

Digital Twins in Power Systems

Nils Weber, 01 July 2026



CURRENT

Enabling Network Technology
throughout Europe

Agenda

High Level Introduction

25 min

- What is a Digital Twin – VDE & ENTSO-E
- Why are Digital Twins required?
- Legal and regulatory aspects
- Legacy Data & Digital Twin Factory
- High Level summary

Technical Deeper Dive

35 min

- Scan-to-BIM vs. Scan-to-TWIN
- Example Use Cases across the Asset Lifecycle
- Recommendations for action
- Deeper Dive summary

Questions and Answers

30 mins



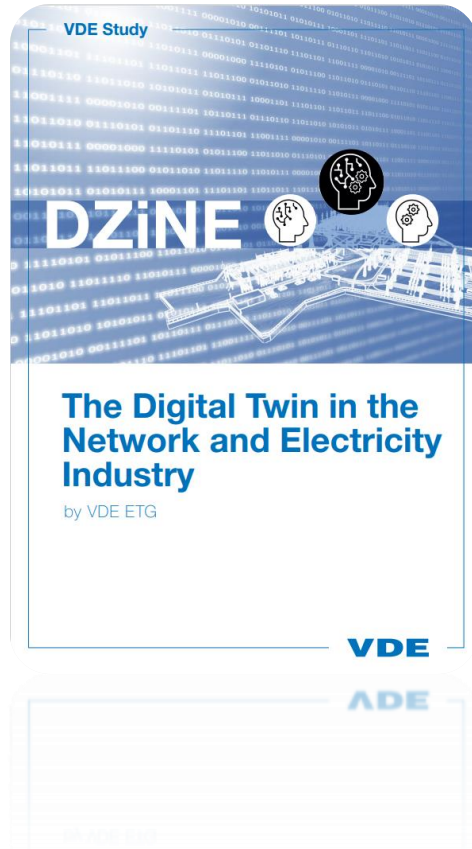
What is your experience level with Digital Twins?

The Slido app must be installed on every computer you're presenting from



In which asset lifecycle phase do you think Digital Twins could provide the most value?

Digital Twin – VDE Study



Organizations

VDE ETG

 **Fraunhofer**

Utilities

EWEnetz

TRÄNSNET BW

 **amprion**
verbindet

RNG Rheinische
NETZGesellschaft

Contractors

SIEMENS

 **DB**
DB Engineering & Consulting

SIEMENS
energy

Universities

 **TECHNISCHE UNIVERSITÄT**
ILMENAU

tu technische universität
dortmund

Fachhochschule
Südwestfalen
University of Applied Sciences

 **BERGISCHE**
UNIVERSITÄT
WUPPERTAL

 **FRIEDRICH-ALEXANDER-UNIVERSITÄT**
ERLANGEN-NÜRNBERG

RWTHAACHEN
UNIVERSITY

R
P **TU** Rheinland-Pfälzische
Technische Universität
Kaiserslautern
Landau

Consultancies

Capgemini

 **ePLAN**

entegraAG

 **MR**

PSI
GridConnect

VENIOS

Digital Twin – ENTSO-E

Digital Twins – Towards a Federated Approach

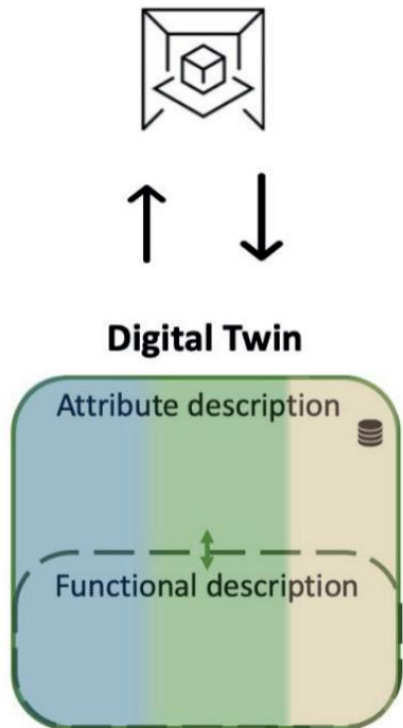
20 February 2026



Elia Group



Definition from the VDE ETG Study



- is a virtual representation of an existing or to-be-created real object.
- has attributes and a **functional** description.
- covers **at least two domains** of the real object.
- reflects the real object with continuous control and high fidelity.
- is closely coupled to the real object via **communication infrastructure** (up to real-time synchronization).
- accompanies the real object throughout its **life cycles**.

