

Drives and motors

# The 6-step energy saving plan

## Efficient control of motor-driven applications

Power and productivity  
for a better world™



# The 6-step energy saving plan

## Step 1 – the facts

Why is everybody talking about energy? It's about saving costs and, on a wider scale, slowing down climate change.

## Step 2 – the savings

In just half-a-day, an energy appraisal can help identify the applications that offer you the best energy saving opportunities.

## Step 3 – the finance

See how energy efficient products pay for themselves over time and find out about the options that make payback even quicker.

## Step 4 – the products

Choose from a wide range of energy efficient equipment that can help your company achieve great cost savings.

## Step 5 – the proof

See how other users have achieved energy savings and CO<sub>2</sub> emissions reduction with the help of ABB drives and motors.

## Step 6 – the action

Now that you have the tools and the information, you can move forward and make a difference in your own organisation.

# Step 1 – the facts

## Climate change – what is it?

Climate change is affecting us all. Already, four of the five warmest years in England since records began 340 years ago, have occurred in the last decade.

## How is it tackled?

Climate change is a global problem requiring actions on a global scale. Under the Kyoto Treaty, the developed countries have agreed a legally binding commitment to reduce greenhouse gas emissions by 5.2 percent below 1990 levels over the period 2008-2012.

## How does it affect the UK?

The UK has set itself a domestic objective to reduce emissions of carbon dioxide (CO<sub>2</sub>) by 80 percent on 1990 levels by 2050.

## How does it affect UK industry?

### Carbon Reduction Commitment (CRC)

#### Energy Efficiency Scheme

The CRC is a tax on large non-energy intensive organisations in both the public and private sector. It directly affects around 5,000 organisations across the UK who consume over 6,000 MWhr/year and have at least one electricity meter measured on the half-hourly market. Its aim is to encourage the adoption of energy efficient practises in order to reduce CO<sub>2</sub> output.

## Climate change levy

The climate change levy is a tax on the use of energy in industry, commerce and the public sector. The levy is applied as a specific rate per nominal unit of energy, for instance 0.485\* pence per kilowatt-hour for electricity. This can increase the average electricity bill by 15 percent.

\*based on April 2011 figures

## Enhanced Capital Allowances

Companies in the private sector are being granted 100 percent first year capital allowances for energy saving investments under the scheme of Enhanced Capital Allowances.

## Climate change agreements

Climate change agreement negotiations have been conducted with more than 40 energy intensive industrial sectors. Each sector has received a target and a set of two-yearly milestones in return for reductions in climate change levy.

## Emissions trading

The Europe-wide emissions trading system started in January 2005, covering emissions of CO<sub>2</sub> by the power sector and sectors of industry with high-energy use. About 1500 UK installations are affected by the scheme.

The UK government has pledged to cut carbon dioxide emissions by 80 percent by 2050.



# Step 1 - the facts

## Did you know?

On an industrial site with an electricity bill of £150,000 per annum, an average of £100,000 per annum will be spent on running motors

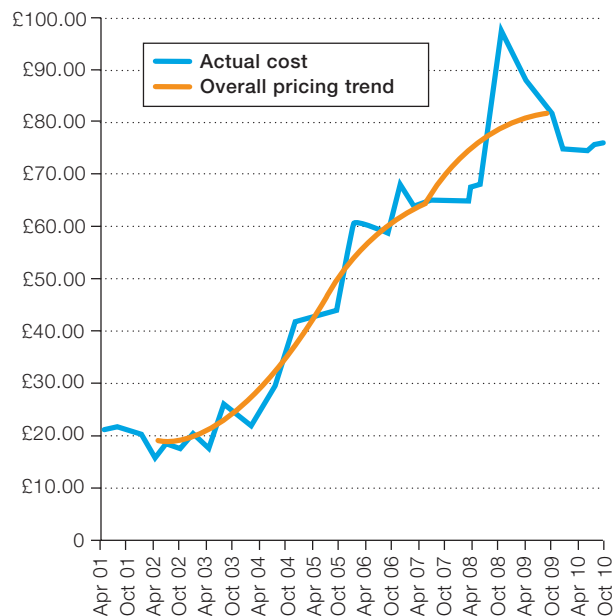
### What is happening to the energy markets?

Energy prices are becoming much more volatile, a reflection of the uncertainties in the supply situation. Coal and gas forward contracts are trading at record price levels. Long-term forecasts suggest that energy prices will continue to rise.

### How does this affect my business?

UK businesses must become energy efficient. If you have not yet reacted to the climate change levy, you may soon be forced into action by energy prices that rise rapidly with or without government interference.

Improved energy efficiency cannot be introduced overnight but is the result of a determined effort over time. A good place to start is to look at your motor-driven applications.



Energy prices are becoming more volatile - the graph shows market average wholesale electricity prices 2002 - 2010.

Energy efficiency is becoming an increasingly important consideration as energy prices continue to rise.





## Step 2 - the savings

Did you know?

Running a motor with a variable-speed drive at 80 percent speed only requires 51 percent of the energy

### The importance of drives and motors

There are some 10 million electric motors in UK industry, running virtually everything that moves. Each may not seem very significant in its own right but together, they are by far the biggest users of electricity in industry. Every percentage point that the average motor efficiency can be improved by is therefore of the greatest importance.

### Calculating energy savings with drives

One of the most effective ways to save energy is to target your motor-driven applications, such as pumps, fans and compressors. Firstly because there are so many of them and secondly because the potential energy savings are so great. If you use a variable-speed drive to reduce the speed of a conveyor belt from 100 percent to 80 percent, then you save 20 percent of the energy. But if you do the same with a pump or a fan, then you save about 50 percent of the energy. How is this possible?

A conveyor belt is a constant torque application. As the name suggests, the torque requirement throughout the speed range is the same, constant. The current to produce torque is relatively constant and just the voltage, and so the power, varies with, and in proportion to, the speed. All of which means that 80 percent speed requires 80 percent power.

Centrifugal fans or pumps, by contrast, are variable-torque applications. The requirement for torque (and hence current) increases with the square of the speed. The voltage again varies in proportion to the speed, so power actually varies in proportion to the cube of the speed. Hence, by reducing the speed by a certain percentage, the power reduces by the cube of the speed change. So 80 percent speed results in  $(0.8)^3 = 51$  percent power.

