DRIVES TRAINING COURSE

Energy saving for faster paybacks

Using Drives to drastically reduce your energy bill

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Savings with variable speed drives

Saving with Variable speed drives

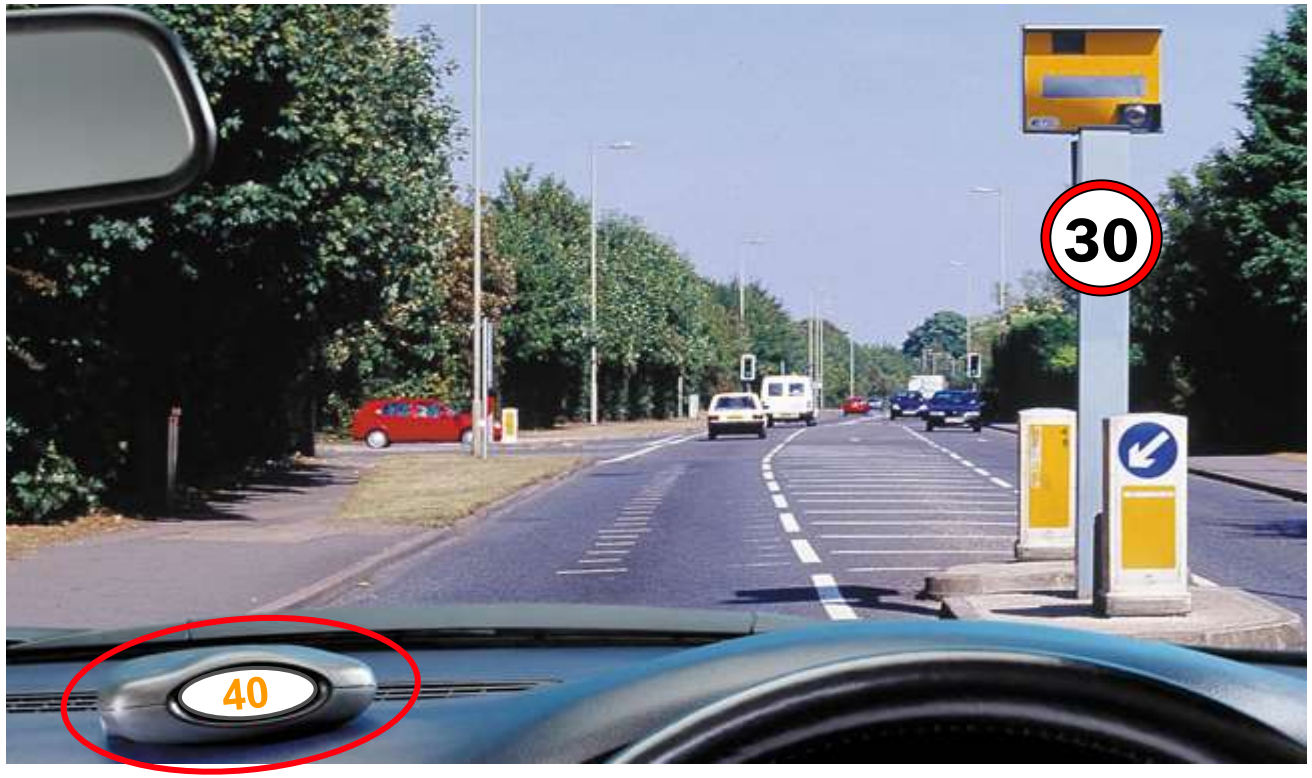
Oversizing message

65% of industrial electrical energy is consumed by motors

‘**95%** of all motors are oversized’

Savings with Variable speed drives

QUESTION - In this situation, what do you do?