What are (Federated) Digital Twins?

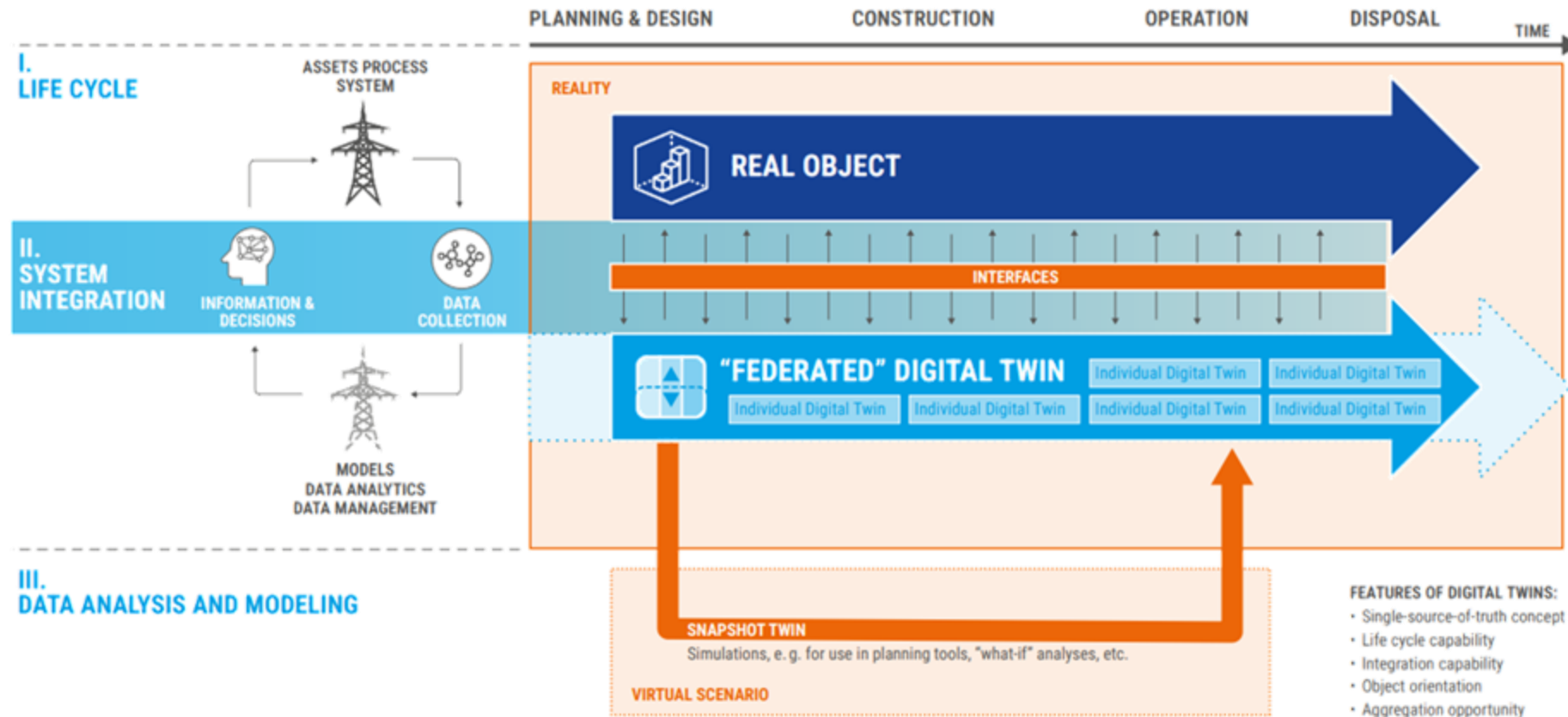


Figure 1: Overview of the digital twin concept. Source: [VDE](#)

Why are Digital Twins required?



