



District heating

Optimizing reliability, efficiency and costs of heat generation, transmission and distribution

Boosting district heating system's performance

District heating systems play an important role in the efficient and sustainable heating of buildings, since they use less energy than if each building had individual heat generation on site. But it is not enough to simply generate heat efficiently – it must be transmitted and distributed with minimal cost and energy loss.



System reliability and process continuity



“District heating must be up and running 24/7 during the cold season – no matter what.”

Modern district heating systems must be fully reliable...

- Air temperature inside buildings during the cold season is a matter of comfort, health and productivity.
- When outdoor temperatures fall below 0 °C, a heating failure may put the building at risk. This can cause infrastructure damage and interruptions in work and life activities.
- Pumps are crucial elements in district heating, since they provide heat carrier circulation between the heat source and consumers. Thus pump operation must be continuous, with no downtime.

... ensured by the best-in-class technologies

- Uninterrupted pumping can be ensured by variable speed drives (VSDs) and softstarters, helping to avoid mechanical stress on the hydraulic system.
- Drives eliminate high starting currents which can have adverse effects on the power network.
- Communication loss backup in drives allows resilient system operation.
- The drives' compliance with 'power-loss-ride-through' standards keeps pump controls operating during short power outages, significantly reducing downtime.
- VSDs withstand high vibrations, and even meet seismic standards, to ensure smooth operation in pumping stations.
- Motors feature protection against bearing currents to increase motor reliability and lifetime.
- ABB Ability™ remote condition monitoring services track the system health and warn about forthcoming failures.



Energy efficiency and sustainability



“How can we get highest efficiency from our district heating, to have the lowest carbon footprint?”

Taking care of the environment...

- Regardless of the energy source, district heating has higher efficiency, with less carbon emission than individual heating.
- District heating unlocks multiple opportunities for renewable thermal energy and residual heat from industrial processes, sewage, waste incineration. It also enables Power-to-X technology converting surplus electricity to heat, which can be stored and used later.
- High energy consumption for heat generation, transmission and distribution negatively affects tariffs and district energy attractiveness for end-users as a result.

... while optimizing energy use in district heating processes

- VSDs provide precise pump control for optimal heat carrier flow rates and pressures, to ensure the building occupants' comfort and match energy use to specific needs.
- On average, VSDs deliver energy savings of 20 to 60 percent.
- Upgrading to IE4 or IE5 efficiency class motors in heating applications significantly reduces energy consumption in heat generation, transmission distribution processes.
- ABB Ability™ Smart Sensors for motors, as well as VSD energy counters, help analyze energy use and enable improvements for the entire system.



Operation and maintenance



“I want smart operation and predictive services, to avoid costly inefficiencies and shutdowns.”

Optimize heating processes and reduce overheads...

- District heating, and 5th generation heat-sharing networks in particular, require transparency for best efficiency and operability. This can be ensured by high level of digitalization and continuous data exchange and analysis.
- Operational costs can be optimized, without compromising heating process continuity.

... through smart functionality...

- Monitoring of temperature, overload, overcurrent, and other protection features in VSDs help prevent failures in heating applications, thus significantly reducing downtime costs.
- The real-time clock in the drives keeps the record of trips and faults, so facility management knows what happened and when.

... IoT capability...

- ABB drives secure seamless connection to supervisory control and data acquisition (SCADA) systems thanks to built-in industrial and building automation protocols.
- ABB Ability™ digital services for drives, motors and pumps provide in-depth monitoring and analysis of powertrain performance to reduce downtime, increase efficiency and allow smart maintenance. Regular inspections can be eliminated, relieving pressure on in-house teams.
- VSD-enabled wireless connectivity provides remote access to hard-to-reach equipment, for easier troubleshooting.

... and advanced maintenance practices

- ABB global service network and preventive maintenance contracts secure speed of response to critical issues in district heating supply.
- Service agreements are available to tackle proactive and reactive maintenance needs.
- ABB Life Cycle Assessment provides a clear understanding of the drive/motor installed base, detailing how assets will evolve over the next few years.
- Genuine spares are readily available locally.



Project costs and return on investments



“Short payback times and low operating expenses are the keys to attracting investors.”

District heating is a way to invest in sustainable urban development...

- Demands for energy savings and decarbonization have accelerated globally, and district heating has become one of the favored solutions to improve urban efficiency and combat climate change.
- Reliable, sustainable and cost-effective heat supply concepts attract both investors and end-users.
- High infrastructure costs result in long payback times and may make investors less interested.
- High operating costs, due to inefficient energy use and unreliable processes, may compromise the sustainability benefits.
- Modern control solutions for district heating can positively impact both capital and operating costs, decreasing the payback period.

