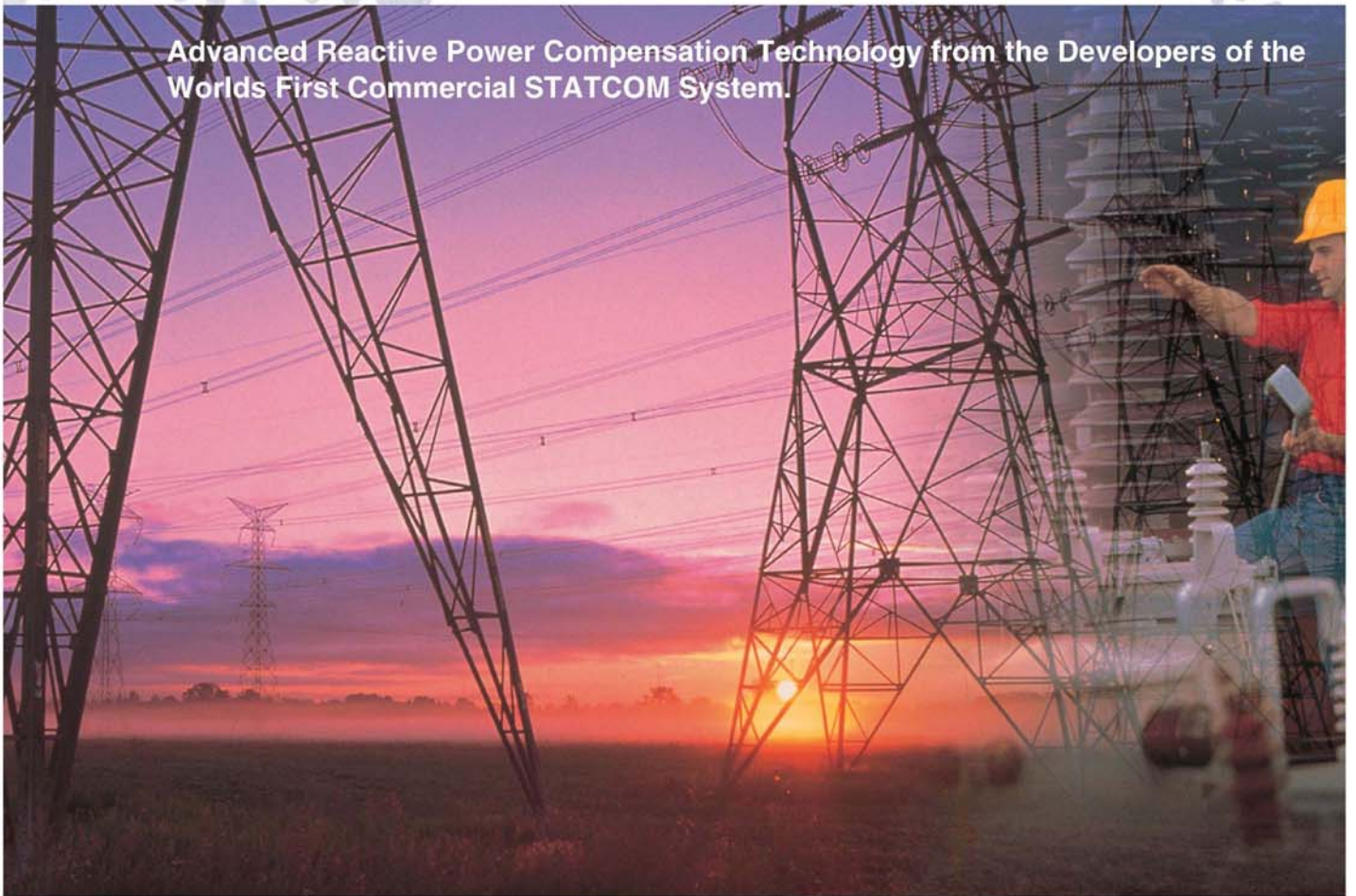


**TMT&D**

TMT&D Corporation

# STATCOM

Advanced Reactive Power Compensation Technology from the Developers of the  
World's First Commercial STATCOM System.

