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# Electrification of the Oil, Gas and Chemical industry



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# Experience the ABB difference

## Complete electrification of oil, gas and chemical facilities



With a global footprint, integrated and optimized solutions portfolio, and local service and expertise - ABB is fully equipped to support the electrification of oil, gas and chemical installations worldwide.



### **Increase safety**

with innovative arc-resistant switchgear and motor control



### **Increase reliability and efficiency, maximize uptime**

through condition monitoring, optimizing operations and asset management strategies



### **Increase flexibility**

with standardized switchgear across all applications



### **Reduce risk and cost while maintaining high quality**

by choosing ABB as a partner for integration and optimization

# Solutions for increased safety

## Join the switchgear revolution with ABB

### NeoGear™

Oil, gas and chemical projects and operations are under significant pressure to reduce asset and operational costs, while increasing efficiency and safety.

As a technology leader with decades of heavy industry segment experience, ABB offers the next generation of digitally-enabled, scalable and flexible low-voltage switchgear and motor control solutions.

Use NeoGear with ABB Ability™, for condition monitoring, predictive maintenance and power management.

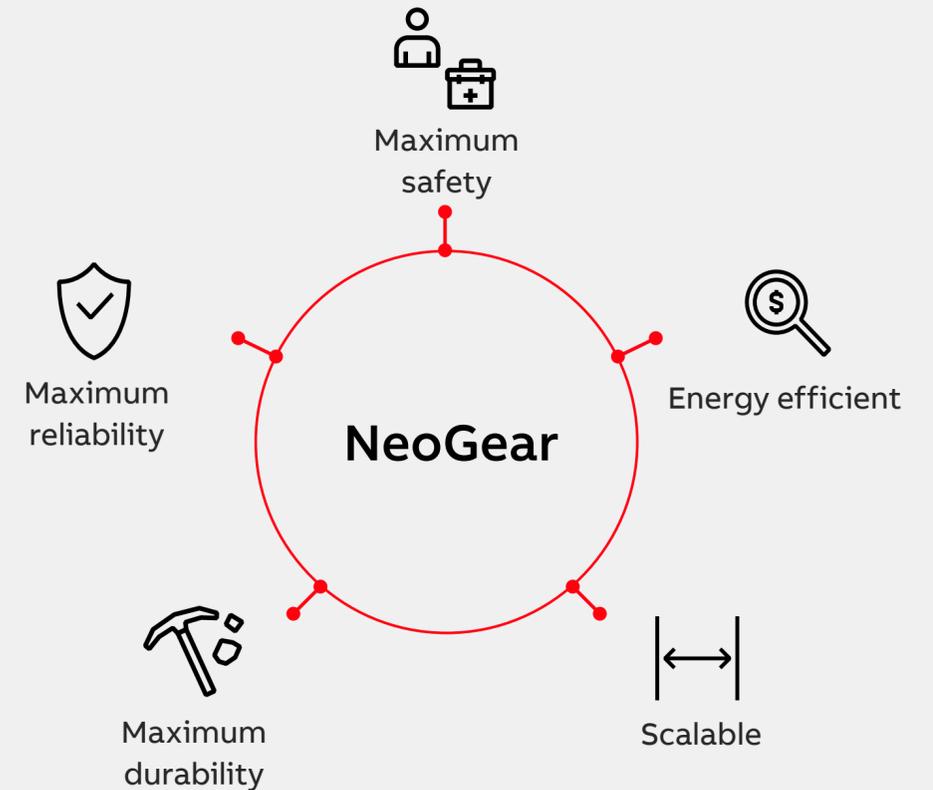
NeoGear is future-proof, ready to support the digital industries of the future with its cloud computing and industrial IoT solutions.

**NeoGear is the biggest breakthrough in switchgear technology, with its innovative busbar concept (bus plate).** Combined with the connectivity and digital smartness of the ABB Ability platform, it offers maximum safety, highest reliability, more flexibility, better efficiency and measurable Return on Investment (ROI).

[Learn more](#) about ABB NeoGear



NeoGear



# Solutions for increased reliability

## Active arc mitigation reduces switchgear repair time

Active arc mitigation is about limiting the time an internal arc is fueled. The main focus is on reducing the degree of damage the arc does to the switchgear and minimizing the necessary repair services or replacements, in order to quickly re-establish the power supply. Available technologies can be distinguished by their arc clearing times and selectivity.

The degree of damage an arc does to the equipment is an exponential function of time. Clearing the arc quickly is the key. It makes a significant difference whether an arc is cleared after 200 ms, 150 ms, 100 ms or faster than 4 ms.

[Learn more](#) about ABB's UFES

[Learn more](#) about ABB's ArcLimiter

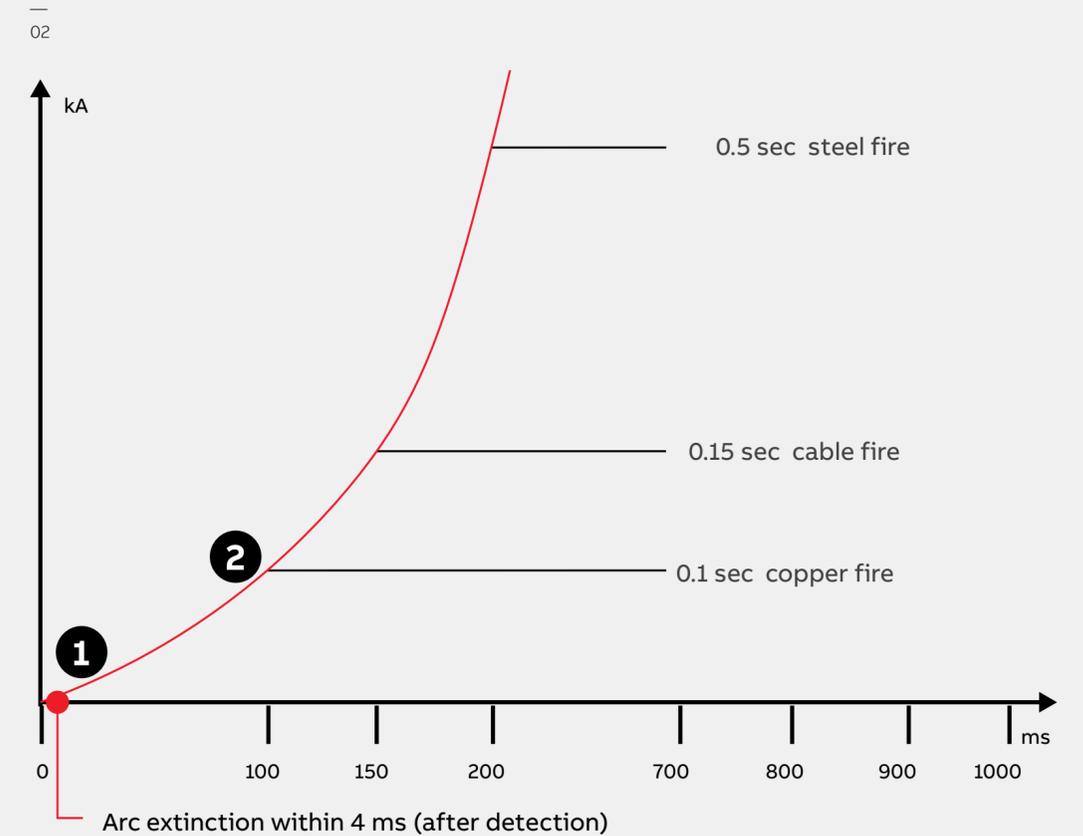
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Solution	Pressure relief flaps	Optical sensors and current transformers (CT)	UFES™ / ArcLimiter™
Technology	Mechanical microswitches on pressure relief flaps trigger circuit breaker trip	Light and current trigger circuit breaker trip	Light and current trigger circuit breaker trip and Ultra-Fast Earthing Switch UFESTM / ArcLimiter™
Arc mitigation time	70 ... 90 ms	40 ... 70 ms	< 4 ms

