REFERENCE GUIDE - IEC



EcoStruxure™ Power for Port Industry (IEC)

Powering “Ports of the Future” with Innovative Digital Solutions

2026/09

EcoStruxure Innovation At Every Level Power

Schneider Electric

SECTION 1 – Introduction to the Port Industry

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We strongly recommend to verify current availability in your region and consult with your local representative before making any decision.

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Purpose of the Document

Target Audience

This document is intended to address Design Firms, End Users, Engineering, Operations and Maintenance, Consultants, Specifiers, EPCs (Engineering, Procurement & Construction) and Service teams, and other qualified personnel for **IEC Market**

Objective

To understand how EcoStruxure Power for Ports can help improve electrical safety, power availability and sustainability across the ports.

The document deep dives into Port Industry to address customer pain points and enable building ***"Ports of the Future".***

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SECTION 1: Introduction to the Port Industry

Introduces the market, trends, and key challenges of the Port Industry.

SECTION 2: How EcoStruxure Power Can Support the Port Infrastructure

Describes the solutions that Schneider Electric, and more specifically EcoStruxure Power, provides for the Port Infrastructure, with typical electrical and digital architectures.

SECTION 3: Digital Solutions & Services

Provides information about EcoStruxure Power capabilities for the Port Industry, sorted by value proposition:

- Overview of Digital Solutions Services
- Capabilities to Build Faster and Flexible Infrastructure
- Capabilities to Improve Safety and Availability
- Capabilities to Operate Electrical Networks Efficiently
- Capabilities to Decarbonize Port Infrastructure
- Transverse Lifecycle Capabilities

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Contains useful documents and links to find out more about capabilities and applications across the industry.

Schneider Electric

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- Port Industry Market Outlook
- Port Industry Trends
- Port Industry Segmentation
- Port Industry Vision
- Port Industry Challenges

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SECTION 1

Introduction to the Port Industry

WHY READ THIS SECTION?

The objective of this section is to:

- Introduce the Port Industry market outlook and trends;
- Present the main challenges of the Port Industry.

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Port Industry Market Outlook

Smart ports leading the shift toward a digital and more sustainable future

Accelerating Decarbonization through Shore Connection

3-10%

fleet-wide reduction in CO_2 emissions projected through the use of shore power

Growing Impact of Power Outages

2B€

estimated productivity losses due to the power blackout in Spain in 2025

Rising Power Demand

4-7x

increase in power demand expected, to meet the additional needs of ships at berth & ports electrification



Surge in Global Container Traffic

1.04B

projected volume, by 2028, measured in TEUs (Twenty-foot Equivalent Unit)

Increase in Cyber Attacks

90K

people impacted by the data breach at the port of Seattle

Sources

Sources

Accelerating Decarbonization through Shore Connection
https://pmc.ncbi.nlm.nih.gov/articles/PMC10395031/#:~:text=Shore%20power%20enables%20ships%20to,and%20electric%20vessels%20%5B12%5D

Growing Impact of Power Outages
https://www.thehrdigest.com/spain-power-outage-e2b-productivity-loss-in-2025-blackout/
https://www.worldcargonews.com/news/2025/04/spanish-ports-returning-to-normal-operations-after-power-outage/?gdpr=deny

Surge in Global Passenger Traffic
https://www.reportlinker.com/clp/global/522774#:~:text=Global%20Shipping%20Container%20Trends%20in,by%2053.5%25%20annually%20since%202005

Rising Power Demand
Internal Schneider analysis from Coalition for the energy of the future

Increase in Cyber Attacks
https://www.cm-alliance.com/cybersecurity-blog/april-2025-major-cyber-attacks-ransomware-attacks-and-data-breaches

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Port Industry Trends

Key trends driving the Port market

Government Regulations & Incentives

Plays a crucial role in ports while also ensuring safety and environmental sustainability
Huge stimulus funding for infrastructure development, targeting:
EU AFIF: 422M€/ 39# Projects for Zero Emission Mobility Transport including Maritime [1]
US: 2.25 B$ - PIDP program (2022-2026) [2]

Increasing Traffic

Sector growth is estimated at around **4.5% to ~6%** [3].
It is driven by rising goods volume due to international trade, rapid industrialization and globalization.

Decarbonization

Strong need to promote more sustainable operations, as ports significantly contribute to countries CO_2 emissions. By 2050, the port of Los Angeles targets to cut **Green House Gas emissions by 80%** [4]

Increasing Cyber Attacks

Cyber attacks on maritime Operational Technology (OT) systems have surged **900% since 2017** [5].
Cybersecurity plays a vital role in global trade and logistics.

Sources

[1] EU funding to boost zero-emission mobility
[2] Port Infrastructure Development Program
[3] Internal Schneider analysis
[4] Sustainability ambitions and initiatives for Los Angeles port
[5] IAPH Cybersecurity Guidelines for Ports and Port Facilities

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Port Industry Segmentation

A wide range of application categories for specific needs

The versatility of ports makes them essential components of regional and global connectivity, influencing trade, development, and the environment.

Industrial Port



Multi-modal hub for diverse logistics:

- Containers
- Bulk cargo (solid & liquid)
- Food & Beverage
- Metals, Minerals & Mining (MMM)
- Oil & Gas

Passenger Port



Dedicated facility for passenger and vehicle transport:

- Tourism: cruise, river cruise, yacht
- Transshipment: Ferry, Roll-on/Roll-off (RoRo) and Roll-on/Roll-off passenger (RoPax)

Naval Base



Strategic hub for deploying naval assets:

- War Ship
- Patroller
- Frigate
- Aircraft carrier
- Submarine

Ship Yard



Specialized site for vessel services:

- New ship construction
- Repair & maintenance

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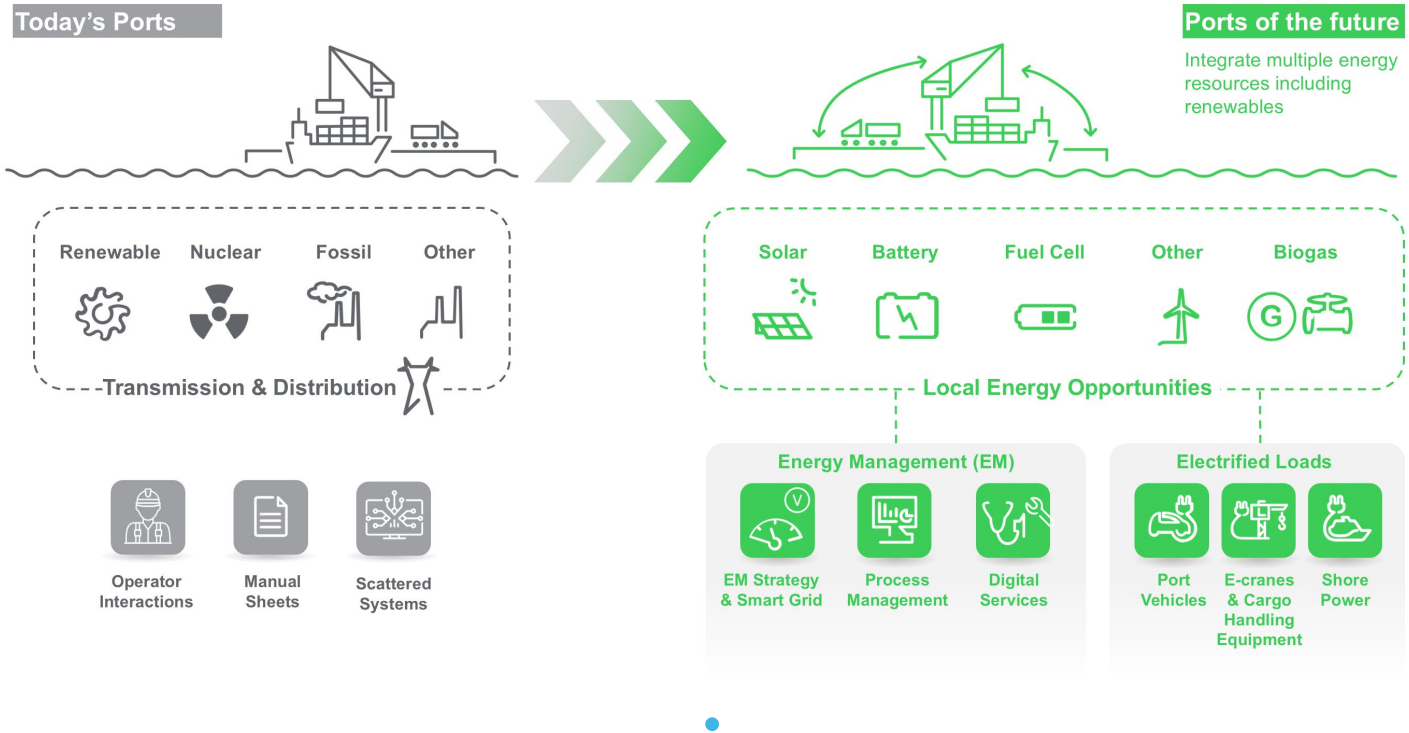
SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

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Port Industry Vision

Ports are on a mission to become more sustainable, digitally integrated hubs, embracing renewable energies and intelligent systems



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Port Industry Challenges

Five key challenges impacting ports

Power Infrastructure & Energy Transition



Ports face increasing pressure to electrify operations and comply with shore power regulations.

Rising power demand challenges the ability to maintain operational efficiency and financial sustainability.

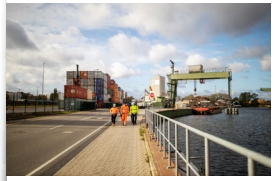
Cybersecurity Threats



Ports are prime cyber attack targets due to their vital economic role.

The increasing automation and digitalization make the Operational Technology (OT) systems more vulnerable to threats & attacks.

Operational Continuity



Ports are the backbone of global trade, operating 24/7; any downtime causes major delays and disrupts operations.

Aging infrastructure , maintenance constraints and growing electrification complexities increase operational challenges.

Workforce & Skill Gaps



Ports face a shortage of skilled labor for maintaining advanced electrical and digital systems.

Aging workforce and lack of young talent exacerbate the issue.

Decarbonization & Sustainability Goals



Ports must reduce emissions and adopt sustainable technologies to meet regulatory and societal expectations.

Achieving Net Zero by 2050 requires balancing sustainability goals with operational and financial constraints.

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Port Industry Challenges

Implication for the ports

Power Infrastructure & Energy Transition

- Undersized electrical infrastructure limits capacity to support electrified operations
- Ports face operational strain and reduced flexibility in meeting sustainability targets

Cybersecurity Threats

- Cyber attacks can paralyze critical systems such as cranes and cargo handling equipment.
- Disruptions lead to delays, congestion, and revenue loss, affecting global trade flows.

Operational Continuity

- Power disruptions halt critical systems such as cranes and conveyors, directly impacting port operations.
- Failures in critical and emergency systems increase overall vulnerability and create safety risks.

Workforce & Skill Gaps

- Lack of qualified staff leads to maintenance delays and safety risks.
- Capacity constraints during peak periods affect service quality.

Decarbonization & Sustainability Goals

- Access to government funding increasingly depends on demonstrated progress in decarbonization.
- Ports risk losing competitiveness to more sustainable players when they delay pursuing their decarbonization goals.

Impacting Port Brand & Finances

SECTION 1 – Introduction to the Port Industry

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- Schneider Electric Solutions for the Ports
- EcoStruxure Power Solutions for the Ports
- Key Areas of a Port Site
- Typical Electrical and Digital Architectures

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SECTION 2

How Schneider Electric Can Support the Port Infrastructure

WHY READ THIS SECTION?

The aim of this section is to:

- Present Schneider Electric value propositions to meet Port Industry challenges;
- Explain how Schneider Electric with EcoStruxure Power solutions can support this industry;
- Provide an example of electrical and digital architectures.

SECTION 1 – Introduction to the Port Industry

SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

Schneider Electric Solutions for Ports ▶

EcoStruxure Power Solutions for Ports

Key Areas of a Port Site

Typical Electrical and Digital Architectures

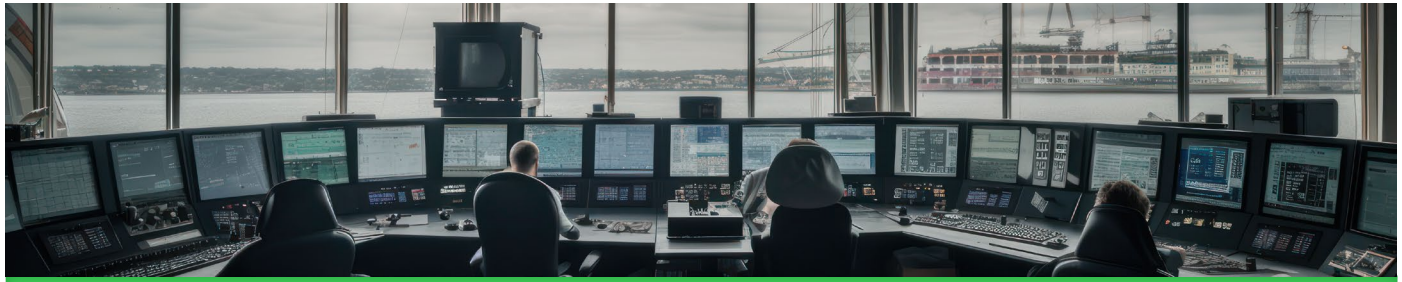
SECTION 3 – Digital Solutions & Services

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Schneider Electric Solutions for Port Infrastructure

Main areas of the ports supported by Schneider Electric

Ports are intricate environments with diverse needs and systems. Here are some key areas where our solutions can provide significant benefits:



Central Operations



Shore Power



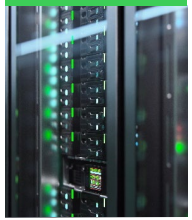
Electrical Distribution



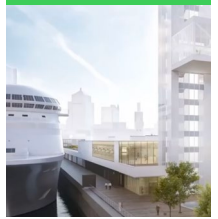
Charging Infrastructure



Microgrid



Data Center



Cruise Terminal & Facility Buildings

Third-Party Systems

** Third-party systems to be interfaced need to be checked for compatibility with Central Operations.*

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Schneider Electric Solutions for Port Infrastructure

Our value proposition is based upon three pillars:

Reliable Electrification

- **Electrify dock** with onshore power supply.
- **Deploy charging infrastructure** for electric vehicles, cargo handling equipment, and electric trucks.
- **Upgrade to more resilient infrastructure** to meet current and future power demand using design simulation systems and services.
- **Help maintain system integrity** over time with Digital Twin systems.

Digitalization

- **Centralize management and maintenance** of the entire electrical distribution system using a comprehensive power management.
- **Break siloes and empower** operator's decision-making by integrating a Unified Operation Center with integrated data management.
- **Strengthen operational resilience** to mitigate Operational Technology (OT) cybersecurity risks.

Decarbonization

- **Define the port decarbonization roadmap** to reach Net Zero emissions.
- **Reduce scope 1**: Implement energy efficiency initiatives.
- **Reduce scope 2**: Optimize onsite renewable energy use through microgrid technologies.
- **Reduce Scope 3 :** Engage port tenants in the decarbonization journey.
- **Extend asset lifespan and reduce waste,** contributing to circular economy.

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EcoStruxure Power Solutions for Port Infrastructure

Our detailed value proposition for electrical distribution

Reliable Electrification

Build Faster & Flexible Infrastructure

Speed up the "design, build, modernize and commission" phases of new facilities using:

- Standardized electrical distribution and digital architectures;
- Design simulation tools based on an Electrical Digital Twin solution.

Support Cybersecurity Implementation

- Select products designed with built-in cybersecurity technologies/features.
- Work with electrical distribution partners with robust internal processes.

Digitalization

Improve Safety & Availability

- Monitor the installation to predict faults, thereby minimizing impact and improving safety.
- Provide automatic power restoration and model Digital Twin to reduce downtimes.

Operate Electrical Networks Efficiently

Enhance the skills of the team with:

- Augmented reality;
- Training in a Digital Twin environment.

Enhance workforce productivity with remote monitoring, analytics, as well as support from digital and field services.

Decarbonization

Decarbonize Port Infrastructure

- Define a feasible decarbonization roadmap.
- Monitor energy to make informed decisions.
- Integrate onsite renewables.
- Adopt Electric Vehicle (EV) charging digital solutions for optimization.

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EcoStruxure Power Solutions for Port Infrastructure

Lifecycle phases addressed by the value propositions presented previous page

Design, Build, Modernize & Commission
(Consultants & EPC)

Operate & Maintain
(Operators, maintenance team, service teams)

- Build Faster & Flexible Infrastructure
- Improve Safety & Availability
- Operate Electrical Networks Efficiently
- Decarbonize Port Infrastructure

Transverse Lifecycle Capabilities: Cybersecurity, Electrical Digital Twin, Interfaces

Find details about EcoStruxure Power digital solutions and services in SECTION 3

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EcoStruxure Power Solutions for Port Infrastructure

Why consider EcoStruxure Power solutions for your port infrastructure?



- From **quay to port gate, with a focus on shore power,**
- From **electrical design** to **operations** and **maintenance**,

EcoStruxure Power delivers a comprehensive digital solution designed to enhance efficiency, reliability, and safety across port operations.

Our **collaborative environment,** enhanced by the **Electrical Digital Twin for the Port**, improves reliability, reduces downtime, while enabling seamless data-driven operations.

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EcoStruxure Power Solutions for Ports

Key Areas of a Port Site ▶

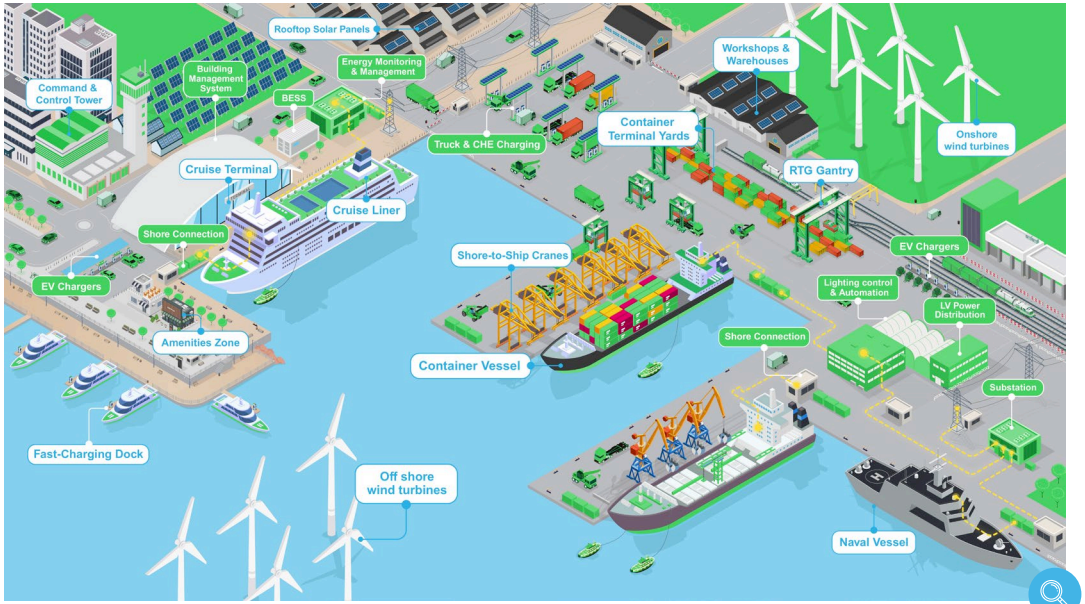
Typical Electrical and Digital Architectures

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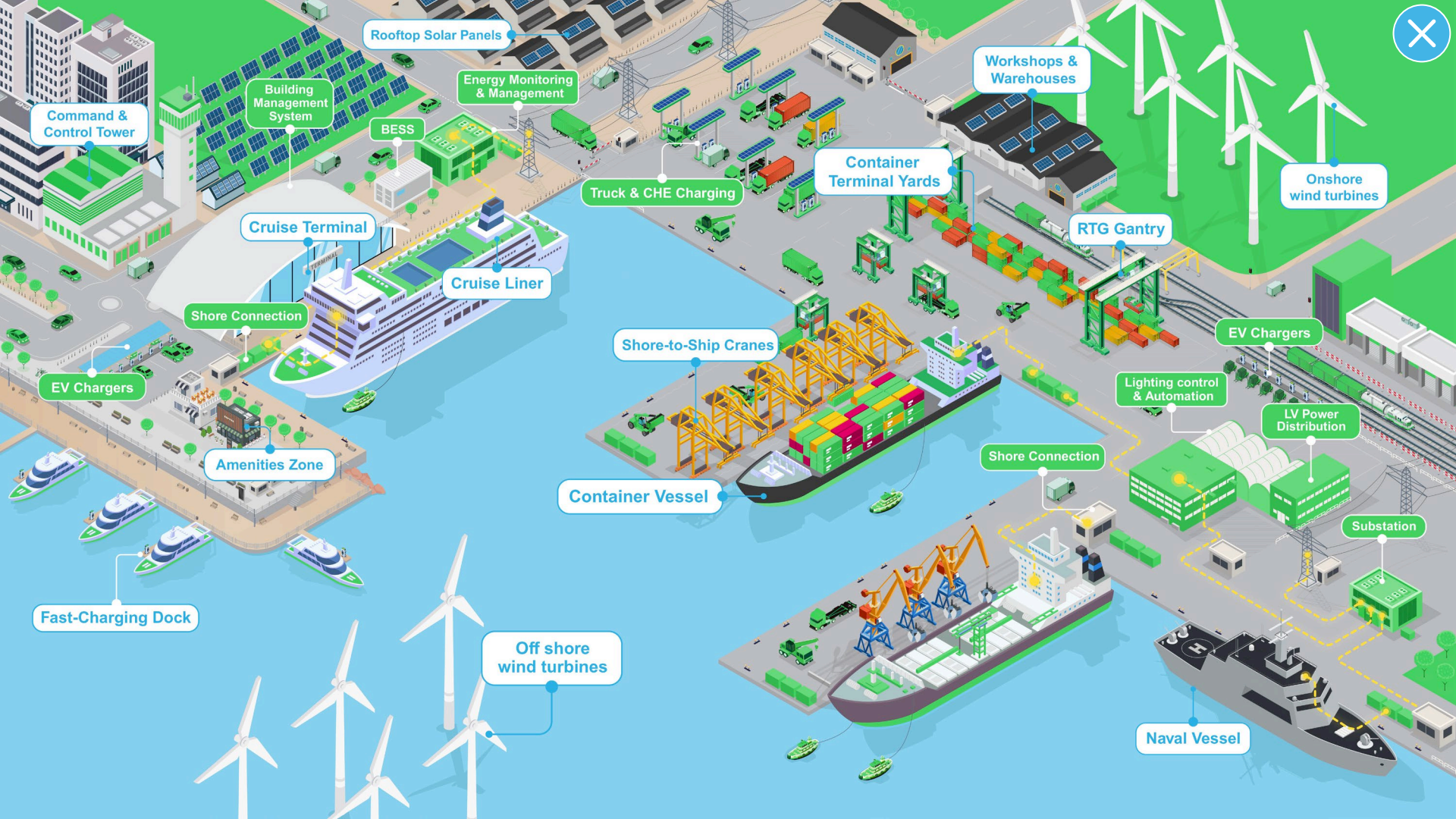
BIBLIOGRAPHY

