Agriculture
Boosting efficiency, sustainability and productivity
How to ensure efficient water management in agriculture

Freshwater is one of the world’s most important resources, but it is limited. Up to 70 percent of water is used for irrigation on fields or in greenhouses, making careful distribution and conservation crucial to ensure a sustainable supply.

Tackle diverse production demands...
• Employees must not be exposed to hazards from operating pumps used for the irrigation process. The risk is high pressure during operation or flooding in case of a broken pipe.

...using best-in-class technology and services
• Using output pressure sensors and pump protection functions in the variable speed drive (VSD) makes it possible to protect people and environment against high pressure water, which could be of danger.
• Pump protection features can help to avoid or minimize flood situations by stopping the pump in case of a detected leakage.
• Advanced safety functions, like safe torque off, make sure that pumps are stopped in a safe way and that unwanted starts are prohibited.

Find the big energy users...
• One of the biggest energy users in irrigation of crops are pumps.

...unlock the saving potential
• Replacing throttle valves with VSDs on pump control reduces energy costs and cuts maintenance needs.
• Using the VSD intelligence to reduce the risk of losing water in case of a pipe burst.
• ABB Ability™ Operations Data Management zenon helps detect ways to optimize energy and resource consumption. It also offers excellent reporting functions that give full production transparency.
• ABB Ability™ Smart Sensors for pumps and motors help identify energy saving potential.
• Upgrading to IE5 efficiency class motors, such as synchronous reluctance technology (SynRM), significantly reduces energy consumption.
**Productivity improvement**

“**To optimize water consumption, we need to match the irrigation with weather conditions.**”

**Keep irrigation accurate...**
- Demand is varying for various crops and fruits, which all need high availability during growth season.
- Getting access to the right data and turning it into useful information is a challenge.

**... with flexible motor-driven solutions**
- Adaption to actual irrigation demand by variable speed pumping.
- Production increase often achieved without any extra investment due to optimal use of water.

“**We need better intelligence on the performance of the irrigation process.**”

**Locate the right information...**
- Manually extracting plant data is time-consuming and inaccurate.

**... through digital solutions**
- Multiple inputs and outputs (I/O’s) provide a variety of process information from the VSD to the motor control.
- Fieldbus technology enables the drives controlling the pumps to integrate with the irrigation control systems, giving greater insights and better control of production.

**Operation and maintenance**

“**How can I control rising costs?**”

**Lower operational overheads...**
- Operational costs must be controlled without compromising safety of the plant, personnel or end product.
- Maintenance must be carefully scheduled around planned downtime.

**... through advanced maintenance regimes**
- Soft starting reduces the risk of water hammer and pipe burst, leading to less wear and tear on pump and motor.
- ABB Ability™ Condition Monitoring delivers accurate, real-time information about VSD and motor events to ensure equipment is available, reliable and maintainable.
- Global service network and preventive maintenance contracts relieve pressure on in-house teams and increase speed of response to critical issues.
- VSD pump control software can protect the pump and the irrigation system against peak pressure and reduce the risk of water leakage.

“**We need the most reliable products and systems to avoid unplanned downtime.**”

**Eliminate production risks...**
- Shutdowns are costly, from lost production time, spoiled goods and reputational damage.

**... by using smart functionality**
- Pressure control, load, under/overvoltage protection and warning features within VSDs help anticipate breakdowns.
- A VSD real-time clock allows timed tracing of faults, telling operators what happened and when.
Improving operational efficiency helps boost output and profitability

Each stage of irrigation can be fine-tuned to improve productivity, increase sustainability and enhance safety.
LATERAL MOVE IRRIGATION
Sprinklers are coupled together and rolled linearly across field surface.

Applications:
- Centrifugal pumps
- Lateral move motors

Requirements:
- Pumps must be robust, highly efficient and well maintained
- Constant pressure to maintain proper water flow

Typical crops:
- Potato’s, corn, grain, sugar cane, strawberries, grapes

DRIP IRRIGATION
Water is supplied directly at the crops. Fertilizer might be added to the water.

Applications:
- Pressure boosting for the water supply to the different drip irrigation sections

Requirements:
- Pressure control is crucial to avoid breaking the pipes and nozzles
- Filling of empty pipes slowly to avoid water hammer
- Low pressure detection to detect broken pipes, to avoid flooding

Typical crops:
- Grapes, citrus fruits, apples

BOOSTER PUMPS
A pumping station pumps water directly into the distribution system. Alternatively, the station is used in gravity flow distribution system to lift the water to higher elevated areas.

