



CENTRALIZED PROTECTION AND CONTROL

Introduction

ENGINEERED
TO OUTFIT

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Benefits and features of centralized protection and control (CPC)



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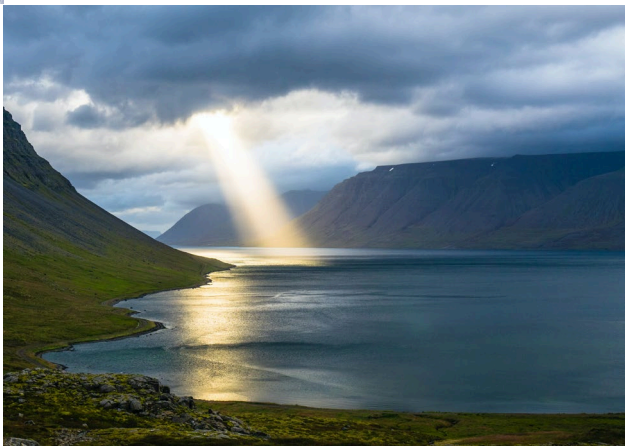
Customer references



01.

Introduction

- Why centralized protection and control (CPC)?
- ABB's offering
- Difference between centralized and virtualized protection



03.

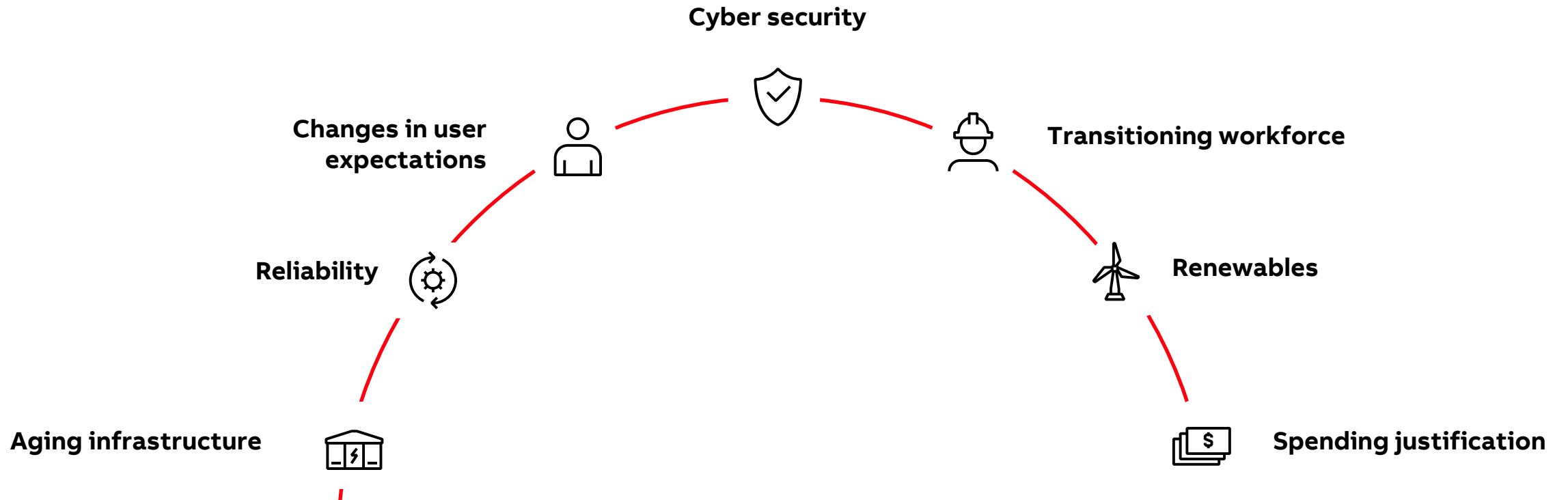
Centralized protection solutions

- Merging units
- Solution example
- Fleet management

01

INTRODUCTION

Why centralized protection?



Why centralized protection?

Product life cycle difference between existing primary equipment and secondary technology

Shortage of experienced personnel to manage increasingly complex secondary installations

Renewables and distributed generation

- Bi-directional power flow
- Meshed network
- Requires new or advanced functions/applications

Need to automate with smaller investment

- Quicker deployment
- Inexpensive extensibility, upgrades and life cycle support
- High levels of flexibility, reliability, availability and safety

Standardized solutions based on IEC 61850

- Simple and future-proof
- New ways to handle multi-vendor environments/ interoperability



Centralized protection and control for distribution networks

ABB's centralized protection and control (CPC) offering:

- Smart substation control and protection SSC600 (turnkey hardware included)
- Smart substation control and protection SSC600 SW (standalone software)

These products offer centralized protection, control and monitoring functionalities for superior solutions to utility and industrial customers for the substation's entire life cycle.



