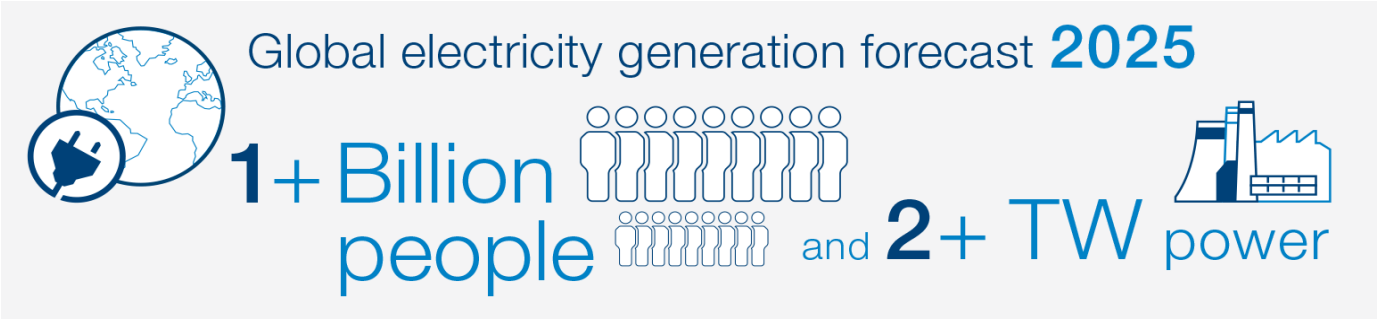
BU Power Generation, March 2015

Introducing ABB in Power Generation Overview

Power and productivity for a better world™

Global Power Generation
Market outlook to 2025 / Challenges in front of us



- Utilities with mixed portfolio of conventional and renewable generation
- Conventional power plants with changed operational profile and life time policy
- Growing demand of power and water in emerging markets
- Distributed generation
- Regional diversity of investments in power & water with majority of investment in gas generation and renewables
- Global EPCs with strong push into new markets
- Footprint in emerging markets
- After sales service driven by life-time extension and energy efficiency

Global Power Generation
Business positioning

- ABB’s Power Generation is a leading provider of integrated power and automation solutions for conventional and renewable power plants, and water applications
- Our comprehensive portfolio includes turnkey electrical and automation systems, including instrumentation, all supported by a service offering to optimize performance, reliability, and efficiency, while minimizing environmental impact

Global Power Generation
Our portfolio

Power and Water Automation

Instrumentation and control systems and products for all power and water applications

Plant Electrification

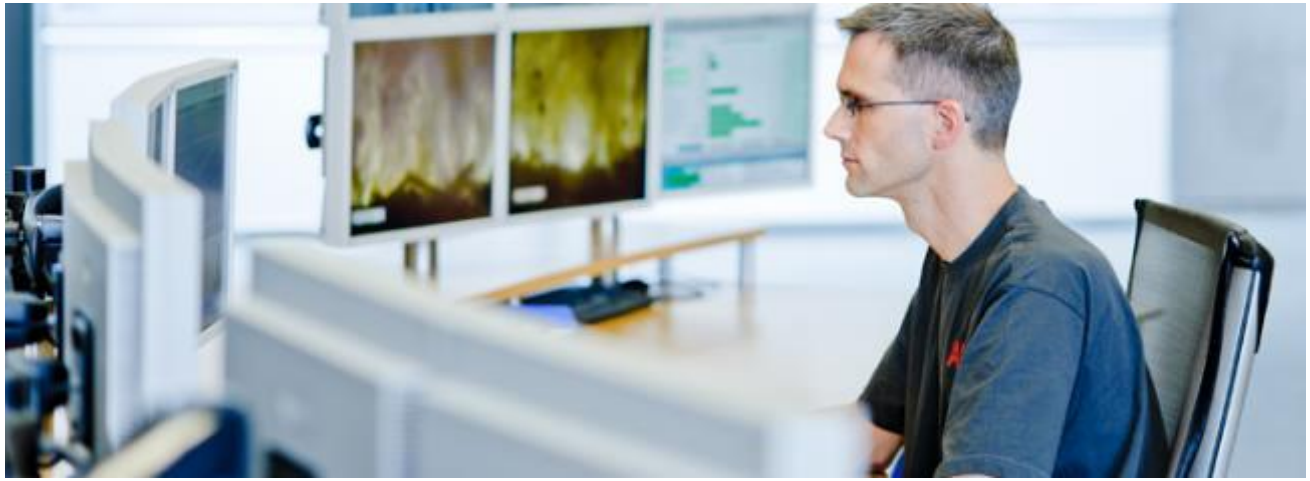
Turnkey projects for integrated electrical balance of plant for thermal and water, PV, hydro and pump storage plants

