

A Summary of the Draft IEEE P1409 Custom Power Application Guide

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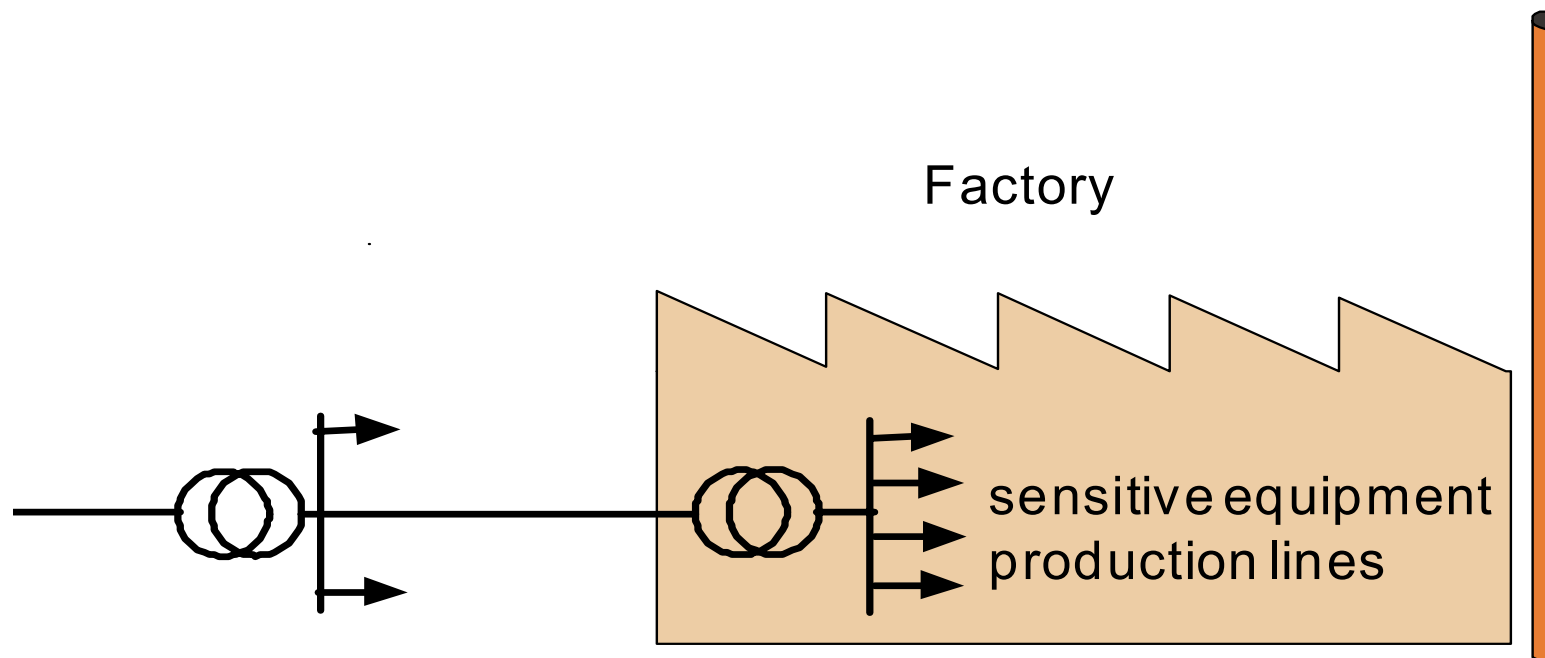
IEEE Distribution Custom Power Task Force

- Started in 1993 within the Working Group on Distribution Voltage Quality under the Distribution Subcommittee of the T&D Committee
- Recently moved to the newly formed PQ Subcommittee of T&D
- Charged with writing P1409: Trial-Use Guide for Application of Power Electronics for Power Quality Improvement on Distribution Systems Rated 1 kV through 38 kV

Scope:

This guide introduces and defines the emerging technology of custom power. This technology involves devices and circuit configurations of power electronic equipment used in distribution systems of power providers rated 1 kV through 38 kV for the purposes of mitigating problems associated with power quality.

