



VArPro™ STATCOM  
Dynamic reactive power compensation  
Renewable energy integration solutions



**VArPro STATCOM gives you proactive solutions for reactive needs**

# Ensure grid code compliance and maximize plant productivity – VArPro™ STATCOM

**With over a GigaVAR of STATCOM installations worldwide, ABB is a pioneer and a leader in reactive power compensation solutions. ABB's VArPro STATCOM solution allows renewable plants to safely connect to the grid and optimize power transfer.**

**Installing a STATCOM at one or more suitable points on the network is a powerful and cost effective method to increase grid transfer capability and enhance voltage stability.**

Renewable energy offers a great deal of benefits as it is abundant, can be locally produced, is safer to produce and maintain, and has minimum environmental impact. Because of these positive attributes, more and more utilities are adding wind and solar to their power supply mix.

However, the electrical grid is a complex machine that requires a balance between energy supply and demand. Adding variable sources of energy, such as renewables, may greatly alter this critical balance. Power quality issues can quickly emerge as soon as wind speed changes, or sun exposure varies throughout the day. Advances in grid technologies are available to help clean and sustainable energy power the businesses, schools and homes in local communities.



VArPro STATCOM benefits	
<b>Grid code compliance</b>	STATCOMs can readily address grid operator's requirements for reactive power compensation, voltage control, and fault ride through capabilities. Not adhering to the interconnection regulations can result in utility fines and even curtailment.
<b>Maximize profitability</b>	Variable generation sources not only cause disturbances on the grid, but are highly vulnerable to external faults located on the nearby network. Placing a VArPro STATCOM at the point of interconnection will protect a renewable energy plant against network faults, voltage drops, and other issues that often result in the wind turbines or solar arrays tripping offline, therefore lowering the power output and potential for revenue.
<b>Improve network reliability</b>	Integrating wind or solar power into today's grid while adhering to high reliability standards is no easy task. Issues involving voltage fluctuations, harmonic emissions, flicker, and faults can create for an unstable network, limiting the adoption of clean and renewable energy supply. A STATCOM functioning at the point of interconnection not only secures the electrical grid, but enables the continued adoption and use of renewables.

# The VArPro™ STATCOM solution

## VArPro STATCOM ensures a seamless connection of renewables, optimizing plant power flow and profitability

### Value and performance

Intermittent sources of energy such as wind and solar can impact the quality and reliability of the electrical network. ABB's VArPro STATCOM can detect and instantly compensate for voltage fluctuations, mitigate impacts of flicker, and correct power factor, protecting wind farms, solar parks and the electrical grid.

Controlling the voltage and reactive power at the point of interconnection will allow for the renewable energy facilities to comply with stringent grid codes, prevent curtailment and fines from the system operator, and enhance power transfer from the wind turbines to the electrical grid. ABB's VArPro solution has the control functionality and the reliability.

As a fully controllable power electronic device, a STATCOM is capable of providing both capacitive and inductive VARs. ABB's VArPro STATCOM solution ranges from 100 kVAr up to 100 MVAR. Our modular design with enhanced reliability features allows developers of any plant size to connect to the grid, minimize operating cost and profitability.

### + Utility grade with advanced controls

Our grid expertise supports precise system control for grid code compliance

### + High availability

Built-in redundancy and protection system ensures lowest cost of ownership

### + Minimized risk due to proven technology

Global installed base with high reliability and strong track record

### + Modular and scalable systems sizes

Flexible designs can accommodate to system sizes from 100 kVAr and up to 100 MVAR

### + Rugged design for harsh environments

Containerized solution protects sensitive equipment for low maintenance cost and peace of mind regardless of climate conditions

### + Turnkey systems and optimization studies

Leverage ABB's vast product offering and expertise in substation designs



VArPro STATCOM installation at a substation in the Canadian Maritimes to support a growing wind farm installation