... employing cost-effective solutions.

- District heating ROI can be improved with ultra-low harmonic drives since they ensure power quality and network operation stability, while reducing the size of supply transformers and backup generators.
- ABB's strict quality control – all the way from drive or motor component selection to factory acceptance testing – ensures the reliability and performance of the equipment making investments reasonable.
- Ultra-low harmonic drives save on operating costs and tariffs for district energy consumers, since they help maintain a unity power factor and eliminate reactive power penalties from the utility.
- IoT enabled drives, motors and pumps give valuable information about their performance, helping to schedule maintenance intelligently and lower operating costs.

Economical, reliable, sustainable district heating

District heating offers many advantages in making heat generation, transmission and distribution more energy efficient, cost-effective and reliable. The potential use of waste or ambient heat sources also makes it more sustainable.

1 HEATING SUBSTATIONS

Heating substations can be standalone buildings or located in a building basement. They receive a heat carrier from a heat generating facility and deliver it to a building's internal heating and domestic water supply systems, often at lower temperature and pressure levels.

Applications:

- Circulation pumps

Requirements:

- Provide the consumers with the heat demand according to outdoor climate parameters.
- Heat demand changes with daytime and season, so the heat carrier flow in the building heating system must be adjusted accordingly.
- Domestic water consumption is never uniform. Water supply must be adjusted according to consumption rates, for best energy efficiency.
- Pump sleep mode stopping the domestic hot water pump during low demand, instead of running it slow below its efficient operating range.
- Keeping up the required pressure and flow in the system.
- Multi-pump control for efficient handling of the demand variations over the day and for redundancy purposes, where a standby pump steps in if the main one fails.
- Pump performance monitoring, to support predictive maintenance planning.

2 BOOSTER SUBSTATIONS

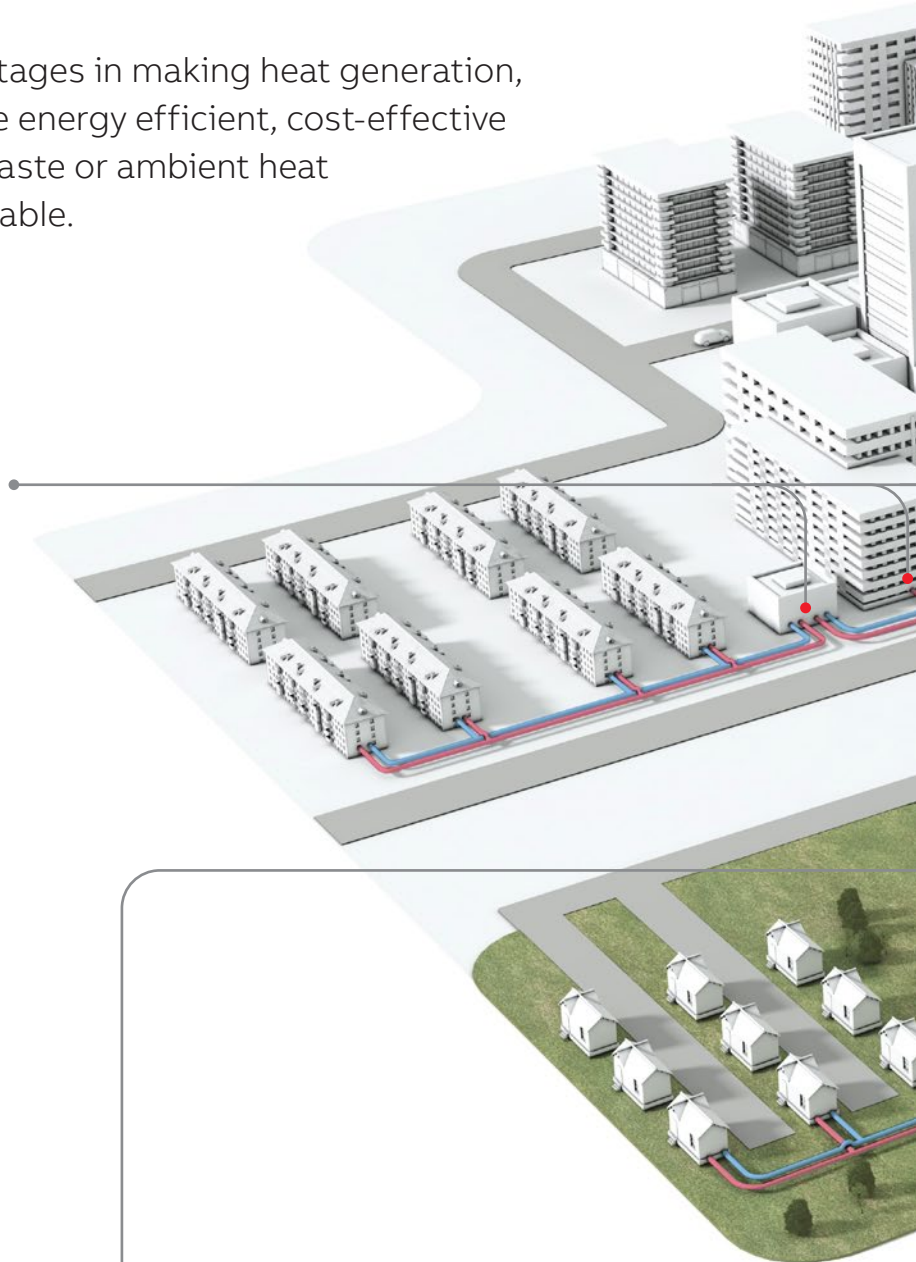
Pressure can drop significantly over long pipelines, so booster pump stations maintain the required pressure in each pressure zone and deliver the heat carrier to the consumption point.

