# Grid Code Compliance using a Hybrid Statcom

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# 4. Demonstration of Potential Effects on Dynamic Stability

national**grid**
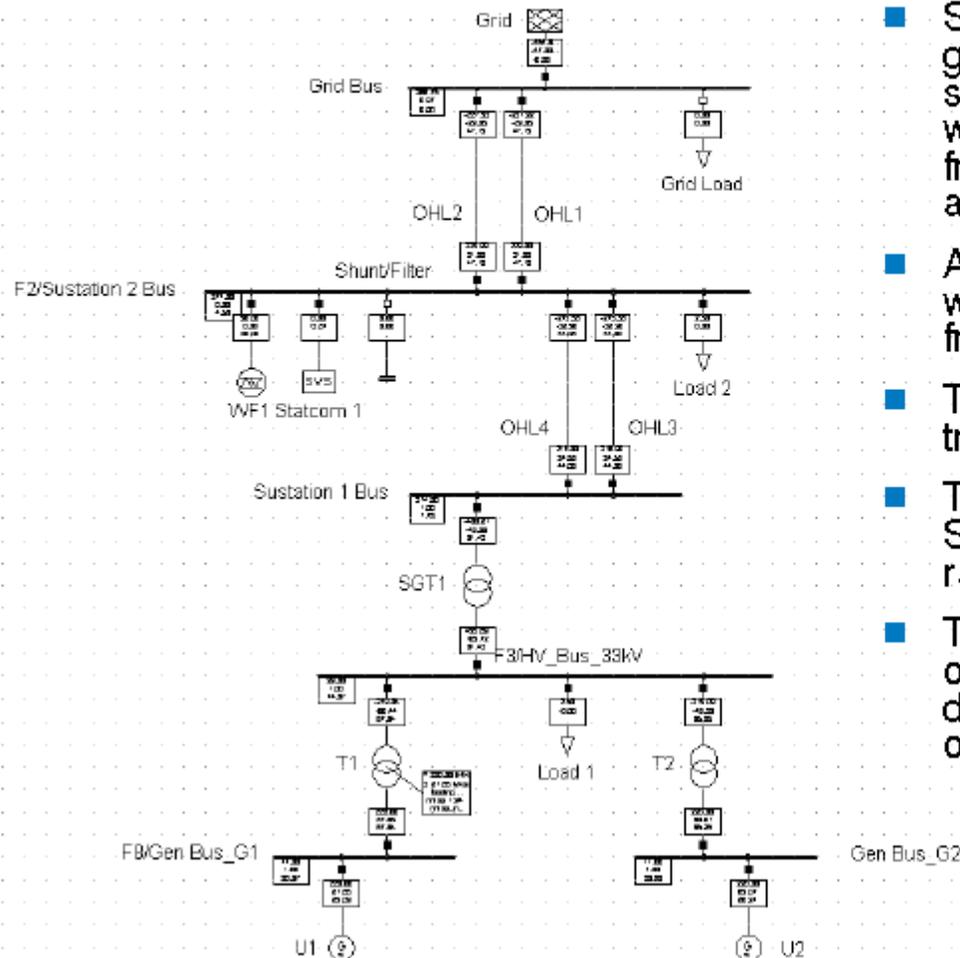


- System comprises of ~400MW of generation connected to a grid system via 60km and 80km of OHL with a 150MW WF connected 60km from the Power Station and operating at 21% of it full rating.

- A short circuit is applied to OHL 1 with full reactive capability available from the WF via Statcom 1.

- The fault on the line is cleared by tripping OHL 1 after 140ms.

- The study is then repeated with the Statcom output limited to 33% of its rating.

- The following slide shows the effect of limiting reactive capability on dynamic stability for the above operating conditions.

