F&B CUSTOMER DAY 2018 | SURABAYA , SEPTEMBER 5, 2018

VSD Driving Energy Efficiency in F&B

Helping to do more with less

Karthikeyan, A, Area Sales Manager – Low Voltage Drives

Agenda

1. Situation today - Customer Challenges and Expectations
2. Importance of Energy Efficiency in F&B
3. What is a drive ? How drives save energy ?
4. ABB experience in diverse application within F&B
5. Summary - Importance of Total Cost of Ownership

Three main forces

That are shaping the future of consumer companies

1.

Changing face of the customer

2.

Evolving geopolitical dynamics

3.

Advances in technology and innovation

And can be addressed by focusing on cost, quality and flexibility

1  Changing face of the consumer

2  Evolving geopolitical dynamics

3  Advances in technology and innovation

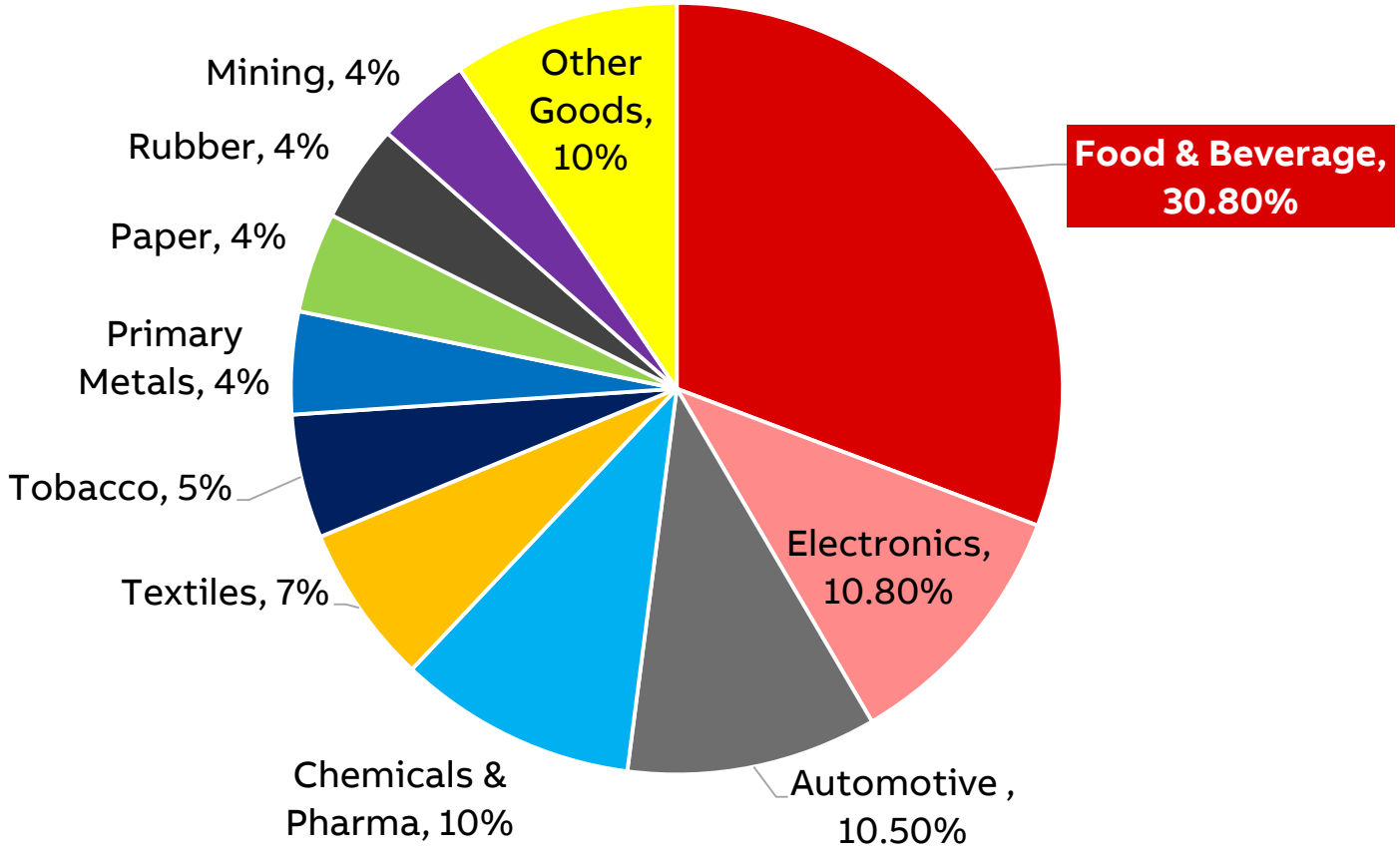
1 Reduction of conversion **cost** and COGS

2 Enhance **quality, sustainability** and traceability

3 Increase in supply chain **flexibility**

F&B – A key sector in manufacturing industry

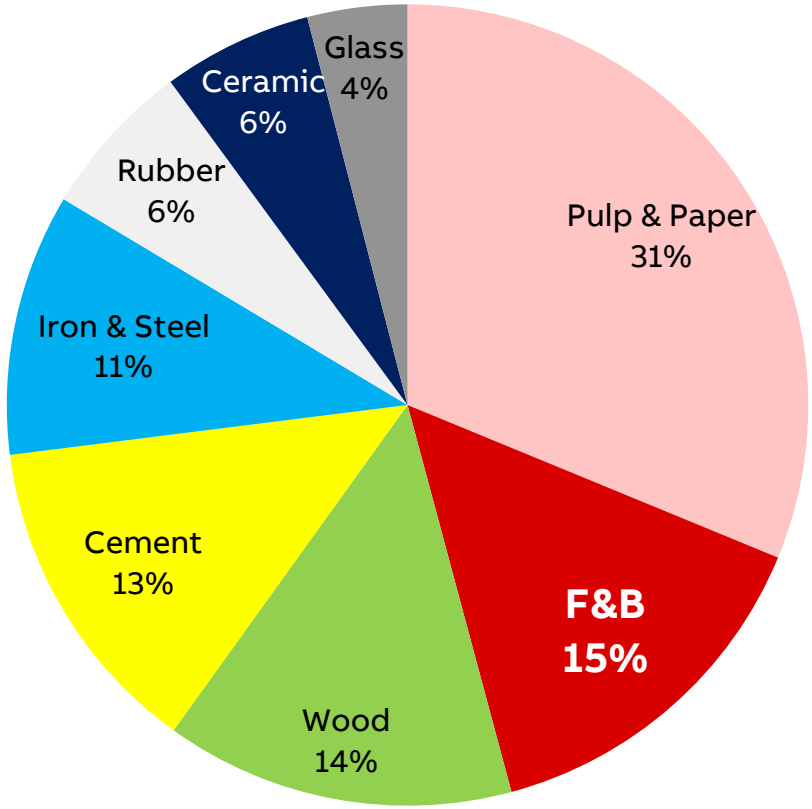
Contribution to manufacturing sector



Energy Efficiency key to improve competitiveness, Energy Cost vary between 10-30% of the Cost

Energy saving potential

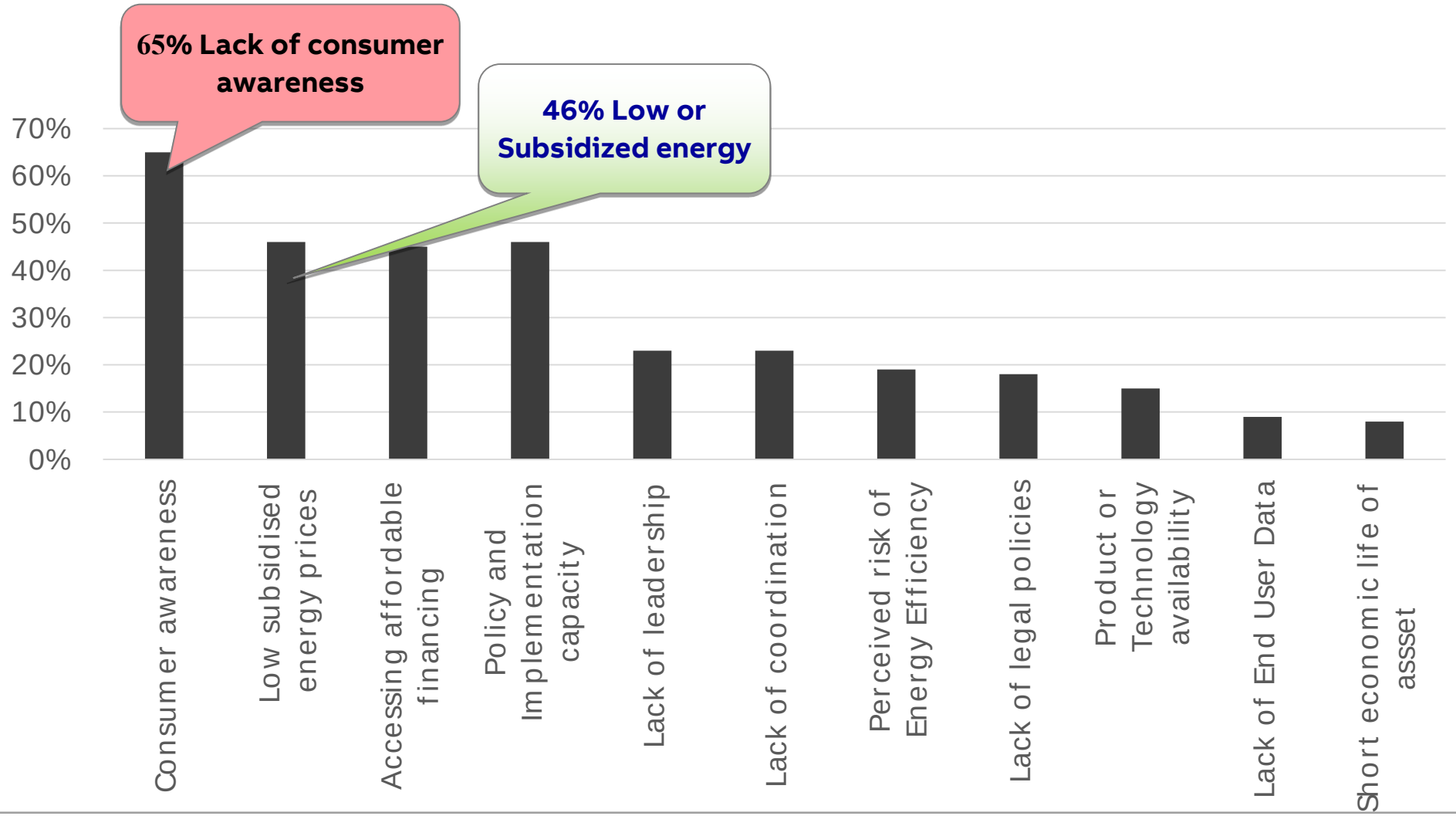
Opportunity to improve Energy Efficiency