Key Areas of a Port Site

Typical areas and systems



Example of Port Site Infrastructure


Rooftop Solar Panels
Building Management System
Energy Monitoring & Management
Command & Control Tower
BESS
Workshops & Warehouses
Container Terminal Yards
Truck & CHE Charging
Onshore wind turbines
Cruise Terminal
RTG Gantry
Cruise Liner
Shore Connection
Shore-to-Ship Cranes
EV Chargers
EV Chargers
Lighting control & Automation
LV Power Distribution
Shore Connection
Amenities Zone
Container Vessel
Substation
Fast-Charging Dock
Off shore wind turbines
Naval Vessel

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Key Areas of a Port Site

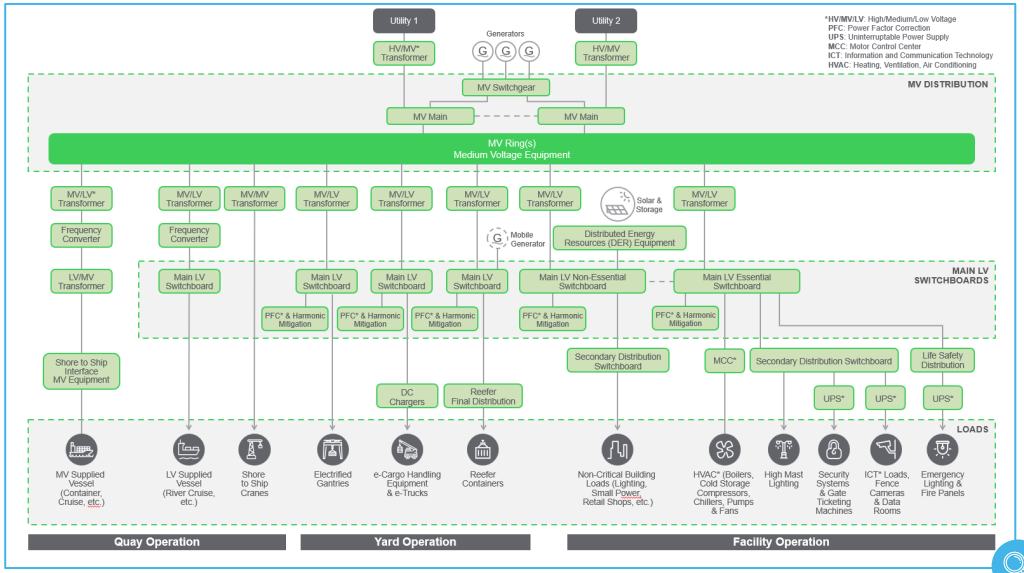
Typical Electrical and Digital Architectures ▶

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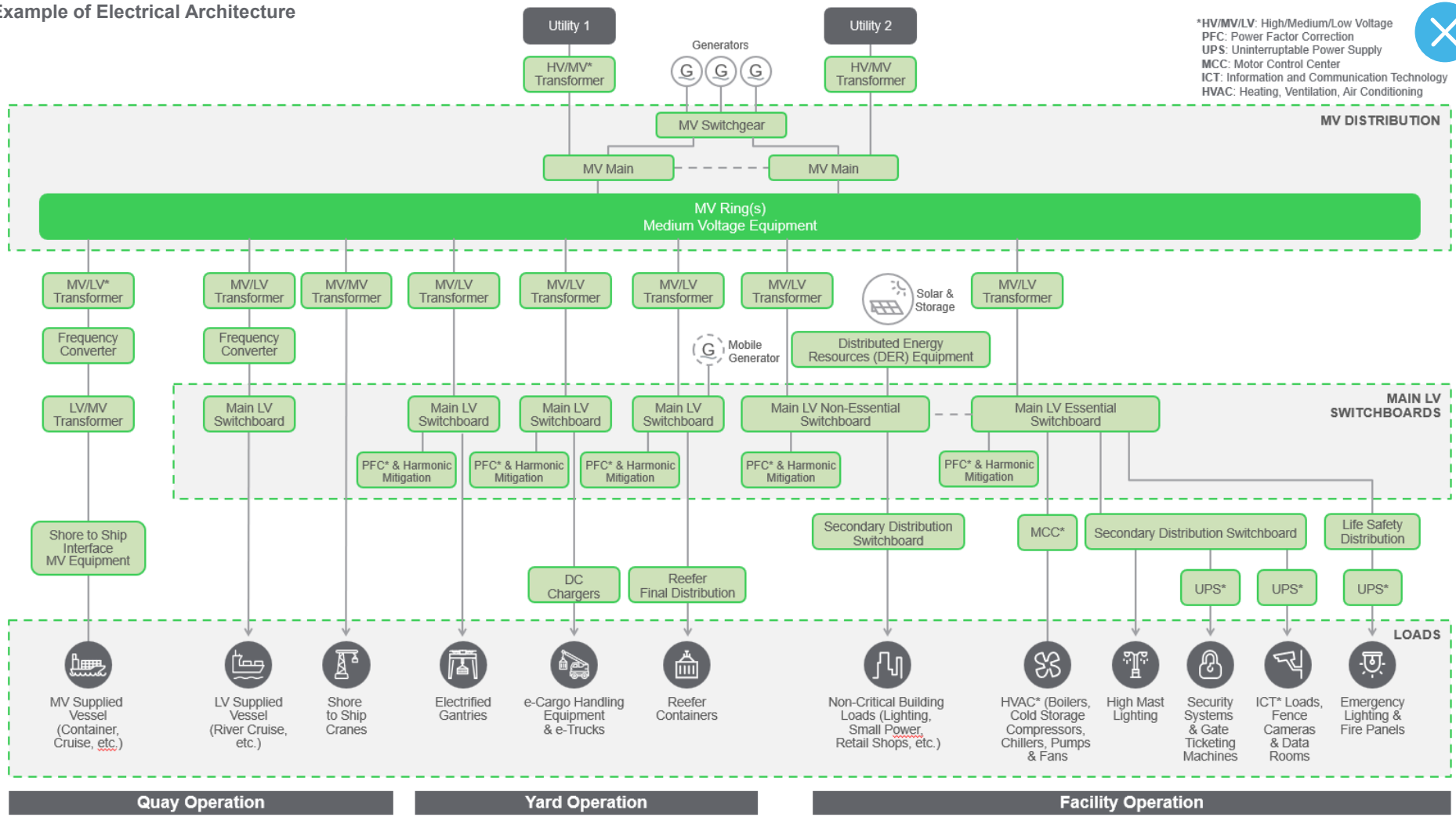
Typical Electrical and Digital Architectures for a Port Site

Typical electrical architecture



Example of Electrical Architecture

Example of Electrical Architecture



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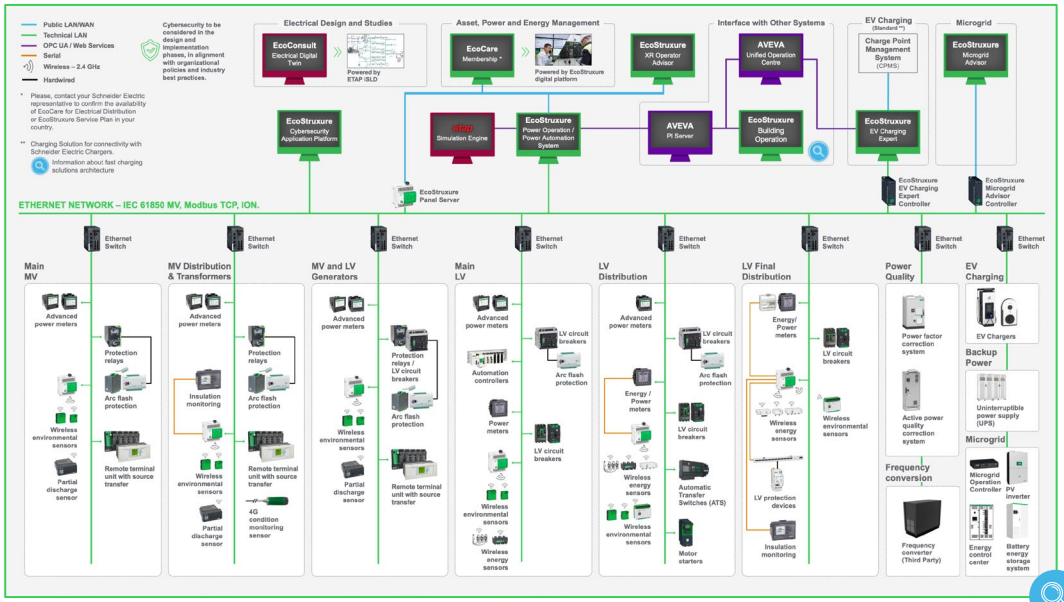
Typical Electrical and Digital Architectures ▶

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Typical Electrical and Digital Architectures for a Port Site

Suggested digital architecture (high-level view)



Example of Digital Architecture (High-Level View)

Example of Digital Architecture (High-Level View)

- Public LAN/WAN
- Technical LAN
- OPC UA / Web Services
- Serial
- Wireless – 2.4 GHz
- Hardwired

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

* Please, contact your Schneider Electric representative to confirm the availability of EcoCare for Electrical Distribution or EcoStruxure Service Plan in your country.

** Charging Solution for connectivity with Schneider Electric Chargers.

Information about fast charging solutions architecture

Electrical Design and Studies

- EcoConsult – Electrical Digital Twin
- Powered by ETAP iSLD

Asset, Power and Energy Management

- EcoCare – Membership *
- Powered by EcoStruxure digital platform
- EcoStruxure – XR Operator Advisor

Interface with Other Systems

- AVEVA – Unified Operation Centre
- AVEVA – PI Server
- EcoStruxure – Building Operation

EV Charging (Standard **)

- Charge Point Management System (CPMS)
- EcoStruxure – EV Charging Expert
- EcoStruxure EV Charging Expert Controller

Microgrid

- EcoStruxure – Microgrid Advisor
- EcoStruxure Microgrid Advisor Controller

- EcoStruxure – Cybersecurity Application Platform
- etap – Simulation Engine
- EcoStruxure – Power Operation / Power Automation System
- EcoStruxure Panel Server

ETHERNET NETWORK – IEC 61850 MV, Modbus TCP, ION.

Ethernet Switch

Main MV

- Advanced power meters
- Protection relays
- Arc flash protection
- Wireless environmental sensors
- Remote terminal unit with source transfer
- Partial discharge sensor

MV Distribution & Transformers

- Advanced power meters
- Protection relays
- Insulation monitoring
- Arc flash protection
- Wireless environmental sensors
- Remote terminal unit with source transfer
- Partial discharge sensor
- 4G condition monitoring sensor

MV and LV Generators

- Advanced power meters
- Protection relays / LV circuit breakers
- Arc flash protection
- Wireless environmental sensors
- Remote terminal unit with source transfer
- Partial discharge sensor

Main LV

- Advanced power meters
- LV circuit breakers
- Arc flash protection
- Automation controllers
- Power meters
- LV circuit breakers
- Wireless environmental sensors
- Wireless energy sensors

LV Distribution

- Advanced power meters
- LV circuit breakers
- Arc flash protection
- Energy / Power meters
- LV circuit breakers
- Wireless energy sensors
- Automatic Transfer Switches (ATS)
- Wireless environmental sensors
- Motor starters

LV Final Distribution

- Energy/ Power meters
- LV circuit breakers
- Wireless energy sensors
- Wireless environmental sensors
- LV protection devices
- Insulation monitoring

Power Quality

- Power factor correction system
- Active power quality correction system

Frequency conversion

- Frequency converter (Third Party)

EV Charging

- EV Chargers

Backup Power

- Uninterruptible power supply (UPS)

Microgrid

- Microgrid Operation Controller
- PV inverter
- Energy control center
- Battery energy storage system

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EcoStruxure Power Solutions for Ports

Key Areas of a Port Site

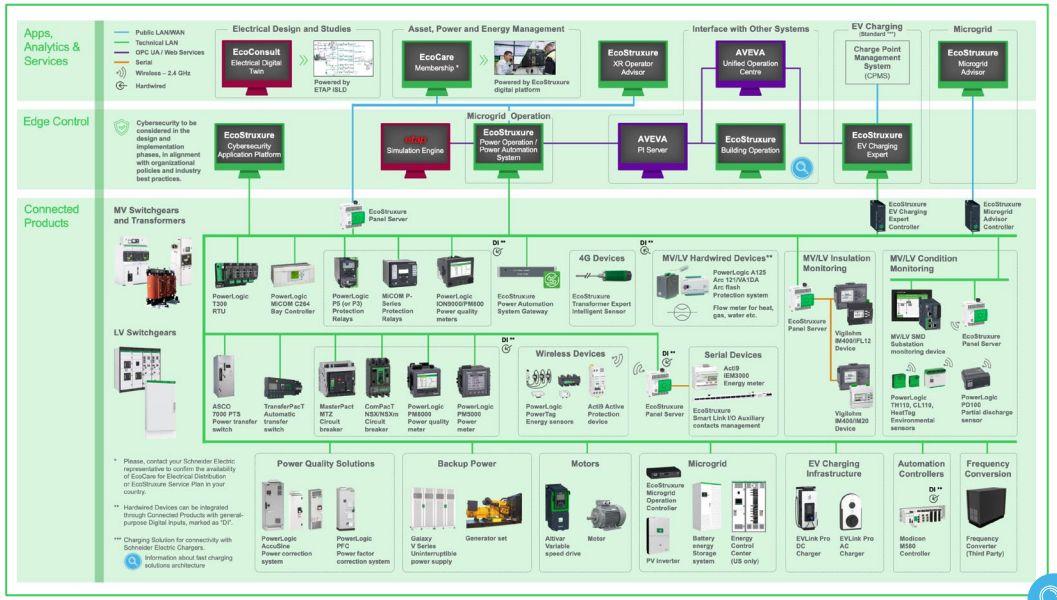
Typical Electrical and Digital Architectures ▶

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Typical Electrical and Digital Architectures for a Port Site

Corresponding detailed digital architecture



Example of Digital Architecture (Detailed View)

Example of Digital Architecture (Detailed View)

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin



Powered by ETAP iSLD

Asset, Power and Energy Management

EcoCare
Membership *



Powered by EcoStruxure digital platform

EcoStruxure
XR Operator Advisor

Interface with Other Systems

AVEVA
Unified Operation Centre

EV Charging (Standard ***)

Charge Point Management System (CPMS)

Microgrid

EcoStruxure
Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

EcoStruxure
Cybersecurity Application Platform

etap
Simulation Engine

Microgrid Operation

EcoStruxure
Power Operation / Power Automation System

AVEVA
PI Server

EcoStruxure
Building Operation

EcoStruxure
EV Charging Expert

Connected Products

MV Switchgears and Transformers



EcoStruxure Panel Server

EcoStruxure EV Charging Expert Controller

EcoStruxure Microgrid Advisor Controller

PowerLogic T300 RTU

PowerLogic MiCOM C264 Bay Controller

PowerLogic P5 (or P3) Protection Relays

MiCOM P-Series Protection Relays

PowerLogic ION9000/PM8000 Power quality meters

DI **

EcoStruxure Power Automation System Gateway

4G Devices

EcoStruxure Transformer Expert Intelligent Sensor

DI **

MV/LV Hardwired Devices**



PowerLogic A125 Arc 121/VA1DA Arc flash Protection system

Flow meter for heat, gas, water etc.

MV/LV Insulation Monitoring

EcoStruxure Panel Server

Vigilohm IM400/IFL12 Device

Vigilohm IM400/IM20 Device

MV/LV Condition Monitoring

MV/LV SMD Substation monitoring device

EcoStruxure Panel Server

PowerLogic TH110, CL110, HeatTag Environmental sensors

PowerLogic PD100 Partial discharge sensor

LV Switchgears



ASCO 7000 PTS Power transfer switch

TransferPacT Automatic transfer switch

MasterPact MTZ Circuit breaker

ComPacT NSX/NSXm Circuit breaker

PowerLogic PM8000 Power quality meter

PowerLogic PM5000 Power meter

DI **

Wireless Devices



PowerLogic PowerTag Energy sensors

Acti9 Active Protection device

DI **

EcoStruxure Panel Server

Serial Devices

Acti9 iEM3000 Energy meter

EcoStruxure Smart Link I/O Auxiliary contacts management

* Please, contact your Schneider Electric representative to confirm the availability of EcoCare for Electrical Distribution or EcoStruxure Service Plan in your country.

** Hardwired Devices can be integrated through Connected Products with general-purpose Digital Inputs, marked as "DI".

*** Charging Solution for connectivity with Schneider Electric Chargers.

Information about fast charging solutions architecture

Power Quality Solutions



PowerLogic AccuSine Power correction system

PowerLogic PFC Power factor correction system

Backup Power



Galaxy V Series Uninterruptible power supply

Generator set

Motors



Altivar Variable speed drive

Motor

Microgrid

EcoStruxure Microgrid Operation Controller

PV inverter

Battery energy Storage system

Energy Control Center (US only)

EV Charging Infrastructure



EVLink Pro DC Charger

EVLink Pro AC Charger

Automation Controllers

DI **

Modicon M580 Controller

Frequency Conversion



Frequency Converter (Third Party)

SECTION 1 – Introduction to the Port Industry

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SECTION 3 – Digital Solutions & Services

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- Capabilities to Operate Elec. Networks Efficient.
- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

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SECTION 3

Digital Solutions & Services

WHY READ THIS SECTION?

This section provides information about EcoStruxure Power capabilities for Port Industry aligned with our future-ready solutions.

SECTION 1 – Introduction to the Port Industry

SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

SECTION 3 – Digital Solutions & Services

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Introduction

EcoStruxure Power empowers ports to meet evolving demands with smart and scalable digital solutions

Design, Build, Modernize & Commission
(Consultants & EPC)

Operate & Maintain
(Operators, maintenance team, service teams)

Build Faster & Flexible Infrastructure

These capabilities leverage standardized electrical distribution systems, along with digital design and simulation tools, to accelerate the “design, build, modernize and commission” phases of new port infrastructure.

Improve Safety & Availability

These capabilities enable ports to continuously monitor installations, allowing early detection of faults and minimizing impact—thereby enhancing safety and operational uptime.

They also support automatic power restoration and leverage Digital Twin modeling to improve infrastructure resilience.

Operate Electrical Networks Efficiently

These capabilities enhance operator effectiveness and productivity at ports by integrating advanced tools such as extended reality.

They also play a crucial role in developing a highly skilled and future-ready workforce.

Decarbonize Port Infrastructure

These capabilities enable effective energy monitoring across port operations, facilitate the integration of renewable energy sources, and accelerate electrification throughout the port ecosystem.

Transverse Lifecycle Capabilities

Comprehensive Digital Solutions and Services that support “Design, Build, Operate & Maintain” phases of the port infrastructure throughout the entire project lifecycle.

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SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

SECTION 3 – Digital Solutions & Services

Introduction

Overview of Digital Solutions & Services

Capabilities to Build Faster Flexible Infrastruct.

Capabilities to Improve Safety & Availability

Capabilities to Operate Elec. Networks Efficient.

Capabilities to Decarbonize Port Infrastruct.