01 Selected options for active arc mitigation by clearing times

02 Arc flash damage by clearing time  
1) after 4 ms  
2) after 100 ms

Increase reliability/maximize uptime while reducing switchgear repair time by 80 percent using ABB's Ultra-fast Earthing Switch (UFES)



# Active arc mitigation maximizes switchgear uptime

State-of-the-art technology uses optical sensors and current transformer signals to trip the breaker, and initiate the operation of ABB's Ultra-fast Earthing Switch (UFES). UFES clears the arc in less than 4 ms, taking the arc's energy away from ionizing the surrounding gas and burning material, to a controlled, 3-phase bolted connection to the ground. The UFES system is available for new ABB switchgear, but it can also be retrofitted to existing medium and low-voltage, ABB and non-ABB switchgear.

The UFES helps prevent costly, time consuming system outages and enables the user to return back to service within hours of an internal arc.

[Learn more](#) about ABB's UFES

①



②



Ultra-fast earthing switch (UFES)  
1) arc mitigation after 4 ms  
2) arc mitigation after 90 ms

# Reclosers and sectionalizers for increased production

The power supply to the well pads in onshore upstream applications is often achieved through cost-effective medium-voltage overhead lines.

Avoid the loss of power flow in 80 percent of the cases by using the synergy of outdoor reclosers and electronic sectionalizers. In a brownfield installation reclosers can replace outdoor circuit breakers while electronic sectionalizers replace the fuse elements used to protect the lateral overhead lines. This approach reduces transitory (80 percent of the cases) and permanent faults (left 20 percent) providing a significant improvement in productivity and profitability:

- Increased productivity – avoid loss of production/unscheduled outages due to transient faults
- Quick implementation – the Gridshield® recloser integrates CTs/VTs and protection as a package, and WiAutoLink® replaces the fuses protecting the lateral overhead lines
- Flexibility and control – simplified operation and maintenance, as well as integration with existing SCADA systems

- Safety of operation – the safety lockout handle on the recloser prevents power restoration during i.e. maintenance - the 3-phase electronic sectionalizers ensure 3-phase opening, avoiding damage to the equipment, i.e. a fault feeding a low-voltage motor or transformer with two phases



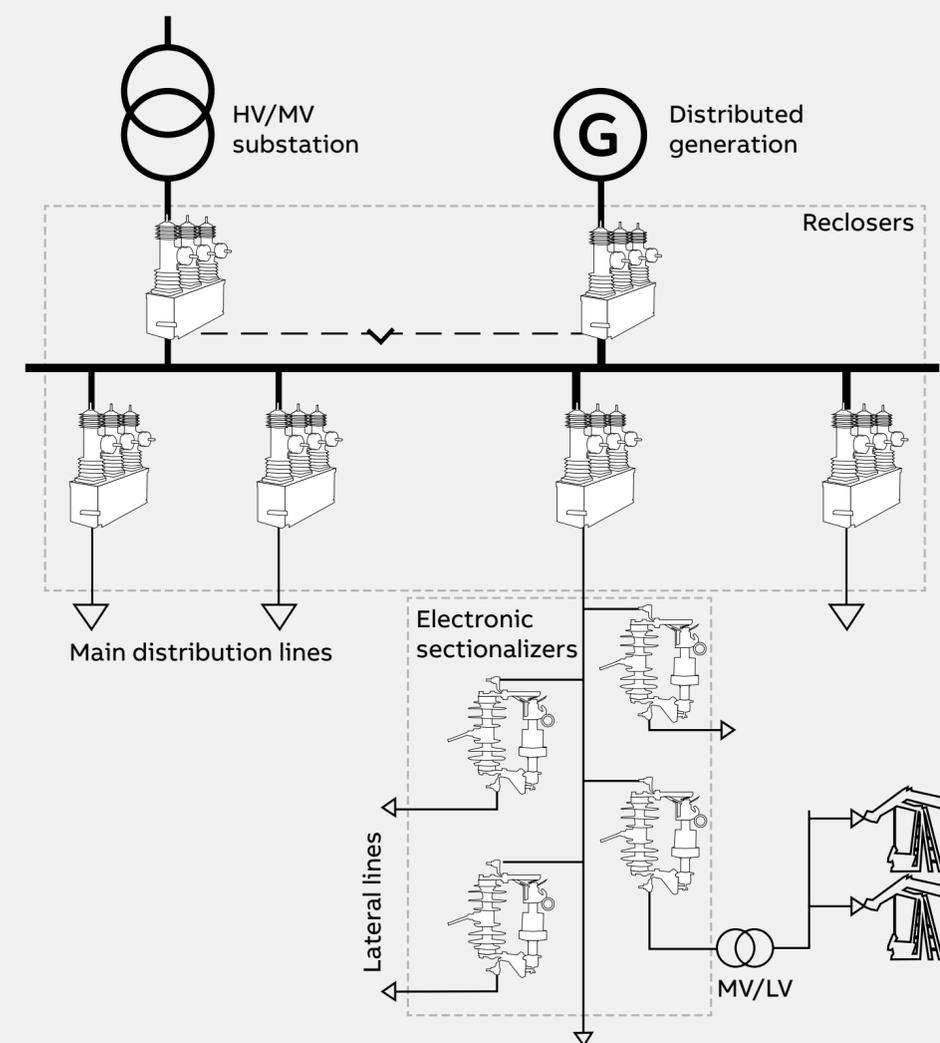
01 Gridshield recloser

02 WiAutoLink electronic sectionalizer

03 Example of an upstream site with reclosers and electronic sectionalizers

Reduce nuisance outages and improve productivity and profitability

[Learn more](#) about ABB's apparatus



# Solutions for increased flexibility

## Digital switchgear decreases delivery and installation time

Planning and executing electrical infrastructure projects are challenging with issues such as tight time schedules and budgets or limited space available in the yard or eHouse. Optimizing voltage levels, number of transformers, the amount of switchgear panels and their layout is a must.

Once the design is complete and orders have been placed, the project requirements may change – motor sizes increase, more savings or additional space must be found – this leads to another round of optimization and redesign, with all the extended project completion time and cost involved.

[Learn more](#) about ABB UniGear digital

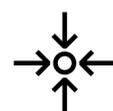
Digital switchgear addresses these pain points. It is based on the combination of smart technologies – current and voltage sensors and IEC 61850 communication with modern numerical Relion® protection relays – as part of ABB's reliable, well-proven switchgear.

