Water is the gold of the 21st century.
It’s a planetary resource that concerns all countries. Schneider Electric has the solutions this market needs and will enable you to face your challenges.

The Schneider Electric network of partners, distributors, system integrators, panel builders, electrical contractors, water process OEMs and consulting engineers operates in every country.

Schneider Electric boosts your productivity with services and solutions that cut operating costs:
- power quality and power savings that reduce energy bills
- improved process management for treatment plants, pumping stations, and distribution systems
- increased service life of process equipment

Schneider Electric systems meet North American and international regulations and standards.
They’re safe, dependable, and environmentally friendly.

Schneider Electric is committed to environmental responsibility and sustainable development.
A water or wastewater facility’s sole purpose is to prepare water for human consumption, or for return to the environment. A dramatic irony is that these processes also cause harm to the environment through greenhouse gas and hazardous wastes production, as well as electricity consumption.

Schneider Electric is committed to sustainable development. We do this in several ways:
- provide an energy plan that helps our customers use as little grid energy as possible
- ensure that our products meet the RoHS (Reduction of Hazardous Substances) and REACH (Registration, Evaluation, and Authorization of Chemicals) directives.
- create and provide custom designs that help you lower your operating costs.

Examples include using variable frequency drives on pumps and blowers, so you are only using energy when you have to; and using programmable logic controllers that maintain memory without a battery, which removes lithium hazards and replacement costs, and protects against SSO and CSO events.

This commitment to sustainable development will help you reduce operation, maintenance, and hazardous waste disposal costs, as well as reduce your facility’s carbon footprint.
The right answer for your water and wastewater applications ...
You want
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You want to optimize design and construction costs ...
To provide water on a long-term basis at a reasonable price for the population, you need to achieve all of your objectives at the lowest possible cost. Of course, you also need to get the maximum number of efficient infrastructure retrofits/expansions from the money you have allocated.

Schneider Electric has the means to reduce both design and operating costs.

Optimizing costs requires structured design. To help customers achieve this, Schneider Electric offers proven power and automation architectures, and the design, calculation, and checking tools needed to adopt them.

**From design ...**

Design tools help you quickly and efficiently determine your design parameters and choose equipment to match your needs. As a consequence, design and installation costs are reduced, and the different solutions are easily compared.

Variable frequency drives from Schneider Electric can be supplied with an embedded controller. With this “Controller Inside,” you can develop and load your own application, or use our preconfigured water applications.

**... to operating tools**

Collaborative tools allow design, engineering, and commissioning, from the sensor up to the Supervisory Control and Data Acquisition (SCADA) system. Combined with proven methodologies and predefined application know-how, these tools provide support (including operation and maintenance) throughout a project’s life cycle, and during expansions and process changes. Their unique design and user interface limit the need for operator and maintenance training.

**Communication**

Motor Control Centers (MCCs) also reduce design costs. Using the latest communication technologies, intelligent Motor Control Centers (iMCCs) have smaller components, and reduced cabling to optimize hardware and labor costs.
You need to reduce your operating costs ...

Electrical energy represents 1/3 of the total operating costs for water and wastewater agencies and utilities.

Our water and wastewater process and energy efficiency experts.
Up to a 30% savings in energy

You can reduce your operating costs through load shifting and high-efficiency motors and drives, as well as power monitoring and process optimization. Our solutions for power management and control can reduce your energy consumption by up to 30 percent.
Electrical energy may account for as much as 30 percent of your operating costs. Three aspects of energy efficiency should be considered for a high level of power quality:

**Energy Savings** > reduced consumption for all types of operations

**Energy Cost Optimization** > reduced cost for the energy used by the different operations

**Availability and Reliability** > coupling design strategy with proper maintenance and operation can provide enhanced reliability, fewer outages, and sustained energy savings

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**Solutions for energy savings**

The latest generation of low-loss transformers and high-performance motors improves system efficiency by up to five percent.

When high-power motors are requested (>500 HP), the use of a medium voltage (MV) supply reduces line currents, thus reducing the watts lost in transformers, cables, and motors. A low voltage (LV) supply may become cost prohibitive because of the limited availability of equipment, or due to that equipment’s prohibitive size and need for multiple sets of cables.

