Symphony Plus
SD Series control and I/O

Power and productivity
for a better world™

ABB

Introducing SD Series
Flexible automation for a changing world

In our increasingly interconnected digital world, transformative collaborative business opportunities abound – increased productivity, improved performance, higher efficiencies and smarter operations through tighter integration of the plant or fleet. Consider in a typical production plant, terabytes of data is generated daily by equipment, smart devices, and process and business systems – more data produced in one day than in a full month just ten years ago. For plant managers in the power and process industries, the challenge is to find a flexible automation solution that seamlessly adapts leading digital technology for smarter, safer and more reliable control.

Introducing the newest addition to the Symphony® Plus family: the SD Series – a green portfolio of completely scalable control and I/O products that work in any environment or geographic location, delivering total automation for your process regardless of application type, size, or physical setting. Through seamless interconnections with smart field and electrical devices and higher level applications, these rugged control and I/O products deliver lower energy consumption, an extreme operating temperature range, and a scalable architecture in a compact, modular footprint, making SD Series the best automation solution for your new installation, upgrade or expansion.
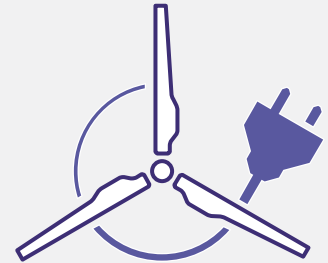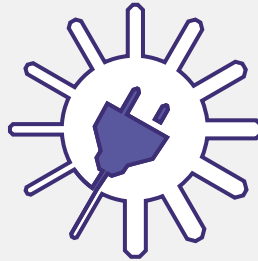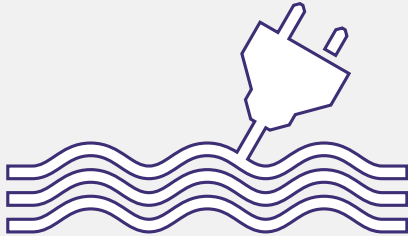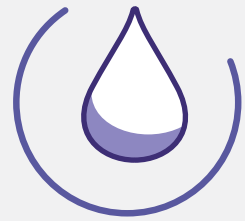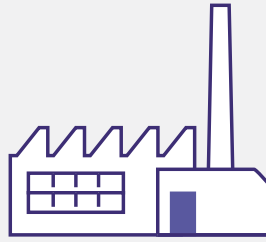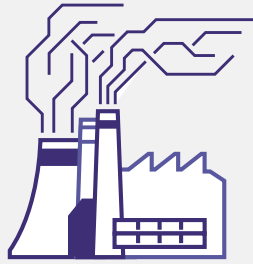
1 SD Series Control & I/O provide flexible control for conventional power, water and wastewater, renewable power as well as process industries.

Designed for total plant automation for a wide and varied set of process applications, the SD Series features modular DIN rail packaging, a flexible, high-performance Fast Ethernet-based plant network, and intelligent electrical and field device integration via PROFIBUS, HART, IEC61850, IEC 60870-5-104, DNP 3.0 and Modbus TCP communication protocols. The SD Series also protects investments made in previous controllers, while delivering higher performance, reliability and capacity.

From design conception through start-up and commissioning, the SD Series helps reduce project deployment costs by:
– Minimizing DCS and extended support footprint
– Simplifying design complexity
– Compressing project schedules

Once installed and in operation, the SD Series lowers total cost of ownership by:
– Increasing process reliability
– Minimizing equipment downtime
– Improving production yields
– Reducing maintenance and support costs
– Reusing physical and intellectual asset investments
– Enabling new products/functions to be added with ease

Flexible, scalable portfolio
Fast, accurate and uninterrupted control for small, mid-range and high-end applications

Compact, modular design
Sleek DIN-rail mounted design and streamlined vertical and horizontal mounting reduce control & I/O footprint

Green, energy efficient design
Extremely low power consumption, lead free RoHS compliant build makes SD Series the most environmentally friendly control & I/O portfolio

Operating in extreme conditions
Designed with a wide operating temperature range. Eliminate costly climate control equipment and specialty sealed cabinets without degrading performance or operating life
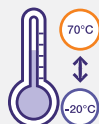
Smart device integration
Seamless integration of intelligent devices produce tighter and more reliable control, greater visibility to device performance and cost-effective proactive maintenance practices

Time-tested and field-proven
SD Series' use of ABB's best-in-class control technologies allow for easy and risk-free reuse of time-tested and field-proven control application solutions

SD Series
Green, energy efficient automation solutions

2 Energy efficiency is fundamental to a sustainable future

Energy consumption represents a very significant operating expense in production processes. For power producers, between 4 and 15 percent of a power plant`s entire output is used to power auxiliary systems, from water treatment, fuel preparation, and environmental systems to lighting and air conditioning. Without these systems, the plant can't run, however, reducing energy consumption leads directly to improved bottom line profits whether in the form of higher revenue or lower operating costs.

