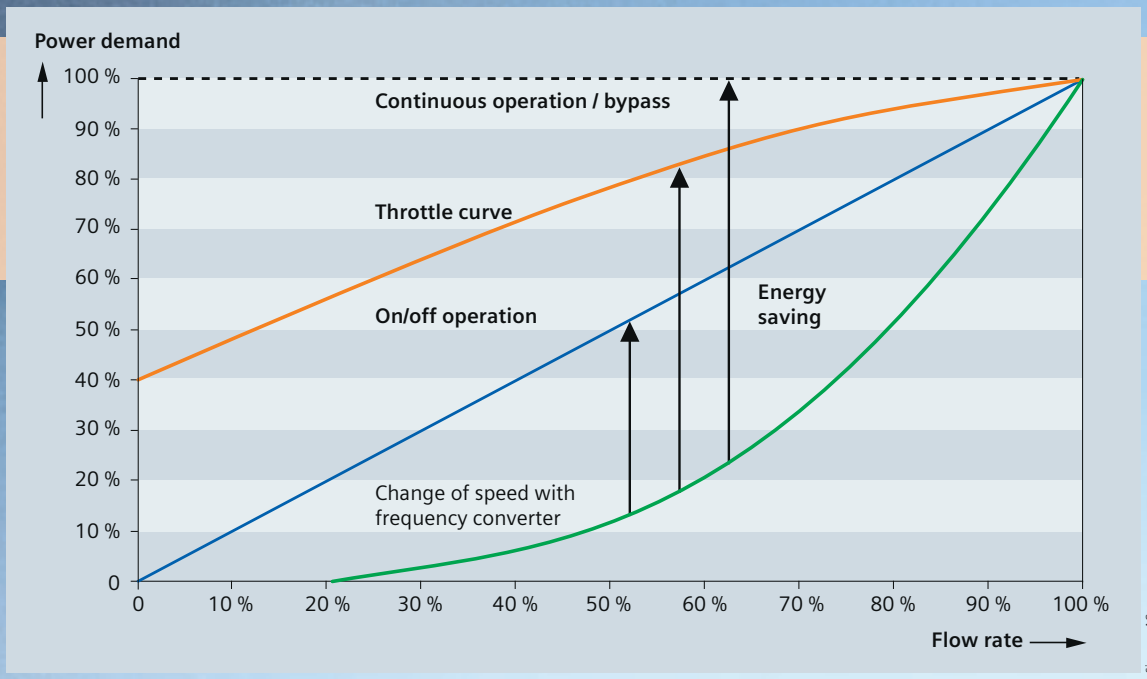
Always the Perfect Drive Solution

Different drive concepts are available for pump, fan, and compressor applications, enabling maximum energy efficiency and cost-effectiveness as well as optimum plant management with regard to the individual production profile and the required control accuracy.

Depending on the individual application, four basic drive concepts can be used in pump, fan or compressor applications: throttle control, the 2-point control with a soft starter, the soft starter frequency converter cascade, and the pure frequency converter control.

Simple solution for production rates close to the maximum

A throttle control consists of the throttle valve, a motor, and a circuit breaker / contactor combination. The production rate is regulated by the electromechanical throttle valve, while the motor is continuously running at nominal speed. This solution, which is the easiest and most cost-effective one to acquire and install, is only profitable in the long run if the production rate is always close to the maximum and subject to only slight fluctuations. In case of fluctuating



Savings potential of throttle, 2-point control, and pump cascades depending on the production rate

production rates, this concept results in considerable losses of partial loads – similar to always driving a car at full throttle and regulating the speed with the brakes.

Level control with optimum efficiency

The second concept, the 2-point control with a soft starter, is suitable for controlling the level of a tank, for instance. The 2-point control ensures that there is always sufficient liquid in case of variable extraction. A sensor monitors the level in this process. If the minimum level is reached, a pump is switched on via the soft starter, which is turned off again once the top level is reached. Both the pump and the tank must be dimensioned in a way that the on and off phases are relatively long, thus avoiding frequent switching. The electronic phase angle control of the soft starter prevents hard impacts in the pipe system and conserves the mechanical components. Thanks to this technology, the power consumption of these switching devices falls almost to that of a simple contactor. Motor and pump run at nominal speed with optimum efficiency and thus ensure efficient operation. The costs for installation, acquisition, maintenance, and operation are particularly low for this drive solution.

Controls for complex production profiles

If production rates fluctuate more significantly, the soft starter frequency converter cascade and the pure frequency converter control are the right solutions. With both, power demand can be reduced by up to 60 percent compared to a throttle control, and in extreme cases even up to 70 percent.

In the case of the cascade, the drive solution consists of a combination of one or more soft starters with one frequency converter that takes care of the fine control. Here, the single-speed soft starter is automatically switched on once the maximum pump output of the variable-speed first pump is exceeded. If the maximum output of the first pump is, for example, at 50 percent of the total output of the application (the volume of the base load depends on the application; in practice it could also be 40 or 60 percent of the total output), the frequency converter now controls the exact demand between 50 and 100 percent. The control fluctuations during the changeover from frequency converter to soft starter in this drive solution are unproblematic for many applications. The advantages of both drive technologies – frequency converters and soft starters – can be optimally exploited here, and production is made considerably more energy efficient by splitting the pump output into two smaller units, especially for lower loads, since the pumps are running at the optimum operating point.

If the process requires high control accuracy and speed, the pure frequency converter control would be the right choice. Even in the case of extremely fluctuating production rates, the frequency converters adjust the motor speed quickly and precisely to the currently required production rate. Only the currently required energy is actually being consumed, and this result is achieved with maximum ease of use.