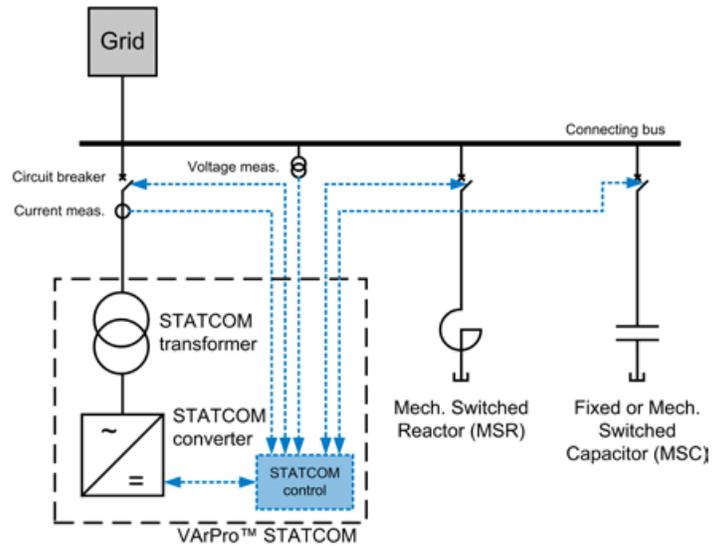
# Engineered for user simplicity

## What is a STATCOM?

A STATCOM (static synchronous compensator) is a voltage regulating device. It is based on a power electronics voltage-source converter and can act as either a source or sink of reactive power. It is a member of the flexible AC transmission systems (FACTS) family which detects and instantly compensates for voltage fluctuations or flicker, as well as controls power factor. As a fully controllable power electronic device, the STATCOM is capable of providing both capacitive and inductive VARs.

### Features

- Power factor control
- Voltage regulation
- Independent phase control
- Flicker compensation
- Active harmonic filtering (application specific)
- Multiple system parallel control
- High and low voltage ride through
- Modular inverter blocks for simple long term maintenance
- Flexible transformer integration for optimal footprint and low installation costs
- Optional overload capacity up to 300 percent



The ABB VARPro STATCOM system, installed at a wind farm in the UK to ensure grid code compliance.

# VArPro™ STATCOM ratings

Modular building blocks for optimized system sizes and easily tailored solutions

System ratings	
VArPro 1000	50 kVAr – 1,000 kVAr
VArPro 2000	1,000 kVAr – 2,000 kVAr
VArPro 3000	2,000 kVAr – 3,000 kVAr
VArPro 5000	3,000 kVAr – 5,000 kVAr
VArPro STATION	5 MVar – 32 MVar
Connection	
AC grid voltage <sup>1</sup>	480 V to HV
Grid frequency <sup>2</sup>	50 Hz or 60 Hz
Harmonic distortion	IEEE / IEC compliant
Performance	
Response time	Sub-cycle
Output control	Independent phase control
Overload <sup>3</sup>	application specific

Standards	
Safety, EMC	Designed to CE mark requirements
Quality	ISO 9000 / ISO 9001
Environmental	
Protection class indoor	NEMA 1 / IP20 / IP23
Protection class outdoor	NEMA 3R, NEMA 4, NEMA 4x / IP54
Ambient temperature range <sup>4</sup>	-40°C to 40°C
Cooling	Forced air or liquid cooling

<sup>1,2,4</sup> Other values available upon request

<sup>3</sup> Optional overload capability up to 300%



Containerized, or outdoor and indoor cabinet enclosure configurations

# VArPro™ STATCOM engineering studies

Increase productivity, stability, efficiency and safety with a power system study

VArPro STATCOM studies	
<b>Feasibility studies</b>	<ul style="list-style-type: none"><li>– Determine the impact of network modifications to assist with planning and design requirements</li></ul>
<b>Harmonic analysis</b>	<ul style="list-style-type: none"><li>– Identification of harmonic generating equipment</li><li>– Provide filter sizing and solutions</li><li>– Recommend efficient sizing of new components</li></ul>
<b>Load flow</b>	<ul style="list-style-type: none"><li>– Analyze the power system to determine optimal operating conditions</li><li>– Evaluate under operations and outline fault conditions</li></ul>
<b>Short circuit</b>	<ul style="list-style-type: none"><li>– Calculate available fault current at specific points in the system</li><li>– Determine if over current component sizing is correctly applied on site</li><li>– Verify settings to withstand possible fault currents</li></ul>
<b>Coordination studies</b>	<ul style="list-style-type: none"><li>– Review over current and overvoltage set points for protective devices</li><li>– Evaluate size and proper insulation</li></ul>
<b>Transient impact analysis</b>	<ul style="list-style-type: none"><li>– Record and evaluate system response during load application or rejection</li><li>– Assess the impact of the system response at various component levels</li></ul>
<b>Failure analysis</b>	<ul style="list-style-type: none"><li>– Study component failure to determine financial impacts and lost time effects</li><li>– Provide effective and preventative component solutions</li></ul>
<b>Analysis Tools</b>	<ul style="list-style-type: none"><li>– PSS®E</li><li>– DlgSILENT PowerFactory</li><li>– PSCAD®</li><li>– MATLAB Simulink</li></ul>



# ABB's remote asset enterprise

Improving your bottom line through ABB's remote services and virtual technical support team.



In today's operating climate, many businesses are required to increase operational efficiency with fewer available resources. Remote monitoring presents an effective solution for around the clock monitoring and network uptime, with

little investment. The remote asset enterprise allows ABB's experienced professionals to remotely monitor valuable assets, freeing users to allocate their valuable resources more productively.

