MOTION

From farm to fork in a sustainable, reliable and safe way

Greenhouse fruit and vegetable solutions guide

Introduction

Farm to Fork strategies focus on making value chains fair, healthy and sustainable. The large-scale greenhouse production industry is facing significant challenges. Energy and raw material prices are increasing, while consumers are demanding ever lower prices. Meanwhile, the global population continues to grow, and consumer tastes are changing, with plant-based and sustainably produced foods soaring in popularity, while wholesalers and supermarkets are forcing prices down, putting increasing pressure on greenhouse producers to improve efficiency and reduce waste to maintain profitability. As such, the industry requires solutions that can help to make vital improvements within the areas of:

- **Sustainability** – where improvement comes in the form of energy savings, optimized use of water and raw materials and ventilation, protection of the local environment, and reduction of waste
- **Reliability** – where the need to reduce wear and tear on assets in use, prolong equipment life, and eliminate the risks of unplanned downtime are all critical to profitable operation
- **Safety** – where it is vital to ensure that food safety is maintained throughout the value chain

ABB offers application-based solutions for the greenhouse sector across the entire value chain. Our domain expertise, energy efficient motors and variable speed drive / variable frequency drive (drive) technology can help to substantially reduce energy costs, while programmable logic controllers (PLC) can deliver integrated control systems that help to provide enhanced digital visibility and control over the processes within the greenhouse production, preparation and packing sectors – from Farm to Fork.

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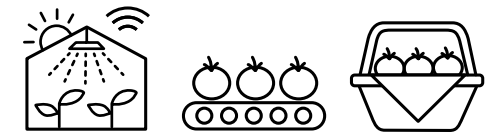

Greenhouse production

Challenges facing the greenhouse industry
New technologies have facilitated a rapid transformation in farming techniques. Growing crops indoors in controlled conditions reduces the risk of damage and loss through weather, disease, and insects. Greenhouses provide a safe artificial environment to maximize the output of farming activities, providing higher quality, better tasting produce, and a more sustainable food system. To ensure sustainable food production, new technologies, approaches, and innovations are required. One example of this is vertical farming, which Involves growing crops in vertically stacked layers, providing a more efficient use of land while allowing for a wider variety of plants to be grown simultaneously.

Precision control of conditions for optimal growth
One of the major challenges facing greenhouse producers is efficiency. Maintaining a controlled environment for growing food requires constant careful monitoring, all year round, of variables such as temperature, light and ventilation, as well as oxygen, CO2 and water levels. As such, plants grown in a greenhouse can have a larger carbon footprint than those grown outdoors. Even small efficiency gains can reap large benefits across the whole facility.

Maximum reliability is the minimum requirement
Eliminating waste is vital to ensure profitability. Equipment must be reliable and downtime kept to a minimum. If a pump is not running, or fertilizer not added, this can affect product quality, and crops may even die, leading to waste and additional cost. Different crops often require different conditions, making adaptability a high priority to ensure food is high quality, and avoid safety issues such as mould that can shorten food shelf-life.

Solutions across the greenhouse production value chain
ABB offers a suite of solutions that can deliver vast benefits for greenhouses and vertical farms, as well as equipment manufacturers and system integrators that supply them. Across the value chain, ABB understands the applications and issues that matter for indoor agriculture, and can help the industry tackle the sustainability, reliability and safety challenges facing the sector.