# Results of Dynamic Stability Study – Power Flow from Synchronous M/C's

nationalgrid

Statcom operating
at full rating ±47MVAr

Statcom operating at
33% of rating ±16MVAr

F8\U1: Active Power in MW

Statcom out of Service

F8\U1: Active Power in MW
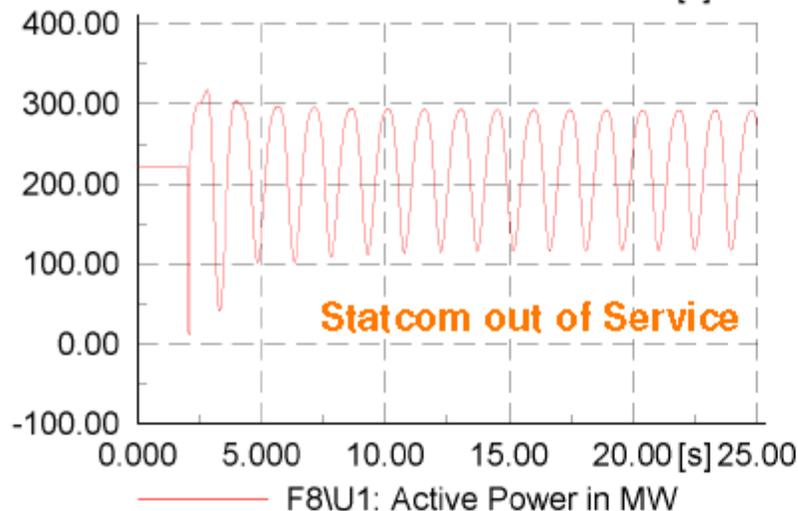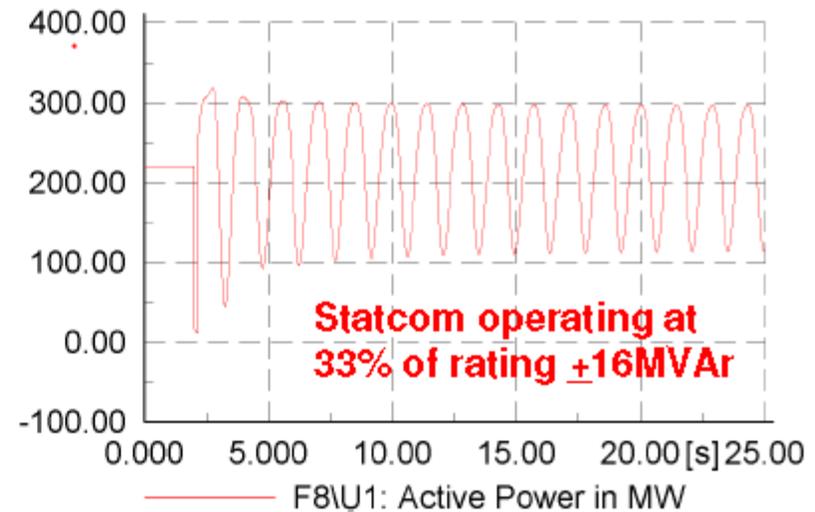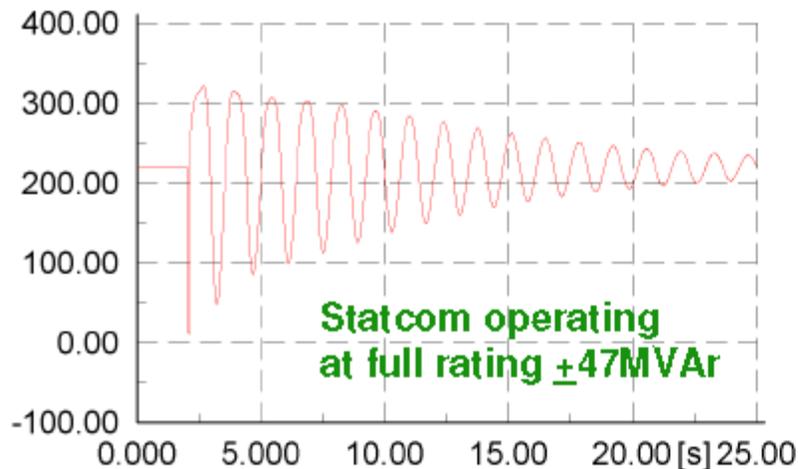
This study demonstrates how limiting the reactive capability of dynamic voltage support can effect:

- Dynamic Stability of Synchronous Generation on the System and therefore…

- The transfer capability of a transmission system

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# A few comments

- The case being used is dynamically unstable and not transiently unstable.
- It should not be expected to solve a dynamically unstable with a SVC or Statcom.
- Potential Overload rating of Statcom has been ignored,
- We had a problem with our DSTATCOM Powerfactory model in the latest version of Powerfactory.
- We did our comparison with a PSS/E model.

## No Statcom
### PowerFactory (NGET) Result
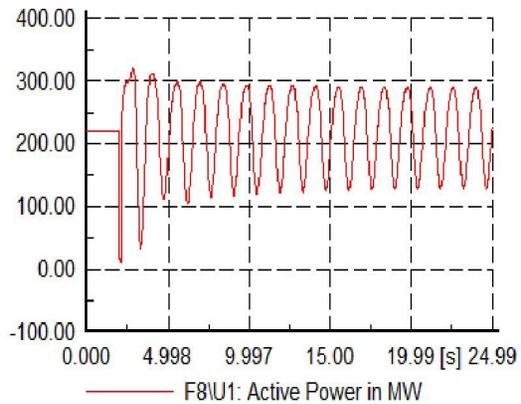
## 47(54)MVAr Statcom
### PowerFactory (NGET) Result