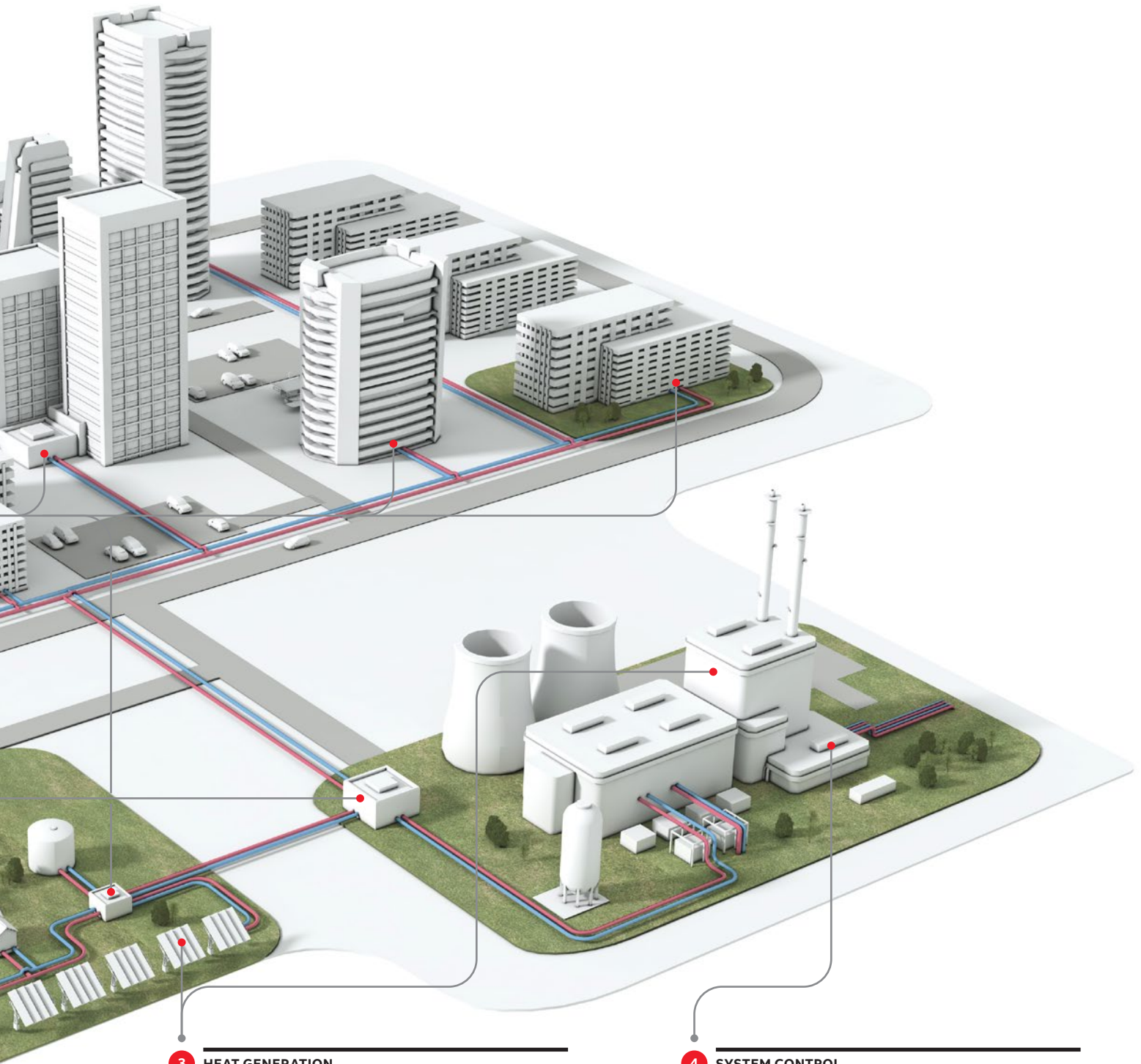
Applications:

- Booster pumps

Requirements:

- Ensure stable pressure at the consumer side.
- Pump performance monitoring, to support predictive maintenance planning.
- Leakage detection in the pipe/pump network.
- Multi-pump control for redundancy purposes.





3 HEAT GENERATION

Heat can be generated by dedicated heating plants or as a co-product of power generation. For carbon footprint reduction purposes, it is becoming common to use sustainable sources for heat generation instead of fossil fuels. These may include biomass, ambient heat from ground, water, the sun or air, as well as residual heat from industries, sewage, waste incineration, etc.

Applications:

- Boiler burner, pumps, heat pump compressors

Requirements:

- Burners with a variable fuel throughput require a corresponding volume of combustion air, so variable speed control of blower is needed for efficient combustion.
- Adjusting compressor speed in a heat pump to a heating need saves energy.
- Adjusting circulation rate in the heating network to a heating need saves energy.
- Increased security of heat generation for mission-critical facilities.

4 SYSTEM CONTROL

SCADA system enables a high degree of automation, with fast, redundant and trouble-free communications, and provides access to all vital process information. It also supports the optimum integration of multiple decentralized heat sources into one coherent, efficient heating system.

Applications:




- District heating system, including heat generation, transmission and distribution

Requirements:

- Easy integration of key system components (including drives) into the SCADA system.
- Scalable, flexible and open architecture.
- Built-in digital applications for district heating operation optimization.
- Support condition monitoring of the system, and also allow integration of GIS, weather and consumption data.


Unlock the hidden potential in district heating systems

Motors equipped with variable speed drives and controllers that run heating applications are excellent at providing comfort for the building's occupants, while ensuring the heating process continuity and efficiency. But there are many other important and profitable benefits to be gained as well.

Equipment	Challenge	Solution	Benefit
 Heating substations	<ul style="list-style-type: none"> High energy consumption by pumps 	<ul style="list-style-type: none"> VSDs adjust pump speed to the building load Motors with IE5 efficiency VSD-based filter monitoring alarms if filter is clogged and pressure drops abnormally 	<ul style="list-style-type: none"> 20 to 60 percent energy savings with VSDs compared to a valve control or bypass Up to 30 percent improved efficiency at partial loads with ABB synchronous reluctance ferrite-assisted motors
	<ul style="list-style-type: none"> Substation uptime 	<ul style="list-style-type: none"> VSD pump protection includes overcurrent, overvoltage, motor overheating, under/overload control Less mechanical and electrical stress with VSD control, compared to direct-on-line start Smart sensors collect information on pump performance, to allow predictive maintenance 	<ul style="list-style-type: none"> Heating continuity and building occupants' comfort Easier, hassle-free operations
	<ul style="list-style-type: none"> Automation system overcomplexity 	<ul style="list-style-type: none"> VSD-based control capabilities for local control and extended external control tasks VSD-based fieldbuses without employing external gateways 	<ul style="list-style-type: none"> Decreased infrastructure complexity and costs, with low risk for errors
	<ul style="list-style-type: none"> Pump acoustic noise or vibration 	<ul style="list-style-type: none"> VSD-based resonance control VSD switching frequency adjustment for lower motor noise 	<ul style="list-style-type: none"> Quiet environment for enhanced comfort and productivity
	<ul style="list-style-type: none"> Control reliability 	<ul style="list-style-type: none"> Control backup within VSDs – in case of external communication loss, VSDs can take over the control 	<ul style="list-style-type: none"> Pump will continue running in a preset for local control mode until the external communication is recovered
	<ul style="list-style-type: none"> Electrical harmonics in the power network 	<ul style="list-style-type: none"> ULH drives reduce harmonics content in the network to an absolute minimum 	<ul style="list-style-type: none"> Network stability and elimination of large active filters for harmonics mitigation Elimination of non-wattage penalties from the utility
	<ul style="list-style-type: none"> Heat pump uptime 	<ul style="list-style-type: none"> VSDs allow compressors to start without overloading the power system 	<ul style="list-style-type: none"> Building occupants' comfort
 Heat pumps	<ul style="list-style-type: none"> High energy consumption by compressors 	<ul style="list-style-type: none"> VSDs adjust compressor speed to the building load Motors with IE5 efficiency 	<ul style="list-style-type: none"> 20 to 60 percent energy savings with VSDs compared to a valve control system Up to 30 percent improved efficiency at part loads with ABB synchronous reluctance ferrite-assisted motors
	<ul style="list-style-type: none"> Heating/hot water temperature control 	<ul style="list-style-type: none"> VSD-based burner control ensures the hot water for heating or domestic use has the required temperature 	<ul style="list-style-type: none"> Building occupants comfort and hygiene
 Boilers	<ul style="list-style-type: none"> Heating/hot water temperature control 	<ul style="list-style-type: none"> VSD-based burner control ensures the hot water for heating or domestic use has the required temperature 	<ul style="list-style-type: none"> Building occupants comfort and hygiene