Greenhouse production

Challenge

SUSTAINABILITY

I need to make efficient use of water to reduce costs and environmental impact, while recirculating where possible

RELIABILITY

I cannot afford downtime on my water pumps as my crops will suffer

SAFETY

My plants must have the right amount of water to ensure healthy growth

Solution

Drives and high-efficiency motors make it possible to control flow and pressure of water to the actual need, at the best possible energy efficiency

Drives optimized for pump applications. Soft pipe filling function reduces stress on pipes, valves and pumping equipment

Drives and PLCs can monitor and control large amounts of pumping equipment simultaneously to ensure maximum uptime with minimum wastage

Pumping

Greenhouse production

Challenge

SUSTAINABILITY
Running drip irrigation systems involves high energy cost for running my pumps frequently throughout the day

RELIABILITY
Small waterborne particles can clog my systems, I need to prevent this from happening. Pressure control is also crucial to avoid damage to pipes and nozzles

SAFETY
Even a temporary outage can harm my crops and affect product quality, but faults to drip irrigation systems can be difficult to detect visually

Solution

Drives improve pumping efficiency, with even a small improvements quickly adding up due to the number of running hours

Drives can control flow and pressure and monitor filters to indicate when cleaning is needed

PLC can monitor all applicable variables to ensure that optimal conditions are constantly maintained

Drip irrigation

Greenhouse production

Challenge

SUSTAINABILITY

I need to reduce my water consumption where possible

RELIABILITY

Sprinkler irrigation requires high pressure to force water out, potentially wearing out valves and nozzles

SAFETY

I need to ensure my plants get the right mix of nutrients so that they are healthy and safe to eat

Solution

Precision control of motors ensures less water is lost to waste

Drives and remote monitoring equipment provide early warning of unusual pressure variations

PLC can provide continuous monitoring of nutrient levels, and provide feedback to drive to alter output accordingly

Sprinkler irrigation

Greenhouse production

Challenge

SUSTAINABILITY

Maintaining the right CO2, humidity and oxygen levels in my facility at all times can consume large amounts of electricity

RELIABILITY

Any downtime can potentially damage my plants

SAFETY

My heating, cooling and ventilation systems have to run optimally to create the best conditions for growth

Solution

Drives and high efficiency motors could significantly reduce energy usage, in some cases up to 25% or more

Remote monitoring ensures that any potential issues can be flagged up before they develop into failures

Sensors feeding back to the PLC can monitor air quality, RH, oxygen and CO2 levels, and provide constant feedback for motor operation

Fans

Greenhouse production

Challenge

SUSTAINABILITY

Vertical farming facilities are more energy intensive and cost more to run than traditional greenhouses, making efficiency a top priority

RELIABILITY

Vertical farming is a 24/365 operation, and I cannot afford any outages

SAFETY

I have to ensure the right mix of fertilizer and water to ensure optimal growth

Solution

Drives and high efficiency motors could significantly reduce energy usage, in some cases up to 25% or more

Drives and monitoring equipment provide early warning of failures and can help to compensate for failures elsewhere

PLC programming can monitor and control dosage levels to ensure healthy plants

Vertical farming

Greenhouse production

Challenge

SUSTAINABILITY

Boilers require lots of energy to function, making efficiency a priority

RELIABILITY

Identifying potentially faulty boilers can be difficult through manual inspection alone

SAFETY

Certain products must be heated to kill any contaminants

Solution

Drive can control burner fans and water supply to save fuel, lower CO_2, and reduce energy usage

Remote monitoring equipment provides early warning of faults

PLC can track many batches simultaneously to ensure effective treatment

Boilers

Food sorting, preparation and packaging

Challenges at the food preparation stage
In crop farming of all kinds, labor shortages are an increasing problem in many regions, and are a problem with no easy answer. Investment in the automation of processes can help to reduce reliance on manual labor, while speeding up processes to ensure that products can reach shelves more quickly, and allowing a wider variety of goods to be processed on the same production line. High throughputs require high efficiency in order to ensure maximum profitability, while equipment such as conveyors and cutters must be able to operate with extreme precision to minimize waste.

Waste is not an option
Plant-based foods are soaring in popularity, with consumers expecting an ever increasing variety of products, many of which may require different conditions in which to grow optimally. Greenhouses must be able to keep pace with demand for an expanding and diverse array of products in increasing volumes, while ensuring that each product is of the highest quality, as any waste equates to money lost. As such, equipment dedicated to washing and processing food must be extremely reliable to prevent any downtime.