As a part of the ABB Ability™ portfolio of connected digital solutions, digital switchgear helps customers gain operational efficiency and brings unprecedented flexibility, driving the fourth industrial revolution.

[Learn more](#) about ABB Ability



Example: UniGear Digital



### One-size fits all

Flexibility towards changing load flows, easier modification and last-minute changes.



### Increased safety

Sensor technology ensures safe voltage levels and a safer working environment for personnel.



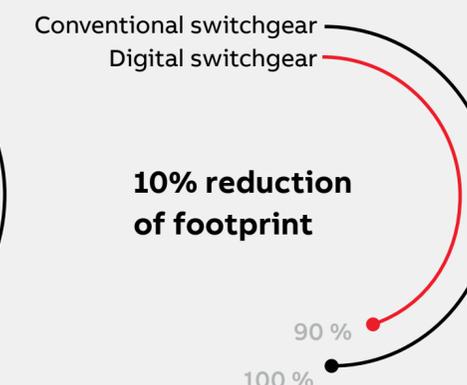
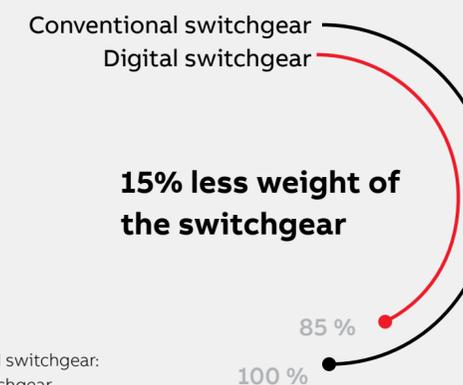
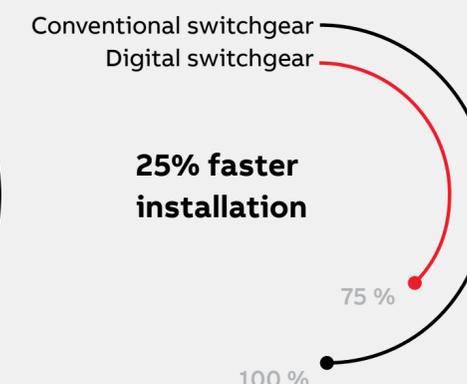
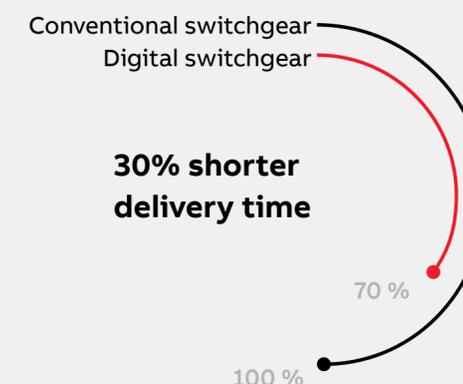
### Climate-friendly and energy saving

Significantly lower energy consumption and reduced CO<sub>2</sub> emissions.



### Improved asset management

Digital services to optimize maintenance costs and performance during the entire switchgear lifetime.



Key benefits of digital switchgear:  
Example of 11 kV switchgear  
(30 panels) for an onshore project

# Digital switchgear with integrated relays simplify wiring and improve robustness

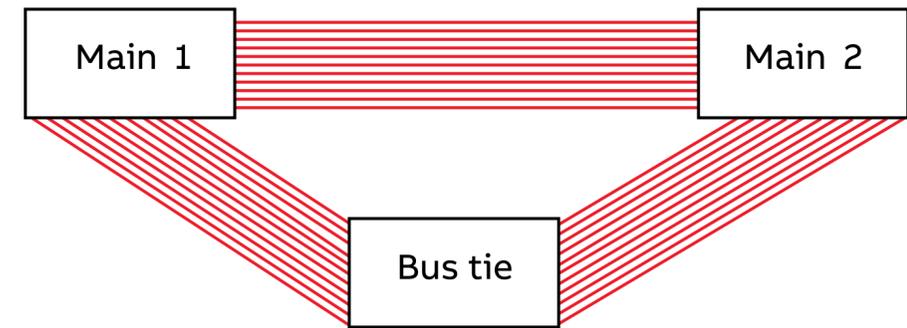
Key item 1: IEC 61850 and modern numerical Relion relays to simplify wiring, enhance flexibility and improve robustness

ABB's Relion® protection relays implement the core elements of the IEC 61850 standard. GOOSE (Generic Object Oriented Substation Events) via process bus enables fast and reliable horizontal communication (e.g. for inter-tripping, interlocking and blocking), simplifying project execution and operation.

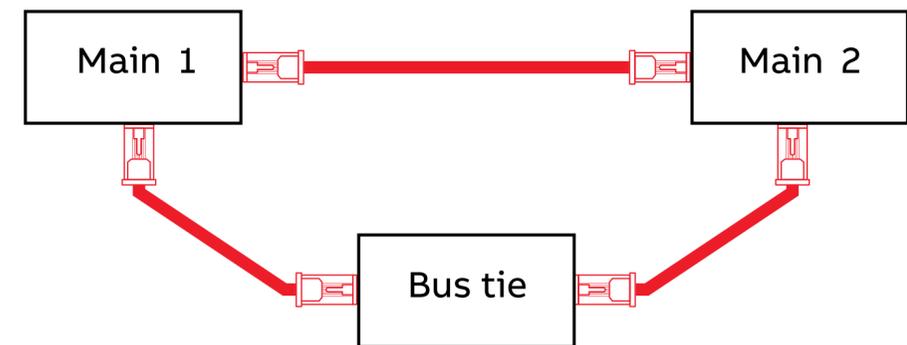
- FixNative IEC 61850 technology saves time and costs during engineering, testing, installation and commissioning. It provides fully factory pre-tested logic and communication that can be plug-and-play at site, while still allowing last-minute changes through quick and easy reprogramming with no need for any costly and time-consuming physical rewiring.

- Digital communication enables reliable and fast performance. The signals are exchanged at more than double the speed of conventional hardwiring. The continuous self- and cross-supervision of all protection relays and connections ensures that any loss of communication is immediately indicated. The electrician will know exactly where to go and what to look for. In comparison, a conventional wire breakage would only be noticed once it is needed to function when it is already too late. ABB's Relion with IEC 61850 GOOSE reduces risk and headaches during operation.
- IEC 61850 enables sending and receiving sampled measured values (SMV), and provides a means for sharing digitized analog values within the substation network. The utilization of SMV further enhances the flexibility of the solution.
- One common look and feel, menu guidance and software tools enable ease of use, fast engineering and intuitive handling.

[Learn more](#) about ABB's Relion



- Single wire pulling and testing one-by-one
- No detection of loss of communication



- Factory pre-tested
- More than double the speed
- Increased reliability
- Reduced time and cost for installation and testing

—  
Traditional vs. state-of-the-art  
IEC 61850 relay interconnection

# Digital switchgear current and voltage sensors reduce failure risk, and increase safety

Key item 2: Current and voltage sensors – avoiding endless calculation and clarification loops, while reducing risk of failures and increasing safety.