Potential to improve EE by atleast 15%

Source : Independent Study

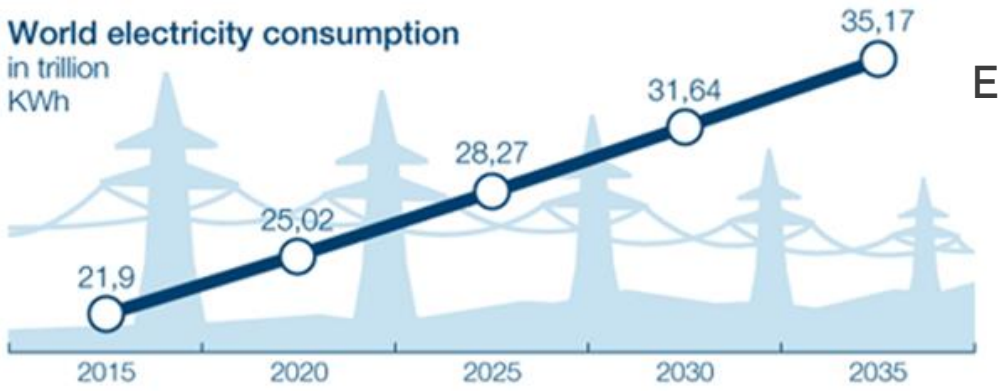
Energy efficiency barriers



Source : IEA Energy Efficiency Study

The world’s demand for energy will not go away

ABB Drives help use energy more efficiently



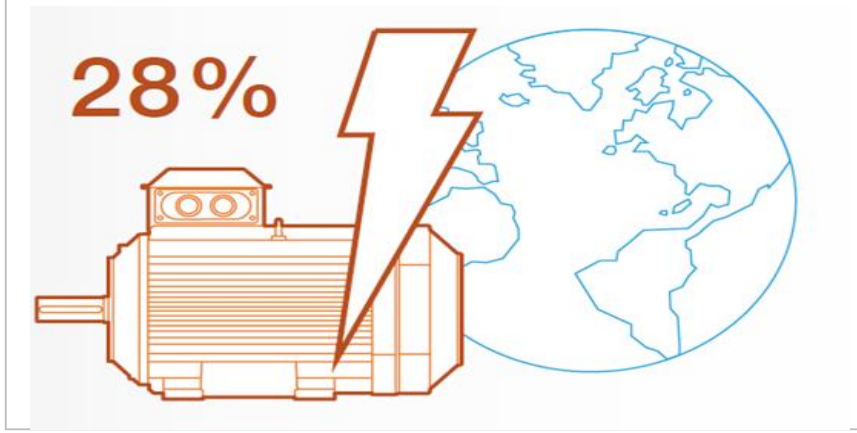
Electricity demand

+84%

by 2050

Less than

10% of the Motors are equipped with VSDs.



Motors consume about

28%

of the world’s electricity

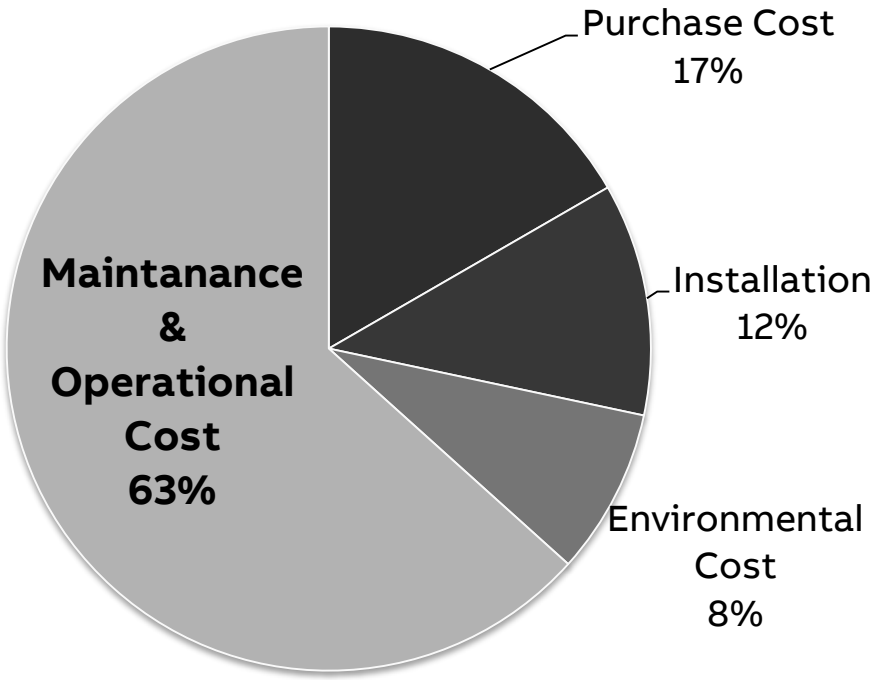
Energy efficiency measures can reduce consumption by up to

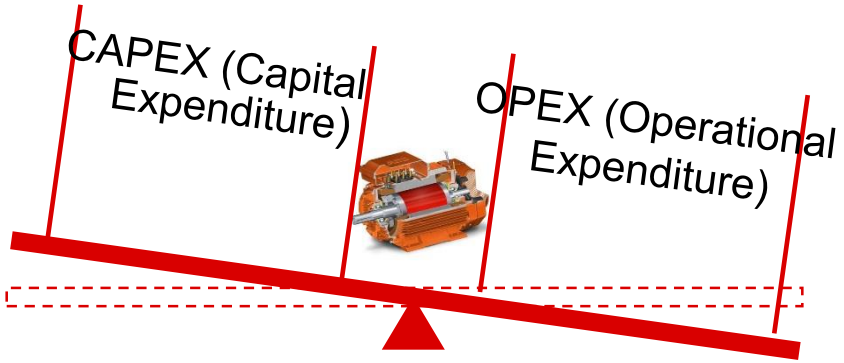
60%

Why to concentrate on Motor – Drive system

Huge potential for savings

Life Cycle Cost of Pumps





For 1 USD spent for CAPEX for electrical motors, there will be an average expenditure of 100 USD to operate the machine in the following 10 years

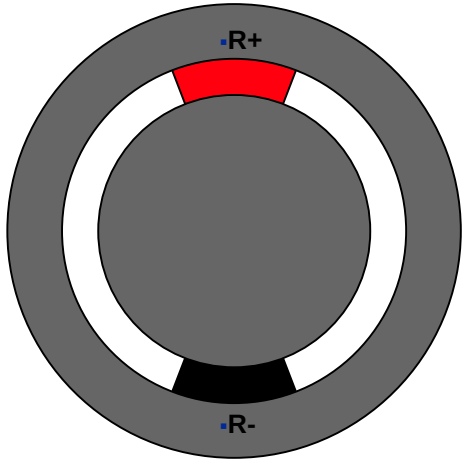
Total Cost of Ownership

How more Efficient Motors can help save energy

Why do we use drives

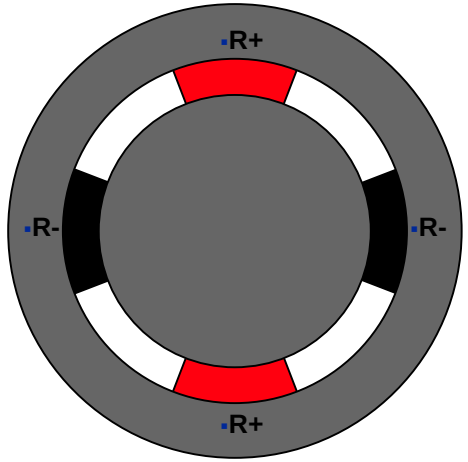
Motors run at fixed speeds

2-pole



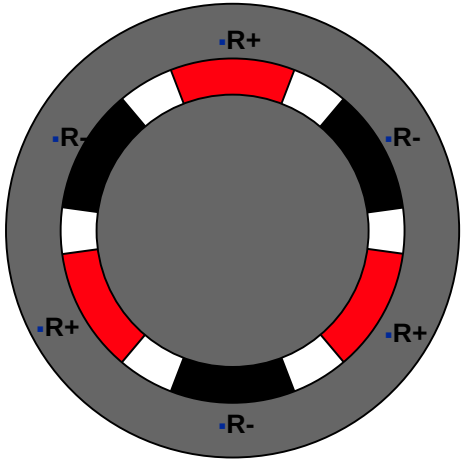
3000 rpm

4-pole



1500 rpm

6-pole



1000 rpm

Why do we use drives?

In a word, control

Benefits of control

The needs of many modern systems vary. This can be because of

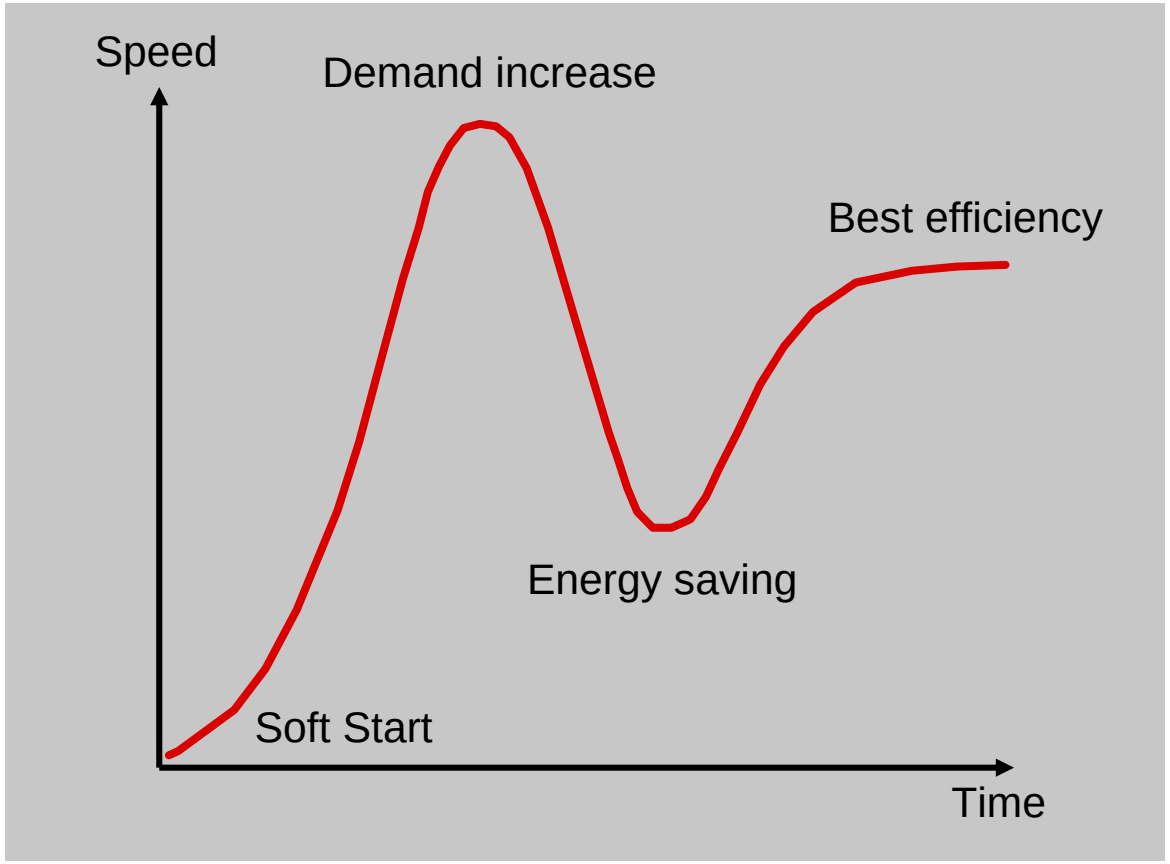
- Demand
- Changes in tariffs
- Energy reduction

Let's look at an example using a pump.

By controlling the speed of the motor, we can effectively and efficiently control the flow, level, or pressure of the system.

This is true even if the demand of the system changes.

Using this type of control removes the need for throttling using valves or bypass systems that are inefficient.



Affinity Law Pump Characteristics

Why does using drives save so much energy?