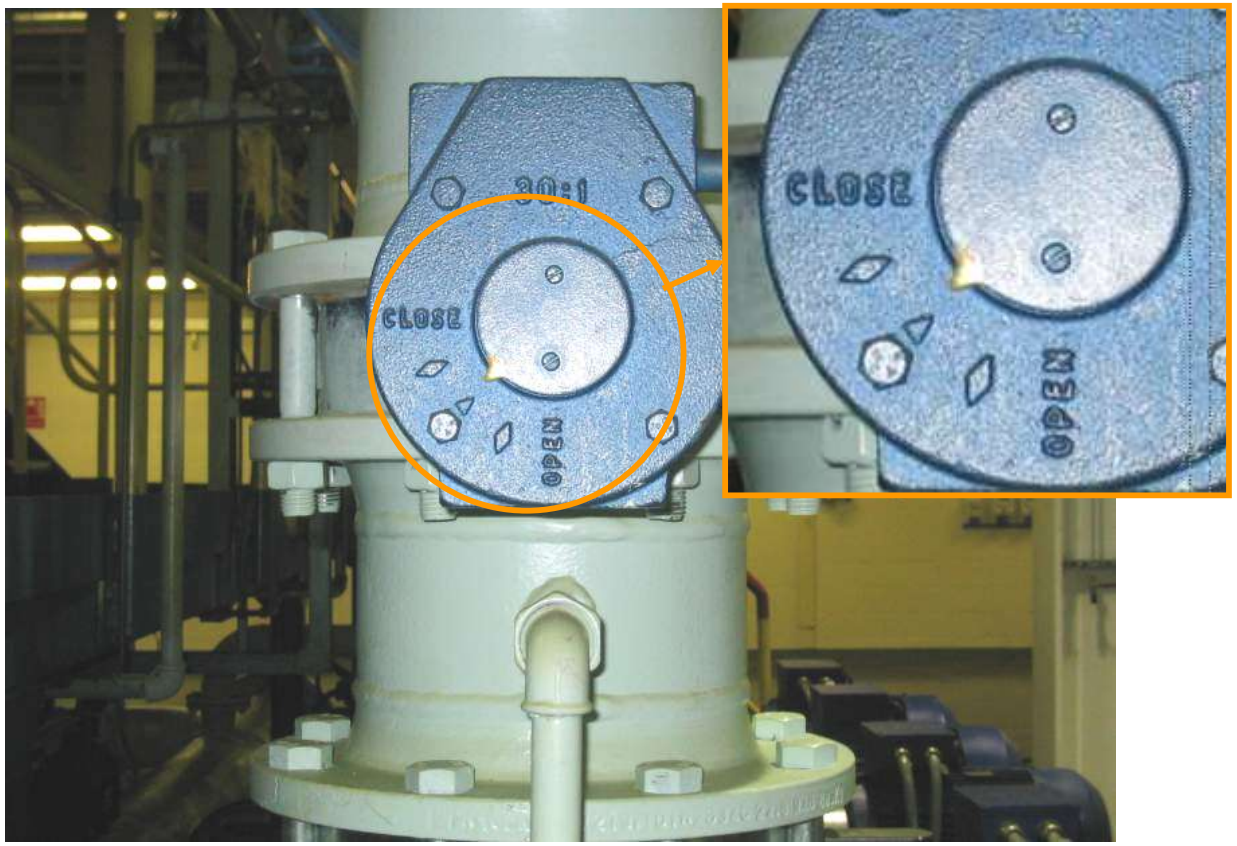


A. Take your foot off the accelerator and slow down?

B. Keep your foot hard on the accelerator and control your speed with the brakes?

Savings with Variable speed drives

Industry uses the braking method!



Then why does industry insist on using the “keep going and apply the brakes method?”

