Water treatment plants
Providing clean and safe drinking water
Benefits of improving efficiencies throughout a water facility

Urban water use accounts for typically 70 percent of the electricity associated with water supply and treatment. Water use efficiency and applying the latest innovations helps avoid the need to develop new water supplies and infrastructure.

Tackle diverse safety demands…
Choosing innovative technology can help tackle stricter anti-pollution laws and water quality standards.

...using best-in-class technology

Wheeled module drives can be rapidly manoeuvred into a panel, eliminating manual lifting which could lead to injury and reducing time exposed to potentially dirty environment.

Arc flash mitigation protects staff by ensuring all panels undergo arc flash testing.

Tested, validated solutions lower risk, save design time and secure your implementation.

Remote monitoring support for motors, pumps and bearings using smart sensors and cloud-based technology.

Safe torque off built into variable speed drives, brings motor-driven applications to a safe and efficient stop.

Globally certified drives and motors packages protect plant and people and conform to worldwide regulations using tested and certified motors and drives for potentially explosive atmospheres.

Know where to look…
With pumps, motors and other equipment operating 24 hours a day, seven days a week, water facilities are among the biggest consumers of energy and, therefore, among the largest contributor to total greenhouse gas emissions.

…and how to unlock the saving potential

Energy optimization is a dynamic control within a drive that adapts to changes in the motor load and reduces the energy needed to deliver the required torque.

Energy monitor is built within a drive and works out energy savings in kWh, MWh, CO₂ emissions and money saved.

High efficiency VSD-motor package lowers energy between 20 to 60 percent and reduces carbon dioxide emissions.

IE4 and higher efficiency class motors are among the most efficient available, contributing to further energy reduction.

Synchronous reluctance motors (SynRMs) reduce total losses by up to 40 percent, bringing optimal efficiency and reliability.

ABB Ability™ Smart Sensors for either pumps and/or low voltage motors helps to spot energy saving opportunities among the motors running pumps.

“We must maintain water quality and quantity requirements, while exceeding safety standards and complying with legislation.”
Safety Manager

“Our aim is to optimize operating costs and environmental efficiency.”
Energy Manager
Build in resilience...
The primary aim is to reduce the total cost of ownership and energy consumption through pump and asset monitoring and optimization solutions. Non-revenue water is a huge issue, including leaks due to water hammer, and pressure fluctuation.

... with flexible motor-driven solutions

Matched drives and motors packages ensure correct dimensioning of the drive and motor and guaranteed package efficiencies.

Harmonics - Using an ultra-low harmonic (ULH) drive will not intensify harmonics in the power network. Instead it reduces the losses in the mains supply, improves the mains quality and reduces the risk of disturbance to other equipment connected to the mains. Using ULH drives with generators will reduce the generator size required and allow for better generator stability compared to a similar standard drive.

Long cable runs between 30 and 100 m need a drive with du/dt or sine filters. A drive with an inbuilt choke is needed for cable runs of 100 m or more without additional equipment.

Cyber security is paramount by ensuring that drives can be integrated into a system that meets IEC 62443 requirements.

Fieldbus communications offers greater flexibility than point-to-point hardwiring, thereby improving the volume and speed of information sharing between the drive and other connected devices.

Communications loss backup mode enables the drive to automatically switch to internal PID control, allowing for resilient operation of the system while maintaining accurate control of the process, rather than using fixed speed backup modes.

Lower operational overheads...
Preventive maintenance planning is critical for maximum powertrain availability, quality of operation and lifetime, predictable budgeting and cost management.

... by utilizing smart functionality

Life cycle assessment provides a clear understanding of the drive/motor installed base, detailing how assets will evolve over the next few years.

Preventive maintenance plan provides regular inspections and component replacements according to a product-specific maintenance schedule.

Genuine spares must be readily available locally. Online ordering facilities should provide 24-hour access.

PC tools provide optimal commissioning and monitoring software that stores drive parameter sets and operation and maintenance documentation. Allows customization of the drive, reducing the need for a PLC to control small systems.

Service agreements are available that tackle proactive and reactive maintenance needs.

Digital services like remote condition monitoring, automatically and continuously collects performance data from drives and motors and provides alerts and information to enable issues to be predicted before failure can occur.
Finding improvements every step of the way

Every stage of water treatment can be fine-tuned to ensure a quality that exceeds drinking water guidelines, is clearer and smells and tastes better all year.