What is custom power?



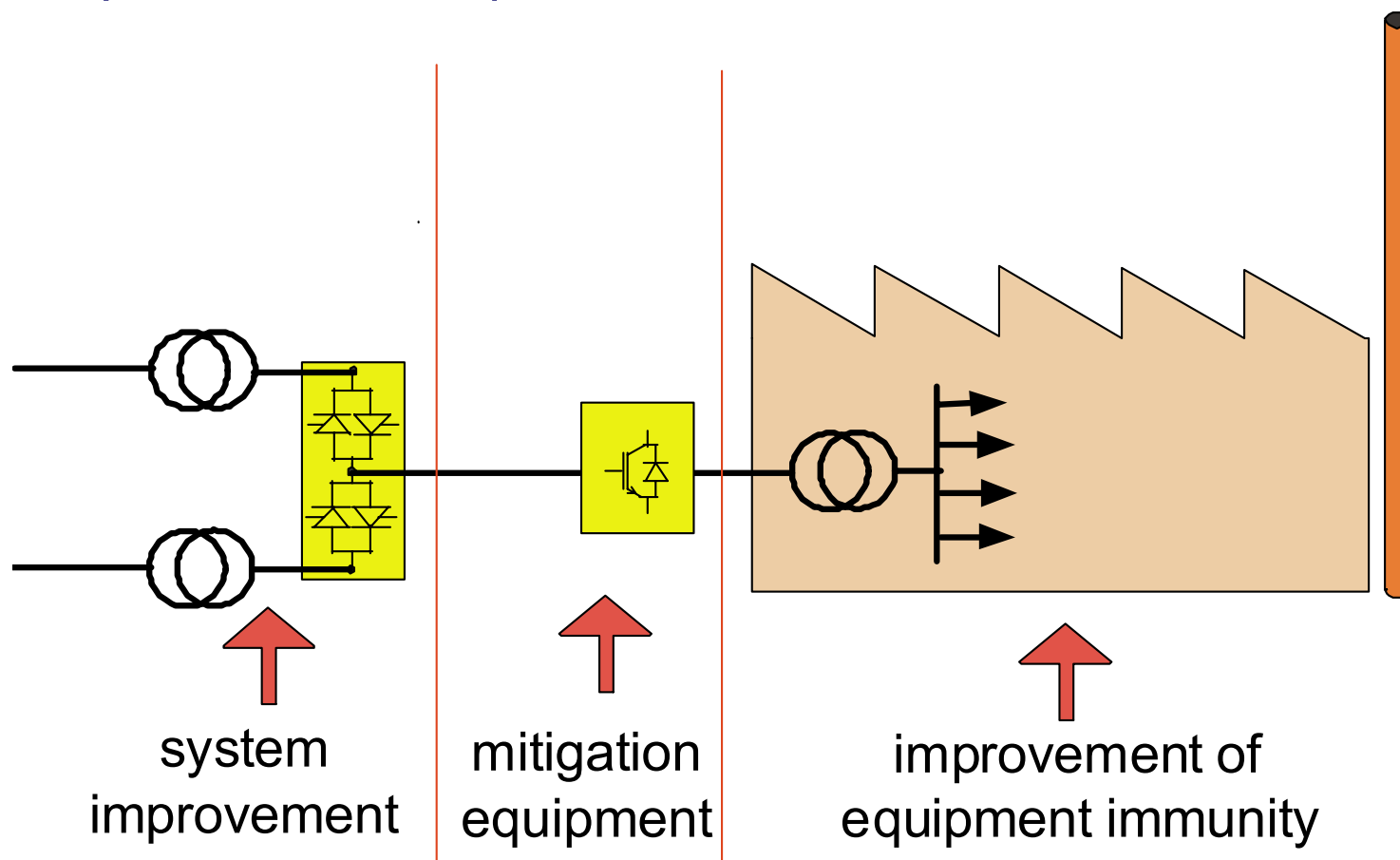
Automated factories use sensitive equipment:

- **power electronics** (AC and DC drives)
- **process-control electronics** (computers, PLCs)

Voltage sags and short interruptions cause process interruptions with **associated costs** due to **loss of production**

What is custom power?

