Offer

Extreme Light Infrastructure ERIC (ELI ERIC)
Dolní Břežany

Eco Consult - Electrical Digital Twin

Offer number:	MPE0286/24 IN11 TD
Prepared by:	Michal Perutka
Date	11.12.2024

Reference number:

OFFER	MPE0286/24 IN11 TD

Project name:	Eco Consult - Electrical Digital Twin
Offered by: Schneider Electric CZ, s. r. o. U Trezorky 921/2 158 00 Prague 5 Company ID: 60467550	Addressee: Extreme Light Infrastructure ERIC (ELI ERIC) Za Radnicí 835 252 41 Dolní Břežany Company ID: 10974938
Prepared by: **Michal Perutka** Tel +420 225 382 919 Mobile +420 603 884 332 Email: Michal.perutka@se.com	Contact person: **Václav Knechtl** Tel. +420 Mobile: +420 732 348 870 Email: Vaclav.Knechtl@eli-beams.eu
Branch: Schneider Electric CZ, s. r. o. Mlýnská 70 602 00 Brno	Branch
Date: 11/12/2024	Our reference: 113023721

Dear Mr. Knechtl,

Thank you for your interest in the Digital Twin solution in the ETAP program. We are pleased to present you with the attached budget proposal for the provision of ETAP PSMS system services, including integration and automation.

Contents

1. Description of the application and subject of performance:

1.1 EcoConsult Electrical Digital Twin objectives

The single-pole diagram of the electrical system installed in a given building is an essential document used for maintenance in any operation, and therefore it is necessary to keep it as up to date as possible. All personnel involved in the maintenance and operation of the electrical system should have access to the most recent revisions of the diagram. These diagrams must be regularly reviewed and updated to minimize risks to personal safety and maximize operational reliability.

To address these issues, EcoConsult Electrical Digital Twin aims to:

- Digitally display and browse the single-pole diagram, including the characteristics of its equipment (information on the nameplate/catalog sheet) and display the load on the power system.
- Simplify the management and planning of future changes by enabling Schneider Electric to remotely update the digital model and provide calculations within the energy system on demand.
- Reduce downtime by enabling faster analysis of the causes of outages and other undesirable events in the electrical installation.
- Provide the foundation for digital transformation

    Following the creation of a digital twin, the following can be performed:
- Short-circuit calculation
- Protection settings analysis
- Load flow analysis
- Cable cross-section dimensioning
- ArcFlash analysis + label design

1.2 Reference documents

This offer is based on the following documents:
Ref. 1:   A372_02_47_300_Electrical_line_diagram
Ref. 2:   4 - single-pole wiring diagram of the production plant_NOTE
Ref. 3:   03 Single-pole diagram_REMINDER

1.3 Scope of activities

- The current technical design concerns the modeling of the electrical distribution infrastructure of the facility from **the point of connection to the distributor's network to the outlets of the primary low-voltage switchgear** at the Extreme Light Infrastructure ERIC (ELI ERIC) site in Dolní Březany**.**
- Remote installation of ETAP on a virtual or physical server. Remote access will be required throughout the entire engineering process.
- Delivery of one ETAP software package for one LAN user. This license will be used to perform predictive simulations in a single-pole diagram. The modeling capacity is 200 buses.
- Permanent license for predictive simulations: Load Flow, short-circuit current, protection coordination (the aforementioned predictive simulations are a necessary part of the license package due to the total number of buses in the system)
- ETAP software update for the installed version for 1 year.
- Permanent PSMS (Power System Monitoring and Simulations) license for displaying measured values from PME directly in the ETAP single-pole diagram.
    - The PSMS function will collect data from the SCADA "PME" system. ETAP will be connected to PME via OPC UA (PME is an OPC UA server, ETAP is a client). No data will be sent from ETAP to PME.
    - **Note**: The proposed PSMS solution only applies to the HV network up to the first level of LV panels.