The SD Series is part of a solid portfolio of energy efficient products from ABB, which together can significantly reduce energy used and often wasted in plants and processes. Combined with ABB variable speed drives and high efficiency motors, the SD Series can significantly reduce your energy consumption.

Controlling your green initiative
Green-designed SD Series products consume less than 50% of the power required by today's typical DCS control and I/O products. By requiring significantly less 24 VDC power, SD Series products generate less heat. As a result, these modular products can be fitted into a smaller cabinet space, without the need for fans, louvers, air filters or forced cooling. This further reduces the system's control and I/O power requirement, as well as footprint and maintenance support costs, while the need for fewer components improves system reliability. As an added bonus, low power consumption reduces the system's UPS (Uninterruptible Power Supply) size requirements.

By using extreme-temperature rated components (-20° C to 70° C ambient), SD Series products can be installed near field devices and control elements they interface with, without additional costly climate control systems that are necessary in remote environments. As a result the overall footprint of SD Series installations is smaller, requiring fewer long-field cable runs and reducing installation costs. SD Series is equally suited for use in harsh or corrosive applications, such as the caustic environments associated with desalination or water treatment applications. SD Series G3 coating offsets the need for costly special sealed cabinets and air purging systems, without degrading performance or product life.

Beyond its power efficient design, SD Series IEC61850 electrical integration options further reduce energy costs and losses by providing greater visibility to the performance of electrical equipment (i.e. motor control centers, switchgear, transformers, excitation systems and protective relays). Communication rates of 5 ms between the SD Series controllers and electrical devices improve plant or process availability with rapid response to power glitches or interrupts.

The environmentally sustainable SD Series products are lead-free and compliant with RoHS hazardous substance restrictions, thereby reducing end-of-life disposal and documentation costs.
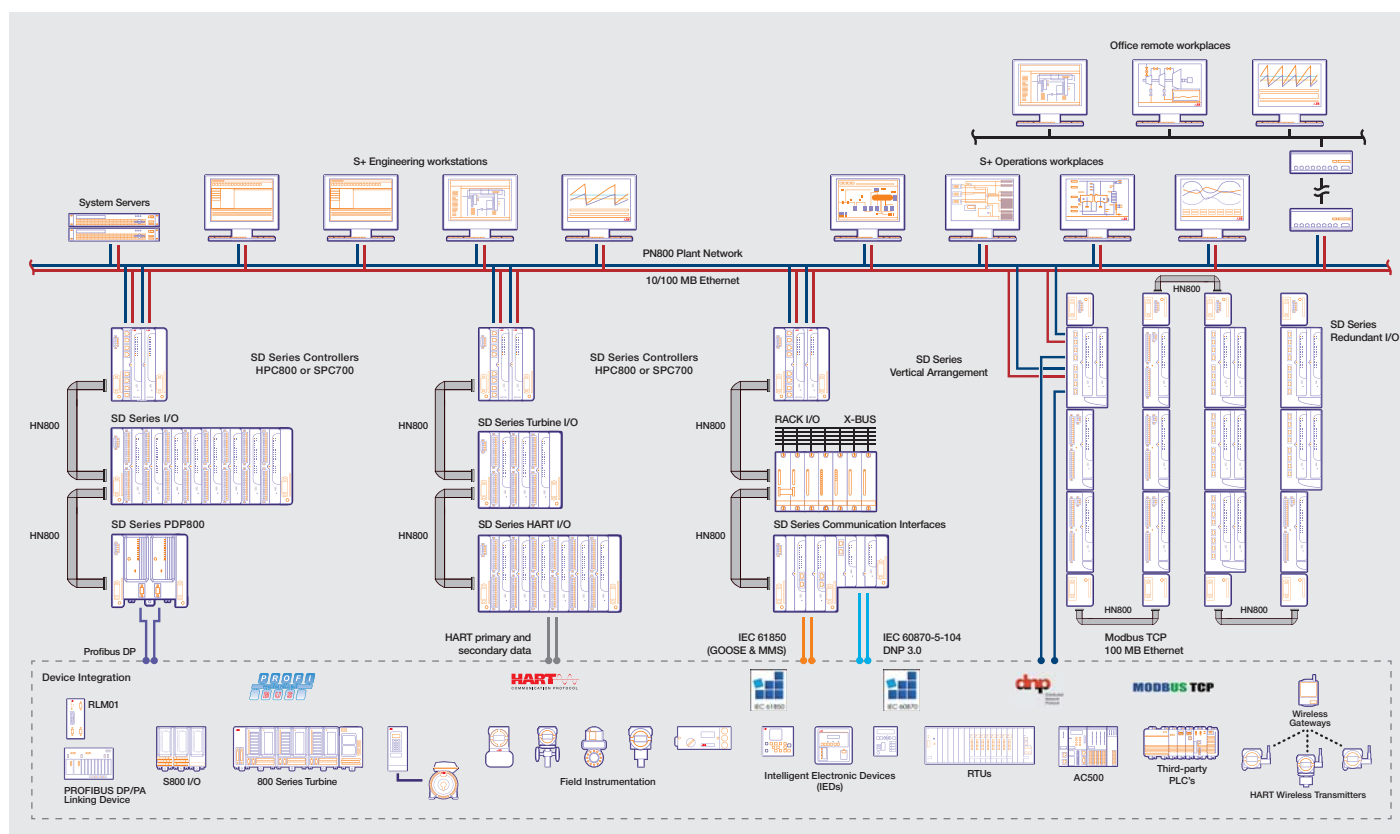
3 Functional overview of SD Series capabilities

