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# Simple ways to maximize the efficiency of your application

## Integrated Drive Systems (IDS) for any industry

No matter what industry you're in, the price of your inputs is bound to fluctuate – usually trending in a direction that doesn't favor profits. You can't control the rising costs of raw materials and energy, but you can control how much you get out of them. The simplest way to do this is by maximizing the efficiency of your equipment.

Performance and productivity are directly related to energy use, reliability and maintenance costs. The improved performance offered by a highly efficient drive train helps increase output and decrease energy consumption. It also reduces wear and tear, thereby limiting maintenance costs and downtime while extending the life of your equipment. To attain this level of efficiency, one need only turn to the application-specific engineering found in integrated drive systems.

### Accommodating the demands of oil and gas applications

In the oil and gas industry, narrow margins require continuous production – which means continuous motion. The ongoing nature of these operations demands enormous amounts of energy and places a great deal of mechanical stress on equipment.

That's not to mention the harsh operating conditions where most drilling, pumping and refining take place. Salt spray, extreme temperatures, explosion hazards and remote locations serve to heighten the importance of efficiency and reliability. Fortunately, the right drive system can minimize problems.

Wherever liquid substances must be transported, you'll find centrifugal pumps. They extract oil and gas from wells that are thousands of feet deep and push the substances through pipelines that are hundreds of miles long. The ruggedness of the pumps is important – the ruggedness of the drive system even more so. If either fails, the resulting safety risks and downtime costs can be catastrophic.

The key is to tailor the system to the application and its environment. For example, when the loading conditions of a fixed-speed pump system vary, throttling the valve or closing the dampers is a common approach. But because you're still running at full speed, you generate significant motor losses and premature system component wear. It's like pressing the gas pedal and the brake pedal at the same time when trying to slow your car on the highway: fuel efficiency goes out the window, and you wind up wearing out your brakes and engine a lot sooner. With pump systems, it's the motor and energy efficiency that suffer.

## Perfectly matched components for oil and gas applications

Properly integrated drive systems take these types of operating demands into account. Variable frequency drives (VFDs) are a natural fit for variable loading conditions. They offer precision speed control, so that energy isn't wasted and you're not causing excessive wear that can affect reliability. A single-source solution amplifies these savings by ensuring that the drive and motor are engineered for optimal performance. If you were to integrate the functionality separately, you would leave yourself vulnerable to design inconsistencies that could negate the benefits of a VFD.

Voltage stress, shaft currents and harmonics are other issues that can be addressed by working with a single supplier. Otherwise, the responsibility lies with you, the end user, to thoroughly understand how the application's requirements relate to the drive train's design, and then coordinate the integration of the appropriate functionality across multiple vendors. A lot can be lost in translation, and if improper sizing or engineering leads to drive failure, you'll have a difficult time getting any of your vendors to accept responsibility.

With a single-source supplier such as Siemens, however, responsibility for the entire drive train is assumed from the start. Siemens uses a system-engineering approach whereby each component is selected and sized by an engineer, allowing for the appropriate expertise to be applied at critical stages of development. Everything from high peak voltages to induction motor shaft currents is addressed during design to prevent damage and extend the life of the system.

The extensive portfolio of solutions that Siemens offers also provides much-needed flexibility in identifying the right drive train solution for specific applications. Siemens has proven experience certifying an explosion-proof motor as part of its Integrated Drive Systems (IDS). And its 100% emission-free STC-ECO motor-compressor solution has helped upstream operations reduce emissions, downtime and safety concerns caused by poor seal reliability.

Perhaps most notably, the Siemens SINAMICS PERFECT HARMONY VFD incorporates fail-safe technology that further reinforces reliability in oil and gas operations. Its Advanced Cell Bypass technology allows the drive to remain operational even in the event of a cell fault. This is the type of failure that would overwhelm conventional drives, bringing production to an abrupt – and costly – halt.

Plus, when service is needed, you only have a single call to make. With Siemens IDS, intelligent, real-time monitoring by a single PLC immediately alerts you of any issues that arise and triggers instant diagnostics that precisely identify the point of failure. By receiving the same information you do, Siemens experts are able to expedite resolution so you can get back up and running quickly.

## Opportunities for energy savings in the pulp and paper industry

Motor-driven systems are responsible for the majority of energy use across all industries, of which the fan systems used in the pulp and paper industry account for 20 percent. According to the U.S. Department of Energy, that amounts to approximately $7.5 billion annually – a number that could be reduced by as much as 25 percent (or 1100 GWh) simply by improving fan efficiency.