## 16(18)MVAr Statcom
### PowerFactory (NGET) Result

— F8\U1: Active Power in MW

— F8\U1: Active Power in MW

— F8\U1: Active Power in MW
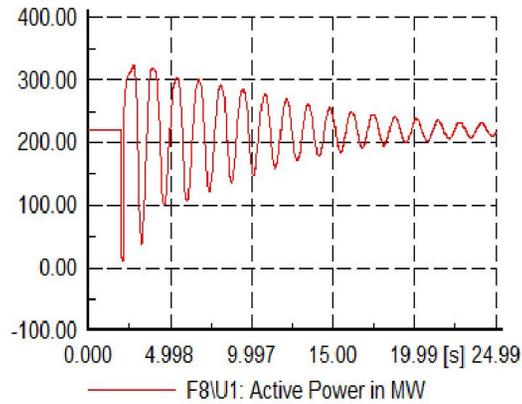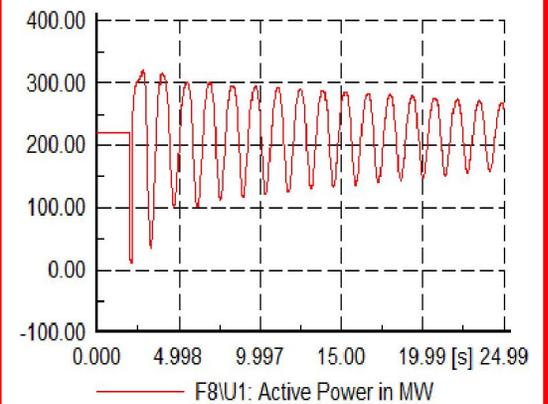
## No Statcom
### PSS/E Result
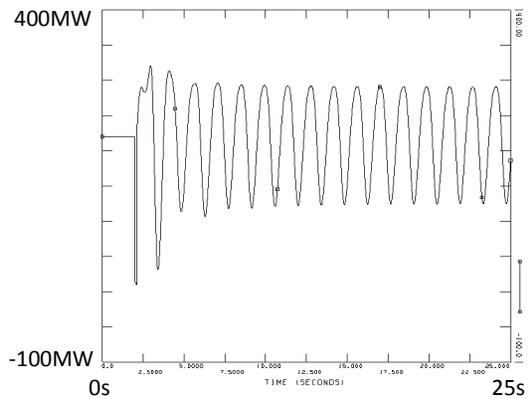
## 47(54)MVAr Statcom
### PSS/E Result
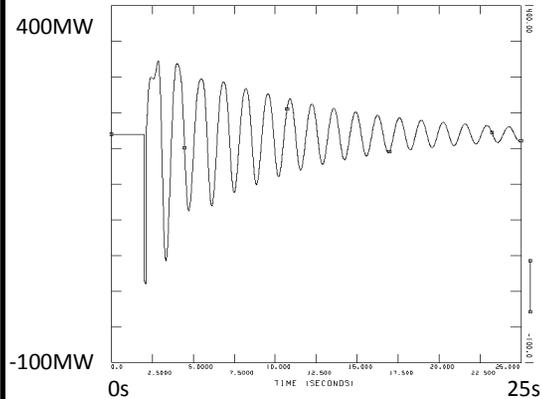
## 16(18)MVAr Statcom
### PSS/E Result
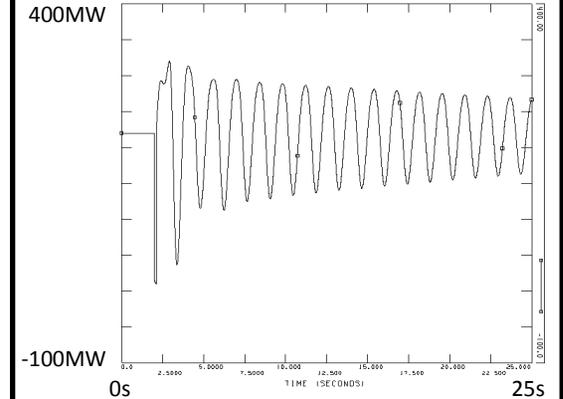
## 47(54)MVAr Statcom PowerFactory (NGET) Result
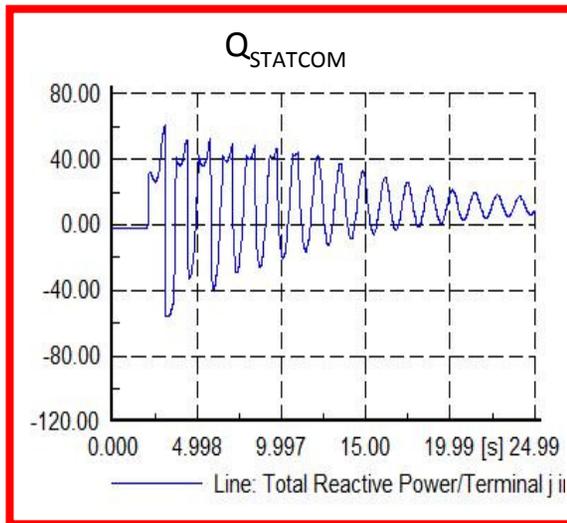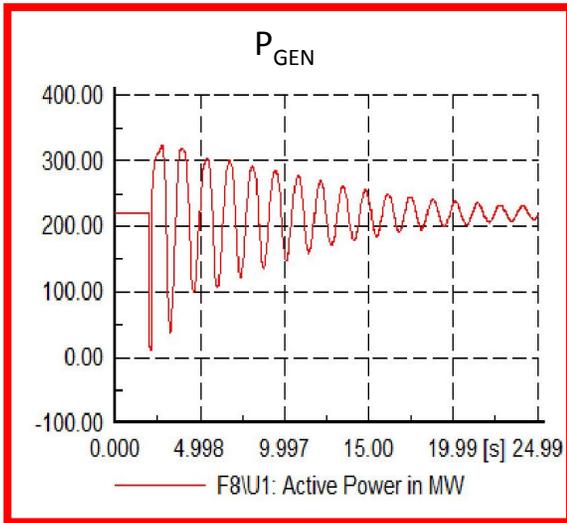