ABB's sensors are based on advanced measurement principles that provide significant benefits over instrument transformers.

- Current sensors are based on the Rogowski coil principle (accuracy of class 0.5 for metering and of class 5P for protection)
- Voltage sensors are based on the resistive divider principle (accuracy of class 0.5 for metering and of class 3P for protection)

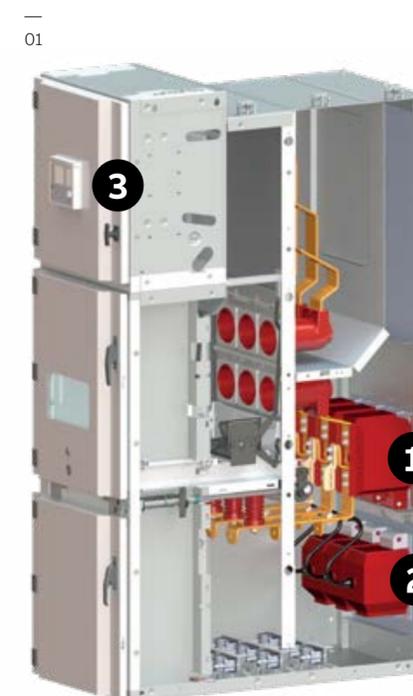
The sensors are optimally designed to fit into the switchgear, while allowing enough space in case additional CTs are required, e.g., for transformer differential protection or for utility hand-over metering.

The linear characteristic of current sensors vs. instrument transformers allows reliable operation in

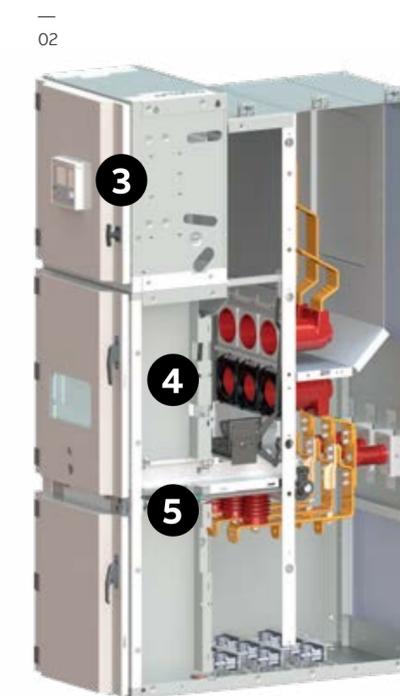
a wide range of primary currents and flexibility toward changing load flows in the sense of one-size-fits-all. The use of sensors saves additional space and increases competitiveness. No need for dedicated bus VT panels reducing the footprint required inside the eHouse. Traditional CTs and VTs are sensitive to incorrect handling during testing or maintenance. Sensors eliminate the risk of failure and the related costly downtime, increase safety and maximize system uptime.

ABB Ability™ unlocks operational efficiencies and optimized asset management approaches, through the application of predictive algorithms to the data collected (breaker condition monitoring, emperature monitoring, etc.). Thermal and circuit breaker parameters are monitored and predictive algorithms support the asset management processes.

Save time and cost, increase safety and simplify operation with digital switchgear



01 Traditional switchgear with instrument transformers



02 Digital switchgear with sensors

- ① Current transformer (CT)
- ② Voltage transformer (VT)
- ③ Relion® protection relay with IEC 61850
- ④ Current sensor
- ⑤ Voltage sensor

# Portfolio of dual-standard generator circuit breakers address all power needs

## What's specific about a generator network?

In self-generating, islanded oil and gas installations, or in plants with back-up generation, the number of possible fault conditions, their likelihood and effects, are higher and more severe than in normal distribution applications. They include:

- Fault between the generator and the GCB, called system-source fed fault. It reveals the contribution of the network via the step-up transformer and is characterized by much higher stress (high current peak, DC component and TRV) at the fault interruption than in distribution networks
- Fault between the GCB and the step-up transformer, called generator-source fed fault, fault currents with an even higher DC component and delayed current zeros.
- Out-of-phase fault (OoP), caused by a missing synchronization grade between the generator phases and the network phases.