Skilled-Labour Shortage



Energy System transformation



Cost efficiency

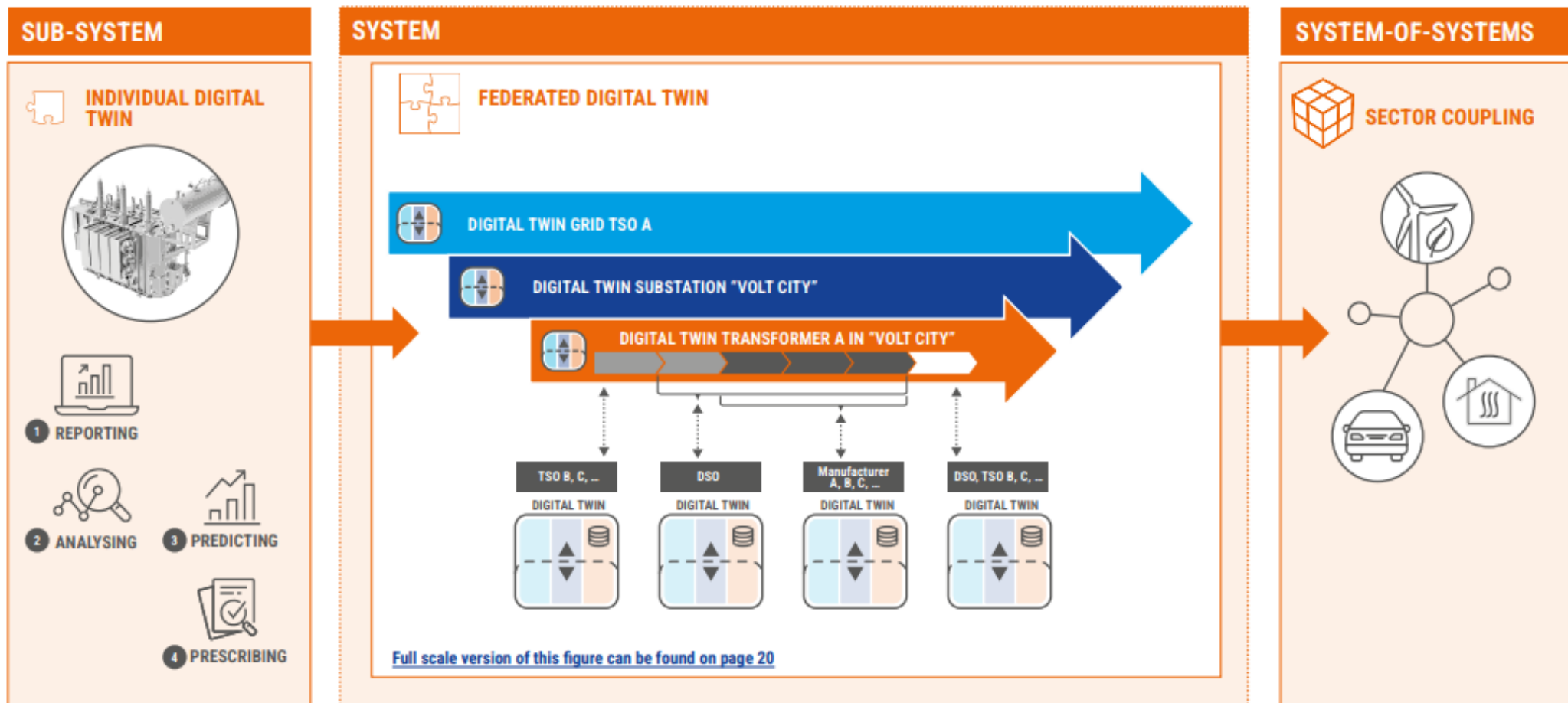


Digital Paradox

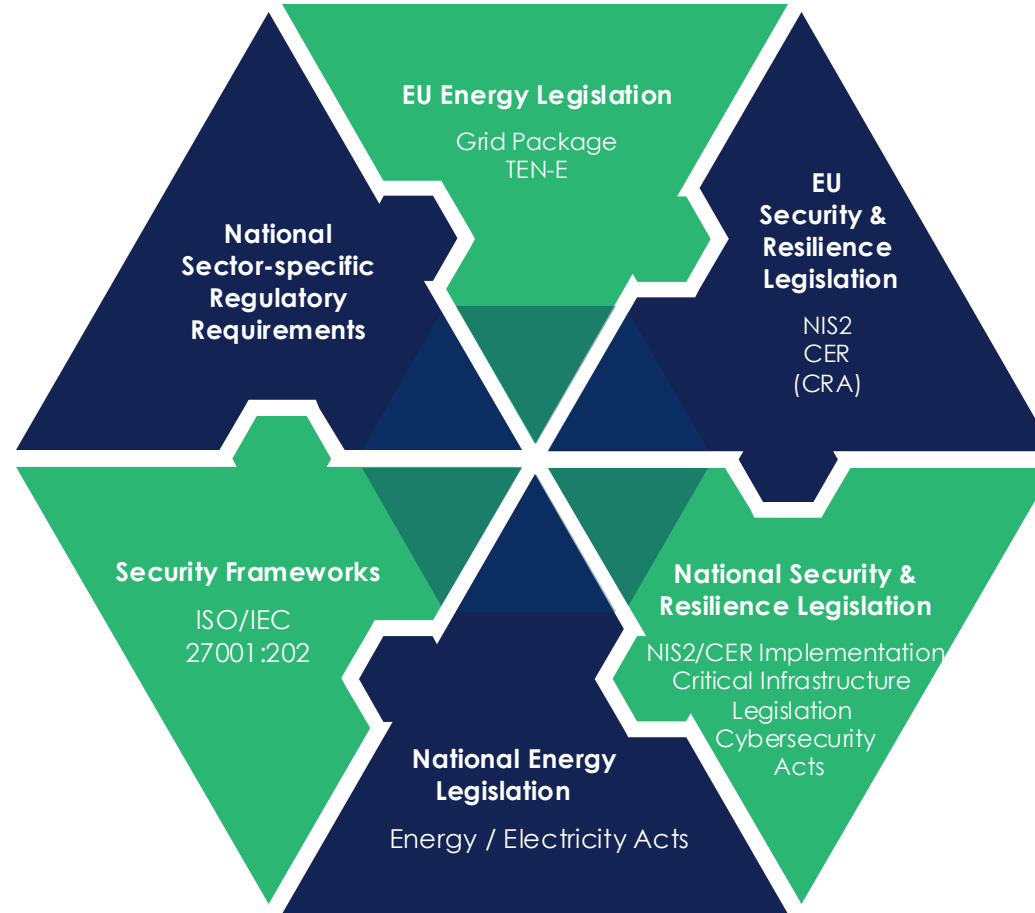


EU Grid Package!

Federated Digital Twins



Legal and regulatory aspects





How do you evaluate the data quality of design & asset data of substations

Digital Twin Factory



High Level Summary



Technological and organizational journey



Digital Twins are a business-critical integration layer



Base for future AI-applications and intelligent, automated operational management