Transverse Lifecycle Capabilities

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(Consultants & EPC)

Build Faster & Flexible Infrastructure

- Network Load Flow and Voltage Drop Simulation
- Electrical Network Short Circuit and Selectivity Simulation
- Arc Fault Protection and Coordination
- Device Coordination and Selectivity
- AC&DC Electrical Network Bus Design and Simulation
- Power Quality Simulation & Modelling
- Power System Study
- Renewable & Microgrid Energy Storage Sizing Simulation

Operate & Maintain
(Operators, maintenance team, service teams)

Improve Safety & Availability

- Electrical Distribution Monitoring, Alarming and Event Analysis
- Power Quality Monitoring, Correction and Compliance
- Arc Flash Protection
- Continuous Thermal Monitoring
- Circuit Breaker Settings Monitoring
- Power Source and Load Control
- Advanced Protection and Automation
- Simulate Before Operate
- Insulation Monitoring

Operate Electrical Networks Efficiently

- Asset Performance
- Capacity Management
- Backup Power Testing
- Predictive Simulation
- Guided Procedures Through Extended Reality
- Operator Training Simulation

Decarbonize Port Infrastructure

- Net Zero Consulting Services
- Utility Bill Verification
- Cost Allocation and Tenant Billing
- Energy Monitoring and Usage Analysis
- Energy Efficiency Compliance
- Microgrid
- EV Charging (Standard)
- EV Fast Charging

Transverse Lifecycle Capabilities

- Electrical Digital Twin - iSLD
- Interface with Other Systems (BMS, Unified Operations Center, Other)
- Cybersecurity

SECTION 1 – Introduction to the Port Industry

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- Transverse Lifecycle Capabilities

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Capabilities to Build Faster and Flexible Infrastructure

Design, Build, Modernize & Commission
(Consultants & EPC)

Build Faster & Flexible Infrastructure

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- Electrical Network Short Circuit and Selectivity Simulation
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- Renewable & Microgrid Energy Storage Sizing Simulation

Operate & Maintain
(Operators, maintenance team, service teams)

Improve Safety & Availability

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Schneider Electric

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Transverse Lifecycle Capabilities

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Network Load Flow and Voltage Drop Simulation

etap

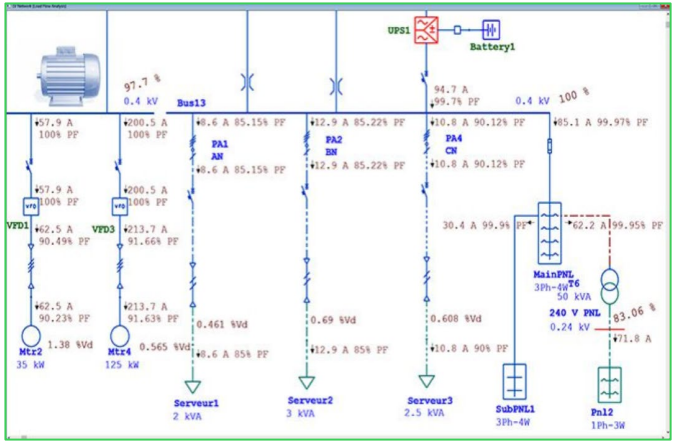
Perform power flow analysis and voltage drop calculations

Primary Department

- Project Procurement / Delivery
- Design Firms

Benefits

- Simulate bus voltages, branch power factors, currents, system losses, power generation versus loading.
- Use ETAP Electrical Digital Twin model with powerful calculation engines and user-friendly interface.
- Simulate using multiple loading and generation conditions.



Network Load Flow and Voltage Drop Simulation in ETAP

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Electrical Network Short Circuit and Selectivity Simulation

etap

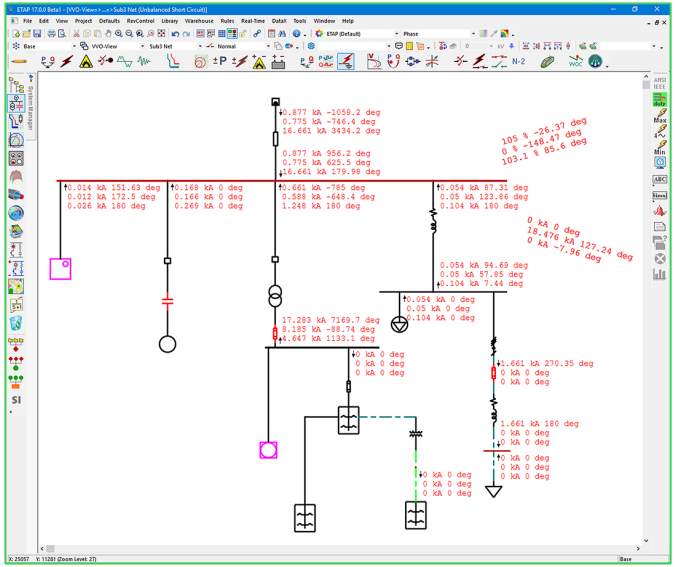
Design and simulate unbalanced short circuits

Primary Department

- Project Procurement / Delivery
- Design Firms

Benefits

- Expedite design studies with a wide range of calculation scenarios, including advanced fault analysis.
  - IEC & ANSI duty calculation for balanced and unbalanced faults
  - Simultaneous fault at selected nodes
  - Inclusive 3-phase and 1-phase fault analysis
  - Pre-fault system loading consideration



Electrical Network Short Circuit Simulation in ETAP

Schneider Electric

Arc Fault Protection and Coordination

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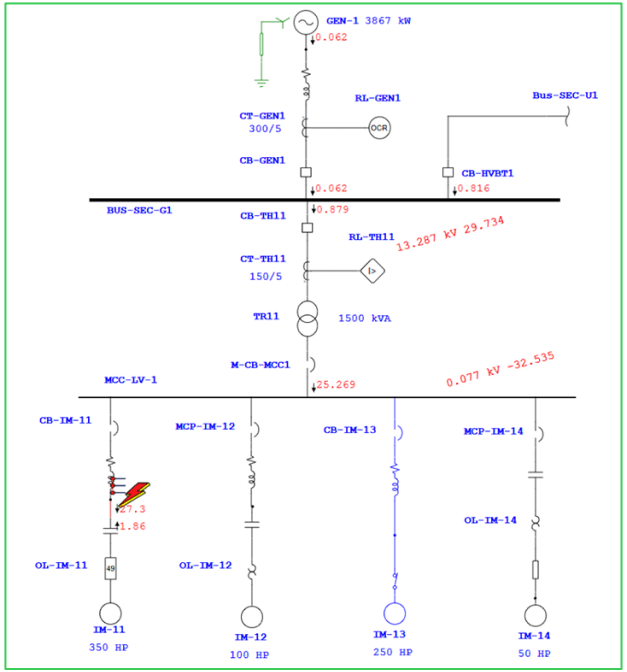
Perform sequence of operation for arc fault and bolted fault

Primary Department

- Project Procurement / Delivery
- Design Firms

Benefits

- Evaluate, verify, and confirm the operation and selectivity of the protective devices.
  - Various types of faults for any location
- Support displaying animation on the single-line diagram.
- Enable 3-phase / 1-phase sequence of operation.



Arc Fault Protection and Coordination in ETAP

Device Coordination and Selectivity

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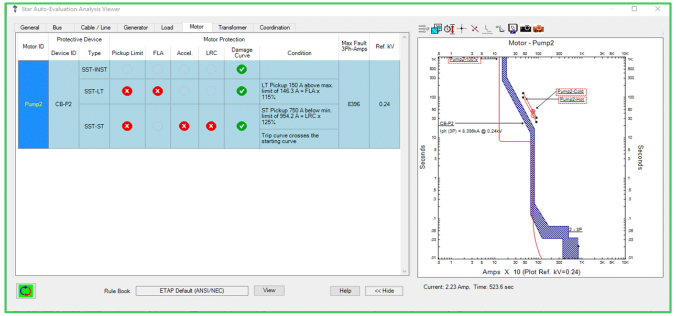
Automatically detect and evaluate the system protection and coordination/selectivity

Primary Department

- Project Procurement / Delivery
- Design Firms

Benefits

- Evaluate the system protection as well as the coordination/selectivity between circuit breakers.
  - Verified and validated libraries
  - Graphically adjustable device settings
  - Continuously synchronized with the one-line (single-line) diagram and integrated equipment database
- Provide detailed device settings reporting.



Device Coordination and Selectivity in ETAP

AC and DC Electrical Network Bus Design and Simulation

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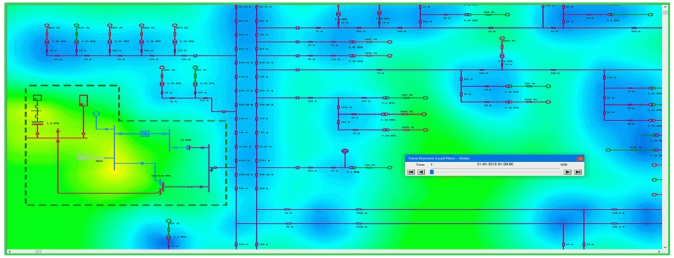
Optimize bus design allocation and simulation

Primary Department

- Project Procurement / Delivery
- Design Firms

Benefits

- Provide a single solution/environment.
  - Unified AC & DC solution from HV to LV
  - One unique platform and one database
- Enable efficient profile management.
  - User-defined loading and generation profiles
  - External data profile based on field measurements
- Enhance scalability.
  - Load growth study for future planning
- Facilitate event simulations within the calculation period.



ETAP Electrical Network Model

Power Quality Simulation and Modeling

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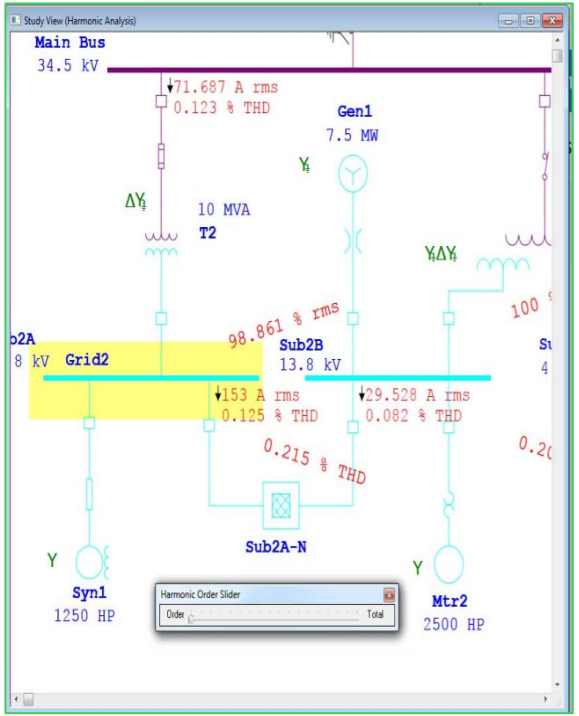
Evaluate and validate distortion due to harmonics

Primary Department

- Project Procurement / Delivery
- Design Firms

Benefits

- Simulate harmonic current and voltage sources:
  - To identify potential harmonic problems (report of harmonic voltage and current distortion limit violations);
  - To identify the need for a harmonics filter.
- Simulate and analyze the size of the harmonics filter the system will need, to optimize performance and reduce nuisance trips.



Power Quality Simulation and Modeling in ETAP

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Power System Study

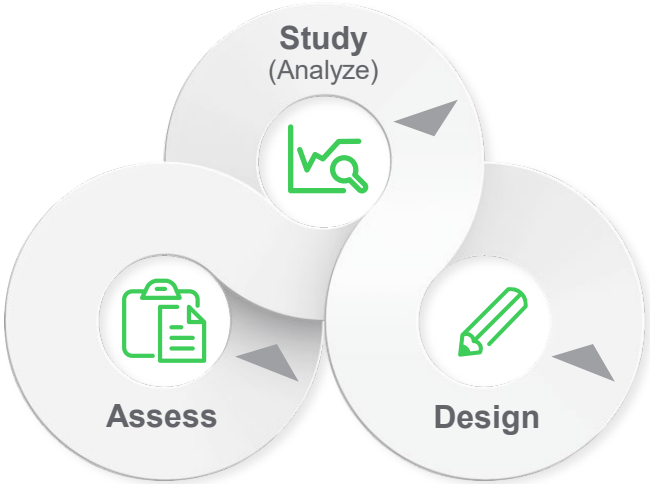
Work with engineering experts to provide Power System Studies

Primary Department

- Project Procurement / Delivery
- Design Firms
- Electrical Department

Benefits

- Partner with a global team of experts, engaged with industry standards committees, to develop common safety standards and practices.
- Create a standardized approach to Power System Studies to support multisite deployments with consistent results.



Renewable and Microgrid Energy Storage Sizing Simulation

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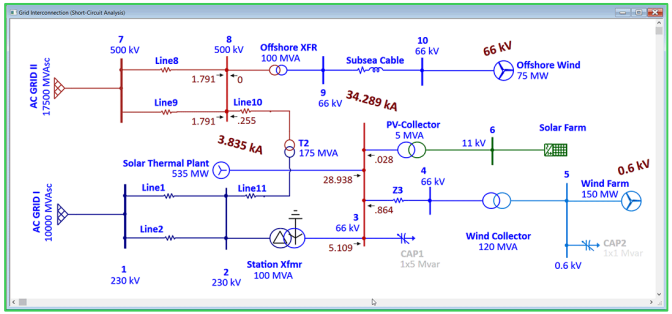
Design and optimize the microgrid system

Primary Department

- Design
- Construction

Benefits

- Build renewable energy models combined with full spectrum power system analysis calculations for:
  - Accurate simulation;
  - Predictive analysis;
  - Equipment sizing;
  - Field verification of wind, solar farms and other Distributed Energy Resources (DERs).
- Enable designers and engineers to conceptualize the collector systems, determine wind penetration and perform grid interconnection studies.



Microgrid Energy Storage Sizing Simulation in ETAP

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- Power Quality Simulation & Modelling
- Power System Study
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Operate & Maintain
(Operators, maintenance team, service teams)

Improve Safety & Availability

- Electrical Distribution Monitoring, Alarming and Event Analysis
- Power Quality Monitoring, Correction and Compliance
- Arc Flash Protection
- Continuous Thermal Monitoring
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- Power Source and Load Control
- Advanced Protection and Automation
- Simulate Before Operate
- Insulation Monitoring

Operate Electrical Networks Efficiently

- Asset Performance
- Capacity Management
- Backup Power Testing
- Predictive Simulation
- Guided Procedures Through Extended Reality
- Operator Training Simulation

Decarbonize Port Infrastructure

- Net Zero Consulting Services
- Utility Bill Verification
- Cost Allocation and Tenant Billing
- Energy Monitoring and Usage Analysis
- Energy Efficiency Compliance
- Microgrid
- EV Charging (Standard)
- EV Fast Charging

Transverse Lifecycle Capabilities

- Electrical Digital Twin - iSLD
- Interface with Other Systems (BMS, Unified Operations Center, Other)
- Cybersecurity

Schneider Electric

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Electrical Distribution Monitoring, Alarming and Event Analysis

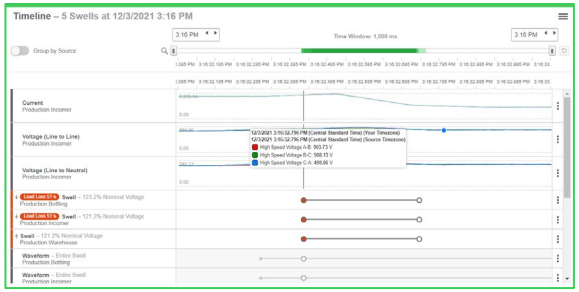
Monitor and control electrical network, analyze the root causes of electrical events

Primary Department

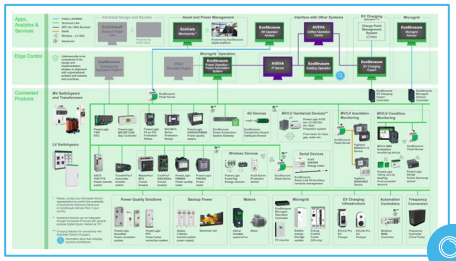
- Facility Management / Utilities Management
- Electrical Department

Benefits

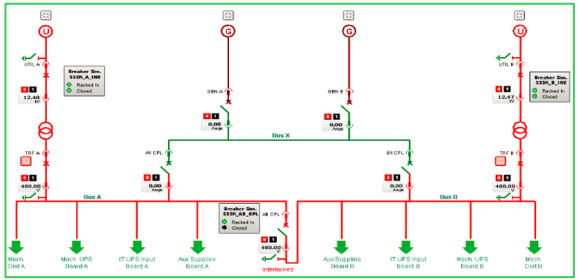
- Automatically classify and describe any electrical events.
- Show real-time status of the power distribution.
- Provide a customized single-line diagram.
- Offer 24/7 power monitoring and alarm notification.
- Use system intelligence to determine root cause and location of events.



Event and Alarm Status Timeline in EcoStruxure Power Operation



Electrical Distribution Monitoring, Alarming and Event Analysis Reference Architecture



Electrical Distribution Monitoring and Alarming Single-line Diagram in EcoStruxure Power Operation

Learn more about:

- Electrical distribution monitoring and alarming (IEC)
- Power Event Analysis (IEC)

Electrical Distribution Monitoring, Alarming and Event Analysis Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

- EcoConsult — Electrical Digital Twin
- Powered by ETAP iSLD

Asset and Power Management

- EcoCare Membership *
- Powered by EcoStruxure digital platform
- EcoStruxure XR Operator Advisor

Interface with Other Systems

- AVEVA Unified Operation Centre

EV Charging (Standard ***)

- Charge Point Management System (CPMS)

Microgrid

- EcoStruxure Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

- EcoStruxure Cybersecurity Application Platform
- etap Simulation Engine

Microgrid Operation

- EcoStruxure Power Operation / Power Automation System
- AVEVA PI Server
- EcoStruxure Building Operation
- EcoStruxure EV Charging Expert

Connected Products

MV Switchgears and Transformers



LV Switchgears



- EcoStruxure Panel Server
- EcoStruxure EV Charging Expert Controller
- EcoStruxure Microgrid Advisor Controller

DI **

- PowerLogic T300 RTU
- PowerLogic MiCOM C264 Bay Controller
- PowerLogic P5 (or P3) Protection Relays
- MiCOM P-Series Protection Relays
- PowerLogic ION9000/PM8000 Power quality meters
- EcoStruxure Power Automation System Gateway

4G Devices

- EcoStruxure Transformer Expert Intelligent Sensor

MV/LV Hardwired Devices**

- PowerLogic A125 Arc 121/VA1DA Arc flash Protection system
- Flow meter for heat, gas, water etc.

MV/LV Insulation Monitoring

- EcoStruxure Panel Server
- Vigilohm IM400/IFL12 Device
- Vigilohm IM400/IM20 Device

MV/LV Condition Monitoring

- MV/LV SMD Substation monitoring device
- EcoStruxure Panel Server
- PowerLogic TH110, CL110, HeatTag Environmental sensors
- PowerLogic PD100 Partial discharge sensor

- ASCO 7000 PTS Power transfer switch
- TransferPacT Automatic transfer switch
- MasterPact MTZ Circuit breaker
- ComPacT NSX/NSXm Circuit breaker
- PowerLogic PM8000 Power quality meter
- PowerLogic PM5000 Power meter

Wireless Devices

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- Acti9 Active Protection device
- EcoStruxure Panel Server

Serial Devices

- Acti9 iEM3000 Energy meter
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** Hardwired Devices can be integrated through Connected Products with general-purpose Digital Inputs, marked as "DI".

*** Charging Solution for connectivity with Schneider Electric Chargers.

Information about fast charging solutions architecture

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- PowerLogic PFC Power factor correction system

Backup Power

- Galaxy V Series Uninterruptible power supply
- Generator set

Motors

- Altivar Variable speed drive
- Motor

Microgrid

- EcoStruxure Microgrid Operation Controller
- PV inverter
- Battery energy Storage system
- Energy Control Center (US only)

EV Charging Infrastructure

- EVLink Pro DC Charger
- EVLink Pro AC Charger

Automation Controllers

DI **

- Modicon M580 Controller

Frequency Conversion

- Frequency Converter (Third Party)

Power Quality Monitoring, Correction and Compliance

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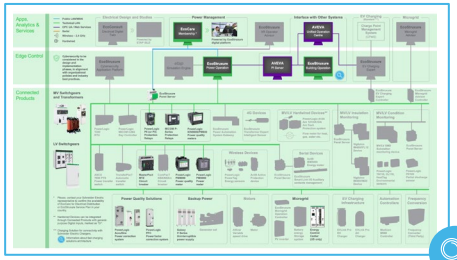
Help protect sensitive equipment from power quality issues

Primary Department

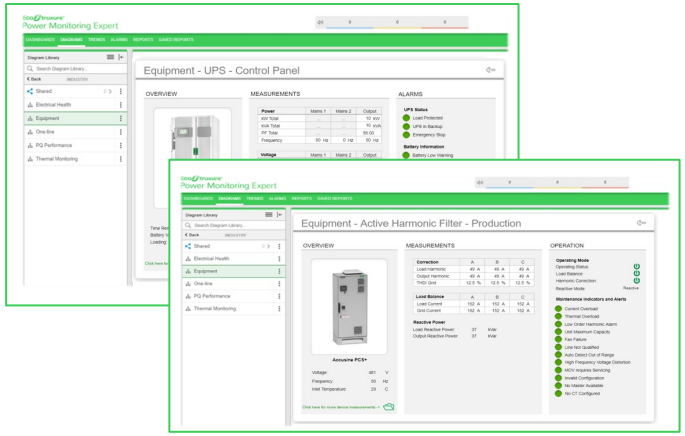
- Facility Management / Utilities Management
- Electrical Department

Benefits

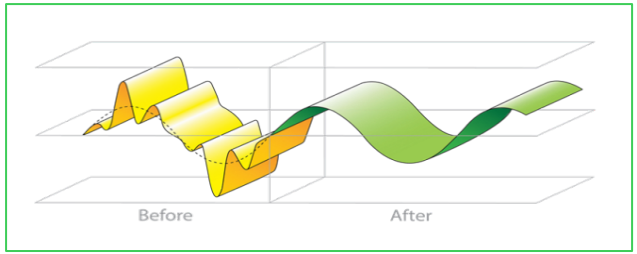
- Monitor sensitive process lines and busbars.
- Provide clean power to sensitive process equipment.
- Track power quality problems to help avoid downtime.
- Reduce financial impact of power factor on energy bill.