Growing food safely and sustainably
Meanwhile, hygiene standards are becoming stricter, with any food safety incident in recall potentially resulting in heavy fines and negative publicity. Many greenhouses will carry out sorting, packaging and labelling on-site. These processes must be hygienic in order to ensure that food leaving the facility is clean and safe to eat. HVAC systems must be able to keep food preparation areas free of dust, and remove pathogens and contaminants from the air to ensure optimum food safety.

Ensuring maximum sustainability, reliability and safety in food processing and packaging
ABB products are designed to meet the needs of the increasingly sophisticated modern industrial processing facility. From ultra-premium efficiency IE5 SynRM or EC Titanium™ motor and drive packages, to advanced industrial PLCs, ABB is equipped to help greenhouse facilities to improve the sustainability, reliability and safety of their operations.

Food sorting, preparation and packaging

Challenge

SUSTAINABILITY

Pumping is a high energy process, and I need to improve efficiency wherever possible

RELIABILITY

Equipment outage can halt production, leading to food wastage and additional costs

SAFETY

I need to keep equipment clean to prevent contaminants from entering the food chain

Solution

SynRM motors or EC Titanium motor-drive packages can achieve up to IE5 efficiency levels

In the event of failure in PLC control, drives built-in features and functions can control the process until PLC control is re-established

Motors are built with a robust design to ensure easy cleaning and maintenance

Pumping

Food sorting, preparation and packaging

Challenge

SUSTAINABILITY

Plants and vegetables can quickly degrade, so it is vital to get them into the cold chain as fast as possible

RELIABILITY

Any delay due to equipment downtime can be costly to my operations

SAFETY

Food must reach shelves quickly to ensure that it is fresh and fit for consumption

Solution

Drive and PLC can provide telemetry to prove that correct temperatures and relative humidity are maintained at all times

Drive helps to extend equipment lifetime through smoother operation, ensuring less wear and tear

Drive ensures effective cooling to slow plants' natural respiration and transpiration processes

Cooling

Food sorting, preparation and packaging

Challenge

SUSTAINABILITY

I need to optimize my conveyors to prevent damage to products

RELIABILITY

Each conveyor may have different maintenance requirements, while longer conveyors can require numerous motors and long cables

SAFETY

I must keep personnel safe from dangerous moving machinery

Solution

Drives can adapt speed to individual products, while smooth start and stop for conveyors reduces damage to goods for less waste

PLC combined with drives and motors ensures perfect synchronization of multiple conveyors for less wear on equipment

Integrated functional safety in drives reduces risk to personnel

Conveyors

Food sorting, preparation and packaging

Challenge

SUSTAINABILITY

Mixing and cutting can require high precision

RELIABILITY

Mixers require high starting torque, putting strain on equipment

SAFETY

I have to keep my employees safe from machinery, and ensure that contaminants do not enter the food chain

Solution

High precision speed control in drives can deliver highly accurate precision control without the need for an external encoder

Drives provide precise speed and torque control to reduce strain on mechanical equipment

Integrated functional safety within drives reduces personnel risk, while ABB's Food Safe motor is designed to withstand harsh washdowns

Mixers and cutters

ABB Motion solutions for greenhouses and preparation of vegetables and fruit

High efficiency motors

- ABB offers a comprehensive range of reliable and high efficiency motors for all greenhouse production and processing applications – from farm-to-fork
- Super premium efficiency IE4 induction and permanent magnet motors can significantly reduce energy usage, while meeting and exceeding Minimum Energy Performance Standards (MEPS) around the world
- Ultra-premium efficiency IE5 SynRM motors / NEMA EC Titanium motors and VSD packages can achieve unprecedented energy savin gs for processing and logistics applications

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Variable speed drives/variable frequency drives