Effects of speed variation - Simple physics

Pump speed has a direct effect on Pump performance

Flow (Q) α Speed (n)

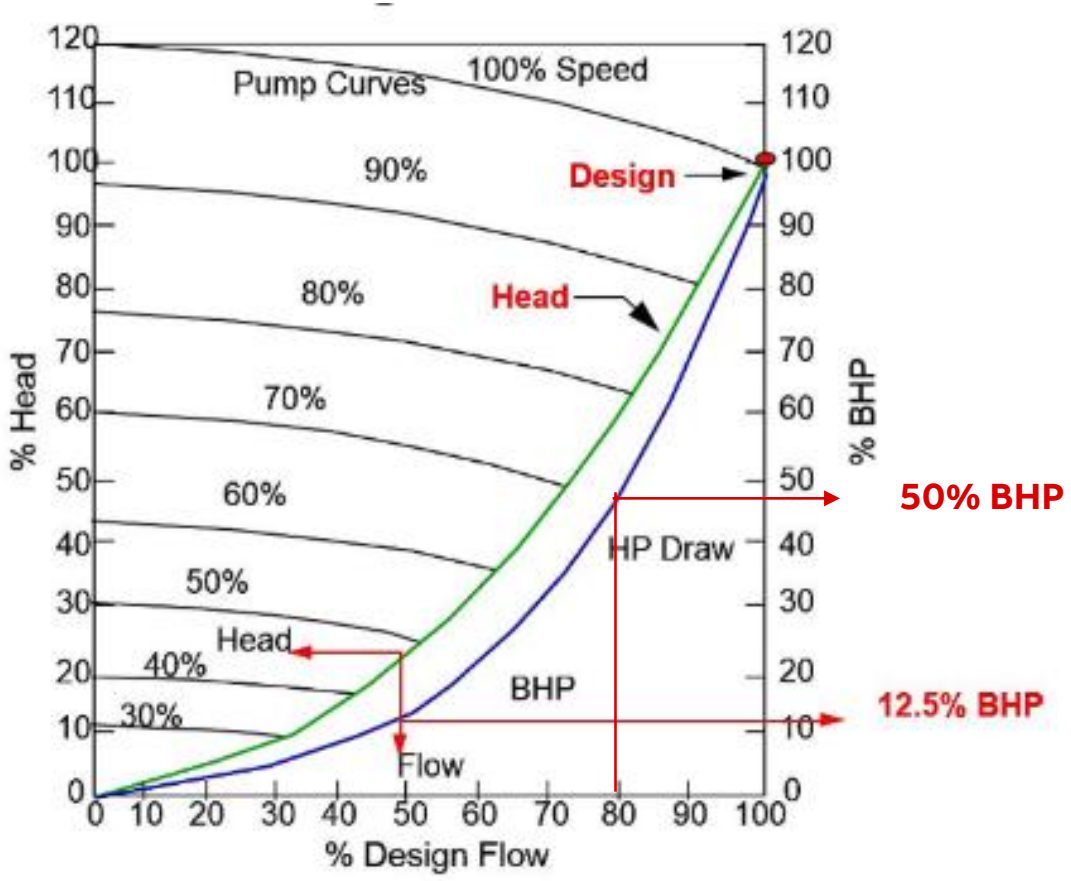
Head (m) α Speed (n^2)

Power (kW) α Speed (n^3)

Torque required increases as the speed increases.

Slowing down in variable torque loads saves lots of energy

Centrifugal loads such as pumps and fans

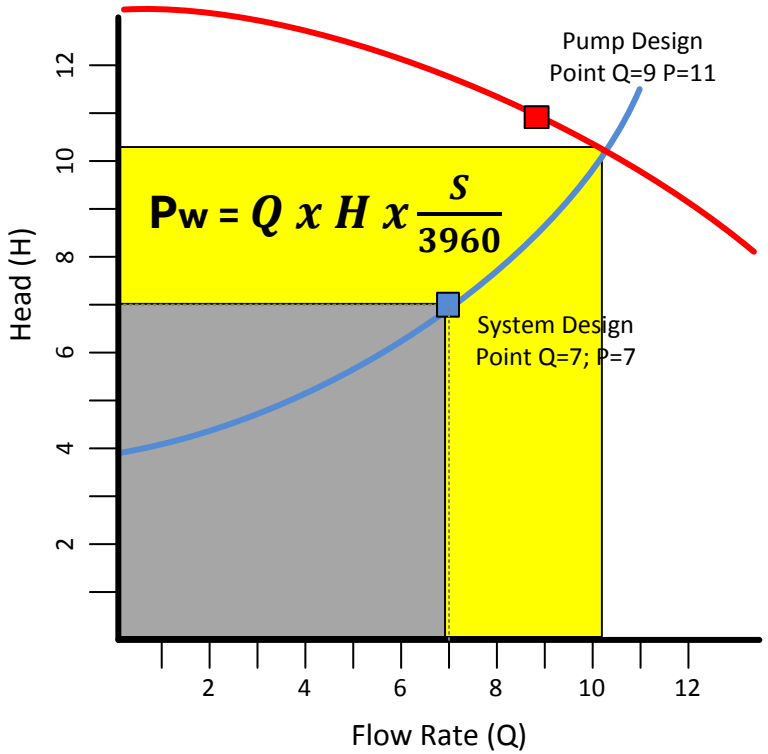


Variable speed pumping

How VFDs save energy in pumping applications

Operating pump at rated speed:

- Common practice is to oversize pumps for maximum flow and head, plus safety margins
- This makes for very inefficiency pumping
  - Power consumed is a function of Flow x Head

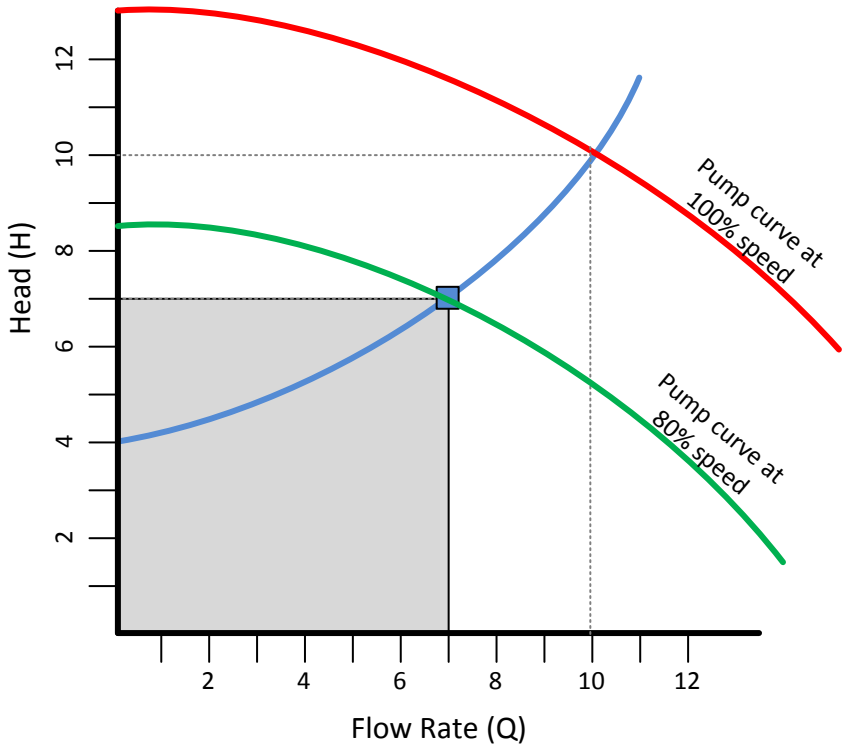


Variable speed pumping

How VFDs save energy in pumping applications

Controlling flow by using VFDs:

- Variable speed control allows for **exactly matching the pump operating point with the system needs**
- Most energy efficient pumping control solution in most applications
- **Allows for the pump to be oversized to meet future or periodic high flow requirements,** without wasting energy during the majority of operation
- **Allows for improved pump efficiencies** in many applications
- Provides a payback on investment for the user