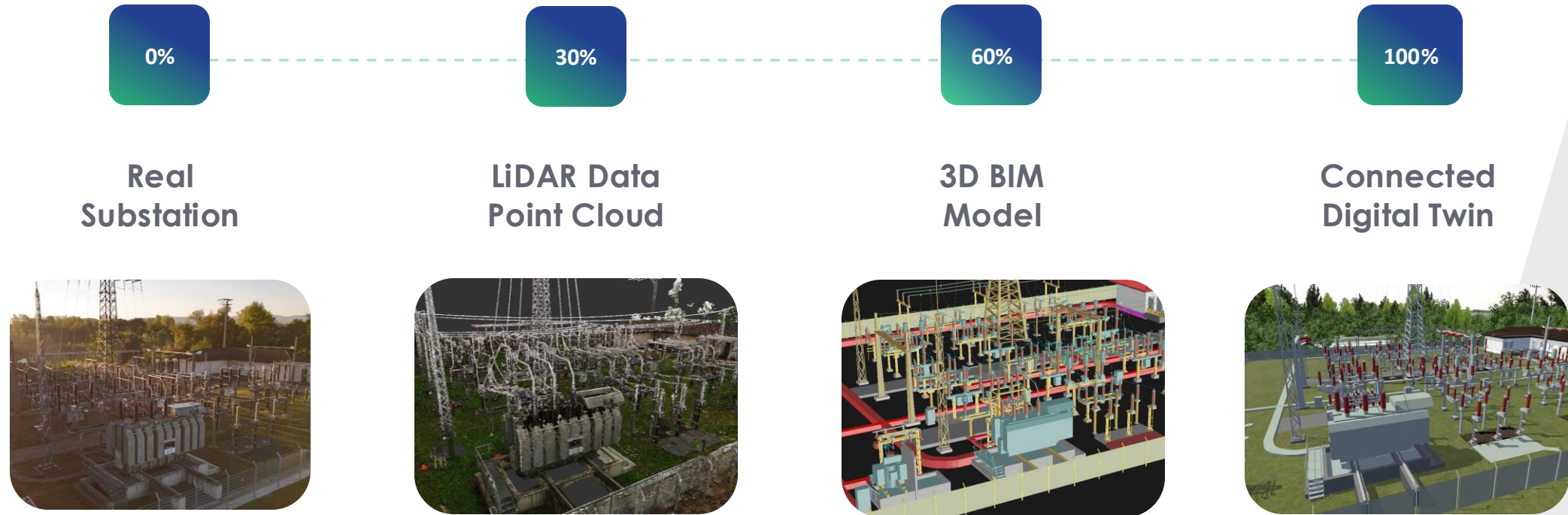
No out of the box solution but orchestra of solutions