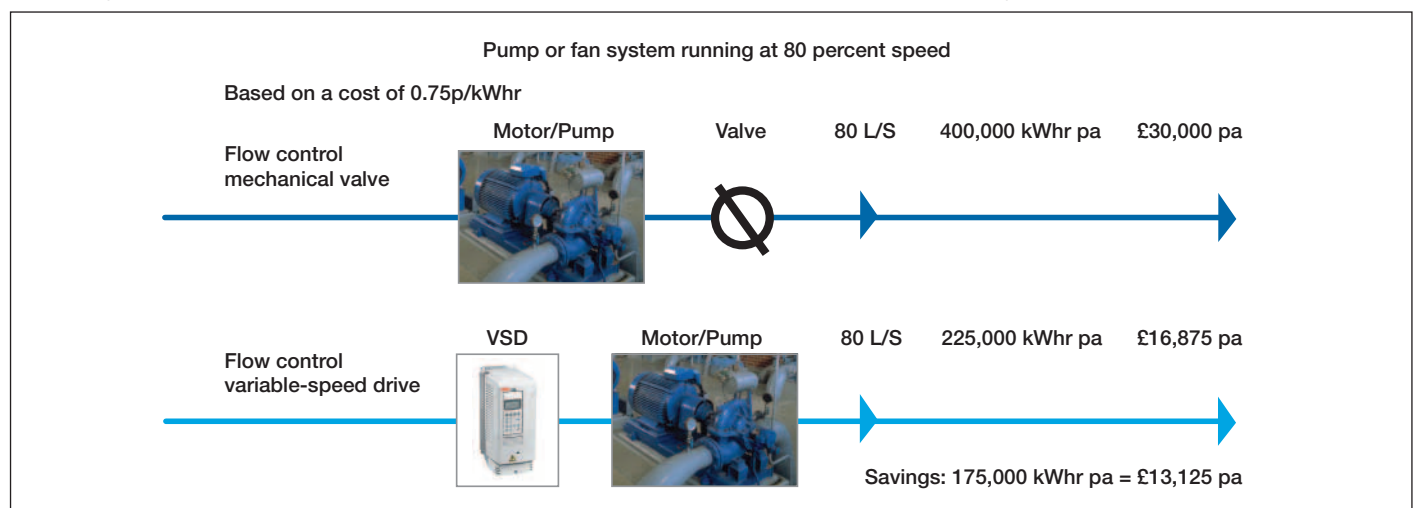


Pump systems can make huge energy savings when used with a variable-speed drive.

Please note that this calculation only gives a rough estimate of your possible savings. For a more accurate assessment, use the ABB Energy Saving Calculator, described on page 22.

Even further improved energy efficiency is offered through a technique called motor flux optimisation. This is particularly beneficial in pump and fan applications and under light loading conditions. At 25 percent load, efficiency is up to 10 percent better.

Controlling flow with a variable-speed drive is far more efficient than the traditional method of throttling the flow with a control valve or damper.



## Step 2 - the savings, motors

### Did you know?

On average, rewinding reduces efficiency by 1.1 percent, and in some cases up to 3 percent. Always use an AEMT approved repairer who will minimise efficiency loss to less than 0.5 percent

#### Managing motors wisely

A fully loaded motor will typically consume the same in electricity costs within 30 days of operation as its purchase price. The energy costs over the life of a motor far exceeds the purchase price, even for motors not in continuous service.

The importance of energy efficiency to a motor's life cycle costs is often not well understood. It is startling to realise that an 11 kW motor costing about £700 can consume over £67,000 worth of electricity over a 10 year operating life. Even small differences in efficiency make big differences to a motor's life cycle costs.

However, when swift action is needed, the efficiency of the new motor is rarely considered. The natural instinct of many plant managers is to send a failed unit out to be rewound. But blindly following this habit can cost the company many thousands of pounds in unnecessary energy costs. Motor rewinding could cause a decrease in efficiency of over 1 percent.

#### Rewind and replace

The solution is to adopt a motor management policy that gives clear guidelines on when to purchase high efficiency motors. In effect, the decision on whether to rewind or replace is taken long before the motor fails, helping to reduce energy costs, decrease downtime and lower stock inventories.

#### When to upgrade

The most practical time to upgrade is when a motor fails. As a rule of thumb, small motors and motors with long running hours should be replaced. Large motors that only run occasionally and motors in imperial frame sizes can be rewound. But there are also times when replacement of a fully functioning motor can be justified on energy grounds and based on CO<sub>2</sub> reduction.

#### Plan your maintenance

Motors will wear as they age, causing larger frictional losses. Proper maintenance will prolong the life of a motor and give optimum efficiency. For instance, poorly aligned direct couplings lose up to 5 percent efficiency and may result in premature failure of bearings.

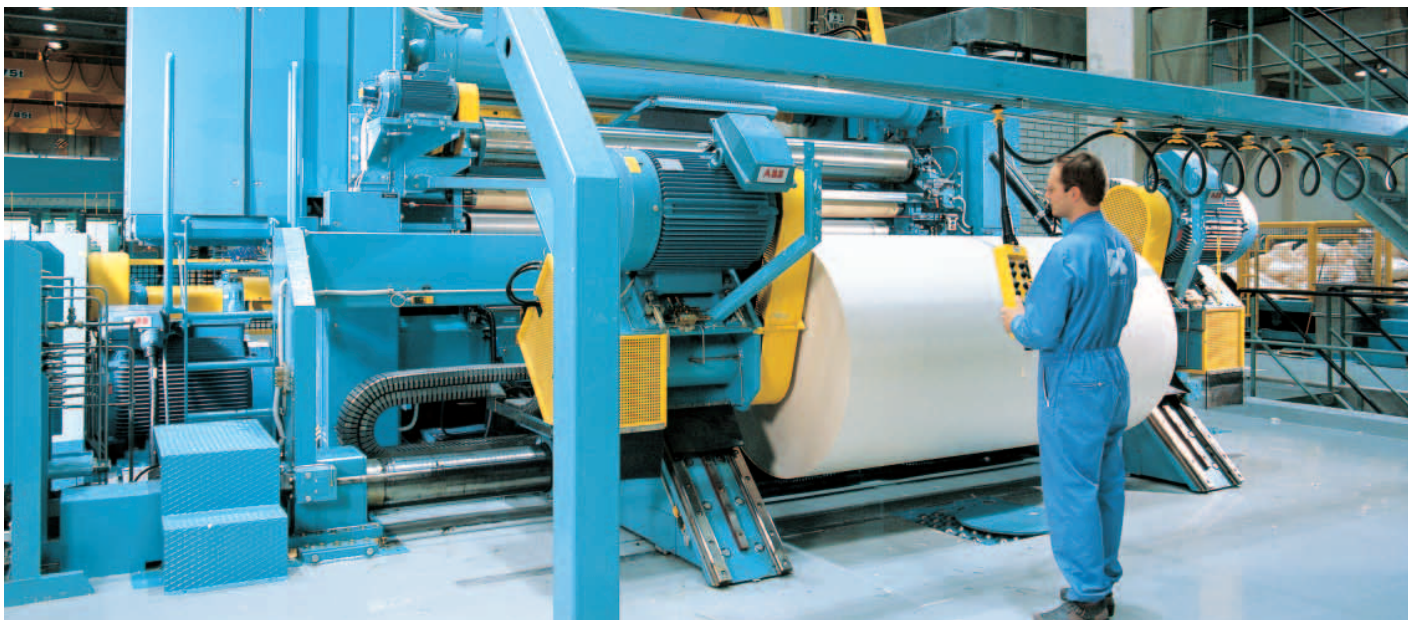
#### Switch off to save energy

Motors left running when not required waste a significant amount of energy. For example, an 11 kW motor which does not need to run at weekends will waste around £2,000 of energy per year if left running 24/7. Even under no load, motors can consume as much as 40 percent of full load power.