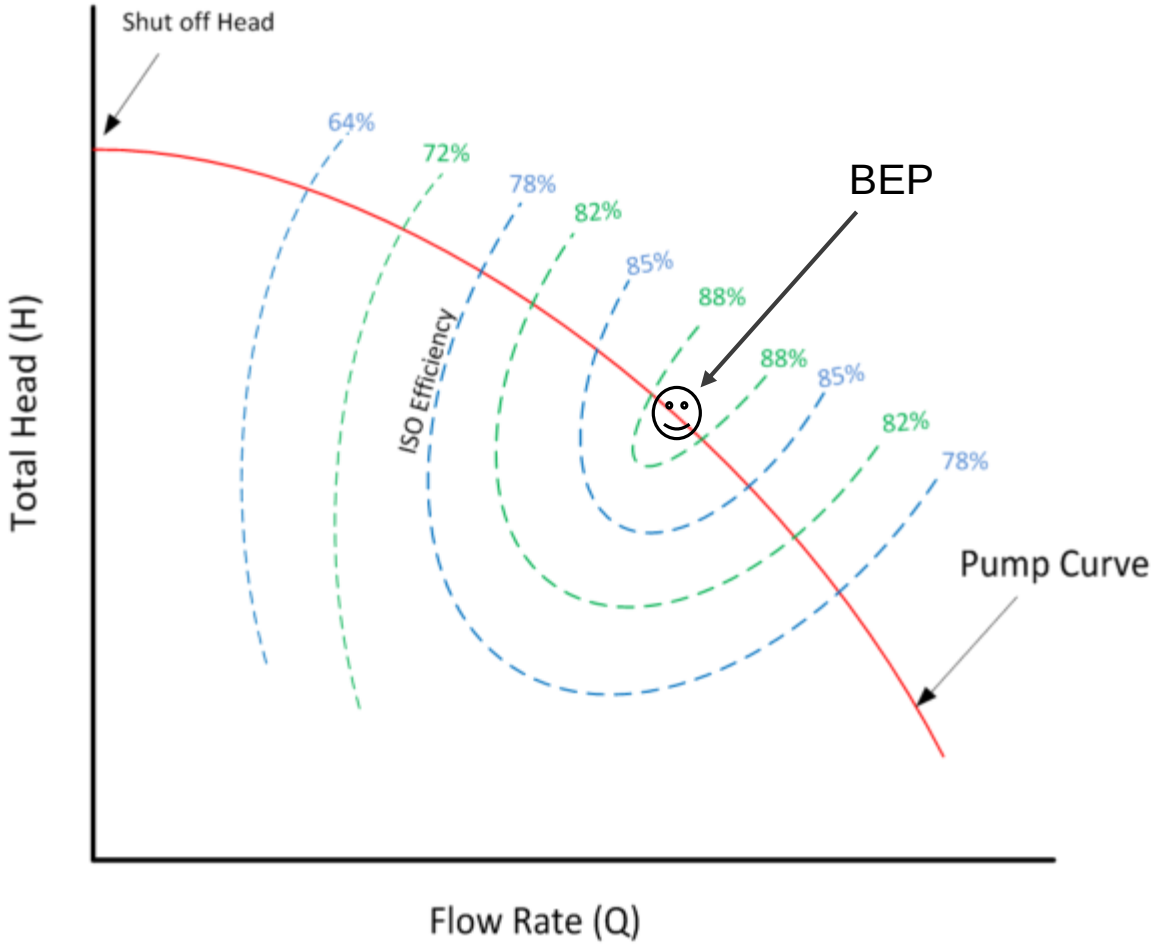


Variable speed pumping

Pump Efficiencies

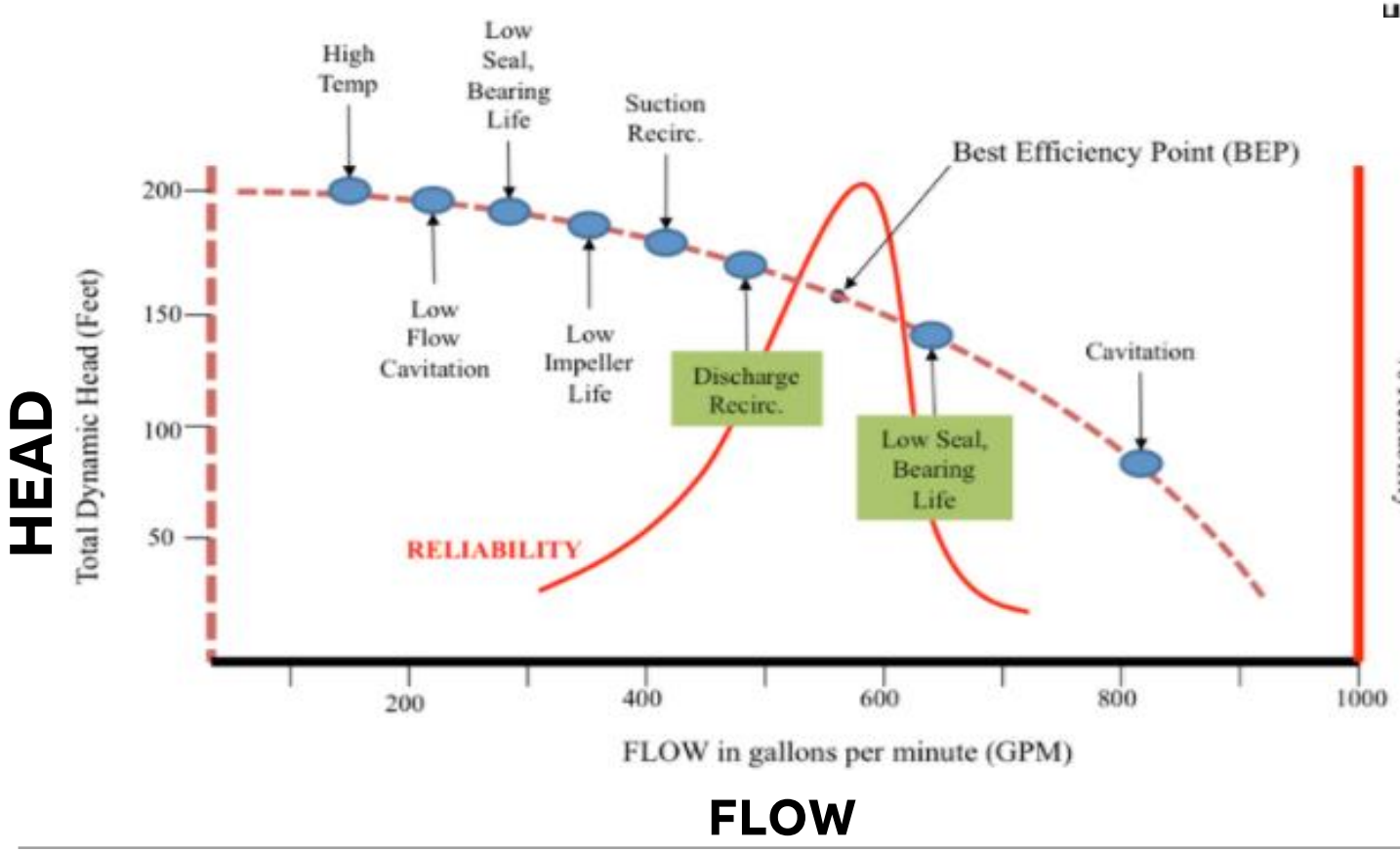
Pump Operating at Rated Speed:

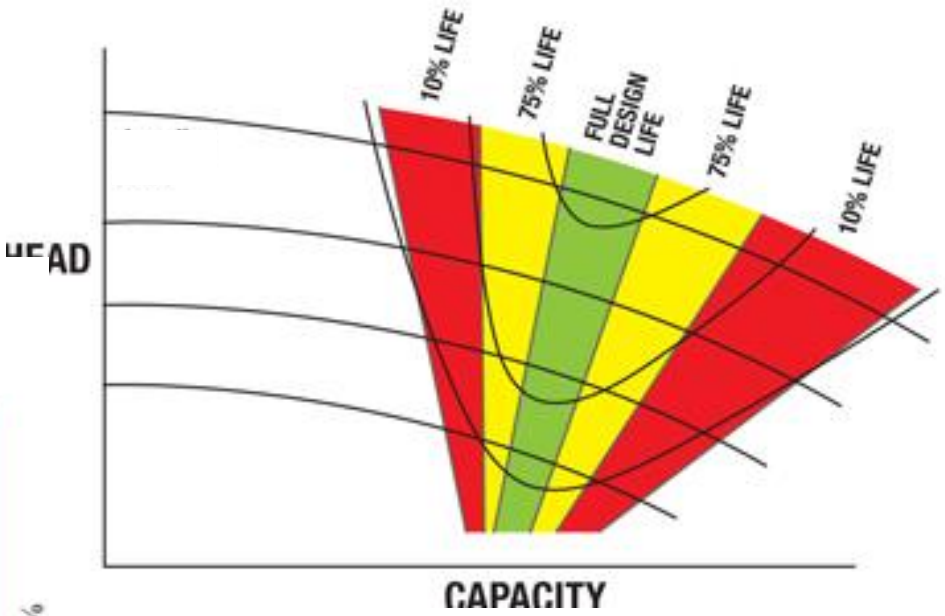
- Only one operating point of Best Efficiency (BEP) on the pump curve
- As Head Increases from BEP, Efficiency decreases as the operating point moves up the pump curve towards Shut-Off Head
- As Flow Increases (which means Head Decreased) from BEP, Efficiency decreases as the operating point moves down the pump curve.



Variable speed pumping

Best Efficiency Point and system reliability





The **BEP** is NOT just the point of best efficiency, but rather the operating condition that results in equilibrium.