RIVER ABSTRACTION
River water quantity and quality depends on its run-off system, the seasonal changes and the general soil and vegetation through which it flows en route to the sea. Several methods enable river water abstraction and these are controlled through abstraction licenses.

Applications:
• Centrifugal and submersible pumps.

Requirements:
• Pumps are used to raise water to point of use.
• Suction pumps are used to draw off water in small-scale well-point systems.
• Piston and centrifugal pumps are best suited for single and multiple well-point systems.
• Submersible pumps can be used with larger diameter well-points. Here, the pump is installed directly within the well-point.

GROUNDWATER EXTRACTION
Groundwater extraction is via an aquifer which is a water-bearing rock that transfers water to wells and springs.

Applications:
• Multi-stage mixed flow pump with special submersible motor.

Requirements:
• Submersible centrifugal pumps are used to raise water to point of use.
• Pump and motor is installed directly in the well.
• High installation costs focuses attention on protecting well and pump to ensure a long life time.
• Configurable ramps in the VSD for reducing turbidity and for gentle check valve operation.

PUMPING STATION
A pumping station pumps water directly into the distribution system. Alternatively, the station is used in gravity flow distribution systems to increase pressure where water levels are insufficient.

Applications:
• Centrifugal pumps and vertical turbine pumps.

Requirements:
• Capital costs are high, but energy is the costliest aspect of running pumps.
• Pumps must be highly efficient and well maintained.
**CHEMICAL COAGULATION**

Chlorine dioxide is added to break down matter such as decaying leaves. Aluminum sulfate is used as the main coagulant. A polymer is added to strengthen the primary coagulant’s bonding chains.

**Applications:**
- Pumps.
- Mixers.

**Requirements:**
- Once chemicals are added, rapid mixing thoroughly disperses the chemical coagulants, evenly distributing them throughout the raw water.
- Fine particles clump together and are removed during the treatment process by settling, skimming, draining or filtering.

**FLOCCULATION**

A slow mixing process that causes small coagulated particles to form larger particles called floc.

**Applications:**
- Mixers/stirrers.
- Pumps.
- Skimmers.
- Aerators.

**Requirements:**
- The contacts or collisions between particles require gentle stirring created by a mixing paddles.

**DISINFECTION**

Chlorine is used within the disinfection process to kill or inactivate water-borne microorganisms.

**Applications:**
- Pumps.

**Requirements:**
- Water flows gradually through a series of baffles, providing time for additives to mix thoroughly and retain contact with disinfectant for longer.

**SEDIMENTATION**

Removes particles suspended in water to reduce the load on the filters.

**Applications:**
- Filter pumps.
- Aeration compressor.

**Requirements:**
- Sedimentation is the process by which solid particles suspended in water settle at the bottom of the tank, through forces such as gravity. The particles form a sludge which is then removed via a sludge pipe.
- Clearer surface water is collected from the tank.

**FILTRATION**

Water is filtered through a granular material such as coal or sand to remove any final impurities not collected during stage 6.

**Applications:**
- Pumps.
- Mixers.

**Requirements:**
- Pumps optimize the filtration process.
- Filtration process can be controlled/monitored on: pressure, volume, temperature etc.
- Filters will decay over time, changing pump’s load point.
- Filtration process is subject to strict control as it is critical to quality of water leaving facility.
Water distribution system

9 MAIN DISTRIBUTION PUMP STATION
Transporting large volumes of water through a piped distribution system requires the use of pumping stations.

Applications:
• Centrifugal pumps.

Requirements:
• To guarantee safe water quality, positive pressure must be maintained and controlled to avoid contamination.

10 BOOSTER STATION
Booster pumps can be used when raising water pressure in a distribution system, such as pumping from ground level to a water tower.

Applications:
• Centrifugal pumps.

Requirements:
• Booster stations raise water to overcome static lift due to higher elevation.
• Operating systems utilizing pressure control leads to less fluctuation in pressure, while gradual increases in speed reduce water hammer.
Unlock the potential in water applications