- ABB drives are made with efficiency and performance in mind to empower productivity for greenhouse operators and processors. They provide flexibility to optimize processes and control across the value chain, while achieving high reliability for less downtime
- Achieves substantial energy savings by delivering precision control to ensure that a motor only uses the energy it needs for a given output
- Built-in features and functionality tailored to greenhouse production processes, e.g. anti-cavitation function for pumps in the ACS580 and ACQ580 drives and softpipe fill.
- EnergySave Calculator tool allows you to predict energy performance and savings prior to investing
- Functional safety built-in

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Programmable Logic Controllers (PLCs) and Human Machine Interfaces (HMIs)

- ABB automation devices deliver solutions with high performance and flexibility to be effectively deployed in applications across the greenhouse value chain
- ABB range of PLCs can provide solutions for small, medium and high-end applications
- Ideal choice for high availability, extreme environments, condition monitoring, motion control and safety solutions
- Constantly monitors process variables and can instruct motor and drive equipment to adjust operations instantaneously to match requirements in real-time
- Safety PLC specifically designed for safety applications involved in machinery and process automation

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Advanced services

ABB offers a range of advanced services and digital solutions based around the ABB Ability™ platform, which can help to maximize the potential of your motor-driven applications across the entire powertrain.

ABB Ability™ Mobile Connect
ABB Ability™ Mobile Connect for drives allows equipment manufacturers to communicate with drive users or service personnel on-site, helping them easily commission and troubleshoot drives remotely. Chats and sharing of images and backups via smartphone makes the technical support process quick and efficient.

This increases opportunities to provide online technical support for end customers – without complex connectivity infrastructure. This is ideal for facilities in remote locations lacking in modern communications provision.

ABB Ability™ Condition Monitoring for drives
ABB Ability™ Condition Monitoring for drives keeps you one step ahead of process issues. The service provides fact-based insight into the performance and efficiency of drives, via KPIs and signal data, to keep processes running smoothly.

Irregularities in operations can be identified and solved long before they result in equipment failure, reducing downtime while enabling a shift towards predictive maintenance, while allowing additional opportunities to optimize performance based on the data.

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Advanced services

ABB Ability™ Condition Monitoring for powertrains
ABB Ability™ Condition Monitoring for powertrains optimizes the performance and efficiency of rotating equipment. It enables full transparency on all parameters for drives, motors and pumps, and can also be applied to applications such as compressors, conveyors, mixers and extruder main shafts.

ABB Ability™ Smart Sensors
ABB's Condition Monitoring solutions are underpinned by Smart Sensors: small devices which can be fitted directly to the chassis of a motor with minimal installation and no wiring required. The device gathers near real-time data measuring parameters such as temperature, vibration, magnetic flux and noise, which can then be aggregated, stored and analyzed by the cloud to gain unprecedented insight into equipment condition and performance. Potential equipment issues can therefore be detected before they turn into faults, without having to manually inspect the motor.

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Engage ABB support locally
As well as serving the market directly, ABB continuously develops a network of value-adding channel partners that enhance ABB's market reach and proximity around the world. Local expertise, combined with a world-leading product and service offering, can help to provide support at every stage of the greenhouse value chain.

ABB's carefully selected channel partners are regularly trained in the latest products, techniques and best practices, as well as being periodically assessed on their core competencies to ensure that customer expectations can always be fulfilled, 24 hours a day, anywhere in the world.

The ABB Value Provider program ensures that approved third parties deliver authorized sales, support, service and engineering in cooperation with ABB, bringing ABB's products and services straight to the customer's front door.

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Summary

Across the value chain for production of fruit and vegetables in natural or processed form, key stakeholders face an array of challenges in ensuring maximum efficiency with minimum waste, while attempting to reduce costs wherever possible to ensure that food is grown sustainably.

ABB's Motion portfolio delivers a wide range of solutions with tangible benefits for improving the efficiency of greenhouse operations, from Farm to Fork.

To find out more about how ABB can help you

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https://campaign-mo.abb.com/farm-to-fork-greenhouses

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