#### MotorAdvantage

Aimed at companies operating a continuous process, MotorAdvantage provides organisations with the tools and information to minimise downtime on critical motor driven applications. Users can make improvements within their plants maintenance schedules and stockholding, helping to improve overall plant performance whilst minimising un-scheduled downtime.

A clear motor management policy ensures high efficiency motors are used where they are most needed.



## Step 2 - the savings, drives

### Did you know?

Using a variable-speed drive to reduce a conveyors speed from 100 percent to 80 percent, saves 20 percent in energy. But with a pump or a fan, the saving is closer to 50 percent.

#### Fast and efficient energy appraisal

The starting point for a successful energy saving plan is to determine just where energy can be saved. The experience gathered over the years by ABB and its partners means that they can get straight to the heart of the savings.

This know-how has been documented in ABB's energy appraisal scheme. The scheme identifies the applications where energy savings can be made by using drives and motors and provides an estimate of those savings and their financial impact.

##### 1. Outlining the scope of supply

ABB, or one of its partners, meets with you to discuss in detail the benefits, requirements and input needed for a successful energy appraisal. ABB not only looks at fixed speed motors but also at existing AC drives to ensure that the application is running at maximum efficiency.

##### 2. Monitoring and data collection

An on-site appraisal is undertaken with extensive analysis of selected applications. From this, ABB can determine operating parameters and the energy consumed.

##### 3. Data analysis

Using ABB's dedicated energy saving software, the findings are analysed and potential savings identified.

##### 4. Recommendations

An action plan is prepared, comprising an executive summary and a detailed engineer's report. The reports highlight the applications that can save the most. The figures are then translated into monthly savings - the amount that could be saved in energy bills. Refer to table below.



During an energy appraisal, ABB not only looks at fixed speed motors but also at existing AC drives to ensure that the application is running at maximum efficiency.

##### 5. Implementation

Using the recommendations from the appraisal, ABB can identify the correct drive and motor for the respective application. It can help with the installation and start-up or commissioning of a drive and motor.

##### 6. Verification and follow up

Once the new equipment is fitted, actual savings are monitored alongside the predicted results. This helps justify the investment in drives and motors.

#### Extract from typical executive summary showing energy saving potential.

Equipment appraised	Investment	Energy saved per year (kWh)	Pay back time years	Annual savings following installation
Cooling towers	£11,286	252,958	0.6	£18,972
Heating pumps	£14,900	255,000	0.8	£19,125
Boiler fans	£4,996	75,964	0.9	£5,697
<b>Totals</b>	<b>£31,182</b>	<b>583,922</b>	<b>0.7</b>	<b>£43,794</b>



## Step 2 - the savings

### Replacing existing drives and motors

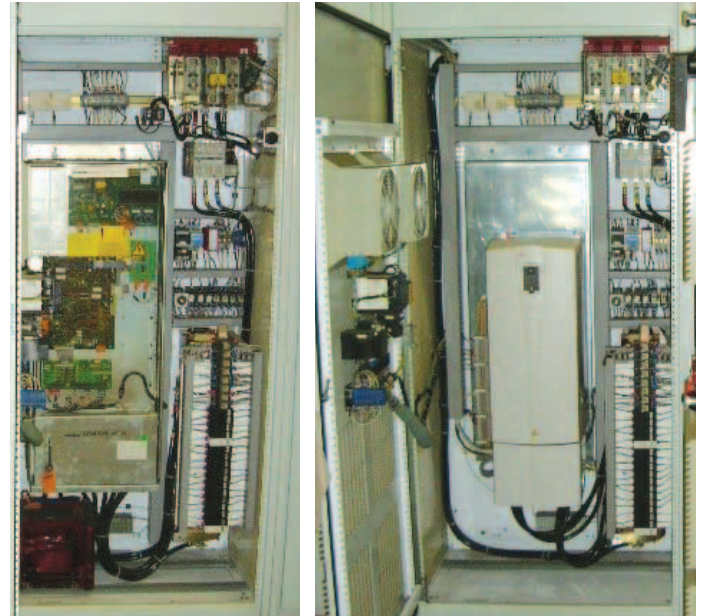
If an average 1980s AC motor and drive are replaced with an ABB high efficiency motor and state-of-the-art drive, the payback time due to lower energy consumption could be less than 12 and up to 36 months, depending on annual operating hours, energy price and the utilisation of today's drives technology, such as flux optimisation (see p.15). Replacing old drives and/or motors brings many other benefits:

**More energy efficient** - today's drives and motors are approximately 3 percent more efficient than their predecessors.

**Lower running costs** - it is highly likely that older motors and drives from any manufacturer will start to suffer breakdowns. While ABB and its partners offer a full spares and repairs service, it could be beneficial to cut your maintenance bill and replace the motors and drives. This has the advantage of extending the warranty.

**Greater reliability** - lower component count means new drives last longer and help reduce downtime. Likewise, high efficiency motors tend to run cooler, thereby extending the life time and intervals between maintenance.

**Fitting state-of-the-art variable-speed drives in place of ageing ones gives energy savings as well as improved reliability.**



Before

After

The new drive on the right saves installation space compared to the old drive on the left, which has yet to be removed. Severn Trent Water is saving thousands of pounds in energy and maintenance costs since replacing two old drives from the 1980s with the latest ABB standard drives at its Ladywood sewage pumping station in Ironbridge, Shropshire.

**Smaller size** - a new drive delivers much more power, size for size. A modern ABB drive can in some cases be just one third of the size of a drive only a few years older. This saves valuable space when replacing the drive.

**Latest technology** - users with new drives and motors can benefit from recently introduced features, for instance flux optimisation, which can reduce the energy consumption in pump and fan applications by 10 percent, as well as offering several communications protocols such as Modbus and Profibus.



## Step 2 - the savings

### Energy efficiency increases profits

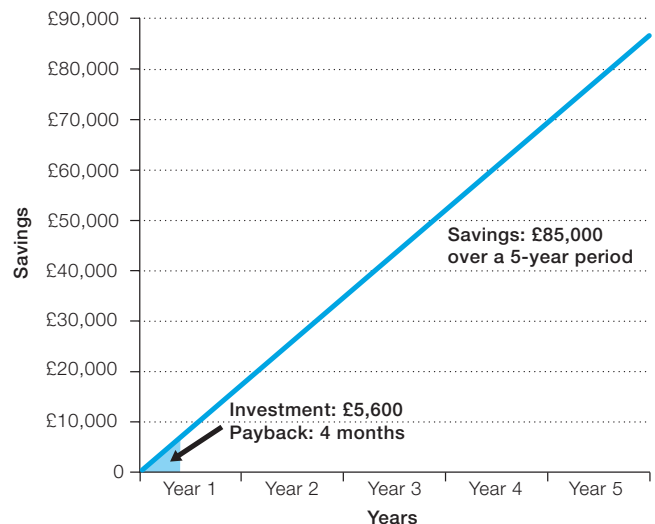
When you install a variable-speed drive from ABB, the capital costs can be quickly repaid.