Savings with Variable speed drives

Load Types

Drives save Energy by varying the speed of the driven load

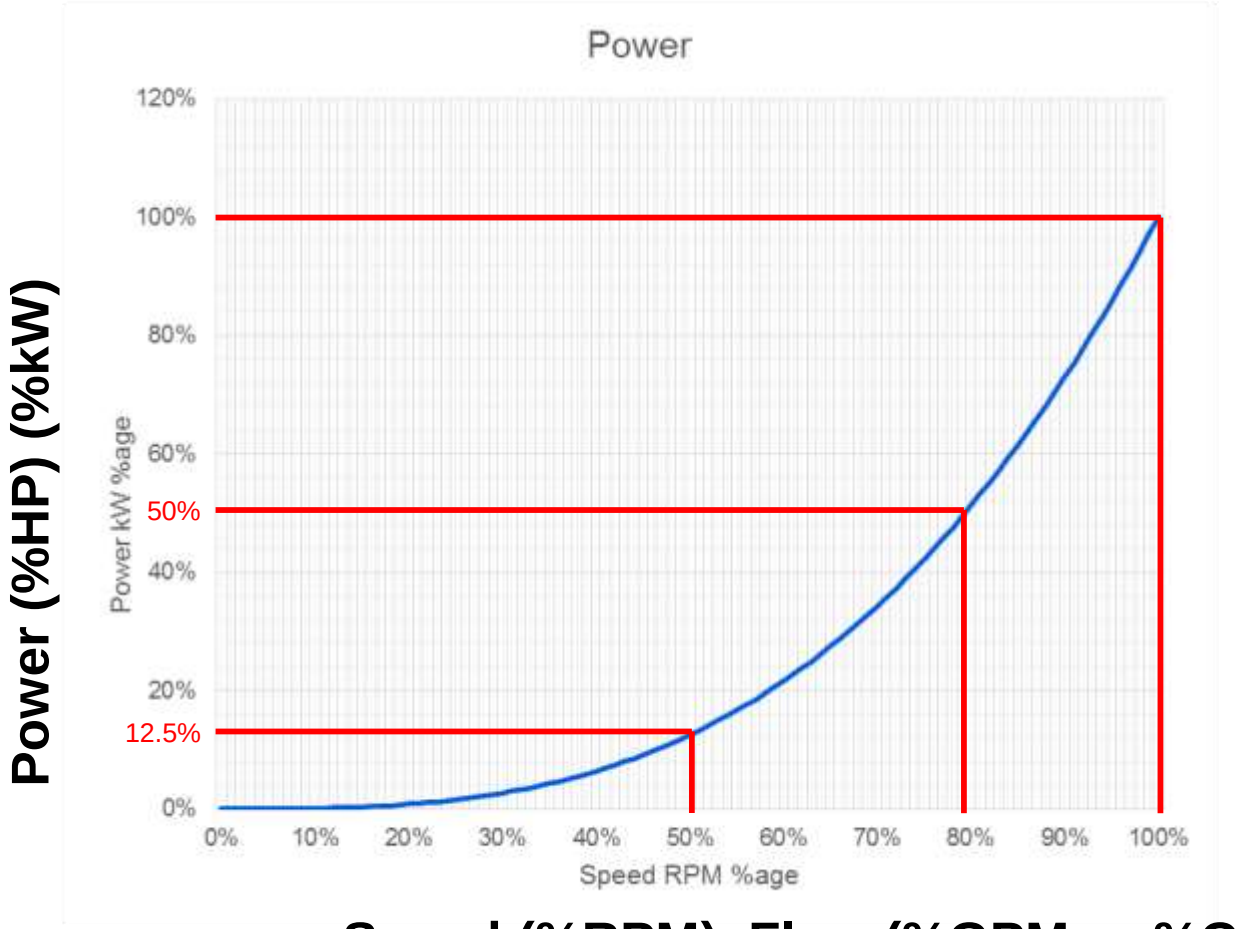
There are 2 basic types of load

– Variable Torque loads – Power varies with the cube of the speed
  - Centrifugal Pumps
  - Centrifugal Fans
  - Cooling Tower Fans

– Constant Torque loads – Power varies linearly with speed
  - Conveyors
  - Extruders
  - Screw Type Air Compressors
  - Positive Displacement Pumps, Vacuum Pumps
  - Hydraulic power packs
  - Punch Presses