Smart substation control and protection SSC600 and SSC600 SW



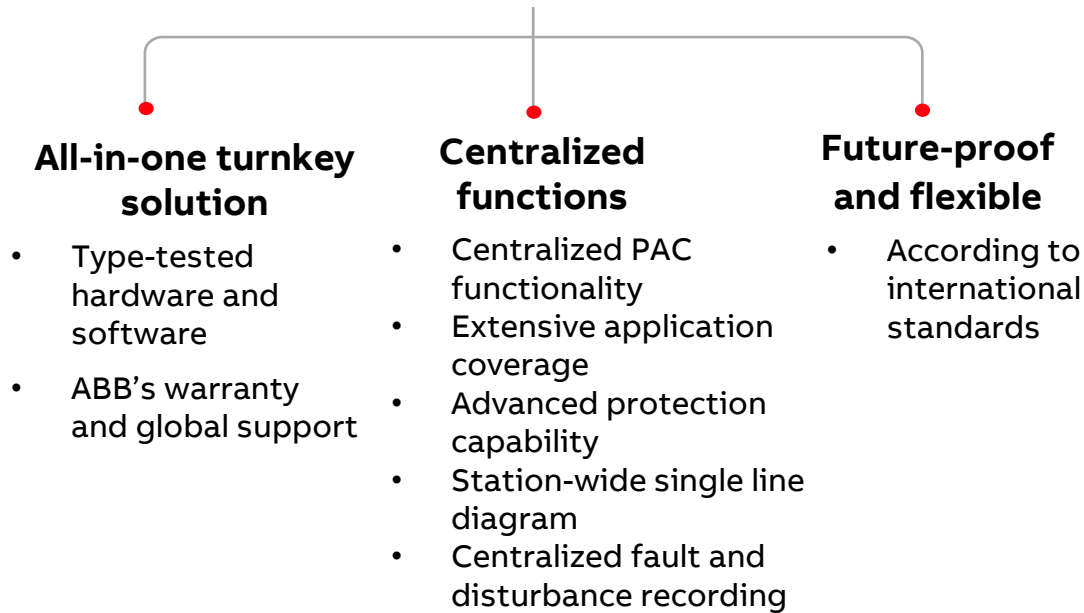
With software based on existing Relion® technology, SSC600 and SSC600 SW are designed for a wide range of power distribution applications – from basic feeder protection and control to complex multibay substation applications.

Industrial computer technology allows fast utilization of modern high-performance computing and reliable operation.

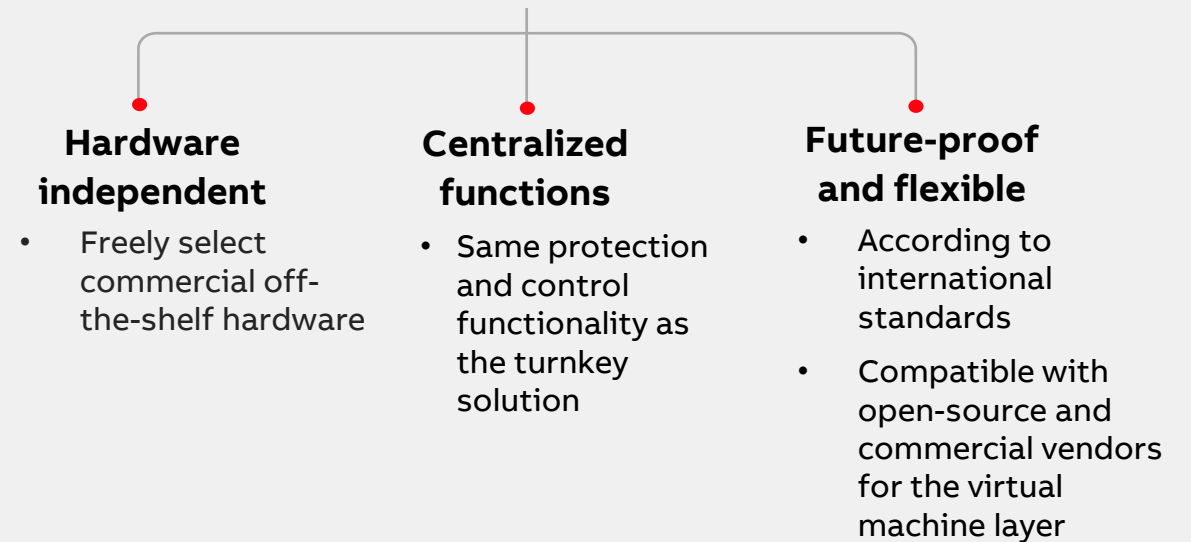
Difference between centralized and virtualized protection