Variable-speed drives often give payback within months on energy savings alone. In addition, by optimising the speed for the requirements of the process, users often find they get better product quality and reduced maintenance costs.

A UK manufacturer who installed an ABB drive on one of its fans found that a speed reduction of 20 percent resulted in a 56 percent reduction in power from 118 kW to 51 kW, saving over 440,000 kWh a year. The cost of the drive was £5,600 and the energy savings £17,000 per year or £1,400 per month. This gives a straight payback of four months. After the four months, the drive continues to save money for the company every month and will continue to do so for the rest of its life. Not many other investments offer this type of payback – imagine for instance how much more you would need to sell to improve annual profits by £17,000.

The rewards for investing in energy efficient motors are worth pursuing as the direct-on-line installations are so numerous. The electricity the motor consumes during its lifetime makes up the overwhelming part of its lifetime cost.

The purchase cost is very small in comparison and is overtaken by electricity cost already after just one month of continuous operation. A 90 kW energy efficient motor can cost £1,500 more to buy than a standard efficiency motor, but can save over £10,000 over the course of a 10-year service life compared to a standard efficiency motor. In addition, because the high efficiency motor has lower energy losses it will have a lower running temperature giving improved reliability. This makes high efficiency motors a better choice in critical applications, for instance in the paper industry where stand still costs are high.



After installing a variable-speed drive energy spend falls dramatically.

## Step 3 - the finance

### Energy Efficiency Financing

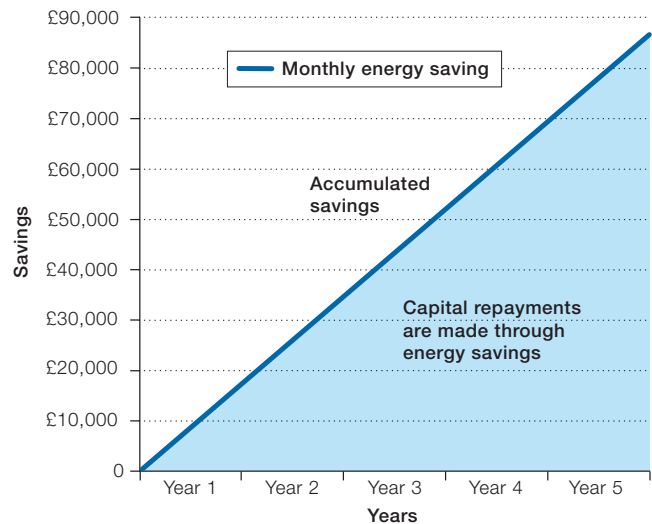
Financing for energy efficient equipment is available through the Carbon Trust. Organisations can take advantage of leases, loans and other financing options to help make paying for an energy reduction programme simple and affordable.

The financing packages are designed to allow energy efficient equipment to be purchased and paid for through the savings achieved as a result of reduced energy bills. The scheme is open to all kinds of businesses and organisations, with financing available from £1,000, and there are potentially no upper limits.

If a business takes out financing to fund the purchase of a variable-speed drive and high efficiency motor on an application with long running hours and large potential energy savings, they will be able to cover the cost of the equipment within a short time period (usually under 12 months).

Even projects with less spectacular energy saving figures, for instance: drive applications with shorter running hours; replacement of an old drive with a newer model; or investments in energy efficient motors, are well worth looking into. The Carbon Trust will consider any energy saving project and the way the financing is structured, the investment will pay for itself through the energy savings the new equipment achieves.

You can work out your potential savings using ABB's free energy saving calculator available at [www.abb.co.uk/energy](http://www.abb.co.uk/energy)



Carbon Trust financing is paid for through savings achieved as a result of reduced energy bills.

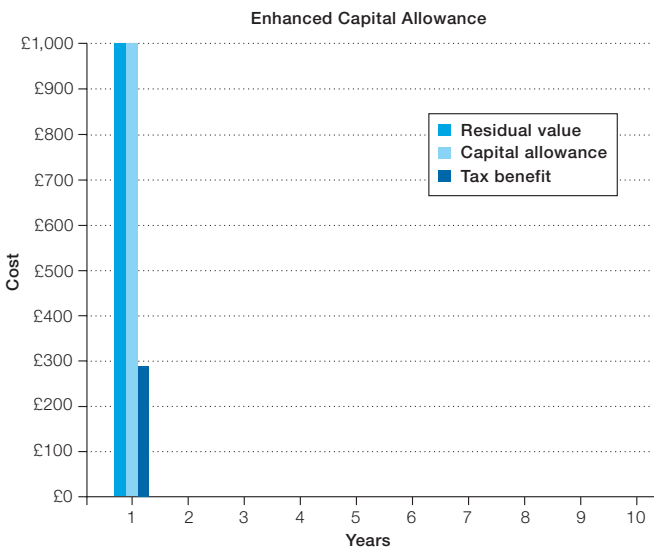
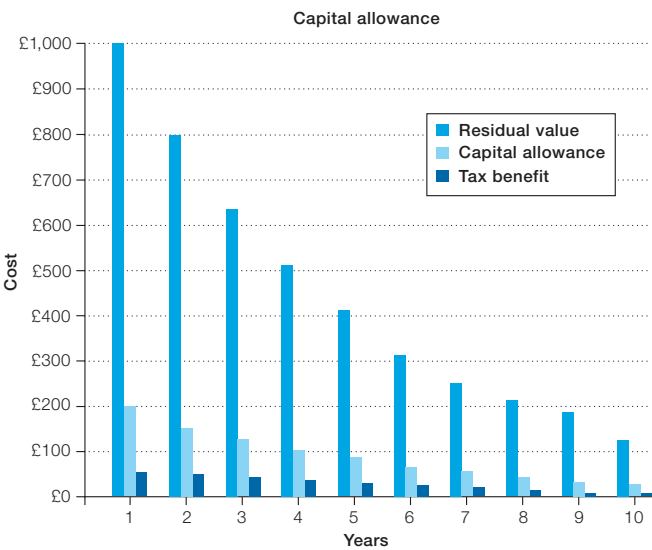
# Step 3 - the finance

## Enhanced Capital Allowances

The government has introduced Enhanced Capital Allowances (ECAs) to give a further financial incentive for users to choose energy efficient products. Variable-speed drives in motor-driven applications qualify, along with high efficiency motors in all applications, enabling companies to write off the full cost against tax in the year of purchase.

Capital allowances reduce the amount that businesses have to pay in income or corporation tax. With ECAs, 100 percent first year capital allowances are granted for energy saving investments in the private sector. Firms making qualifying investments will be able to deduct the full costs of those investments when arriving at their corporation tax or income tax bills.

Normally, capital allowances are given at 20 percent on a reducing balance basis. Over 10 years, almost all of the allowances will have been claimed. The ECA scheme enables users to claim 100 percent allowances in the first year. The UK Energy Technology List, at <http://etl.decc.gov.uk/etl>, gives the names of all the approved products. For an overview of which products qualify for ECAs, please see pages 13-17.