Savings with Variable speed drives

Variable Torque Loads

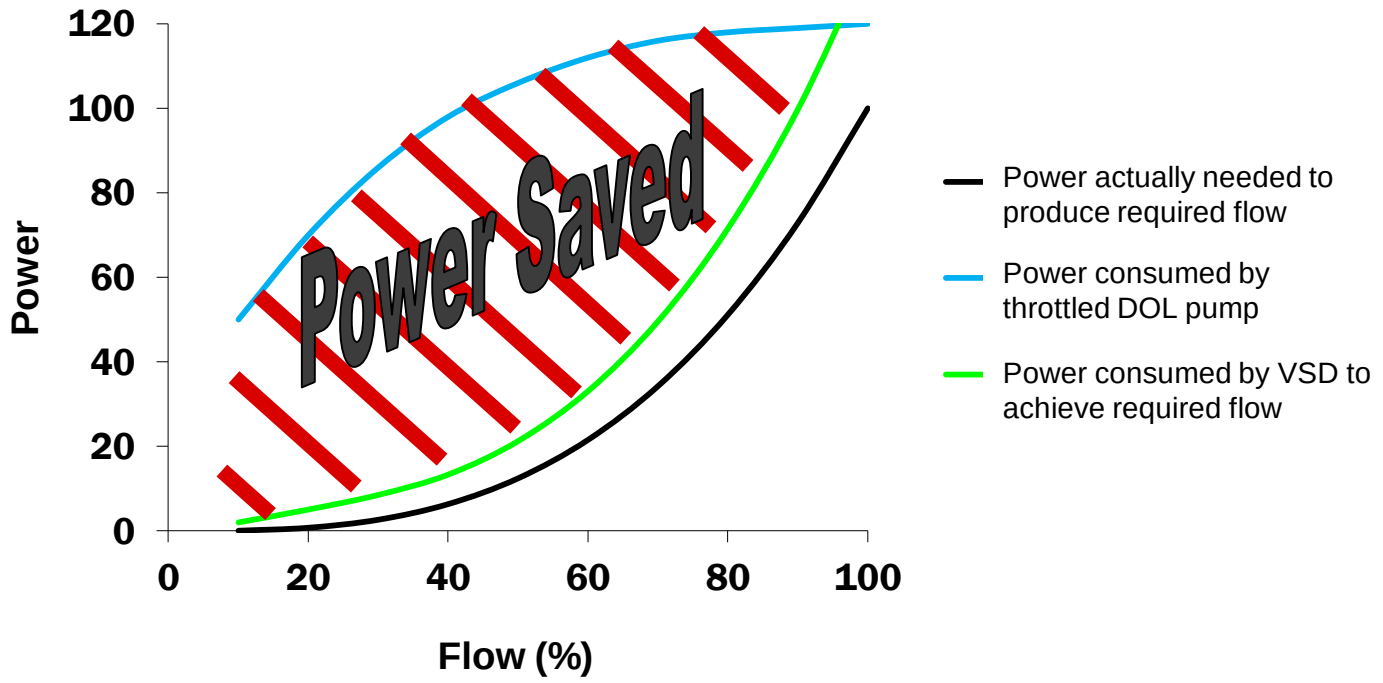


Power is proportional to (Speed)^3

Savings with Variable speed drives

Variable Torque Loads

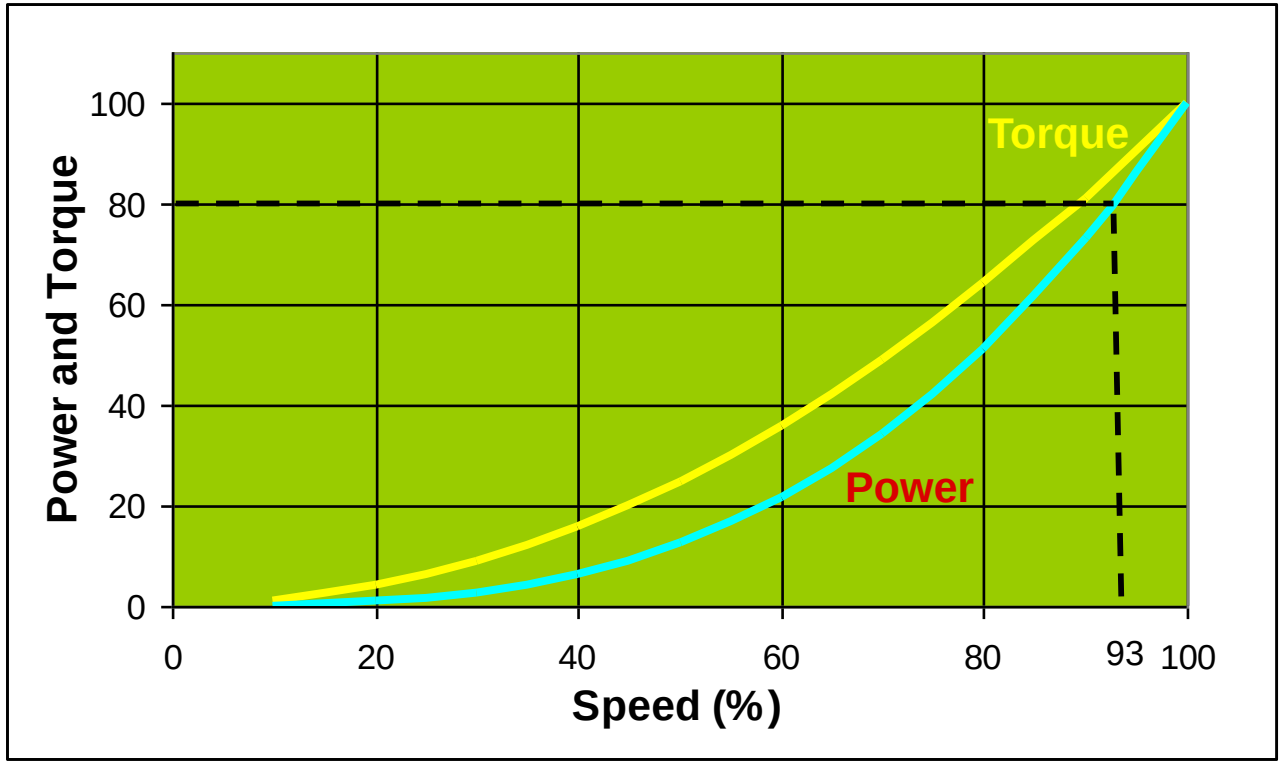
– Variable Torque loads yield the best savings, because of the cube relationship between the speed and the power



