar: HECO Plans for Meeting Clean Energy Targets and Role of Grid Forming Inverters	
Question	**Answer**
Has HECO faced nodes with SCR minor to 2.5? What are the recommendations?	Yes, we have nodes with very low SCR ratio. Normally, if proposals received from developers on those nodes are battery paried projects, we require GFM control on the inverter with battery component. Meanwhile, through comprehensive mdoel review process and study (i.e., planning study and IRS), we make sure project can be operated as we want in this low SCR condition.
What is the basis for the selection 1.6 pu overcurrent rating? also how 5s over current requirement is chosen?	According to the equation shown in the presentation, we evaulated recent proposals and found that projects with acceptable stabilty response performance in planning study reach 1.6 or even higher. Worth noting that this 1.6 does not mean 1.6 pu of inverter MVA rating. The 5 seconds come from combination of system characteristics, protection requirements (both transmission and distribution), and planning consideration.
Can you think of any reason why mandatory 20s cessation should be in specified DER regulations? A question from UK re G99 for those who are familiar.	Not sure about this 20 seconds cessation requirement. Would like to discuss if more detailed contents are provided.
How do you model the DER in your stability analysis? Do you model it as a voltage source or current source?	DER is modeled as single phase inverter aggregated on distribution or sub-transmission bus with generic GFL control and ride-through settings per grid codes.
Have you been considering large scale (floating) off shore wind?	Offshore wind is considered as an option in our long term planning study.
On side11, what does negative IBR on the horizontal axis mean? Expected it to go down to 0MW only	We have grid scale standalone BESS which is designed to be able to charge from grid.
What planning criteria/compliance are used to perform the dynamic study (contingency)?	Our Company's trasmission planning criteria is used for the study.
What's main differences among P1, P2 and P3 DER models?	P3 represents the DER installed post 2016 which complies with the latest grid code. P1 and P2 represents the legacy DER which were installed before 2016. P1 and P2 mainly

what is the difference between dynamic and static UFLS?	Dynamic UFLS updates UFLS settings among a pool of circuits according to SCADA data readings via communication. In the static UFLS, a pre-selected circuits with pre-defined UF trip settings are configured. They will not change utill next review time, which could last a few years during which the selected circuits may have significant DER penetration growth. Regarding the dynamic UFLS, more detailed info can be found here https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Recommended_Approaches_for_UFLS_Program_Design_with_Increasing_Penetrations_of_DERs.pdf
What are Standalone Solar IBR Plant? Are they solar plants without storage?	Correct. They only have PV panels and PV inverters.
Can you comment on whether your regulators are enabling cost recovery for studies and implementation of GFI?	Implementation of GFI are via renewable generation procurement and are part of our day-to-day work activites, and special cost recovery is not requested.
What is the priority requirement for grid scale GFL IBRs during VRT (active or reactive)?	Most are reactive priority during VRT. It really also depends on study results.
when talking about controlled DER in slide 21 is through an IPP aggregator or HECO distributed system operator?	It could be either controlled by Hawaiian Electric throught an aggregator or directly controlled by Hawaiian Electric.
How do you plan to keep generation/demand balance in the grid in case of super low load situations. Do you have a control over all the renewables in Hawaii?	So far, control on DER is only allowed during emergency condition. Most of grid scale renewable are controllable and most of future grid scale renewable are dispatchable. Grid scale storage will be used for balancing generation and demand if demand is very load and generation is high.
Let's say, a fault occurred and you lost %30 of the load and your renewables still continue generating. You tripped all the spinning units but it's not enough.	In our system, underfrequency issues are more severe under fault conditions. We don't see significant load trip before UFLS happens.
How much of the renewables can you shed in short period of time? Can you clear that fault before it leads you to total blackout?	We don't see a great need of shedding renewable in the system event. We see more short term generation needs to stablize frequency when large amount of DER going to momentary cessation.
It was mentioned that the simulation that EMT simulation done in PSCAD was time consuming. Would real-time simulator be an option for faster EMT simulation?	It could be an option, as long as the island wide system model, including all those OEM specific renewable project model, can be implemented in the real time simulator.
Would you please elaborate why the overcurrent capability of GFM battery needs to last 5 seconds? For what purpose(s)? Thank you.	See response to question in row 8.

how do you model GFI in absence of O&M models, do you use the definition of a voltage source behind an impedance? if so what is the impedance value?	We so far only use OEM model to represent GFI in the planning study.
Are you working with vendors of your simulation tools to incorporate the gaps you see?	Yes, vendors provide their EMT model for our planning study.
Why were synchronous condensers not as helpful as synchronous machines? I think you said but I missed it.	Sorry for not making it clear. This is for transmission level synchrnous condenser application to improve system stability. Our system footprint is very small and all those transmission level substations are electrically close with each other. So when three-phase fault happens on the transmission system, system voltage is very low. It is not cost effective to relay on condenser to improve system voltage during fault in this situation. Basically, condenser is blocked in this case. However, we believe condenser is still helpful for our system from other perspective, such as increasing system fault current, provding steady state voltage support, providing physical inertia.
Who is HECO using (what manufacturers / vendors) for Grid Forming Invertors?	From received bids, we see GFM inverter from Tesla, SMA, GPTech.