Three ways to solve the problem:



Mitigation equipment based on power electronics: **CUSTOM POWER**

Custom Power – IEEE P1409 Definitions

- **custom power:** the concept of employing power electronic (static) controllers in 1 kV through 38 kV distribution systems for supplying a compatible level of power quality necessary for adequate performance of selected facilities and processes.
- **custom power controller:** an active power electronic device with the ability to perform current interruption and/or voltage regulation in the distribution system to improve power quality.

Two classes of custom power devices:

- Reactive power injection/harmonic compensation devices: protect the source from the load
- Voltage sag/interruption mitigation devices: protect the load from the source

Custom Power Devices

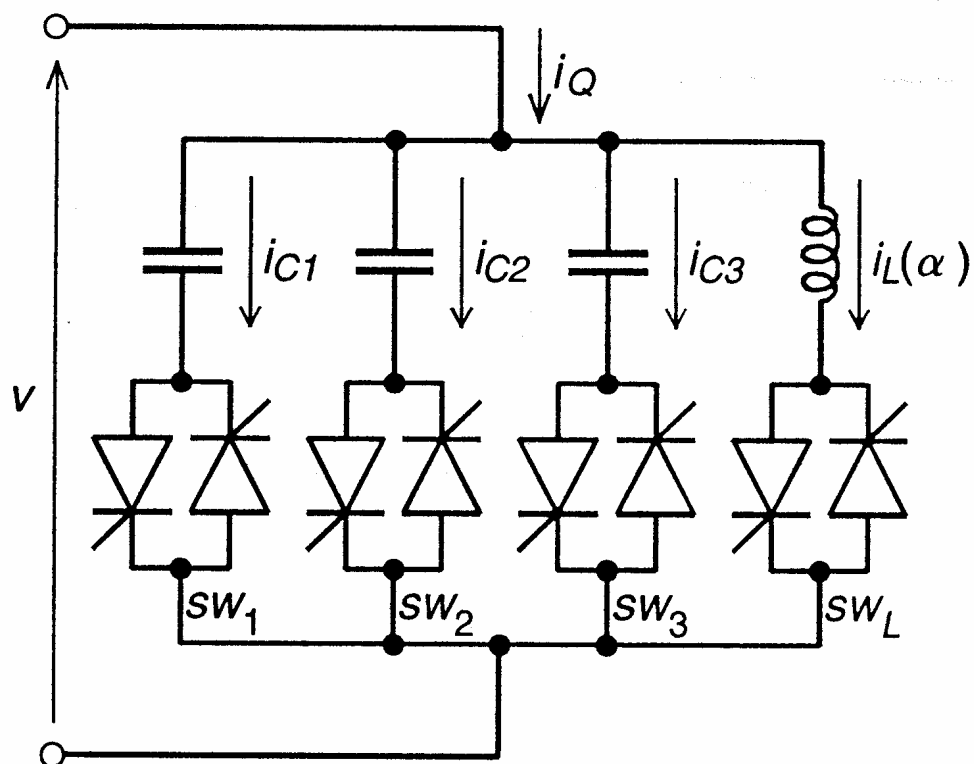
Reactive power injection/harmonic compensation devices:

- Static var compensator (SVC), based on reactors and capacitors controlled by thyristors
- D-STATCOM: STATCOM based on IGBT technology, voltage source converter connected in shunt with the system

Voltage sag/interruption mitigation devices:

- Static Transfer Switch (STS), based on two thyristor switches to perform quick load transfer
- Static Series Compensator (SSC), series-connected Voltage Source Converter based on IGBT technology
- Static Voltage Regulator (SVR), based on a transformer with taps controlled by thyristor switches
- Back-up stored energy source, like a DSTATCOM with energy storage