Service and Energy Efficiency

All service activities performed on ABB and non-ABB products / systems, and customer processes

Power and water utilities, municipalities and EPCs specialized in power plants and IPPs for industrial conglomerates

Global Power Generation
Competitive advantages



- Cutting edge technology with a track record of innovation
- Product portfolio covering the entire plant
- Strong local presence supporting customer focus
- Global manufacturing and engineering footprint
- Globally installed base and proven track record
- Significant service presence to support installed base
- Skilled, experienced workforce

Global Power Generation
Facts about ABB in power generation and water

- Global leader in power generation and water industries
- Reliable supplier in all power generation and water applications
- Turnkey capabilities supported by
  - First class product selection
  - Broad process and system know-how
  - One of the largest installed bases in the world

Global Power Generation
Core management team

Massimo Danieli
Managing Director

Ferdinand Schulz
Controlling

Markus Bruegmann
Global Sales and Marketing

Marco Sanguineti
Technology

Sandro Joerg
Business Development

Stefania Mascheroni
Communications

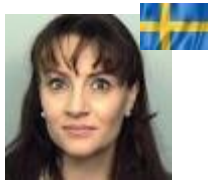
Marina Bill
Product Management

Federica Momoli
Human Resources

Tatiana Oswald
Quality, OpEx & HSE

Thomas Frizlen
Supply Chain Management

Ingo J. Wagner
Power and Water Automation



Marina Bill
Automation Products

Frederic Trefois
Plant Electrification

Stefan Hatt
Service

Global Power Generation
Regional Structure

AMERICAS

Americas
Mark Taft

AR BR CA CL MX US

AMEA

Middle East
Derek Duggan

AE BH KW PK QA SA

Africa
Markus Bruegmann (a.i.)

DZ EG ZA

Asia Pacific
Massimo Danieli (a.i.)

AU ID JP KR MY NZ SG TH

India
Vivek Ramachandra

IN

China
Han-Wei Han

CN HK TW

EUROPE

Central / Eastern Europe
Michael Velte-Andree

AT CH CZ DE PL RU UA

Southern Europe
Danilo Moresco

ES FR GR HR IL IT TR

Nordics
Mikael Stromback

EE FI LT LV NO SE

Western Europe
Gerton Dekkers

BE DK GB NL

Key

PSPG Region Name
HBU Manager

LBU / LPG

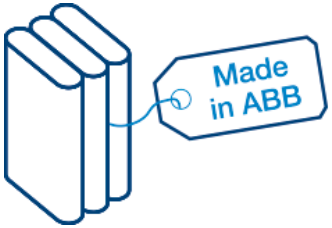
Global Power Generation
Footprint - equipment and value-added services

Distributed sourcing – seamless to project site through Local Execution Centers

- Erection material
- Earthing and lightning
- Consumables
- Commissioning

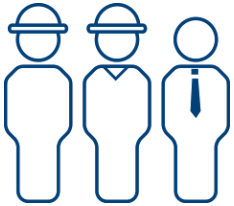
Centralized one-point lead for sales and execution team

- Sales and Proposal
- Project management
- Supply chain
- Engineering
- Software and logic design