Alongside energy saving, improved productivity and greater safety, there are many other benefits from using variable speed drives (VSDs) and high efficiency motors on motor-driven applications.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Solution</th>
<th>Benefit</th>
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<tbody>
<tr>
<td><strong>Pumps</strong></td>
<td>• Reduce energy use and carbon emissions&lt;br&gt;• Variations in process demands&lt;br&gt;• Complex and mechanically controlled water networks&lt;br&gt;• Precise and optimal speed control&lt;br&gt;• Direct-on-line starting creates pressure shocks that damages pumps, seals, pipe joints and valves&lt;br&gt;• High cost when operating remote sites&lt;br&gt;• Cavitation shortens the impeller lifetime&lt;br&gt;• Risk of turbidity and total suspended solids (TSS)&lt;br&gt;• Maintaining reliability in multistage/bore hole pumps</td>
<td>• Motor-drive: 80 percent speed saves half the energy, according to affinity laws&lt;br&gt;• Drive: Built-in multipump control function ensures operation of pumps according to actual demand&lt;br&gt;• Motor-drive: Simplify the water network by eliminating need for control valves, by-pass lines and instrumentation, with speed control, built-in protections and functions&lt;br&gt;• Motor-drive: Enables the Best Efficiency Point (BEP) pumping&lt;br&gt;• Motor-drive and softstarter: Soft start of motor reduces stress on water and electrical network&lt;br&gt;• Motor-drive: Intelligent drives and smart sensors enable remote control and monitoring of pumps&lt;br&gt;• Motor-drive: Software features to prevent cavitation&lt;br&gt;• Drive-motor: Smoother start and optimize control in combination with a turbidity sensor&lt;br&gt;• Drive-motor: Fast ramp to minimum speed</td>
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<tr>
<td><strong>Blowers/Compressors</strong></td>
<td>• Over aeration&lt;br&gt;• High operation and energy costs&lt;br&gt;• Harmonics which can cause power quality issues&lt;br&gt;• Right amount of oxygen</td>
<td>• Control the amount of dissolved oxygen&lt;br&gt;• Motor-drive: controls the dissolved oxygen&lt;br&gt;• Drive: Better blower efficiency&lt;br&gt;• Motor-drive: variable speed allows accurate oxygen level control</td>
</tr>
<tr>
<td><strong>Mixers</strong></td>
<td>• Better mixing quality</td>
<td>• Motors-drive: optimal speed control for the mixing operation</td>
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Critical functions that empower potable water plants

Drives, soft starters, motors, gearing and mounted bearings all play a vital part in keeping water flowing. Choosing the right product feature for the right environment is essential in ensuring an optimized production.

**Variable speed drives**

**Energy efficiency**
- Control operating costs by seeing energy costs in local currency, kWh and CO₂ emissions.

**Communication**
- Use information such as water flow rates to get the VSD to adjust motor speed and torque.
- Get detailed insight into productivity performance and quality control through fieldbus comms connecting VSD with plant monitoring systems.

**Ingress protection**
- IP55 for wet and corrosive environments.

**Functional safety**
- Safely stop pumps using in-built safe torque off (safety level SIL3 / PL e).

**Low harmonics**
- Eliminate supply disturbances that could trip production with built-in active supply unit and integrated low-harmonic line filter.
- Makes design and operation of the back-up generator easy and reliable.

**Softstarters**

**Prolong pipe and pump life**
- Uses torque control to gently open and close valves and reduce water hammer during starts and stops.

**Protect pump system**
- Motor preheat ensures a dry and warm motor, prolonging pump life and increasing uptime.
- Coated boards and IP66 / UL Type 4x externally mounted keypads for harsh conditions.

**Simplify use**
- Application wizards simplify commissioning and control of pump.

**Pressure and flow control**
- Ensure optimal operation of water asset with built-in VSD features.

**Multi-pump control**
- Ensures stable and uninterrupted production with multi-pump controls by optimizing the speed and number of running pumps.

**Sensorless flow calculation**
- Reduces costs by eliminating external components.

**Soft pipe filling**
- Increases piping and pump system lifetime by avoiding pressure peaks.

**Level control**
- Ensures optimal efficiency when filling or emptying a tank.

**Flow and pressure protection**
- Protects pumping system from a low and / or high pressure and flow and prevents pump from running dry.

**Pump priority**
- Achieves energy savings by alternating pumps based on pump efficiencies.

**Sleep boost**
- Saves energy and extends pump life by decreasing start/stop cycles throughout the day.

**Quick ramps**
- Reliable operation of submersible pumps and smooth operation of check valves.

**Energy efficiency**
- Control operating costs by seeing energy costs in local currency, kWh and CO₂ emissions.

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**Drive and motor packages**

**Synchronous reluctance motor and drive (SynRM)**
- Save energy across the water treatment process with IE4 synchronous reluctance motors and drive packages.