The model does not include low-voltage secondary switchboard outlets (point 4 in the diagram below). However, Schneider Electric can provide an additional quote for extending the scope of work at the customer's request

offer for extending the scope of work.
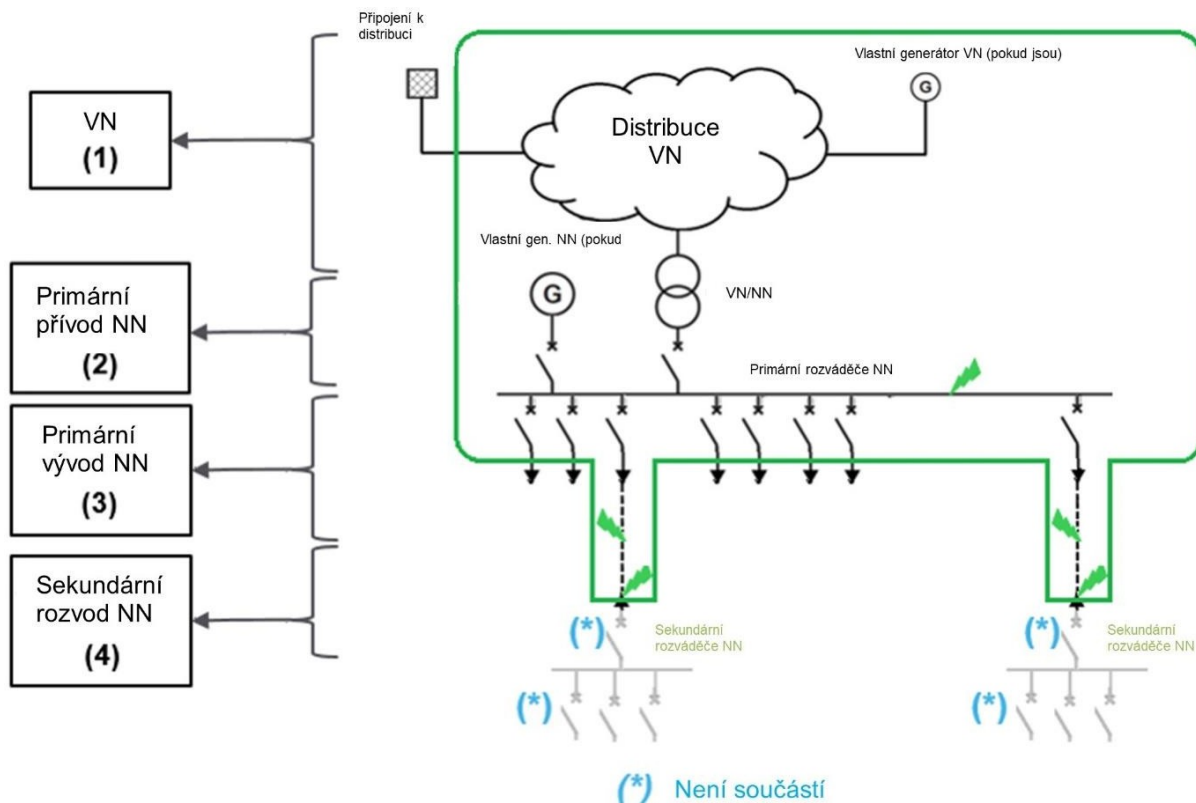
1.4   Scope of delivery

This offer does not include the performance of the analyses or studies listed below. However, at the customer's request, Schneider Electric may provide an additional price quote for:

- **ArcFlash analysis (evaluation of the thermal effects of an electric arc),**
- **Harmonic analysis,**
- **Dynamic and transient analysis**

Any feature or service not expressly described in this document shall be considered outside the scope of this proposal.

2. Hardware/software requirements

Since the ETAP Real-Time environment is highly customizable, scalable, and distributable, each project may have different specific requirements. The minimum requirements for standard projects are listed below.

General requirements for ETAP software:

Operating system (64-bit) (not provided by SE)
- Windows workstation version
    - Microsoft® Windows® 11 (Pro, Enterprise)
        - 21H2, 22H2, or 23H2
    - Microsoft® Windows® 10 (Pro, Enterprise)
        - 20H2, 21H2, or 22H2
- Windows Server version
    - Microsoft® Server 2022
    - Microsoft® Server 2019

    Microsoft® SQL Server Standard 2019 or 2022 (for playback functionality).