Savings with Variable speed drives

Variable Torque Loads

– MOST pump and fan systems are oversized, so speed can nearly always be reduced

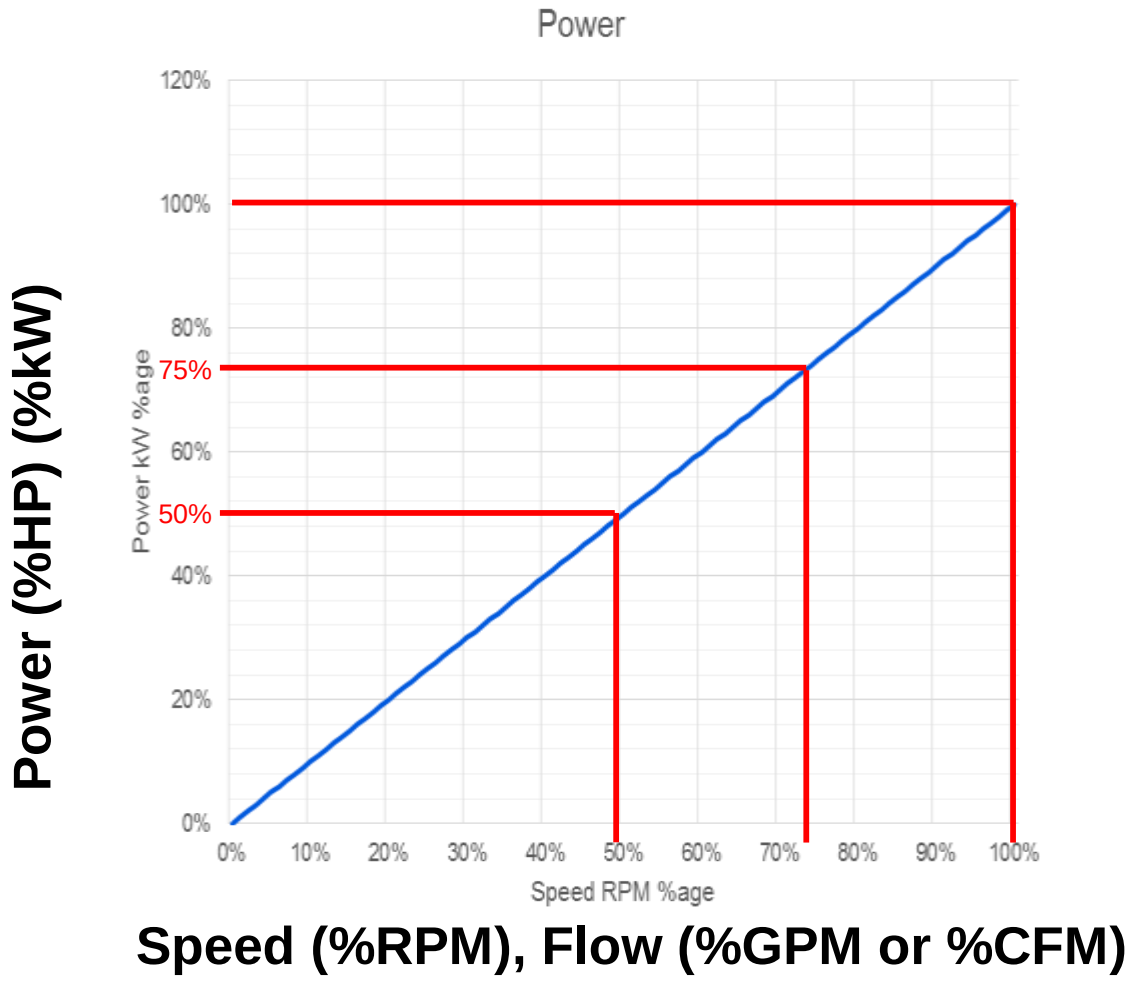


Flow α Speed,
Torque α Speed^2
Power α Speed^3

Just 7% speed reduction (3.5Hz), gives 20% energy saving

Savings with Variable speed drives

Constant Torque Loads



Power is proportional to Speed

Savings with Variable speed drives

Constant Torque Loads

Constant torque loads do not save as much on speed reduction

Their savings come from taking control

- **Air Compressors**
  - Most factories have an air supply for tools etc.
  - Generally run constantly, 24/7, but NOT on-load constantly
  - When air system reaches pressure, they continue to run, then vent out through a valve

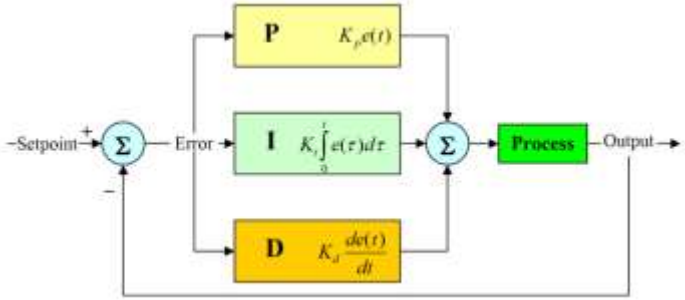
- **Hydraulic power packs**
  - Generate hydraulic fluid at pressure for operating machinery
  - Generally run constantly, 24/7, but NOT on load constantly
  - When hydraulics fluid reaches pressure, they continue to run, then vent through a burst valve

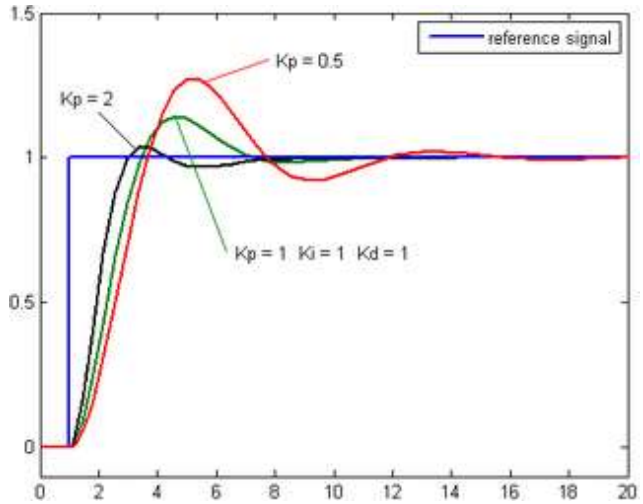
– Both systems benefit greatly from PID control

Savings with Variable speed drives

Understanding PID control

- PID controllers compare a setpoint to a feedback value
- The 2 quantities are subtracted, and an error is generated
- The error is then subject to 3 types of gain
  - Proportional
  - Integral
  - Derivative
- The resultant signal then instructs the process to react
  - Either increase or decrease
- The feedback monitors the process to determine the new error
- Changing the PID values “tunes” the operation of the PID controller, to give the desired response





The savings - Our best demo

Our best salesman

The Balloon machine

ABB & MKE Energy Audits

ABB & MKE Onsite Energy Audits Appraisals

Identifying the most energy wasteful motor-driven applications

Whatever your motor-driven application – whether pumps and fans or compressors and mixers – it is highly likely that the installation is using more energy than it needs. There can be many reasons including:

- over-dimensioned motors
- low-efficiency motors
- variable load processes running at full speed
- poorly maintained assets

Energy Appraisal

An ABB Energy Appraisal identifies the most energy wasteful motor-driven applications and recommends ways to boost efficiency and improve a facility's sustainability. You can now select from two types of Energy Appraisals or a combination of both. They can also be included in an ABB Motion OneCare agreement.