## 47(54)MVAr Fully-rated DStatcom
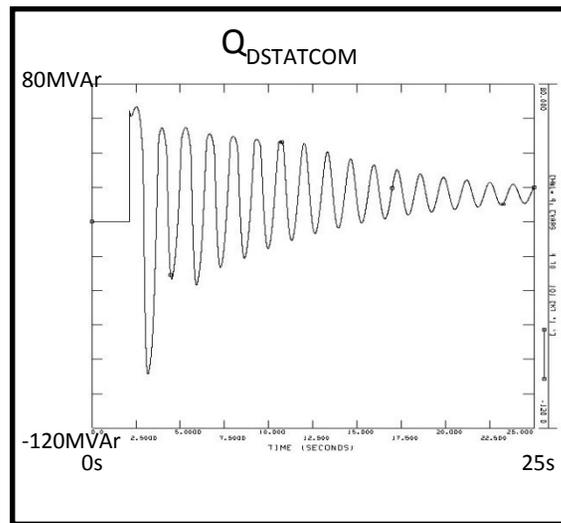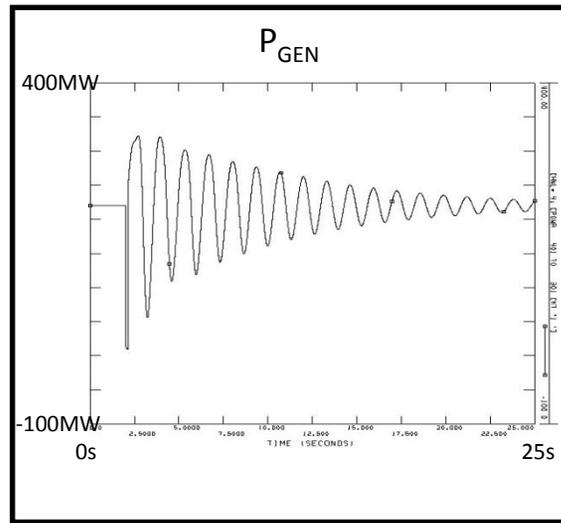


## 42(48)MVAr Fully-rated DStatcom

## 47(54)MVAr Statcom PowerFactory (NGET) Result



P_GEN
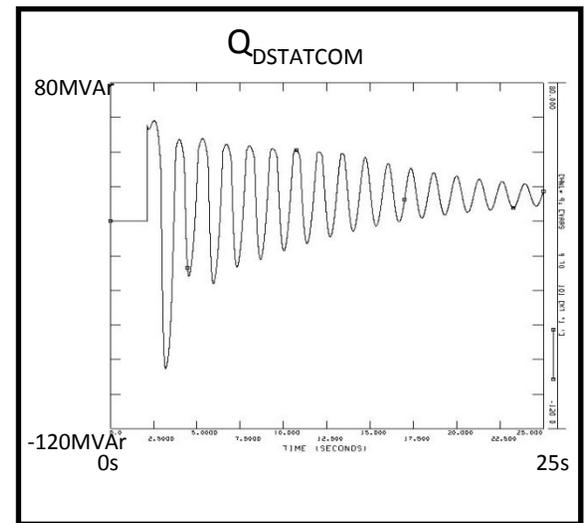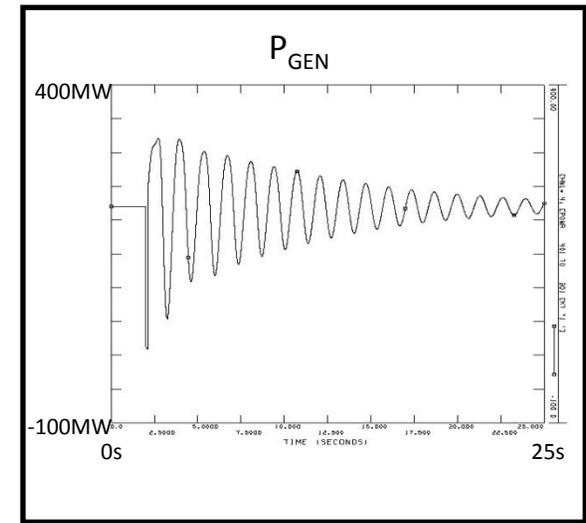