Additional software requirements (provided by SE)
- Microsoft® .NET Framework v1.1, Service Pack 1
- Microsoft® .NET Framework v2.0, Service Pack 1
- Microsoft® .NET Framework v3.5, Service Pack 1
- Microsoft® .NET Framework v4.7.2, Service Pack 1
- Microsoft® ODBC Driver 17 for SQL Server
- MongoDB 6.0

Computer configuration requirements (not provided by SE)
- USB port (if separate licensing is required)
- 100 to 200 GB of hard disk space (depending on project size and number of buses)
- Minimum display resolution – 1024x768 pixels
- Minimum 19" monitors (recommended)
- Two-monitor setup (highly recommended)

PSMS server hardware requirements - 200 buses (not provided by SE)
- Intel Dual/Quad core - 3.0 GHz with Hyper-Threading with high-speed system bus (or equivalent)
- 64 GB RAM

Playback Server hardware requirements - 200 buses (not provided by SE)
- Intel Dual/Quad core - 3.0 GHz with Hyper-Threading with high-speed system bus (or equivalent)
- 64 GB RAM
- Hard drive (to be confirmed after order placement, once the customer confirms the storage duration)

PSMS Analysis Console Hardware Requirements - 200 bus and higher (not provided by SE)
- Intel Dual/Quad core - 3.0 GHz with Hyper-Threading with high-speed system bus (or equivalent)
- 64 GB RAM - (high-speed)

3. Data collection

The basis for successful data collection will be cooperation with the SE consultant to complete the data in the table in Appendix 1 entitled "List of electrical network components" on the part of the customer.

Information to be provided by the customer

The following information is required for the study.

- Existing single-phase diagram drawings (if available)
- Reactive power
- Harmonic spectrum
- Voltage and current
- Status (open/closed) of all switches / CB

The lack of this data/information has a direct impact on the performance of the service.

4. Product description

4.1 ETAP Real-Time platform

The ETAP Real-Time solution includes a set of basic modeling tools, built-in analytical modules, and libraries of technical equipment that enable the creation, configuration, customization, and management of energy system models.

The ETAP Real-Time™ platform offers an integrated solution of model-driven design software and control hardware for the development, simulation, optimization, testing, and deployment of electrical power systems with the inherent ability to fine-tune the network model for maximum system resilience.

ETAP enables designers and engineers to conceptualize substations and related electrical power distribution systems. ETAP includes comprehensive electrical models combined with calculations for analyzing the entire spectrum of power systems for accurate simulation, predictive analysis, equipment sizing, and field verification of electrical power systems.

4.2 Benefits:

Using EcoConsult Electrical Digital Twin will help you:

- **Increase safety**
  - By obtaining intelligent visualization of the electrical network, which collects and evaluates all information in real time
  - By identifying overused electrical equipment through power flow evaluation
- **Maximizing efficiency** – by digitizing the single-pole network diagram, you can easily obtain a comprehensive overview of the network configuration and determine the necessary upgrades
- **Save costs by reducing** data collection **time** for future studies and providing easy access to electrical distribution topology and data (e.g., in the case of audit requirements). There is no need to recreate the model from scratch and collect data in order to deliver the required studies such as ArcFlash, short-circuit calculation, etc.
- **Create advanced connectivity and sustainable operation** – Extend local monitoring and analysis by connecting the electrical digital twin to the PME system. This connection allows you to simulate the state of the network after a change in its topology, together with predictive analysis.

After creating a digital twin, you can use related services that will help you:

- Ensure **short-circuit calculation** (e.g., to check the tripping capabilities of existing protective devices and their settings).
- **Improve the resilience and operability of the power system** by drawing up a protection coordination plan to improve system security and continuity of operation (Protection Settings Analysis).
- **Verify the load on individual outlets** using load flow analysis to ensure that there is no overloading of cables, circuit breakers, or transformers, for example. This will give you an overview of the free capacity of individual outlets for possible future expansion. Any planned expansions can be simulated on the model and their impacts (voltage, current, frequency, and power) assessed.
- **Increase operator safety** by evaluating the amount of heat energy emitted when an arc flash occurs at various points in the power supply system. Define its level and markings to alert operators to potential risks and what class of personal protective equipment must be used during maintenance. (ArcFlash analysis)
- **Securing the single-pole diagram update process** through a multi-year service plan. Our consultant provides updates to the electrical digital twin once a year.