Static Var Compensator (SVC)



Based on passive components controlled by static switches:

- thyristor-controlled reactor (TCR)
- thyristor-switched capacitor (TSC)

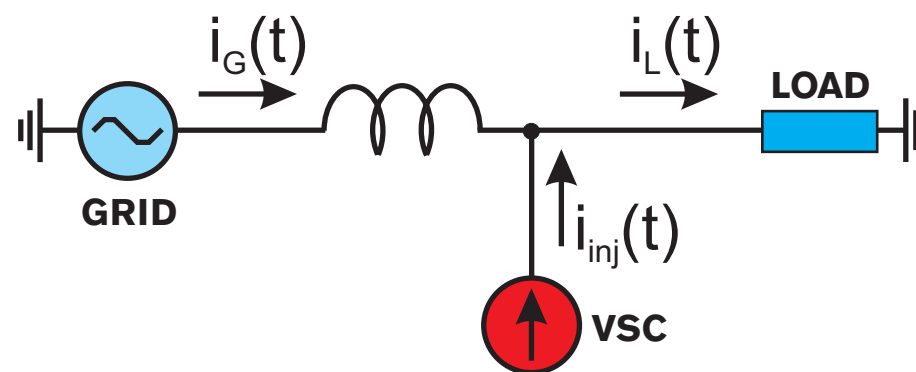
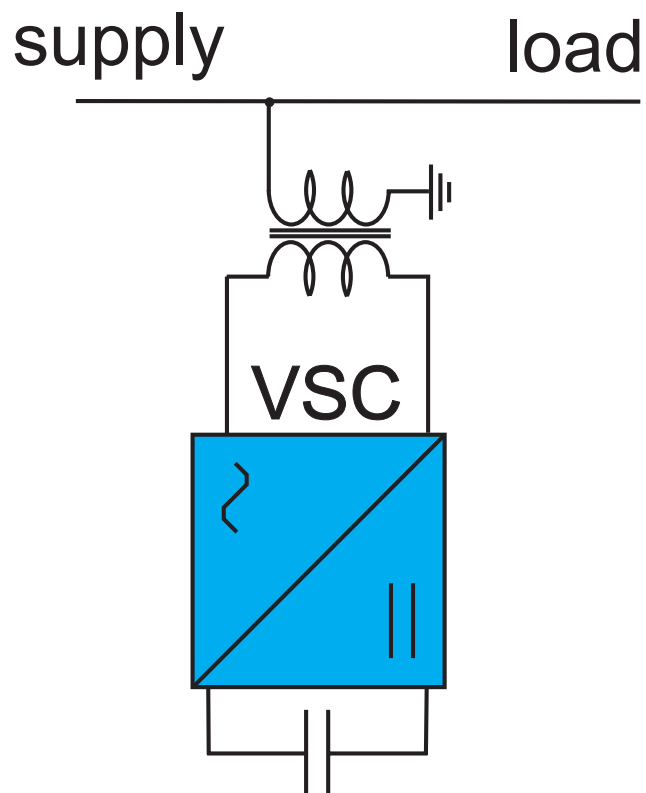
Applications:

- reactive power compensation
- flicker mitigation

D-STATCOM

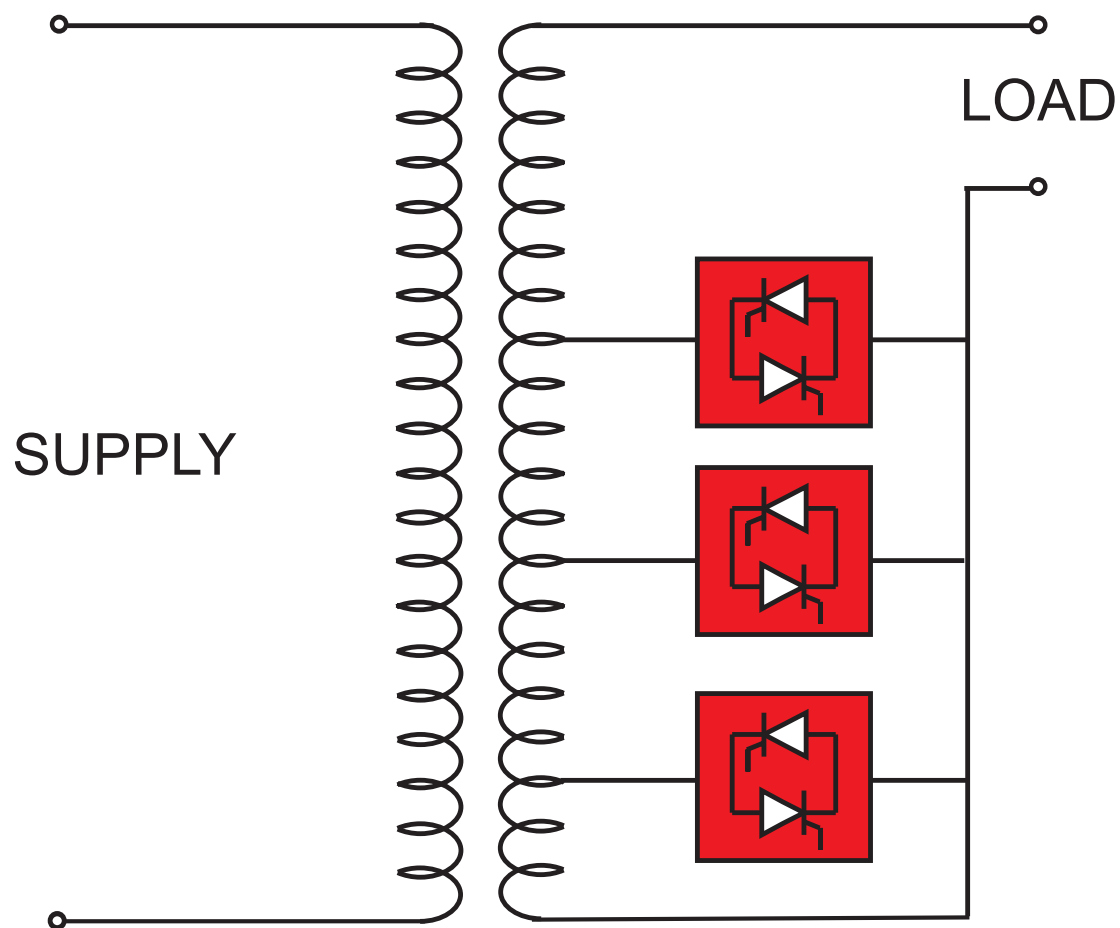
Applications in distribution systems

- reactive power compensation (voltage regulation, power factor correction)
- flicker mitigation
- active current filtering (harmonic cancellation)