- Vibration
- Bearing failure
- Mechanical Seal Failure
- Shaft breakage

ABB expertise in F&B Segment

Help to do more with less

Sugar

Grain and Flour

Meat and Poultry

Dairy & Beverage

Edible Oil

Snacks & Bakery

Palm Oil Plant

Key process and products

Areas for improvement

Sterilization

Crushing / Thresher

Digester

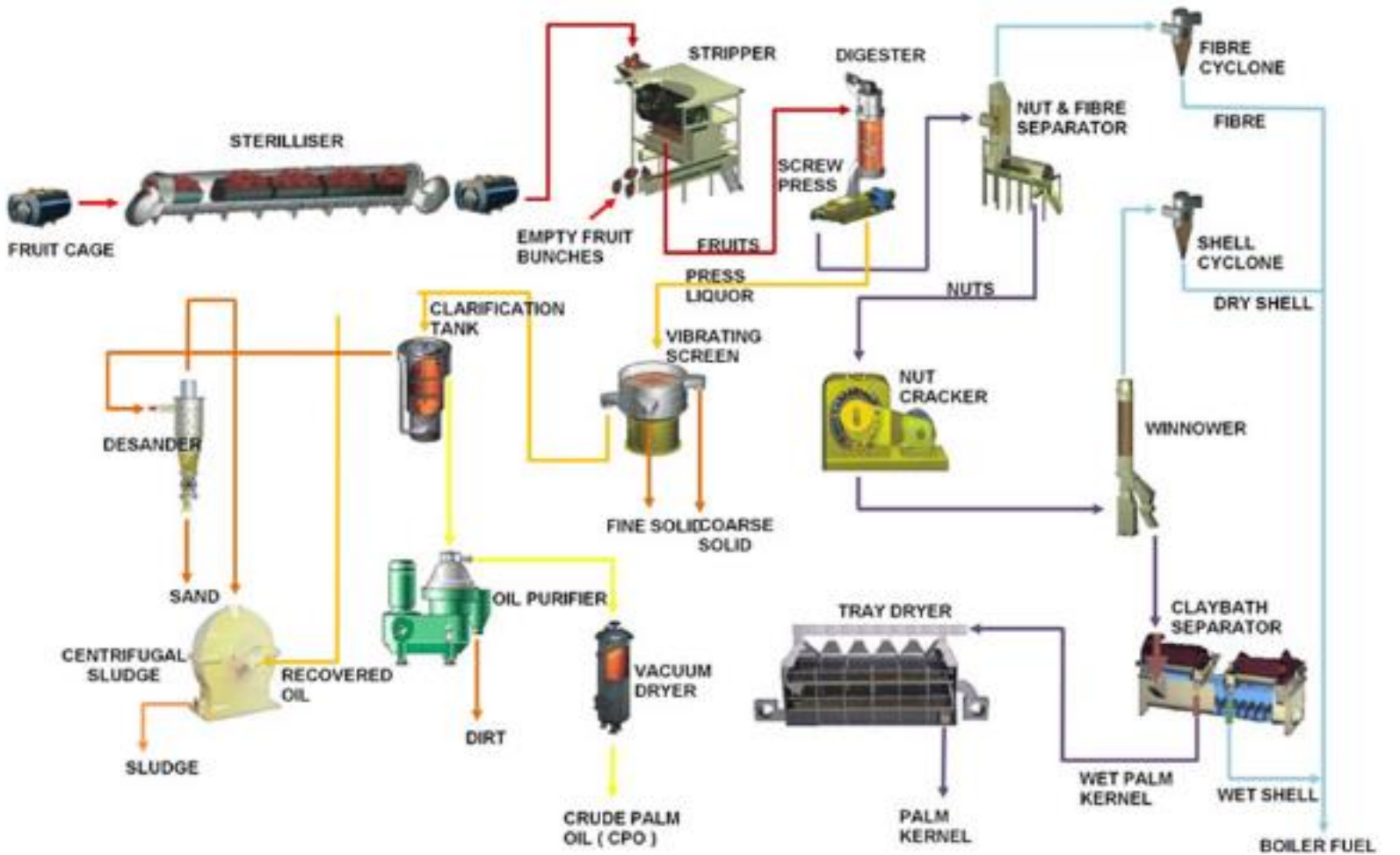
Screw Press

Clarification

Separators

Boiler – Steam for Process

Crude Palm Oil



Palm Oil Process

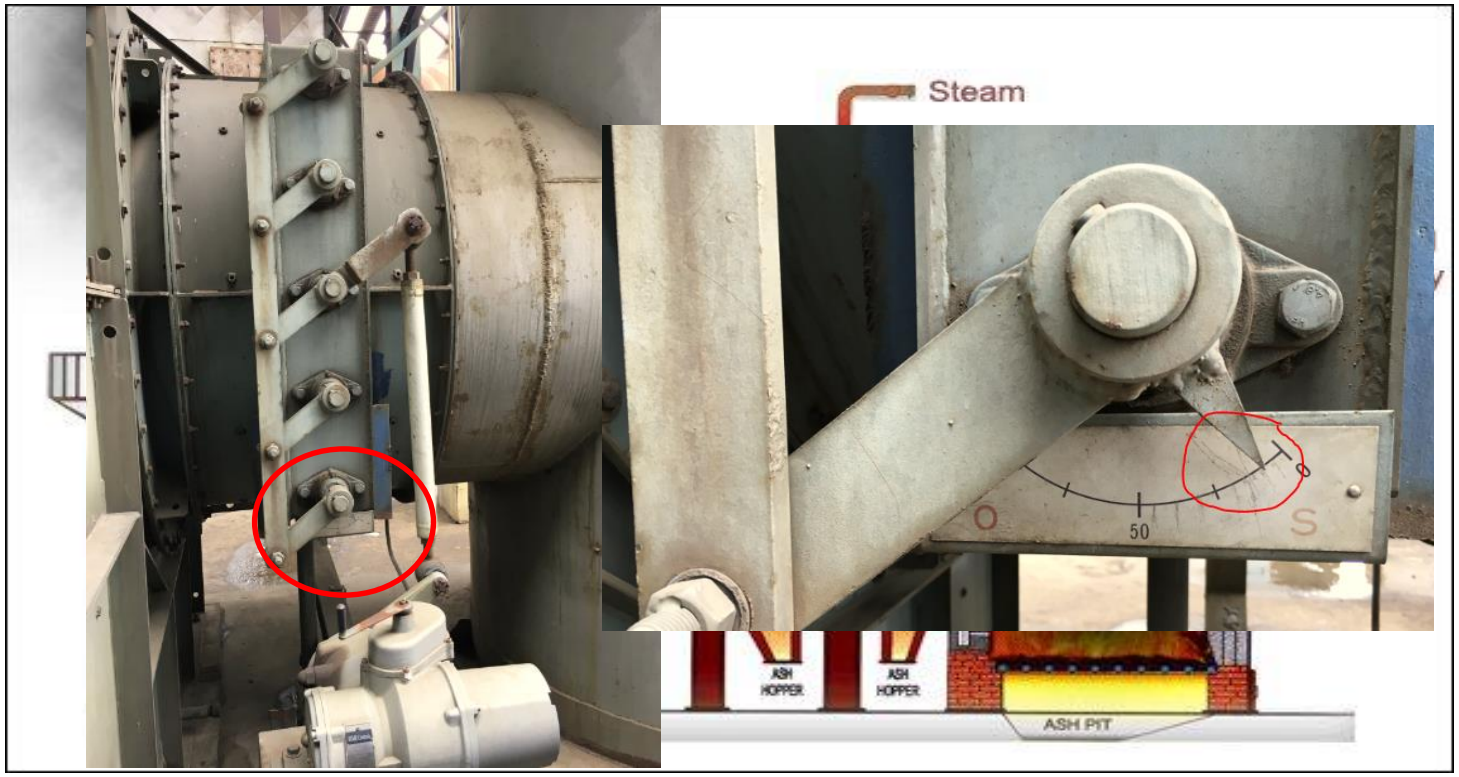
Boiler

Typical Automation Solution

Steam – Most important input for the process Cogeneration in Palm Oil Plant

Typical Application Area in Boiler
- **ID, FD Fan**
- Fuel Feeders

Key Benefits
- **Maintain required pressure in furnace**
- Energy Saving
- **Reduce Auxillary Power Consumption**



Palm Oil Process

Key process and products

Refining to Oleo Chemicals

Refining - Removal of impurities

Oleo Chemical Plants

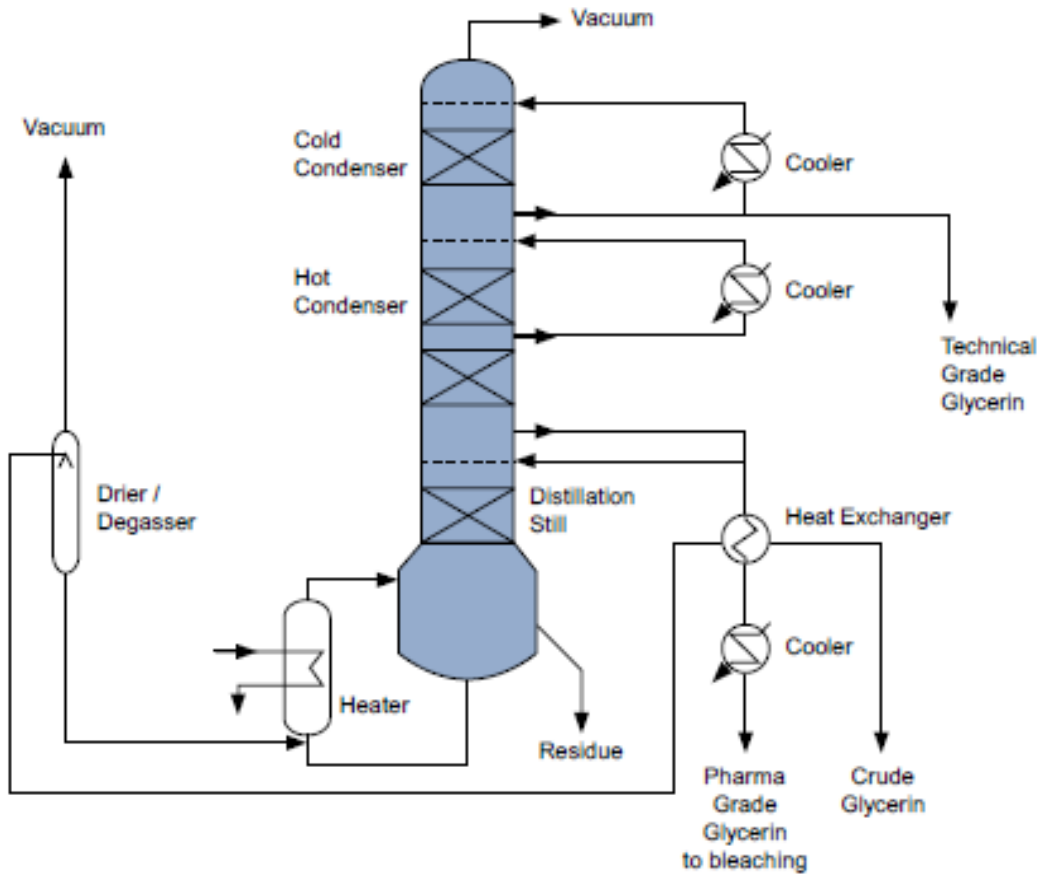
- Biodiesel
- Oil Splitting, Distillation
- Hydrogenation
- RBD Palm Oil, RBD Olein, RBD Stearin

Major Application

- **Pumps – Process and Secondary Chilled Water Pumps**
- Chiller Compressors
- Decanters

~ 40% of Power Consumption is in Cooling Tower in Oleo Plant

Opportunity for Energy Savings – Drives & Motors



Palm Oil Process

Cooling Tower

Energy Savings opportunities

~ 40% of Power Consumption is in Cooling Tower in Oleo Plant

Opportunity for Energy Savings – Drives & Motors

Fans operate at constant speed regardless of ambient temperature and humidity

Process cooling requirements vary depending on demand.

Solution

Closed loop control of Cooling Tower Fan based on Sump or return header.

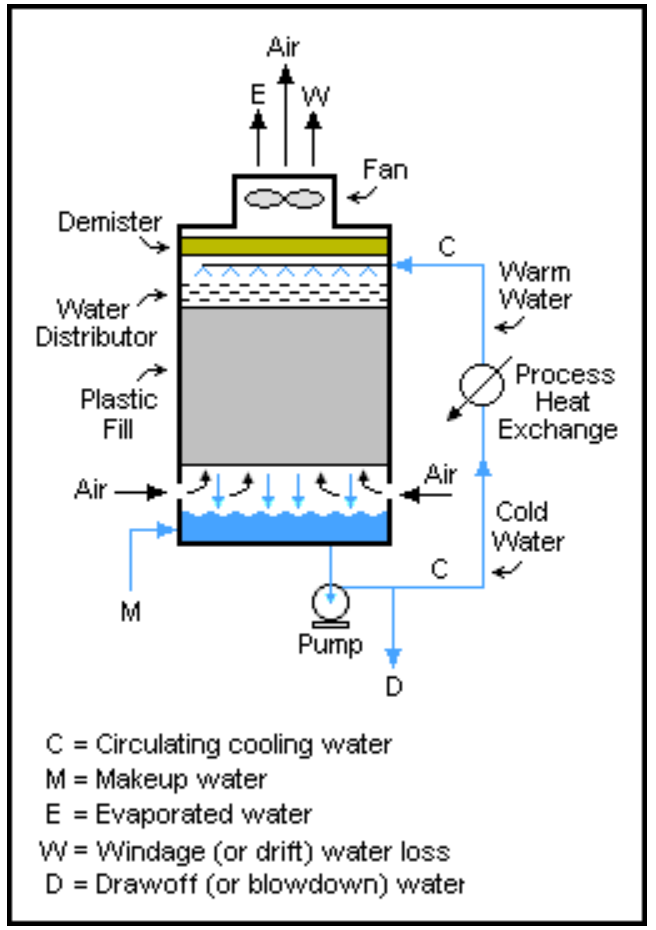
Multiple cooling Towers – Staging of Cooling Towers

Estimated Savings

- **Energy saved = 9500 kWh (operating time 300 days x 24 hrs)**
- **Cost savings = $ 1050**

Estimated Cost of Project = $ 2300

Simple Payback = 2.1 years



Energy efficiency

Chiller Compressor

Energy saving opportunities

Present Operation (Rated Motor Power 200kW)

This screw type chiller supplies chilled water to HF3 line process

Chilled water demand varies by 15-20%

This varying demand is met by slide valve type capacity control mechanism

Chiller runs only 3 months a year

Proposed Control Scheme

Use VSD instead of slide valves to meet the varying capacity requirements imposed by process

Estimated Savings

- Energy saved = 33,000 kWh (operating time 90 days x 24 hrs)
- Cost savings = $ 3800

Estimated Cost of Project = $ 8400

Simple Payback = 2.2 yrs

Energy efficiency

Pumps

Raw water treatment plant in a Beverage Plant

Present Operation (Rated Motor Power 11kW x 3)

- Raw water is supplied to the process lines through a common header
- Water is pumped throughout the circuit irrespective of numbers of line in operation
- During less water requirements the header pressure goes up

Proposed Control Scheme

- Control the flow by a VSD with pressure feedback from the main header to meet the process requirement while saving energy

Estimated Savings

Energy saved = 16,700 kWh (operating time 300 days x 24 hrs)

Energy savings = $ 1920

Estimated Cost of Project = $ 1200

Simple Payback = 0.65 yrs

Energy Efficiency

Refrigeration Compressor cold storage

Refrigeration Plant

Solution overview

- Compressor's are a key application in a Refrigeration Plant.
- Critical and Compressors consume almost 75-85% of Power in a cold storage plant
- Standard Reciprocating compressors has "Fixed capacity control
- Operate at 100% / 66% / 33%" – No linear capacity control
- With **Closed loop PID Control in ACS580** customer can have **"Step less capacity control"** and save energy compared to traditional control.
- Precise Cooling & Closed loop Control
- Stable Control – Stable Temperature