4.3   Power System Monitoring & Simulation – PSMS

ETAP Power System Monitoring & Simulation (PSMS) is an intelligent PC-based power management software application that functions as an operator workstation for monitoring, controlling, and optimizing the operation of your power system, while also serving as an engineering workstation capable of using real-time data to perform analyses of the entire power system spectrum.

PSMS integrates with existing metering devices, programmable logic controllers, data collection and archiving systems, and provides the following exclusive features and capabilities:

- Simultaneous monitoring, simulation, and control
- Complete display of real-time and calculated data
- Prediction of system response to operator actions
- Real-time simulation of system device response
- Advisory system for operators that utilizes predicted system performance
- Comprehensive optimization goals and constraints
- Time-lapse playback with simulation option
- Real-time operation of system components
- Steady-state control and dynamic supervisory control

PSMS is designed to function as an operator workstation for monitoring, simulation, and control of power systems, capable of performing system studies such as load flow, short circuit, motor starting, transient stability, and others on demand. The unique combination of supervisory and simulation capabilities of the PSMS system provides a new robust set of control tools for efficient power system operation. The simulation capabilities of the PSMS system also provide an environment that is effective for operator training and assistance.

PSMS modules include:

4.3.1 Intelligent monitoring with condition estimation

PSMS can monitor and record unusual activities using event and alarm logging tools. This measure enables early detection and notification of problems before a critical failure occurs.
Changes in system information are graphically displayed and recorded. Calculated results are compared with measured parameters and provide alerts for devices with missing data and out-of-range data.

- Local and system-wide alarm notification
- Alerts based on device evaluation
- Out-of-range measurement notification
- Graphical, tabular, and audible reporting
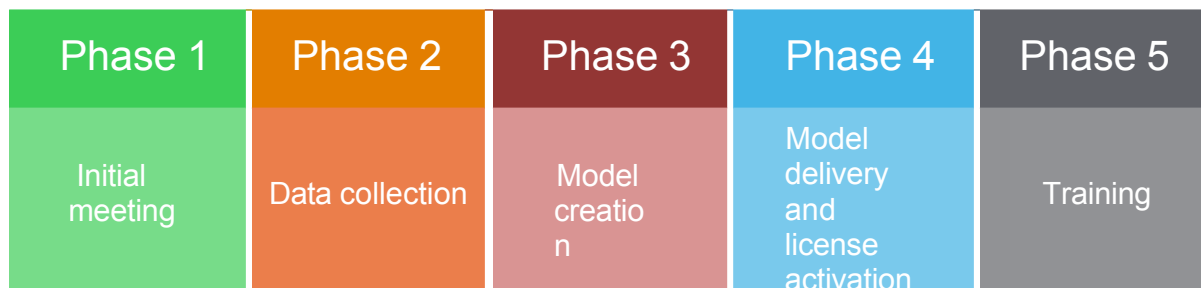- Prediction of abnormal conditions and critical failures
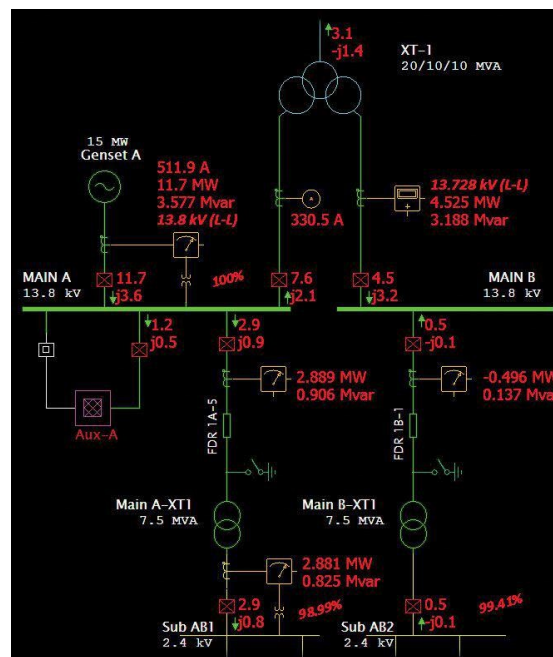
4.4 Predictive simulation