Power Quality Monitoring, Correction and Compliance Reference Architecture



Power Quality Information in EcoStruxure Power Operation



Before and After Power Quality and Power Factor Correction Implementation

Learn more about:

- Power Quality Monitoring & Compliance (IEC)
- Power Quality Correction (IEC)
- Power Factor Correction (IEC)

Power Quality Monitoring, Correction and Compliance Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin

Powered by ETAP iSLD

Power Management

EcoCare
Membership *



Powered by EcoStruxure digital platform

EcoStruxure
XR Operator Advisor

Interface with Other Systems

AVEVA
Unified Operation Centre

EV Charging (Standard ***)

Charge Point Management System (CPMS)

Microgrid

EcoStruxure
Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

EcoStruxure
Cybersecurity Application Platform

etap
Simulation Engine

EcoStruxure
Power Operation

AVEVA
PI Server

EcoStruxure
Building Operation

EcoStruxure
EV Charging Expert

Connected Products

MV Switchgears and Transformers



EcoStruxure
Panel Server

EcoStruxure EV Charging Expert Controller

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PowerLogic P5 (or P3) Protection Relays

MiCOM P-Series Protection Relays

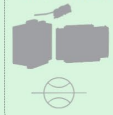
PowerLogic ION9000/PM8000 Power quality meters

EcoStruxure Power Automation System Gateway

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Serial Devices

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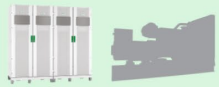
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PowerLogic PFC Power factor correction system

Backup Power



Galaxy V Series Uninterruptible power supply

Generator set

Motors



Altivar Variable speed drive

Motor

Microgrid

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Battery energy Storage system

Energy Control Center (US only)

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EVLink Pro AC Charger

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Arc Flash Protection

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- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

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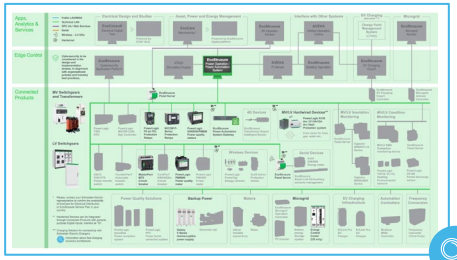
Help protect employees and equipment

Primary Department

- Facility Management / Utilities Management
- Electrical Department

Benefits

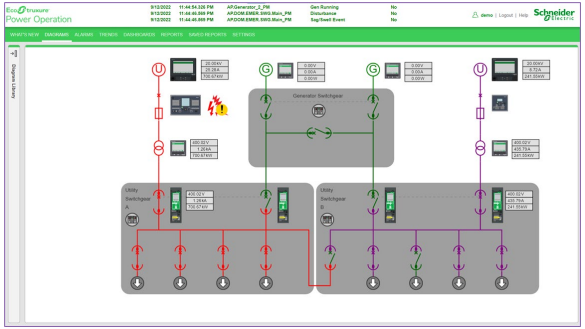
- Help prevent loss of life and reduce the risk of equipment and electrical room damage.
- Improve maintenance team awareness to help troubleshoot and identify the root cause of arc flash events.



Arc Flash Protection Reference Architecture



Arc Flash in a Switchboard



Arc Flash Alert and Location in EcoStruxure Power Operation

Learn more about:

- Arc Flash Protection (IEC)

Arc Flash Protection Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

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EcoConsult
Electrical Digital Twin

Powered by ETAP iSLD

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EcoCare
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Microgrid

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Continuous Thermal Monitoring

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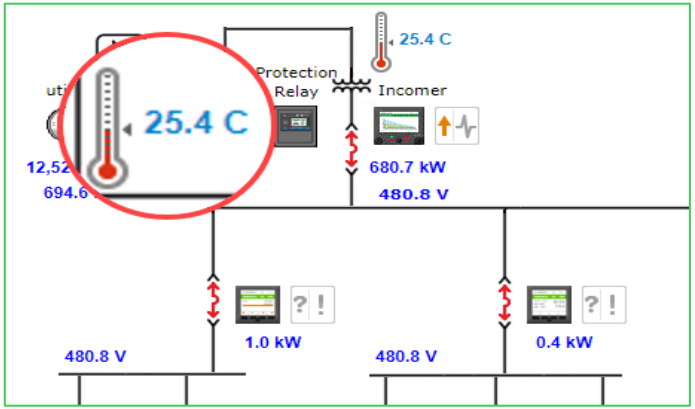
Help prevent electrical fires and help protect equipment

Primary Department

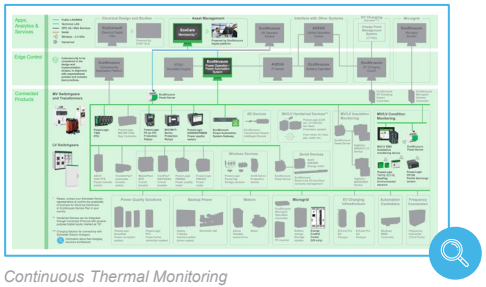
- Facility Management / Utilities Management
- Electrical Department

Benefits

- Bring early detection of temperature abnormalities.
- Help reduce the risk of equipment and electrical room damage and improve service continuity.
- Enable cost effective maintenance.



Continuous Thermal Monitoring in the Single-line Diagram of EcoStruxure Power Operation



Continuous Thermal Monitoring Reference Architecture

Learn more about:

- Continuous Thermal monitoring (IEC)

Continuous Thermal Monitoring Reference Architecture

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Hardwired

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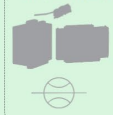
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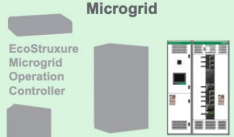
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EcoStruxure
Microgrid
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Controller

PV inverter

Battery
energy
Storage
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Energy
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EV Charging Infrastructure



EVLink Pro
DC
Charger

EVLink Pro
AC
Charger

Automation Controllers



Modicon
M580
Controller

Frequency Conversion



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Converter
(Third Party)

Circuit Breaker Settings Monitoring

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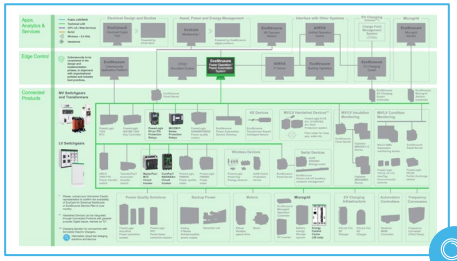
Help avoid unplanned downtime due to electrical failure

Primary Department

- Facility Management / Utilities Management
- Electrical Department

Benefits

- Help ensure the integrity of protection settings throughout the entire lifecycle from design to operations.
- Compare current circuit breaker settings with commissioned settings.
- Help detect inappropriate setting modifications periodically.
- Provide peace of mind due to complete breaker hierarchy oversight.



Circuit Breaker Settings Monitoring Reference Architecture

Circuit Breaker Settings Report

Trip Settings - Main LV Switchboard

Main LV

Breaker Name	Protection Type	Active Protection Settings	Long Time Pickup (A)	Long Time Delay (S)	Long Time I2t	Short Time Pickup (A)	Short Time Delay (S)	Short Time I2t	Instantaneous Pickup (A)	Date of Data Reading
HC_Critical.MAIN_Bkr	5.0 (LSI)	Group A	1,600	0.50	I2T On	6,400	0.10	I2T Off	48,000	7/26/2018 10:59:32 AM
HC_Equipment.MAIN_Bkr	5.0 (LSI)	Group B	1,600	0.50	I2T On	9,600	0.20	I2T On	48,000	7/26/2018 10:54:32 AM
HC_Essential.MAIN_Bkr	5.0 (LSI)	Group A	3,150	0.50	I2T On	12,600	0.10	I2T Off	94,500	7/26/2018 10:34:32 AM
HC_Life_Safety.MAIN_Bkr	5.0 (LSI)	Group A	800	0.50	I2T On	3,200	0.10	I2T Off	24,000	7/26/2018 10:34:32 AM
HC_Non_Essential.MAIN_Bkr	5.0 (LSI)	Group A	1,600	0.50	I2T On	6,400	0.10	I2T Off	48,000	7/26/2018 11:24:32 AM

Breaker Name	Ground Fault Pickup (A)	Ground Fault Delay (S)	Ground Fault I2t	Earth Leakage Pickup (A)	Earth Leakage Delay (S)	Date of Data Reading
HC_Critical.MAIN_Bkr	N/A	N/A	N/A	N/A	N/A	7/26/2018 10:59:32 AM
HC_Equipment.MAIN_Bkr	N/A	N/A	N/A	N/A	N/A	7/26/2018 10:54:32 AM
HC_Essential.MAIN_Bkr	N/A	N/A	N/A	N/A	N/A	7/26/2018 10:34:32 AM
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HC_Non_Essential.MAIN_Bkr	N/A	N/A	N/A	N/A	N/A	7/26/2018 11:24:32 AM

Configuration Settings of the Circuit Breakers - Highlights Changes Between the Baseline and the Last Known Values in EcoStruxure Power Operation

Learn more about:

- Circuit Breaker Settings Monitoring (IEC)

Circuit Breaker Settings Monitoring Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

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Capabilities to Improve Safety & Availability

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Capabilities to Decarbonize Port Infrastruct.

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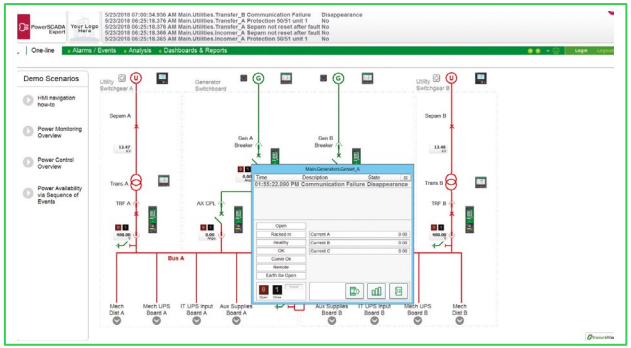
Maximize availability through smart control & load management

Primary Department

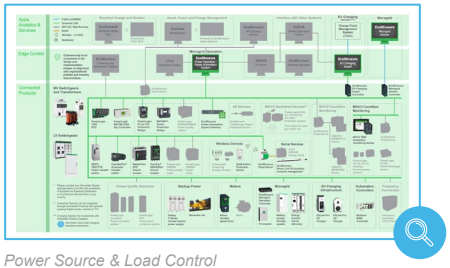
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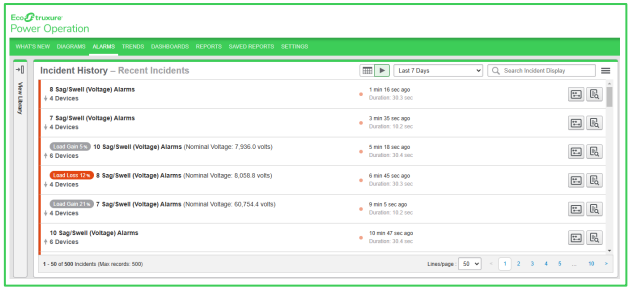
- Remotely control, visualize, and supervise automatic transfer schemes.
- Help preserve critical loads by automatically transferring to alternate power.
- Get real-time visibility, automation and control of the entire electrical infrastructure.
- Visualize and audit sequences of operations.



Animated Single-Line Diagram with Live Status of the Entire Electrical Distribution Network in EcoStruxure Power Operation



Power Source & Load Control Reference Architecture



High Speed and High Precision Sequence of Events in EcoStruxure Power Operation

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BIBLIOGRAPHY

Advanced Protection and Automation

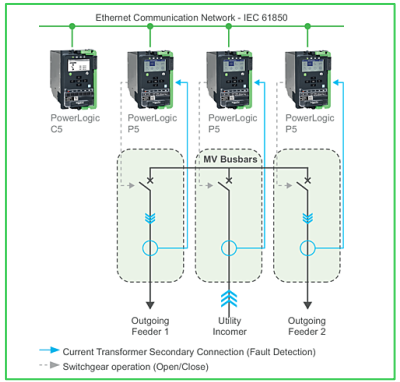
Enhance reliability of electrical networks using protection and fault tolerant automation schemes

Primary Department

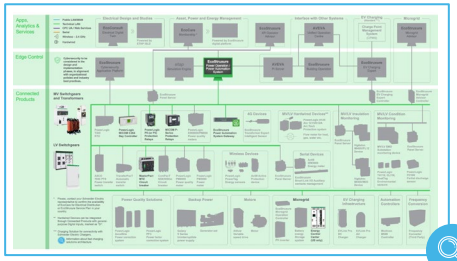
- Facility Management / Utilities Management
- Electrical Department

Benefits

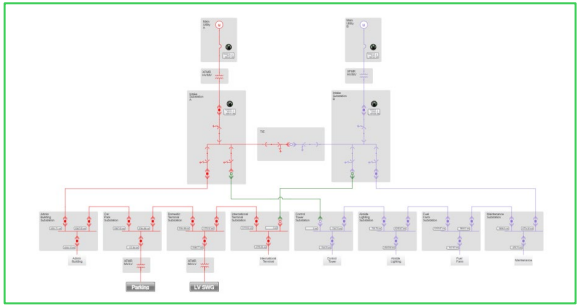
- Help protect electrical networks from faults like short-circuit, overload, etc.
- Support continuity of service in case of outages with an autonomous and fast response to events (such as self-healing, automatic transfer switch, and load-shedding).
- Assist in restoring power quickly and more safely using electrical diagnostic information and remote control of breakers.



Protection and Automation in MV Incomer Substation



Advanced Protection and Automation Reference Architecture



Animated Single-Line Diagram with Live Power Network Visualization in EcoStruxure Power Operation

Learn more about:

- Advanced Protection and Automation (IEC)

Advanced Protection and Automation Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin

Powered by ETAP iSLD

Asset, Power and Energy Management

EcoCare
Membership *

Powered by EcoStruxure digital platform

EcoStruxure
XR Operator Advisor

Interface with Other Systems

AVEVA
Unified Operation Centre

EV Charging (Standard ***)

Charge Point Management System (CPMS)

Microgrid

EcoStruxure
Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

EcoStruxure
Cybersecurity Application Platform

etap
Simulation Engine

EcoStruxure
Power Operation / Power Automation System

AVEVA
PI Server

EcoStruxure
Building Operation

EcoStruxure
EV Charging Expert

Connected Products

MV Switchgears and Transformers



EcoStruxure Panel Server

EcoStruxure EV Charging Expert Controller

EcoStruxure Microgrid Advisor Controller

PowerLogic T300 RTU

PowerLogic MiCOM C264 Bay Controller

PowerLogic P5 (or P3) Protection Relays

MiCOM P-Series Protection Relays

PowerLogic ION9000/PM8000 Power quality meters

EcoStruxure Power Automation System Gateway

4G Devices

EcoStruxure Transformer Expert Intelligent Sensor

MV/LV Hardwired Devices**

PowerLogic A125 Arc 121/VA1DA Arc flash Protection system

Flow meter for heat, gas, water etc.

MV/LV Insulation Monitoring

EcoStruxure Panel Server

Vigilohm IM400/IFL12 Device

Vigilohm IM400/IM20 Device

MV/LV Condition Monitoring

MV/LV SMD Substation monitoring device

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PowerLogic PD100 Partial discharge sensor

LV Switchgears



ASCO 7000 PTS Power transfer switch

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PowerLogic PM5000 Power meter

Wireless Devices

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Serial Devices

Acti9 iEM3000 Energy meter

EcoStruxure Smart Link I/O Auxiliary contacts management

Power Quality Solutions

PowerLogic AccuSine Power correction system

PowerLogic PFC Power factor correction system

Backup Power

Galaxy V Series Uninterruptible power supply

Generator set

Motors

Altivar Variable speed drive

Motor

Microgrid

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PV inverter

Battery energy Storage system

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EVLink Pro AC Charger

Automation Controllers

Modicon M580 Controller

Frequency Conversion

Frequency Converter (Third Party)

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Information about fast charging solutions architecture

Simulate Before Operate

SECTION 1 – Introduction to the Port Industry

SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

SECTION 3 – Digital Solutions & Services

- Introduction
- Overview of Digital Solutions & Services
- Capabilities to Build Faster Flexible Infrastruct.
- Capabilities to Improve Safety & Availability
- Capabilities to Operate Elec. Networks Efficient.
- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

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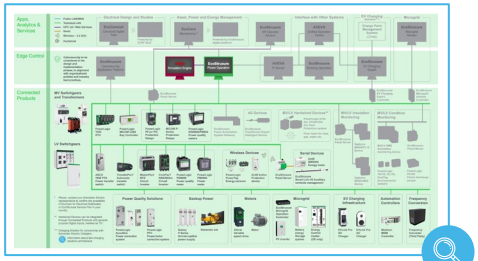
Empower operators with predictive outcomes

Primary Department

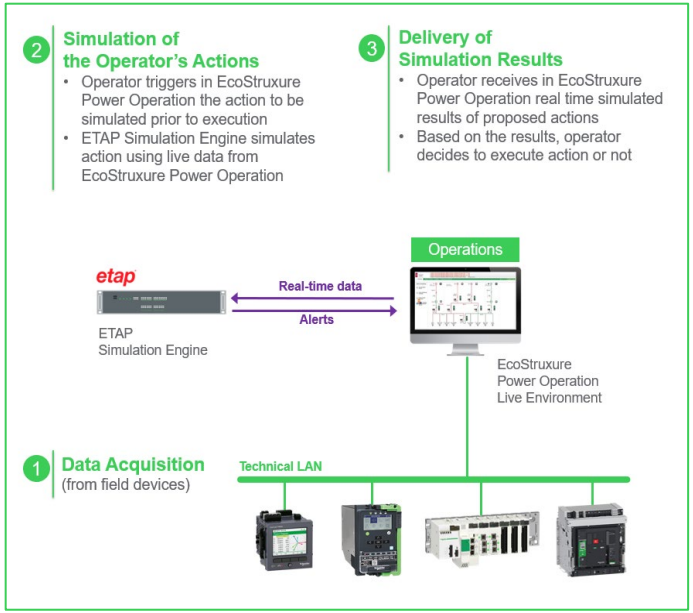
- Facility Management / Operations Team

Benefits

- Provide operators with a list of potential side effects, prior to executing a command.
- Empower employees to feel more confident when operating their facilities by providing real time guidance.
- Reduce human error that could lead to outages or safety concerns.



Simulate Before Operate Reference Architecture



Principle of Simulate before Operate Application

Learn more about:

- Simulate Before Operate (IEC

Simulate Before Operate Reference Architecture

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Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

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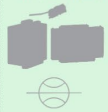
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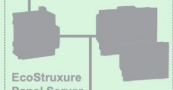
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Insulation Monitoring

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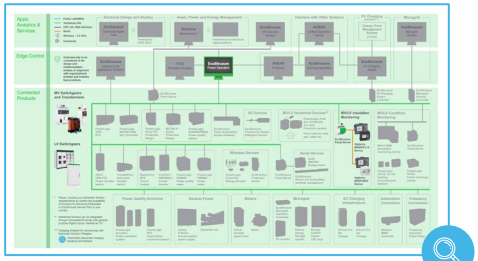
Help protect operating personnel and equipment across port terminals

Primary Department

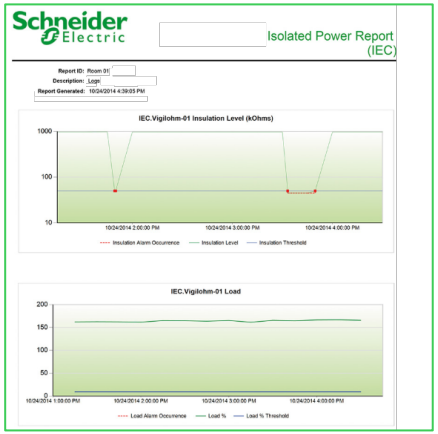
- Facility Management / Maintenance Team

Benefits

- Help reduce the risk of equipment damage & optimize protection against electrical faults during lifting loads & controlling gantry cranes.
- Insulation Monitoring Device activates an alarm in case the Total Hazard Current exceeds 5 mA.
- Fault Location Device pinpoints the location of the insulation fault (feeder /sockets) for quick troubleshooting.



Insulation Monitoring Reference Architecture



Timestamp	Cause	Cause Value	Effect	Effect Value	Priority
10/24/2014 3:49:39 PM	Insulation Status Alarm	Insulation Status Alarm Inactive	Insulation Status Alarm	Insulation Status Alarm	200
10/24/2014 3:33:11 PM	Resistance kohms	Resistance Register Active	Insulation Status Alarm	Resistance reached 45	200
10/24/2014 1:50:01 PM	Insulation Status Alarm	Insulation Status Alarm Inactive	Insulation Status Alarm	Insulation Status Alarm	200
10/24/2014 1:49:24 PM	Resistance kohms	Resistance Register Active	Insulation Status Alarm	Resistance reached 49	200

Isolated Power Report with measurements for impedance, load, and temperature in the selected date range.