Principle of operation

Voltage Sag Mitigation Devices

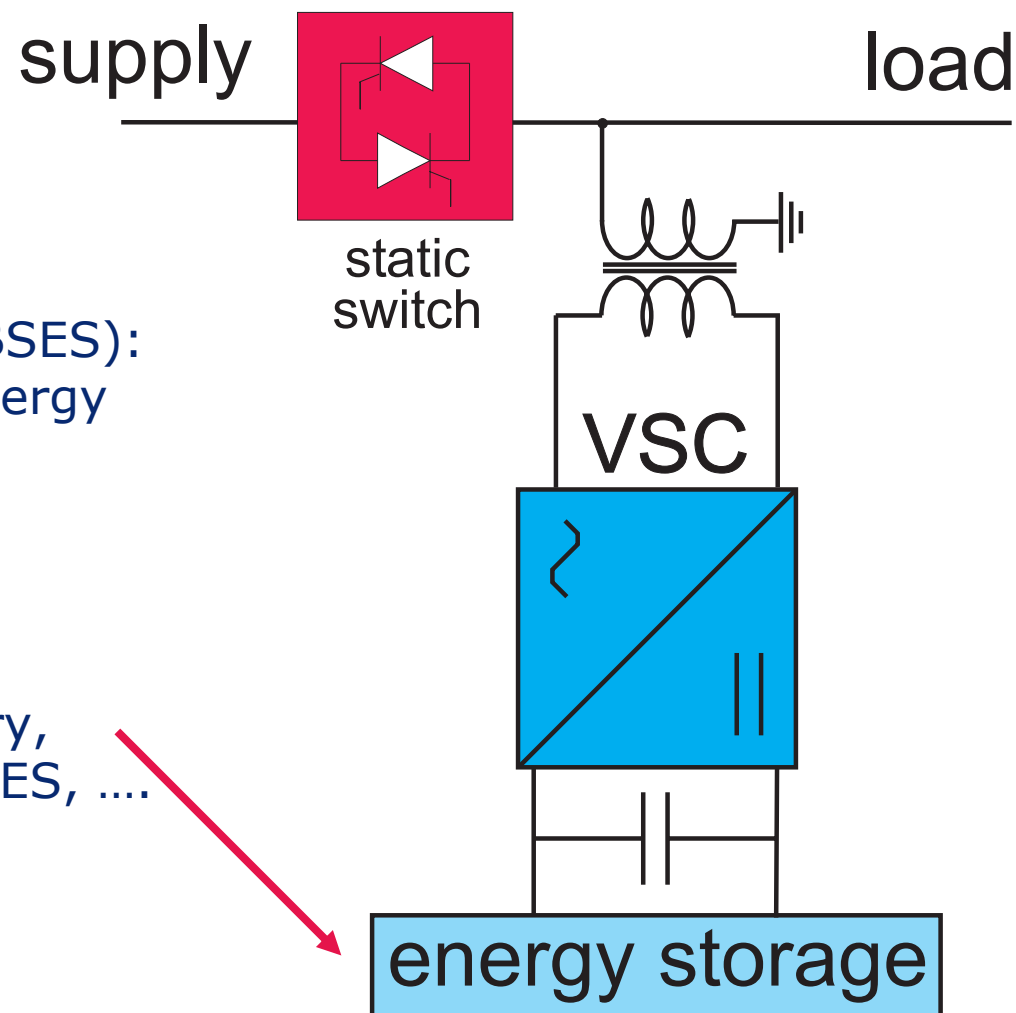


Static Voltage Regulator (SVR): transformer with taps controlled by thyristors, response in one half-cycle, regulation only in steps