## Remote asset enterprise service packages

	Monitoring on-demand	Real-time performance analysis	Continuous monitoring and diagnostics
Remote trouble shooting	●	●	●
Automatic notifications and alerts	●	●	●
Fault and early warning detection system	●	●	●
Event logging and visualization		●	●
Voltage and current measurements		●	●
System performance reports		●	●
Trending analysis			●
Predictive maintenance			●

# VArPro™ STATCOM service and support

## Rapid Response

We guarantee fast and flexible service response to maximize your equipment availability.

### Rapid Response

- **Repairs:** During emergencies or planned production breaks, when equipment or processes fail and need instant repairs.
- **Spare parts:** Delivery of spares and consumables.
- **Replacement:** Troubleshooting, identifying and analyzing the root causes of equipment failures and suggesting the most effective courses of action.
- **Training:** Equipment and system training services for personnel.

### Operational Efficiency

**Remote monitoring:** Outsource asset monitoring to experienced professionals with an easy access to our virtual engineer support team. Allow for real-time visibility into equipment performance with fast and secure information retrieval.

## Lifecycle Management

We provide you powerful tools and our knowledge base to optimize and extend the lifecycle of your equipment.

## Operational Efficiency

We optimize the usability and efficiency of your equipment and systems to increase productivity.

### Lifecycle Management

- **Installation and commissioning:** Installation supervision and commissioning of the equipment by qualified engineers reduces start-up time, increases safety and reliability, while decreasing lifecycle costs.
- **Extensions, upgrades and retrofits:** Upgrade current installations with next generation product and software to ensure maximum return on investment
- **Service agreement:** Tailored service agreements that guarantee quick help in all situations, including lifecycle services to keep equipment and assets in full working condition and updated to use the latest technology

### Performance Improvement

**Engineering and consulting:** Engineering and consulting assistance in identifying areas for improvement in the reliability, availability, maintainability and safety of production processes. We offer advanced services that allow for appropriate sizing of systems and determine the optimal solution for each application.

## Performance Improvement

Your strategic partner in improving productivity, usability, reliability, safety, cost and energy efficiency and emissions control.

# VAr compensation experience

## Reference installations across renewable applications

### Naguabo, Puerto Rico

#### Challenging grid code met for renewable integration

With high energy prices, Puerto Rico is implementing renewable energy to manage costs and promote their energy independence. To that goal, a wind farm was developed on the eastern coast of the island, facing the winds of the Atlantic. The Punta Lima wind farm includes 13 wind turbines with capacity to meet the energy demands for 9,000 homes in several towns in the area.

Power regulators in Puerto Rico need to ensure that wind and solar plants have minimal impact on the entire network. As a result, strict interconnection requirements have been put in place requiring a STATCOM solution. ABB provided a 12 MVar containerized VArPro STATCOM unit, along with a switched capacitor bank and a switched shunt reactor. This solution is allowing the wind farm operator to automatically control the amount of reactive power, address voltage stability, limit grid impedance, and enhance the power output of the wind farm.



### Massachusetts, USA

#### Solar application challenge

In the northeastern part of the United States, a utility has a collection of distributed generation (DG) in the form of solar PV on their distribution network. Due to the variable nature of solar, the utility started to detect voltage concerns on the network surrounding the solar PV cluster.

To help mitigate voltage variations caused by the intermittency of the cluster of solar PV installations, ABB's VArPro STATCOM was installed to ensure feeder and station voltages were within acceptable limits. Due to the modular design, a solution was provided tailored to the unique needs of the distribution network within the solar PV cluster. This included smaller system sizes in the 1 to 2 MVar range that were strategically placed throughout the area.



## Glasgow, Scotland, UK

### Grid code compliance for Europe's largest wind farm

Whitelee Windfarm in the UK extended its size to above 500 MW of generating capacity. One of the biggest challenges faced by this impressive investment was the strict national grid code requiring the turbines to compensate for the specified reactive power. Because wind turbines sometimes have limited reactive power capability, the contribution of the wind farm was not sufficient, thus calling for additional compensation equipment.

In response, ABB offered a holistic STATCOM solution with robust and reliable reactive power compensation, including three liquid cooled medium voltage STATCOM units of  $\pm 15$  MVar each at 33 kV, installed within shipping containers. The scope of delivery also included transformers as well as an external water/air heat exchanger.

This unique line up of technology added the missing functionality to the wind farm, making it compliant with the national grid code. As a pure static device with no switched passive elements, the STATCOM provides outstanding performance for both steady state and dynamic operation. In addition, the fast dynamic voltage control, which operates during balanced as well as unbalanced grid faults (fault ride through), allows the system to meet the demanding requirements specified by the transmission operator. Gaining this additional capacity, Whitelee can now generate enough to power the equivalent of over 304,000 homes.



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