Applications:
- Centrifugal pumps

Requirements:
- Capital costs are high, but energy is the most costly aspect of running pumps
- Pumps must be highly efficient and well maintained

SOLAR PUMPS
Clean energy for sustainable food growth.

Applications:
- Irrigation, community water supply and agriculture

Requirements:
- Drives with solar-specific and pump control functions ensure reliable power supply throughout the day with on and off-grid compatibility
- Harnessing the power of the sun provides an environmentally friendly pumping without producing any CO₂ emissions
- Pumps must be efficient and well maintained

CENTER PIVOT IRRIGATION
Sprinklers fixed to a frame rotate around a pivot to water crops.

Applications:
- Centrifugal pumps
- Pivot motors

Requirements:
- Smooth operation to ensure even water distribution and prevent equipment damage
- Constant pressure to maintain proper water flow through nozzles/spray heads
- Pumps must be robust, highly efficient and well maintained

Typical crops:
- Potato’s, corn, grain, sugar cane, strawberries
Unlock the potential in irrigation systems

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>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pumps</strong></td>
<td>• Wide variations in pumping requirements due to seasonal changes, demand, etc</td>
<td>• Drive: Built-in multi-pump control function ensures operation of pumps according to actual demand</td>
</tr>
<tr>
<td></td>
<td>• Drive: Adapts output to react to seasonal swings in demand and available supply</td>
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<tr>
<td></td>
<td>• Irrigation equipment is often installed in remote, difficult to access locations</td>
<td>• Motor-drive: Intelligent drives and smart sensors enable remote control and monitoring of pumps</td>
</tr>
<tr>
<td></td>
<td>• Drive: Pump protection functions use data from pump curves and pressure transmitters to detect any abnormalities</td>
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<td></td>
<td>• Anticipate longer operating lifetime of the pumps</td>
<td>• Motor-drive: Intelligent drives and smart sensors enable remote control and monitoring of pumps</td>
</tr>
<tr>
<td></td>
<td>• Pipes and sprinkler heads must be protected to prevent leakage and water waste</td>
<td>• Drive: Soft pipe filling protects networks from pressure peaks when starting pump systems and prevents water waste by alerting if the target pressure is not reached in the set time</td>
</tr>
<tr>
<td></td>
<td>• Drive: 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</td>
<td>• Reduced water hammer and other mechanical stress</td>
</tr>
<tr>
<td></td>
<td>• Prevents water waste by alerting if the target pressure is not reached in the set time</td>
<td>• Increased equipment lifetime</td>
</tr>
<tr>
<td></td>
<td>• Complex and mechanically controlled water networks</td>
<td>• Drive: 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</td>
</tr>
<tr>
<td></td>
<td>• Cavitation caused by changes in pressure shortens impeller lifetime</td>
<td>• Drive: Detect inlet pressure to predict occurrence of cavitation</td>
</tr>
<tr>
<td></td>
<td>• Drive-motor: Fast ramp to minimum speed</td>
<td>• Reduces wear on motors</td>
</tr>
<tr>
<td></td>
<td>• Motor protection by using output filters (dU/dt or Sine Wave filters)</td>
<td>• Increased uptime</td>
</tr>
<tr>
<td></td>
<td>• Maintaining reliability in multistage/borehole pumps</td>
<td>• Increased service intervals</td>
</tr>
<tr>
<td></td>
<td>• Unplanned interruptions because of power outages or weak networks</td>
<td>• Protects motor bearings</td>
</tr>
<tr>
<td></td>
<td>• Drive: Ability to keep pumps running during short power outages and automatic restart after longer power cuts</td>
<td>• Avoid mechanical stress on the pump with repetitive starts and stops</td>
</tr>
<tr>
<td></td>
<td>• Drive: Ability to keep pumps running during short power outages and automatic restart after longer power cuts</td>
<td>• Avoid unnecessary visits for manual pump start-up</td>
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</table>
Drip irrigation is an efficient way to irrigate greenhouse crops.

