Water Wastewater Solutions Guide

Providing efficient, reliable and sustainable answers



Water is the gold of the 21st century



Water is 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 reduces the design cost of your installations:

- preferred architectures for both power and control
- design tools ranging from network calculations to water and wastewater specific drawing packages
- repetitive solutions
- reduced cabling and size of equipment

Schneider Electric's 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 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:

- possible
- 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, protecting against SSO and CSO events.

 provide an energy plan that helps our customers use as little grid energy as

• ensure that our products meet the directives of RoHS (Reduction of Hazardous Substances) and REACH (Registration, Evaluation, and Authorization of Chemicals) • create and provide custom designs that help you lower your operating

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.

\$

A worldwide company

- \$23 billion in revenue in 190 countries
- local presence in 100+ countries
- more than 200 factories

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Power & Control offer complies with international standards

- We devote more than 4 percent of sales to research and development (R&D)
- Our 7,300-member R&D team is vigilant in ensuring that water and wastewater needs are incorporated into every facet of design and development.

Water Solution Guide

Drinking water

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You need to reduce your oper

You are looking for high ava

You are looking for a compression

You have to distribute water 3

You have to manage a netwo

You have to adapt the proces

You need different solutions f (architecture overvi

You need qualified, reliable services

The right answer throughout the life cycle of your water process

Boosting station

Desalination

Lifting station

Wastewater

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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 and/or expansions from the money you have allocated.

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

Optimising 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.

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, allowing you to develop and load your own application, or use our pre-configured water applications.

Operation

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 - during expansions, as well as process changes. Their unique design and user interface limit the need for operator and maintenance training.

Communication

Motor Control Centres (MCC) also reduce design costs. They use the latest communication technologies (intelligent Motor Control Centres, iMCC): smaller components and reduced cabling optimise hardware and labour 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% saving in energy

You can reduce your operating costs through load shifting and high-efficiency motors and drives, as well as power monitoring and process optimisation. 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

- operations



Solutions for energy savings

The latest generation of low-loss transformers and high performance motors allows system efficiency by up to 5%.

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.



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.

Cost-saving evaluation software

Energy Cost Optimisation > reduced costs of the energy used by different

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



By adjusting the speed of rotation, the absorbed electrical power may be reduced by 50 percent at 80 percent of nominal flow.



System efficiency improved by up to



Solutions for energy cost optimisation

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 over-sizing 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 analyse 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 transparentready web-enabled power and control equipment from Schneider Electric.



Process diagnostics and optimisation

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 analyse data that can then be used to optimise 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 startup, 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 high availability 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:

- between functional units so grid problems don't stop biological treatment
- coordination of motor protection and control, minimising downtime



Essential to the continuous operation of water and wastewater treatment facilities, UPS systems protect process controllers and monitoring and control rooms from power outages. Schneider Electric provides high power UPS solutions 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, UPS systems, and switchgear.



APC SMART-UPS RT 1500VA 120V

Automation solutions in water treatment

Redundant PLC, the

heart of a process with a high level of availability

Schneider Electric's Hot Standby PLC offer is designed for your sensitive applications that require high control system availability, and for which interruptions are unacceptable. Remarkable performance, transparent switch-over 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 optimised 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 fibre 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 fibre 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 are looking for a comprehensive power and control 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 modernisation.

Intelligent Motor Control Centres (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 energised

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 optimised 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 standardisation which, in turn, provides consistent user interfaces, operating modes, and diagnostic capabilities that reduce training and maintenance costs.

Third-parties Instruments ce ised

intelligent Motor Control Centre

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 standardised 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 standardised 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 availability 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-andvariable-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 boosting stations

One way to increase system availability is to use multiple, variable frequency drives. Schneider Electric offers a predeveloped, 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.

Voltage pumping station

Low-voltage pumping station

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 characterised 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.

APC SMART-UPS RT 1500VA 120V

Schneider Electric access control and video security offer

Even before the heightened awareness brought on by terrorist threats, many public and private institutions had begun incorporating video security into critical infrastructures.

Video technology provides the visual images necessary to improve situation awareness, deter vandalism, theft, or other crime, and accelerate response and management decisions.

Due to their obvious importance, water and wastewater treatment facilities have increasingly turned to electronic security systems.

Telemetry System

You have to adapt the process to regulation changes

Regulations are raising water quality level requirements. The quantity of information that must be analysed, processed and acted upon increases constantly. Sludge treatment, air treatment and biological treatment are examples of units that need to be added or improved in many wastewater treatment plants. The flexibility and evolution capability of our PLC based solutions 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 be easily 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 synchronisation 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 analogue 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 standardisation; only the communication interface has to be adapted. This standardisation leads to greater flexibility and cost savings at the engineering, bidding, and commissioning stages.

Effective SCADA system to monitor, analyse, and optimise 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 analysing 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.

Water treatment plants Architecture overview

Water treatment plants system design standpoint, often is more important than whether it is used for water or

plant type into four broad categories based on daily flow and the number of equivalent

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

T1 Small treatment facility

Inhabitants	1,000 - 10,000	Man and Balance	
m³/day (drinking water or wastewater)	1,000 – 5,000	and the second	
Motors	16	the sum	
Power demand	15–150 kW		
Instruments	10	The Colorest Colorest	

T2 Medium treatment facility

Inhabitants m3/day (drinking water or wastewater) Motors Power demand Instruments

200

T3 Large treatment facility

Inhabitants	100,000 - 500,000
m3/day (drinking water or wastewater)	50,000 - 200,000
Motors	200
Power demand	1.5–15 MW
Instruments	300

Inhabitants	
m3/day (drinking water or wastewater)	
Motors	
Power demand	
Instruments	

500,000 and up 200,000 and up 500 15+MW and up 1,000

Water pumping stations Architecture overview

Remote water pumping stations

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.

P1

Small lifting, pumping and tank station

Number of pumps Power demand Instruments

2 < 500 kW 4

-	
1	
8	
1. 10	

P2 Pumping and small booster station

Number of pumps Power demand Instruments 4 100–1000 kW 12

P3 Booster or complex pumping station

Number of pumps	5+
Power demand	500+ kW
Instruments	50

You need services...

To support your water process throughout its life cycle, from the design stage, during operation and to modernisation, we offer various services available in all countries. Our network of qualified partners and our projects and service centres are at your disposal and are able to provide a unique power and control services offer.

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 modernise 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.

Make the most of your energy[™]

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