Variable-frequency drives are used to great advantage in pumping applications. By adjusting the speed of rotation, the absorbed electrical power may be reduced by 50 percent at 80 percent of nominal flow.

In water and wastewater installations, harmonics are mainly generated by variable-frequency drives, ozone generators, and UV electronic ballasts. These should all be carefully managed to avoid resonance, particularly when power factor correction capacitors are present. Increased current demands and nuisance tripping are the most frequent adverse consequences of harmonics. Schneider Electric can provide assistance and solutions for harmonic management in compliance with utility regulations.

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System efficiency improved by up to 5%
Solutions for energy cost optimization
The cost for energy consumption may be reduced in different ways.

Power factor correction provides several advantages:
• avoids invoicing of reactive energy by the utility
• reduces current demand
• eliminates transformer oversizing and allows the full system capacity to be used

Power factor correction is generally achieved through the use of capacitor banks.

Power-monitoring devices are used for three main reasons:
• to know which parts of the facility consume the most power
• to monitor energy efficiency
• to analyze system harmonics

Three types of technologies are available:
• stand-alone power monitor
• LV and MV protection relays
• High-performance metering units

Data from metering and protection devices, as well as a suite of other devices can be transmitted using transparent-ready Web-enabled power and control equipment from Schneider Electric.

Process diagnostics and optimization
Detecting problems as early as possible avoids process downtime and reduces operating costs. Schneider Electric offers easy-to-use diagnostic tools that quickly access important information, such as the root cause and process values needed to fix a problem.

At the SCADA level, tools such as Process Analyst are available to create reports and analyze data that can then be used to optimize the process and reduce electricity consumption.

Soft starters are available in a wide range of power ratings, and are particularly suitable for pumping and other water applications. Multiplexing is commonly used for cascading start-ups and decelerations of multiple motors. This provides the following advantages:
• less mechanical stress at motor start-up, thus improving reliability
• controlled torque at motor stoppage, preventing water hammer and damage to pipes
• power peak shaving, preventing penalties
• reduced losses at motor start-up
You are looking for reliable water treatment ...
A variety of technologies is required to make water produced by springs, aquifers, lakes, rivers, and oceans drinkable. Available space and the volume of water to be treated affect technical choices subsequently made in order to meet water quality regulations and authorities’ contracts.

Automation systems and electrical networks must be studied to provide high performance and availability. The solution must include software and hardware architecture with redundancy at all levels:

**Reliability affects power as well as automation**
A high level of reliability is required for all parts of an application identified as critical, and may include redundancy for:
- power architecture and standby generators
- uninterruptible power supply (UPS required)
- motor control and programmable logic controller (PLC)
- communication and supervision control and data acquisition (SCADA)

**Power solutions**
Different circuit configurations can be selected, as listed here in increasing order of power availability:
- radial single feeder
- secondary selective
- loop feed (primary selective)

The implementation of backup generators is very common in water and wastewater treatment plants where water distribution cannot be interrupted for periods longer than a few minutes. Instantaneous throw-over is not necessary, as storage tanks are generally present. Automatic transfer switches are naturally associated with generators for rapid throw-over and smooth switch back to normal supply.

Protection coordination is a key tool in improving supply continuity. It ensures:
- isolation between functional units so grid problems don’t stop biological treatment
- coordination of motor protection and control, minimizing downtime

Essential to the continuous operation of water and wastewater treatment facilities, UPSs protect process controllers and monitoring and control rooms from power outages. Schneider Electric provides high power UPSs for control rooms and small units for field automation devices. For a critical application such as UV and ozone, a fully secure power solution can be engineered, with relevant redundancies, UPSs, and switchgear.
Redundant PLC, the heart of a process with consistent reliability

The hot standby PLC from Schneider Electric is designed for your sensitive applications that require high-control system reliability, and for which interruptions are unacceptable.

Remarkable performance, transparent switchover, and communication ensure your 24/7 services.
Reliability mainly focuses on the following three levels

**SCADA** On the SCADA side, Schneider Electric offers seamless, integrated, and scalable redundancy that can be expanded to avoid not only network errors, but also PC hardware errors. The result is a highly optimized and available solution.