Learn more about:

- Insulation Monitoring (IEC)

Insulation Monitoring Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

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- Capabilities to Improve Safety & Availability
- Capabilities to Operate Elec. Networks Efficient. ▶
- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

BIBLIOGRAPHY

Capabilities to Operate Electrical Networks Efficiently

Design, Build, Modernize & Commission
(Consultants & EPC)

Build Faster & Flexible Infrastructure

- Network Load Flow and Voltage Drop Simulation
- Electrical Network Short Circuit and Selectivity Simulation
- Arc Fault Protection and Coordination
- Device Coordination and Selectivity
- AC&DC Electrical Network Bus Design and Simulation
- Power Quality Simulation & Modelling
- Power System Study
- Renewable & Microgrid Energy Storage Sizing Simulation

Operate & Maintain
(Operators, maintenance team, service teams)

Improve Safety & Availability

- Electrical Distribution Monitoring, Alarming and Event Analysis
- Power Quality Monitoring, Correction and Compliance
- Arc Flash Protection
- Continuous Thermal Monitoring
- Circuit Breaker Settings Monitoring
- Power Source and Load Control
- Advanced Protection and Automation
- Simulate Before Operate
- Insulation Monitoring

Operate Electrical Networks Efficiently

- Asset Performance
- Capacity Management
- Backup Power Testing
- Predictive Simulation
- Guided Procedures Through Extended Reality
- Operator Training Simulation

Decarbonize Port Infrastructure

- Net Zero Consulting Services
- Utility Bill Verification
- Cost Allocation and Tenant Billing
- Energy Monitoring and Usage Analysis
- Energy Efficiency Compliance
- Microgrid
- EV Charging (Standard)
- EV Fast Charging

Transverse Lifecycle Capabilities

- Electrical Digital Twin - iSLD
- Interface with Other Systems (BMS, Unified Operations Center, Other)
- Cybersecurity

Schneider Electric

Asset Performance

SECTION 1 – Introduction to the Port Industry

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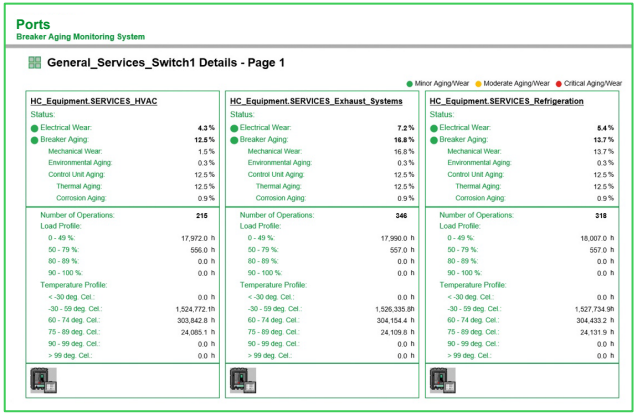
Benefit from a strategic maintenance approach

Primary Department

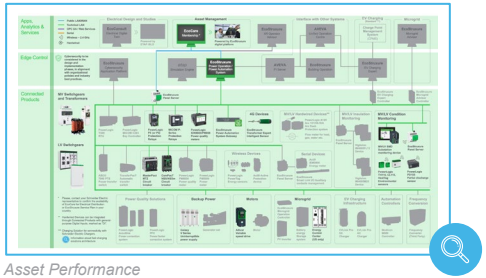
- Facility Management / Utilities Management
- Maintenance/Electrical/Operations Team

Benefits

- Move from reactive or preventive to condition-based (predictive) maintenance strategies for critical assets like circuit breakers, gensets, transformers, etc.
- Provide event details and notification to the operator if a protection setting has been changed.
- Receive notifications and diagnostics reports from expert service engineers with recommendations to optimize maintenance by asset.



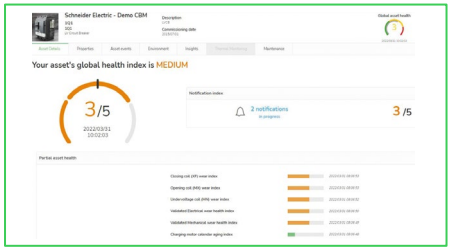
Aging Diagram for Circuit Breakers in EcoStruxure Power Operation



Asset Performance Reference Architecture



EcoStruxure Asset Advisor Risk Level Dashboard



EcoStruxure Asset Advisor Asset Health Dashboard

Learn more about:

- Asset Performance (IEC)

Asset Performance Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
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OPC UA / Web Services
Serial
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Hardwired

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Capacity Management

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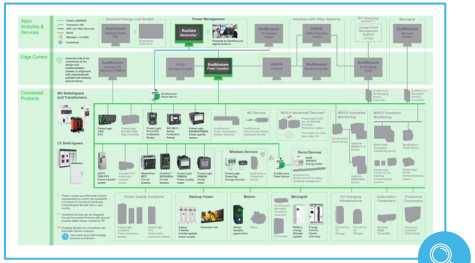
Monitor the capacity of electrical distribution

Primary Department

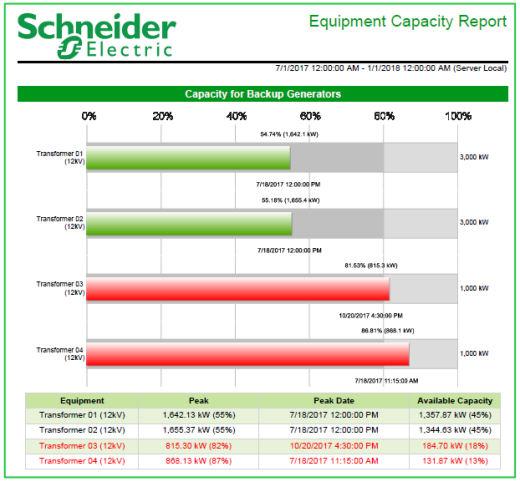
- Facility Management / Utilities Management
- Electrical Department

Benefits

- Monitor electrical network capacity.
- Track and review capacity efficiency.
- Minimize downtime by tracking the capacity of transformers, circuit breakers, UPSs, generators, etc.



Capacity Management Reference Architecture



Breaker Capacity Single-line Diagram in EcoStruxure Power Operation

Learn more about:

- Capacity Management (IEC)

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TransferPacT
Automatic
transfer
switch

MasterPact
MTZ
Circuit
breaker

ComPacT
NSX/NSXm
Circuit
breaker

PowerLogic
PM8000
Power quality
meter

PowerLogic
PM5000
Power
meter

Wireless Devices

PowerLogic
PowerTag
Energy sensors

Acti9 Active
Protection
device

EcoStruxure
Panel Server

Serial Devices

Acti9
iEM3000
Energy meter

EcoStruxure
Smart Link I/O Auxiliary
contacts management

* Please, contact your Schneider Electric representative to confirm the availability of EcoCare for Electrical Distribution or EcoStruxure Service Plan in your country.

** Hardwired Devices can be integrated through Connected Products with general-purpose Digital Inputs, marked as "DI".

*** Charging Solution for connectivity with Schneider Electric Chargers.

Information about fast charging solutions architecture

Power Quality Solutions



PowerLogic
AccuSine
Power correction
system

PowerLogic
PFC
Power factor
correction system

Backup Power



Galaxy
V Series
Uninterruptible
power supply

Generator set

Motors



Altivar
Variable
speed drive

Motor

Microgrid

EcoStruxure
Microgrid
Operation
Controller



PV inverter

Battery
energy
Storage
system

Energy
Control
Center
(US only)

EV Charging Infrastructure



EVLink Pro
DC
Charger

EVLink Pro
AC
Charger

Automation Controllers



Modicon
M580
Controller

Frequency Conversion



Frequency
Converter
(Third Party)

Backup Power Testing

SECTION 1 – Introduction to the Port Industry

SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

SECTION 3 – Digital Solutions & Services

- Introduction
- Overview of Digital Solutions & Services
- Capabilities to Build Faster Flexible Infrastruct.
- Capabilities to Improve Safety & Availability
- Capabilities to Operate Elec. Networks Efficient. ▶
- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

BIBLIOGRAPHY

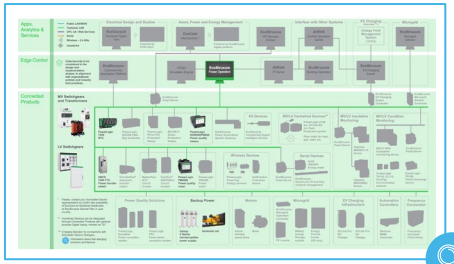
Enhance reliable backup power for critical port operations

Primary Department

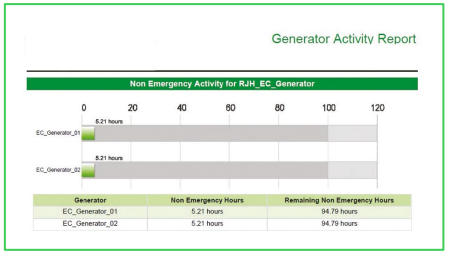
- Facility Management / Utilities Management
- Maintenance Department

Benefits

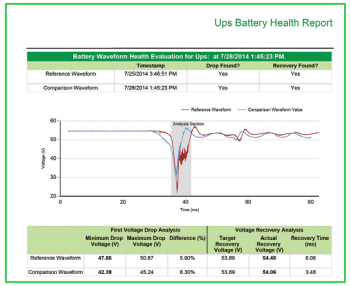
- Record key test parameters related to generator reliability like run time, exhaust temperature etc.
- Capture generator battery and UPS electrical signature helping to identify degradation over time.
- Mitigate human error and save time by automating testing and reporting.



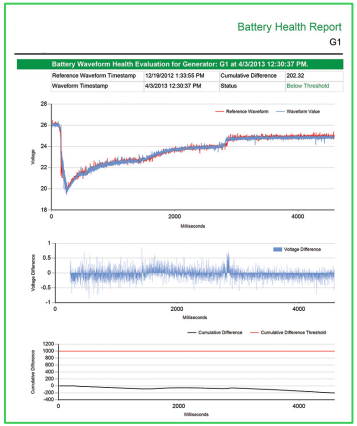
Backup Power Testing Reference Architecture



Generator Activity Report in EcoStruxure Power Operation



UPS Battery Health Report in EcoStruxure Power Operation



Generator Battery Health Report in EcoStruxure Power Operation

Learn more about:

- Backup Power Testing (IEC)

Backup Power Testing Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin

Powered by ETAP iSLD

Asset, Power and Energy Management

EcoCare
Membership *

Powered by EcoStruxure digital platform

EcoStruxure
XR Operator Advisor

Interface with Other Systems

AVEVA
Unified Operation Centre

EV Charging (Standard ***)

Charge Point Management System (CPMS)

Microgrid

EcoStruxure
Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

EcoStruxure
Cybersecurity Application Platform

etap
Simulation Engine

EcoStruxure
Power Operation

AVEVA
PI Server

EcoStruxure
Building Operation

EcoStruxure
EV Charging Expert

Connected Products

MV Switchgears and Transformers



LV Switchgears



EcoStruxure Panel Server

EcoStruxure EV Charging Expert Controller

EcoStruxure Microgrid Advisor Controller

PowerLogic T300 RTU

PowerLogic MiCOM C264 Bay Controller

PowerLogic P5 (or P3) Protection Relays

MiCOM P-Series Protection Relays

PowerLogic ION9000/PM8000 Power quality meters

EcoStruxure Power Automation System Gateway

4G Devices

EcoStruxure Transformer Expert Intelligent Sensor

MV/LV Hardwired Devices**

PowerLogic A125 Arc 121/VA1DA Arc flash Protection system

Flow meter for heat, gas, water etc.

MV/LV Insulation Monitoring

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Vigilohm IM400/IFL12 Device

Vigilohm IM400/IM20 Device

MV/LV Condition Monitoring

MV/LV SMD Substation monitoring device

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PowerLogic PD100 Partial discharge sensor

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TransferPacT Automatic transfer switch

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Generator set

Motors

Altivar Variable speed drive

Motor

Microgrid

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PV inverter

Battery energy Storage system

Energy Control Center (US only)

EV Charging Infrastructure

EVLink Pro DC Charger

EVLink Pro AC Charger

Automation Controllers

Modicon M580 Controller

Frequency Conversion

Frequency Converter (Third Party)

Predictive Simulation

SECTION 1 – Introduction to the Port Industry

SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

SECTION 3 – Digital Solutions & Services

Introduction

Overview of Digital Solutions & Services

Capabilities to Build Faster Flexible Infrastruct.

Capabilities to Improve Safety & Availability

Capabilities to Operate Elec. Networks Efficient. ▶

Capabilities to Decarbonize Port Infrastruct.

Transverse Lifecycle Capabilities

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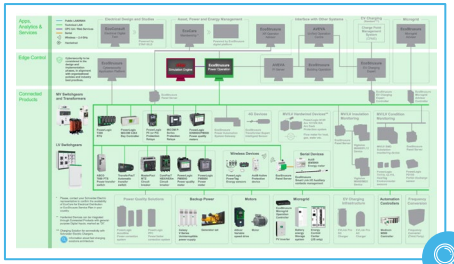
Help employees make better decisions

Primary Department

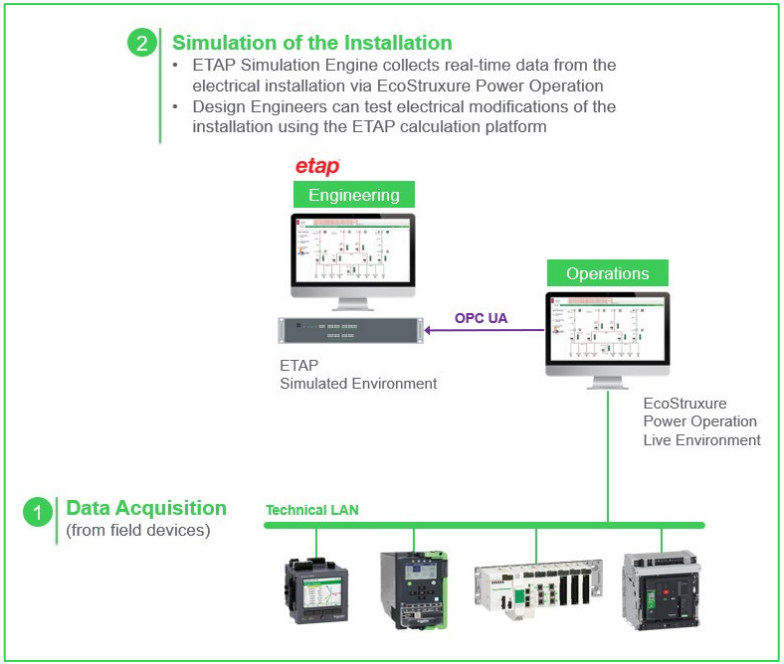
- Facility Management / Operations Team
- Electrical Department

Benefits

- Reduce safety risks by practicing emergencies and high-risk situations.
- Enhance operational efficiency by running “what-if” scenarios.
- Provide faster analysis response to incidents.



Predictive Simulation Reference Architecture



Principle of Predictive Simulation Application

Predictive Simulation Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin

Powered by ETAP iSLD

Asset, Power and Energy Management

EcoCare
Membership *

Powered by EcoStruxure digital platform

EcoStruxure
XR Operator Advisor

Interface with Other Systems

AVEVA
Unified Operation Centre

EV Charging (Standard ***)

Charge Point Management System (CPMS)

Microgrid

EcoStruxure
Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

EcoStruxure
Cybersecurity Application Platform

etap
Simulation Engine

EcoStruxure
Power Operation

AVEVA
PI Server

EcoStruxure
Building Operation

EcoStruxure
EV Charging Expert

Connected Products

MV Switchgears and Transformers



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EcoStruxure Microgrid Advisor Controller

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PowerLogic MiCOM C264 Bay Controller

PowerLogic P5 (or P3) Protection Relays

MiCOM P-Series Protection Relays

PowerLogic ION9000/PM8000 Power quality meters

EcoStruxure Power Automation System Gateway

4G Devices

EcoStruxure Transformer Expert Intelligent Sensor

MV/LV Hardwired Devices**

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EV Charging Infrastructure

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EVLink Pro AC Charger

Automation Controllers

Modicon M580 Controller

Frequency Conversion

Frequency Converter (Third Party)

Guided Procedures Through Extended Reality

SECTION 1 – Introduction to the Port Industry

SECTION 2 – How EcoStruxure Power Can Support the Port Infrastructure

SECTION 3 – Digital Solutions & Services

- Introduction
- Overview of Digital Solutions & Services
- Capabilities to Build Faster Flexible Infrastruct.
- Capabilities to Improve Safety & Availability
- Capabilities to Operate Elec. Networks Efficient. ▶
- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

BIBLIOGRAPHY

Reduce the risk of human error when working on electrical equipment

Primary Department

- Facility Management / Utilities Management
- Maintenance Team

Benefits

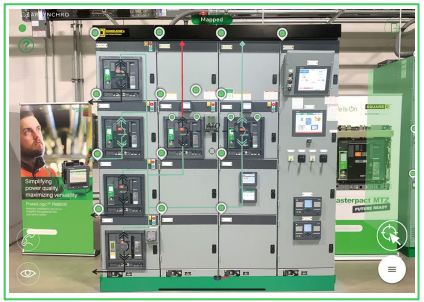
- Help analyze the status and data of equipment.
- Provide guidance to perform complicated or unfamiliar procedure.
- Enable remote collaboration with experts in other locations.
- Leverage “X-ray” vision and virtually overlay contextual asset and site information, live data, events and alarms.



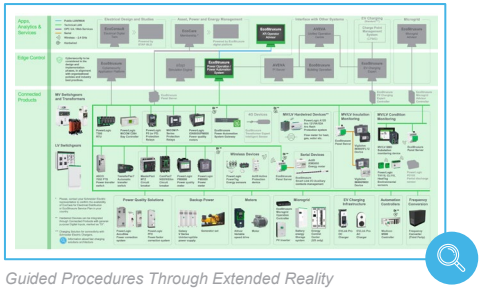
Overlaid Live Data



"X-Ray" Vision



Contextual Asset or Site Information Overlaid on Top of Equipment



Guided Procedures Through Extended Reality Reference Architecture

Learn more about:

- Guided Procedure Through Extended Reality (IEC)

Guided Procedures Through Extended Reality Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin

Powered by ETAP iSLD

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XR Operator Advisor

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Microgrid

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Edge Control

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Cybersecurity Application Platform

etap
Simulation Engine

EcoStruxure
Power Operation / Power Automation System

AVEVA
PI Server

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Building Operation

EcoStruxure
EV Charging Expert

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LV Switchgears



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MiCOM P-Series Protection Relays

PowerLogic ION9000/PM8000 Power quality meters

DI **

EcoStruxure Power Automation System Gateway

4G Devices

EcoStruxure Transformer Expert Intelligent Sensor

DI **

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Battery energy Storage system

Energy Control Center (US only)

EV Charging Infrastructure

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EVLink Pro AC Charger

Automation Controllers

DI **

Modicon M580 Controller

Frequency Conversion

Frequency Converter (Third Party)

Operator Training Simulation

SECTION 1 – Introduction to the Port Industry

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- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

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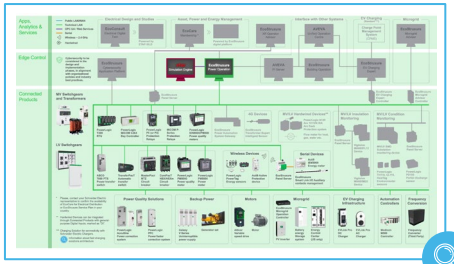
Train new employees and build confidence on new systems

Primary Department

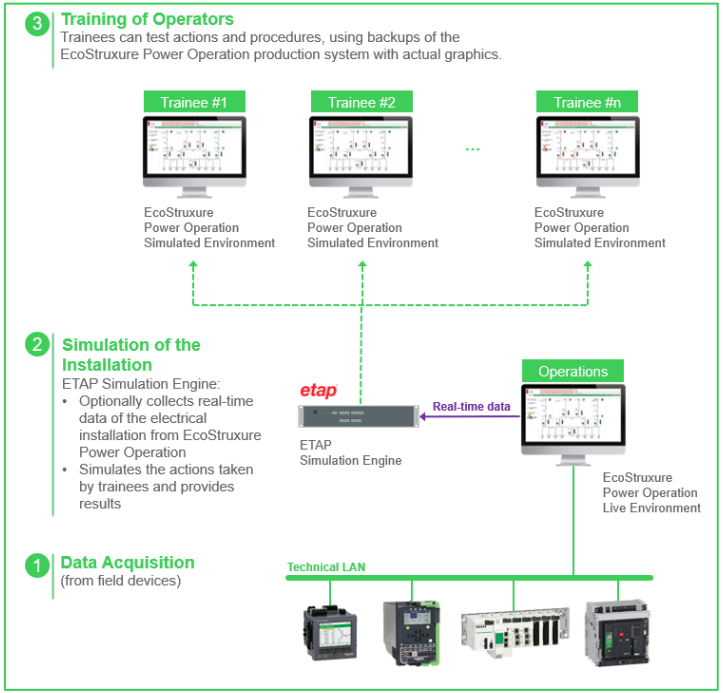
- Facility Management / Utilities Management

Benefits

- Practice operation within a simulated but highly realistic environment to enhance safety and operational efficiency.
- Track and review trainee actions to analyze and challenge them.



Operator Training Simulation Reference Architecture



Principle of Operator Training Simulation Application

Learn more about:

- Operator Training Simulation (IEC)

Operator Training Simulation Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

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EcoStruxure
Power Operation

AVEVA
PI Server

EcoStruxure
Building Operation

EcoStruxure
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Capabilities to Operate Elec. Networks Efficient.