Smart Substation Control and Protection SSC600



Smart Substation Control and Protection SSC600 SW



02

**BENEFITS AND
FEATURES**

The main benefits of CPC

Reduced complexity

- A single central processing unit concentrating P&C into a single device
- Station-wide visibility: Monitor your power distribution via a single human-machine interface (HMI)

Optimized asset management

- System upgrades and maintenance become easier and faster with a single device
- Reduce the amount of different hardware variants to only merging units and a centralized protection device

Unprecedented flexibility

- Wide application coverage
- Fully modular software
- Application package concept



The main benefits of centralized protection



Reduced complexity



Optimized asset management



Unprecedented flexibility



Reduced complexity with station-wide visibility

Station-wide visibility:

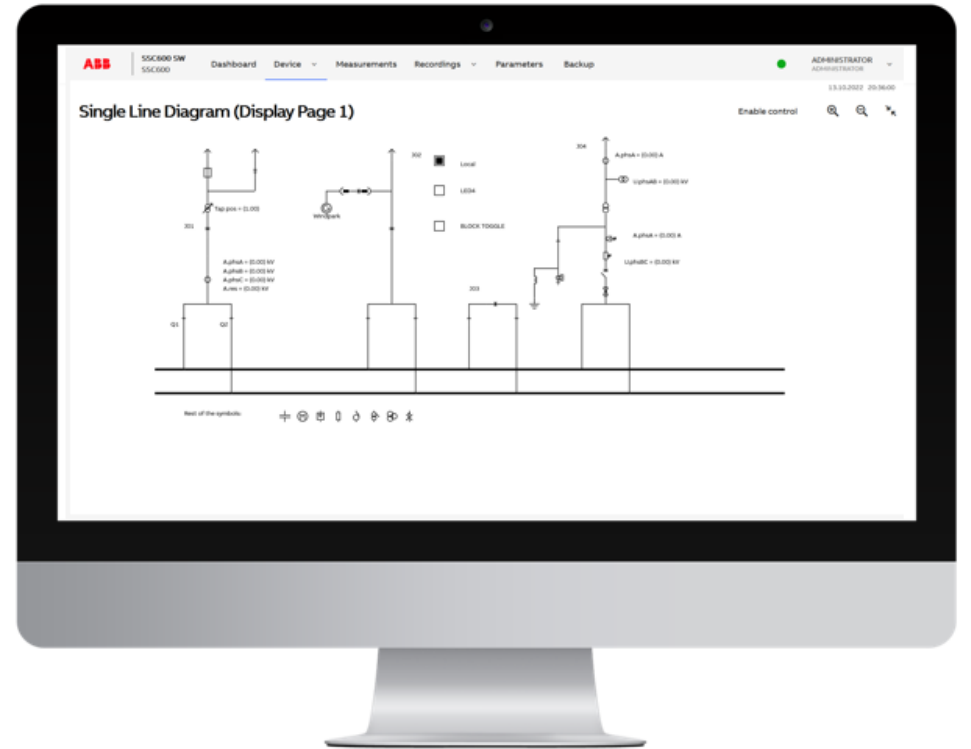
- Visualization of whole substation in one single line diagram (SLD)

Control and monitoring:

- All in one place for ease of use and increased situational awareness

Helps operator with various tasks:

- Fault analysis
- Device statuses
- Configuration backups
- Monitoring of historical data
- Parameter settings