**Network** Ethernet, which has proven itself to be the industry standard, provides the solution for communication architectures requiring high levels of availability. Communication can easily be adjusted to the required level, such as redundant media and/or network interfaces, self-healing fiber optic rings, and communication backups.

**Control** Adding a redundant processor can increase the system reliability. If the primary processor experiences an outage, the secondary processor will assume control in a smooth, seamless action. A dedicated Ethernet fiber link is used to keep the two processors in sync. Further redundancy is achieved by using redundant power supplies and redundant I/O.

**Automation components for harsh environments** Headworks, biosolids, chemical storage areas, and remote pump stations are some of the harsh environments encountered in water and wastewater facilities. Unless properly protected, these environments can shorten the life of equipment. Conformal coating is one tool Schneider Electric offers to protect equipment from chemical and corrosive environments.
You want the advantages of a unified comprehensive power and automation solution ...
In complex processes such as membrane filtration, integrated solutions for power and control are required to reach the expected performance level. Therefore, a large amount of process information must be exchanged between different parts of the plant.

For such applications, Schneider Electric provides dedicated water-solution architectures and tools covering the complete project life cycle, from design to operation and modernization.

**intelligent Motor Control Centers (iMCC)**

Overall performance of motor control could be improved by using type-tested equipment that offers:

- seamless integration into the control system
- reduced downtime through predictive maintenance
- factory-tested solutions
- reduction of space, installation time, and maintenance
- easy addition or modification of feeders while energized

**Collaborative Control System (CCS)**

Water and wastewater applications predominantly use the following:

- controllers
- SCADA systems
- instrumentation
- drives
- sensors and I/Os

All these devices must be integrated, configured, and optimized during commissioning and operation. Schneider Electric collaborative tools handle each of these while reducing integration costs. Proven application knowledge has been integrated into libraries, ensuring excellent quality and standardization which, in turn, provides consistent user interfaces, operating modes, and diagnostic capabilities that reduce training and maintenance costs.
Membrane filtration

Reverse osmosis is the most common technique used for desalination, and is an alternative to distillation. It may also be used to recycle water to produce drinking water from wastewater. Nanofiltration is another method to produce drinking water from surface water.

Membrane filtration is an emerging water treatment technology, for both industrial and public use. The reduced space needed for the plant and its ability to treat all types of raw water are key drivers.

Membrane and other technologies have led to higher performance constraints. For example, reverse osmosis requires high pressure, and increases electrical energy use and the need for high power motors. Electrical distribution and motor control are therefore significant parts of the process.

While the cost and efficiency of membranes have greatly improved, working with them requires special care.

Strict water pre-treatment is necessary because of their sensitivity to some pollutants. In addition, membranes may deteriorate unless they are maintained under high pressure. Consequently, power interruptions should be avoided as much as possible. Power and control are highly interconnected.

Link to the instrumentation

An instrumentation link based on standardized protocols enables significantly improved mastery of complex filtration processes. Extensive process feedback and access to device parameters increases performance and diagnostic capabilities. Asset management tools with standardized interfaces allow access to devices and a broad range of parameters and diagnostic information. Preventive maintenance reduces unexpected downtime and operating costs, and improves reliability.

Service-oriented architectures and open protocols guarantee an efficient solution.
You have to distribute water 24/7 . . .

Increase pumping station reliability and performance levels
Significant pressure is required to pump water throughout cramped urban areas and remote rural zones. To get it, drinking water distribution systems rely on booster stations. Designed to accommodate users’ constantly shifting water demands, these stations employ fixed- and variable-technologies, controllers, medium- and low-voltage motor controls, and power distribution equipment. In all cases, perfect integration into the electrical and automation networks is necessary.

**Schneider Electric offers additional advantages through a set of innovative solutions for pumping stations:**

**Increased availability and performance with multi-drive solutions for booster stations**

One way to increase system availability is to use multiple, variable-frequency drives. Schneider Electric offers a pre-developed, constant-pressure system in which one pump has a variable-frequency drive (VFD) with an embedded programmable controller card. The other motors are constant speed, and use starters or soft starts. Based on signals from the VFD, the system will adjust the drive’s speed to meet pressure, start additional pumps when necessary, and provide a runtime-based, lead/lag rotation to account for constant speed bumps. This solution offers seamless control and potential cost savings.