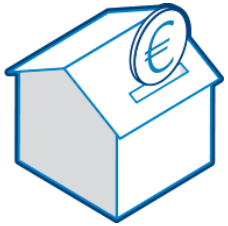
Made in ABB of critical components

- DCS hardware and software
- HV and MV equipment
- MV and LV drives



Localized Services through Local Execution Centers

- Grid connectivity
- Site management
- Testing and commissioning

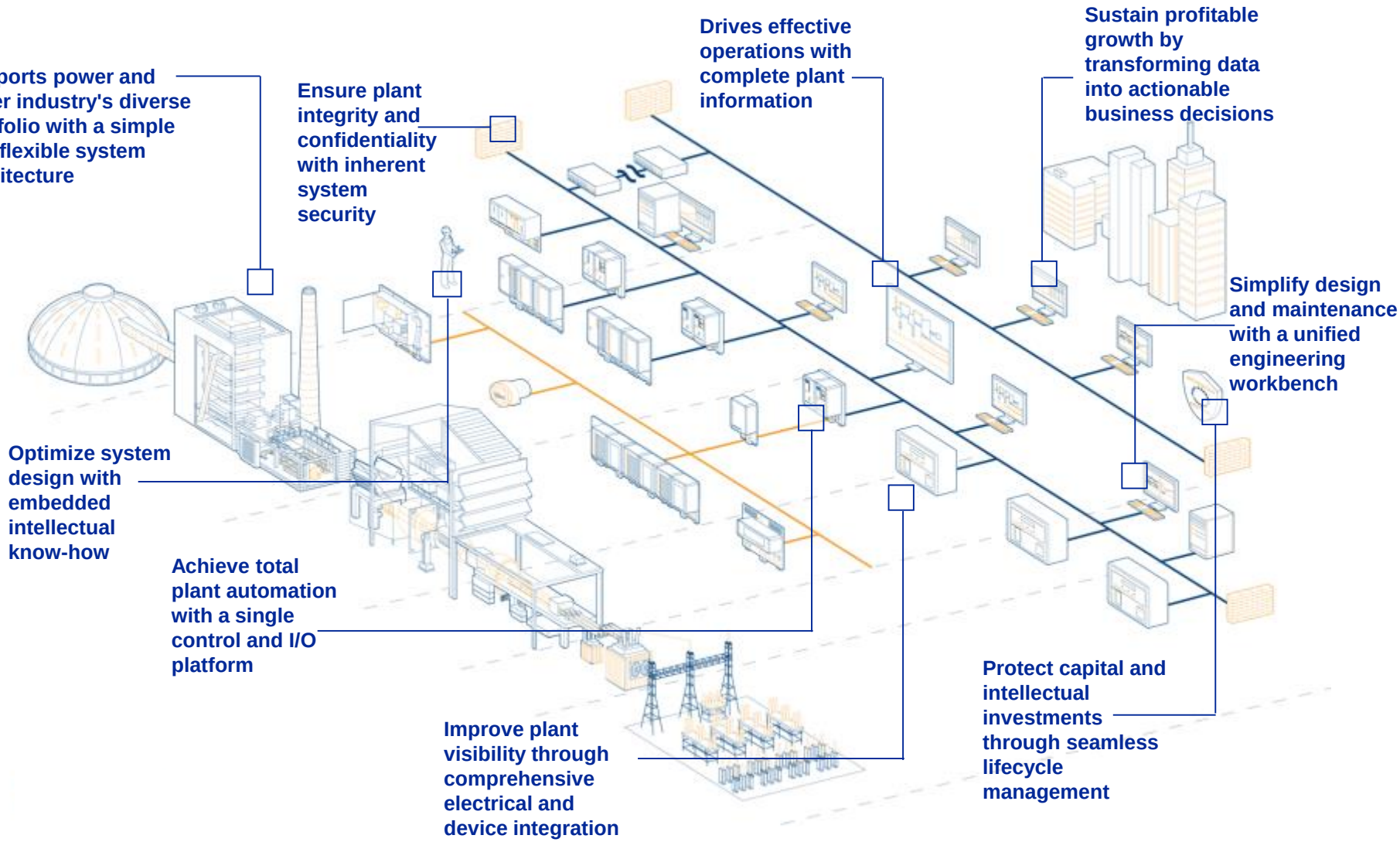


Low-cost manufacturing for main in-plant equipment

- Transformers
- DC and UPS system
- Cable system
- DCS cabinets

Global Power Generation

Symphony Plus automation: defining great performance



Global Power Generation
Symphony Plus for power generation and water sectors

- Specifically designed control for power generation and water plants
- Evolution of Symphony control systems
  - Backward compatibility with previous systems
    - From Network90, Infi90, to Harmony
    - From Contronic to Melody
  - Continues ABB tradition of “evolution without obsolescence”
- Key characteristics include:
  - Simple system architecture and scalable control platform
  - Seamless integration for a secure and reliable control environment
- Key focus areas are:
  - Improving plant productivity and energy efficiency
  - Ensuring operational security and plant safety with cyber security
  - Lowering cost of ownership

Symphony Plus distributed control system
ABB's control systems expertise at your service

more than **30** years of continuous system enhancement and support 'Evolution without obsolescence'

6,500+ Symphony Plus DCS running worldwide

400+ Water, waste-water and desalination installations worldwide

Symphony Plus

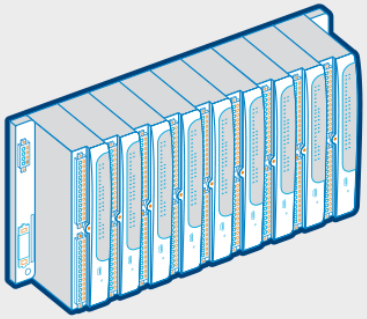
3,000+ Turbine control systems in operation

40+ GW of additional capacity controlled since **2011**

Symphony Plus distributed control system
ABB's control systems expertise at your service

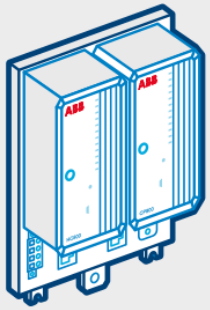
80,000+
Operator consoles
running worldwide