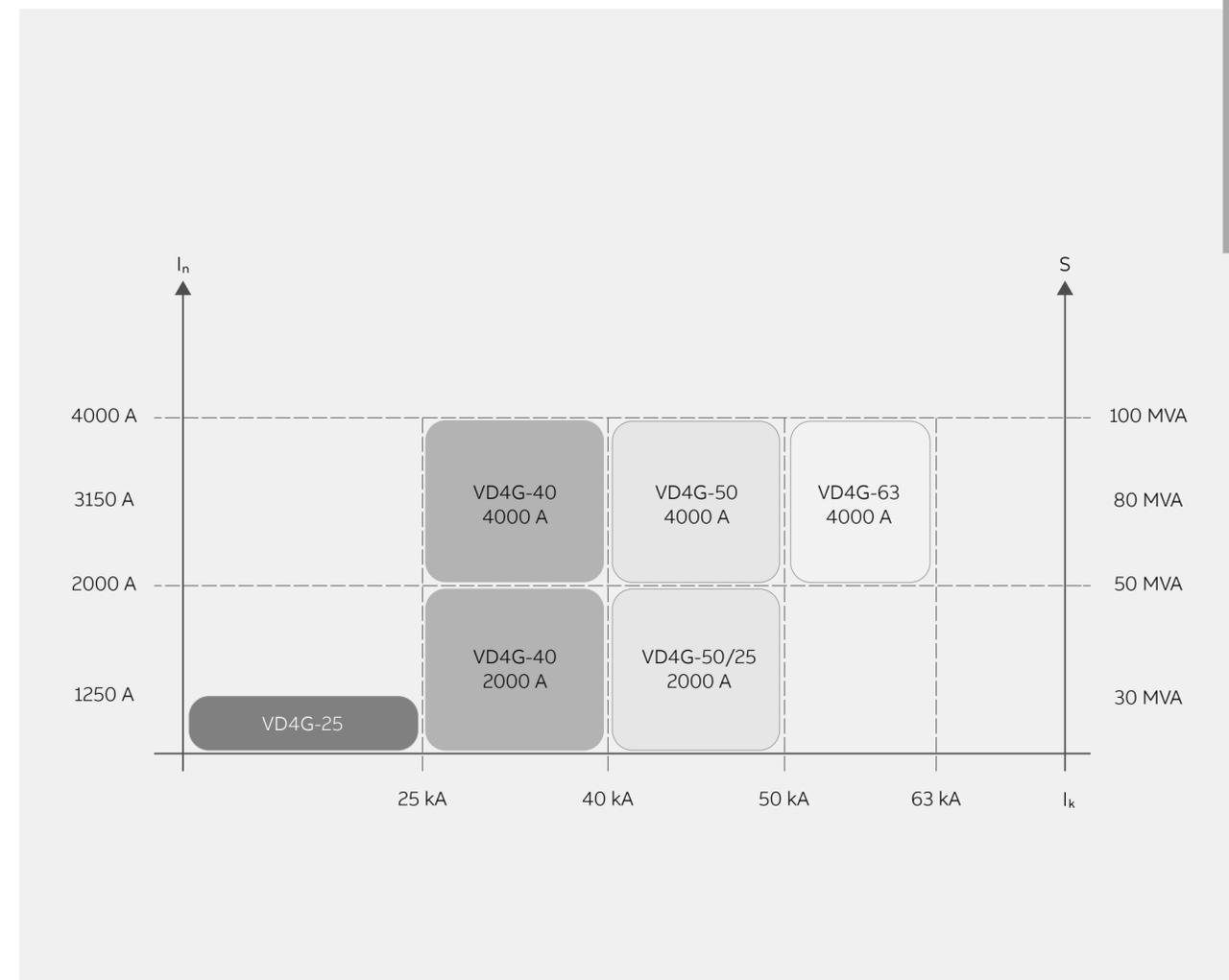
## Key benefits

- Suitable for installation in standard medium-voltage switchgear for the most cost-effective solution due to compact design
- Type tested according to the new global standard, IEC/IEEE 62271-37-013, which replaces the earlier IEEE standards for generator applications
- Available with ratings up to 63kA for system-source fed fault breaking capability and 50/37 kA up to 130 percent dc for generator-source fed fault breaking capability
- Type tested for severe conditions of fault with delayed zero crossings and very high X/R up to 50, 3 times higher than the one of typical distribution breakers

ABB offers its new vacuum generator circuit breakers up to 15 kV, 4000A, 63 kA in accordance to the new dual logo IEC/IEEE 62271-37-013 to satisfy your business needs in power generation applications.

[Learn more](#) about ABB's VD4G

VD4G



VD4G 25/16	VD4G 40/25	VD4G 50/25	VD4G 50/50	VD4G 63/50
up to 1250 A	up to 4000 A	up to 2000 A	up to 4000 A	up to 4000 A
25 kA Ik SFF*	40 kA Ik SFF*	50 kA Ik SFF*	50 kA Ik SFF*	63 kA Ik SFF*
16 kA Ik GFF**	25 kA Ik GFF**	25 kA Ik GFF**	50 kA Ik GFF**	50 kA Ik GFF**

\*SFF: System-source fed fault  
\*\*GFF: Generator-source fed fault

# Re-think network design, using fault current limiter interrupting

As oil, gas and chemical facilities grow and expand, so do their electrical systems, via network interconnections or addition of generation capacity. The result is increasing short-circuit current contribution, often exceeding the installed equipment's ratings. There are three options to deal with this:

- Replace and upgrade the equipment to the needed kA-level (can be expensive)
- Wait until a short-circuit occurs that damages the equipment and then upgrade (unsafe, no timing control)
- Short-circuit management via fault current limiter between buses/in the generator in-feed (keep existing gear, be safe)

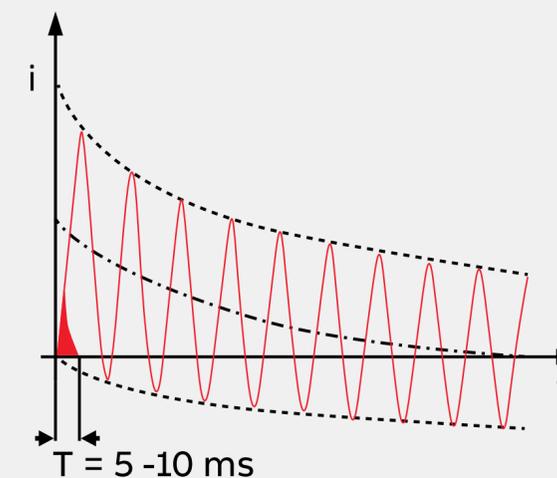
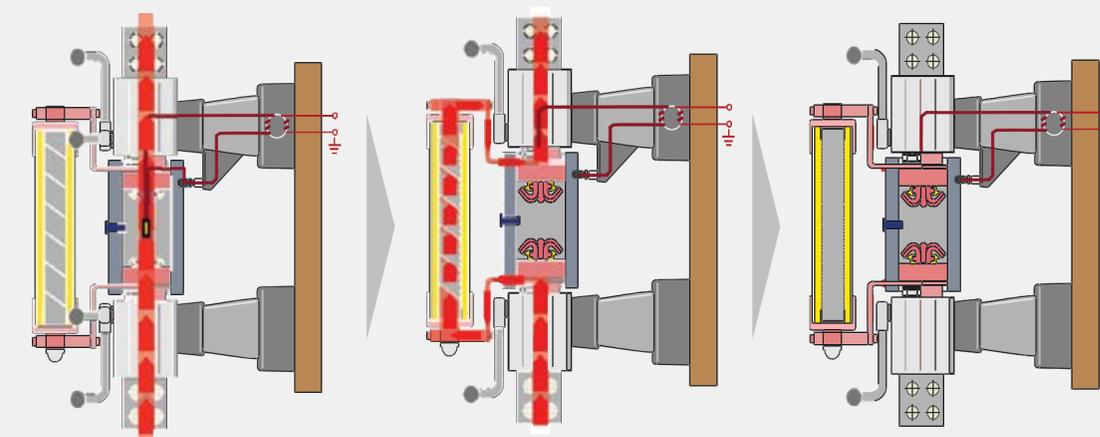
The fault current limiter is an insert to the busbar that detects and clears short-circuit currents, with a main current carrying path and a fuse arranged in parallel. Since the fuse's resistance is slightly higher, practically all current is passing through the main path during normal operation. A current sensor connected to a measuring and tripping unit detects short-circuit currents by measuring the instantaneous current (and as option also the current's rate of rise). In case of a short-circuit, the explosive device is triggered, immediately

interrupting the main path. The current would continue to flow through the parallel fuse which ultimately clears the current – all occurring in only five to ten milliseconds.

In networks with a lot of rotating equipment, it is not uncommon that the short-circuit level becomes so high that the voltage needs to be stepped up to a double busbar high-voltage gas-insulated switchgear (GIS) as main substation, and then stepped down again to further distribute power to the different parts of the process. By smart engineering using fault current limiters, the double busbar HV GIS can be replaced by a single busbar medium-voltage air-insulated switchgear (AIS), saving switchgear investment and space, and saving step-up and step-down transformers, and the space and cost involved.

