Poultry farming
Boosting safety, productivity and sustainability - from egg to broiler production
Helping poultry housing make the grade

As customer demands evolve, the need to improve poultry welfare, maintain a sustainable environment and retain profitability, are being achieved with the latest IoT-enabled powertrain components. Variable speed drives, for instance, are highly reliable devices with a mean time between failure (MTBF) exceeding 60 years (or over 500,000 hours), while often achieving in excess of 50 percent energy saving.

Challenges
- Poultry are very sensitive to temperature and require the best cooling and heating system inside the house.
- Sustainability means ensuring the energy footprint is totally optimized: from drying manure and using the pellets as heat, to embracing renewables.
- Target is optimum energy efficiency, lower bills and reduced CO₂ emissions.

Solutions
- Applying VSDs and high efficiency motors to as many applications as practical - from ventilation fans and pumps to conveyors and hammermills – reduces energy use by up to 60 percent and cuts maintenance needs.

Challenges
- Focus is to protect the health and safety of chickens and personnel.
- Ultra-reliable automation systems are critical to meet the egg laying demand.
- There is a push to make layer houses self-sufficient in their energy use.

Solutions
- VSDs, softstarters, motors and generators are critical to the continuous operation of ventilation, conveying, emergency power back-up and pumping systems.
- Powertrain equipment helps meet specific design requirements, while reducing power consumption and increasing safety for poultry and personnel.

“Only happy hens lay efficiently. Poultry require a draft free and dry house. Proper ventilation, humidity and temperature management is essential.”

Energy & Facilities Manager

“The layer houses I design need to meet the strictest animal welfare codes while fulfilling the world’s ever-changing sustainability regulations.”

End-user

Consultant
Challenges
• Connecting and integrating components into ventilation, conveying or pumping systems must be straightforward, ensuring smooth interoperability.
• Efficient layer house management requires detailed access to fault logs and operational data for condition monitoring and troubleshooting.
• Equipment reliability is vital to avoid breakdowns and damaged reputations.

Solutions
• Support of all major communication protocols ensures VSDs, softstarters and PLCs are an integral part of a building management system and can contribute to an overall control strategy.
• Broad range of mechanical power transmission equipment including gearmotors for conveyors.

Challenges
• A portfolio of automation technologies that are matched and fully compatible from selection and dimensioning to installation and commissioning.
• Local supply of genuine spare parts and field servicing engineers is essential for machinery shipped globally.

Solutions
• Broad offering including VSDs, motors, PLCs, HMIs, safety products, choice of real-time Ethernet technologies, software programming.
• Global service network and preventive maintenance contracts relieve pressure on in-house teams and increase speed of response to critical issues.
Improving operational efficiency boosts output and profitability

A typical egg production facility is home to over 100 variable speed drives controlling motors in a diverse array of applications. The aim is to ensure production is optimized, efficient, reliable, and safe.

**1. FOOD MIXING AND DOSING**

Feed for the chickens is produced in food kitchens. Trucks despatch food ingredients like corn and molasses which are stored in silos. Ingredients are transferred to a cleaning and grinding process before being mixed to a recipe which varies depending on the time of day. Augers transfer the day-specific feed into the relevant storage bunker.

**Applications:**
- Pumps
- Conveyors
- Hammermills/ grinders
- Mixers
- Augers

**Requirements:**
As food kitchen is 24-7 with a process of cleaning, grinding and mixing ingredients, reliability is of utmost importance.

**2. WASHING, SORTING, AND PACKAGING**

Automatic washers remove manure and other debris from the shells, the wastewater of which is pumped to holding tanks before being transferred to fields for crop irrigation. Cameras can detect any cracks in the eggs before machines are used to sort the eggs by size and then packed into appropriate-sized trays. Robots are used to stack the trays ready for transportation.

**Applications:**
- Pumps
- Synchronized conveyors
- Packaging machines
- Refrigeration & cooling

**Requirements:**
Gentle conveyor control, smooth transfer between belt systems, refrigeration to ensure eggs retain freshness and quality.

**3. LAYER HOUSES**

Chickens move freely and produce their eggs. As such, internal recirculation fans help maintain pressure, distribute fresh air and avoid wet spots. Ventilation starts manure-drying process, reducing amount of ammonia produced and released. This improves air quality in the building and increases nutrient value of manure. Each layer house typically shelters between 50,000 to 100,000 chickens. Eggs are collected on conveyors and transferred to the sorting and packaging area.