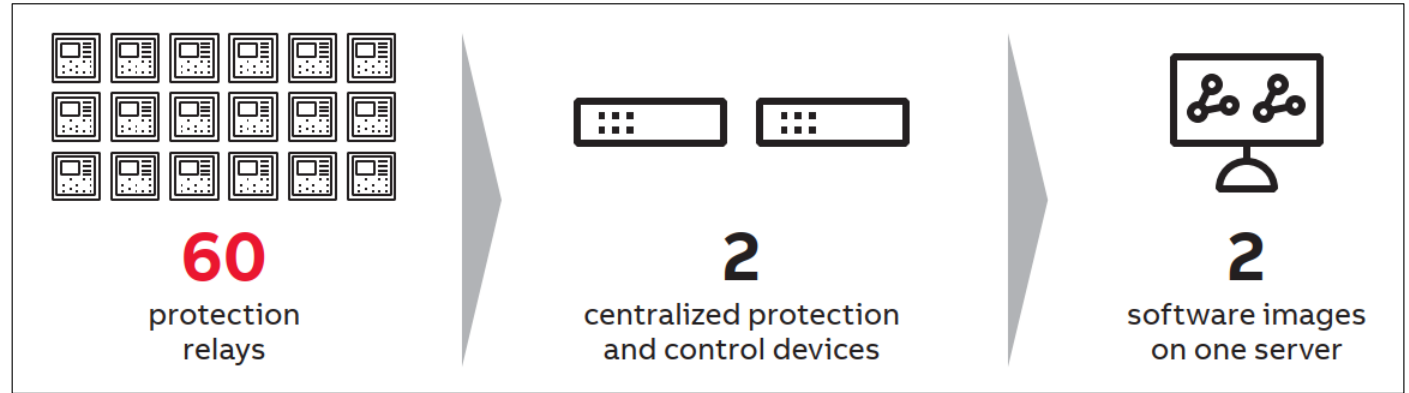




Optimized asset management

As the power grid evolves, substation technology also needs to change. Managing maintenance of an ever-growing list of different devices in modern substations can become a challenge.

- One SSC600 device can handle the functionality of 30 protection relays.
- Centralizing P&C functionality in the substation supports optimal, lifelong asset management and up to 15% savings in substation life cycle costs.
- With SSC600 SW grid operators are no longer tied to specific hardware, which allows optimization of IT infrastructure.
- With a virtualized approach, multiple SSC600 SW instances can be installed on a single computer for even bigger systems.





Flexibility with modular software

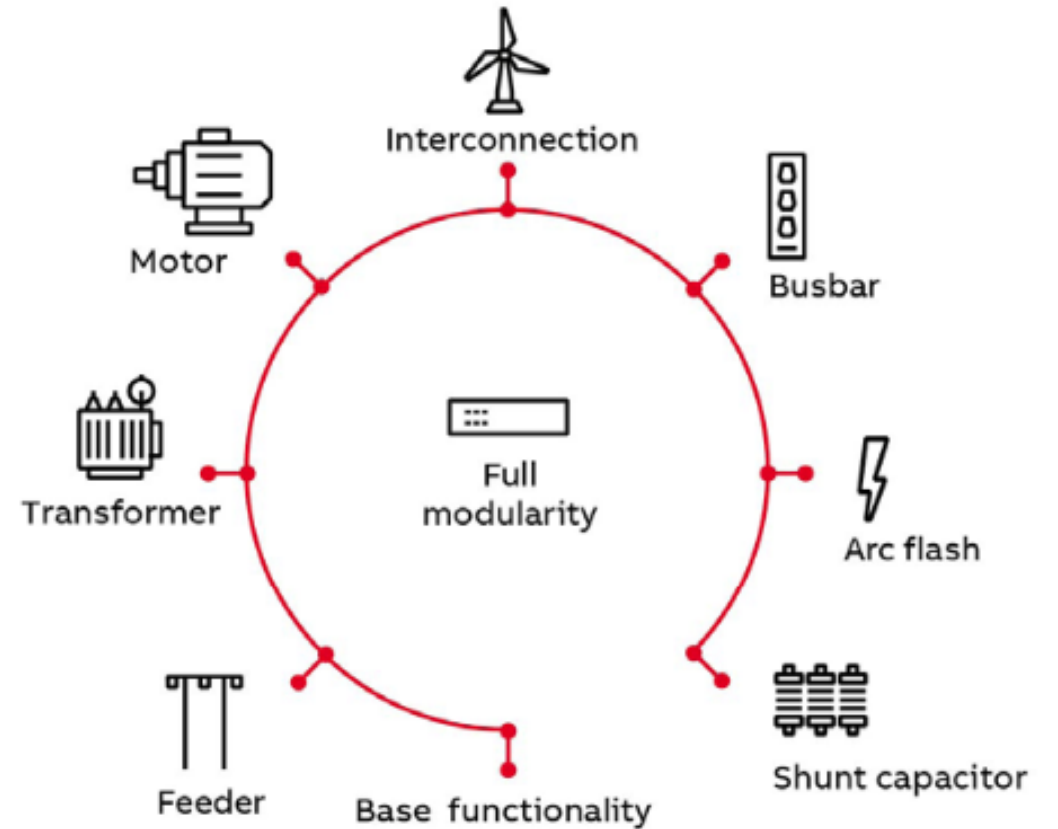
- Modular software that allows you to create your own, unique solution for your specific protection requirements
- Flexibility to extend the life cycle of the installation by updating and adding functionality to the existing protection scheme
- Only one device to modify instead of all bay-level protection and control devices





Flexibility with wide application coverage

- Extensive application coverage with one device for flexibility and optimal cost-effectiveness
- Centralized protection and control in one single device for up to 30 feeder, motor and transformer bays