Capabilities to Decarbonize Port Infrastruct. ▶

Transverse Lifecycle Capabilities

BIBLIOGRAPHY

Capabilities to Decarbonize Port Infrastructure

Design, Build, Modernize & Commission
(Consultants & EPC)

Build Faster & Flexible Infrastructure

- Network Load Flow and Voltage Drop Simulation
- Electrical Network Short Circuit and Selectivity Simulation
- Arc Fault Protection and Coordination
- Device Coordination and Selectivity
- AC&DC Electrical Network Bus Design and Simulation
- Power Quality Simulation & Modelling
- Power System Study
- Renewable & Microgrid Energy Storage Sizing Simulation

Operate & Maintain
(Operators, maintenance team, service teams)

Improve Safety & Availability

- Electrical Distribution Monitoring, Alarming and Event Analysis
- Power Quality Monitoring, Correction and Compliance
- Arc Flash Protection
- Continuous Thermal Monitoring
- Circuit Breaker Settings Monitoring
- Power Source and Load Control
- Advanced Protection and Automation
- Simulate Before Operate
- Insulation Monitoring

Operate Electrical Networks Efficiently

- Asset Performance
- Capacity Management
- Backup Power Testing
- Predictive Simulation
- Guided Procedures Through Extended Reality
- Operator Training Simulation

Decarbonize Port Infrastructure

- Net Zero Consulting Services
- Utility Bill Verification
- Cost Allocation and Tenant Billing
- Energy Monitoring and Usage Analysis
- Energy Efficiency Compliance
- Microgrid
- EV Charging (Standard)
- EV Fast Charging

Transverse Lifecycle Capabilities

- Electrical Digital Twin - iSLD
- Interface with Other Systems (BMS, Unified Operations Center, Other)
- Cybersecurity

Schneider Electric

Net Zero Consulting Services

EcoStruxure + Services

SECTION 1 – Introduction to the Port Industry

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- Capabilities to Improve Safety & Availability
- Capabilities to Operate Elec. Networks Efficient.
- Capabilities to Decarbonize Port Infrastruct.
- Transverse Lifecycle Capabilities

BIBLIOGRAPHY

Track and reduce carbon emissions to demonstrate the carbon neutrality of the company

Primary Department

- Facility Management / Utilities Management
- Sustainability Office

Benefits

- Leverage our consulting services to define a Net Zero strategy.
- Implement the strategy using Schneider Electric Solutions to move towards Net Zero.

Define a Plan with Sustainability Schneider Consultants

Scope 1 & 2	Scope 3
Focus • Port purchased electricity for operations. • Port-owned fleet vehicles, buildings and stationary sources. ***Actions identified*** • Reduce electricity usage. • Reduce/eliminate GHG fuel use. • Source more sustainable energy.	***Focus*** Ships, trucks, cargo handling equipment, rail, harbour craft, port employee vehicles, tenant warehouses. ***Actions identified*** • Reduce third-party emissions. • Support tenants to move towards more sustainable energy.

Execute with Schneider Electric Solutions – Key Actions to Lead

ELECTRIFY Operations	REDUCE Energy Use	REPLACE Energy Source	ENGAGE Value Chain
• Onshore power supply • Truck and fleet electrification	• Energy usage monitoring and analysis • Energy efficiency of terminal and other buildings	• Microgrid • Battery storage	• Circularity • Engage your ecosystem of tenants on decarbonization

Schneider Electric

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Transverse Lifecycle Capabilities

BIBLIOGRAPHY

Utility Bill Verification

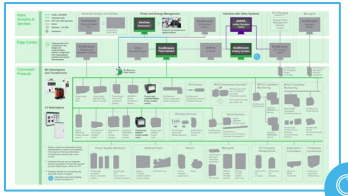
Identify billing errors in your utility bills

Primary Department

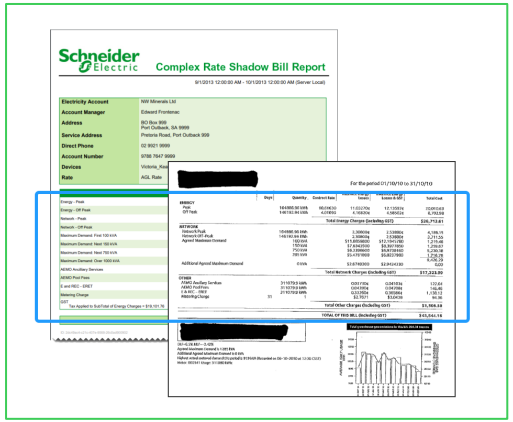
- Finance / Accounting Department
- Sustainability Office

Benefits

- Automatically generate a shadow bill of site energy consumption.
  - Take measurement at the same location, same frequency and accuracy as the utility meter.
- Help identify billing errors.
  - Provide evidence to illustrate errors to the utility for cost savings.
- Identify opportunities to reduce consumption
  - Analyze over the course of billing periods.
  - Gain insights of billing “levers” to change behavior (peak shaving, demand response, etc.).



Utility Bill Verification Reference Architecture



Shadow Billing in EcoStruxure Power Operation

Learn more about:

- Utility Bill Verification (IEC)

Utility Bill Verification Reference Architecture

Apps, Analytics & Services

- Public LAN/WAN
- Technical LAN
- OPC UA / Web Services
- Serial
- Wireless – 2.4 GHz
- Hardwired

Electrical Design and Studies

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AVEVA
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EV Charging (Standard ***)

Charge Point Management System (CPMS)

Microgrid

EcoStruxure
Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

EcoStruxure
Cybersecurity Application Platform

etap
Simulation Engine

EcoStruxure
Power Operation

AVEVA
PI Server

EcoStruxure
Building Operation

EcoStruxure
EV Charging Expert

Connected Products

MV Switchgears and Transformers



EcoStruxure
Panel Server

EcoStruxure
EV Charging Expert Controller

EcoStruxure
Microgrid Advisor Controller

PowerLogic T300 RTU

PowerLogic MiCOM C264 Bay Controller

PowerLogic P5 (or P3) Protection Relays

MiCOM P-Series Protection Relays

PowerLogic ION9000/PM8000 Power quality meters

EcoStruxure Power Automation System Gateway

4G Devices

EcoStruxure Transformer Expert Intelligent Sensor

MV/LV Hardwired Devices**

PowerLogic A125 Arc 121/VA1DA Arc flash Protection system

Flow meter for heat, gas, water etc.

MV/LV Insulation Monitoring

EcoStruxure Panel Server

Vigilohm IM400/IFL12 Device

Vigilohm IM400/IM20 Device

MV/LV Condition Monitoring

MV/LV SMD Substation monitoring device

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PowerLogic TH110, CL110, HeatTag Environmental sensors

PowerLogic PD100 Partial discharge sensor

LV Switchgears



ASCO 7000 PTS Power transfer switch

TransferPacT Automatic transfer switch

MasterPact MTZ Circuit breaker

ComPacT NSX/NSXm Circuit breaker

PowerLogic PM8000 Power quality meter

PowerLogic PM5000 Power meter

Wireless Devices

PowerLogic PowerTag Energy sensors

Acti9 Active Protection device

EcoStruxure Panel Server

Serial Devices

Acti9 iEM3000 Energy meter

EcoStruxure Smart Link I/O Auxiliary contacts management

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Information about fast charging solutions architecture

Power Quality Solutions

PowerLogic AccuSine Power correction system

PowerLogic PFC Power factor correction system

Backup Power

Galaxy V Series Uninterruptible power supply

Generator set

Motors

Altivar Variable speed drive

Motor

Microgrid

EcoStruxure Microgrid Operation Controller

PV inverter

Battery energy Storage system

Energy Control Center (US only)

EV Charging Infrastructure

EVLink Pro DC Charger

EVLink Pro AC Charger

Automation Controllers

Modicon M580 Controller

Frequency Conversion

Frequency Converter (Third Party)

SECTION 1 – Introduction to the Port Industry

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Introduction

Overview of Digital Solutions & Services

Capabilities to Build Faster Flexible Infrastruct.

Capabilities to Improve Safety & Availability

Capabilities to Operate Elec. Networks Efficient.

Capabilities to Decarbonize Port Infrastruct.

Transverse Lifecycle Capabilities

BIBLIOGRAPHY

Cost Allocation and Tenant Billing

Identify energy savings by allocating costs across departments and tenants

Primary Department

- Finance / Accounting Department
- Sustainability Office

Benefits

- Gain insight into which departments, processes, buildings, or floors are contributing to energy costs.
- Improve energy accountability by allocating costs to departments and tenants.
- Generate tenant energy billing for various tenants across the port (e.g., restaurants).

Schneider Electric

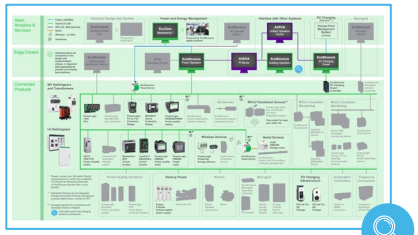
Multiple Billing Report

Date of Meter Reading: 2/1/2017 12:00:00 AM - 3/1/2017 12:00:00 AM (Server Local)

Areas	Book Store
Rate	ShoppingStd Rate

	Number of Units	Unit Cost	Cost ($)
Energy Consumption Charge Victoria_Bertram.main (17 %): 3,846.09 kWh	3,846.09 kWh	$0.05762	221.61
Peak Demand Charge [Book Store Peak @ 2/15/2017 3:00 PM] Victoria_Bertram.main (17 %): 13.16 kW	13.16 kW	$6.89	90.65
Processing Fee			20.00
		Total ($)	**332.26**

Billing Report generated for a tenant in EcoStruxure Power Operation



Cost Allocation and Tenant Billing Reference Architecture

Learn more about:

- Cost Allocation (IEC)

Cost Allocation and Tenant Billing Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin

Powered by ETAP iSLD

Power and Energy Management

EcoCare
Membership *



Powered by EcoStruxure digital platform

EcoStruxure
XR Operator Advisor

Interface with Other Systems

AVEVA
Unified Operation Centre

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Energy Monitoring and Usage Analysis

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- Capabilities to Improve Safety & Availability
- Capabilities to Operate Elec. Networks Efficient.
- Capabilities to Decarbonize Port Infrastruct. ▶
- Transverse Lifecycle Capabilities

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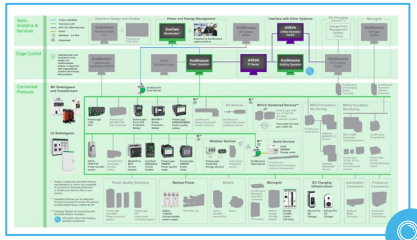
Determine where to focus energy conservation initiatives

Primary Department

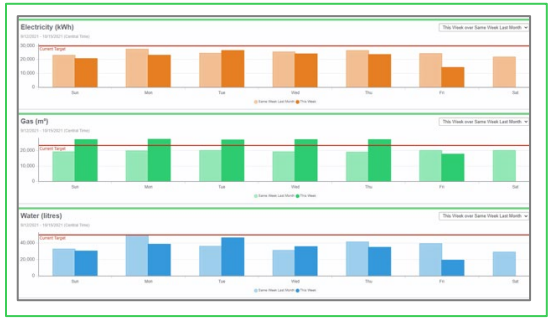
- Sustainability Office

Benefits

- Bring awareness to utility consumption.
  - Turn data into easy-to-interpret graphical dashboards and reports to raise awareness amongst key stakeholders.
- Identify “quick-win” opportunities for energy savings:
  - By comparing and visualizing energy usage and cost for different utilities over different time periods;
  - By identifying and prioritizing which areas lend themselves to a high energy-saving return on investment.



Energy Monitoring and Usage Analysis Reference Architecture





Energy Usage Analysis Dashboards in EcoStruxure Power Operation

Learn more about:

- Energy Monitoring (IEC)

Energy Monitoring and Usage Analysis Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

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Information about fast charging solutions architecture

Energy Efficiency Compliance

SECTION 1 – Introduction to the Port Industry

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Capabilities to Decarbonize Port Infrastruct.

Transverse Lifecycle Capabilities

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Comply with standards related to energy management systems

Primary Department

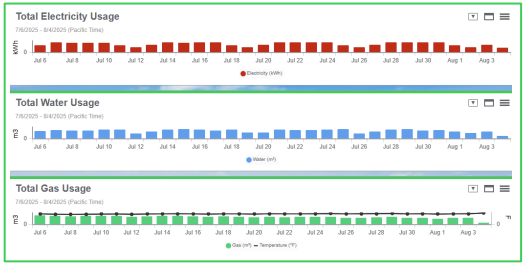
- Sustainability Office

Benefits

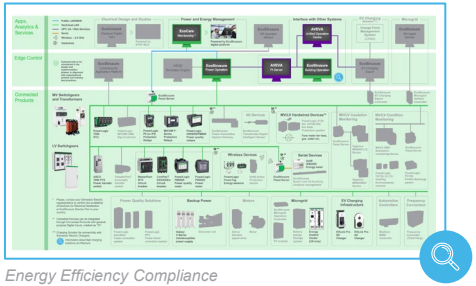
- Report and show facility compliance to local sustainability requirements:
  - To support compliance efforts across ports with key focus in cruise terminals and administrative buildings;
  - To benefit from tax credits;
  - To gain credibility to participate in new projects.



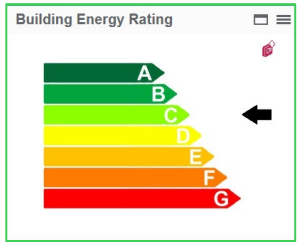
Sustainable Organizations and Standards



EcoStruxure Power Operation
"Energy - All utilities" Dashboard



Energy Efficiency Compliance
Reference Architecture



EcoStruxure Power Operation
Energy Star Compliance Dashboard

Learn more about:

- Energy Efficiency Compliance (IEC)

Energy Efficiency Compliance Reference Architecture

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Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
Wireless – 2.4 GHz
Hardwired

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EcoStruxure
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PowerLogic
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RTU

PowerLogic
MiCOM C264
Bay Controller

PowerLogic
P5 (or P3)
Protection
Relays

MiCOM P-
Series
Protection
Relays

PowerLogic
ION9000/PM8000
Power quality
meters

DI **

EcoStruxure
Power Automation
System Gateway

4G Devices

EcoStruxure
Transformer Expert
Intelligent Sensor

DI **

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MV/LV Insulation Monitoring

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IM400/IFL12
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PowerLogic
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TransferPacT
Automatic
transfer
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MasterPact
MTZ
Circuit
breaker

ComPacT
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Circuit
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PowerLogic
PM8000
Power quality
meter

PowerLogic
PM5000
Power
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DI **

Wireless Devices

PowerLogic
PowerTag
Energy sensors

Acti9 Active
Protection
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DI **

EcoStruxure
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Serial Devices

Acti9
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EcoStruxure
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Altivar
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Microgrid

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Microgrid
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PV inverter

Battery
energy
Storage
system

Energy
Control
Center
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AC
Charger

Automation Controllers

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- Transverse Lifecycle Capabilities

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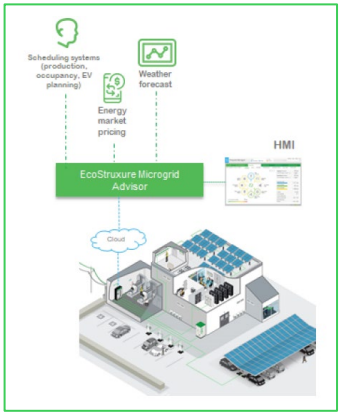
Reduce carbon footprint by leveraging Distributed Energy Resources (DER)

Primary Department

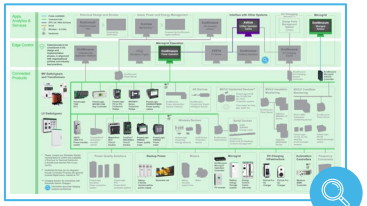
- Project Procurement / Delivery
- Design Firms
- Facility Management / Utilities Management

Benefits

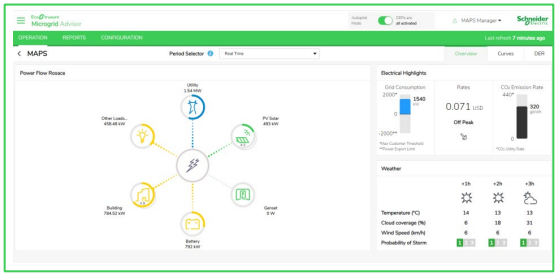
- Enhance power system reliability, despite grid instability often resulting from powerful storms and grid unavailability.
- Build renewable energy models combined with full spectrum power system analysis calculations for:
  - Accurate simulation;
  - Predictive analysis;
  - Equipment sizing;
  - Field verification of wind, solar farms and other DERs.



Principle of Microgrid Simulation



Advanced Microgrid Reference Architecture



Microgrid Management in EcoStruxure Microgrid Advisor

Learn more about:
- Microgrid (IEC)

Microgrid Reference Architecture

Apps, Analytics & Services

- Public LAN/WAN
- Technical LAN
- OPC UA / Web Services
- Serial
- Wireless – 2.4 GHz
- Hardwired

Electrical Design and Studies

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Asset, Power and Energy Management

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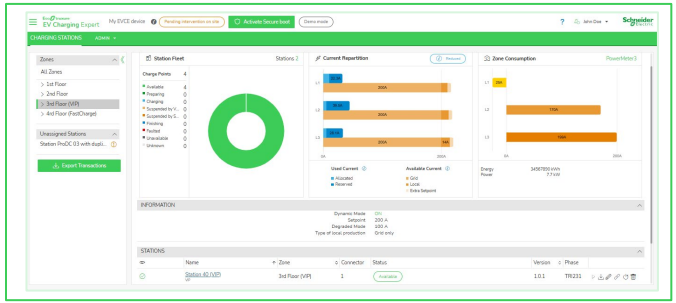
Manage smart loads, monitor and control remotely passenger vehicles

Primary Department

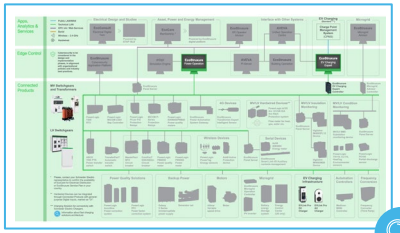
- Facility / Utilities Management
- Sustainability Office

Benefits

- Integrate seamlessly with Schneider Electric branded chargers.
- Optimize energy allocation to EV infrastructure in real time, based on energy demand (EV + other loads) and defined system settings.
- Manage peak and off-peak hours for charging electric vehicles, using Dynamic Load Management.
- Get notified when an incident occurs to reduce downtime.



Charging Station details in EcoStruxure EV Charging Expert.



EV Charging (Standard) Reference Architecture

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Public LAN/WAN
Technical LAN
OPC UA / Web Services
Serial
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- EcoStruxure Microgrid Advisor Controller

LV Switchgears



- PowerLogic T300 RTU
- PowerLogic MiCOM C264 Bay Controller
- PowerLogic P5 (or P3) Protection Relays
- MiCOM P-Series Protection Relays
- PowerLogic ION9000/PM8000 Power quality meters
- EcoStruxure Power Automation System Gateway

4G Devices
- EcoStruxure Transformer Expert Intelligent Sensor

MV/LV Hardwired Devices**
- PowerLogic A125 Arc 121/VA1DA Arc flash Protection system
- Flow meter for heat, gas, water etc.

MV/LV Insulation Monitoring
- EcoStruxure Panel Server
- Vigilohm IM400/IFL12 Device
- Vigilohm IM400/IM20 Device

MV/LV Condition Monitoring
- MV/LV SMD Substation monitoring device
- EcoStruxure Panel Server
- PowerLogic TH110, CL110, HeatTag Environmental sensors
- PowerLogic PD100 Partial discharge sensor

- ASCO 7000 PTS Power transfer switch
- TransferPacT Automatic transfer switch
- MasterPact MTZ Circuit breaker
- ComPacT NSX/NSXm Circuit breaker
- PowerLogic PM8000 Power quality meter
- PowerLogic PM5000 Power meter

Wireless Devices
- PowerLogic PowerTag Energy sensors
- Acti9 Active Protection device

- EcoStruxure Panel Server

Serial Devices
- Acti9 iEM3000 Energy meter
- EcoStruxure Smart Link I/O Auxiliary contacts management

Power Quality Solutions
- PowerLogic AccuSine Power correction system
- PowerLogic PFC Power factor correction system

Backup Power
- Galaxy V Series Uninterruptible power supply
- Generator set

Motors
- Altivar Variable speed drive
- Motor

Microgrid
- EcoStruxure Microgrid Operation Controller
- PV inverter
- Battery energy Storage system
- Energy Control Center (US only)

EV Charging Infrastructure
- EVLink Pro DC Charger
- EVLink Pro AC Charger

Automation Controllers
- Modicon M580 Controller

Frequency Conversion
- Frequency Converter (Third Party)

* Please, contact your Schneider Electric representative to confirm the availability of EcoCare for Electrical Distribution or EcoStruxure Service Plan in your country.

** Hardwired Devices can be integrated through Connected Products with general-purpose Digital Inputs, marked as "DI".

*** Charging Solution for connectivity with Schneider Electric Chargers.

Information about fast charging solutions architecture

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Transverse Lifecycle Capabilities

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EV Fast Charging

Enable dynamic energy and load management system for smart charging needs (trucks, terminal tractors, etc.)

Primary Department

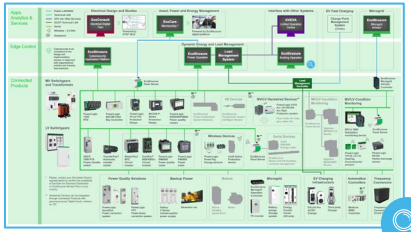
- Procurement / Delivery
- Facility / Utilities Management

Benefits

- Use a platform capable of connecting different charger brands and types.
- Optimize energy by dynamically varying the charging scenarios to help prevent costly peak loads.
- Increase reliability by using a local/edge load management system.
- Option to enhance site resiliency for optimal charge performance with muti-source energy.



Fast Charging Solution for Ports



EV Fast Charging Reference Architecture

Electrifiable Vehicles in Ports

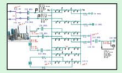
EV Fast Charging Reference Architecture

Apps, Analytics & Services

Public LAN/WAN
Technical LAN
OPC UA / Web Services
OCCP Technical LAN
Serial
Wireless – 2.4 GHz
Hardwired

Electrical Design and Studies

EcoConsult
Electrical Digital Twin



Powered by ETAP iSLD

Asset, Power and Energy Management

EcoCare
Membership *



Powered by EcoStruxure digital platform

Interface with Other Systems

AVEVA
Unified Operation Centre

EV Fast Charging

Charge Point Management System (CPMS)

Microgrid

EcoStruxure
Microgrid Advisor

Edge Control

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.