Grid operators become System Integrators for Digital Twins

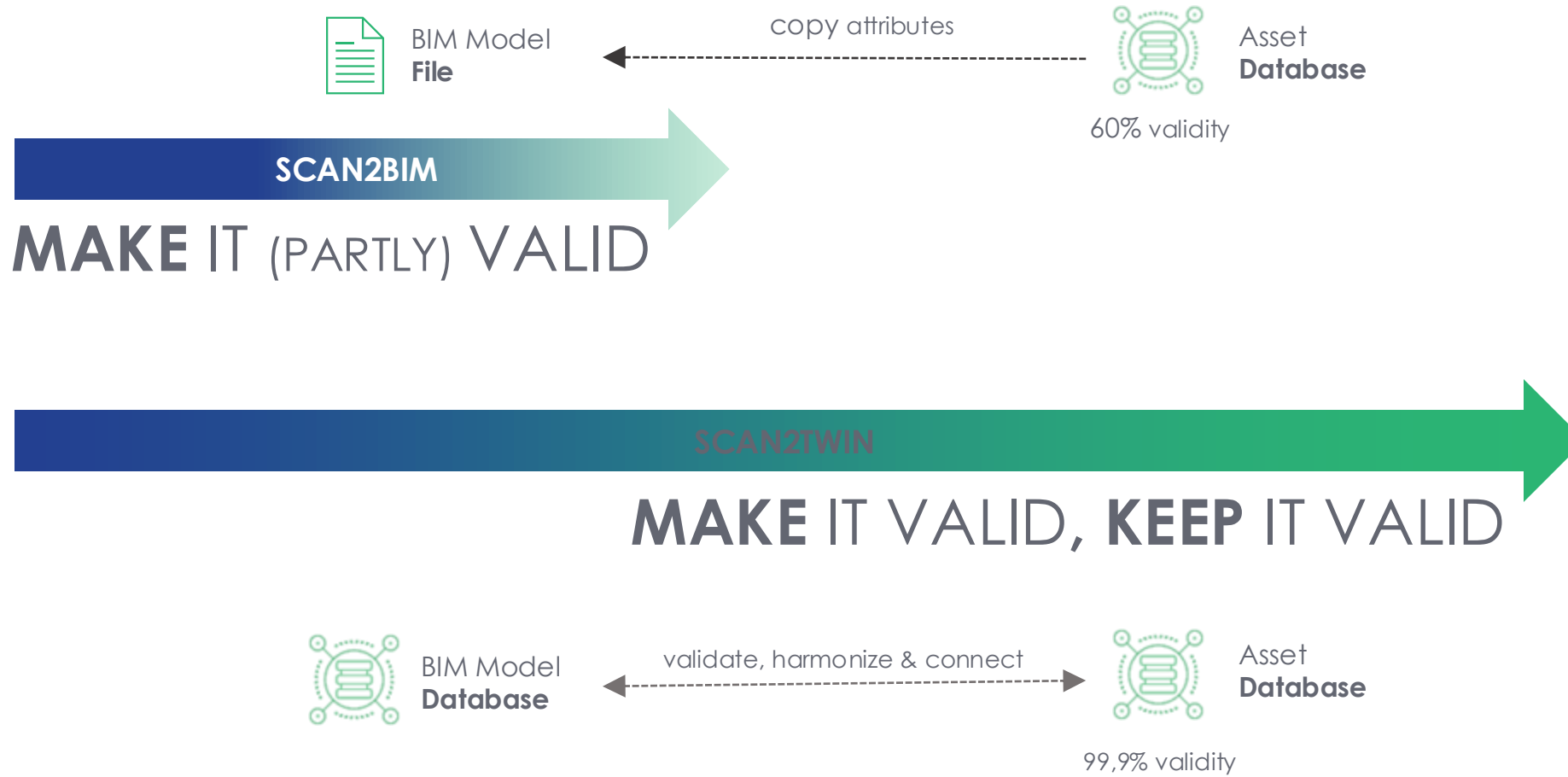
Technical Deep Dive

The Journey of Substation Digitalization



Scan2BIM vs. Scan2TWIN

Comparison of Digitalization Methods



Key Benefits of a Scan-to-BIM Model

Utility Perspective



Better Brownfield Tenders

- Better data quality improves bids
- Bid prices decrease up to 30% by lower risk margins



Cut of 4 Weeks Project Duration per Station

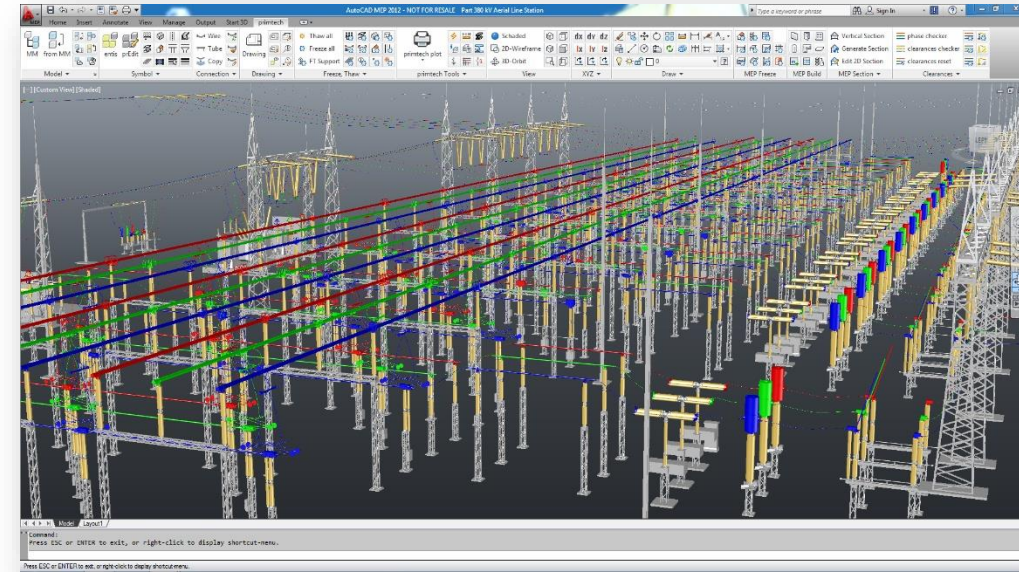
- Faster and standardized engineering workflows
- 4 weeks based on an average DSO 110kV site (*e.on Group*)