Capital allowances reduce the income or corporation tax when companies make investments. Normally, capital allowances are given at 20 percent on a reducing balance basis. But for investments qualifying for Enhanced Capital Allowances, for instance variable-speed drives and energy efficient motors, you can claim 100 percent already in the first year. You keep the money in your company, instead of it trickling back over the next 10 years and can use it productively.



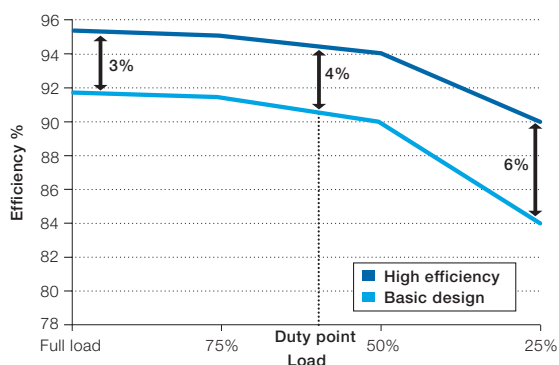
## Step 4 - the products, motors

### Choose the most energy efficient motors

High efficiency electric motors are generally 3 percent better in efficiency than standard designs. Using such motors would help to reduce CO<sub>2</sub> emissions by up to 2 million tonnes per annum, while reducing the UK industrial electricity bill by up to £120 million. ABB's high efficiency motors satisfy the market demand for reduced energy costs without an excessive capital cost penalty to the user.

### Effect of reduced or varying load

Motors generally run at 65 percent of full load. The graph shows how the high efficiency motor maintains efficiency across a greater load range, whereas a basic design motor would incur further losses.



### High efficiency in variable-speed operation

All motors lose efficiency when used at reduced speed with a variable-speed drive, but the high efficiency motor retains much more of its efficiency across the speed range. The lower the speed, the greater the difference.

### Energy efficiency improves reliability

High efficiency motors can improve reliability because less of the energy is converted to heat which keeps the temperature low inside the motor. While the normal running temperature in high quality motors running at full load can be as low as 60-80 °C, lower quality motors can run in excess of 90 °C. Theoretically, a reduction of 10-15 °C will double the life of the windings. It will also give longer life to the bearing grease, extending the re-greasing intervals.

### Motor purchase price versus running cost

(considering IE2 high efficiency motor)

Output (kW)	11 kW	45 kW	90 kW	355 kW
Approximate purchase price	£615	£2,300	£4,100	£16,700
Motor efficiency (full load)	90.4%	93.9%	94.7%	95.9%
Input (kW)	12.17 kW	47.92 kW	95.04 kW	370.18 kW
Daily running cost	£21.91	£86.26	£171.07	£666.32
Time to consume own cost in energy used	29 days	27 days	24 days	26 days

Based on continuous duty at £0.075 per kWh

### Motor purchase price versus running cost

(considering IE3 premium efficiency motor)

Output (kW)	11 kW	45 kW	90 kW	355 kW
Approximate purchase price	£770	£2,750	£4,750	£19,200
Motor efficiency (full load)	92.3%	95.2%	95.9%	96.7%
Input (kW)	11.92 kW	47.27 kW	93.85 kW	367.11 kW
Daily running cost	£21.46	£85.09	£168.93	£660.80
Time to consume own cost in energy used	36 days	33 days	29 days	30 days
Additional cost saving over IE2 p.a.	£164	£427	£782	£2,017
Additional CO <sub>2</sub> saving over IE2 p.a.	1,095 kg	2,847 kg	5,212 kg	13,447 kg
Payment for additional IE3 investment	<12 mths	<13 mths	<10 mths	<15 mths

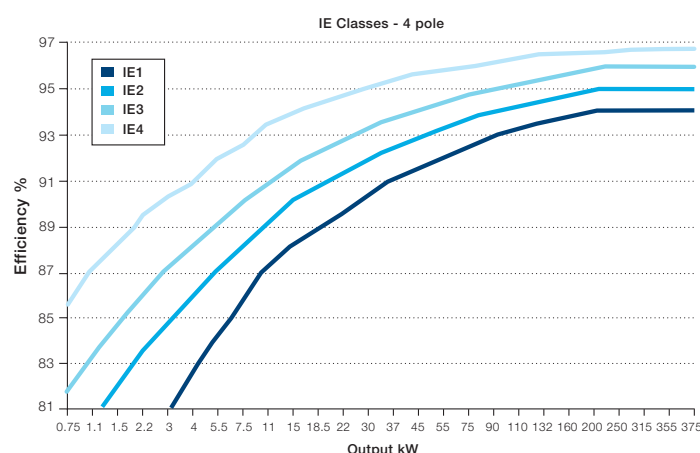
Based on continuous duty at £0.075 per kWh

### Energy classification

The International Electrotechnical Commission has introduced a new standard relating to energy efficient motors. It defines four IE (International Efficiency) efficiency classes for single-speed, three phase, cage induction motors.

Super Premium efficiency	IE4	Super premium
Premium efficiency	IE3	Premium
High efficiency	IE2	Comparable to EFF1
Standard efficiency	IE1	Comparable to EFF2

### IE efficiency classes for 4-pole motors at 50 Hz



### ABB supports EU energy efficiency programme

ABB is an official endorser of the European Commission's Motor Challenge Programme (MCP), a voluntary scheme to encourage the use of high-efficiency motor-driven systems throughout industry.

Looking for suppliers that are MCP Endorsers helps end users to know which companies will help them achieve their

## Step 4 - the products, motors

energy saving goals. For ABB, MCP Endorser status is a natural continuation of the company's efforts to design energy efficient motors.

### Enhanced Capital Allowances (ECAs)

#### Eligibility criteria – motors

Cage induction, fixed speed motors between 200 and 700 V/ 50 Hz, are eligible for ECAs, regardless of application, provided they meet or exceed the energy efficiency criteria (below). In addition, all multi-speed motors used in liquid or gaseous movement applications are eligible.

#### Replacement motors

If you purchase a motor from the Energy Technology Product List you will be able to claim ECAs on the cost of that motor along with any capital costs incurred directly on the

**Table 1: Minimum efficiencies at full load**

Power (kW)	2 Pole	4 Pole	6 Pole	8 Pole
1.1	82.8	83.8	–	–
1.5	84.1	85	–	–
2.2	85.6	86.4	–	–
3	86.7	87.4	–	–
4	87.6	88.3	–	–
5.5	88.6	89.2	86	86
7.5	89.5	90.1	89	89
11	90.5	91	89	89
15	91.3	91.8	90	90
18.5	91.8	92.2	90	90
22	92.2	92.6	91.5	91.5
30	92.9	93.2	92	92
37	93.3	93.6	93	93
45	93.7	93.9	93.4	93.4
55	94	94.2	93.8	93.8
75	94.6	94.7	94.3	94.3
90	95	95	94.5	94.5
110	95	95.1	94.8	94.8
132	95	95.5	95	95
150	95.8	95.7	95.5	95.5
185	96.1	95.9	95.6	95.6
200	96	95.8	95.5	95.5
250	96	96	95.9	95.9
280	96.3	96.3	96	96
315	96.4	96.4	96	96
355	96.4	96.5	–	–
400	96.5	96.5	–	–

\* The amount that you are able to claim when purchasing motors independent of plant or machinery is the full motor cost plus installation costs incurred. (Invoices and receipts will be required). The table shows ABB list prices for the motor only. For more details please see <http://etl.decc.gov.uk/>

installation of the motor. In order to do this you will need to keep a record of your expenditure, i.e. your invoice statement in order to claim on the correct amount. Do not use the amounts in table 2 below.