Another cost-effective and ready-to-use solution features two pumps (either across-the-line or by soft starts), and an all-in-one controller with pre-programmed software.
You have to manage a network of pumping stations ...

Often, water sources are far from consumption points. In addition, wastewater collection is required, and coordination between pumping stations is necessary to manage water flow. This can create unique problems in remote locations, extensive and/or poor communication networks, difficult and expensive maintenance, and less-accessible electrical energy.
A telemetry system is the answer
All links between remote sites are periodic and characterized by exchanges triggered by cyclical polling from the central system, due either to operator request or the occurrence of an event:
• data transmission between remote sites and the central supervisory system (SCADA)
• communication protocols (Modbus/TCP, EtherNet/IP, DNP3, Modbus, etc.)
• media (cable, radio, GSM modem, Internet, etc.)
• handling of time-stamped events, measurements, and buffering of data in case of interrupted links

Remote terminal unit (RTU) functionality integrated in modular, programmable logic controller (PLC)

RTU functions and PLC flexibility form the basis of the integrated Schneider Electric offer.
Offering master and slave communication opens the door to different architectures. Our solutions are based on reliable and industrially proven hardware designed for the harsh environment of water wastewater pumping stations. The Modicon PLC range offers many ways to meet the myriad requirements.

SCADA: the central point
Due to pumping networks’ vast size, monitoring, operating, and maintaining them requires seamless communication integration. Our offer includes standard SCADA features such as scalability, reporting, redundancy, and diagnostics. With specific RTU functions such as multiple protocols and the handling of modems, time-stamped alarms and data are included. For processing using Microsoft Office or standard reporting tools, data can easily be exchanged in SQL, Oracle, and other formats.
You have to adapt the process to regulation changes ...
New regulations are raising water quality requirements nationwide. Meanwhile, the quantity of information that must be analyzed, processed, and acted upon increases constantly—requiring new or improved biosolids, air, and biological treatment units in many wastewater treatment plants. The flexibility and evolution capabilities of PLC-based solutions from Schneider Electric make them suitable for the functional unit improvements required in the treatment process.
Distributed control architectures
Distributed control architecture allows OEM-provided packaged plants to easily be incorporated into the main control system. Its structure of independent functional units, each equipped with a modular PLC connected via an industrial network to the SCADA system, provides a reliable and flexible solution. Such architectures can easily be modified or expanded by adding new functional units. Data exchange and synchronization are based on standard, industrial Ethernet protocols. Our solutions are based on reliable and industrially proven hardware, designed for the harsh environment of water and wastewater treatment plants.

Automation islands as an integration platform
The easy integration of digital and analog signals, motor starters, and variable-frequency drives is the key to improving and adapting water and wastewater process applications in a flexible way. Compatibility with various networks and field busses allows device layout standardization; only the communication interface has to be adapted. This standardization leads to greater flexibility and cost savings at the engineering, bidding, and commissioning stages.

Effective SCADA system to monitor, analyze, and optimize the water process
To reach the quality levels set by regulations, the SCADA system has to log and treat all relevant process information used to monitor a plant. SCADA systems from Schneider Electric log data in standard formats such as SQL and Oracle. Also, our Process Analyst is the perfect tool for analyzing data such as measurements, alarms, and digital data sources in a single environment. The intuitive user interface quickly provides the operator with the relevant information.

Electrical distribution and motor control retrofits
Schneider Electric offers electrical distribution equipment retrofits to meet the increased quality requirements. For example, modern equipment with embedded power monitoring and communication can be implemented for better, and easier, energy management. And adaptive, variable-frequency drives allow for easier process adjustment and more accurate process control.

Latest PLC technologies
Scalable migration is one of the key features of Schneider Electric’s PLC range:
- Existing inputs/outputs can be kept; a new generation of processor provides new services and increases the performance of the application.
- Even when all the hardware has to be changed, the software can be converted and reused with the latest hardware to benefit from the new features. All these retrofit features provide flexibility, high performance, and cost effectiveness for the process control, and protect previous investments.
## Architecture overview

**Water treatment plants**

From an automation and power system design standpoint, the size of a treatment facility often is more important than whether it is used for water or wastewater.

Thus, we can divide the plant type into four broad categories based on daily flow and the number of equivalent inhabitants.