—  
Managing short-circuit current via fault current limiters enables:  
Significant savings on power cables (e.g. use 31.5 kA cables instead of 50 kA cables)  
Use MV AIS instead of HV GIS as main substation (and save the step-up and -down transformers)  
Safe system expansions, without exceeding the equipment's rated kA-level

[Learn more](#) about ABB's Is-Limiter



—  
Short-circuit management via fault current limiter

# Switchgear and motor control for every application

Example: switchgear and motor control

[Learn more](#)

about ABB's MV switchgear

[Learn more](#)

about ABB's LV switchgear

	Standards	Rated voltage (kV)	Busbar (A)	Circuit current (A)	Short-time current (kA)
<b>Air-insulated, arc resistant</b>					
UniGear ZS1	IEC, GOST, CSA*, ...	...24 (*27.6)	...4000	...4000	...50
UniGear MCC	IEC, GOST	...12	...4000	...4000	...50
UniGear ZS2	IEC, GOST,...	...36	...3150	...3150	...31.5
MNS 3.0	IEC, GOST, CCC,...	...0.69	...6300	...6300	...100
NeoGear	IEC	...0.4	...3200	...3200	...80
SafeGear	ANSI/NEMA, CSA	...15	...4000	...4000	...50
SafeGear HD	ANSI/NEMA, CSA	...15	...4000	...4000	...63
SafeGear MCC	ANSI/NEMA, CSA	...7.2	...3000	...720	...50
MNS-MCC	ANSI/NEMA, CSA	...0,48/0,60	...2500	...2500	...65
MNS-SG	ANSI/NEMA	...0,48/0,60	...5000	...4000	...65/100
<b>Air-insulated, non-arc resistant</b>					
Advance	ANSI/NEMA, CSA	...15	...4000	...4000	...50
Advance 27	ANSI/NEMA, CSA	...27	...2000	...2000	...25
ReliaGear ND	ANSI/NEMA	...15	...2000	...2000	...31.5
ReliaGear LV SG	ANSI/NEMA	...0,48/0,60	...5000	...5000	...65/100
ReliaGear LV MCC	ANSI/NEMA	...0,48/0,60	...4000	...4000	...65/100
<b>Gas-insulated, arc resistant</b>					
ZX2	IEC, ANSI/NEMA, CSA, GOST, BS	...42	...4000	...4000	...40
ZX1.2	IEC, CSA, GOST, BS,...	...42	...2500	...2500	...31.5
ZX0.2	IEC, CSA, GOST, BS,...	...36	...2500	...2500	...31.5
ZX0	IEC, CSA, GOST, BS, ...	...24	...1250	...1250	...25

Additional ratings and standards available on request.



UniGear ZS1



NeoGear



SafeGear

# Protection relays and drives

Example: ABB Relion® series for medium-voltage protection and control  
Efficient engineering using PCM600 software tool

[Learn more](#)

	605 Series	611 Series	615 Series	620 Series	630 Series	REX640
<b>Applications</b>						
Feeder and protection control	X	X	X	X	X	X
Motor protection and control	X	X	X	X	X	X
Transformer protection and control			X	X	X	X
Generator protection and control			X		X	X
Voltage (U) protection and control		X	X			X
Line differential protection and control			X			X
Busbar protection		X				X
Cap. bank (Var) protection and control			X			X
Self-powered feeder protection	X					



The Relion relays for medium-voltage networks

Example: low-voltage variable frequency drives

[Learn more](#)

	Rated voltage (V)	Rated current (A)	Typical power (kW/HP)	
<b>Type of application and typical LV drive model</b>				
Machinery Example (wall/MCC mounted): ACS355 (car wash, gate opener, etc.)	230, 460	2.4...44	0.37...20 / 0.5...30	
General purpose Example (wall/MCC mounted): ACS550/580 (pump, fan, etc.)	230, 460, 600	4.6...144	0.75...250 / 1...350	
Industrial Example (wall/MCC mounted): ACS880-01 (electrical submersible pump, Direct Drive Cooling Fan, etc.)	230, 460, 600	4.4...271	0.5...250 / 0.75...350	
Industrial Example (free standing cabinet): ACS880-07 (propulsion, winch, etc.)	460, 600	96...2,860	45...2,800 / 60...3,000	
Industrial Example (active front end): ACS880-11 (rod pump, extruder, conveyor, etc.)	230, 460, 600	9...180	4...110 / 7.5...150	

# Technology to support complex project requirements

## Integrated product packaging solutions

ABB has a comprehensive portfolio of pre-fabricated, factory-tested solutions to support the most complex project requirements.

### EcoFlex productized eHouses

- Pre-engineered and configured equipment selections and layouts

### Modularized eHouse

- Design flexibility to manage equipment layouts, site footprint and logistics requirements

### Single large structure eHouse

- Roll-on, roll-off logistics concept of single shipment modules

### Skid mounted modules

- Equipment mounted on skid frame

### Mobile substation

- Fully mobile trailer mounted design

### Benefits of package or integrated solutions:

- **Single project manager:** single point of contact to execute the entire package, from document deliverables through to deliveries of equipment to site.

[Learn more](#) about ABB's eHouses

- **Mitigate risk:** transfer risk to ABB for coordinating design interface of all elements to form a single package or integrated solution.
- **Reduce resources:** ABB's responsibility for scope of works reduces your resource requirements to engineer and manage the project.
- **Predictable delivery and cost schedule:** the majority of work for eHouses and integrated solutions is performed off site, client is insulated from local labor shortages, environmental and industrial factors.
- **Equipment security:** ABB is responsible for integration and execution - completed and tested in secured offsite location.
- **Equipment longevity and warranty:** product warranties commence when eHouse is completed, not when loose products are delivered.
- **Simplify HSE management:** works performed offsite reduce requirements for HSE Management during construction phase.
- **Reduce site resources:** comprehensive factory acceptance test (FAT) can be performed before delivery reducing site commissioning time.
- **Simplify commercial agreement:** single contract for the entire package, reducing requirements for multiple commercial agreements.



Equipment installation and testing



UPS and DC battery systems



Bus ducts



Fire and gas systems



Low-voltage drives



Cable tray and bulk material



Heating, ventilation and Air conditioning (HVAC)



Medium-voltage drives



Power management system



Medium-voltage gas-insulated switchgear



MV air-insulated switchgear and motor control



Low-voltage switchgear and motor control



Medium/small power transformer



Distribution transformer



— Example of an eHouse

# ABB at work

## Key project highlights



### Leading International Oil Company, site: Australia

Increased operator safety and equipment operability with ABB blast-rated eHouse solutions

- 10 eHouses (6 blast-proof)
- Medium and low-voltage switchgear and motor control, uninterrupted power supply (UPS) and distributed control system (DCS), low-voltage drives, electrical control and monitoring system (ECMS), transformers, bus duct, ducted HVAC and blast proof pressurization



### Major downstream company, site: South Africa

Maximized plant uptime and profitability by providing temporary distribution solution for maintenance and emergency supply

- Flexible mobile substation that can quickly be relocated to where needed
- One-size-fits-all switchgear for various voltage levels and load currents, based on UniGear Digital with the flexibility and power of Relion protection relays and the IEC 61850 standard



### Multinational petrochemical company, site: USA

Increased project execution efficiency and cost savings by developing master agreement with end user

- 9 blast-proof eHouses (up to 98m x 15m)
- Gas insulated switchgear (GIS), medium and low-voltage switchgear and motor control, electrical control and monitoring system (ECMS), power distribution boards, inverter, HVAC, fire and gas detection and alarm system, uninterrupted power supply (UPS), bus duct, relay coordination



### Major upstream company, site: United Arab Emirates

Reduced client risk and execution efficiency by delivering fully tested pre-fabricated eHouse solutions

- 23 eHouses
- Medium and low-voltage switchgear and motor control, medium and low-voltage drives, soft starters, power management system (PMS)

# Installation support, life cycle services and asset management

## Services for efficiency and optimal performance

Start-up, parts and field services - installed base reliability



- **Installation and commissioning**  
Initial installation, start-up, and commissioning of new equipment and services
- **Spare parts**  
Certified spare parts and packages of certified quality ensuring high product reliability
- **Training**  
Personnel training on ABB products, systems, processes and technology
- **Maintenance**  
Maintaining nominal condition of switchgear and its components, on site, by certified technicians