01

Equipment	Challenge	Solution	Benefit
 Booster pump stations	• Pump uptime	<ul style="list-style-type: none"> • VSD supervisory functions show possible coming mechanical failures like bearing wear or events like stalled impeller and dry run • Smart sensors measure pump motor health parameters like vibration and temperature • Auto-restart after power failure 	• District heat supply continuity and citizen's comfort
	• Pressure shocks	• Soft pump start and stop, thanks to the VSD, helps avoid water hammer	• Pump and piping system has increased lifetime and decreased maintenance costs
	• Pipe leakage	• Leakage monitoring via VSD alarming when pressure in a pipe drops abnormally	• No infrastructure damage and associated costs due to leaks
	• Booster set lifetime	• VSD-based intelligent pump control distributes pump work hours equally	• Optimized operation for extended equipment lifespan
	• System cost	• VSD use eliminates the need for pressure-reducing valves	• Optimized costs, without compromising functionality



01 Sustainable solar energy already plays a big role in supplying cities with heat.

02 Gas boilers heating water by means of fuel combustion.

Features and functions that benefit district heating systems

ABB offers an extensive range of devices for district heating applications. These range from motors, drives and softstarters to SCADA systems which bring all components seamlessly together for effective automation and control. Choosing the right products and services is essential for giving your district heating systems the highest possible efficiency and reliability.



Variable speed drives

Low harmonics

- Built-in active front end and line filter mitigate harmonic disturbances to a minimum of 3 percent, for best power network reliability

Real-time clock

- Trips and faults are date and time stamped, so facility management knows what has happened and when

System efficiency

- VSDs increase system efficiency by adjusting motor speeds to the current needs
- Advanced Energy Optimizer feature improves energy use further by reducing the motor's magnetic losses
- Active front end drives reduce system losses due to almost non-existent harmonics and unity power factor

Built-in PID control

- Application control without employing external controllers, decreases automation system complexity and costs

Control redundancy

- External communication loss is handled seamlessly by a VSD taking control until the external communication is restored

Embedded communication

- Control, monitoring and diagnostics for applications through embedded Modbus, BACnet, or other optional protocols eliminates the need for external gateways

Intelligent pump control

- Control of multiple pumps in the set for higher efficiency – next pump steps in when the load increases
- Distribution of work hours equally between all pumps in the set, for extended equipment lifetime
- Redundancy – in case if one of the pumps fails, the rest take over the load



Pump dry run protection

- Prevent damage when the pump starts running outside its load curve, due to no liquid in the system

Pipe leakage or blockage protection

- Get a warning/stop the pump when the pressure in the system is outside set limits

Pump soft start and stop

- Allows smooth pump starts/stops, to avoid water hammer and damage to pipelines and connected equipment