Symphony Plus



1.5+ Million
I/O points being controlled

250,000+
Symphony controllers
installed worldwide



Global Power Generation
Turbine products and solutions

Excitation and power system stabilizer	Synchronization	Generator protection	Static starter	Diagnosis and supervision of generators
Gas turbine automation system				Turbine control and protection
Steam turbine automation system				Turbine auxiliary control and automation
Solutions for combined cycle power plants				Supervision and monitoring
Solutions for retrofits				Sensors, actuators, electro-hydraulic solutions

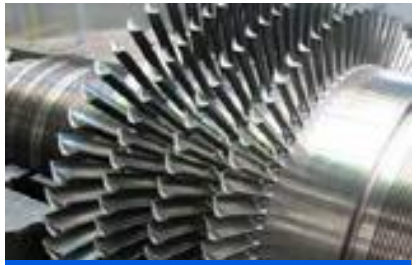
Consulting	Service and Support	Operator Training Simulators

ABB provides well proven I&C, electrical and hydraulic solutions for all makes and types of steam, gas and hydro turbines for new and retrofit business

Global Power Generation
Turbine control solutions


Utility Steam Turbines


Combustion Turbines


Auxiliary Steam Turbines

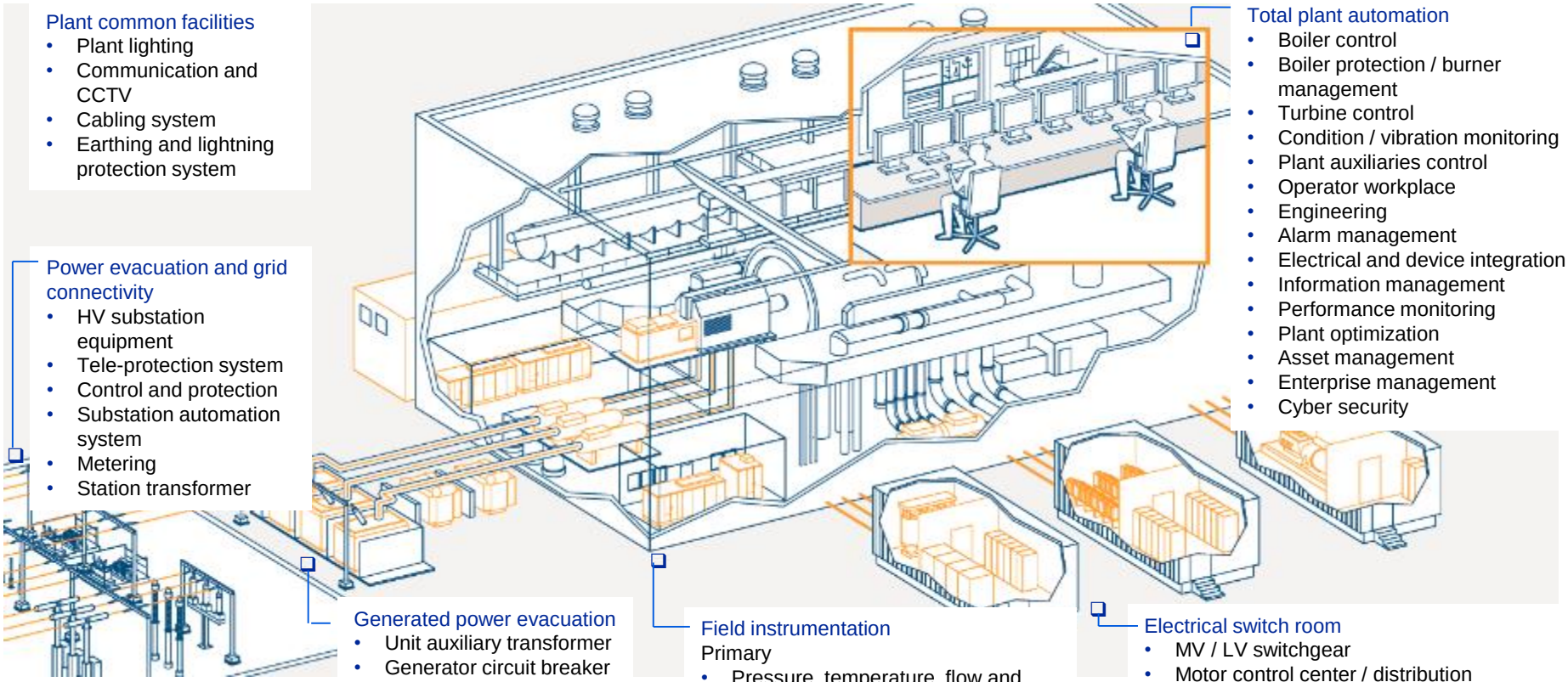

Industrial Steam Turbines


Hydro Turbines


Renewable

- Control solutions for all turbine types (steam, gas, hydro, etc.) sizes and manufacturers
- Flexible, scalable and open system architectures
- Technologically advanced , cost efficient solutions for both retrofit and greenfield applications
- Single-vendor solution for all turbine functions
- Governor, excitation, protection, condition monitoring, auxiliary systems, etc.
- Integrated DCS, turbine control, condition monitoring, synchronization, excitation, static frequency converters and protection systems
- Partnerships with major turbine OEMs around the world providing proven and standard solutions
- Mechanical and hydraulic upgrade options designed to improve availability and performance of aging mechanical systems
- Field service expertise including turnkey installation
- Turbine specific research and development
- Life cycle policy of “evolution without obsolescence”

Global Power Generation
Total plant electrification: defining value-added integration



Plant common facilities
- Plant lighting
- Communication and CCTV
- Cabling system
- Earthing and lightning protection system

Power evacuation and grid connectivity