Offline energy analysis is a thing of the past. PSMS is the next logical step for industrial and manufacturing plants that use energy system analysis packages. Now you can get real-time data from an online system model on demand, perform full-spectrum system analysis, and simulate "what-if" scenarios, all in one application.
Predictive Simulation is a powerful set of analytical modules that allows you to predict system behavior in response to operator actions and events using real-time and archived data. With Predictive Simulation, you can not only perform analyses using real-time system parameters and an online system model, but also simulate "what-if" scenarios and predict the outcome before performing system actions.

5. Digital twin modeling

5.1 Work methodology

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Initial meeting	Data collection	Model creation	Model delivery and license activation	Training

Customer involvement plays a key role in achieving the quality of the electrical model of the digital twin. The following detailed sections describe the participation required in each phase.

5.2 Prerequisites and tools

EcoConsult Electrical Digital Twin will be implemented using ETAP software (the latest available version of the program).

Authorized Schneider Electric personnel will model the customer's electrical system in a single-pole view based on the information collected and approved during the data collection phase.

Language: The calculated model will be delivered **in English only. Format:**
The model will be sent to the customer in native ETAP format.
Revision: This offer includes a maximum of **one revision** of the model based on customer comments on the first delivery.

For any additional revisions, Schneider Electric will estimate the time/cost impact. If additional costs and delays are incurred, an agreement will be provided prior to implementation.

Approval:
The approval period begins when the model is sent to the customer by email. The customer has **two weeks** to approve it or raise comments. After this period, the model will be considered approved. If the model is reviewed by multiple parties, the Customer must collect all comments related to a single revision and submit them to Schneider Electric at once.

5.3 Phase 1: Initial meeting

Before data collection and model creation, an initial online or face-to-face meeting will be held to clarify and discuss the following points:

- presentation of the data collection document,
- verification of methodology and scope of work,
- schedule for data collection and presentation of results,
- presentation of the model template and discussion of customer requirements.

The goal of the kickoff meeting is for the customer and Schneider Electric representative to agree on the scope of work and methodologies.

5.4 Phase 2: Data collection

List of electrical network components:

Before starting the ETAP modeling, Schneider Electric will submit a document (in MS Excel format, Appendix 1) describing the characteristics of the equipment and the operating conditions of the network. The data collection document will be written in **English** (in Czech upon request) and will be based on information gathered during the on-site data collection.

System data collection:
    Performed by the
    customer:
    Schneider Electric will send the customer a blank data collection document in Excel format. The customer is responsible for completing this document. This file will only be provided to Schneider Electric, which works with this Excel file. A sample list of the main input data is available in the appendix. The purpose of this list is to highlight the essential data that the customer must provide. In case of uncertainty, an SE consultant is available.

Information about HV and LV power cables (length, type, number, etc.) must be based on documents provided by the customer. If this information is not available, the customer's technical representative will estimate the cable length with estimated maximum and minimum values. If these are not available, cable cross-sections will be estimated based on the existing nominal values of the protective device.

If some data is not available, the customer and Schneider Electric will make assumptions clearly stated in the database document. Schneider Electric's assumptions will be based on both knowledge of the power system environment and Schneider Electric's own database and experience. These assumptions will need to be approved by the customer prior to any computer modeling.

Approval of the "List of Electrical Network Components" document

The completed "List of Electrical Network Components" document (including the customer's and Schneider Electric's assumptions) is sent to the customer in PDF format by email for approval. After this document is sent, the customer has two weeks to approve it or submit comments.

After this period, the output will be considered approved by the Customer.

Once the completed database document (including the Customer's and Schneider Electric's assumptions) has been approved by the Customer, any further changes to the list of input data will delay implementation and will be subject to additional charges. The time and cost implications will be assessed by Schneider Electric teams and submitted to the Customer for approval before proceeding with the model update.

5.5   Phase 3: Model creation

Objectives
Enter information about the equipment at the site into the ETAP program, structured according to the customer's electrical network architecture and equipment naming conventions.