#### OEM products

Where you acquire a larger item of plant or machinery that has a qualifying motor already installed, the proportion of the cost that relates to the motor will attract ECAs. In order to establish if the piece of equipment bought contains any qualifying components you will need to speak with your supplier or distributor. They will be able to provide you with evidence of which components have been used and then you will be able to check if they are listed. The amount that you are able to claim on when buying a secondary piece of equipment that contains an eligible motor is given in the table below. Most of ABB's range of motors qualify for ECAs. The following is an extract from ABB's motor catalogue.

**Table 2: Aluminium motors (4 poles 1500 rpm, 50Hz)**

Power (kW)	Motor Ref.	List Price/£* Foot mounted (see note below)	Incorporated ECA/£** (see note below)
1.1	M3AA 90 LB	£306	£256.00
1.5	M3AA 90 LD	£367	£298.00
2.2	M3AA 100 LC	£417	£353
3	M3AA 100 LD	£467	£422
4	M3AA 112 MB	£558	£486
5.5	M3AA 132 M	£714	£615
7.5	M3AA 132 MA	£917	£823
11	M3AA 160 MLA	£1,076	£1,197
15	M3AA 160 MLB	£1,286	£1,124
18.5	M3AA 180 MLA	£1,616	£1,719
22	M3AA 180 MLB	£1,904	£1,953
30	M3AA 200 MLA	£2,373	£2,395
37	M3AA 225 SMA	£3,193	£3,379
45	M3AA 225 SMB	£3,886	£3,936
55	M3AA 250 SMA	£4,643	£4,518
75	M3AA 280 SA	£5,355	£5,578

\*\* The amount that you are able to claim when buying a secondary piece of equipment that is incorporated with an eligible motor is given here. It incorporates the costs of the motor, enclosures, mountings, terminal boxes and other miscellaneous modifications and extras as well as installation. Installation includes cabling, wiring, end shields, safety guards, mounting, craneage, alignment, shimming and balancing. The values in this column apply to "standard motors" which includes standard, non-sparking, increased safety and multiple speed motors. Flameproof motors also qualify, but with higher values. See the website [www.eca.gov.uk](http://www.eca.gov.uk) for more details.

## Step 4 - the products, drives

### Choosing energy efficient products

AC drives reduce energy wastage in all phases of operation. Changing production volumes by mechanical means is very inefficient. With AC drives, this can be achieved by changing the motor speed. Particularly in pump and fan applications, this saves lots of money, because the shaft power is proportional to the cube of the flow rate (see page 5). AC drives save energy because the motor does not use more electrical energy than required.

For all applications, ABB offers the most extensive AC drive product range available, from 0.18 kW to 27 MW.

### Benefits of variable-speed drives include:

- Reduced maintenance through smooth starting methods
- Accurate process control through infinitely variable stepless speed control
- Full protection of cables and motor against many faults
- Soft start and stopping avoids any mechanical damage to the process
- Wide range of speed, torque and power gives accurate speed control that results in process optimisation and an improved quality end product
- Improved power factor helps maintain motor efficiency at reduced load
- EMC protection against interference with other sensitive equipment
- Production increase through increased top speed (application dependent)

### ABB's drive family includes:

ABB industry-specific drives 0.37 to 5,600 kW

ABB micro drives 0.18 to 4 kW

ABB machinery drives 0.37 to 560 kW

ABB motion control products 0.75 to 60 kW,

ABB general purpose drives 0.55 to 355 kW

ABB industrial drives 0.55 to 2,800 kW

ABB medium voltage drives 315 to 27 MW



ABB machinery drives are designed to meet the requirements of an extensive range of machinery applications across all industrial sectors.



Among the built-in features of ABB drives are safe torque-off, EMC filters, brake choppers and drive protection.



## Step 4 - the products, drives

### Energy Saving Features

There are many features within ABB drives that enhance energy efficiency. Here are a few examples:

#### Energy monitoring built in as standard

Many drives across the ABB drives family feature built in energy monitoring so users can identify the energy they are saving compared to the application being controlled direct-on-line. The savings are displayed on the keypad in local currency; in tonnes of CO<sub>2</sub> saved; and in kWh and MWh so information can be used to provide a picture of an applications performance.

#### Flux optimisation

ABB's motor control platform, direct torque control (DTC), also features a function called flux optimisation which minimises motor losses. The result is an additional 10 percent energy saving compared to standard AC drives on pump, fan and other centrifugal applications.

#### Regenerative drives

Further energy saving can be achieved by using regenerative drives. These drives pass the energy produced by a decelerating load back to the supply.



The regenerative drive offers significant energy savings compared with other braking methods such as mechanical and resistor braking, as energy is fed back to the supply network.

### Energy saving tools

For comparison of energy consumption between different flow control methods in pumps and fans, ABB has developed calculation tools for estimating the savings that become available when applying electric speed control to certain flow machines.

#### PumpSave

For comparing AC drive control against throttling, on/off and hydraulic coupling control in pumps. Calculate how much energy and money you could be saving with ABB drives while also deriving other benefits such as soft starting and stopping, an improved power factor and connection into process automation. PumpSave also carries out a simple dimensioning and recommends an appropriate ABB drive type.

#### FanSave

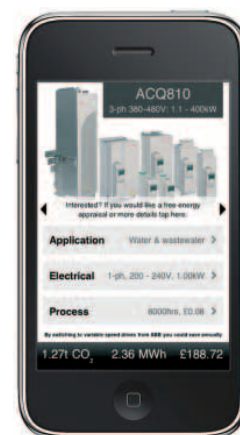
For comparing AC drive control against traditional flow control methods in fans. Calculate the savings you can achieve by replacing outlet damper, inlet vane or pitch control methods with electronic speed control from an ABB drive. FanSave also carries out a simple dimensioning and recommends an appropriate ABB drive type.

#### ABB energy calculator APP

The free ABB energy calculator APP allows you to calculate the energy savings you can achieve on a typical pump or fan load by replacing direct-on-line control with a variable-speed drive. Simply select your industry and your operating duty profile; the voltage, phase and motor power rating; running hours; and electricity costs. The APP then estimates how much CO<sub>2</sub>, energy and money you can save by installing an ABB drive to control the application (Available online and through BlackBerry App World and the Apple iTunes store).

To download a series of energy saving tools go to:

**[www.abb.co.uk/energy](http://www.abb.co.uk/energy)**



## Step 4 - the products, drives

### Enhanced Capital Allowances

#### Eligibility criteria – Drives

If you purchase a variable-speed drive (VSD) which appears on the Energy Technology Product List for a liquid or gas movement application, then you will be able to claim ECAs on the provision of that item.