Flexibility with application packages

Base functionalities*	Basic protection	Cable/line application (5-10-15-20-30 bays)	Transformer protection (0-2-4 bays)	Motor application (0-5-10-15-20-30 bays)
Web HMI with station SLD	Current protection_50/51	Directional EF_67N	Thermal overload_49/T/G/C	Thermal overload_49M
Breaker monitoring	Earth-fault_50N/51N	3-ph. direct. reverse power_32R/32O	Transformer differential_87T	Neg.seq. OC for machines_46M
Measurements_3I/3V/In/Vn/f/...	3-phase undervoltage_27	Phase-discontinuity_46PD	Low-impedance REF_87NL	Loss of load supervision_37
Fault recorder	3-phase overvoltage_59	Thermal protection_49F	3-phase underimpedance_21G	Motor load jam_51LR
Disturb. recorder (centralized)	Residual overvoltage_59N	Autoreclosing_79	Tap-changer position indication_84M	Motor startup supervision_49/66/48/51LR
IEC 61850-9-2LE and IEC 61869-9	Neg.seq. overvoltage_47O-	Synchrocheck_25		Phase reversal 46R
IEC 61850 GOOSE/ R-GOOSE/MMS/R-SV	Pos.seq. undervoltage_47U+	Directional OC_67P	Bay-level applications (for selected and available streams)	Emergency startup_ESTART
Advanced logics	Negative-sequence OC_46	Fault passage indicator_67NFPI	Tap-changer indication and control with voltage regulator	
Alarms	Frequency protection_81		Distance protection_21P, 21N	Multi-bay level applications (up to 30 bays)
Events and audit log	Three-phase inrush detect._68HB	Advanced cable/line application (5-10-15-20-30 bays)		Load-shedding and restoration across 4 bus sections_81LSH
PRP redundant communication	Circuit-breaker failure_51BF	MF-admittance EF_67NYH		Low imp. busbar differential_87BL/87B
Redundant power supply	Switch onto fault_SOTF	Admittance EF_21YN		Arc protection_50L/50NL
Time synch. with IEEE 1588 v2	Load blinder_21LB	Intermittent EF_67NIEF	Power quality	
Fuse failure supervision_VCM,60		Wattmetric EF_32N	<ul style="list-style-type: none">Current total demand and harmonic distortion (TDD and THD)Voltage total harmonic distortion (THD)Voltage variationVoltage unbalance	
Master trip_94/86	Communication protocols	Low-voltage ride-through protection_27RT	Line differential protection_87L	Shunt capacitor protection
Anomaly detector ANOGAPC	IEC 60870-5-104	Fault locator_21FL	<ul style="list-style-type: none">Up to 4 feeders	3-ph overload_51,37,86C
	DNP3	Direct. react. power underv._32Q/27		Current unbalance_60N
				3-ph current unbalance_60P
				Cap. bank switching resonance_55ITHD