The ETAP program offers the ability to customize the visualization of the network topology. The final model settings will be discussed and agreed upon during the kick-off meeting. The current offer includes a selection of available customizations limited to the capabilities of the ETAP program.

Schneider Electric can, at the customer's request, propose an additional offer that will include specific requirements involving new developments in the ETAP tool.

5.6   Phase 4: Model delivery and license deployment

Objectives

- Present the model to the responsible personnel for the facility
- Provide a basic ETAP license for digital viewing and browsing of single-pole diagrams and their properties (information on the device's nameplate), including an e-learning module for self-study.
- A license subscription is required to visualize the model in digital twin mode; otherwise, the model will only be provided in PDF format.

5.7   Phase 5: Training

Training in basic work with the supplied ETAP license, including access to e-learning for self-study.

Price calculation:

Item	M/J	Amount (CZK without VAT)
Project engineering including: - Creation of a Digital Twin model - Server configuration - Remote testing - Operator training (1 day)	1	1,982,088.00
Software license → 200 buses – permanent ETAP software for one LAN user, including Also includes: - ETAP Real Time PSMS Server - Advanced monitoring (status estimation) - RT console for predictive simulation - ETAP Design License for PSMS - 1 year of software support and maintenance (Software support is included in the first year. In addition to user support, the the Software Maintenance Agreement (SMA) also includes one full year of program updates.)	1	1,564,944.00
Total delivery price:		**3,547,033.00**

Terms and conditions:

Payment:	Cashless transfer, payment in advance
Delivery time:	Approximately 10 working weeks from the date of receipt of all necessary documentation
Offer validity:	Until December 31, 2024
Invoicing:	Electronic

Email for sending orders: cz-servis@se.com

Schneider Electric CZ, s. r. o. declares that all information and materials provided are for informational purposes only, are non-binding, and do not constitute grounds for concluding any contract. Other terms and conditions not defined in this document are governed by the General Terms and Conditions of Schneider Electric CZ, s. r. o. See the appendix to the GTC.

Sincerely

Michal Perutka Service
offers

List of attachments:
No. 1: List of electrical network
components No. 2: GTC_SECZ
No. 3: GTC_SECZ_SERVICES
No. 4: Related Schneider Electric LV and HV services
No. 5: Asset maintenance leaflet CZ

Example of a list of electrical network components

This section lists the main input data required to perform the electrical model. This is not a complete list; it will be supplemented during the detailed data analysis at the beginning of the modeling process. After placing an order, the company will be sent a blank template (in MS Excel format) of the complete list for data collection.

Designation		Value	Unit
Upstream MV Utility Network			
Short-circuit power (min and max)	Ssc		MVA or current
Earthing system			-
Line to earth short-circuit power			MVA or current
Rated voltage	U		kV
«as found» protection relays and settings (on the DSO/grid side)			-
X/R	Ratio		-
Transformer(s)			
Rated apparent power	Sn		MVA
Rated primary voltage	Up		kV
Secondary voltage at no-load	Us		kV
Coupling type		Delta-Wye, Delta-Delta, Delta-Delta-Wye	-
Voltage short-circuit ratio (% Impedance)	Usc		%
Neutral earthing system			-
Inrush current	Ii/Ir		-
Inrush time constant	Tin		s
Generator(s)			
Rated apparent power	Sn		MVA
Rated active power	Pn		MW
Rated voltage	U		kV
Rated power factor	FP		-
Subtransient reactance	X''d		%
Transient reactance	X'd		%
Permanent reactance	Xd		%
Negative reactance	X2		%
Permanent three-phase fault current	Ik3		A
Winding impedance			ohms
Cables			
Type of cables connection		Radial / not radial?	
Conductor material		Copper / aluminum?	
Insulation material		XLPE / PVC / EPR / other?	
Cross section (conductor)	S		mm² / AWG / KCMIL
Number of cables per phase		1-8	-
Length	L		M or ft.
Single conductor or 3 conductors			-
Current transformers and Core Balance Current Transformers (CBCT)			
Primary rated current	Ip		A
Secondary rated current	Is		A
Rated output power	Sn	5, 10	VA
Accuracy Limit Factor	ALF	10, 20	-
Accuracy Class	P	5P, 10P, X...	-
Connection (Residual, Zero Seq, Indiv phase)	R, Zs, P		
MV protection relays and LV tripping units			
Brand / Range			-
Type			-
Actual settings LD, LDT, SD, SDT, Inst, Ground, Ground time			-
Operating modes			
Confirmation of operating modes			With status of the Diesel Generator and switches (Open/Close?)

