

Synchronous Condenser (SC) Description

- A SC is a device that controls voltage on an electric utility's transmission or distribution system. Voltage is the "pressure" needed to deliver electricity through such a system.
- Another device that controls voltage is a capacitor. Capacitors have no moving parts. Their simple design keeps their costs and maintenance requirements low.
- SCs have internal parts that spin like a motor or generator. Their sophisticated design results in higher maintenance requirements and higher costs than those of capacitors.
- This higher cost may be justified because SCs are more effective than capacitors at controlling and stabilizing voltage.
- SCs are located in utility substations, inside buildings or protective enclosures. They tend to run for long periods (weeks or months), make significantly less noise than generators, and produce no smoke or emissions.
- SCs do not make electric *power* like a generator, so they are not *mechanically* connected to a source of propulsion like an engine or water wheel. They have only electrical connections (to the system whose voltage they control). They take in a very small amount of electric power to operate.
- One type of SC uses a special material in its windings (i.e. internal coils of wire). When the windings are bathed in liquid nitrogen to cool them, they have no electrical resistance, a property known as superconduction. This lowers the already-minimal power requirements of the SC, often making it even more cost effective than a conventional design, over the course of its life.

The synchronous condenser - what will it fix and what will it *not* fix?

- As stated in the CV's *Supplemental Technical Report* there are 5 "root problems" that afflict southern VT:
 1. **Equipment failures that threaten the Southern Loop (46 kV)**
 2. **Equipment failures that threaten Brattleboro (69 kV)**
 3. **Long-term failure of VY's T4 transformer**
 4. **Future load growth in southern VT**
 5. **Future *regional* system problems that have some relationship to southern VT**
- The synchronous condenser will have a strong remedial impact on the 1st root problem and a modest remedial impact on the 4th root problem, with no effect on the others.
- However...even the 1st root problem will not be *completely* corrected.
- Because the synchronous condenser is considered to be only the first step of a broader strategic solution plan (yet to be fully defined) the shortcomings of the synchronous condenser operating by itself are not of particular concern.