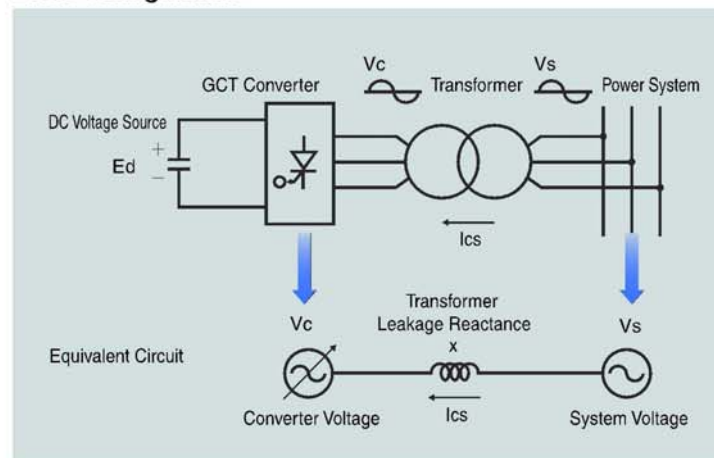


# STATCOM Overview

The function of a Static Compensator (STATCOM) is similar to that of a synchronous condenser. In general, it provides reactive power compensation to solve a variety of power system and industrial system voltage fluctuation and stability conditions. A complete STATCOM system basically consists of a DC voltage source, self-commutated converters using GCT thyristors, and a step-up transformer.



## Basic Configuration



# General Performance

It is essential to balance the supply and demand of active and reactive power in an electric power system. If the balance is lost, the system frequency and voltage excursion may occur resulting, in the worst case, in the collapse of the power system. Appropriate voltage and reactive power control is one of the most important factors for stable power system operation. Static Var Compensation (STATCOM) technology is one of the advanced power electronics systems known as FACTS controllers, which provides fast and continuous capacitive and inductive reactive power supply to the power system.



# STATCOM Features

- a. Compact size
- b. System voltage support and stabilization by smooth control over a wide range of operating conditions.
- c. Dynamic response following system contingencies
- d. High reliability with redundant parallel converter design and modular construction.
- e. Flexibility of future reconfiguration to BTB (Back to Back) power transmission or UPFC (Unified Power Flow Controller) and other configurations.

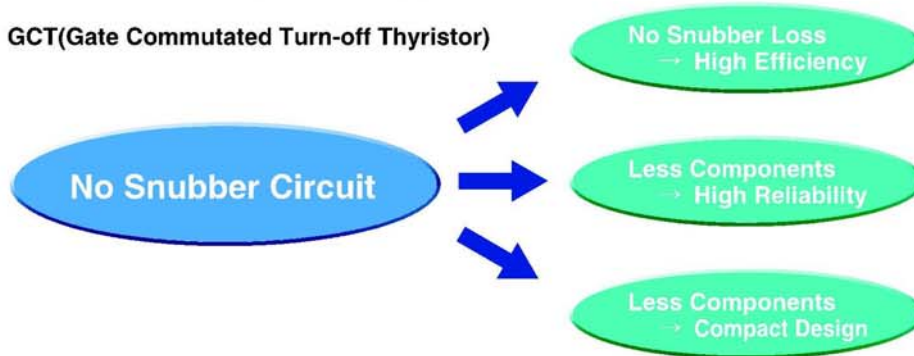
## Operation Mode

Mode	Waveform	Phasor	Description
No load mode			If $V_c = V_s$ , $I_{cs} = 0$
Capacitive operation mode			If $V_c > V_s$ , $I_{cs}$ appears to be leading current. Since the magnitude of the current can be controlled continuously by adjusting $V_c$ , the STATCOM will function as a capacitor whose capacitive reactance is continuously controllable.
Inductive operation mode			If $V_c < V_s$ , $I_{cs}$ appears to be lagging current. In this mode, the STATCOM will function as a reactor whose inductive reactance is continuously controllable.

# STATCOM Key Components

An enhanced self-commutated device - the gate commutated turn-off thyristor (GCT) has an improved gate structure and gate drive circuitry. This dramatically reduces the system operating losses due to the elimination of the snubber circuit. In contrast, the snubber circuit is required in the conventional switching operation of the GTO, as well as IGBT devices. Consequently, fewer components, as well as lower losses, are achieved in the GCT-based converter application. Rated at 6 kV, 6 kA, the GCT is the world's largest semiconductor device available for high-performance power applications, and is proposed for every project.