- HV substation equipment
- Tele-protection system
- Control and protection
- Substation automation system
- Metering
- Station transformer

Total plant automation
- Boiler control
- Boiler protection / burner management
- Turbine control
- Condition / vibration monitoring
- Plant auxiliaries control
- Operator workplace
- Engineering
- Alarm management
- Electrical and device integration
- Information management
- Performance monitoring
- Plant optimization
- Asset management
- Enterprise management
- Cyber security

Generated power evacuation
- Unit auxiliary transformer
- Generator circuit breaker
- IPB
- Generator step-up transformer
- Transformer monitoring
- Protection equipment

Field instrumentation

Primary
- Pressure, temperature, flow and level transmitter
- Positioner and position transmitter
- Combustion instrument

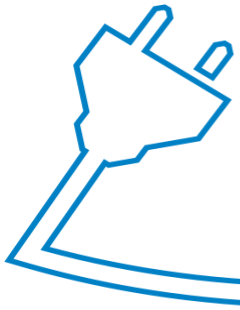
Analyzer
- Flue gas
- Continuous emission monitoring system (CEMS)
- Steam and water analysis (SWAS)

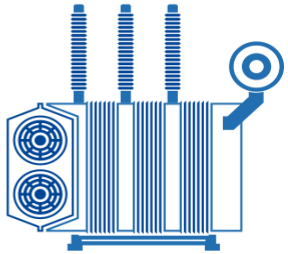
Electrical switch room
- MV / LV switchgear
- Motor control center / distribution protection
- Non-segregated phase bus-duct
- Distribution transformer
- Diesel gen-set and UPS
- Variable frequency drive and soft starter
- Control and safety systems cabinets
- Emergency diesel generator

Global Power Generation
Integrated electrical, control and instrumentation systems

Consulting enterprise & technology leadership	Risk management	Improved plant Performance & Efficiency	Integrated competitive Solutions	Fast-track E-Houses
Electrical System know-how	Health & Safety	Turnkey Capability	Life cycle Support & Services	Global Presence & References

Integration of electrical, control and instrumentation systems





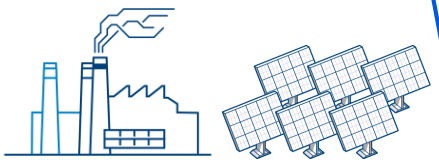
De-risk is a huge part of "value"

offered in integrated electrical, control and instrumentation systems solution

Global Power Generation

Integrated electrical, control and instrumentation solutions for fossil-fired power plants

- Partnership and collaboration from all stages of project
- Risk mitigation
- Simplified plant control
- Coordinated multi-disciplined design
- Sustainability