Life cycle services - asset availability



- **Retrofit of circuit breakers (CB)**  
Replacement of CBs with obsolete oil technology by modern vacuum technology
- **Retrofits for safety**  
Integration of an active arc fault protection system to maximize safety of MV equipment
- **Retrofit of protection technologies**  
Integration of advanced protection and communication capabilities with full compatibility of the functions
- **Extensions**  
Expansion of the installed switchgear with the latest product line or a reproduction of older gear types

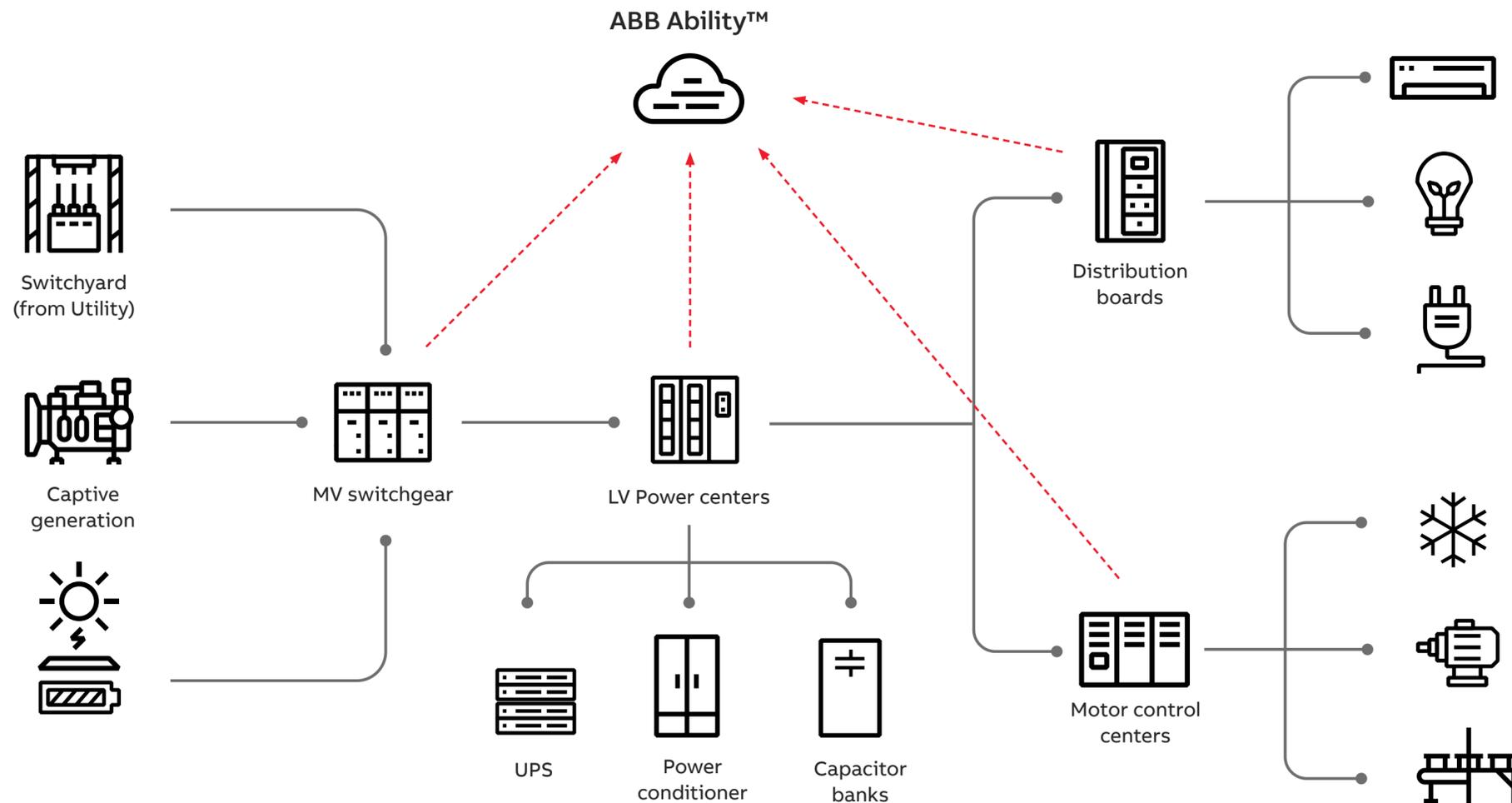
Smart asset management - technical and commercial asset predictability



- **Engineering and consulting**  
Recommendations on the product application and providing customized solutions
- **Monitoring and diagnosis**  
Inspection of installed equipment to improve performance and extend asset lifetime
- **Asset assessments**  
Documenting the condition of substation equipment and recommendations for the future

[Learn more](#) about ABB's Service

# Predictive maintenance and operations optimization



**People and equipment protection**  
We are committed to world-class products, systems and services with health and safety as our key priority.

**100% safe**  
with remote monitoring and planning

**Efficiency and production continuity**  
We enable energy efficiency and energy flow control. Pluggable power management solutions to maximize production continuity.

