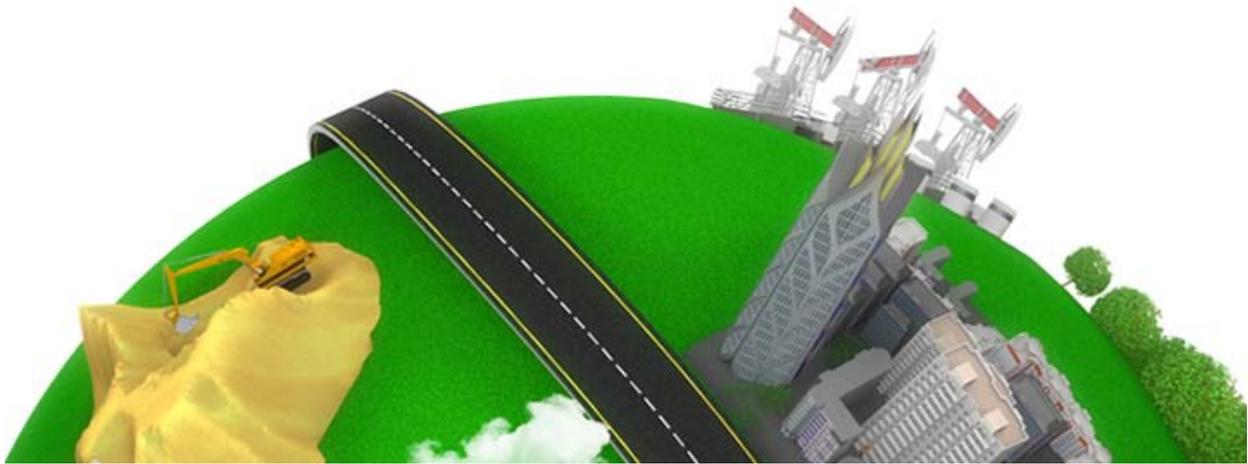


## What is an AC drive and how does it work?



An AC drive is a device used to control the speed of an electrical motor in an energy-efficient way. It can also be utilized to convert energy from natural and renewable resources like the sun, wind or tides, and transmit it to the electrical network or for local consumption. In hybrid technologies, AC drives are used to combine conventional energy sources and energy storages to create total energy management solutions.

The need for energy conservation in order to save the environment is a key driver in the development of speed control devices, and AC drives provide the optimum method of controlling the speed of electrical motors to match load demand. Even small changes in motor speed can cause significant changes in energy consumption.