Acceptance of the offer

By signing this offer below, you confirm that you have read and understood this document and Schneider Electric's General Terms and Conditions of Sale, and that you fully accept their content by signing on behalf of the customer. If you accept this offer, you agree that the provisions of the offer will apply immediately upon acceptance of the offer and prior to the signing of any further contract (or the issuance of an order based on this offer), as well as in the event that no further contract is formally concluded (or no order is placed), and that our relationship is based on this offer and your acceptance of the offer, with the proviso that the use of any of the buyer's terms and conditions is not permitted. If, after acceptance of this offer, any contract is concluded or any order is issued on the basis of this offer, such documents shall be governed exclusively by the terms and conditions set out in this offer and its annexes, unless expressly agreed otherwise in writing by both contracting parties.

Signature of the person authorized to act on behalf of the

supplier: Supplier: Schneider Electric CZ, s.r.o.

First and last name:

Signature authorization:

Date of signature:

Signature of the person authorized to act on behalf of the

customer: Customer:

First and last name:

Signature authorization:

Date of signature:

Contact person at the installation site (First and last name):

Contact details of the person at the installation site (Phone):

SE CZ Training Center
Professional education

Training topics:

- Product training for distributors and electricians
- Industrial automation – control units and terminals
- Converters, servo drives, motor control and protection
- Machine and equipment safety Building
- automation
- Energy management
- Power distribution
- Webinar recordings – product training and electrical engineering basics

Can't find what you're looking for? Send us an email at **skolicicentrum@se.com**

Training services portal: one platform – many possibilities

Take advantage of access to training courses on a wide range of topics tailored to your needs. The portal offers both free and

paid courses, online or in person, in Czech and other languages. Find topics that interest you and take advantage of Schneider Electric's wealth of experience.

Sign up quickly and easily for the training courses you are interested in

Get access to the complete range of training courses, including free e-learning courses

Keep track of the latest training dates in the calendar

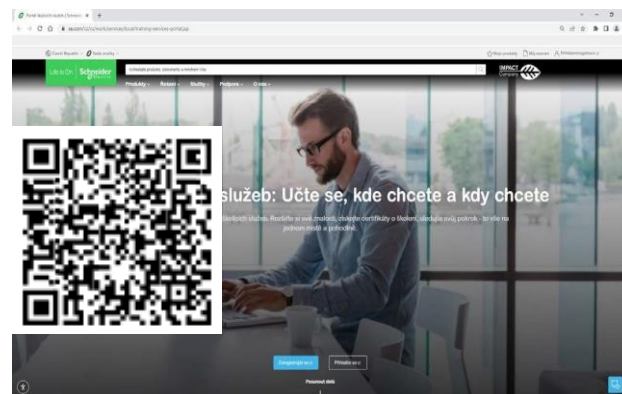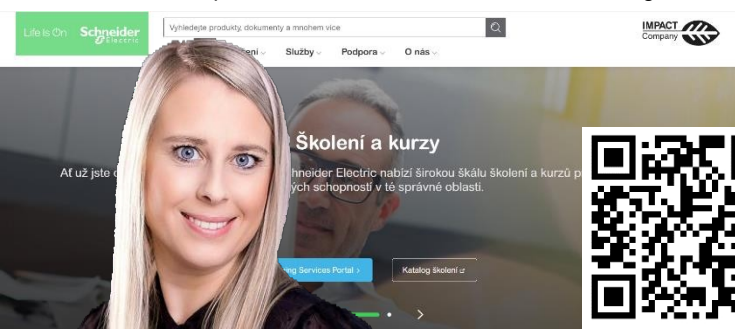Decide for yourself where and when you want to acquire new knowledge

Follow news about the our offerings

Get a digital certificate for each course you complete

Course catalog:

https://www.se.com/cz/cs/work/services/training/

"Our knowledge for your growth."

Zdeňka, training center