**Up to 70%**  
monitored failure causes

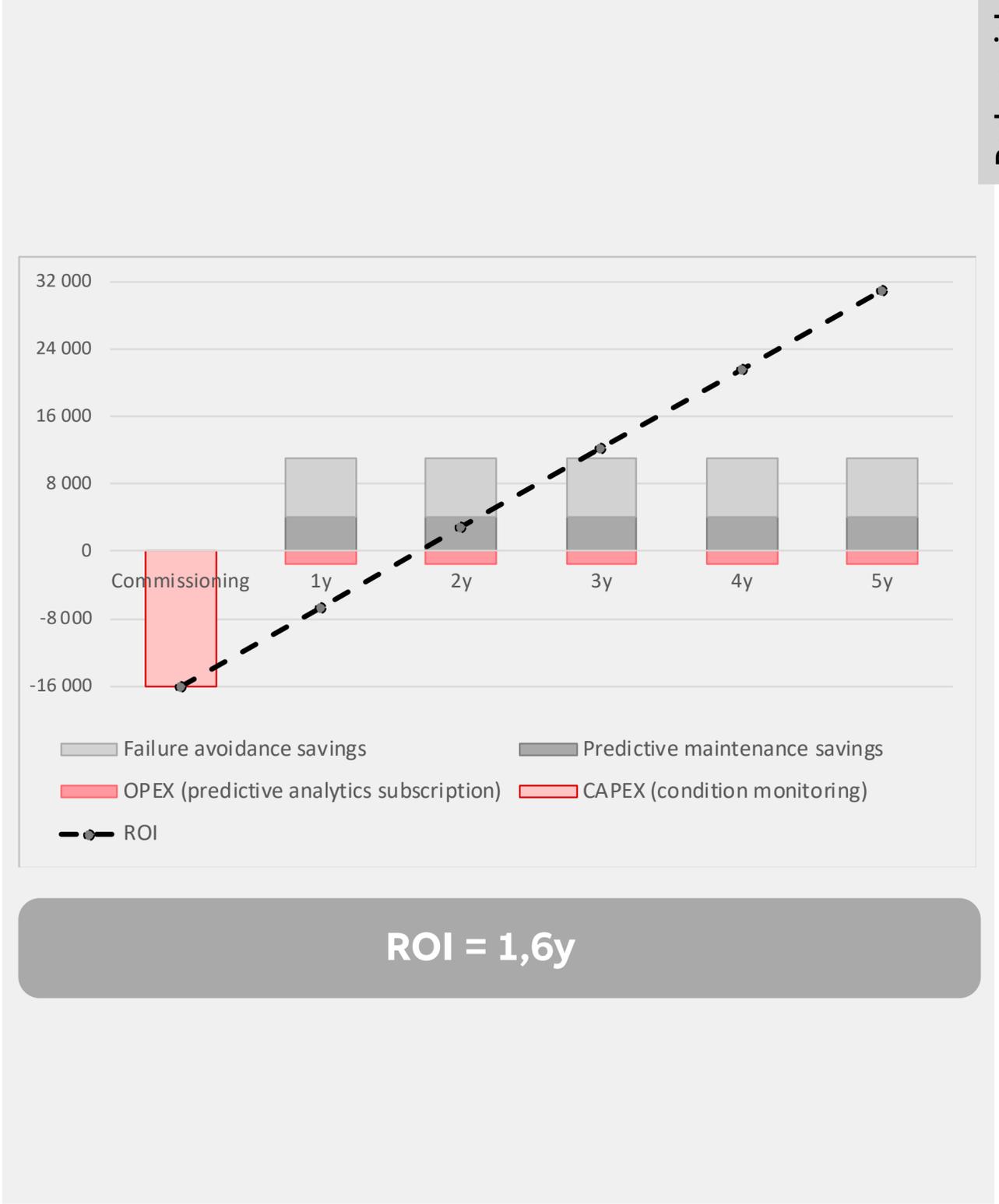
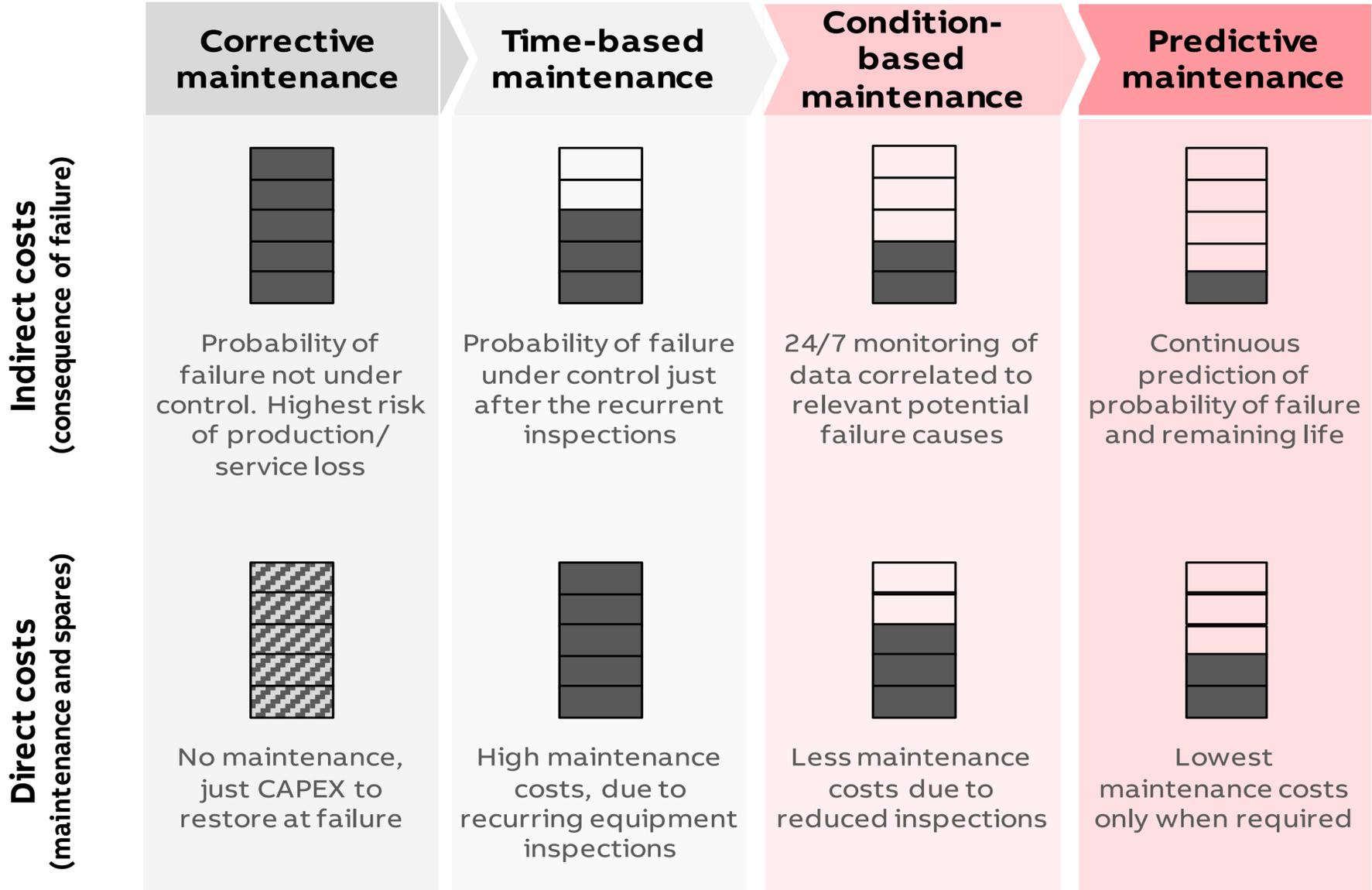
**Asset performance and optimization**  
We monitor the reliability and efficiency of your assets to optimize the operation and maintenance processes.

**Up to 30%**  
maintenance savings

**Flexibility and sustainability**  
We provide flexible, scalable and modular digital solutions, which allow also an efficient integration of renewables and e-mobility.

**100% flexible**  
for brown and green field

# Maintenance strategy



Reduce risk and cost

# Abbreviations

<b>Acronym</b>	
AFE	active front end
AIS	air-insulated switchgear
CB	circuit breaker
CSS	compact secondary substation
CT	current transformer
DC	direct current
DCS	distributed control system
ECMS	electrical control and monitoring system
EPC	engineering, procurement and construction
ESP	electrical submersible pump
F&G	fire and gas detection (and alarm) system
FAT	factory acceptance test
GIS	gas-insulated switchgear
GOOSE	generic object oriented substation events
GRP	glass reinforced polyester
HSE	health, safety and environment
HV	high-voltage
HVAC	heating, ventilation and air-conditioning
IEC	International Electrotechnical Commission
IP rating	ingress protection
LV	low-voltage
MCC	motor control center
MV	medium-voltage
PDB	power distribution board
PMS	power management system
SMV	sample measured values
UFES	ultra-fast earthing switch
UPS	uninterruptible power supply
VAR	volt-ampere reactive
VT	voltage transformer



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