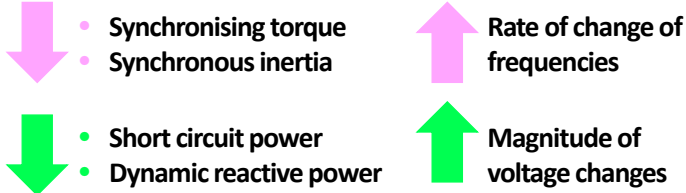


INTRODUCTION

- Renewable generation (dispersed and non-synchronous) is displacing conventional plant, with consequences for system behaviour:



- These technical challenges need to be addressed if renewable policy targets are to be achieved in full.

OBJECTIVES

- Identify and test strategies that ensure the security and stability of the Ireland system with high renewable penetrations.
- First to be examined is the installation of synchronous condensers.
- The studies show improvements in
 - ✓ Rate of change of frequency
 - ✓ Post-disturbance voltage performance
 - ✓ Short circuit power (albeit local)

TEST SYSTEM

- 2020 Ireland power system (network model).
- Case studies:
 - Base case: system with expected future generation.
 - 3 sync cond case: addition of three 250 MVA synchronous condensers (110 kV connected) in the North West region (wind-rich area).

FREQUENCY STABILITY

- Summer night valley case. 350 MW infeed trip.

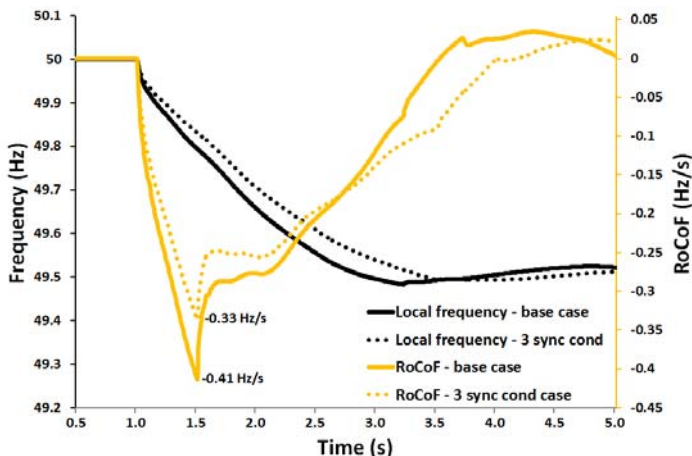


Fig. 1 Local frequency and rate of change of frequency (RoCoF)

VOLTAGE & FREQUENCY SECURITY LINK

- Summer peak case. 100 ms 3-phase-to-ground line fault in North West.

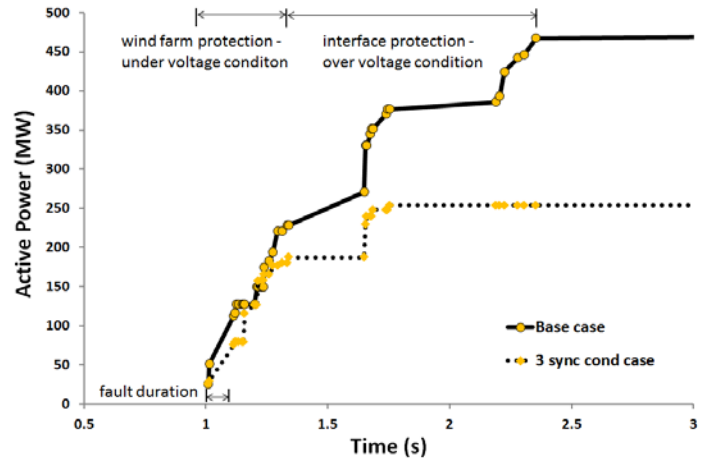


Fig. 2 Active power imbalance due to wind farm trips, with and without (base case) synchronous condensers online

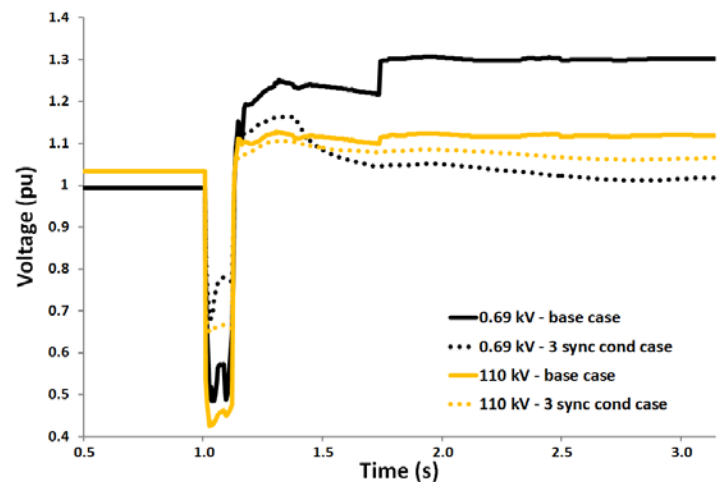


Fig. 3 Local wind farm and transmission system voltages, with and without (base case) synchronous condensers online

FUTURE WORK

Analyse and compare the system dynamic performance with the following strategies implemented:

Frequency	Voltage
Inertial constraint within unit commitment	Installation of STATCOMs
Emulated Inertia from variable speed wind turbines	Enabling V/Q control of distributed resources
Wind turbine post-fault current injection options	
Cost analysis	

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