Each category shows a suggested automation philosophy for a facility of that size.

<table>
<thead>
<tr>
<th>T1</th>
<th>Small treatment facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhabitants</td>
<td>1,000–10,000</td>
</tr>
<tr>
<td>Million gallons per day (MGD)</td>
<td>0.2–2</td>
</tr>
<tr>
<td>Motors</td>
<td>16</td>
</tr>
<tr>
<td>Power demand</td>
<td>15–150 kW</td>
</tr>
<tr>
<td>Instruments</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T2</th>
<th>Medium treatment facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhabitants</td>
<td>10,000–100,000</td>
</tr>
<tr>
<td>Million gallons per day (MGD)</td>
<td>2–20</td>
</tr>
<tr>
<td>Motors</td>
<td>50</td>
</tr>
<tr>
<td>Power demand</td>
<td>150–1500 kW</td>
</tr>
<tr>
<td>Instruments</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T3</th>
<th>Large treatment facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhabitants</td>
<td>100,000–500,000</td>
</tr>
<tr>
<td>Million gallons per day (MGD)</td>
<td>20–200</td>
</tr>
<tr>
<td>Motors</td>
<td>200</td>
</tr>
<tr>
<td>Power demand</td>
<td>1.5–15 MW</td>
</tr>
<tr>
<td>Instruments</td>
<td>300</td>
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</table>

<table>
<thead>
<tr>
<th>T4</th>
<th>Extra large treatment facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhabitants</td>
<td>500,000 and up</td>
</tr>
<tr>
<td>Million gallons per day (MGD)</td>
<td>200 and up</td>
</tr>
<tr>
<td>Motors</td>
<td>500</td>
</tr>
<tr>
<td>Power demand</td>
<td>15+MW and up</td>
</tr>
<tr>
<td>Instruments</td>
<td>1,000</td>
</tr>
</tbody>
</table>
Medium treatment facility
Remote pump station

Pump stations can be categorized into three types. These types are broken down by the number of pumps.

For each pump station type, Schneider Electric has an integrated power and automation architecture.

<table>
<thead>
<tr>
<th>Pump Station Type</th>
<th>Number of Pumps</th>
<th>Power Demand</th>
<th>Instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>2</td>
<td>&lt; 500 kW</td>
<td>4</td>
</tr>
<tr>
<td>P2</td>
<td>4</td>
<td>100–1000 kW</td>
<td>12</td>
</tr>
<tr>
<td>P3</td>
<td>5+</td>
<td>500+ kW</td>
<td>50</td>
</tr>
</tbody>
</table>

**Water pumping stations overview**

**architectures**

**P1**  
Small lifting, pumping, and tank station

**Number of pumps**  
2

**Power demand**  
< 500 kW

**Instruments**  
4

**P2**  
Pumping and small booster station

**Number of pumps**  
4

**Power demand**  
100–1000 kW

**Instruments**  
12

**P3**  
Booster or complex pumping station

**Number of pumps**  
5+

**Power demand**  
500+ kW

**Instruments**  
50
You need services ...
Our network of qualified partners, distributors, and service centers are at your disposal—able to provide a unique power and control services offer in any country. Wherever you happen to be, we are fully able to support your water process throughout its life cycle, from the design stage through operation and modernization.

**Design services**
To ensure efficient solutions for your project and high-performance operation:
- consultancy and expert services
- energy efficiency solutions
- critical power solutions

**Operating services**
To reduce operating costs, avoid application downtime, and maintain performance level:
- maintenance and spare parts management
- site audits and repairs
- training

**Energy and retrofit services**
To reduce risks after a long period of operation and improve the performance of applications, we offer services to redesign and modernize your power and control base:
- diagnostics and feasibility studies
- retrofit expertise and consultancy
- project support
- energy audits

**A flexible approach**
Our systematic approach to retrofits is the key to extending equipment life at a fraction of the replacement cost. We can replace or recondition LV and MV circuit breakers, develop switchgear retrofit solutions, and replace or repair drives—regardless of the original manufacturer.

We conduct power quality and harmonic studies to identify criteria that can reduce equipment life and interfere with reliable operation. As the upgrades come online, our installation services verify that the new equipment is properly installed and ready to meet optimum performance standards.