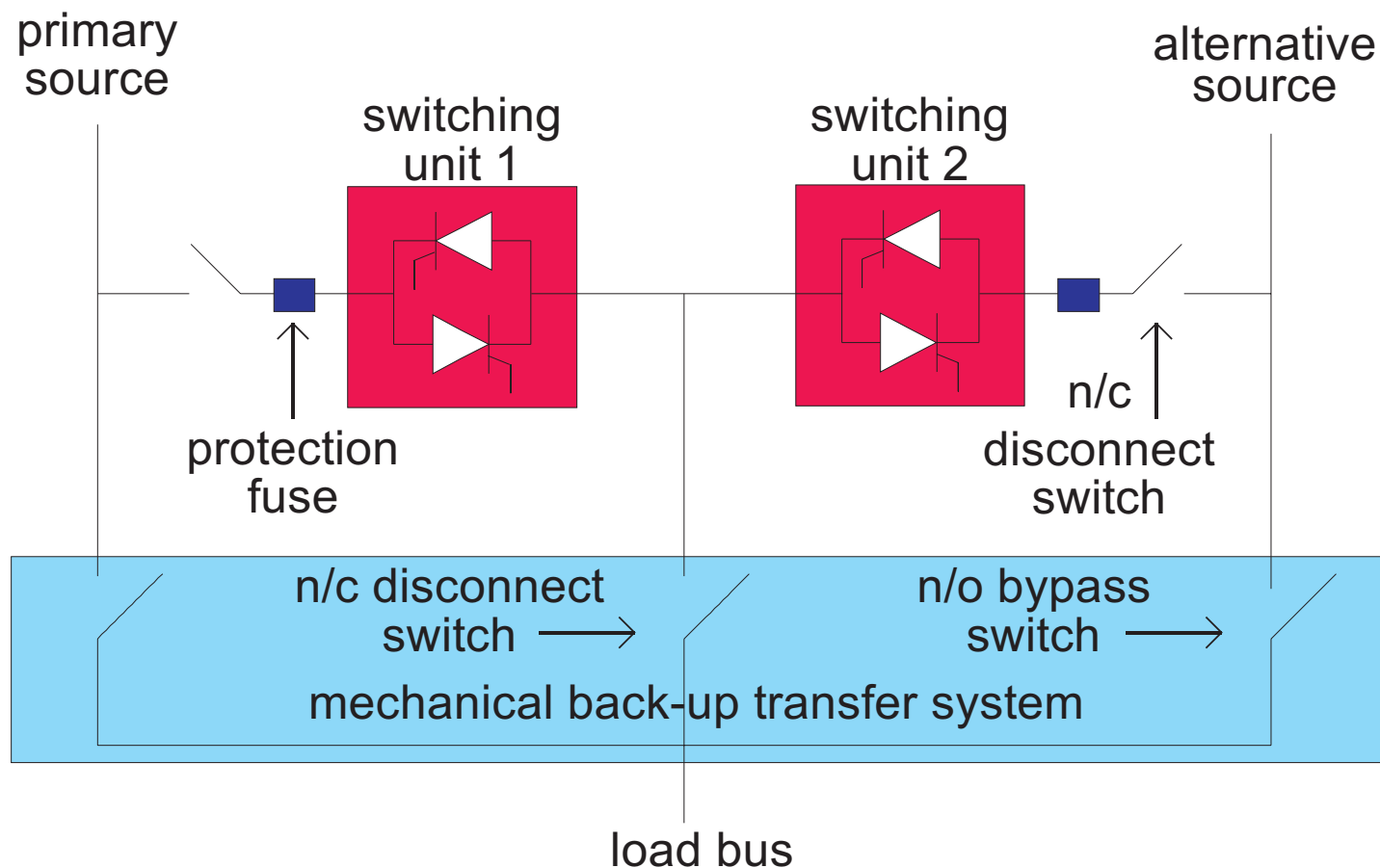
Voltage Sag Mitigation Devices

Back-up stored energy source (BSES):
the load is switched on to the energy
source when there is a dip or
interruption