**Globally certified drives and motors packages**
- Protect plant and people and conform to global regulations using tested and certified motors and drives for potentially explosive atmospheres.
Motors

- Protection against external conditions
- Bearing locked at D-end to avoid axial play
- Bearings can be either greased for life or regreaseable, fitted with grease relief systems
- Fan and motor fins optimized for low noise levels
- Oversized terminal box fitted as standard for ease of installation
- IP55 protection against ingress of water or solids. IP56 protection available as option
- Surface treatment (polyurethane or epoxy) in accordance with corrosion class C3M, with C4 and C5 as an option
- IE3, IE4 or IE5 efficiency levels to support emissions reduction
- Suitable for frequency converter operation

Bearings

- Stainless steel or corrosion resistance bearings in stainless or polymer housing.
- Sealed and lubed for life bearings to minimize maintenance costs.
- Multiple housing styles, bore sizes and locking mechanisms.
- Variety of sealing options to protect the bearing from contamination.
- Roller bearings have patented easy-on, easy-off adapter mounting and removal system.

Gearing

- Two-piece harsh duty seal.
- 13 step coating system.
- Provides 3x the corrosion resistance of epoxy paint.
- Premium sealing systems used to keep contaminants out and lubrication in.

- General purpose modular induction motor’s pre-engineered platform ensures short and on-time delivery
- High power density and efficiency reduces cost of ownership
- Provides same output power with a smaller frame size - less weight, a smaller installation footprint and lower costs
- Horizontal or vertical mounting
- Compact design, interface flexibility and low noise

- Dodge Vertical Gearmotor has smaller footprint and is lighter than traditional pump drive systems.
- Higher efficiency and power factor
- Optimal pump shaft speed
From the water 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 drives, motors, mounted bearings and pumps.

Intelligent powertrain
The powertrain is equipped with sensors and cloud connectivity and can comprise motors, drives and mechanical components including bearings, couplings and gearboxes – and also pumps.

Turning data into valuable information
Data gathered from VSDs’ inbuilt sensors and loggers, together with that collected from ABB Ability™ MACHsense-R and Smart Sensors fitted to motors, bearings and pumps, can be aggregated, 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 service activities more effectively.
Accessing data for analytics
Through condition monitoring, detailed information on parameters like temperature and vibration can be extracted into a company’s own portal and systems page. 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.

Gain a digital advantage
Ensuring that the right person is exposed to the right information at the right time brings:
• Insight into production challenges, helping to control operating costs.
• Greater overview into various aspects of the water process, thereby improving quality and reducing variations, errors and waste.
• Lower risk of production failure.
• Change the maintenance from reactive to predictive.
Keep your clean water plant 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.

Even before you buy a drive, motor or bearing, 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 operations and maintenance phases of the products life cycle, providing preventive maintenance programs tailored to your clean water plant needs.

ABB ensures that you are aware of any upgrades or retrofit opportunities. By registering your drives and motors ABB’s engineers will proactively contact you and advise on your most effective replacement option.

All of which helps maximize performance, uptime and efficiency throughout the lifetime of your powertrain.
Agreements
Comprehensive bundling of relevant services into one contract to suit your needs.

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

Technical support & repairs
Quick and accurate response during emergencies and efficient support during planned production breaks.

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

Installation & commissioning
Highly-trained and reliable installation and commissioning experts at your service.

Global service network 24/7

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

Engineering & consulting
Ways to identify and improve the reliability, usability, maintainability and safety of your production processes.

Extensions, upgrades & retrofits
Up-to-date systems and devices with the best possible performance level.

Training
Comprehensive and professional training either at ABB premises or your own.
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 authorized value providers 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, we work closely with clean water to develop custom products, services and solutions to help standardize processes across multiple sites and streamline your supply chain.

We have seven global R&D centers with more than 8,000 technologists and invest $1.5 billion annually on innovation.

**End-to-end product portfolio**
Alongside its variable speed drives, motors, soft starters, bearings and couplings, ABB’s automation offering includes a wide range of scalable PLCs, a selection of HMIs, instrumentation and robotics. With functional safety options, from built-in safe torque off to safety PLCs, you can readily implement bespoke safety requirements.
ABB’s offering includes:

- **Power protection and power quality solutions** to safeguard equipment and processes
- Industry leading **robotic automation solutions** that improve your speed-to-market, flexibility and help make packaging a differentiator
- A complete range of **protection, connection and wire management solutions** that withstand harsh environments and extreme temperature swings, and provide the reliability needed for continuous operations

**Streamline sourcing**

ABB’s end-to-end product and services portfolio streamlines your sourcing and purchasing activities and standardizes production across multiple sites; saving you money on spare part inventories while reducing maintenance costs.