**GCT(Gate Commutated Turn-off Thyristor)**



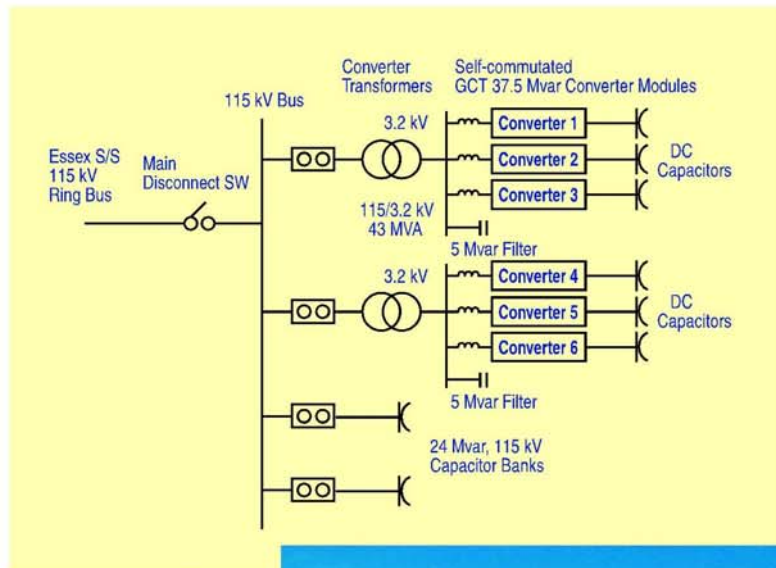
3

**Circuit Features of the "GCT Thyristor"**

The diagram compares two circuit topologies. On the left, a GTO-based circuit includes a Free Wheeling Diode, a GTO, and a Snubber circuit. On the right, a GCT-based circuit is shown as a Snubber-less Circuit. Below the diagrams are two photographs of the physical components. The left photograph shows a large GTO device with a snubber circuit, labeled "6kV, 6kA". The right photograph shows a smaller GCT device, labeled "6kV, 6kA".

# Application Example 1

VELCO Essex STATCOM-Based FACTS Project  
-41 to +133 Mvar Dynamic range  
115 kV ac System



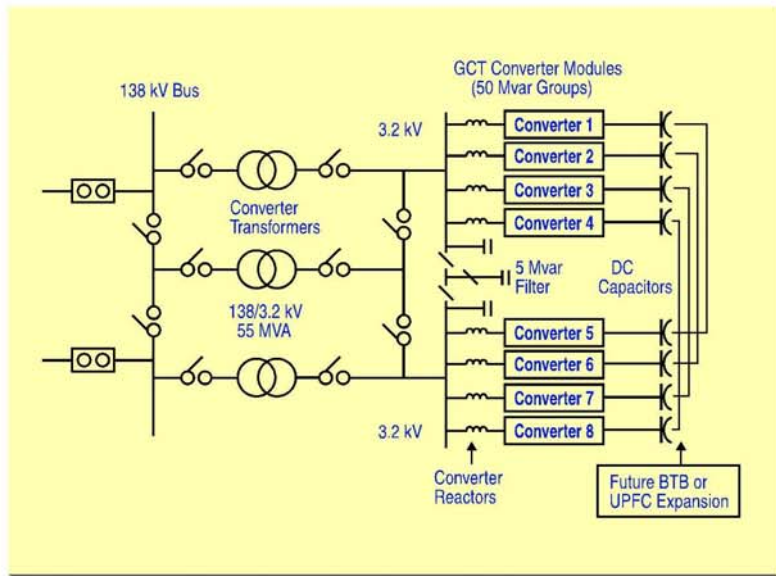
Essex FACTS Project  
-Single Line Diagram