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<tr>
<td><strong>Sprinklers (inc. center pivot &amp; lateral movement irrigation systems)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pressure spikes leading to water hammer and leakage</td>
<td>• Motor-drive: Adjusts motor speed to constantly achieve required pressure</td>
<td>• Protects sprinklers from damage and prolongs their lifetime</td>
</tr>
<tr>
<td></td>
<td>• Drive: Pump protection functions use data from pump curves and pressure transmitters to detect any abnormalities</td>
<td>• When running in constant pressure mode it is possible to turn off the system in case of pressure drop at the output, which is an indication of a broken pipe, by adding a low pressure protection function</td>
</tr>
<tr>
<td></td>
<td>• Cavitation caused by changes in pressure shortens pump lifetime</td>
<td>• Reduced water hammer and other mechanical stress</td>
</tr>
<tr>
<td></td>
<td>• Dry running causes damage to pumps and sprinklers</td>
<td>• Avoids pipe burst</td>
</tr>
<tr>
<td></td>
<td>• Outdoor installation in harsh environment</td>
<td>• Increased equipment lifetime</td>
</tr>
<tr>
<td><strong>Drip irrigation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pressure spikes leading to water hammer and leakage</td>
<td>• Motor-drive: Adjusts motor speed to constantly achieve required pressure</td>
<td>• Protects pipes from damage and prolongs their lifetime</td>
</tr>
<tr>
<td>• Managing different demand levels for different drip irrigation sections</td>
<td>• Drive: Intelligent Pump Control (IPC)</td>
<td>• Allows more pumps to be started if demand is increasing, with no need for external controller</td>
</tr>
<tr>
<td></td>
<td>• Drive: Pump protection functions use data from pump curves and pressure transmitters to detect any abnormalities</td>
<td>• Energy efficient pumping depending on actual need</td>
</tr>
<tr>
<td></td>
<td>• Flow can be affected by low pressure caused by broken pipes</td>
<td>• When running in constant pressure mode automatically turns off the system in case of low pressure at the output</td>
</tr>
<tr>
<td></td>
<td>• Cavitation caused by changes in pressure shortens pump lifetime</td>
<td>• Turns off the pump in case of low inlet pressure, protecting the pump from cavitation</td>
</tr>
</tbody>
</table>

Drive: Soft pipe filling protects networks from pressure peaks when starting pump systems and prevents water waste by alerting if the target pressure is not reached in the set time.

Drive: Dry run protection function

Drive: Dilution protection

Drive: Low pressure protection

Drive: Inlet pressure measurement allows potential cavitation to be detected before it can cause damage.

Drive: Motor-drive function

Drive: Pressure transmitters

Drive: Pressure measurement

Drive: Pump protection functions

Drive: Soft pipe filling

Drive: Dry run protection function

Drive: Dilution protection

Drive: Low pressure protection

Drive: Inlet pressure measurement

Drive: Motor-drive function

Drive: Pressure transmitters

Drive: Pressure measurement

Drive: Pump protection functions

Drive: Soft pipe filling

Drive: Dry run protection function

Drive: Dilution protection

Drive: Low pressure protection

Drive: Inlet pressure measurement

Drive: Motor-drive function

Drive: Pressure transmitters

Drive: Pressure measurement

Drive: Pump protection functions
Optimized functions that benefit irrigation systems

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 flow performance through fieldbus comms connecting VSD with plant monitoring systems

Ingress protection
- IP55 for wet and corrosive environments

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

**Pressure and flow control**
- Ensures optimal operation of water asset using built-in VSD features
- Maintain constant pressure or constant flow

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

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

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

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

**Solar pump drive**

**Maximum uptime**
- Operates without grid directly from photovoltaic (PV) cells

**Ease of installation**
- Compatible with all pump types and set up for serial production

**Return on Investment (ROI)**
- Superior ROI compared to diesel-powered pumping

**Softstarters**

**Built-in bypass**
- Reduce system complexity and size, saving time and money during installation
- Reduce heat generation from internal losses by activating bypass at full speed

**Harsh environment use**
- Ensure uninterrupted production in dusty or wet environments with IP66 keypad and coated electronics

**Flexible communication**
- Operate in local and remote mode by accessing all major communication protocols and built-in Modbus-RTU
Motors
- Protection against external conditions
- Bearing locked at D-end to avoid axial play
- Bearings can be either greased for life or regreasable, 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

Ball bearings
- Shaft attachments which offer proven locking performance
- Sealing system prevents contamination and allows purging of grease increasing reliability
- End covers available to protect workers from rotating shafts

Drive and motor packages
Synchronous reluctance motor and drive (SynRM)
- Save energy across the water treatment process with IE5 synchronous reluctance motor 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

Gearing for lift irrigation
Tigear 2
- Single reduction right angle worm gear reducer in a power dense design
- Harsh duty seals available prevent outside elements from entering

Quantis
- Efficient gearing provides up to 98% per stage help to reduce energy costs
- A variety of input and output configurations allows versatility
From the water facility to the cloud and beyond

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.
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.

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 has the right information to 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 irrigation system 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 irrigation 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.

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

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.

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

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

Training
Comprehensive and professional training either at ABB premises or your own.

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

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 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 irrigation providers 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.