Simple, scalable, seamless, and secure

Overview

The SD Series includes a set of high-performance, scalable process controllers that support a plant's total control requirements, from discrete and continuous, to batch and advanced control applications. Supported by a comprehensive range of I/O options, the SD Series delivers powerful, versatile and scalable automation solutions for plant applications of all sizes and requirements.

The common controller environment executes demanding process control applications that are both data and program intensive. Redundancy options are available at all levels of control, I/O and communication, resulting in maximum flexibility and availability.

SD Series controllers connect to both DIN style and traditional Rack I/O modules. Intelligent I/O devices are seamlessly integrated through industry standard fieldbuses and networks. Each device's resident information is available for use in control strategies and higher-level applications to produce tighter, more reliable process control solutions. Inclusion of native turbine specific modules makes it possible to provide a fully integrated single-vendor solution for all aspects of turbine automation within the plant automation platform.

SD Series uses ABB's extensive set of field-proven standard function code algorithms and S+ Engineering's graphical design tools to develop control strategies. By using the same function code algorithms as previous generation Harmony and INFI 90 rack controllers, SD Series supports the easy and risk-free reuse of time-tested, field-proven control application solutions.

All-in-all, SD Series products provide users with the benefits of fast, accurate and uninterrupted control of their process at the lowest design, installation, and operation cost.

S+ Operations, S+ Engineering and other applications communicate with SD Series control and I/O over the flexible high-speed, high-throughput and high-security 100 Mbps Fast Ethernet-based redundant communications Plant Network (PN800). The network-centric architecture allows for integration of field devices, process and electrical system areas and business enterprise systems in a simple, scalable, seamless, secure and sustainable manner. The SD Series functional capabilities are summarized in figure 3.