Energy efficiency & Process Improvement

Variable Speed Drives for Animal Nutrition Plant

Solution

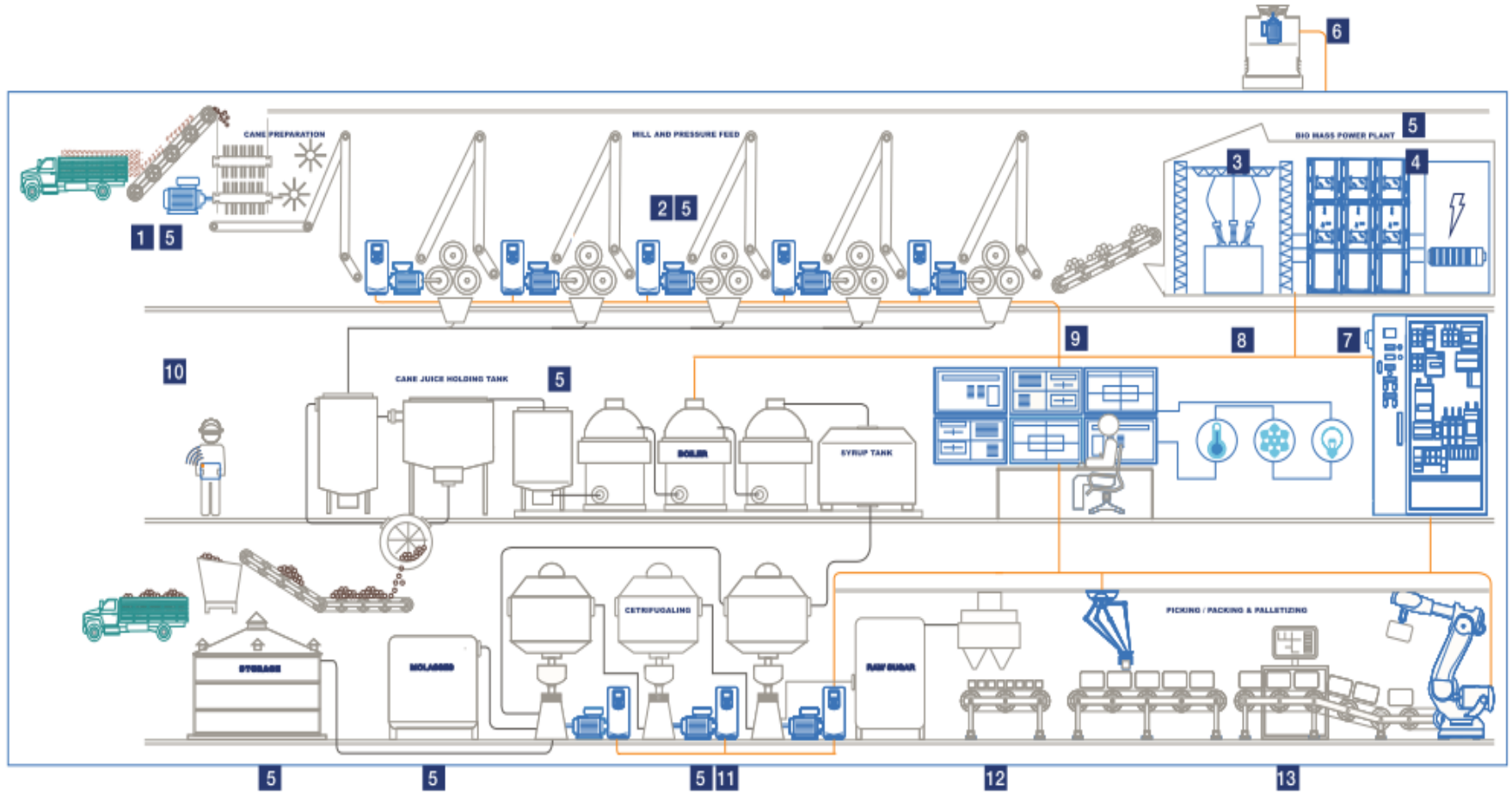
- ACS580 Drives the Cattle feed plant covering wide application,
- Drives covering various applications in feed plant ranging from 5.5 kW to 250kW
- Compressors
- Extruders, Grinders
- Mixers
- Conveyors, Fan & Pumps
- 50+ ACS580 and Softstarters of various ratings covering all applications
- All the drives are connected to the Plant DCS

Sugar process

Improvement areas for Process and efficiency

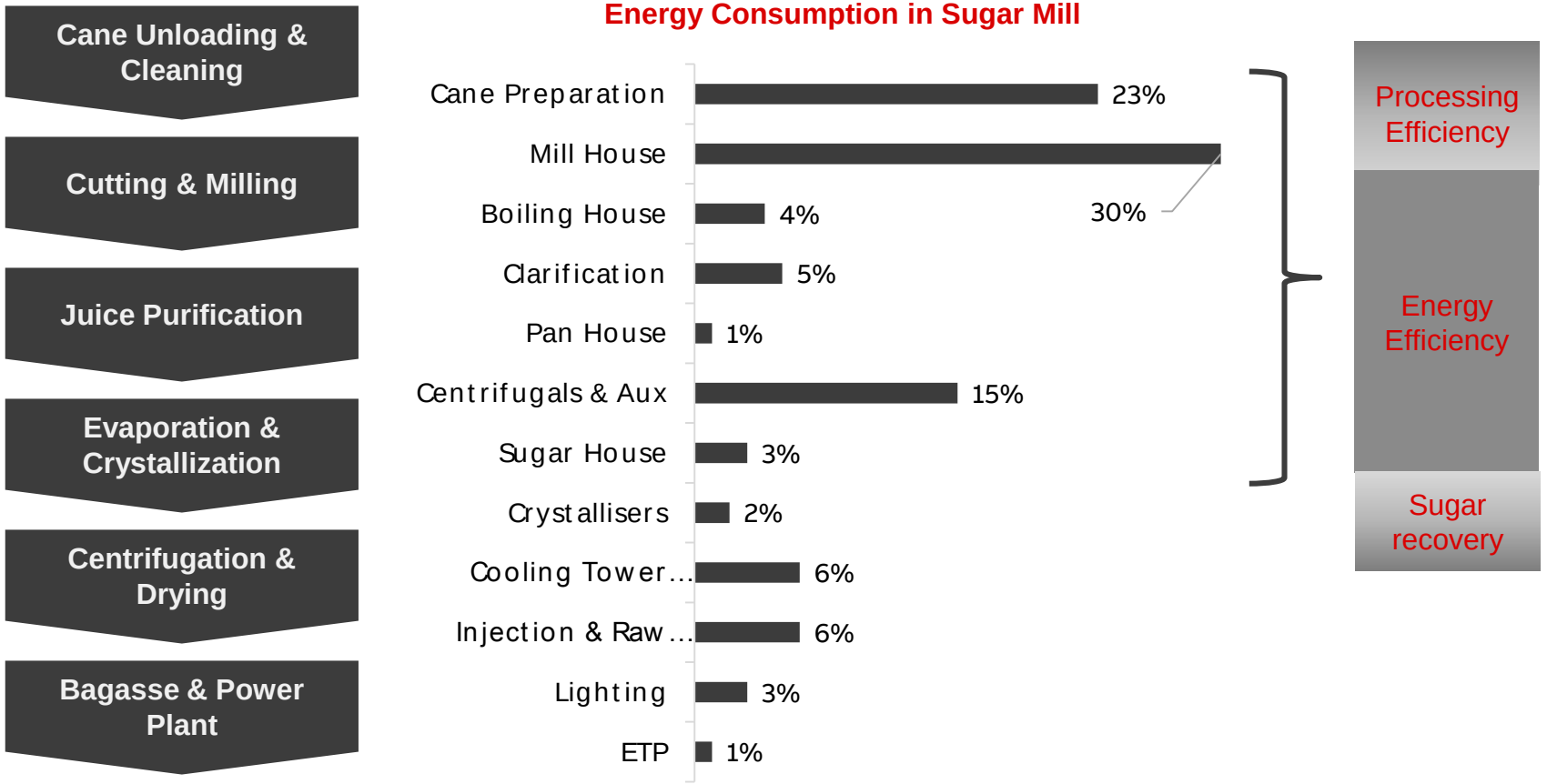
Improvement Areas

1. **Cane Preparation**
a) Cane Carrier,
b) Rake Elevator
c) Chopper & Shredder
2. **Milling Train**
a) Mill Drives
b) Fibrizer
3. Clarification
4. Evaporator
5. **Crystallization & Separation**
a) Process Pumps
b) Vacuum Pan
c) Centrifuge
6. **Cogeneration**
a) Fan – ID/PA/SA Fan
b) Boiler Feed Pump
c) Feeders
7. Water Treatment Plant
8. Utility



The Sugar Process

Opportunity for Optimization in the Sugarcane Process



Source : ISSCT, SIMA

Milling Train

Mill Train: Getting Juice From the Cane

Improvement areas with Drives

- Maximize extraction of Juice is the most important thing
- **Reliability – Less breakdown**, Stoppages
  - **High Ingress Protection** (IP)
  - Proven insulation system
- Ability to handle overloads and transient torque
- Wide Choice for Motor and Drives
- **Excellent motor control**, helps in continuous operation for any sudden loads and **avoids any tripping**
- Optimized **Mill House Efficiency**
- **Cost effective system compared to Steam turbine** and traditional system
- Better automated process through Field Bus communication

Milling

Improving Efficiency

Old System – Steam Turbine

New System – Electric Motor and Drive

Milling

Improving Efficiency

Key Benefits of Electric Motor and Drive

- Mills are run invariably at speeds other than rated speed – Depending on the cane availability
- Turbines are constant speed prime movers
- ~ 25 – 30 % Savings potential with Motor & Drive
- Easy Start and Stop of Mills
- Low Operating Cost – Lubrication, Valves, Free of Oil
- Poor Efficiency : ~ 55 to 60%
- Savings of Steam > Savings in Bagasse
  (1 MT of Steam = 0.45 MT of Bagasse)

New System: Electric Motor and Drive

Boiling House

Key Benefits of Drives In the Boiling Process

Major Applications

- Imbibition Pump
- Juice Pump, Milk of Lime
- Clarifier, Injection Water Pump
- Condensate Pumps
- Mud Circulation Pump
- Vacuum Filter
- Evaporator and Boiling Plant
- Vacuum Pan
- Continuous Pan
- Feed Control Loop
- Seed Magma Feed Control
- Flow of Grain by controlling Metering Pump.

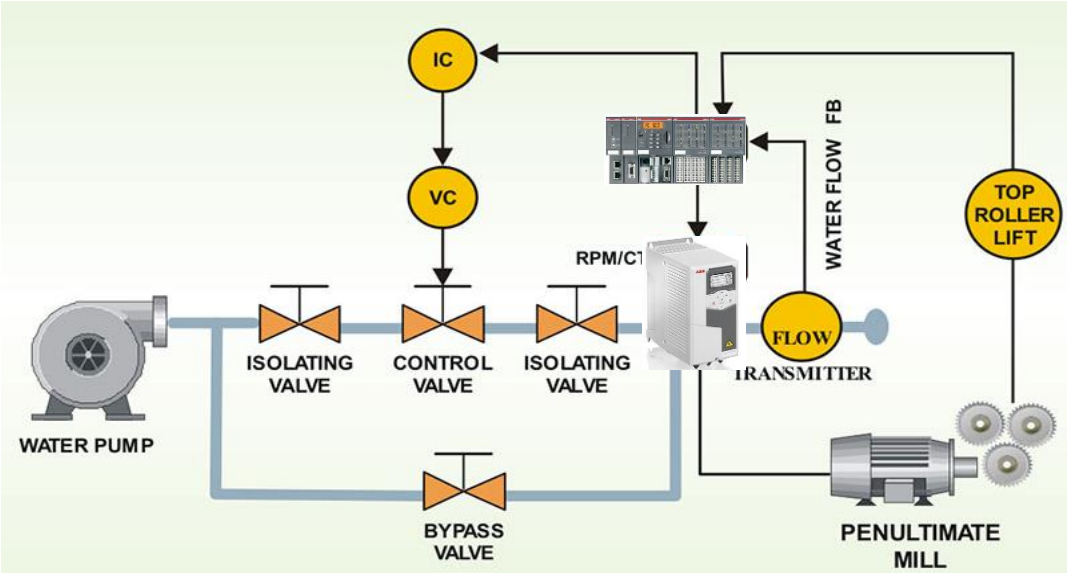
Key Benefits of Drives

- **Maintain the right material flow** in to the process : Flow (l/s), level (m) or pressure (pascal/m^2)
- **Load Types : Variable torque**, high starting torque for high density liquids
- **Closed loop control**
- Automatic start and stop of parallel pumps
- Soft start **minimizes stresses** in the pipes
- **Energy savings with the variable flow** and variable liquid thickness
- **Flexibility to increase the production** capacity for shorter or longer period
- **Integration with plant DCS**