EcoStruxure
Cybersecurity Application Platform

Dynamic Energy and Load Management

EcoStruxure
Power Operation

Load Management System

EcoStruxure
Building Operation

Connected Products

MV Switchgears and Transformers



EcoStruxure Panel Server

Load Management Controller

EcoStruxure Microgrid Advisor Controller

PowerLogic T300 RTU

PowerLogic MiCOM C264 Bay Controller

PowerLogic P5 (or P3) Protection Relays

MiCOM P-Series Protection Relays

PowerLogic ION9000/PM8000 Power quality meters

DI **

EcoStruxure Power Automation System Gateway

4G Devices

EcoStruxure Transformer Expert Intelligent Sensor

DI **

MV/LV Hardwired Devices**



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Flow meter for heat, gas, water etc.

MV/LV Insulation Monitoring

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MV/LV Condition Monitoring



MV/LV SMD Substation monitoring device

EcoStruxure Panel Server



PowerLogic TH110, CL110, HeatTag Environmental sensors

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LV Switchgears



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DI **

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Acti9 Active Protection device

DI **

EcoStruxure Panel Server

Serial Devices



Acti9 iEM3000 Energy meter

EcoStruxure Smart Link I/O Auxiliary contacts management

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PowerLogic PFC Power factor correction system

Backup Power



Galaxy V Series Uninterruptible power supply

Generator set

Motors



Altivar Variable speed drive

Motor

Microgrid

EcoStruxure Microgrid Operation Controller

PV inverter



Battery energy Storage system

Energy Control Center (US only)

EV Charging Infrastructure



EVLink Pro AC/DC Charger

Third party Charger

Automation Controllers

DI **



Modicon M580 Controller

Frequency Conversion



Frequency Converter (Third Party)

Electrifying Ports Ground Equipment and Vehicles

Group of vehicles that can be electrified:

Back to **EV Charging (Standard)**

Back to **Fast Charging**



Container Handling Equipment

- These vehicles—such as forklifts, terminal trucks, stackers, and top handlers—transport containers across ports, moving them to and from designated parking areas.
- Specialised EV charging infrastructure is required to be installed for these equipment.



Electric Trucks

- Ports serve as intermodal hubs where trucks transfer containers from terminals to their final destinations.
- Logistics operators make use of EV charging stations setup at port gates.



Service Fleet & Employee's Vehicles

- Port services fleet vehicles support maintenance teams in navigating port facilities and maintaining infrastructure across the site.
- EV charging infrastructure for service fleet vehicles and employees may be installed:
  - In port carpark
  - At business premises located in the port precinct

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Transverse Lifecycle Capabilities

Design, Build, Modernize & Commission
(Consultants & EPC)

Build Faster & Flexible Infrastructure

- Network Load Flow and Voltage Drop Simulation
- Electrical Network Short Circuit and Selectivity Simulation
- Arc Fault Protection and Coordination
- Device Coordination and Selectivity
- AC&DC Electrical Network Bus Design and Simulation
- Power Quality Simulation & Modelling
- Power System Study
- Renewable & Microgrid Energy Storage Sizing Simulation

Operate & Maintain
(Operators, maintenance team, service teams)

Improve Safety & Availability

- Electrical Distribution Monitoring, Alarming and Event Analysis
- Power Quality Monitoring, Correction and Compliance
- Arc Flash Protection
- Continuous Thermal Monitoring
- Circuit Breaker Settings Monitoring
- Power Source and Load Control
- Advanced Protection and Automation
- Simulate Before Operate
- Insulation Monitoring

Operate Electrical Networks Efficiently

- Asset Performance
- Capacity Management
- Backup Power Testing
- Predictive Simulation
- Guided Procedures Through Extended Reality
- Operator Training Simulation

Decarbonize Port Infrastructure

- Net Zero Consulting Services
- Utility Bill Verification
- Cost Allocation and Tenant Billing
- Energy Monitoring and Usage Analysis
- Energy Efficiency Compliance
- Microgrid
- EV Charging (Standard)
- EV Fast Charging

Transverse Lifecycle Capabilities

- Electrical Digital Twin - iSLD
- Interface with Other Systems (BMS, Unified Operations Center, Other)
- Cybersecurity

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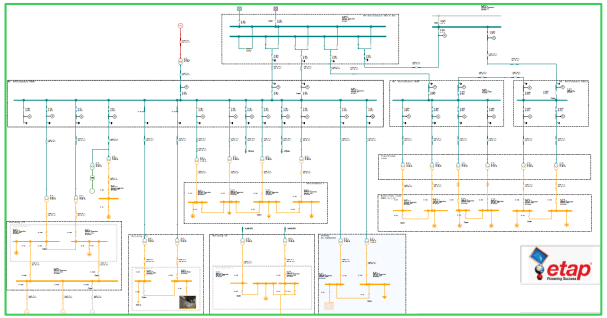
BIBLIOGRAPHY

Electrical Digital Twin – iSLD

Provide end-to-end digital engineering

Benefits

- Provide intelligent user interface for all levels of AC networks, with seamless data flow across the project.
- Simplify creation and commissioning of electrical or control panels with a complex workflow and technical detailing.
- Enable users, from the design to operate phases, to model, simulate, analyze and validate electrical power systems to predict their electrical network behavior.



Electrical Digital Twin Interface

Design Firm | EPC / Main Contractor | Panel Builder / Installer | Operator / Site Manager | End User

Design & Simulate

- etap: Create, configure, customize, and manage your electrical system model
- CANECO ONE: Enable automated calculations, sizing, and diagrams
- AED+: Provide BIM-based electrical design solution

Engineer & Build

- SEE: Create wiring diagrams, 3D- panel design
- SEE: Manage workflow with digital FAT, document transfer, and much more

Operate & Maintain

- etap: Monitor and predict system behaviour using real-time data from smart meters or SCADA.
- Operate with design knowledge
- Design with operation knowledge
- Help prevent system interruption
- Accelerate operator training

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Interface with Other Systems: Building Management System (BMS)

Why integrate mechanical and electrical systems?

Need for data aggregation

Ports infrastructure is undergoing a significant transformation through the integration of information and operational technologies. This trend is evident in modern port operations, where mechanical and electrical systems form the backbone of critical infrastructure.

Systems like advanced sensors, meters, and smart equipment generate vast volumes of data. To harness this data effectively, it is key to implement robust software platforms capable of aggregating and analyzing information from diverse sources. This enables improved decision-making, operational efficiency, and predictive maintenance across port facilities.

Benefits of systems integration

Integrating the systems:

- Creates a unified interface for visualizing, analyzing, and reporting data, simplifying daily tasks for operations and maintenance staff;
- Enables applications to utilize context from both systems to optimize the decision-making processes;
- Enhances overall operational efficiency.

Examples of mechanical and electrical systems integration in ports

Energy performance monitoring
Track and model energy usage across various zones of ports such as cruise terminals, warehouses and administration buildings.

Asset management
View mechanical and electrical asset performance in one place.

Fault management
Detect faults and respond through an integrated interface.

Learn more about:

- Data Integration and Interoperability between Systems (IEC)

Interface with **AVEVA PI**

Interface with **Unified Operations Center**

Interface with Other Systems: Building Management System (BMS)

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How is data acquired and integrated within the architecture?

Data Integration

The method/tool to integrate the data depends on the data type, and on the direction of the transfer:

From: EcoStruxure Power Operation (EPO) with Advanced Reporting and Dashboards

To: EcoStruxure Building Operation (EBO)

The integration is performed through:

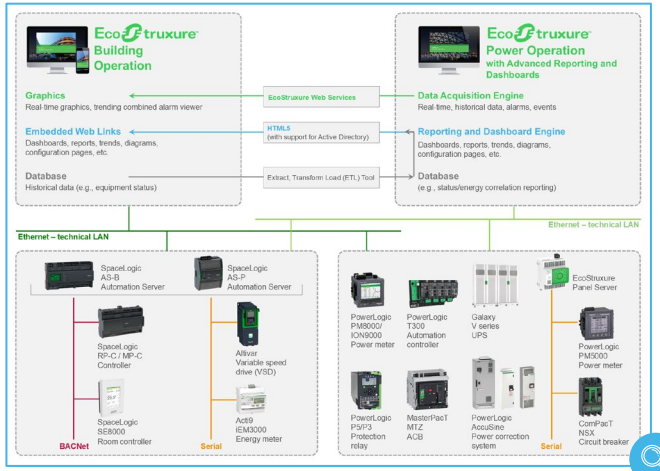
- EcoStruxure Web Services
  Used for real-time data, alarms, and historical data;
- Web interface integration (Single Sign On)
  Used for power and energy dashboards, graphical diagrams, trends, reports, and configuration pages.

From: EcoStruxure Building Operation (EBO)

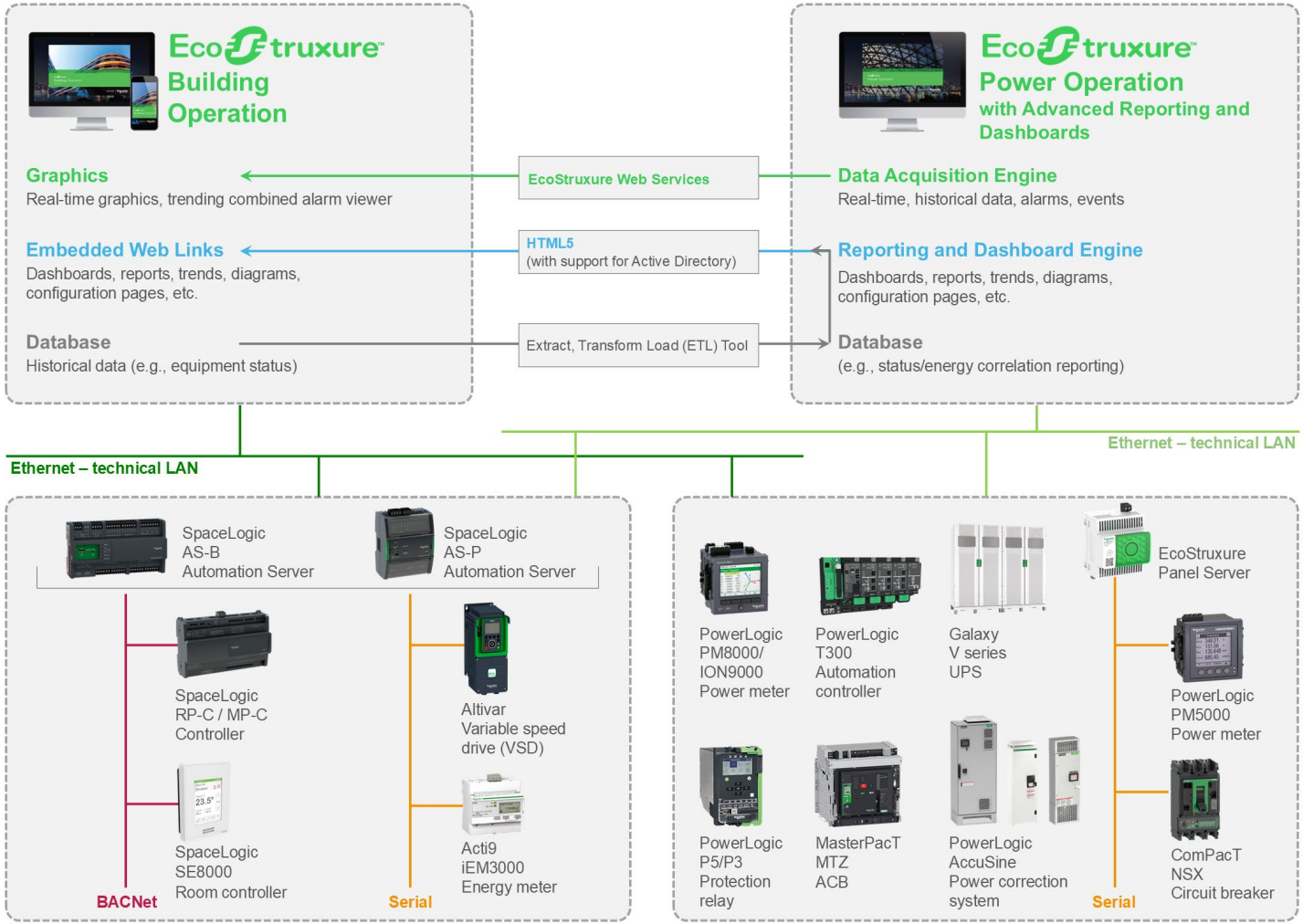
To: EcoStruxure Power Operation (EPO) with Advanced Reporting and Dashboards

The integration is performed through:

- An Extract Transform Load functions
  Used for historical building management data to enable energy data correlation.



Example of Combined Solution with EcoStruxure Building Operation and EcoStruxure Power Operation with Advanced Reporting and Dashboards

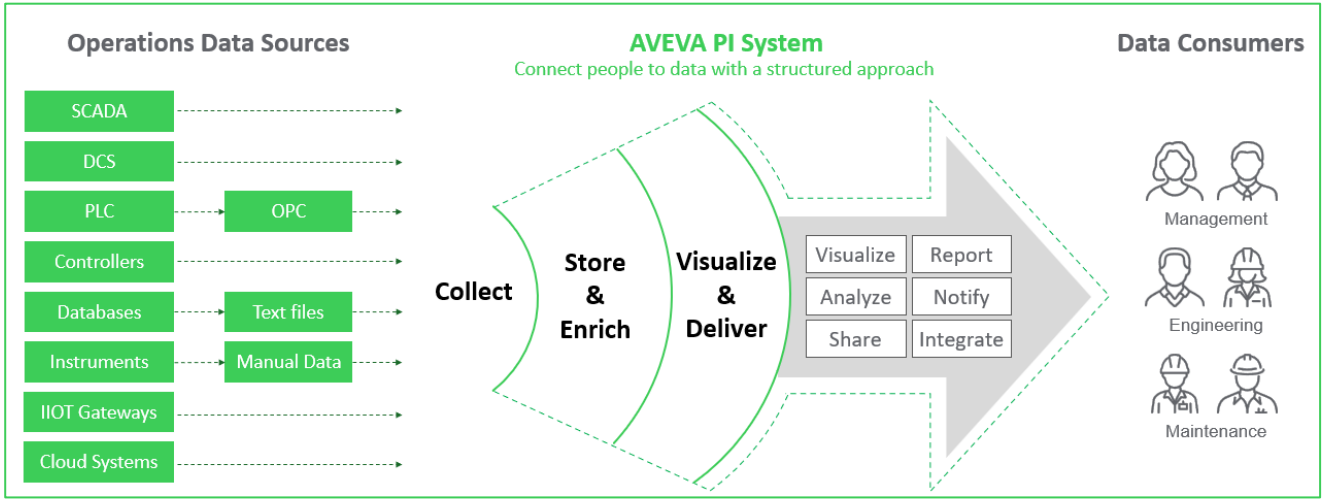


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Interface with Other Systems: AVEVA PI

What is AVEVA PI

The AVEVA PI System is an integrated portfolio of solutions that empowers industrial operations to collect, cleanse, store, enrich, and visualize real-time operational data.



Principle of AVEVA PI

Interface with **Building Management System**

Interface with **Unified Operations Center**

Interface with Other Systems: AVEVA PI

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Why integrate with AVEVA PI?

Need for a central integration hub

Ports are complex environments with numerous disconnected systems and manual processes. As a result, data is often scattered across different operations (such as vessels, cranes, trucks, energy, and security system), making it difficult to manage and analyze effectively. Data also needs to be integrated across different stakeholders like ship liners, terminal operators, logistic companies.

To manage this complexity, ports need a centralized integration hub like AVEVA PI—that acts as a “Digital Nerve Centre”, connecting with vendor agnostic systems and streamlining data flow.

Benefits of AVEVA PI

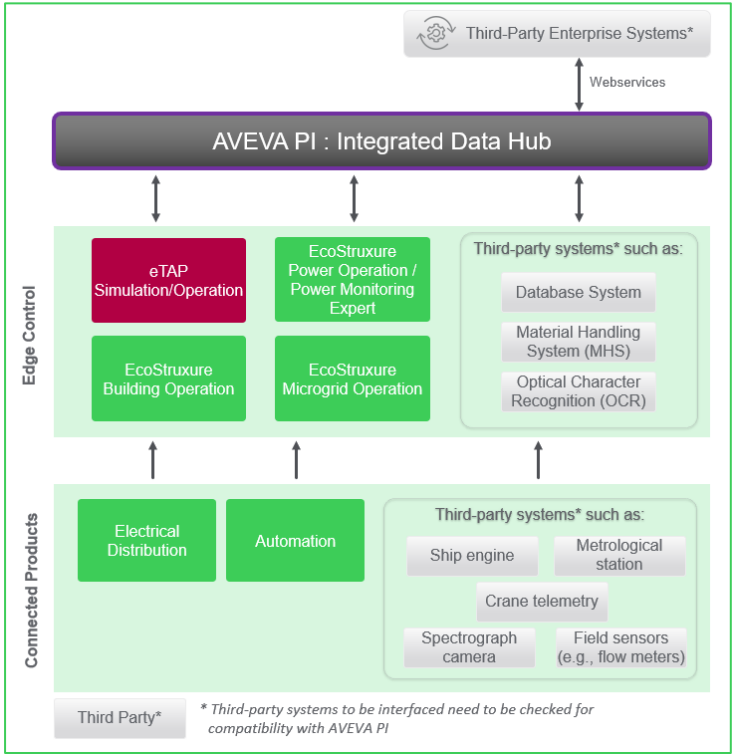
- Make better decisions with real-time data, proactive maintenance, and compliance tracking;
- Connect with multiple vendor agnostic systems for complete data visibility, vessel visit, container monitoring, and predictive equipment maintenance;
- Manage operations and optimize energy use with a centralized, agnostic data hub, to meet growing energy demands while engaging multiple stakeholders;
- Scale across the enterprise by integrating both legacy and new systems;
- Monitor sustainability goals in the context of daily operations.

Interface with Other Systems: AVEVA PI

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Examples of AVEVA PI integration in ports

- **Building port energy data hub**
  Track and contextualize energy usage across various operations and consumers of the ports (vessels, trucks, reefers, etc.).
- **Empowering teams for informed decision-making**
  Gain data-driven visibility into port operations, providing actionable insights to improve overall productivity.
- **Improving operational efficiency**
  Leverage the data insights to enhance performance of gantry cranes, also leading to travel time optimization.



AVEVA PI Reference Architecture

Interface with Other Systems: AVEVA Unified Operation Center

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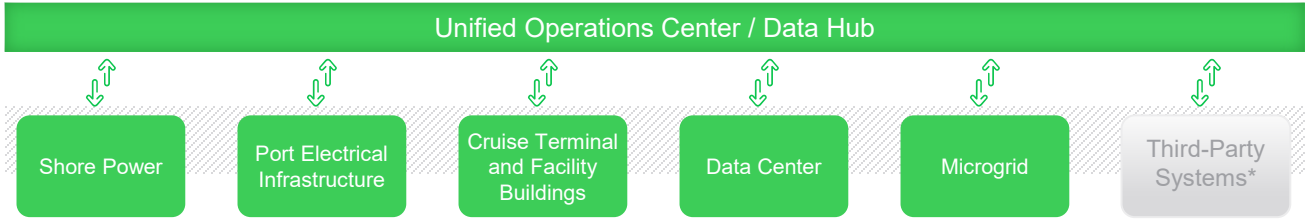
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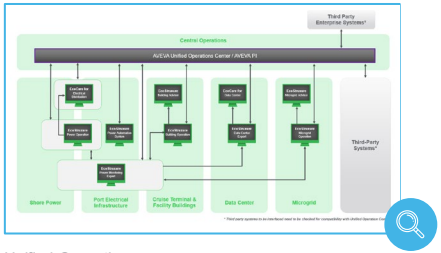
What is AVEVA Unified Operation Center

AVEVA Unified Operations Center (UOC) brings end-to-end operational visibility across port facilities (such as warehouses, workshops, terminals, shipyards, and gates) to enhance operating performance, increase enterprise-wide visualization.

It empowers teams with a centralized, real-time view that supports faster, more informed decision-making. Built on a "system of systems" approach, UOC seamlessly integrates OT (Operational Technology) and IT (Information Technology) into a unified, single-pane-of-glass solution.



