SCD Network Reduction Inabilities

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SCD REDUCTION OVERVIEW

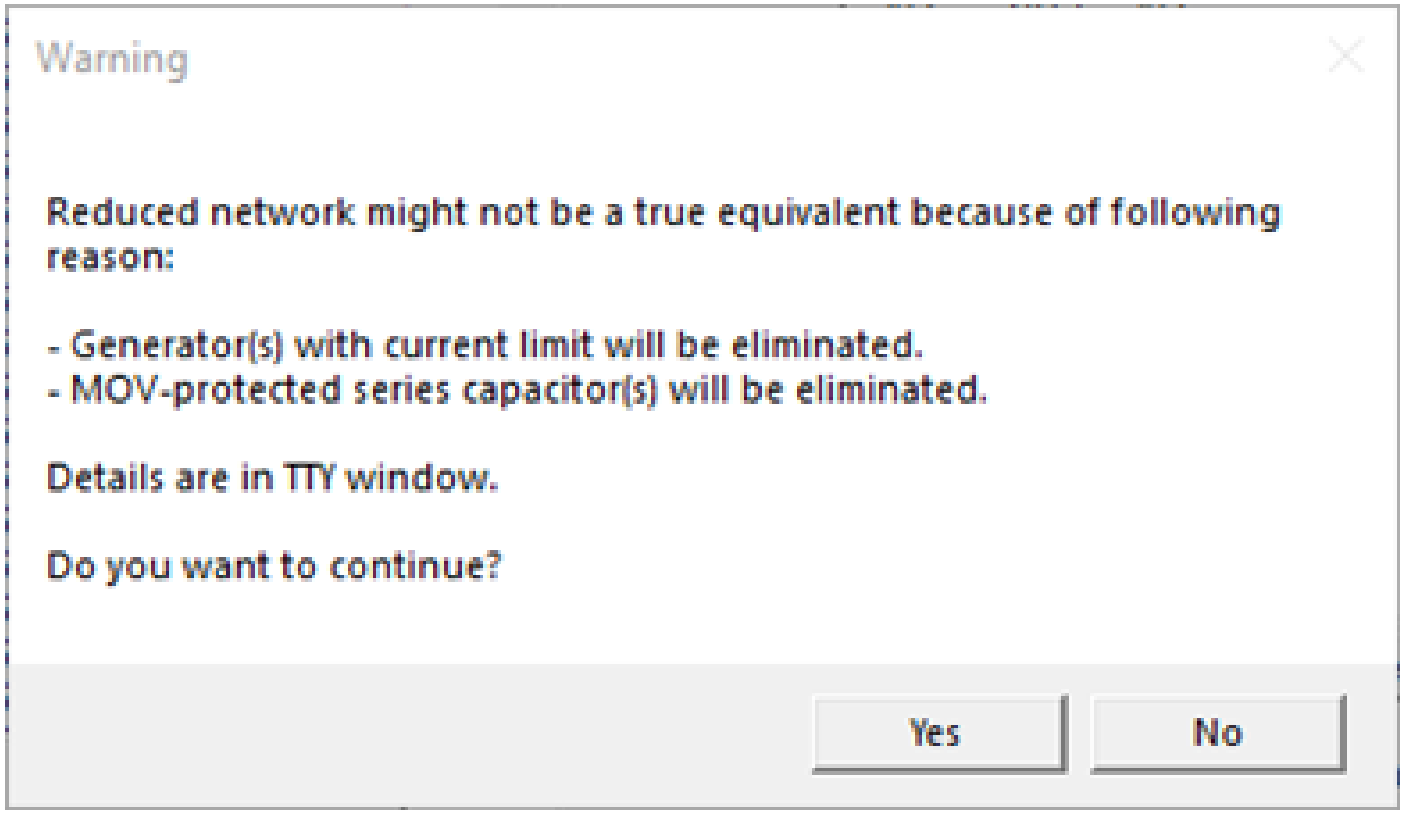
- What is SCD Reduction?

- To reduce the size of your network model by replacing sets of buses and connecting branches with a smaller but exact, numerically equivalent network. For a properly chosen set of buses, this equivalent network will have fewer buses and branches than the original, yet still provide the correct response to faults or other electrical conditions.

- Such equivalents may be useful for purposes such as:
  - the exchange of data with other electric utilities
  - producing a small network model for use with other programs such as the Electromagnetic Transients Program (EMTP)
  - transmission system equivalents (Thévenin impedances) for distribution studies.