Boiling House

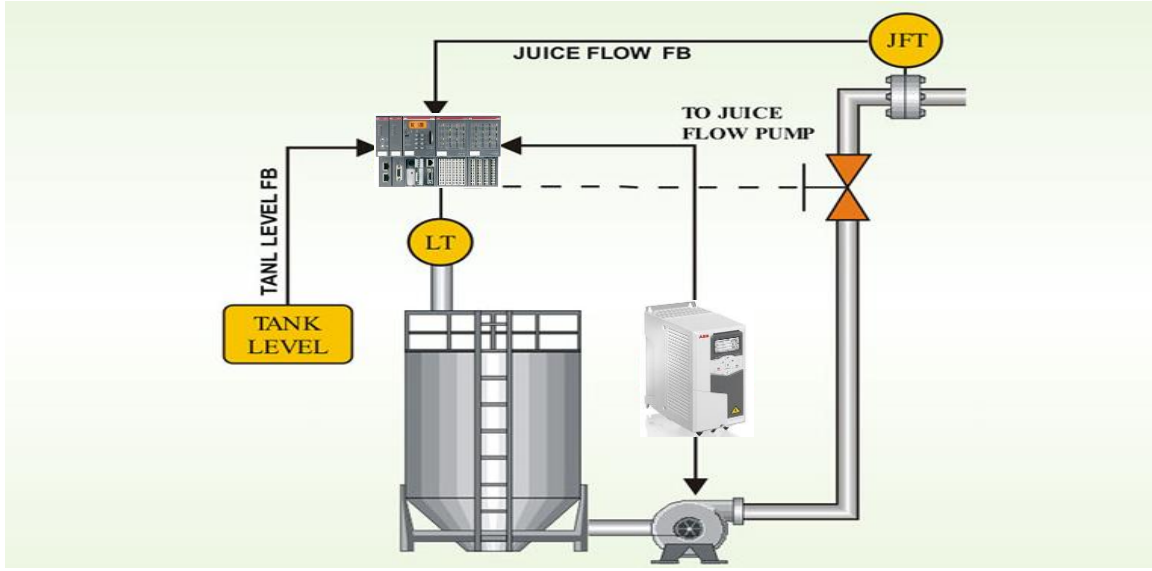
Process and Energy Efficiency

Imbibition Automation



- Maintains dry bagasse feeding, hence results in increased efficiency.
- Improved mill extraction & bagasse poll in terms of recovery.
- Increase in boiler efficiency.
- Water saving.

Juice flow stabilization



- Constant juice flow ensures:
- Improved boiling house performance.
- Better juice **pH control**,
  - results in better efficiency
  - **Sugar quality**.
- Maintaining constant tank level.

All-compatible drives portfolio

Learn it once. Use it everywhere

- Easy, robust, cost efficient products for water and wastewater applications
- From fractional-kilowatt to multi-megawatt
- From low voltage to medium voltage
- Compact and cost effective high IP class solution
- High robustness and quality, guaranteed uptime
- Easiness inside

ACS580 / ACS880
0.75……4500 kW

ACS580 MV
200…6300 kW

Scalable offering from 0,75 to 4500kW

3 different product types for different customer requirements

Wall-mounted drives

Wall-mounted IP21 or IP55 enclosures

- 3-ph 380 - 480 V
- **Power range up to 250 kW**

Multiple mounting methods

- **IP55, Side-by-side,** flange mounting, horizontal mounting

Enclosure classes up to IP55

- **Compact IP55 offering** for installing drive without cabinets

Drive modules for cabinet installation

Drive module for cabinet mounting

- 3-ph 380 - 480 V
- 250 – 500kW
- **Maintenance friendly**

Optimal for cabinet builders and OEMs who are looking for compact and custom engineered solution

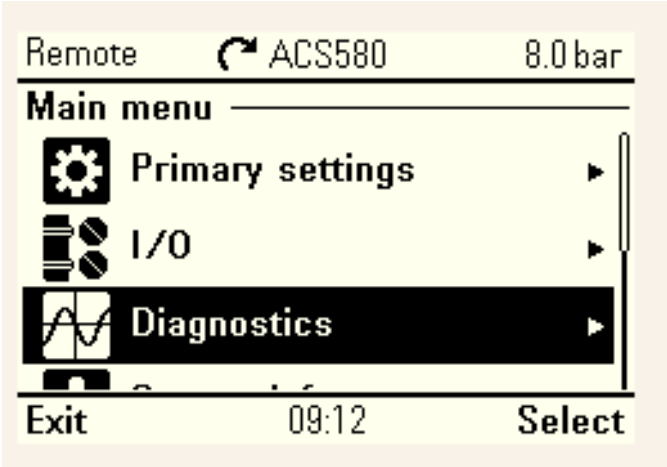
Cabinet-built drives

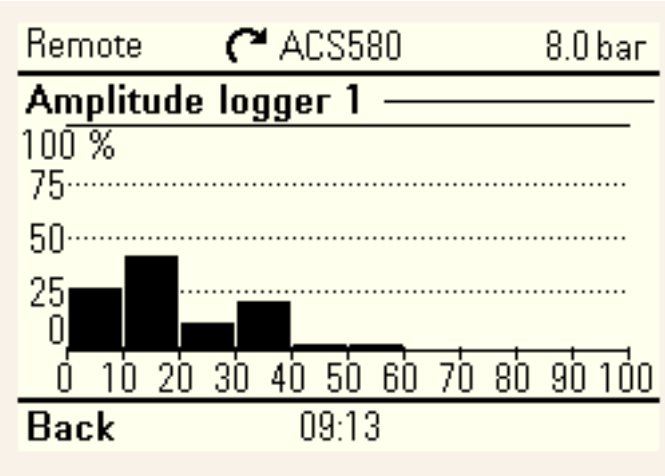
Cabinet-built drives in power range from 75kW to 4500kW

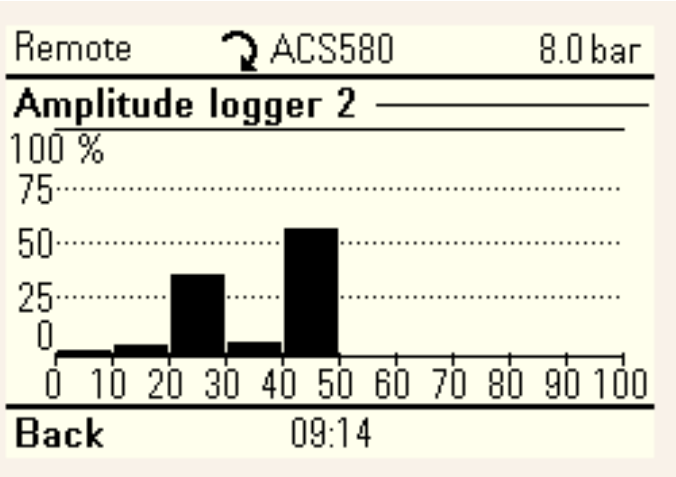
- 3-ph 380 - 480 V
- **Engineered and Manufactured by ABB**