Claims must be based on the costs incurred. Where you have purchased a qualified item that is not already incorporated into a larger item of plant or machinery, you must use the price paid for the qualified component as the base of your claim. In this case, do not use the table below.

For a larger item of plant or machinery that has a qualifying product already installed in it as a component, the proportion of the cost that relates to that qualifying component will attract ECAs. (The remainder of the costs will be eligible for capital allowances at the normal rate). In order to establish if the piece of equipment bought contains any qualifying components you will need to speak with your supplier. They will be able to provide you with evidence of which components have been used and then you will be able to check if they are listed.

For a compressed air system, only one compressor fitted with an eligible VSD per system will attract the ECA. You will not be able to claim for more than one VSD per system. A compressed air system is specified as being one or more compressors on a branch or ring main system.

The amount that you are able to claim when buying a piece of equipment that is incorporated with an eligible VSD is given in the table below. It includes provision for supply of the VSD and typical enclosure (including measures to meet EMC directives) or the cost of integrating it into other equipment. Other costs for associated control equipment such as programmable logic controllers (PLCs), transformers etc are not included.

#### How to claim

ECAs are claimed in the same way as other capital allowances. They are claimed on the Corporation Tax Return for companies and the Income Tax Return for individuals and partnerships.

Eligible products are named on the Energy Technology Product List. Only products on the Energy Technology List on the ECA website will qualify - <http://etl.decc.gov.uk/>. ABB or its authorised partners offer advice and assistance on all aspects of ECAs applied to drives or motors.



**ABB industrial drives have been designed for demanding applications, featuring unrivalled accuracy and programmability.**

Power (kW)	Drive Ref.	List Price/£*	Incorporated ECA/£**
1.1	ACS550-01-O3A3-4	£399	£533
2.2	ACS550-01-O5A4-4	£525	£655
4	ACS550-01-O8A8-4	£651	£878
7.5	ACS550-01-O15A-4	£914	£1,587
15	ACS550-01-O31A-4	£1,428	£2,432
30	ACS550-01-O59A-4	£2,646	£3,956
55	ACS550-01-125A-4	£4,483	£6,999
75	ACS550-01-157A-4	£4,819	£7,899
110	ACS550-01-195A-4	£7,405	£10,570
132	ACS550-01-246A-4	£9,095	£12,157

## Step 5 - the proof

ABB drives save over 220 million tons of CO<sub>2</sub> per year. The equivalent of more than 55 million cars yearly emissions ABB drives saved about 260 TWh in 2010 equivalent to the consumption per year of more than 65 million households across Europe. The following are a small selection of application references benefiting from an ABB drive and/or motor. To discover more visit [www.abb.co.uk/energy](http://www.abb.co.uk/energy).



### Pizza Hut outlet slices 85 percent off electricity costs

An 85 percent reduction in cooker hood electricity costs is being achieved at a fast food outlet following the installation of a 1.5 kW and a 3 kW ABB drive on the air extraction cooker hood system.

Fans were running for 13 hours a day at full speed and consumed between 35 kWh and 45 kWh per day. After the introduction of an ABB component drive, the fans now use, on average, below 10 kWh per day, representing a considerable energy saving and a payback period of just 18 months.



### Severn Trent Water saves £100,000 per year in energy costs

A water company is saving around £100,000 per year on energy costs following the installation of ABB drives.

The company was having problems with pumps being blocked by rags. To solve the problem six 75 kW ABB industrial drives were installed on all the pumps, each equipped with ABB anti-jam software. The anti-jam software module performs a number of cleaning cycles every time the pump starts helping to maintain flow rates in accordance with Environment Agency guidelines.





## Step 5 - the proof

### **Aerospace manufacturer cuts £12,000 from energy costs**

ABB drives, designed into hydraulic systems, are saving Trelleborg over £12,000 a year on energy costs.

The hydraulic pressure in the system was maintained by a motor whereas if there was no demand for hydraulic power, the motors would simply continue to build hydraulic pressure. Four 18.5 kW ABB standard drives were installed to automatically maintain the system pressure just below the system unload value. Energy savings achieved on this application are £2,742 per motor with a payback time of 11 months.



### **Gluten-free baker dishes up £20,000 in energy savings**

Improved speed control on one of its production lines is enabling The Village Bakery to save £20,000 per year.

The new drive has delivered a 10 percent reduction in tin greasing agent. Previously the machine had to start spraying the greasing agent before it 'saw' each tin. Now more of the greasing agent ends up where it's supposed to.

The ABB drive also optimises the speed of the conveyor to match the size and throughput of different products more accurately, leading to savings of around 25 percent in the running costs for the line.



### **ABB drive cuts 20 percent off dust extraction costs for metals manufacturer**

Firth Rixson, a specialist metal forging company is saving 20 percent on the energy use for its dust extraction system after installing an ABB drive.

The manufacturer installed an ABB industrial drive to power a 75 kW extraction fan motor at its plant. By reducing the speed of the fan, savings of 20 percent on consumed energy are achieved, saving 44 tonnes of CO<sub>2</sub> per annum.



## Step 5 - the proof

### **Birmingham theatre cuts energy bill by up to 30 percent**

A Birmingham theatre has cut the energy consumed by motors for heating, ventilation and air-conditioning (HVAC) duties by more than a quarter, following the installation of 29 ABB standard drives for HVAC.

The drives range from 2.2 kW to 30 kW and control motors on the pumps that move hot and chilled water around the building. As a result, the motors have been using between 25 and 30 percent less electricity since the drives were installed, while the cost of running the fans that keep air flowing through the ventilation system has been cut by between 28 and 30 percent.



### **Steel maker to save £1 million with new drives**

Tata Steel (formerly Corus Strip Products) is saving a million pounds in annual energy costs from an installation of ABB drives.

24 ABB industrial drives, ranging from 140 to 400 kW, are being installed to control pumps on the hot strip and cold mills, plus three fans on the coke ovens. The pumps recirculate cooling water in the mills, while the fans are used for dust extraction at the coke ovens. The cost of the drives is about £1 million, with the whole project including pumps, cabling etc. costing around £2.5 million.



### **Water company improves pumping station efficiency**

Bristol Water has improved the efficiency of water pumps at one of its pumping stations from 68 percent to 87 percent following installation of ABB drives.

ABB's partner APDS installed two transformers, three new pump ends with ABB high efficiency motors and three 400 kW ABB industrial drives. These were low harmonic drives to comply with the G5/4 regulations. The 40 mega litre pumps went from consuming 560 kW down to 240 kW.





## Step 5 - the proof

### Semiconductor plant saves £30,000 on cooling cost

X-FAB UK Ltd, based in Plymouth, UK is saving over £30,000 a year in energy costs, since installing six, 37 kW ABB standard drives for HVAC on its three cooling towers. The £15,000 installation is set to give a payback in only six months.

The three cooling towers produce chilled water for the manufacturing process. With the ABB drives, two fans start on the first towers at 20 Hz when the building management system indicates that cooling is needed. If more cooling is required, the next two fans start at 20 Hz and then the remaining two start if there is demand for still more cooling.