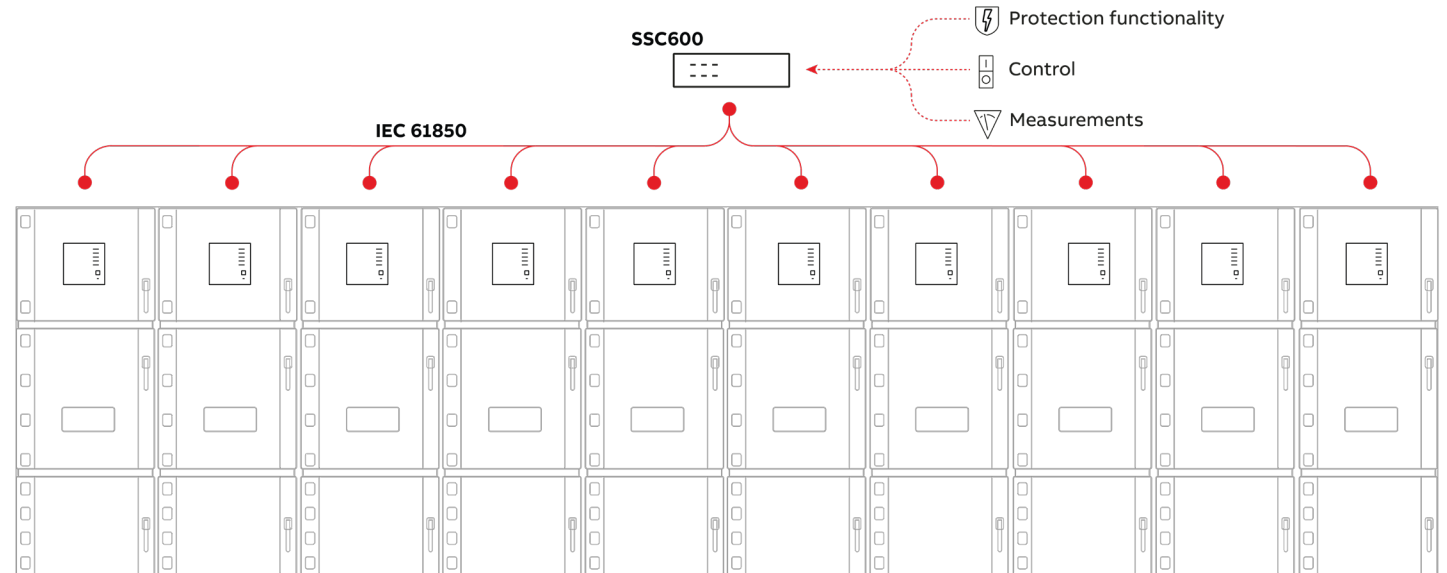
*Always included

03

**CENTRALIZED
PROTECTION
SOLUTIONS**

Centralized protection and control solutions

- A CPC system is made up of an SSC600 device and merging units and/or protection relays with merging unit capabilities for every feeder.
- SSC600 can be deployed in several different architectures, depending on the other solution components used and overall solution requirements.



Merging units



REX600

- One single unit for all measurements and I/O for a single bay – with standard wiring and design on bay level
- Support for non-conventional instrument transformers
 - 4Is + 4Us
 - 6BI + 3BO
- Fulfilling IEC 61869-13 SAMU requirements with backup protection and disturbance recorder
- Supports both IEC 61850-9-2LE and IEC 61869-9 sampled value publishing



REX615

- Up to 8 CT + 8 VT
- Up to 32 BI + 21 BO
- Up to 3 Is + 3 Us + 1 CT

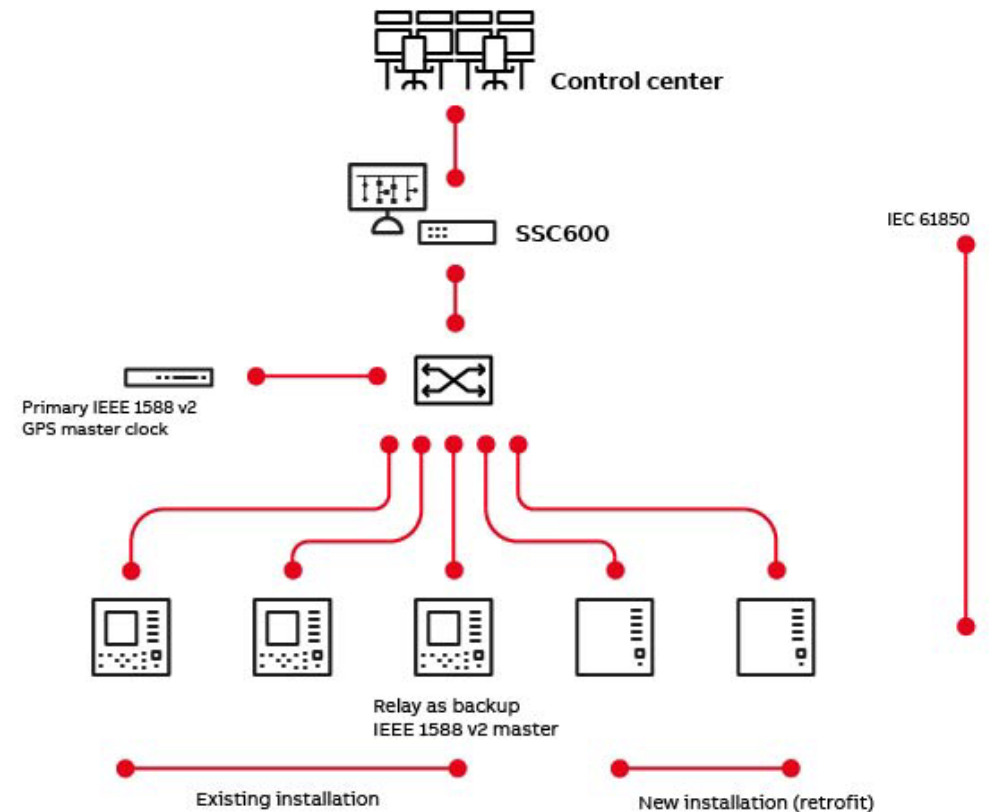


REX640

- Up to 12 CT + 8 VT or 11 CT + 9 VT or 10CT + 10 VTs
- Up to 6 Is + 6 Us + 2 CT + 2 VT or 12 Is + 12 Us
- Up to 96 BI + 10 BO or 56 BI + 42 BO