**Applications:**
- Conveyors
- Air handling units
- Recirculation fans
- Air scrubbers

**Requirements:**
Eggs automatically roll from cages to conveyor for prompt collection and refrigeration.
STORAGE BUNKERS

Three compartments, with each storing separate recipe suitable for different times of day. During night, chicken is in house. From 07:00 to 11:00 chickens lay 95% of eggs. Layer house doors are then opened and creates over-pressure which makes it easier for chickens to leave house. In afternoon, chickens are encouraged to return to layer house by feeding high calcium food.

Applications:
- Conveyors
- Feeders

Requirements:
Fans are adjusted to create an underpressure, so air pressure goes from outside, in, making it easier for chicken to enter the house.
Climate control in poultry houses

With a high reliability and many safety and protection functions built-in, VSDs offer a perfect solution for ventilation systems.

**ROOF INLET/OUTLET VENTILATION SYSTEM**

- VSDs are used to control the fan speed of the inlet and outlet chimneys which are used for standard climate control.
- With this equal pressure system, VSDs are the preferred choice for controlling ventilation, enabling the free movement of chickens between the house and the outside.
- In some layer houses, where chickens remain permanently inside, the ventilation system used is like that in broiler houses (see opposite).
- In emergency situations, VSDs can enter override mode, running fans according to a chosen strategy, ignoring warnings and faults. This allows extended fan runtime in adverse conditions for safe evacuation of layer houses.

**TUNNEL VENTILATION SYSTEM**

- In countries where humidity and temperature are high, typically above 80 percent and 35 °C respectively, a tunnel ventilation system is used in combination with the roof inlet/outlet system to provide a wide range of air exchange.
- The traditional roof-mounted chimneys are used for the intake and extraction of air. However, if the temperature rises significantly, the standard ventilation system switches off. Multiple fans mounted on the walls of the house are used to create a high air velocity, typically 3 m/s, to increase cooling effect for the birds.
- Tunnel ventilation systems are rarely speed controlled, preferring the on-off switching format using contactors. While such control is simple to understand and deploy, it is difficult to control minimum ventilation and is energy intensive.
- In some countries the minimum speed is controlled with a VSD and the fans are only switched on/off when a high ventilation level is needed. This is referred to as a cascade system, whereby using just 20 percent of total fan load, speed control of all fans can be achieved.
VENTILATION – LAYER HOUSES

• As chickens can freely venture inside and outside of the layer house, the roof inlet/outlet ventilation system simply draws in fresh air and extracts CO₂, ammonia, particulate matter and moisture, while equalizing the overall pressure within the house.

VENTILATION – BROILER HOUSES

• Broiler houses require a more sophisticated ventilation control than layer houses as the temperature and humidity variation is broad, to accommodate the air needs as 50 g chicks mature into 3.5 kg chickens.

• Chicks need very little air and so a small number of fans will be switched on for several minutes only. This enables a low ventilation level to be reached.

• Each time the fans are switched on/off they must open/close all the inlet valves, leading to mechanical components needing to respond.
Focus on manure drying...
Helping to reduce ammonia, dust and odours...

Manure drying is a critical process as the cost of shipping wet manure is extremely high. After drying, the manure can be used to produce fertilizer or fuel for boiler systems. Robustness of mechanical and electronic system for use in harsh environment. System needs to run continuously to manage the chicken’s waste product.

VSDs, motors, PLCs, bearings and gearing can be used on the following applications bring energy saving, high reliability and low maintenance costs:

1. **Rotating Belt**
   Slow speed control for dosing wet manure onto plated drying belt.

2. **Synchronized Conveyors**
   Multi-level conveyors move the manure through different drying stages, removing moisture, often over 2 days.

3. **High Pressure Ventilation Fans**
   Warm air is used for drying the wet material using high pressure fans, directed at the conveyors.

4. **Air Scrubbers**
   The air is cleaned using biological cleansers to reduce ammonia, dust and odours.

5. **Output Conveyor**
   Perforated drying belt uses air as the final drying stage.
...and pellet production
...while protecting harsh environments

Dried manure is converted to fertilizer (or fuel) pellets for volume or dust reduction, transport and ease of packaging. The harsh environment requires IP55 enclosures and integrated closed loop controllers.

VSDs, motors, PLCs, bearings and gearing can be used on the following applications bring energy saving, high reliability and low maintenance costs:

1. **HEATED BELT**
   - Heated belts help extract more moisture from the pellets.

2. **PELLETIZER**
   - Dry manure enters the pelletizing press where it is extruded to form pellets.

3. **HAMMERMILL / DOSER**
   - Accurate grinding and dosing is helped by regulating the speed using a VSD.

4. **SYNCHRONIZED CONVEYORS AND AUGERS**
   - Used to transfer the pellets between the different stages of the production process.