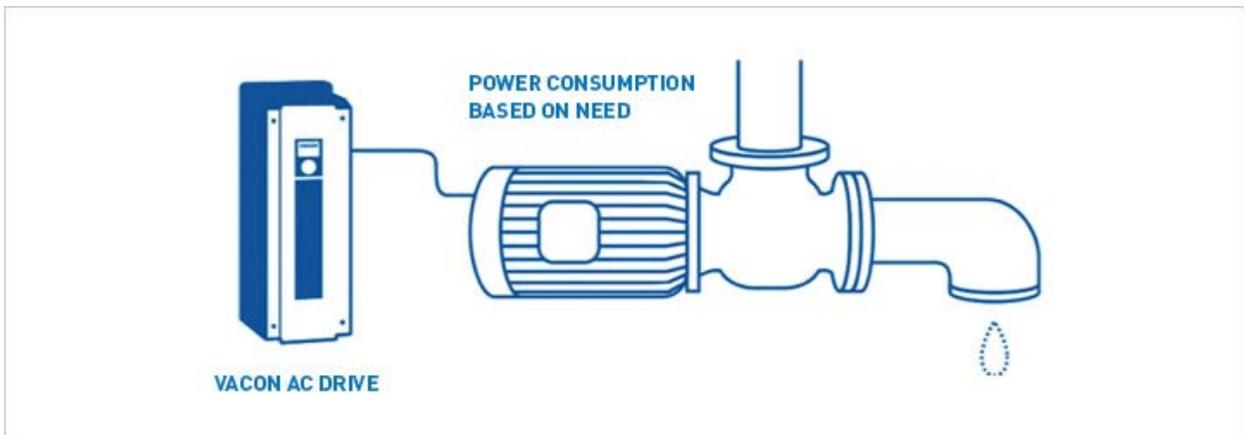
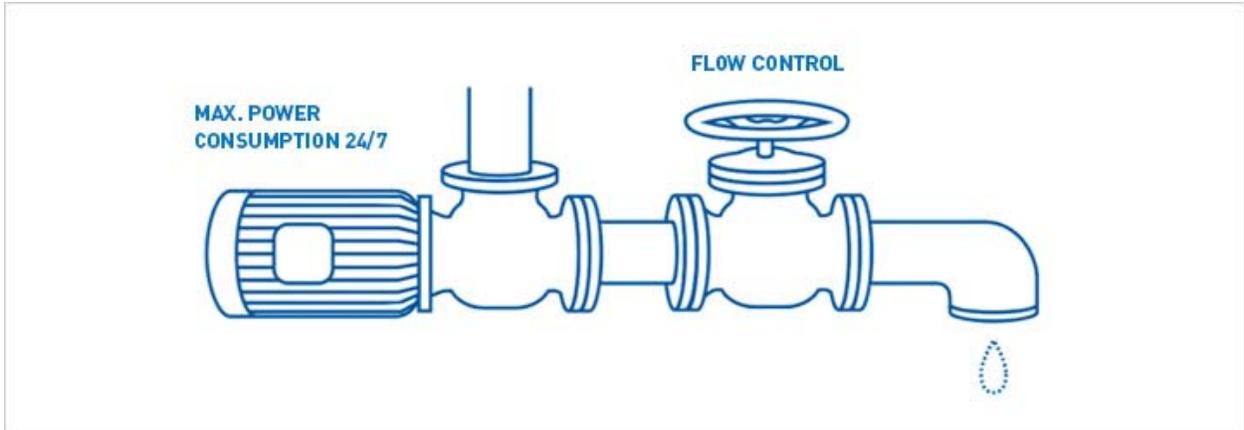
AC drives are well hidden, but nevertheless they play a major and very necessary role in modern, everyday life by making the world and our way of living more sustainable.

### Examples of the positive impact of AC drives

#### Variable speed control

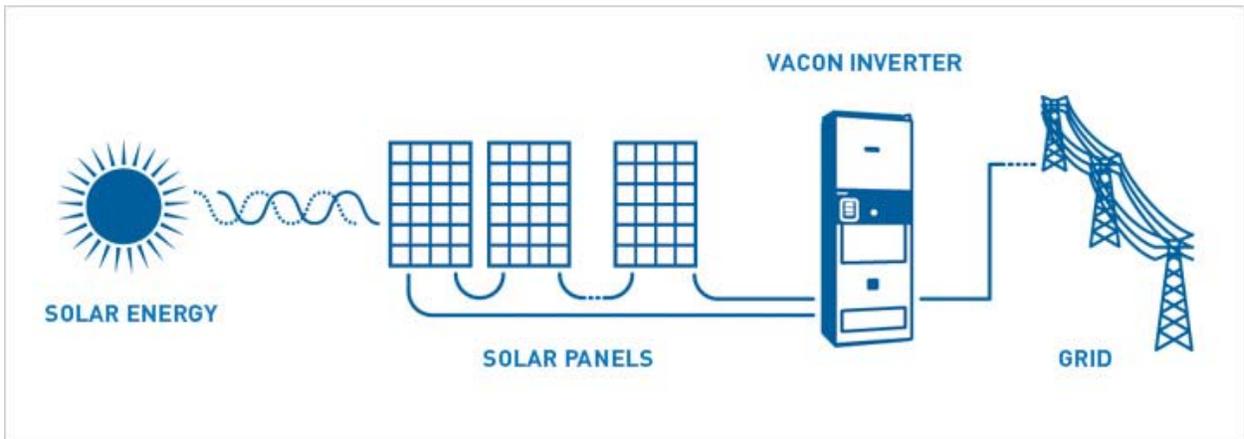
##### Figure 1:

Variable speed control using an AC drive improves energy efficiency and provides significant cost savings. The top graphic shows a pump running without an AC drive. Flow is regulated with a throttling valve. The motor runs at full speed 24/7 and consumes full power. Below, the pump is driven by an AC drive. Pump speed controls the flow and power is consumed based on need.