Solution example – integrated/retrofit

- Solution consisting of a mixture of protection relay(s) with merging unit functionality and merging units utilized in every bay/feeder
- Preferred retrofit use case (mix of existing and new) – where additional or upgrading of functionality is required
- A single IEC 61850 network for process and station bus
- System visualization via SSC600 with Web HMI (WHMI)
- Time synchronization via IEEE 1588 v2 GPS (Global Positioning System) master
- Any capable protection relay can serve as backup time master
- Substation gateway doubles up as HMI
- Direct communication to the control center possible with IEC 61850, IEC 60870-5-104, or DNP3, without an external gateway in between



04

**CUSTOMER
REFERENCES**



“Smart solutions are vital when developing the infrastructure of tomorrow. We wanted to be a pilot user of ABB’s SSC600 to learn about this new technology firsthand. It is an interesting approach, as consolidating multiple relays into one device reduces network complexity and offers effective ways to control protection functions.”

Rein Aron, Area Manager, Enefit Connect.

- Increased flexibility
- Reduced complexity

Estonian utility pilots ABB’s centralized control and protection solution

Challenge

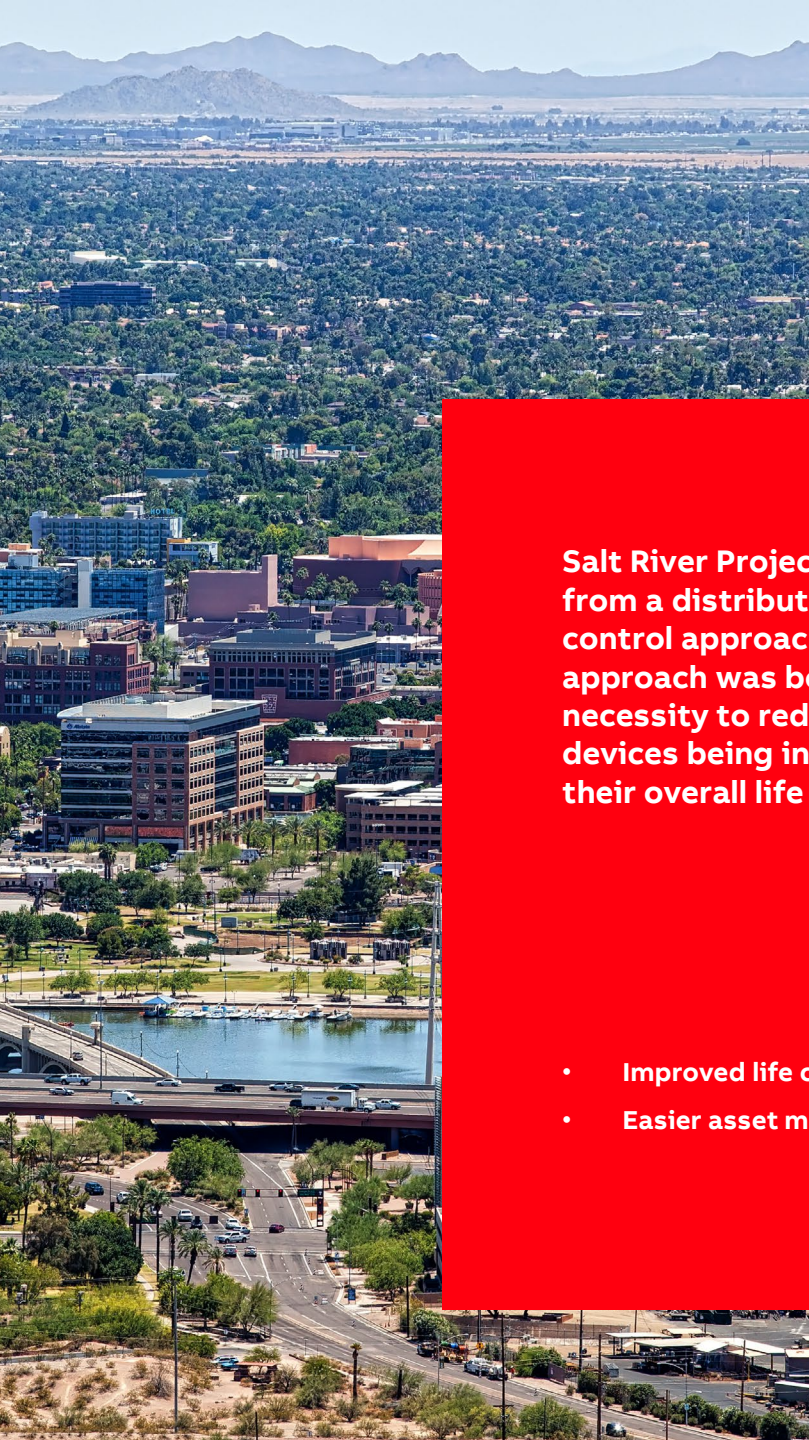
Need to develop the network, increase flexibility and performance due to rapidly evolving changes, such as increasing amounts of renewable energy resources being connected to the grid.