### Aquarium saves £15,000 in energy

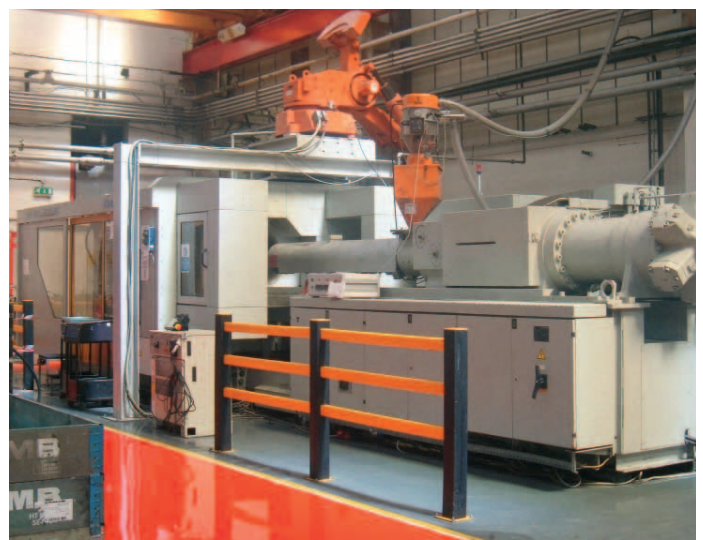
Nine ABB drives are saving the National Marine Aquarium over £15,000 in electricity annually. The aquarium's pumps were controlled by a manual throttle valve. This was wasting energy as the pumps were running at 100 percent speed, with only a proportion of its output being used. Nine ABB drives were installed, ranging from 7.5 to 18.5 kW. Pressure transducers in the pump output now provide a feedback signal to the drive, allowing the drives to determine the correct pump speed for the desired flow rate.



### Plastic manufacturer cuts energy cost by a third

McKechnie, a manufacturer of plastic parts, has used an ABB drive to cut energy consumption by a third on one of its injection moulding machines.

A new control panel combines an ABB industrial drive with an interface from Powermiser, which provides a straightforward, cost-efficient link between the new drive and the existing injection moulding machine motor. The entire project, including full installation and commissioning, is set to deliver a payback of less than two years.



## Step 5 - the proof

### Duck production costs cut by £25,000

Cherry Valley Farms the UK's largest duck producer has reduced its energy costs by £25,000 a year after installing ABB standard drives in some of its refrigeration plant. This represents a saving of 49.6 percent of the energy previously consumed by these applications.

ABB and its channel partner Inverter Drive Systems (IDS) installed ABB standard drives on the condenser fans, controlled by the existing sensors for compressor fixed head pressure. Tests showed that the drives had saved 13 kW in total representing an annual saving of £7,400. With other drives on plant such as air compressors and water pumps, total savings amounted to £25,000.



### UK holiday park saves £77,000 a year with ABB drives

Bourne Leisure, one of the UK's largest holiday park operators is saving £77,000 per year on its energy bills for its swimming pools. This was achieved by fitting variable-speed drives across 36 pools to control the pumps feeding the pool filters. Water is now pumped at a reduced flow rate, helping to save energy and improve the filtration process. Total payback time for the entire project was just over a year.



### New motors save flour maker £15,000 per year

High-efficiency motors from ABB are saving Careform, a leading supplier of bakery products over £10,000 a year in energy costs and a further £5,000 in spare parts. The company invested in 18 high-efficiency AC motors from ABB to run nine flour mills. Failure of the old motors was a major concern and repairing them was a major cost.

- Energy saved about 278,000 kWh/year
- Reduction in CO<sub>2</sub> emissions = 122,000 kg/year
- Other benefits:
  - Reduced maintenance
  - Improved reliability





## Step 6 - the action

### Do your own energy appraisal – we show you how

An energy appraisal is so easy to undertake that ABB encourages its customers to learn the procedure themselves, enabling them to take direct control of their energy savings. If you get an energy appraisal carried out by ABB, the ABB engineer will show you how to identify the savings for yourself, with the help of ABB's Energy Saving Calculator.

This enables you to calculate how much you can save by replacing a fixed speed, damped or throttled, centrifugal load with a variable-speed drive.

Based on motor power, running hours, duty cycle and electricity tariff, the calculator estimates the savings, selects a product and works out the payback time, so that a self-assessment can be made.

ABB's Energy Saving Calculator can be used online at [www.abb.co.uk/energy](http://www.abb.co.uk/energy). The download requires registration.

To find out more about ABB's energy appraisal please call ABB on **07000 DRIVES** (that's 07000 374 837). Alternatively, send an email to [energy@gb.abb.com](mailto:energy@gb.abb.com).

### Keep up with the latest thinking

ABB's dedicated energy site, [www.abb.co.uk/energy](http://www.abb.co.uk/energy), also contains press releases, technical articles, case studies, downloadable literature, a directory of authorised partners and links to related websites such as the Energy Efficiency Best Practice Programme, the Enhanced Capital Allowance scheme and the Carbon Trust.

It also offers advice on legislation currently affecting industry and commerce; such as the CRC Energy Efficiency Scheme. Users can also find information on free, no obligation energy appraisals and arrange a visit through the site.

### ABB energy award

The ABB energy award is given to companies that have achieved particularly effective energy savings using ABB motors and drives. If you or somebody you know wishes to nominate a company, please send us an email on [energy@gb.abb.com](mailto:energy@gb.abb.com) and we will assess the application.



Once you have learned ABB's energy appraisal method, you can easily do your own energy survey.



Craig Valentine, Health and Safety Manager for Bourne Leisure is presented with ABB's special award for energy saving by Douglas Pitt of ABB Drives Alliance member, APDS, right and ABB's James Chalmers, left.

## Step 6 - the action

### Useful websites

- The Carbon Trust **[www.carbontrust.co.uk](http://www.carbontrust.co.uk)** free practical advice to business and public sector organisations to help you reduce energy use.
- Envirowise **[www.envirowise.wrap.org.uk](http://www.envirowise.wrap.org.uk)** government-funded programme offers UK businesses free, independent, confidential advice on environmental issues, including the WEEE directive.
- Enhanced Capital Allowances **[www.etl.decc.gov.uk](http://www.etl.decc.gov.uk)** latest updates from the Government on Enhanced Capital Allowances.
- DEFRA **[www.defra.gov.uk/environment](http://www.defra.gov.uk/environment)** offers information about climate change.
- ESTA **[www.esta.org.uk](http://www.esta.org.uk)** impartial energy saving advice from the Energy Systems Trade Association.
- WIMES **[www.wimes.com](http://www.wimes.com)** about the Water Industry Mechanical & Electrical Specifications.
- United Nations Framework Convention on Climate Change **<http://unfccc.int>** general information on climate change and the Kyoto agreement.
- The United Nations' Intergovernmental Panel on Climate Change (IPCC) **[www.ipcc.ch](http://www.ipcc.ch)** established to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation.



More links on **[www.abb.co.uk/energy](http://www.abb.co.uk/energy)**

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## **Notes:**

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