Fans are commonly used for moving atmospheric air and providing ventilation in production areas, but their most critical application in pulp and paper mills is providing the air for combustion in steam boilers. This is accomplished through induced draft (ID) or forced draft (FD) fans.

Accurate control of the airflow is crucial, as it affects the boiler's performance and safe operation. At the proper levels, the oxygen facilitates efficient fuel consumption – this is what's called stoichiometric combustion.

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If too much air is introduced to the combustion chamber, however, more energy is required to heat it up to flue gas temperature. And because the oxygen is not consumed during combustion, it carries away otherwise usable heat in the form of stack losses. It can also cause the flame to become unstable. Too little air, on the other hand, results in unburned fuel and excessive emissions, both of which can become serious safety hazards.

Typically, the fans are powered by a constant-speed motor that runs continuously; the airflow is then controlled by throttling the dampers. This imprecise method of control wastes energy on both ends of the process: It requires more energy input to keep the motor running at full speed, and yields less energy output due to boiler inefficiency.

In many mills, the steam produced by high-pressure boilers is also used to generate electricity. The steam passes through a turbine, turning its blades and driving a generator that then converts the mechanical energy into electrical energy. These generators have the potential for as much as 98 percent energy conversion efficiency, but the unreliability of the turbines themselves – and their related maintenance costs – quickly erode any savings.

### Maximizing energy efficiency in the pulp and paper industry

Integrated drive systems offer a simple solution for improving energy efficiency in pulp and paper mills. In fan applications, the most effective way to reduce energy consumption is to integrate a VFD as part of the drive train. Efficiency is gained through the optimization of component compatibility, which is best achieved by single-supplier integration of the drive system.

Depending on the fuel being used, the production demands and the process being supported, the drive train can be tailored accordingly. A sole-source approach takes these parameters into account during the design phase to ensure peak performance and maximum efficiency throughout the system's operational life.

On the face of it, replacing your steam turbine drive systems with electric drive systems might seem overly disruptive to your operations and potentially capital-intensive. But a single-source supplier can engineer, integrate and assemble the entire system prior to delivery so as to minimize downtime. Efficiency improvements in the neighborhood of 40+ percent quickly offset costs, and because there's less maintenance, your total cost of ownership shrinks each year thereafter.

When Siemens replaced a 1950s steam turbine for one company, it only took seven days to shut down, replace the turbine with a complete Siemens Integrated Drive System, and get everything back up and running. The fact that Siemens designed and built the entire drive system reduced the complexity and risk of installation and commissioning. In addition to improved control and efficiency, the mill saw an increase in production almost immediately.

### Unique demands of chemical and petrochemical processes

Hazardous conditions are a given in the chemical and petrochemical industry. This places safety at the top of operational priorities and makes it a key driver when sourcing equipment. Of course, productivity is the other primary consideration. To maintain high levels of production without putting man, machine or the environment in harm's way, reliability is the operative word.

Extruder applications are among the industry's most demanding, and as such, are ideal targets for optimization. Precision control is essential, as there's a great deal of variability in the materials being processed, and the system must be able to withstand the extremely high torque and axial forces from the extrusion process. During cleanout, the ability to maintain minimum speeds is particularly important.

In many cases, direct current (DC) motors are still used for extruder applications. In addition to having a limited range of operational speeds, DC motors are at a disadvantage when it comes to maintenance and support. Demand for DC motors has been on the decline, which is why fewer and fewer suppliers offer them. In new installations, alternating current (AC) motors are preferred because they don't have wear items such as brushers or commutators to hamper reliability and escalate repair costs.

What's more, even slight incompatibility between components can put unnecessary stress on any motor, causing issues ranging from lateral vibration to shaft currents and bearing failure. Over time, these problems only become more and more troublesome, requiring increasingly frequent maintenance until the system itself must be replaced – often much earlier than expected.

### Ensuring safe, reliable chemical and petrochemical operations

AC is more forgiving when accommodating a wide range of motor operating speeds, plus it is easily "stepped up" to higher voltages with just a transformer. A long-overdue upgrade to an AC motor is the perfect opportunity to enhance the reliability of your entire drive train.

By working with a single-source supplier, you can ensure that your motor is appropriately sized and paired with other AC components to maximize the reliability of your process. For example, a variable speed drive can offer improved control for handling different extrusion rates and cleanout speeds. But proper integration is the only way to proactively address potential safety issues related to dangerous pressure and speed levels, as well as explosion risks.