* *Third-party systems to be interfaced need to be checked for compatibility with Unified Operation Center*



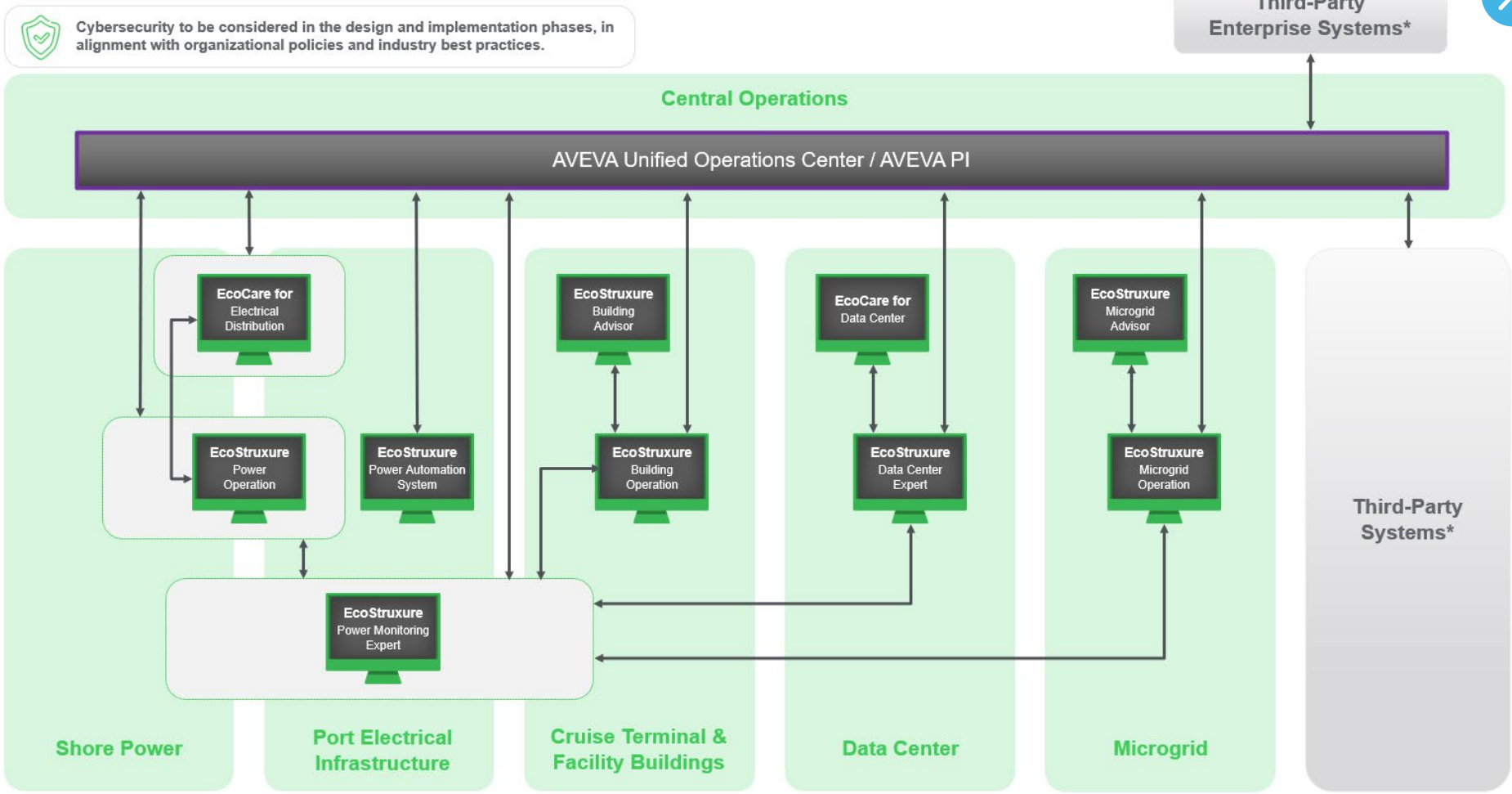
Unified Operations Reference Architecture

Interface with **Building Management System**

Interface with **AVEVA PI**

Unified Operations Reference Architecture

Cybersecurity to be considered in the design and implementation phases, in alignment with organizational policies and industry best practices.



** Third-party systems to be interfaced need to be checked for compatibility with Unified Operation Center*

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Interface with Other Systems: AVEVA Unified Operation Center

Why integrate with Unified Operation Center?

Need for a Unified Operational Center

Ports are complex facilities with many siloed and legacy systems, and intensive manual operations. Improving operational efficiency and reducing congestion requires data to flow across various port operations—such as building systems, energy systems, logistics, traffic control, maintenance, and security.

A centralized core system is essential to enable centralized monitoring, predictive maintenance and improved decision-making, acting as a “Control and Command Centre”.

Benefits of Unified Operation Center

- Improve operational excellence through data exchange and standardized process deployment.
- Provide detailed insights into sub-system operations within specific port areas, enabling faster decision-making and improved coordination between teams.
- Support holistic asset management to minimize downtime and extend the lifespan of critical infrastructure.

Examples of Unified Operation Center integration in ports

Operational Intelligent Dashboard
Delivers historical and real-time analytics to support better planning, enabling port authorities and operators to make informed decisions regarding resource allocation, investments, and policy.

Integrated Asset Health Monitoring
Monitors the condition of mechanical and electrical assets to enable proactive risk mitigation and faster emergency response, thereby reducing downtime.

Workforce Efficiency
Provides incident reporting, automated workflow management, and scheduling tools to enhance workforce productivity and coordination.

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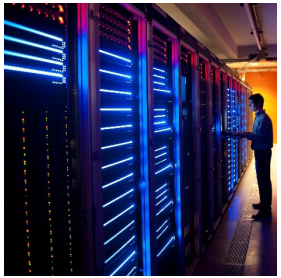
Cybersecurity

Challenges faced by ports



High Level of System Complexity

- Ports rely on a wide array of digital systems which are vulnerable to cyber attacks.
- Systems are deeply interconnected—a disruption in one can cascade to others.
- Many of these systems are highly critical to daily port operations and international trade.



Increasing Sophistication of Attacks

- Ports are becoming high-value targets for cybercriminals and state-sponsored actors due to their role in global trade.
- Attackers use advanced tools and methods to breach port systems.
- Ports need to do constant reassessment due to rapidly changing threat landscape.



A complex Ecosystem of Stakeholders

- Ports involve numerous stakeholders—government agencies, port authorities, shipping lines, terminal operators, logistics providers, customs, freight forwarders, customers.
- Digitalization brings in increased data flow between interconnected systems.

Multiple Regulations and Standards

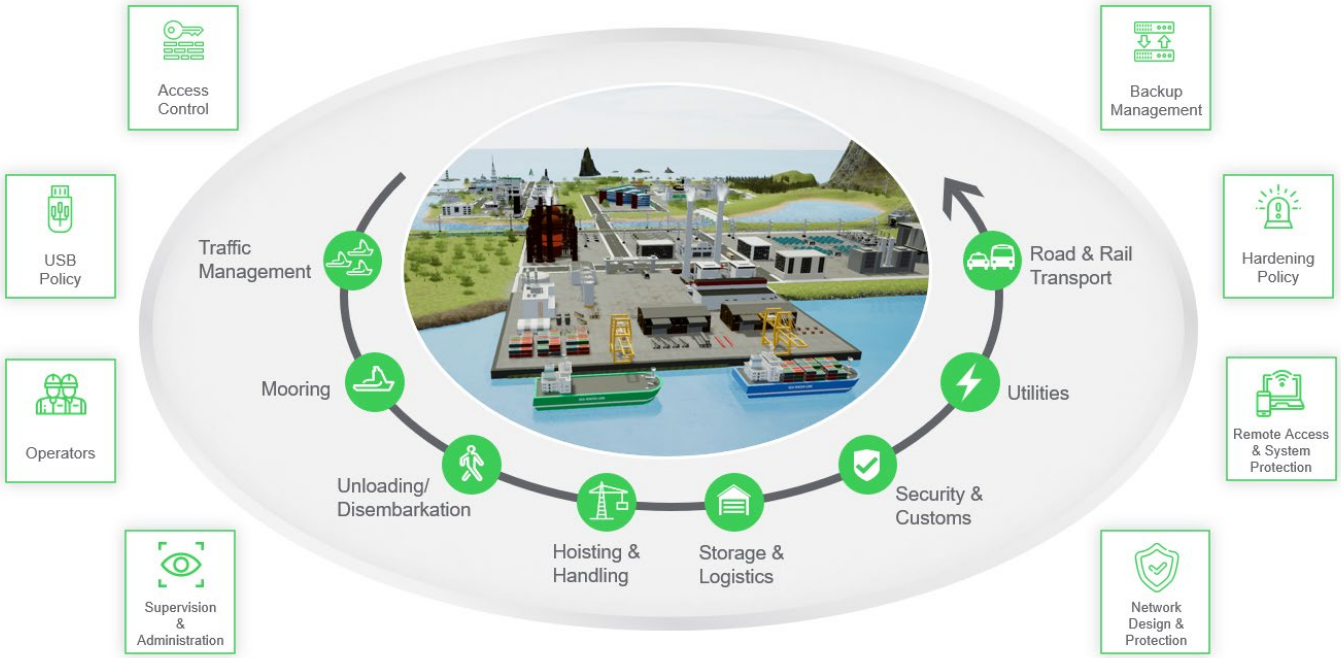
- Ports must comply with local and regional cybersecurity regulations (e.g., NIS directive in EU).
- Global standards like ISO 27001 and IEC 62443 support best practices adoption for cybersecurity.

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Cybersecurity

A transversal OT (Operational Technology) challenge for ports

Ports are critical infrastructures with many interconnected systems spanning diverse operations. As digitalization advances in port activities, managing OT cybersecurity becomes a mandatory requirement.



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Cybersecurity

Our solutions to support cybersecurity journey

At Schneider Electric, we can:

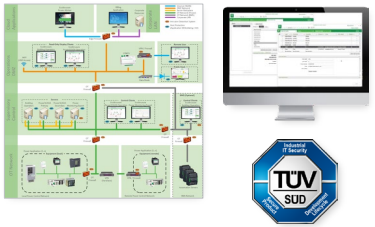
- Provide a selection of cybersecurity certified products
- Provide certified system architectures and solutions
- Deliver lifecycle services

Certified Products



Certified products developed according to IEC 62443 functional requirements with Secure Development Lifecycle processes.

Certified Systems & Solutions



Certified secure system architecture according to IEC 62443-3-3 with documented processes and solutions for a more secure system.

Cybersecurity system configuration software for consistent security policy deployment.

Lifecycle Services



Consulting services from design, implementation, operations and maintenance to tailor your security solutions to your strategy and budget.

Learn more about:

- Cybersecurity (IEC)

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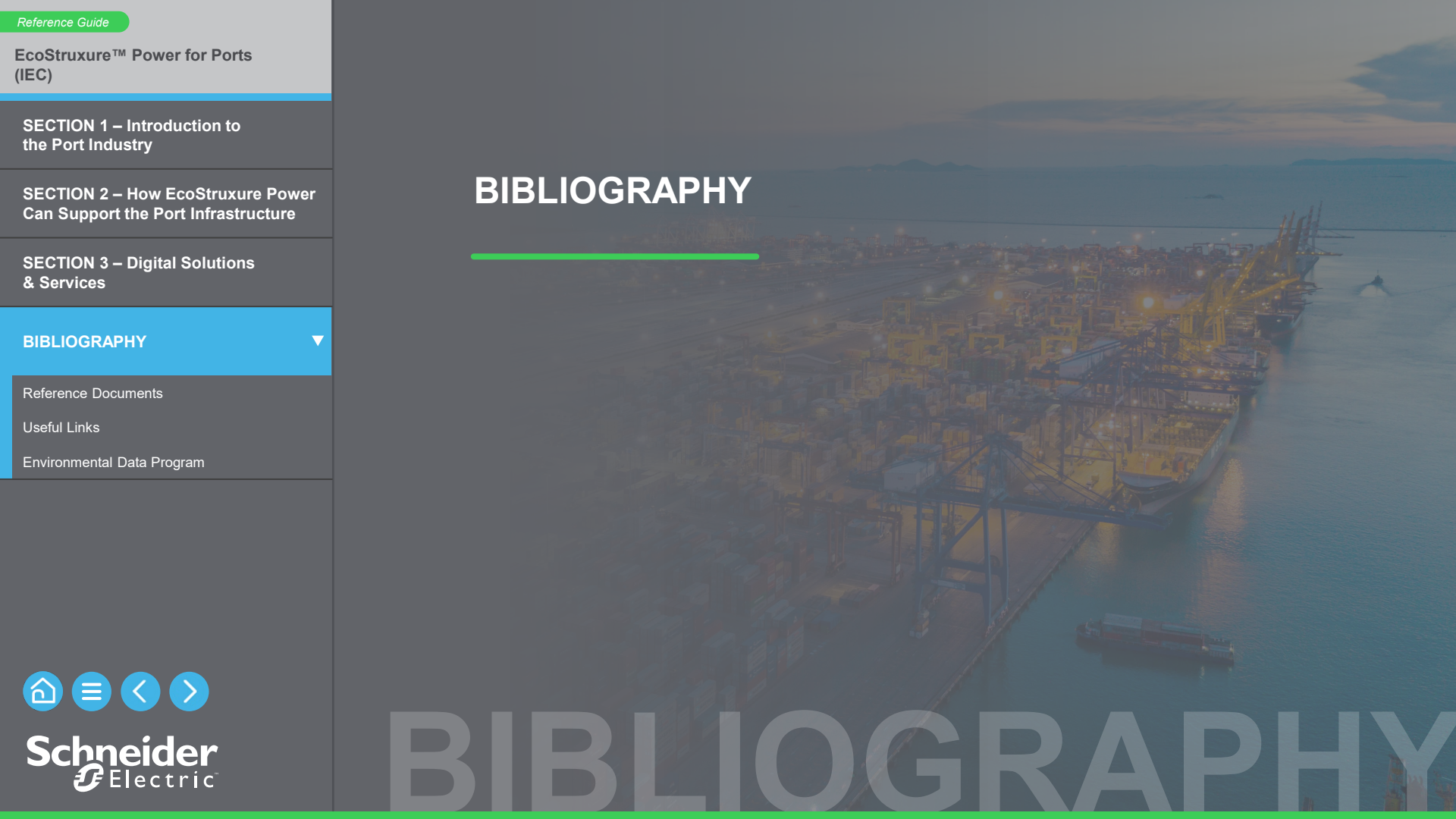
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Reference Documents

Useful Links

Environmental Data Program

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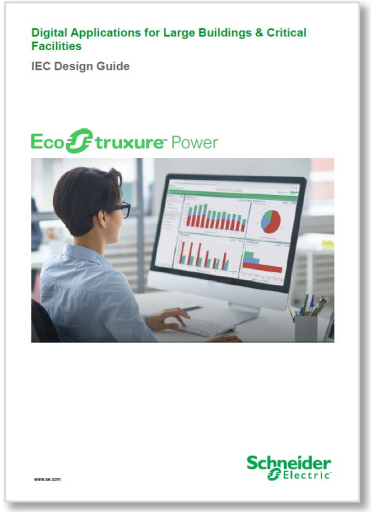
Reference Documents

Useful Links

Environmental Data Program

Reference Documents

Design Guide



Digital Applications for Large Buildings and Critical Facilities

The Digital Applications Design Guide provides comprehensive details on the building blocks of EcoStruxure Power: the IoT applications are driven by a software layer to control the traditional electrical distribution infrastructure.

Developed to help engineering consultants and designers, this guide is an invaluable resource for specifying, designing and prescribing EcoStruxure Power architectures capable of performing one or more of the business-driven applications described within.

General Landing page (Gives access to PDF versions)**:**
https://www.se.com/ww/en/work/campaign/innovation/power-digital-applications-design-guide.jsp

Quick links for the digital IEC Guide
Ref: ESXP2G001EN

- Table of Contents
- General Methodology for Designing Digital Applications
- Overview of Digital Applications

Quick links for the digital NEMA Guide
Ref: 0100DB1802

- Table of Contents
- General Methodology for Designing Digital Applications
- Overview of Digital Applications

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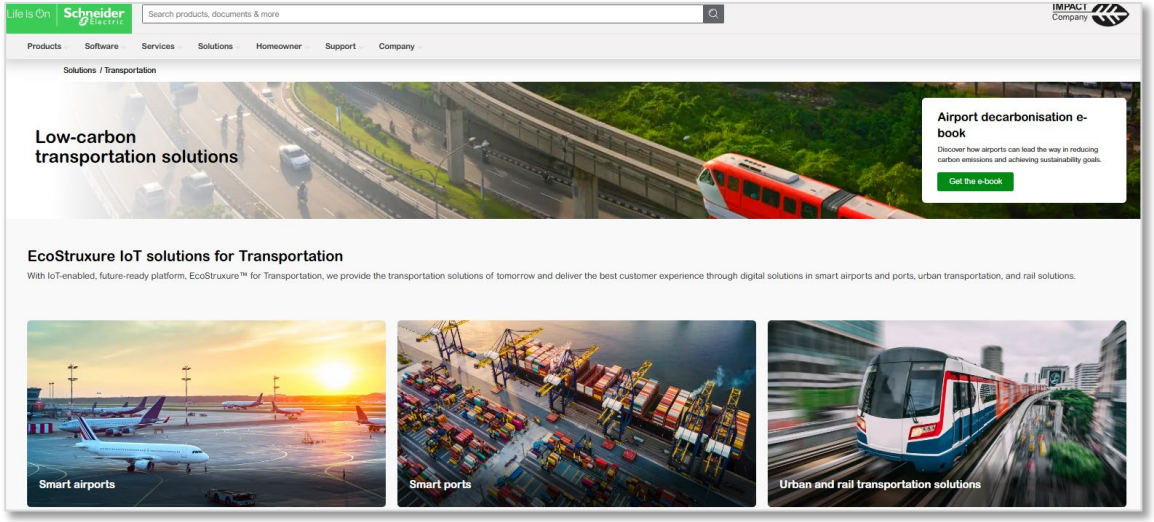
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Useful links

Transportation solutions

Discover EcoStruxure Power solutions for Transportation.



https://www.se.com/ww/en/work/solutions/transportation/

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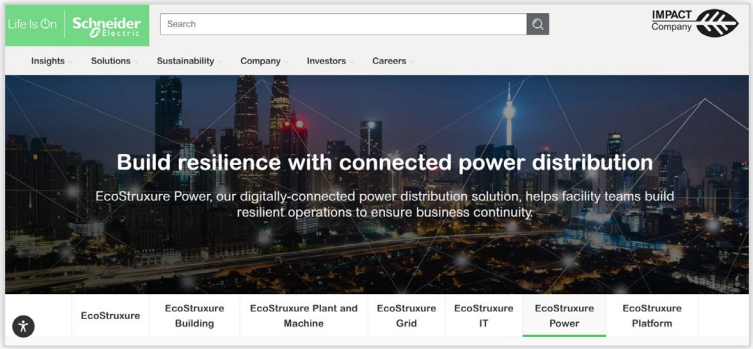
Reference Documents

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Useful links

EcoStruxure Power solutions on se.com



- Discover about EcoStruxure Power.
- Understand the benefits of a digitized power distribution.
- Find the latest documentation published.

https://www.se.com/ww/en/work/campaign/innovation/power-distribution.jsp

EcoStruxure Power Reference Guides for Other Industries

Click on a link, then select your country:

EV BATTERY PLANTS	SEMICONDUCTOR FABS	FOOD & BEVERAGE PLANTS	RAILWAY & URBAN TRANSPORTATION	AIRPORTS	PORTS
					
ESXP2RG001EN	ESXP2RG002EN	ESXP2RG003EN	ESXP2RG004EN	ESXP2RG005EN (IEC) 0100DB2303 (NEMA)	ESXP2RG006EN (IEC) 0100DB2304 (NEMA)

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Environmental Data Program ▶

Environmental Data Program

The need to address ESG regulations

(ESG = Environmental, Social, and Governance)

Governments are committing to carbon neutrality by 2050, leading to new regulations promoting sustainability: ESG reporting is becoming crucial.

The Corporate Sustainability Reporting Directive (CSRD) expands disclosure requirements to nearly 50,000 companies, including those outside the EU. This enhances transparency and accountability.

Consumer Expectations and Greenwashing Risks

Consumers demand sustainable practices, with a rise in repairing, reselling, and reusing products.

However, greenwashing remains a challenge, as some companies make unsubstantiated sustainability claims. Regulators are cracking down on false claims, emphasizing the need for credible and verifiable environmental data.

At Schneider Electric, we have deployed an Environmental Data Program to address this need. Discover more next page.

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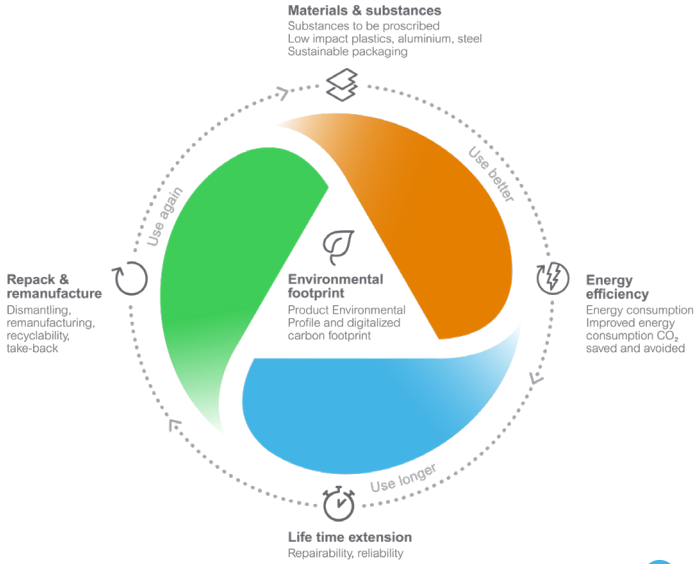
Environmental Data Program ▶

Environmental Data Program

Next-level transparency for better-informed product choices

The Environmental Data Program is a framework for how we, at Schneider Electric, measure, categorize, and compare the environmental attributes and footprint of our products.

Using a rigorous, fact-based methodology, the program provides environmental data from across the product lifecycle.



Use Better: How sustainable a product is, including environmental footprint, materials and substances, packaging, and energy efficiency.

Use Longer: How a product's lifetime can be effectively extended in terms of repairability and updatability.

Use Again: How a product can be reused, from dismantling and remanufacturing to recyclability and manufacturer take back.

With this transparent, fact-based data, customers and partners are empowered to make conscious environmental choices and accurately evaluate and report on sustainability performance.

All our hardware offers have an associated environmental data available on se.com product pages.

Learn more about:

- Schneider Electric Environmental Program

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