Protecting the integrity and confidentiality of system data

The process and power industries face intensifying cyber security risks. In order to increase stability, security and robustness in its solutions, ABB has established an independent Device Security Assurance Center (DSAC) where cyber security robustness is tested as part of the product development process. The DSAC test facility uses state-of-the-art open source, commercial and proprietary robustness and vulnerability analysis tools in its certification testing. All Symphony Plus Ethernet-based devices - including SD Series products such as the HPC800, SPC700, CI850, SCI200 - are continually tested at the DSAC center in different configurations and with an explicit focus on operational performance. This ensures that all Symphony Plus products are robust, secure and of the highest quality.
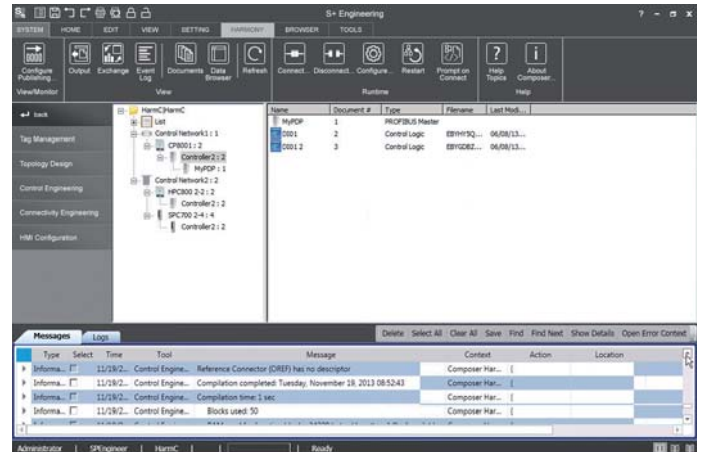
SD Series
High-performance, reliable controllers

4 SD Series scalable controllers HPC800 and SPC700

5 S+ Engineering tool

Powerful process controllers

SD Series controllers are the latest in a long line of ABB field-proven process controllers, that includes the HPC800 high-end and SPC700 mid-range application controllers. Based on a 256 MHz, 32-bit Freescale Coldfire processor, these controllers can adapt to a broad spectrum of applications and process requirements. Configured by S+ Engineering, SD Series controllers feature an extensive library of more than 150 predefined control algorithms or function codes (figure 5). These functions enable easy, building block design of complex control strategies to fit any control application, including continuous, sequential, batch and advanced control. In addition to standard function blocks, SD Series controllers support C programming, batch, and user defined function codes.

SD Series controller features include:
– More than twice the performance of the BRC410 and 15 times the performance of previous generation Harmony Rack controllers
– Simultaneous support for SD Series I/O, Harmony Rack I/O, and S800 I/O subsystems
– Execution of closed loop control of more than 5,000 I/O in less than 250 msec.
– Downloadable firmware
– Extended user configuration memory (NVRAM) and runtime memory (RAM)
– Scalable to 10,000 function blocks (SPC700) and 30,000 function blocks (HPC800)
– Flexible, online configuration capability
– Support for up to 8 segment tasks, each segment supporting execution cycle time down to 1 msec
– Dedicated redundant peer-to-peer controller communication bus support update rates less than 100 msec (HPC800 only)

High reliability and availability

SD Series controllers are designed to provide maximum reliability and availability. With a redundant design at all levels - CPU, power, internal bus, I/O networks, communication ports and plant network – SD Series controller subsystems provide the highest level of availability. Compliance with international standards assures the highest level of reliability and quality needed to meet the most rigorous global specifications and requirements. Together, they provide users with fast, accurate, uninterrupted control of their process.

Soft controller reduces commissioning times

For new plant, upgrade, or expansion projects, SD Series soft controllers can dramatically reduce commissioning and start-up time and costs by permitting thorough testing and pre-tuning of control loops prior to its implementation in the field. The SD Series soft controller uses the same control logic (ie, function block configuration) as the physical SD Series controllers. Coupled with virtual communication devices, the entire SD Series control-based system can be implemented within one or more PCs which allow for testing results made in the virtual environment to be directly transferable to the operating system environment.
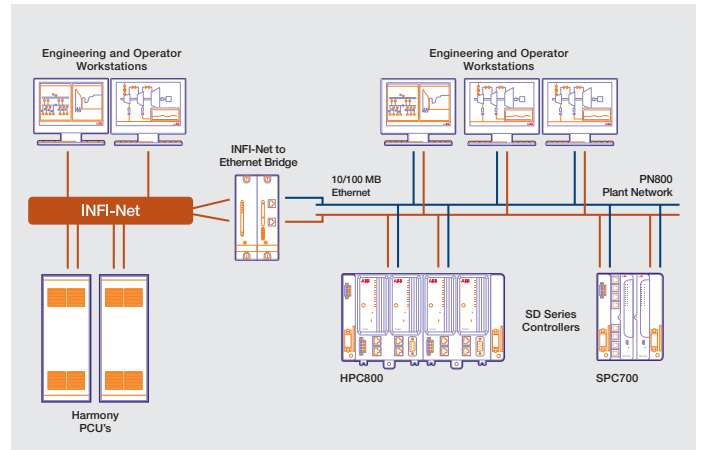
6 Seamless electrical integration via IEC61850

8 INFI-Net to Ethernet bridge (IEB800)

Device integration capability

The SD Series controller architecture seamlessly integrates intelligent field devices and protocols using PROFIBUS DP, HART, Modbus TCP, IEC 61850, IEC 60870-5-104 and DNP 3.0. This provides access to a wide range of intelligent field devices from both ABB and other third-party vendors including transmitters, actuators, motor control centers (MCC), flame scanners, IEDs, etc. Each device's resident information can then be used in control strategies and higher level applications. In addition to producing tighter and more reliable process control solutions, these solutions lower installation costs by reducing wiring and system footprint.