Solution

Turnkey centralized control and protection solution based on ABB Ability™ smart substation control and protection for electrical systems SSC600 and ABB merging units.

Outcome

Increase flexibility and reduced protection system complexity. Effective control of protection functionality.



US utility Salt River Project pilots centralized protection and control

Salt River Project's vision to move from a distributed protection and control approach to a centralized approach was born out of the necessity to reduce the number of devices being installed and improve their overall life cycle strategy.

- **Improved life cycle strategy**
- **Easier asset management**

Challenge

The challenges with past protection and control approaches included installing devices within harsh environments that reach extreme temperatures, a lack of flexibility in the distribution of signals, and a large amount of required labor (both now and during future maintenance and replacements).

Solution

SRP decided to implement a pilot project at one of their 69/12.47 kV substations. The system configuration comprises dedicated merging units and an SSC600 device.

Outcome

Able to meet new protection requirements and benefit from the latest developments in protection relay technology.



The future of resilient power grids is here

SSC600-based centralized protection and control solution

Challenge

Increased amount of distributed energy resources in their network.

Solution

Centralized control and protection solution with Smart Substation Control and Protection SSC600 and Relion protection relays.

Outcome

The success in Kinmen is a strong driving force that supports Taiwan Power Company to further implement and duplicate the solution in other substations in Taiwan.



The advancement of reliable power supply and the introduction of advanced technologies are important to Taiwan Power Company. ABB delivered a system with SSC600 for the Queshan substation on Kinmen island. The result is line with the company's targets: tripping has reduced, the reliability of the power supply improved, and end customer satisfaction increased.

- Reduced downtime
- Improved visibility



Finnish utility Parikkalan Valo selects SSC600

Challenge

The utility was looking for a leading-edge solution to ensure safe and reliable power supply, and the possibility to efficiently manage their electrical network and its assets; ensuring flexibility to meet future needs as requirements change.

Solution

SSC600 represents a new approach to protection and control in distribution networks – centralizing all protection and control functionality in one single device on substation level. The IEC 61850-compliant device is ready to change with the evolving grid.

Outcome

Simplified network management and easier device life cycle management increase the reliability of the substation in everyday operations and also makes it easier to perform software updates.



“Nowadays devices age faster than before, which is also the case in substations. We have now chosen to install an entirely new system to be one step ahead. In addition, with SSC600 we no longer need to manage an installed base consisting of protection devices of different types and ages. With the new SSC600 device, we can update all the protection and control functionality in one go.”

Olli Mattila, Network Manager, Parikkalan Valo

- **Optimized asset management**
- **Easy upgrades**



Acciona Energia takes the next step in power system reliability and operational efficiency

Challenge

To enable the 16.5 MW of power to flow from the Anabaru wind farm, Acciona identified the need to automate the power system infrastructure with a future-proof protection and control solution that would meet the demands of fast changes in the protection requirement that arise, for example, with bidirectional power flow and generation fluctuations.

Solution

ABB supplied and commissioned a solution with SSC600. Amongst many other benefits, SSC600 offers the gateway connectivity to Acciona's control center in Spain.

Outcome

Compared to a conventional RTU (Remote Terminal Unit) -based solution, ABB's SSC600 offers many benefits and in specifically in this case, the extended capabilities offered to form a custom protection and control solution with Relion protection relays, as well as the gateway functionality needed all in one device.



A future-proof protection, control and monitoring solution for Acciona Energia at their substation near the Anabaru wind farm in the state of Karnataka in India – which is now effectively monitored locally and controlled from the control center in Spain. The substation is the home of the first Smart Substation Control and Protection SSC600 device in the wind power segment in the country.

- **Cost savings**
- **Flexibility to adapt as the substation and grid evolve**



UK Power Networks' digital future

Challenge

The ever-increasing pace of change in electrical infrastructure brings many challenges for traditional power networks. Today's environment is far more complex and faces much more demand than it did 15-20 years ago. The new world of distributed energy generation, energy storage and electric vehicles is already here.

Solution

A centralized system where consolidating protection and control functions into fewer devices simplifies the engineering process, maintenance and reduces the substation footprint.

Outcome

The successful pilot paved the way for centralized protection in UK Power Networks' infrastructure, which delivers power to nearly a third of the UK population.



Since late 2019, ABB's pilot installation of SSC600 has been monitoring an 11kV substation in Maidstone, Kent, which is an important location for UK Power Networks, with multiple substations within a single footprint serving a large customer base.

- **Simplified engineering process and maintenance**
- **Reduced substation footprint**

ABB