Less Change Orders

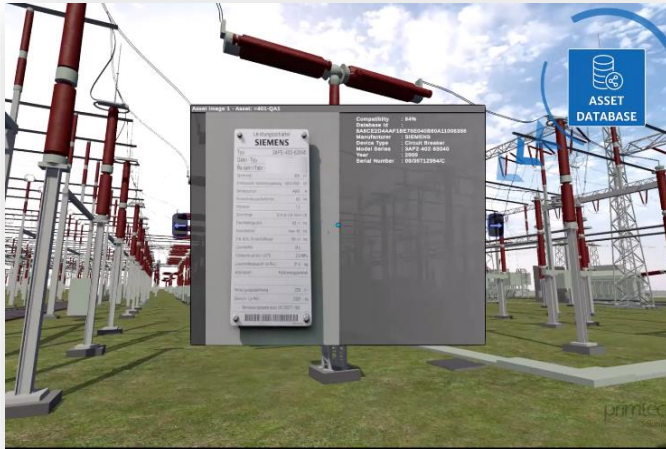
As-planned = as-build

- No unexpected design reviews during construction
- Design is closer to real site conditions



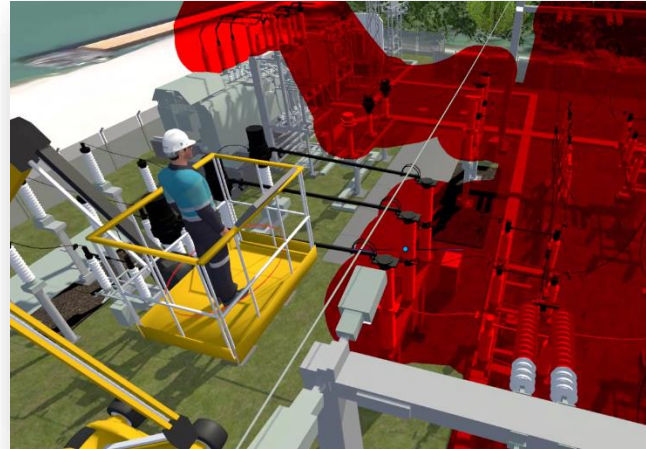
Benefits of a Connected Digital Twin

Utility Perspective



Single Source of Truth 4 everyone

- Easy access to relevant substation data
- Data is linked, not copied
→ increased trust
- No expert knowledge needed



Work Prep & Safety Training

- Better remote visibility to prepare onsite interventions
- Configurable safety trainings derived from the BIM models
- Stakeholder presentation & guided tours



Simulation Capabilities

- Electrical intelligence: power flow and switching simulations
- Brownfield feasibility studies
- Operability check in VR during design stage