- **Application-specific** – aimed at motor-driven fan, pump and compressor applications without smart sensor technology. A site visit is usually required to manually collect individual asset data.
- **Digital Powertrain** – aimed at motors fitted with ABB Ability™ Smart Sensors. Data is collected remotely and regularly from an entire fleet of digitally connected motors, allowing for regular energy use updates. A site visit can still be arranged, if preferred.

Key benefits

Cut energy waste and costs
Identify energy intensive applications in your plant, find ways to cut energy waste and obtain an estimate of potential cost savings

Reduce CO_2 emissions
Discover potential CO_2 emission reductions, the benefit towards meeting local environmental regulations and how it can help to meet your company's sustainability goals

Lower total cost of ownership
See the rapid payback from investing in high-efficiency motors and drives and the significant impact on the total cost of ownership of reducing energy consumption

Minimal disruption to operations
An appraisal is carried out without any impact on a facility's operations. New equipment recommended by the appraisal can be installed during routine maintenance shutdowns, thereby minimizing any disruption to production.

ABB & MKE Onsite Energy Audits Appraisals

Two efficient approaches – one energy saving goal

Which appraisal is right for you?

Deciding on the right ABB Energy Appraisal starts by meeting an ABB expert who will learn about your processes and help identify those applications which may be wasting most energy. Based on your inventory of motors and drives, the outcome determines which Energy Appraisal works best for you: the standard appraisal or the digital appraisal aimed at users embracing Smart Sensor technology.

Digital appraisal

Digital Powertrain data collection

Data automatically collected from Smart Sensors connected to assets. Smart Sensors monitor assets regularly, allowing for more frequent energy assessments which may reveal hidden opportunities.

Standard appraisal

Application-specific data collection

Data from motor and application, including load profile, site conditions, etc. is manually collected through either a site visit or by customers forwarding the information to ABB.

Savings From Onsite Audits

Example 1 - Pool & Jacuzzi Pumps at a high end residential apartments

The table below shows the projected savings and paybacks for the applications subjected to the ABB Energy & Carbon Assessment process.

Application	Running Costs	Annual Savings	Investment	Energy Saved	Payback Time	CO_2 Saved
AHU3 Supply Fan - Fitness Suite	£5,210	£2,078	£2,657	6,110kWh	1y 3m	2 tonnes
AHU3 Extract Fan - Fitness Suite	£5,636	£2,504	£2,657	7,363kWh	1y	2 tonnes
AHU A4 Fresh Air - Supply Fan	£4,224	£1,684	£2,484	4,954kWh	1y 5m	1 tonnes
AHU Core A3	£4,224	£1,684	£2,484	4,954kWh	1y 5m	1 tonnes
Boiler Room Secondary Heating P...	£2,957	£1,231	£4,408	3,622kWh	3y 7m	1 tonnes
Pool Plant Room - Jacuzzi Pump 1	£9,139	£4,433	£2,657	13,039kWh	7m	4 tonnes
Pool Plant Room - Jacuzzi Pump 2	£9,139	£4,433	£2,657	13,039kWh	7m	4 tonnes
Pool Plant Room - Pool Pump 1	£11,089	£4,618	£2,754	13,583kWh	7m	4 tonnes
Pool Plant Room - Pool Pump 2	£11,089	£4,618	£2,754	13,583kWh	7m	4 tonnes
TOTAL:	£62,707	£27,283	£25,512	80,247kWh	11m	23 tonnes

Savings From Onsite Audits

Example 2 – Hot Water Pumps at a manufacturing site

The table below shows the projected savings and paybacks for the applications subjected to the ABB Energy & Carbon Assessment process.

Application	Running Costs	Annual Savings	Investment	Energy Saved	Payback Time	CO_2 Saved
Hot Water Pump 05P1	£59,608	£21,008	£20,368	65,649kWh	11m	19 tonnes
Hot Water Pump 05P2	£59,608	£21,008	£20,368	65,649kWh	11m	19 tonnes
Cold Air Header Fan 2	£117,586	£21,209	£13,970	66,277kWh	8m	19 tonnes
Cooling Tower Motor NO.2	£168,192	£32,749	£8,409	102,340kWh	3m 4d	29 tonnes
TOTAL:	£404,994	£95,974	£63,115	299,915kWh	8m	85 tonnes