5. **CYCLONE**
   - Connects to the silo exhaust and collects any dust that might otherwise escape.

6. **COOLING UNIT**
   - The heated pellets are soft and enter the cooler to harden them, remove remaining moisture and sieve to separate fines.

7. **BAGGING**
   - The pellets are packaged using motors for blowers and transport conveyors.
Maximizing application potential throughout poultry farming

Egg production is needed to meet growing population demands. There is a need to ensure facilities are optimized and efficient, to remove emissions, ammonia and fine dust while saving energy and enhancing food safety and overall productivity.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Solution</th>
<th>Benefit</th>
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<tbody>
<tr>
<td>Augers (Spiral conveyor)</td>
<td>• Demand high reliability as constantly start and stop as the feed’s mixing and dosing requirements change throughout the day.</td>
<td>• Reliability of ABB VSD and motor package provides maximum uptime across all required speed changes, ensuring feed is transported safely, quickly and without being separated. • On-time food delivery for chickens. • Fewer, if any, auger breakdowns.</td>
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<td>Conveyors</td>
<td>• Egg fragility demands a gentle, seamless transfer of products from chicken to tray.</td>
<td>• PID control provides constant feedback loop so motor always operates at correct speed, while automatically compensating for any external factors. • This prevents conveyor drift. • Fewer damaged eggs maintains healthy profitability.</td>
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<td>• Drying and pelletizing manure is costly and demands accurate dosing to avoid waste.</td>
<td>• Using VSD to control motor means speed is more carefully ramped up and down. • Manure is moved uniformly and synchronized with other conveyors.</td>
<td>• High precision control and repeatability leads to a higher quality fertilizer.</td>
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<td>• Motor control centers are located remotely from conveyor, incurring costly, long motor cables.</td>
<td>• Robust IP55/65 motor and VSD package located close to motor. • 3C3 conformal coating inside the VSD protects sensitive electronics.</td>
<td>• Reduced cable costs and lower risk of EMC disturbance.</td>
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<td>Fans</td>
<td>• Good ventilation systems must deliver fresh air inside the house and remove excess heat, moisture and undesirable gases from the house.</td>
<td>• VSDs offer: • easier to equalise pressures • low energy consumption • low noise levels • long service life • Longer interval between maintenance.</td>
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<td>• Pressure between inside and outside layer house needs to be equalized to enable free entry and exit of chickens.</td>
<td>• VSDs accurately control speed of inlet and outlet fans, ensuring a balanced pressure.</td>
<td>• Chickens do not incur obstacle leaving and entering the house, no wet spots.</td>
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<td>• Traditional direct-on-line fan control cannot control over- or under-pressure.</td>
<td>• Power loss ride-through function is used if incoming supply voltage is cut off. • VSD continues to operate using kinetic energy of rotating motor. • VSD is fully operational if motor rotates and generates energy for VSD.</td>
<td>• Boosts reliability of fans ensuring chicken’s welfare is highly maintained.</td>
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<td>• Remote location of egg farms can lead to poor quality mains supply, leading to fan interruption or breakdown.</td>
<td>• VSD provides slow moving circulating fans which are used to push hot air back down to floor level.</td>
<td>• The more uniform the house temperature, the lower the heating costs.</td>
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<tr>
<td>• Hottest air is near ceiling.</td>
<td>• Standards specify how long and at what temperatures ventilation fans should operate in extreme conditions. • Special attention is given to acceleration and braking time.</td>
<td>• Motors must be tested to EN 12101-3 - the most demanding standard for smoke extraction. • In emergency situations, VSDs enter override mode, allowing extended fan runtime in adverse conditions for safe evacuation. • During an emergency, like a fire, ventilation is part of the fire suppression system. It removes smoke and heat from the building, maintains evacuation routes and gives emergency services access to fire location. • VSDs, softstarters, motors and generators are critical to continuous operation of ventilation and fire suppression systems.</td>
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### Feeders
- Accurate and controlled dosage of raw materials and additives is crucial when creating chicken feed.
- VSD speed and/or torque control of feeder motors ensures precise material dosage which is under continuous control.
- Eliminates mechanical dosing systems and enables precise information on dosed amounts of ingredients.

### Hammermills
- High overloads during start and throughout operation.
- Soft starting and reversing, smoothed high torque peaks, easy speed adjustment and change of direction.
- Speed adjusted according to load, improving reliability and prolonging hammermill lifetime.
- Flying start used when a motor is connected to a flywheel or a high inertia load.
- VSD started with a reduced voltage and then synchronized to the rotating rotor.
- Once synchronized, voltage and speed are increased to corresponding levels.
- Reduces start-up times and reduces wear on equipment.