Reference:
1. Electrocon International Incorporated; CAPE Series Short Circuit Reduction Program User's Reference Manual

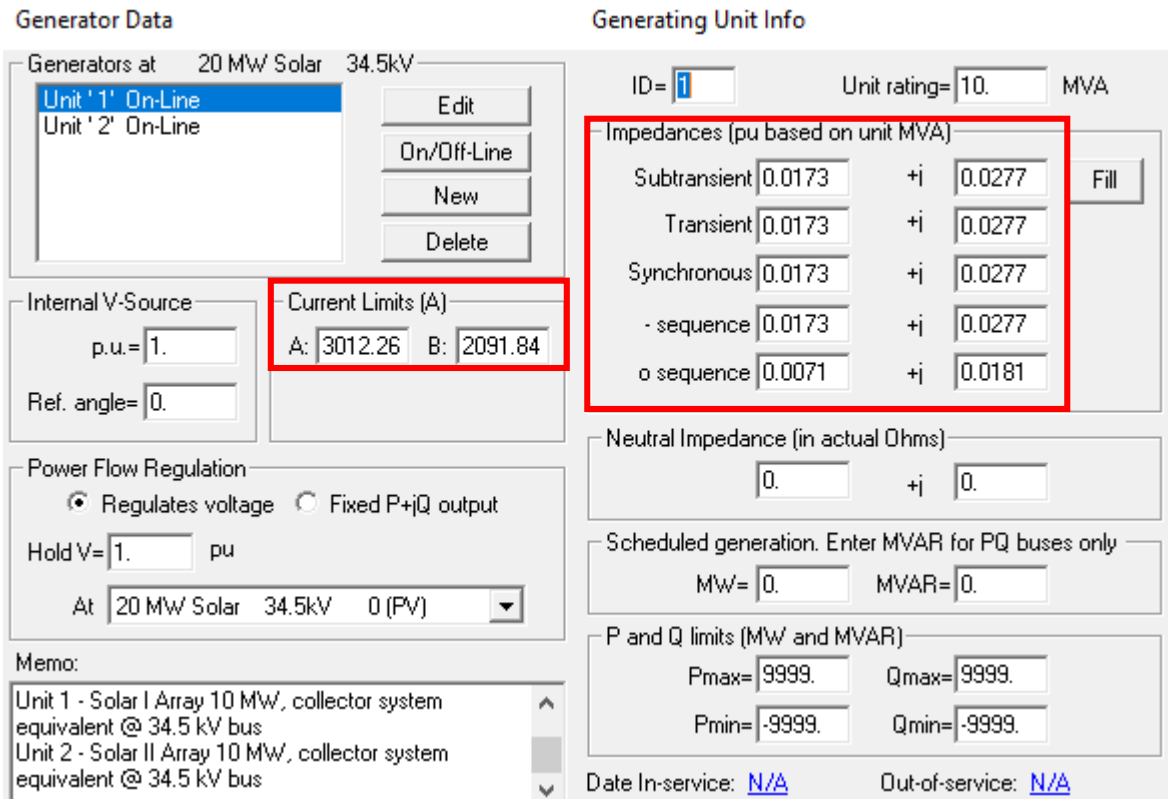
ASPEN WARNING ON NETWORK REDUCTION



Difference between Equivalence and Explicit

- SCE modeled Pacific Gas and Electric (PG&E)'s system as a set of equivalences around the Midway substation
- When a three-phase fault was applied at Midway 525 kV bus on the equivalized network, the fault current increased by **3.4 kA** compared to the non-equivalized network
- Upon further investigation, PG&E has started to model inverter-based resources as current limited generators

Aspen Recommended Modeling Practice



Generator Impedances in this example is 0.0173 + j0.0277 for Subtransient

ASPEN WARNING ON NETWORK REDUCTION

- QUESTIONS

1. Is there a way to have the generators be equivalized with their current limit during short circuit reduction? There are more and more current limiting generation that are being modeled, and in many utilities, short circuit reduction is how data is shared between utilities.
   - Contacted Aspen and found out that there is no way to reduce current limited generators or voltage-controlled current sources
2. If not, are there any work arounds for this issue?
   - It was suggested to work with a bigger network, which means explicitly modelling current limited generation when utilities receive data from adjacent utilities.
   - Utilizing an equivalent subtransient reactance that'll provide similar contributions
     - This would "solve" the breaker rating issue but doesn't address the difference between inverter-based machines and synchronous machines