Can be battery,
capacitor, SMES,



Static Transfer Switch

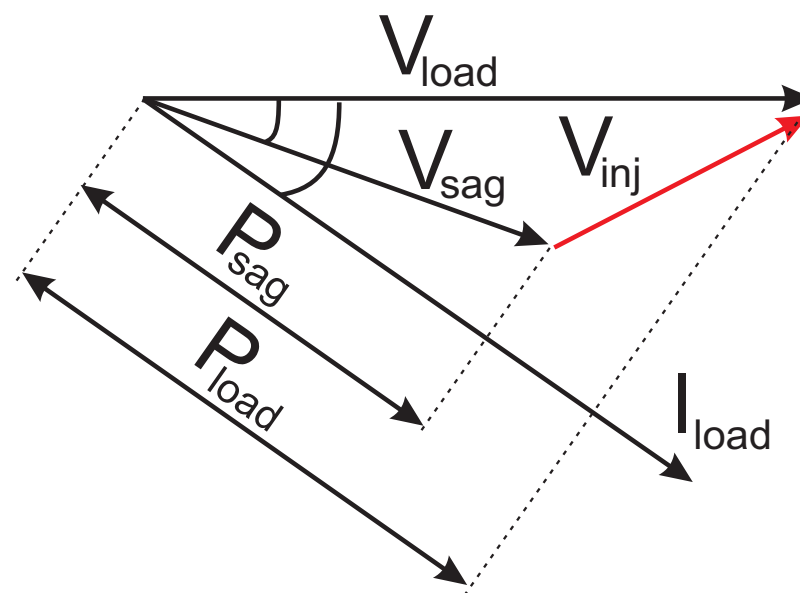
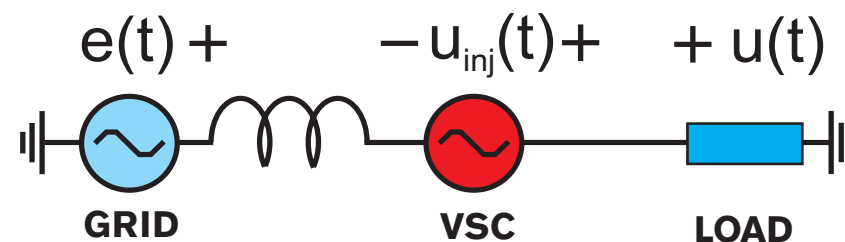
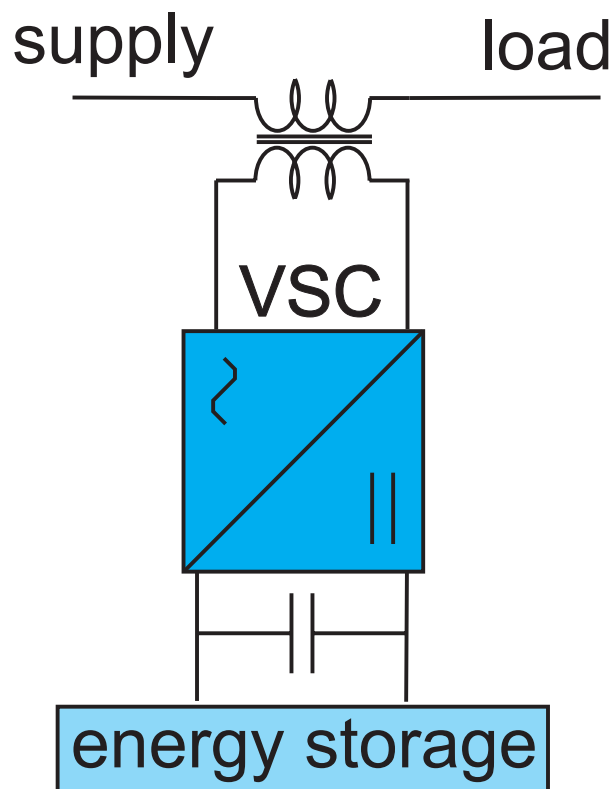


Static Transfer Switch (STS): allows **fast transfer of sensitive loads** from a primary source affected by a disturbance to an available secondary feeder.

Static Series Compensator (SSC)

Series-connected VSC based on IGBTs

Injects a voltage in series with the line



The necessary active power comes from an energy reservoir (Stored energy supply, **SES**) or from the affected line (line energy supply, **LES**)

Structure of the IEEE P1409 Guide

P1409 Draft Guide Topics:

- Definitions
- General Needs: description of power quality phenomena to be mitigated and possible solutions
- Configurations and Performance Objectives: description of custom power devices
- Application Considerations: issues to think about when applying custom power technologies
- Performance Measurements: how to evaluate the performance of custom power devices, where and what to monitor before and after installation
- Case Studies: existing custom power installations
- Economics: when are the benefits of the technology worth the cost?

If you want to participate...

- Web Site
 - <http://grouper.ieee.org/groups/1409>
- Next Task Force Meeting
 - Thursday, 11 September 2003 from 2:00 to 4:00 PM
 - Hyatt Regency Dallas at 300 Reunion Boulevard
 - Moreno AB Conference Room