### Mixers
- Accurate control of mixing speeds is critical to achieving correct feed structure.
- VSDs adapt to varying mixing loads, constantly monitoring the torque that each mixing motor requires and adjusting it when necessary.
- Programming recipe’s exact speed and torque saves production time, reduces energy and improves feed quality.

### Packaging machines
- Swift and repeatable movement between packing stages is critical to avoid waste.
- VSD provides high speed operation that ensures maximum throughput, with minimum waste.
- VSDs enable accurate speed control and positioning with minimum pressure applied to eggshells.

### Pumps
- Different day/night feeding and welfare patterns means water supply varies throughout day.
- Built-in PID control and automatic sleep mode regulates pressure.
- Increases lifetime of pump and saves energy.
- Maintaining correct temperature depends on accurate flow of cooling or heating media.
- VSD provides accurate speed control using built-in PID control or linked to external building management system.
- Avoid pressure peaks in pipelines by building up flow in a controlled manner.
- Mechanical control valves and bypass lines are subject to leaks and pressure surges.
- VSDs simplify pipe systems by eliminating control valves and bypass lines and provide soft-start and stop, thereby reducing wear on motors and avoiding leaks caused by pressure surges.
- Replacing throttling with VSDs to control flow rates, reduces speed of the pump, delivering electrical power savings based on the cube of the reduction.

### Refrigeration & cooling
- Any refrigeration system with a wide load variation during its operating hours, or with a heat load less than peak load, runs risk of high energy use.
- A VSD-motor package increases capacity due to capability of running above nominal speed.
- Stable suction pressure ensures consistent cold room temperature.
- Reduces operating costs and CO₂ emissions.
Features and functions benefiting poultry farming

Drives, softstarters, motors, gearing and mounted bearings all play a vital part in keeping egg production moving. Choosing the right products and features for the right environment is essential in ensuring an optimized production.

Variable speed drives

- **Anti-cavitation software**
  - Extend pump lifetime and secure the process by detecting cavitation and ensuring optimal process or liquid flow.

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

- **Fieldbus compatible**
  - Get detailed insight into productivity performance and quality control through fieldbus comms connecting VSD with plant monitoring systems.

- **Flying start**
  - Reduce wear and save time by starting a motor while the load is still spinning.

- **Low harmonics**
  - Eliminate supply disturbances that could trip production with built-in active supply unit and integrated low harmonic line filter.

- **Reduced noise**
  - Protect staff and animal welfare with lower motor noise through adaptive switching frequency control.

- **Repeatability**
  - Accurately adjust conveyor speed to suit different products.

- **Ingress protection**
  - IP55 for washdown zones.

- **Protection**
  - Temperature, load, under/overvoltage protection, and warning features within drives help anticipate breakdowns.

- **Multiple I/Os**
  - Provide a variety of process information from the VSD to motor control. Egg counters can be connected to VSDs.

- **Mains imbalance outage de-rate**
  - Should one main phase fail, the VSD reduces speed to 70 percent, giving a 50 percent load to the drive to keep it running. Improves motor reliability.

- **Bypass function**
  - Although seldom used, enables load to be connected directly to the mains.

- **Temperature de-rate**
  - If VSD becomes too hot it will reduce its switching frequency to produce less heat but will not stop running.

- **C3C conformal coating**
  - Protects sensitive electronics against ammonia and other aggressive gases.

Softstarters

- **Built-in bypass**
  - Reduce system complexity and size, saving time and money during installation.

- **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.

- **Maximise 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.
 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 VSD 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
High efficiency motor and drive (SynRM)
- Save energy across all applications with IE5 efficiency 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.

Gearing
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 percent per stage help to reduce energy costs.
- A variety of input and output configurations allows versatility.
From the layer house to the cloud and beyond

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

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

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.
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.

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 and change the maintenance from reactive to predictive.
Protecting poultry welfare

From spare parts and technical support to cloud-based remote monitoring solutions, ABB offers the most extensive service offering that ensures your layer house never stops producing. The global ABB service units, complemented by external Value Providers, form a service network on your doorstep. Together they 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, VSD, 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 products life cycle, providing preventive maintenance programs tailored to your facility’s needs.

ABB ensures you are aware of any upgrades or retrofit opportunities. If you’ve registered your VSDs and motors with ABB, then its engineers will proactively contact you advising 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

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

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

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

Global service network 24/7
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 the engineering supply chain responsible for building layer houses, ensuring installation reliability and efficiency are top priority.

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:
• 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 visibility and making the system safe, reliable and efficient.

**Streamline sourcing**

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