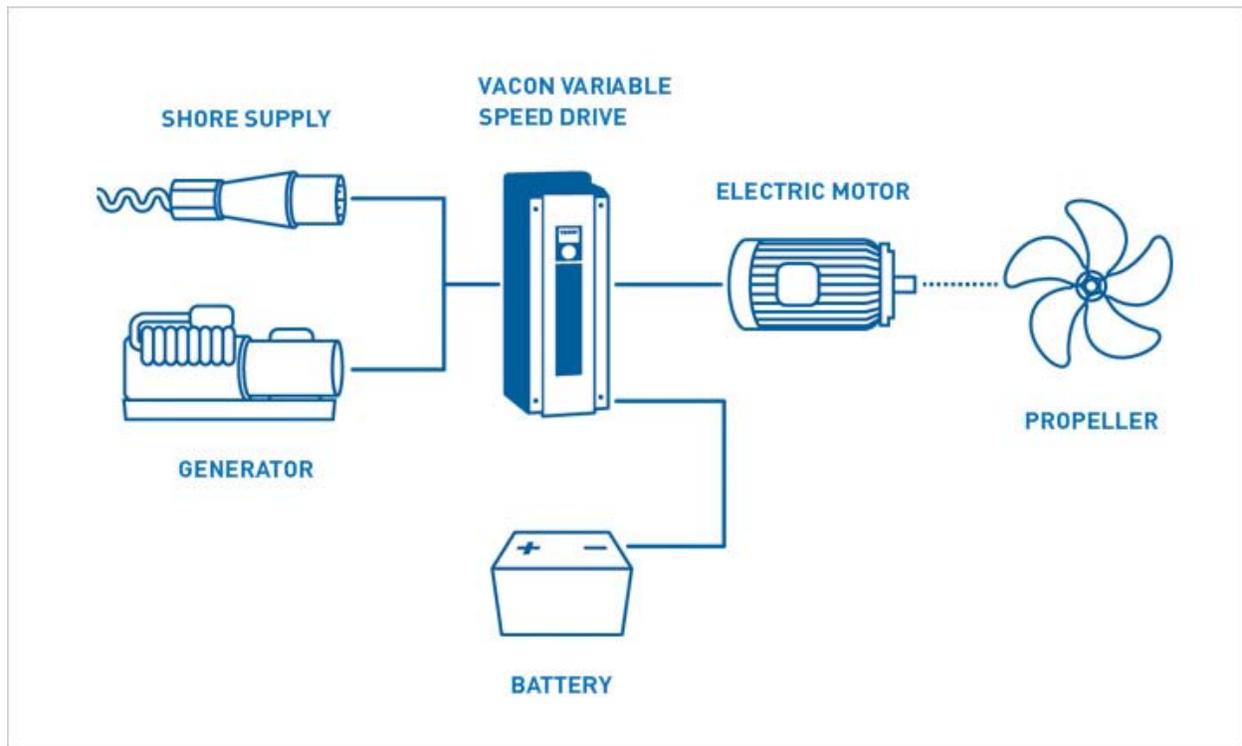
**Renewable energy conversion**

**Figure 2:** Inverters enable energy from renewable sources to be fed to the grid. The graphic shows a solar inverter in a photovoltaic solar power plant converting the energy from solar panels into electricity that powers our homes, factories and everyday lives.



### Energy management solutions

**Figure 3:** Energy management solutions utilize energy storage systems that are controlled with AC drives. Hybrid vessels have low emissions and high fuel efficiency. AC drives charge the battery from the shore connection. During operation, the AC drives combine the power from the diesel-driven generator and the energy stored in the batteries.



### Did you know?

AC drives are also known by various other names such as adjustable speed drives, adjustable frequency drives, variable frequency drives, variable speed drives, frequency converters, inverters and power converters.