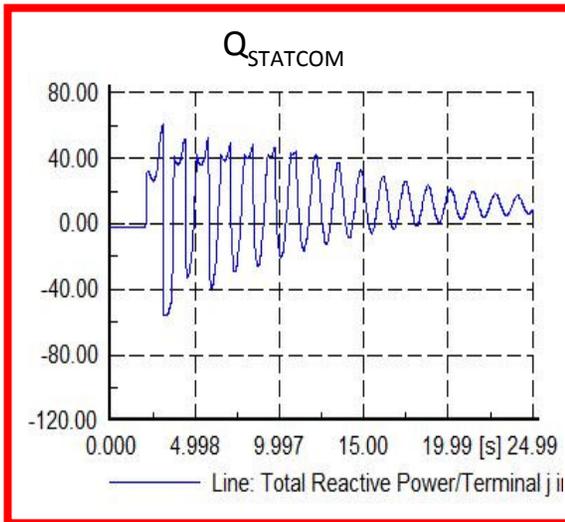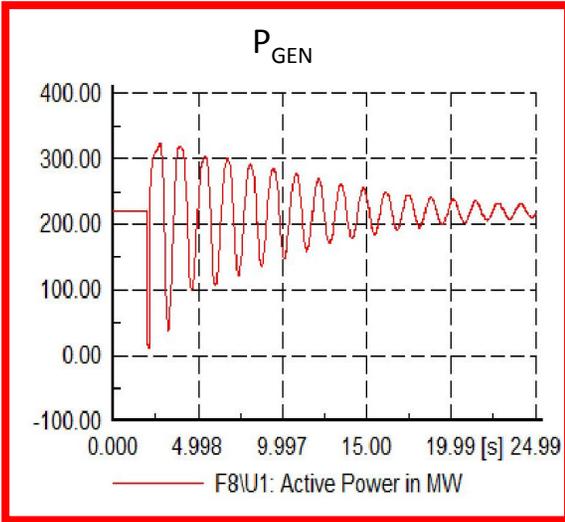


Q_STATCOM

## 47(54)MVAr DStatcom (POD out) 16MVAr Inverter + 2x19MVAr SSDs



P_GEN



V_101 & Q_SSD
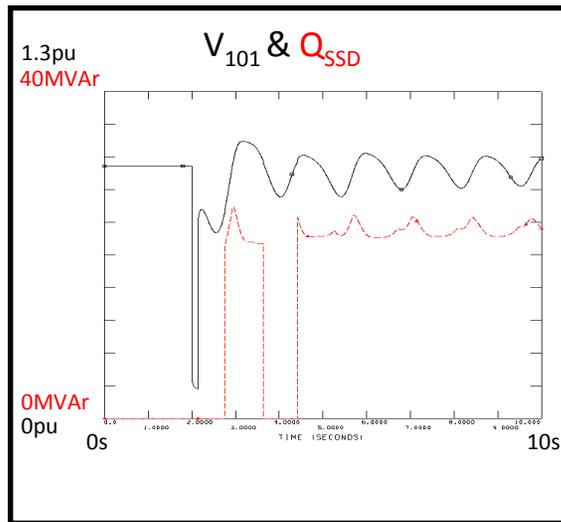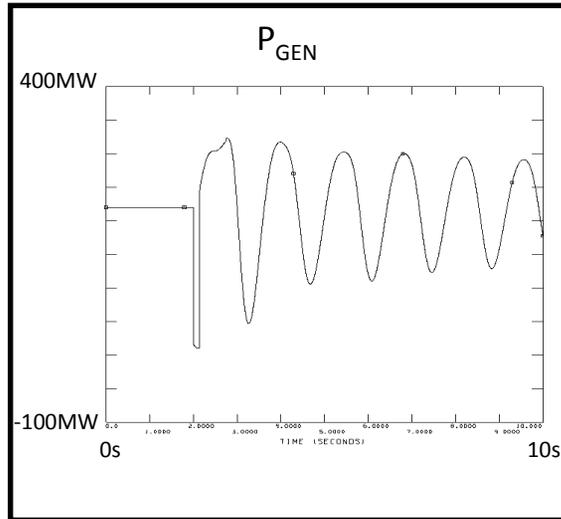
## 47(54)MVAr DStatcom (POD in) 16MVAr Inverter + 2x19MVAr SSDs