Safe torque off

- Built-in feature for safe maintenance of mechanical parts of pumping equipment

Resonance control

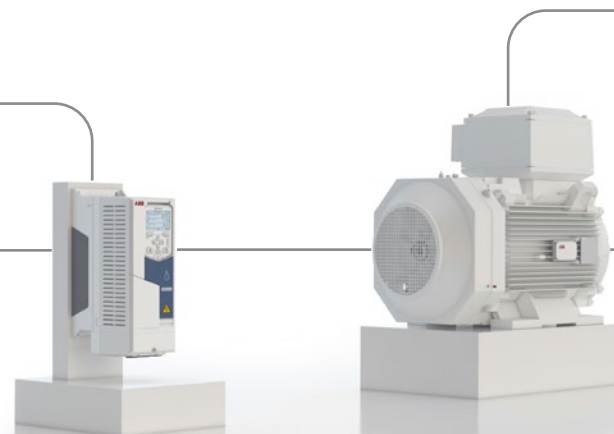
- Allows to avoid pump resonance by skipping resonant frequencies

Sleep function

- Saves energy by stopping the pump during low demand and starting it again when the demand increases by the set value

Sensorless flow calculation

- Eliminates need for external flow meter, for optimized system cost





Softstarters



Soft start and stop

- Minimized mechanical and electrical stresses during starts and stops for applications with constant load

Built-in bypass

- Reduced system size and complexity
- Reduced heat generation from internal losses by activating bypass at full speed

Harsh environment tolerance

- Process continuity in dusty or wet environments with IP66 keypad and coated electronics

Embedded communication

- Control, monitoring and diagnostics for applications through embedded Modbus RTU and other optional protocols



Control solutions



A world-class automation system from a leading supplier

- Scalable, flexible and open architecture
- Fully integrated digital applications built to optimize district heating
- High level of automation for more effective operation, fuel savings and improved system maintenance

Scalable and modular PLC solutions for district heating

- Control with global leading-edge functionality
- Standard district heating software at all levels, from basic functions to fully automated systems



Motors



High reliability

- Protection against external conditions with IP55 as standard
- Wide range of surface treatment and corrosion protection solutions available
- Protection against bearing currents with an extended portfolio of solutions including insulated bearings and shaft grounding
- Bearings locked at D-end to avoid axial play

Efficiency

- Up to IE5 efficiency level without magnets to reduce energy consumption and improve total cost of ownership

Easy installation

- Oversized terminal box as standard to ease installation
- Flexible cabling solutions
- Various mounting arrangements including direct drive, belt or transmission
- Horizontal and vertical mounting



ABB Ability™ Smart Sensors for motors, pumps and bearings



Minimized unplanned downtime

- Failures can be detected well before equipment needs to be shut down, avoiding unplanned downtime

Reduced maintenance costs

- By changing from scheduled to condition-based maintenance, service costs can be considerably reduced

Improved safety

- Eliminate the need for manual motor/pump/bearings check-ups in locations that are hard-to-reach or dangerous