- Emerging economies are driving the increase in energy consumption
- 20% of the world's energy consumption is electrical energy
- 40% of electrical energy is used by electrical motors
- 75% of AC drives are used on pumps and fans
- Global electrical energy consumption could be reduced by 10% if AC drives were used in every suitable application

## Why AC drives are used?



By controlling the speed of an electrical motor, converting energy from natural and renewable resources or using hybrid technologies, AC drives:

1. Enhance process control
2. Reduce energy usage and generate energy efficiently
3. Decrease mechanical stress on motor control applications
4. Optimize the operation of various applications relying on electric motors

Taking into account all of the above benefits, AC drives represent an excellent investment. Payback time is short – typically less than one year – particularly in applications that have a very high energy-saving potential such as fans and pumps.

### **1. Enhancing process control**

Electrical motors can be found in all shapes and sizes – from the very small (in swimming pool pumps) to the very large (in ship propulsion systems). They play an important role in enhancing process control in various manufacturing operations as well as in transportation, material handling and most production processes.

Stepless speed control of motors using AC drives enables easy process control from the lowest to the highest capacities. The full control range enables smooth process ramp ups to stable levels that can be further increased towards design maximum levels leading to higher productivity and potentially greater profitability.

AC drives have good connectivity through versatile interfaces, and they can easily be connected to automation systems. Sensors and other field devices can also be connected to AC drives. All this information can be utilized either to control the application driven by an AC drive or for other process control purposes.

## **2. Reducing energy usage and generating energy efficiently**

Electric motors are everywhere and the energy efficiency of each system can be optimized by an AC drive. The slower you can run a motor – while still allowing it to effectively do its job – the more energy you can save. And lower energy consumption reduces costs, saves resources and limits CO2 emissions.

Take an air conditioning system, for example. You need fans to work at high speeds on the hotter days of the year, but at significantly reduced speeds when the temperature drops.

Additionally AC drives enable feeding braking energy back to the network instead of turning energy into heat with electrical or mechanical brakes, and this naturally saves even more energy. Take a full conveyor transporting iron ore from a high altitude mine site downhill towards a processing plant, for example. The conveyor needs constant braking so that it doesn't accelerate. Using AC drives, the braking energy can be fed to the grid meaning the conveyor is actually producing electricity, in the same way as AC drives convert energy from renewable resources to the grid.

## **3. Decreasing mechanical and electrical stress**

Speed control with smooth starts and stops reduces wear and tear on equipment and the costs involved with maintenance, repairs and replacements.

By ensuring a smooth start up, AC drives reduce the mechanical shock to driven equipment such as fans and pumps. Also process equipment, such as air ducts and water pipes, have less stress put on them. For example, if a pipe is filled without speed control, the fluid is going to reach a closed valve with great force. This can cause a strain on the system which may eventually become too much to bear. By using an AC drive on a pump to control flow, fluids can course through the pipe network gradually according to requirements.

Equally as important, stress in an electrical network is also decreased when AC drives start up, control the speed of and bring equipment to a smooth stop. High inertia systems keep freewheeling for a long time unless they are brought to a controlled stop. With AC drives, a controlled stop is normal practice. A pump suddenly stopping may cause water to hammer into the pipes. AC drives performing a controlled ramp down of the pump speed prevents this situation.

When it comes to converting energy from renewable resources into usable electricity for the grid, it is important to follow the network's required grid codes (technical specifications which define the parameters a facility connected to a public electric network has to meet to ensure safe, secure and economic functioning of the electric system.) AC drives support the network according to the required grid codes and, in case of failure, ensure faults are cleared.

#### 4. Optimizing the operation of various applications

Modern machines and systems are driven by electricity. When AC drives are used to replace, for example, hydraulics, space and weight savings can be achieved. Risks of hydraulic oil leakage are also eliminated. Essential parts of industry today, AC drives also optimize the operation of various applications and reduce lifecycle costs.



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- TUESDAY, 02 DECEMBER 2014 BY DANFOSS

Vacon to become part of Danfoss Group

The global AC drives manufacturer Vacon is now part of the Danfoss Group, effective 1 December 2014. In September 2014, Danfoss announced a public tender offer to acquire all the shares of Vacon. By the end of November, Danfoss obtained approvals from all the relevant authorities, and has now acquired more than 90% of Vacon shares and voting rights in Vacon.

The combination of Vacon and Danfoss will create one of the world's leading players in the drives market, leveraging the best of the two companies.