7 SD Series Communication Interfaces include CI850 (IEC 61850) and SCI200 (IEC 60870-5-104; DNP 3.0)

Based on field-proven technology

SD Series controllers use ABB's set of best-in-class control technologies to build its automation solutions. This allows users to effectively re-apply their extensive library of ABB field-proven, time-tested control solutions with these latest products.

Specifically, SD Series solutions:
– Use the extensive set of field-proven INFI 90 function code algorithms as previous generation controllers
– Use traditional INFI-Net exception reporting over redundant 100 Mbps Fast-Ethernet (PN800)
– Extend current Composer graphical design engineering tools with device management capabilities

Further, Symphony Plus Rack and SD Series control networks, INFI-Net and PN800 respectively, can be connected via a self-configuring INFI-Net to Ethernet bridge (IEB800) module (figure 8). Use of this bridge makes resident data on either network available for use in control applications, or for display in the other system.

SD Series
Comprehensive I/O product portfolio

The SD Series I/O product family includes DIN-Rail mounted digital and analog modules, as well as integration with intelligent field devices and protocols using PROFIBUS DP, HART, IEC 61850, IEC 60870-5-104, DNP 3.0, and Modbus TCP communications. Hardwire I/O and fieldbus I/O coexist and use the same function block library to build real-time control applications. Furthermore, this data is provided to other S+ system nodes (i.e. control, operation, engineering and information nodes) over the redundant Plant Network (PN800). In combination, these I/O modules can form the optimal automation solution. With standard function codes, S+ Engineering is used to configure and maintain all I/O module and channel options.

Traditional SD Series analog input modules interface with field inputs such as pressure and flow transmitter signals, thermocouple inputs, and resistive temperature device (RTD) inputs. Analog output modules provide output signals to adjust final control elements such as control valves, positioners, actuators, etc.

SD Series digital input modules have input channels to read the states of switches, relay contacts, solenoids, etc. Digital output modules provide output channels for DC or AC switching applications. The digital outputs can be used to drive annunciators such as buzzers and lamps, and to drive two-state final control elements such as actuators, relays, and solenoids.

For SD Series Digital I/O, each channel can be individually configured as an SOE (Sequence of Events) point. This flexibility removes the cost and complexity of assigning additional digital inputs as SOE in the field.

Local and remote options
24V DC power requirements, low module power consumption, and a module temperature rating of -20˚C to +70°C (ambient) make SD Series I/O equally suited for local or remote I/O installations. G3 coating makes SD Series I/O suitable for use in corrosive environments without requiring costly sealed cabinets or purging systems. The software configuration is identical when configured as either local I/O or remote I/O or mixed. Remote I/O is communicated up to distances of 3 km from the controller via a fiber optic extension. Sequence of events (SOE) with 1 msec timestamp resolution is available across the entire system, whether the I/O is local or remotely located.

Easy expansion of existing Rack systems
SD Series I/O modules are compatible with HR Series BRC300/400/410 controllers for easy, incremental expansion of existing Rack systems. Typical examples include expansion with remote I/O or HART enhancements to existing Rack installations.