From the facility to the cloud and beyond

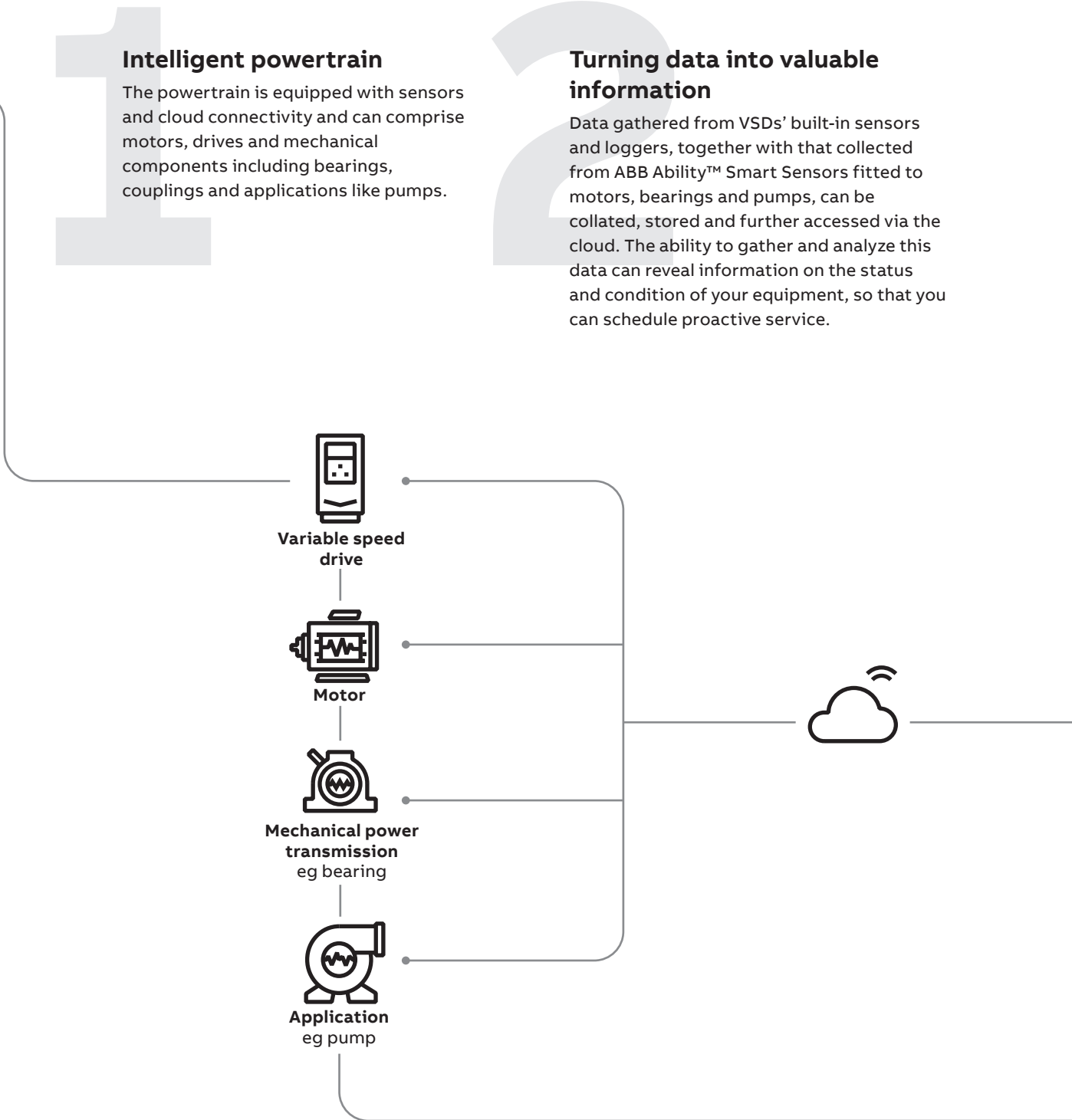
ABB Ability™ Condition Monitoring for powertrains optimizes the performance and efficiency of rotating equipment. It enables full transparency on all parameters for VSDs, motors, mounted bearings and applications like pumps.

1 Intelligent powertrain

The powertrain is equipped with sensors and cloud connectivity and can comprise motors, drives and mechanical components including bearings, couplings and applications like pumps.

2 Turning data into valuable information

Data gathered from VSDs' built-in sensors and loggers, together with that collected from ABB Ability™ Smart Sensors fitted to motors, bearings and pumps, can be collated, stored and further accessed via the cloud. The ability to gather and analyze this data can reveal information on the status and condition of your equipment, so that you can schedule proactive service.



3 Accessing data for analytics

You have access to a monitoring portal to view key operational parameters of individual assets as one unified system. Detailed dashboards give full transparency so that you can take actions that lead to less downtime, extended equipment lifetime, lower costs, safer operations and increased profitability.

4 Gain a digital advantage

Ensuring that the right person has the right information at the right time brings:

- Appropriate response to process challenges, minimizing operating costs
- Greater insight into various aspects of the process, thereby improving system performance
- Lower risk of process failure, while changing your maintenance from reactive to predictive

System reliability and process continuity



Energy efficiency and sustainability



Operation and maintenance



Project costs and return on investments



Keep your facility running

From spare parts and technical support to cloud-based remote monitoring solutions, ABB offers the most extensive service offering to fit your needs. The global ABB service units, complemented by external Value Providers, form a service network on your doorstep. Maximize performance, uptime and efficiency throughout the life cycle of your assets.

With you every step of the way

Even before you buy a generator, drive, motor, bearing or softstarter, ABB's experts are on hand to offer technical advice from dimensioning through to potential energy saving.

When you've decided on the right product, ABB and its global network of Value Providers can help with installation and commissioning. They are also on hand to support you throughout the operation and maintenance phases of the product's life cycle, providing preventive maintenance programs tailored to your facility's needs.

ABB will ensure you are notified of any upgrades or retrofit opportunities. If you've registered your drives and motors with ABB, then our engineers will proactively contact you to advise on your most effective replacement option. All of which helps maximize performance, uptime and efficiency throughout the lifetime of your powertrain.