Fossil-fired power plants

ABB deliverable

- Reliability
- Availability
- Redundancy
- Performance
- Energy efficiency

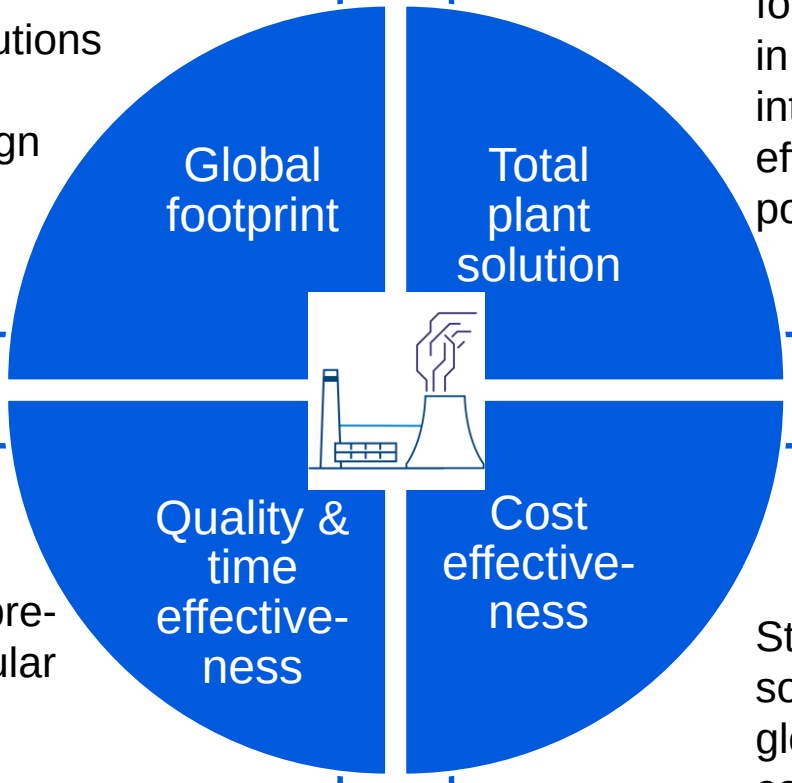
- Involvement from conceptual design to grid connectivity
- Minimizing commercial and technical risk
- Seamless integration of automation and electrical interfaces on a unified platform
- Optimization through plant design, engineering, automation and site management
- Reduce environmental impact

Global Power Generation

Integrated electrical, control and instrumentation solutions for open, close cycle power plant

Competitive solutions and optimized conceptual design

Integrated solution for grid connectivity in plant automation interface for efficient and reliable power generation



Factory-tested, pre-assembled modular solutions for fast track projects

Strategic global sourcing and global operation centers

Global Power Generation

Integrated electrical, control and instrumentation solutions in figures

more than **10** years of **EBoP** experience

55 + GW plant delivered with **EBoP** solutions

250 + EBoP projects delivered since 2011

More than **150** companies in **50** countries benefitted from ABB's **EBoP solutions**

Global Power Generation
Modular containerized solution

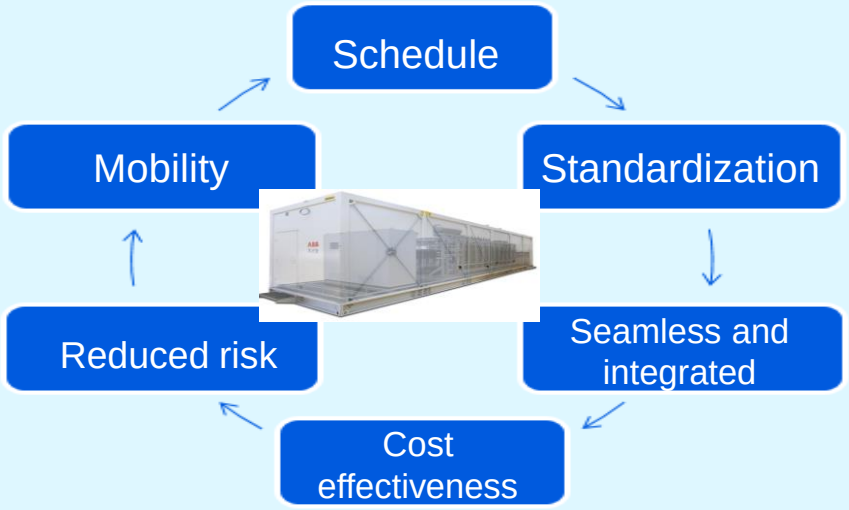
Prefabrication and integrated tests

- Delivered more than 500 factory tested modules to enable speedy project completion and commissioning for fast track projects.
- Pre-assembling and pre-testing in the factory produces high quality and standardized modular deliverables.

- Customers appreciate short erection and commissioning schedule which leads to lesser site activities and efforts thus reduces customers' risks.
- Appropriate for installations with restrictions due to security and time constraints.

Simplified transportation

Ease of installation and commissioning



Global Power Generation
Integrated electrical, control and instrumentation for water plants

Extensive global experience

- 50 years experience in water industry
- Combining in-house technology with process and application know-how
- Notable global footprint from smallest to world's largest

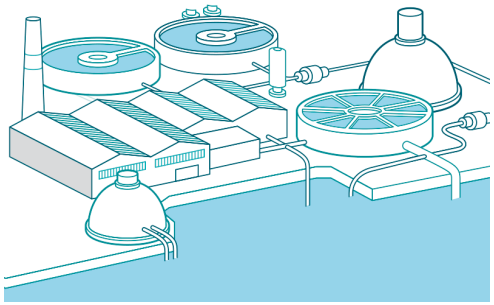
Seamless integration

- Symphony Plus automation platform enables seamless integration of field devices, process and PLC automations, electrical, SCADA, business and maintenance systems

Desalination plants

Pumping stations

Wastewater



Instrumentation, control and electrical solutions for entire water plant, including substation