9 SD Series analog and digital I/O

Turbine Control
In addition to traditional signal-type I/O, SD Series provides for integrated turbine control solutions via a series turbine control-specific modules and include:
– Hydraulic Servo Module (VP01)
– Turbine Protection Module (TP01)
– Turbine Auto Synchronization Module (AS01)
– Condition Monitoring Module (MCM800)

These unique modules make it possible to provide a fully integrated single-vendor solution for all aspects of turbine automation. Symphony Plus turbine solutions are based on proven technology that controls steam turbines, gas turbines and hydroelectric turbines in more than 15 different countries around the world, and have been tested, accepted, and used as part of their standard offering by several major global turbine manufacturers. With step change response times of less than 20 msec, the SD Series turbine offering delivers powerful governor control system solutions.
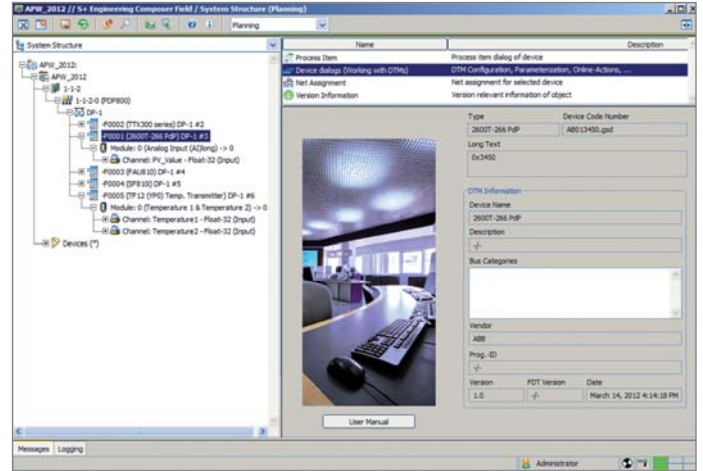
10 Integrated turbine control solutions

11 Plant level access to HART instrument performance

12 S+ Engineering Field Device Management Tools

Intelligent HART I/O

SD Series solutions seamlessly integrate HART field devices through a variety of HART analog input and output modules. This provides access to a wide range of intelligent field devices including transmitters and actuators from ABB and other vendors. Besides the 4-20 mA primary variable, all secondary, tertiary and quaternary variables in a HART device can be accessed by Function Code control applications in the SD Series controller. Data can be calculated, used as part of a control strategy, or for display and alarm purposes at the S+ Operations console.

The SD Series` HART capabilities allow users to take full advantage of their HART instrumentation investments. Too often smart devices are under-utilized because of the limitations of the I/O system to accept the device's information. With SD Series HART modules, incorporation of the secondary variables in control strategies can reduce the overall number of field devices and I/O channels required. Visibility of HART diagnostic data at the system level reduces maintenance costs through the proactive response to degrading performance of field devices before a failure occurs.

SD Series HART I/O features include:
– Each channel's secondary/tertiary/quaternary variables are available for use in control applications
– Update rate of secondary/tertiary/quaternary variables is less than one second (AI05 and AO05)

Field device management

HART and PROFIBUS devices are fully integrated with Symphony Plus, yielding benefits far beyond reduced footprint and cable costs. The S+ Engineering tool suite supports configuration, commissioning and maintenance of HART and PROFIBUS devices using device type manager (DTM) technology. For field devices that have conventional device description files (GSD), a basic PROFIBUS DTM is available to allow standardized configuration. HART devices are integrated, configured and parameterized via standard HART protocol without the need for additional tools by using a standard HART DTM. Individual DTMs can be accessed from the engineering tool's multiple data views, such as the system or location overview and others. S+ Engineering includes automatic net calculation and loading of process items by using the device specific channel configuration generated from the DTM.

SD Series
Field proven technology

United States
170 MW Gas Fired
Generators

Canada
New back-up tunnel
at 1000 MW Hydroplant

Canada
25 MW Gas Turbine Generating
Station retrofit

England
New 37 MW Waste-to-
Power Plant

United States
360 MW Coal Fired
Power Plant retrofit

Italy
590 MW Coal Fire
Power Plant retrof

United States
Water Treatment Plant retrofit

United States
528 MW Coal Fired
Power Plant retrofit

Italy
New Flood Barrier
system

United States
Water Treatment PLC control
replacement at 2640 MW Coal
Fired Power Plant

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Mexico
New 110 MW Combined
Cycle Power Plant