Replacements
Fast and efficient replacement services to minimize production downtime



End-of-life services
Responsible dismantling, recycling and reusing of products, according to local laws and industrial standards



Maintenance
Systematic and organized maintenance and support over the life cycle of your assets





Advanced services

Gain the unique ABB Ability™ digital advantage through data collection and analytics with advanced services



Extensions, upgrades & retrofits

Up-to-date systems and devices with the best possible performance level



Engineering & consulting

Identify ways to improve the reliability, usability, maintainability and safety of your processes



Spares & consumables

Authentic, high-quality ABB spares and consumables with quick delivery



Technical support & repairs

Quick and accurate response during emergencies and efficient support during planned breaks



Installation & commissioning

Highly-trained and reliable installation and commissioning experts



Training

Comprehensive and professional training either at ABB premises or your own facilities



Agreements

Comprehensive bundling of relevant services into one contract to suit your needs

Global service network 24/7

—
“I need operational excellence, rapid response, improved performance and life cycle management.”

With you, wherever you are in the world

Partnering with ABB gives you access to some of the world's most innovative technology and thinking.

Global reach

ABB operates in over 100 countries with its own manufacturing, logistics and sales operations together with a wide network of local channel partners that can quickly respond to your needs. Stock availability is good, with short delivery times for many products backed by 24-hour spare parts delivery.

In addition, ABB interacts closely with energy industry players including consultants, system integrators, energy generating companies and municipal authorities to help optimize costs and increase reliability and efficiency of heat

distribution networks to an absolute maximum, while providing comfort to the end users.

ABB has seven global R&D centers with more than 8,000 technologists and invests \$1.5 billion annually on innovation.

End-to-end product portfolio

Alongside its diverse portfolio of VSDs, softstarters, motors and generators, ABB offers district heating operators:

- Medium voltage components and systems such as air- and gas-insulated switchgears, uninterruptible power supply units, relays,



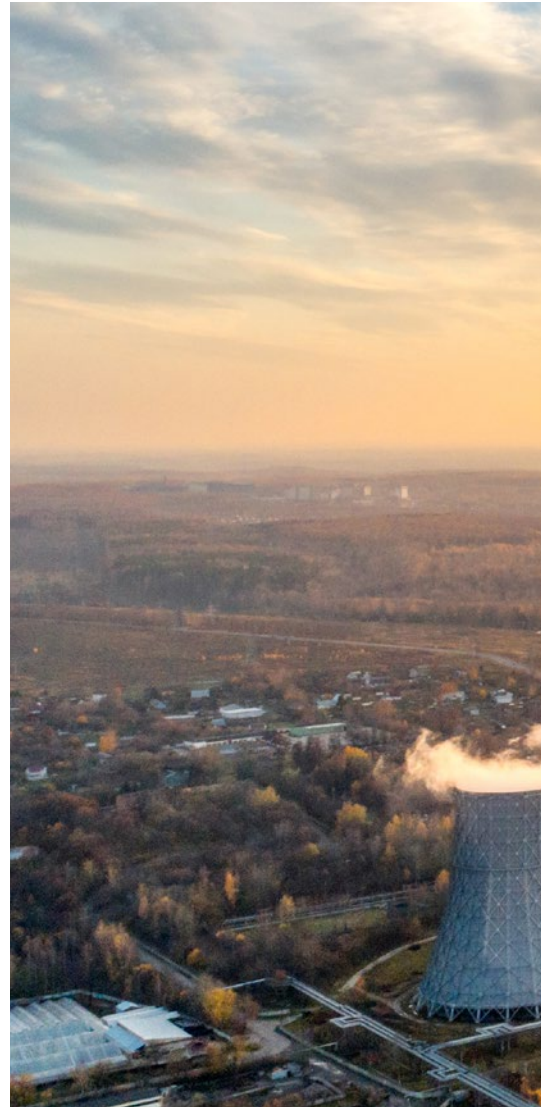
ultra-fast earthing switches, Is-limiters to reduce high short-circuit currents, and more.

- Low voltage components and systems such as switchgears, uninterruptible power supply units, breakers, industrial plugs and sockets, RCD blocks, power distribution units, remote power panels, a wide range of scalable PLCs and HMIs, and more.
- Digital solutions including ABB Ability™ cross-product and system offering providing intelligence all the way to the component level, improving overall system transparency and making it safe, reliable and efficient.

Streamline sourcing

ABB's end-to-end product and services portfolio streamlines your sourcing and purchasing activities by standardizing processes across multiple sites, to save you money on spare part inventories and maintenance costs.





—
For more information, please contact your local ABB representative or visit

new.abb.com/drives

new.abb.com/drives/drivespartners

new.abb.com/drives/segments/hvac

new.abb.com/motors-generators