Inbuilt load analyser

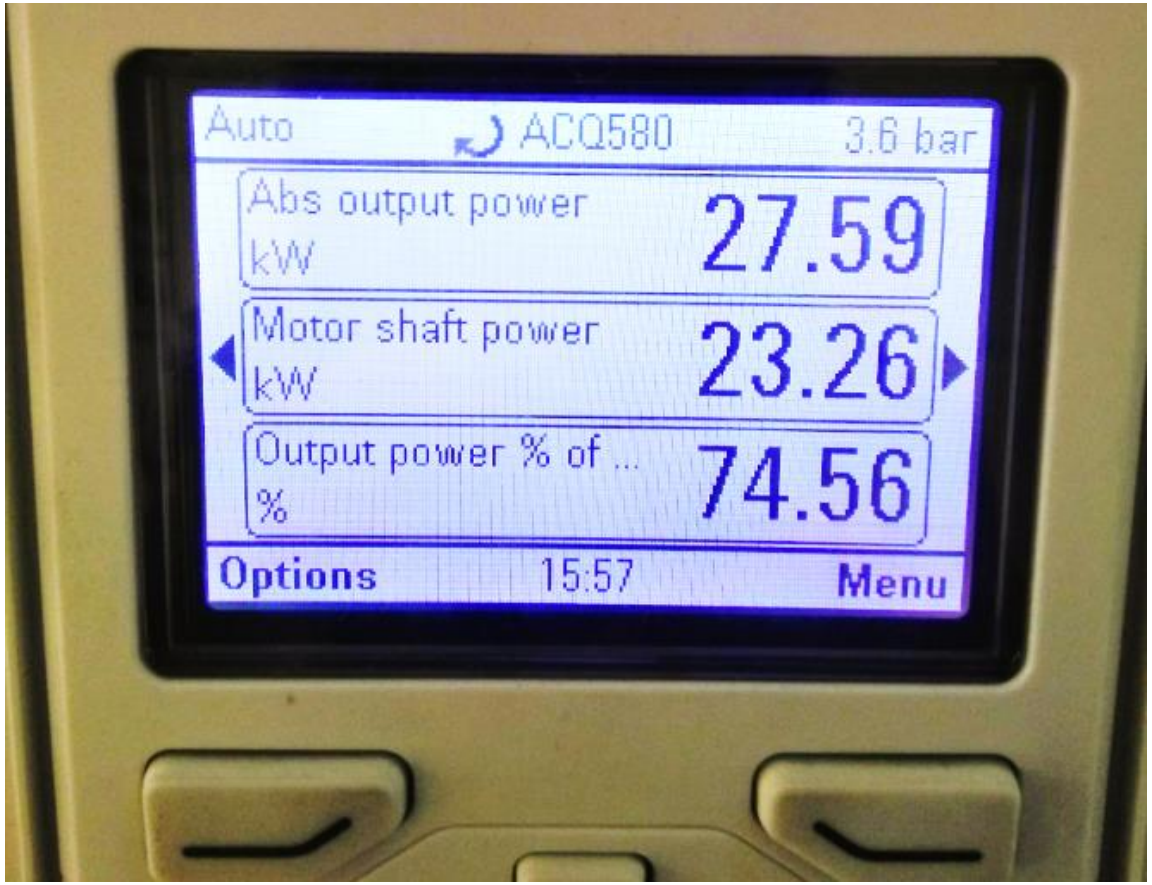
Use data to make informed decision

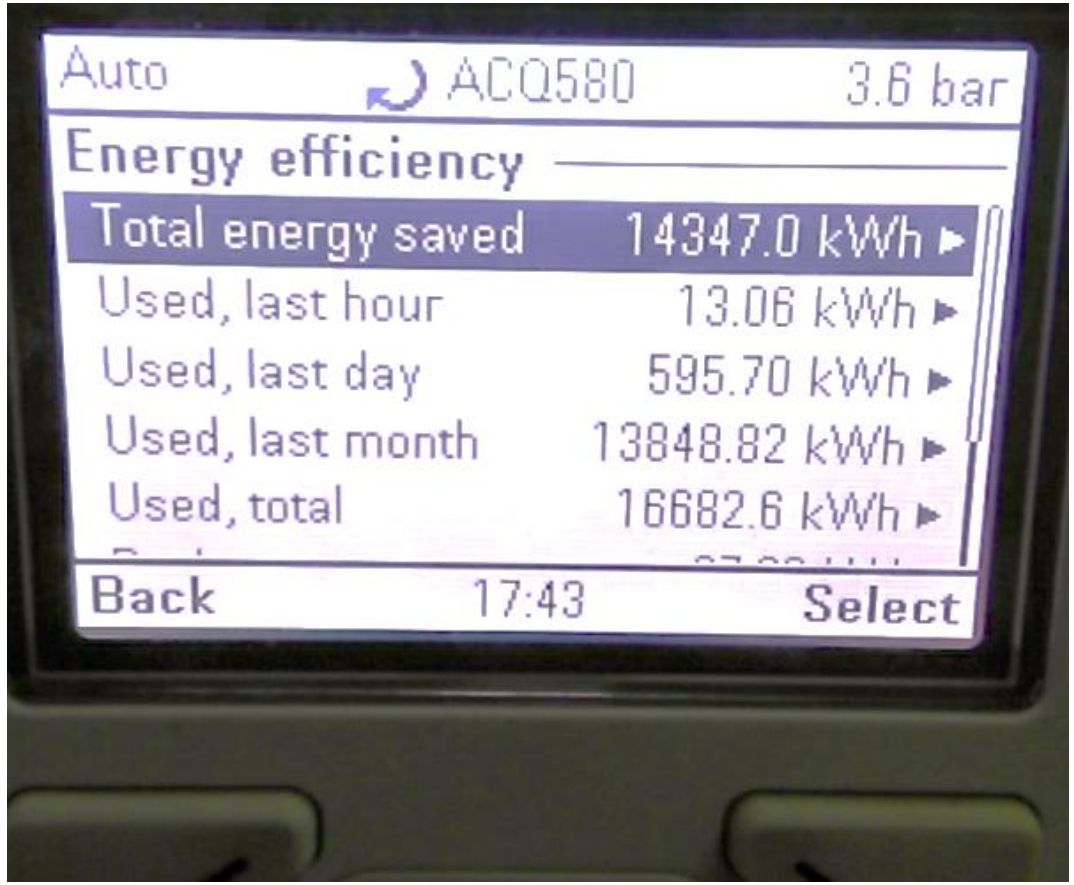




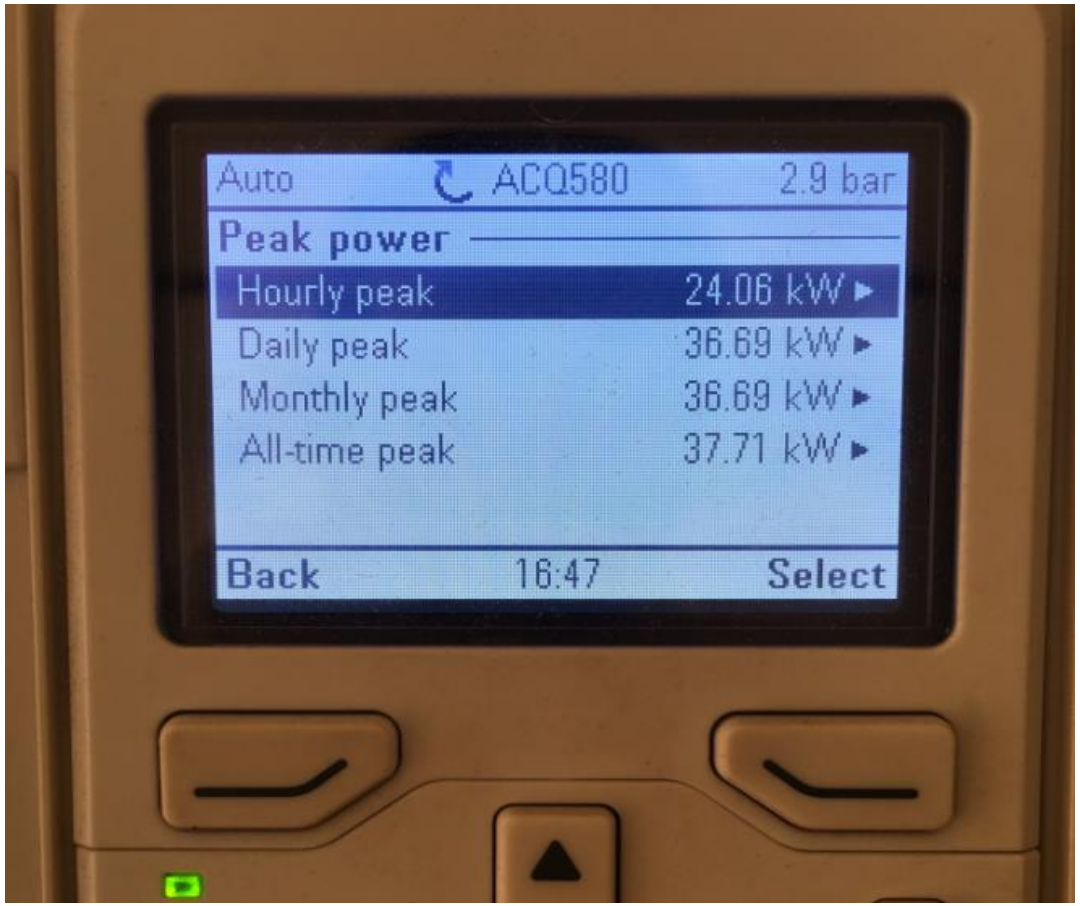


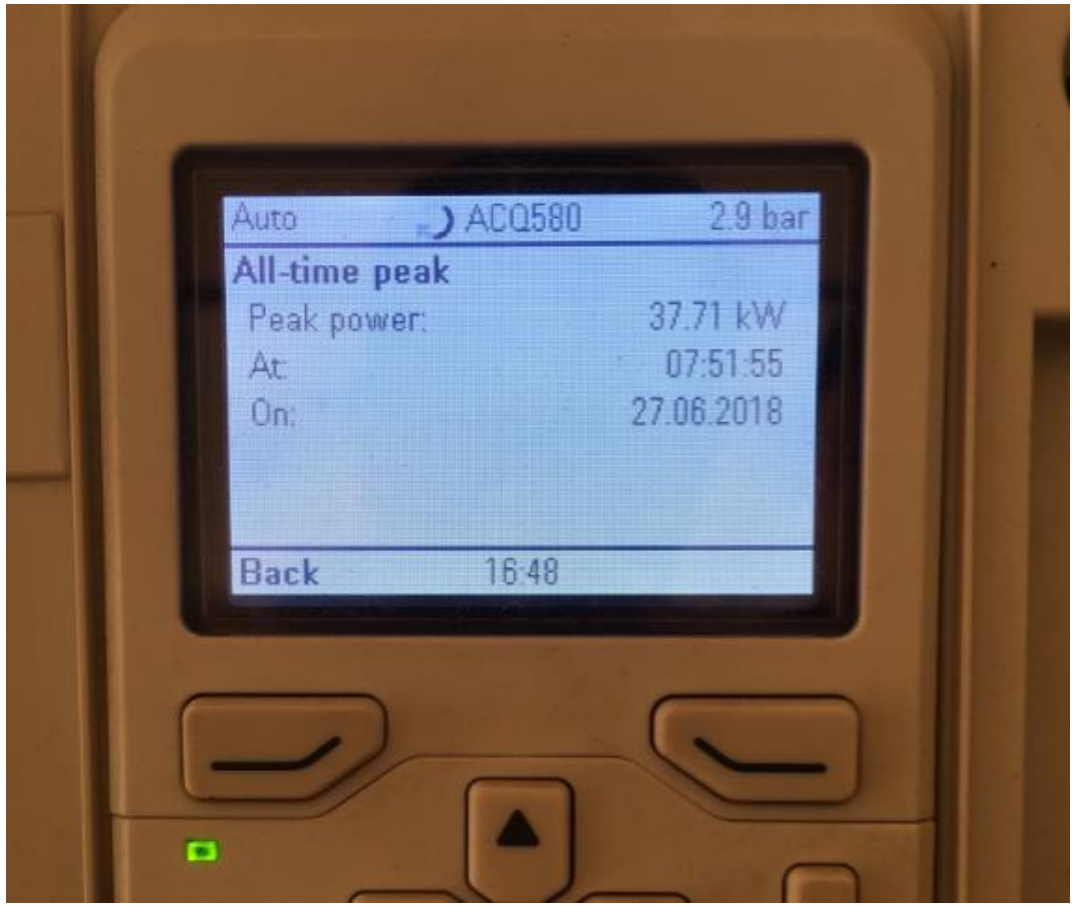
Energy monitor





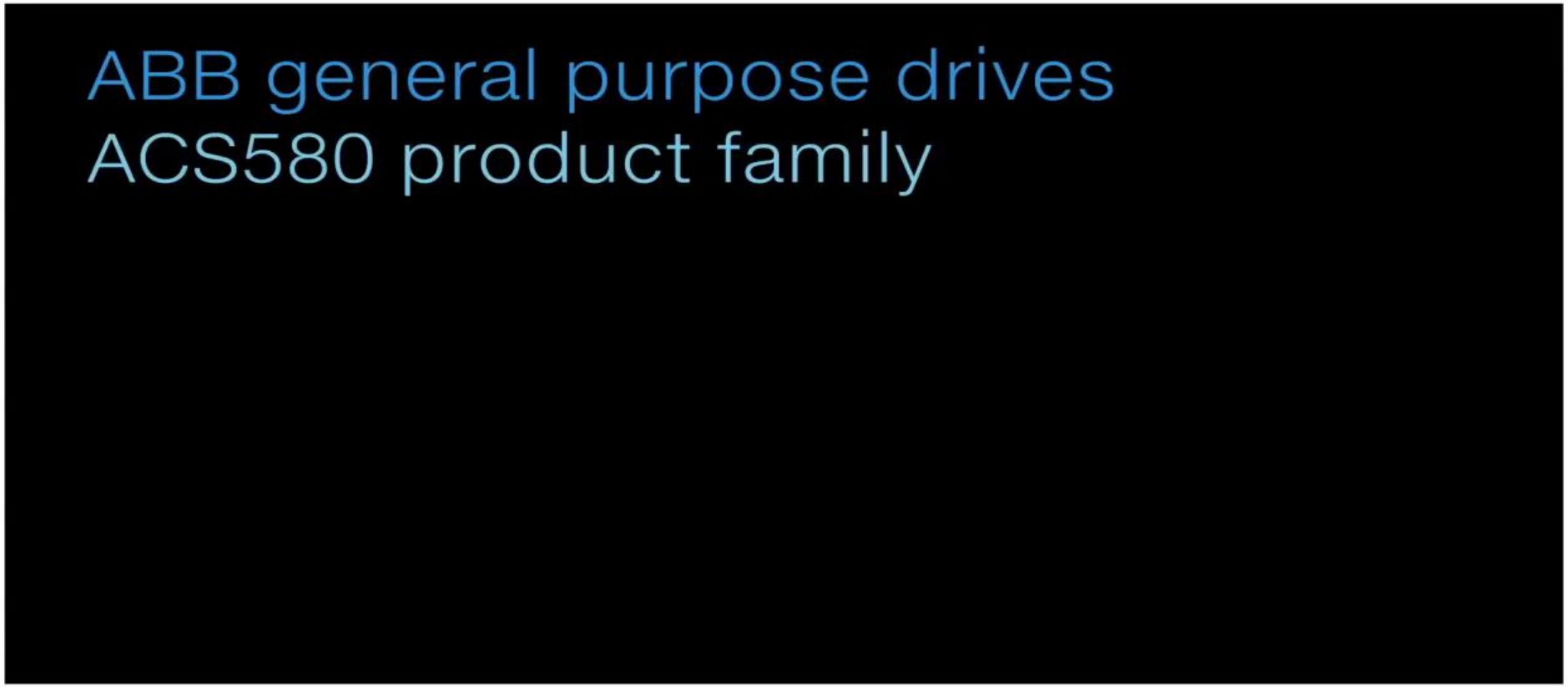
Real-time energy and load monitor





All-compatible drives portfolio

Learn it once. Use it everywhere



Power and productivity for a better world™

The benefits of ABB's solution

Saves cost

—

Consume as per requirement – Increase your competitiveness

Reduced mechanical stress – Reduce your maintenance

Improves quality

—

Closed loop for consistent output -

Connectivity

More sustainable

—

Reduce your specific energy

Data specific actions to reduce Total Cost of Ownership

Have any questions ?

Sales Contact : **Vincentius Suryadi Putra**
Mobile : +62 811 995 2097
Email : Vincentius.suryadi@id.abb.com
Website : http://new.abb.com/drives

So let’s talk