Dominican Republic
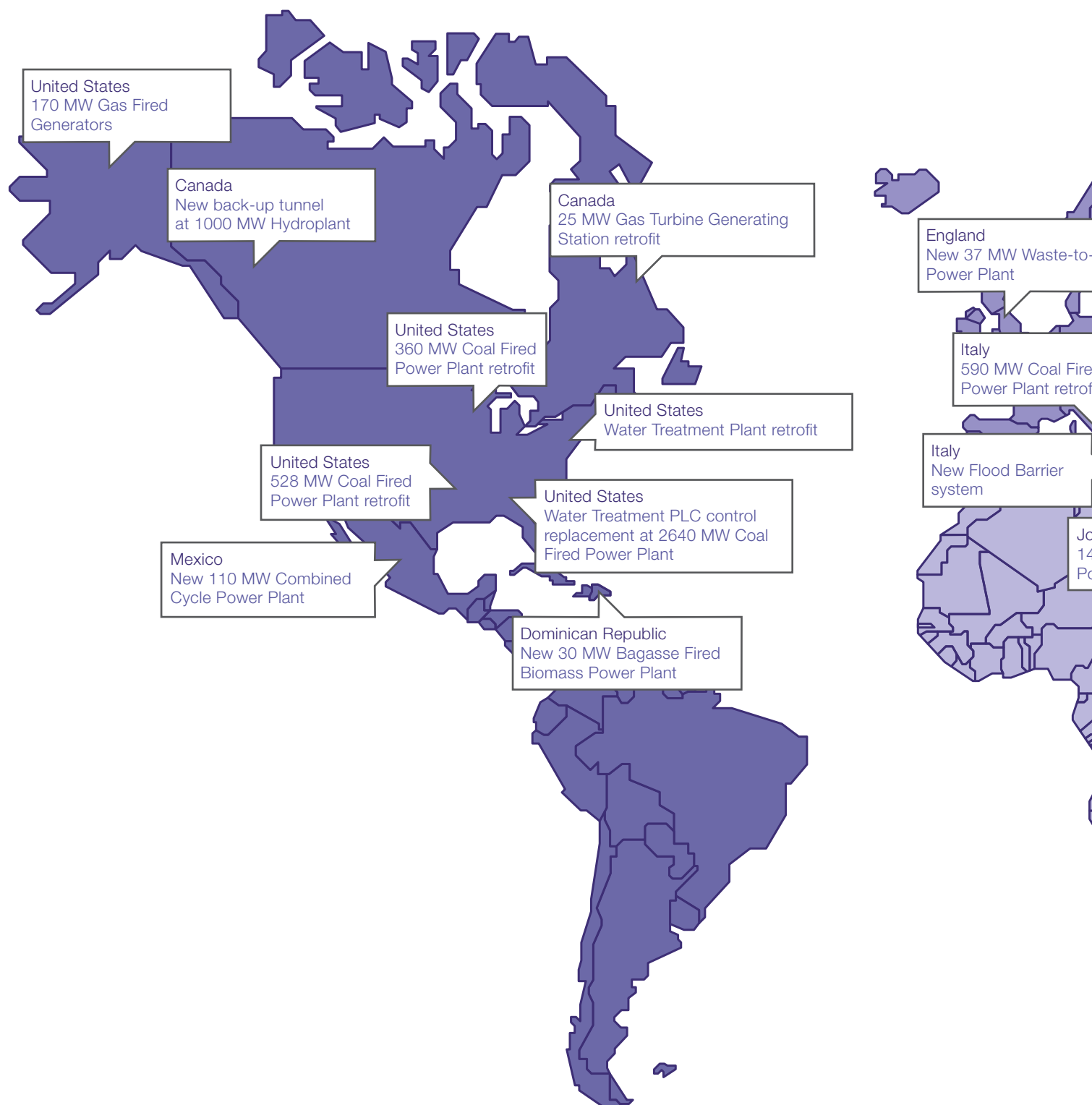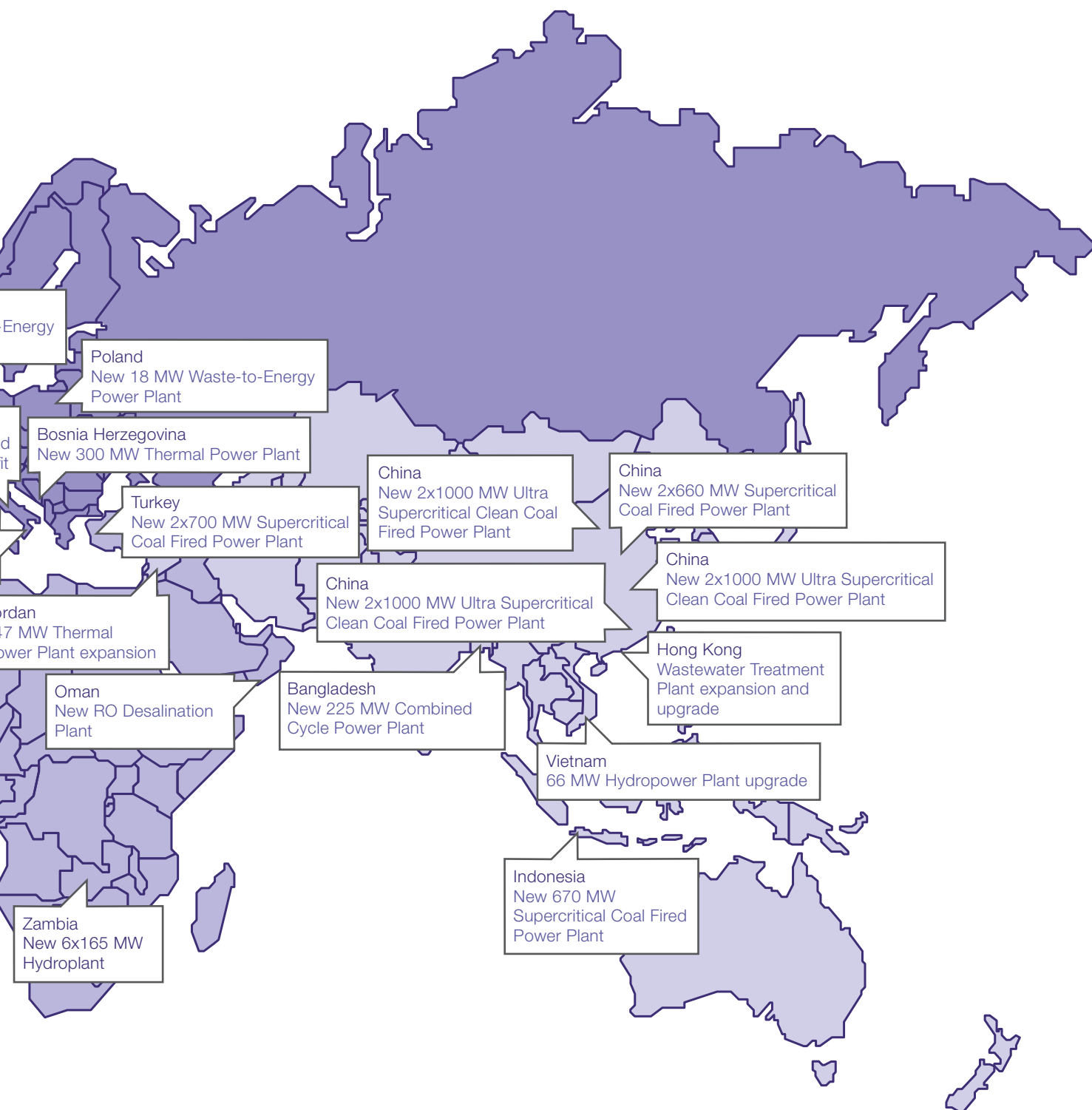New 30 MW Bagasse Fired
Biomass Power Plant