Your supplier should have ample experience with your industry and proven success with engineering safe, effective drive trains for your application. Siemens is a preferred source of solutions that are optimized for hazardous conditions. Its portfolio includes motors and frequency converters from 100W to over 100MW, as well as a range of couplings and gearboxes that are explosion-protected and designed to address specific chemical conditions.

The complex processes employed by chemical and petrochemical facilities demand the exacting attention to detail that only a single-source drive train can deliver. Reliability and safety are areas in which integrated drive systems excel. At Siemens, every consideration is given to the interaction between motors, frequency converters and control systems.

Siemens adheres to strict requirements for a harmonized overall portfolio and close collaboration between end users, EPCs and drive system suppliers. This approach encompasses the overall life cycle of the plant or system, and involves supplying the complete, integrated drive train. All products and processes are in compliance with domestic and international standards and regulations.

## Optimization through integration

Found in critical roles throughout virtually every industry, pumps, fans, compressors and extruders account for the vast majority of applications paired with electric motors. This might make it seem as if motor efficiency should be your focus, but it's only part of a bigger equation. To achieve maximum savings, the motor and drive must be sized appropriately for both the application and each other.

Proper sizing not only promotes greater efficiency, but also prevents excessive wear and tear by minimizing issues such as lateral vibration, shaft currents and electrical losses. The heat generated by wasted energy can put unnecessary stress on components, leading to premature failure. When reliability suffers, productivity suffers.

In process industries such as oil and gas, pulp and paper, and chemical / petrochemical, a drive's parameters and load profile allow experienced engineers to determine the motor's most economical mode of operation. This, in turn, makes it possible to identify which motors and drives are best suited to specific applications and their related environments.

If you're dealing with multiple suppliers, however, you're going to get multiple definitions of what "best suited" means. Narrow portfolios create bias toward products that might not be ideal, but are the closest available. Many vendors are reluctant to share proprietary information, making it difficult to coordinate engineering across components. And when it comes time to assemble your system on-site, differences of opinion can be the difference between an efficient system and a series of service calls.

That's why finding a single supplier with a broad portfolio and deep experience with your process is essential. Sole-sourcing your system not only simplifies engineering and support, but also ensures a perfect fit with fans, pumps, compressors and extruders – no matter what industry you're in.

## Sources

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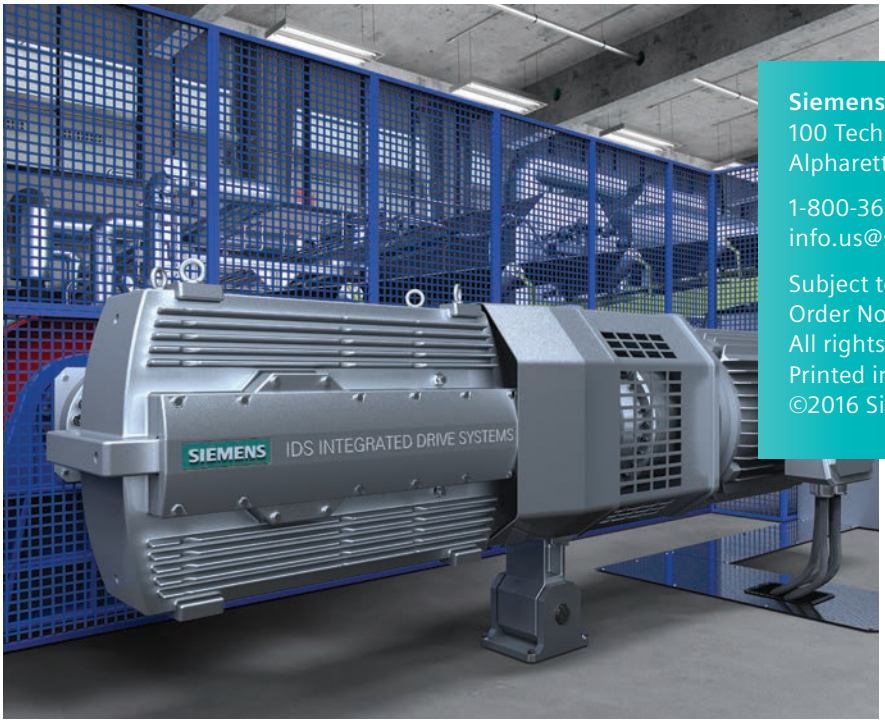


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