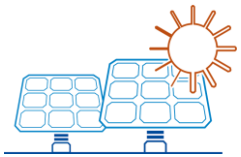
Operational excellence

- Single vendor interface, ensuring continuity, efficient project execution and on-time delivery

Energy efficiency

- Efficient motors and drives - cuts pump energy consumption and reduce motor stress and wear & tear
- A suit of dedicated optimization tools

Global Power Generation
Integrated solutions for photovoltaic power plants

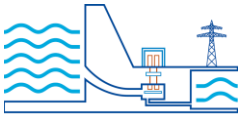


- String monitoring
- Output forecasting
- Reactive power support, frequency support
- Inverters and transformation centers
- Substations and protections
- Security access control
- Supervisory control
- Grid dispatching control
- Solar energy optimization
- Installation and commissioning
- O&M concepts
- Remote plant monitoring
- Maintenance on site
- More than 1,000 MW installed

- ABB electrical and automation solutions for photovoltaic plants maximize performance for rapid return on investment and long plant operating life
- Standard modular sub-systems are fully interoperable, enabling fast, efficient plant construction
- ABB project development services include design, selection of PV modules, trackers and mounting structures

Global Power Generation

Integrated electrical, control and instrumentation solutions for hydropower plants



In partnership and serving end-customers, EPCs and turbine / generator manufacturers

5+MW onwards

- Run-of-river, reservoir, pump storage,
- Low- and high- head plants,
- Greenfield and rehabilitations

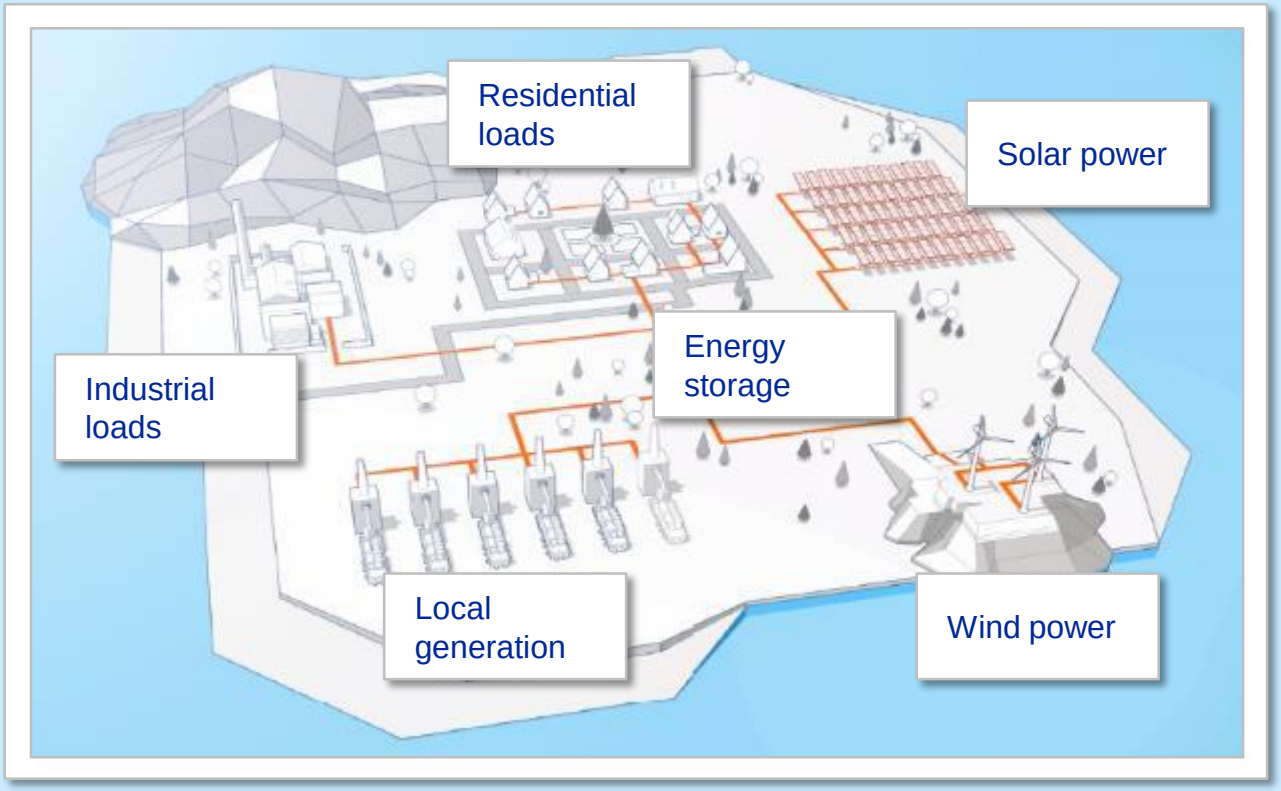
Full solutions

- Complete design, engineered solutions
- Substation, electrical packages and automation solutions
- Installation, commissioning and lifecycle commitment