ABB has delivered or is delivering Symphony Plus solutions that control more than 50,000 MW of new power generation. These solutions range in complexity from the simplest to the most challenging of automation requirements, and for power and water facilities of all sizes. Below is a sample of the breadth of Symphony Plus SD Series based solutions selected for power and water installations around the world.

-Energy

Poland
New 18 MW Waste-to-Energy
Power Plant

Bosnia Herzegovina
New 300 MW Thermal Power Plant

Turkey
New 2x700 MW Supercritical
Coal Fired Power Plant

China
New 2x1000 MW Ultra
Supercritical Clean Coal
Fired Power Plant

China
New 2x660 MW Supercritical
Coal Fired Power Plant

China
New 2x1000 MW Ultra Supercritical
Clean Coal Fired Power Plant

China
New 2x1000 MW Ultra Supercritical
Clean Coal Fired Power Plant

ordan
7 MW Thermal
ower Plant expansion

Hong Kong
Wastewater Treatment
Plant expansion and
upgrade

Oman
New RO Desalination
Plant

Bangladesh
New 225 MW Combined
Cycle Power Plant

Vietnam
66 MW Hydropower Plant upgrade

Indonesia
New 670 MW
Supercritical Coal Fired
Power Plant

Zambia
New 6x165 MW
Hydroplant

Symphony Plus: simple, scalable, seamless, secure.

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