P_GEN



Q_DSTATCOM & Q_SSD
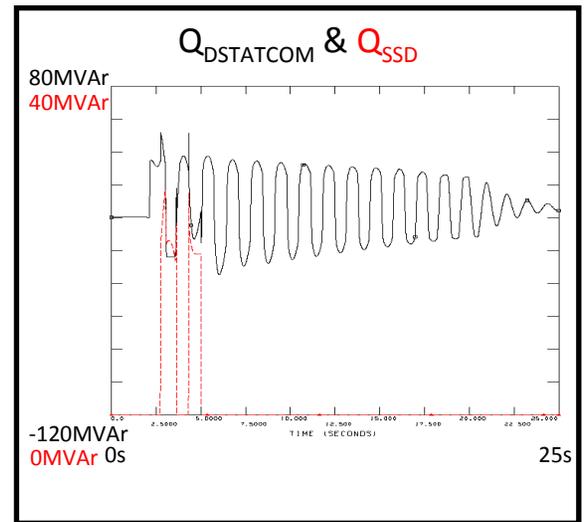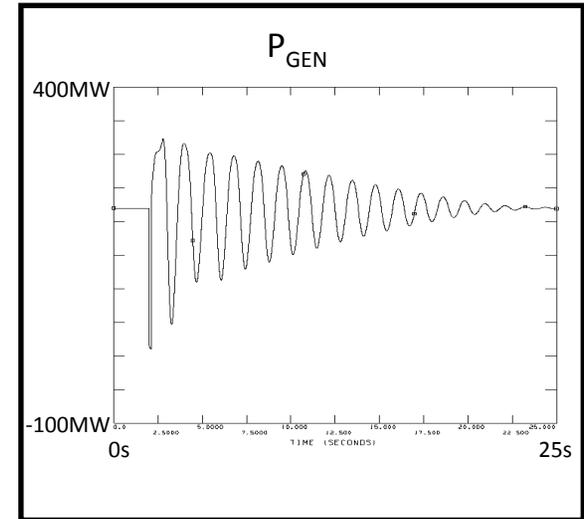
# Can NGET Requirements be met with Current Technology

Required to:-

- ✓ Ensure system voltage is maintained within SQSS limits any dips below 0.85pu last <2.5secs to prevent cascade tripping on FRT
- ✓ Ensure an initial reactive power response within 1 second as currently defined in the GB Grid Code
- ✓ Ensure delivery of available reactive reserves during critical events
- ??Ensure repeatable response within DAR and operator time scales
- ✓ Ensure consistency with RfG
- ✓ Ensure a response provided in the event of interactions with similar equipments in adjacent Power Parks
- ✓Ensure repeatable response such that contingency and defence studies produce reliable results

# Conclusions

- An Hybrid Statcom performs equally well as a fully rated Statcom.

- The Grid Code should only define the performance of the device at it's terminals and should not specify any internal performance.