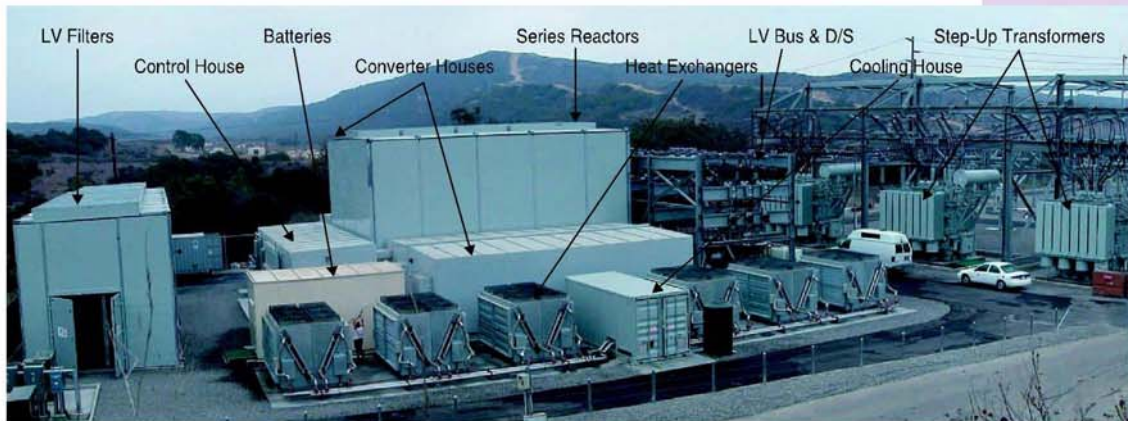
Essex FACTS Project -External View

# Application Example 2

SDG&E Talega STATCOM/BTB FACTS Project  
-100 to +100 Mvar Dynamic range (STATCOM)  
50 MW BTB DC Link (future option)  
138 kV ac System



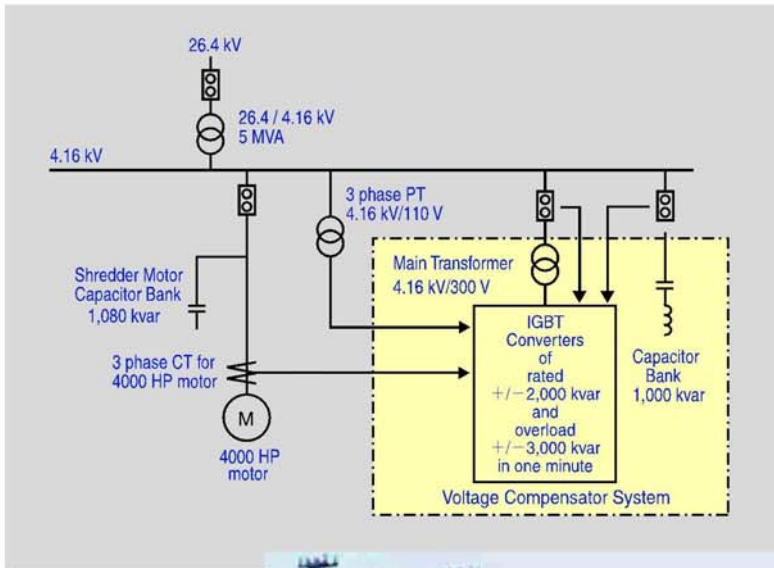
Talega FACTS -Single Line Diagram



Talega FACTS Project -External View

# Application Example 3

Seattle Iron & Metals Corp. D-STATCOM Project  
0 to +5 Mvar Dynamic range  
4.16 kV/26.4 kV ac System



Seattle I & M  
D-STATCOM  
-Single Line Diagram



Seattle Iron & Metals D-STATCOM -External View at Steel Recycle Facility



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## TMT&D Corporation

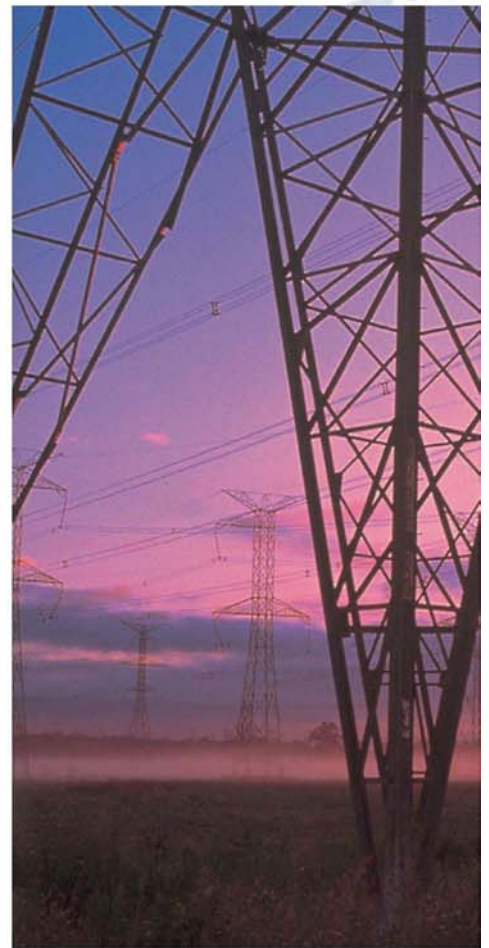
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