Optimal integration

- Seamless integrated electrical and automation solutions based on Symphony Plus
- Protection and excitation system

Global Power Generation
Integrating renewables into microgrids



Micro-grids

For independent, reliable and affordable access to distributed power

Increased penetration of renewable resources lowering environmental impact

Combine grid stabilization – PowerStore™ – and automation – Microgrid Plus

Use our system integration capability – help integrate renewables

Global Power Generation
Microgrids in figures

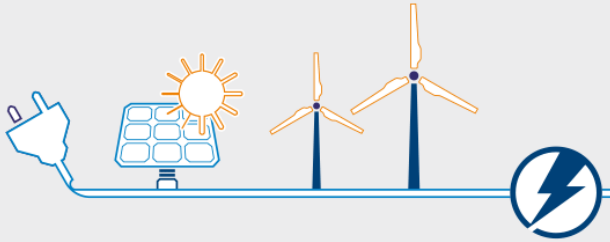
80 + Projects worldwide

75 + MW total size of all **microgrids controlled** with **Microgrid Plus system**

25 + years of **experience**

Fossil fuel saved in **+10,000,000** liter/year

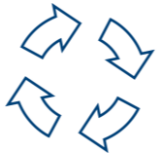
CO_2 emissions reduced **+30,000** tons/year



Global Power Generation
ABB covers the entire service value chain

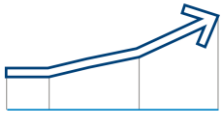
Rapid Response
We guarantee fast and flexible service response to maximize equipment availability

Lifecycle Management
We provide powerful tools and a broad knowledge base to optimize and extend lifecycles of production equipment



Consulting

Operational Efficiency
We optimize the usability and efficiency of equipment and systems to increase industrial productivity



Performance Improvement
We are a strategic partner for improving productivity, usability, reliability, safety, cost-efficiency, energy-efficiency and emissions control

Global Power Generation
ABB service solutions prevent system obsolescence

Advanced ABB service solutions provide continuous automation and control system upgrades that make the most of your investment, while reducing operation and maintenance costs

Using past investments...

- ‘Evolution without obsolescence’ policy grants backward compatibility between ABB`s new offerings and heritage systems, and support across the investment life cycle
- All ABB legacy systems supported
- Seamless evolution to new Symphony Plus control technologies tailored to specific needs and budgets

… to solve future needs

- ServiceGrid solutions match operational and maintenance needs of a power generation facility; planned delivery transforms routine maintenance tasks and frees resources to proactively focus on power production
- Increase performance and efficiency , extend asset life, complement technical resources, protect financial and intellectual investment s, maximize reliability

Global Power Generation
Main benefits of our service portfolio

- Protect investments with stepwise evolution and upgrades of ICE systems
- ‘Evolution without obsolescence’ ensures new generations of ABB plant automation enhance and are backwardly compatible with prior systems
- Upgrades provide increased plant safety, availability, reliability and profitability
- Options for an aging installed base include upgrades, evolution or replacement strategies
- Minimize energy consumption, cost of ownership, while prolonging asset operating life
- All-from-one ABB services cover ICE equipment, from generator terminals to grid connections
- Enhanced service contracts provide performance-related benefits protecting financial and intellectual investments
- Valuable support programs identify plant needs, diagnose inefficiencies, remedial measures and product evolution strategies that improve, maintain equipment performance

Global Power Generation
Service in figures

6,500 units in DCS and **32** B$ installations in electrical

One of the largest installed bases in the world and ranks among the “Top 10

25% of global large power plants run on ABB

- We offer our service capabilities in 48 countries and 8 regional service centers
- All services out of one hand: ABB covers instrumentation, control and electrical equipment - from generator terminals to grid connection
- All plant types are being serviced: gas and CCPPs, steam included nuclear, diesel, hydro, wind, solar, WtE, biomass, water
- ABB energy efficiency solutions can improve power output to the grid by up to 10% without increasing fuel consumption

Global Power Generation
Summary

For more information, visit our websites
new.abb.com/power-generation
new.abb.com/water

- One ABB approach brings global competence to local projects
  - With ABB project management experience
  - Optimized costs using global procurement
  - Reduced commercial risk with ABB guarantees
- Added value to client
  - Increased availability
  - Greater flexibility
  - Optimized operating costs
  - Support to finance projects
- Supports fast track projects
  - Shared responsibilities
  - Guaranteed delivery
  - Access to complete product range

Power and productivity
for a better world™