Always the most energy-efficient and economical solution

By analyzing the investment costs, the plant-specific characteristics, and the individual production profile, it is possible to determine which drive concept is the most energy-efficient and economical one for the individual application. No matter which of the four concepts ends up being the most appropriate solution, with components and systems from the extensive portfolio of Sirius switching devices, Sinamics frequency converters, and Simotics motors, there is always the perfect drive solution available, characterized by the perfect interaction of system components and the seamless integration into higher-level automation environments. +

MORE ON THIS TOPIC:

+ **www.siemens.com/pumps**
+ **www.siemens.com/fans**
+ **www.siemens.com/compressors**

CONTACT:

+ **Contact person:**
Stefan Rausch,
Technical Editor
+ **E-mail:**
stefan.rausch@siemens.com

Efficient Irrigation

In regions with agricultural areas that need to be irrigated even in times of great summer droughts, irrigation should take place as sustainably as possible, both on cost grounds and for environmental reasons. The economic viability of an irrigation system depends above all on the energy efficiency of the pump drives. That is why in Alentejo in the south of Portugal, variable-speed drive systems with Sinamics G150 frequency converters are being used.

Due to its fertile grounds, the region of Alentejo is often called Portugal's granary. However, the summer drought is particularly pronounced here. That is why in the 1990s the Portuguese government decided to build the Alqueva dam, and for this purpose founded the EDIA (Empresa de Desenvolvimento e Infra Estruturas do Alqueva).

Largest dam project in Europe

Today, the Alqueva has a shore length of 1,200 km and holds over four billion cubic meters of water, making it the largest artificial lake in Europe. When completed, 110,000 ha of land are to be irrigated from it. This will enable a more intense cultivation of crops and vegetables and should also improve the yield of the olive groves.

Siemens has already been an important partner of EDIA for irrigation projects in recent years. The last large project was the Brinches Laje pump station near Serpa, designed to provide a flow of 3 m^3/s, from which 12,000 ha of land are being irrigated alone. The most important requirement for the drive system here was to constantly adjust the flow rate to the water requirement, which varied depending on the temperature, the moisture content of the soil, and the state of growth of the plants, without wasting energy in the process.

Great energy savings potential for the pumps

Especially when it comes to fluid flow machines such as pumps, wasting energy is a problem since their power consumption increases exponentially with the number of revolutions. That is why there is a particularly large loss of energy with conventional mechanical controlling concepts in partial-load operation. Here, the motor does not always run at maximum speed, while the excess water is being throttled off with mechanical valves.

However, a variable-speed system with a frequency converter adjusts the speed exactly to the currently required flow rate and thus absorbs only as much energy as is needed at the moment. Due to the "square" characteristic curve of the power consumption, the energy savings in partial-load operation are disproportionate. The EDIA therefore decided to use variable-speed drive systems for the Brinches Laje pump station. Because of the positive experience in recent years, the EDIA selected 10 low-voltage motors of the N-compact line, the speed of which is regulated via Sinamics G150 frequency converters.

Highly efficient drive system

In addition to their reliability and their compact design, the N-compact low-voltage motors are characterized by their high level of efficiency. They contribute considerably to the low energy requirement of the pump station and the correspondingly low operating costs. When it comes to variable-speed operation, the Sinamics G150 frequency converters have an even greater impact on the energy balance. They reduce the energy requirement by a double-digit percentage.

Added to this are further advantages of variable-speed operation. For example, with a frequency converter, the flow

Sinamics G150: Advantages at a glance

- **Cost-effective:** from planning to service
- **Compact:** up to 70 percent less space required
- **Quiet:** noise emissions of typically 69 dB(A)
- **Economical:** up to 50 percent less power required by the drive system
- **Exact:** for flexible adjustment to processes
- **Uncomplicated:** easy operation throughout
- **Unique:** 100 percent system voltage on the motor without adverse effects
- **Modular:** also available as Sinamics G130 modular installation device

The Brinches Laje pump station is designed for a flow of 3 m^3/s and waters 12,000 ha of land with energy-efficient drive systems

rate can be set much more precisely and with shorter response times than with throttles or valves. In case of fluctuations in demand, the pump can also adapt the output to the current demand much more quickly and exactly. Not least, the soft starting and stopping relieves the mechanics of the drivetrain, thus increasing its service life. Pressure waves that cause stress or even damage do not occur in the pipe systems here.

The frequency converters of the Sinamics G150 line are cabinet units for low-voltage individual drives of large output that require no regeneration of energy back into the mains. They are available for delivery from 75 kW to 2,700 kW, and are reliable, quiet, compact, and easy to operate – with low costs from planning to service. EDIA has experienced this already with other pump stations, which made the choice of Sinamics drives for the 10 pumps of Brinches Laje even easier.

Integrated overall concept

The perfectly matched drive systems made of N-compact low-voltage motors and Sinamics G150 frequency converters are part of an integrated overall concept in which all components and systems interact perfectly.

In addition to the drive technology, Siemens also delivered Simatic S7 PLCs, local and remote monitoring systems, instrumentation, and the low-voltage switching technology for Brinches Laje, and connected all system components via industrial communication systems. In this process, the entire drive and automation environment was customized for the requirements of EDIA and its irrigation projects. +

MORE ON THIS TOPIC:

+ **www.siemens.com/sinamics**

CONTACT:

+ **Contact person:**
Stefan Rausch,
Large Drives
+ **E-mail:**
stefan.rausch@siemens.com

+ **Contact person:**
Luis Miguel Cabrita,
Large Drives
+ **E-mail:**
luis.cabrita@siemens.com