Example Use Cases



Selected Use-Cases

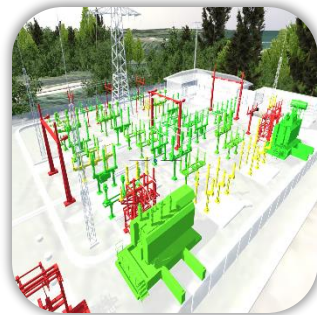
primtech
Solutions



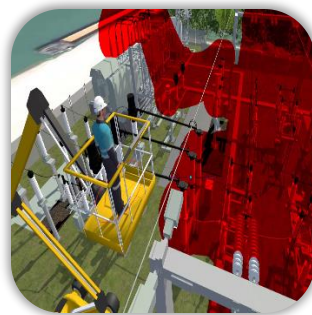
**Conceptual
Design**



**As-Build
verification**



**BIM
Collaboration
Workflow**



**VR
Safety Training**

TR̄ANSNET BW

 **amprion**



**Stakeholder
Communication**

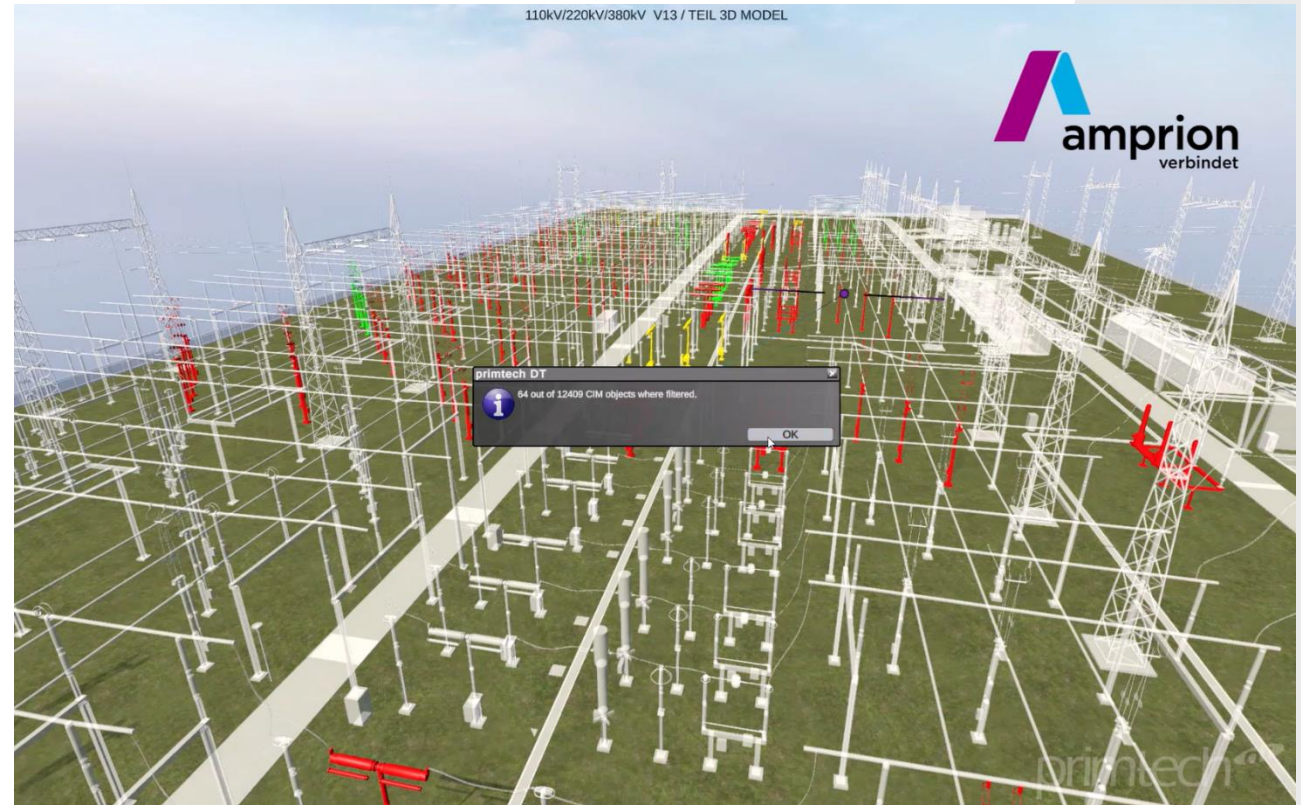


**Electrical
Simulations &
CIM Asset
Management**

Simulation & CIM Asset Management

Feature description:

- Connect Asset Management with substation engineering database
- Break down silos and keep models up to data
- CIM supported data structure
- Filter and visualizes CIM data live in VR for spatial representation

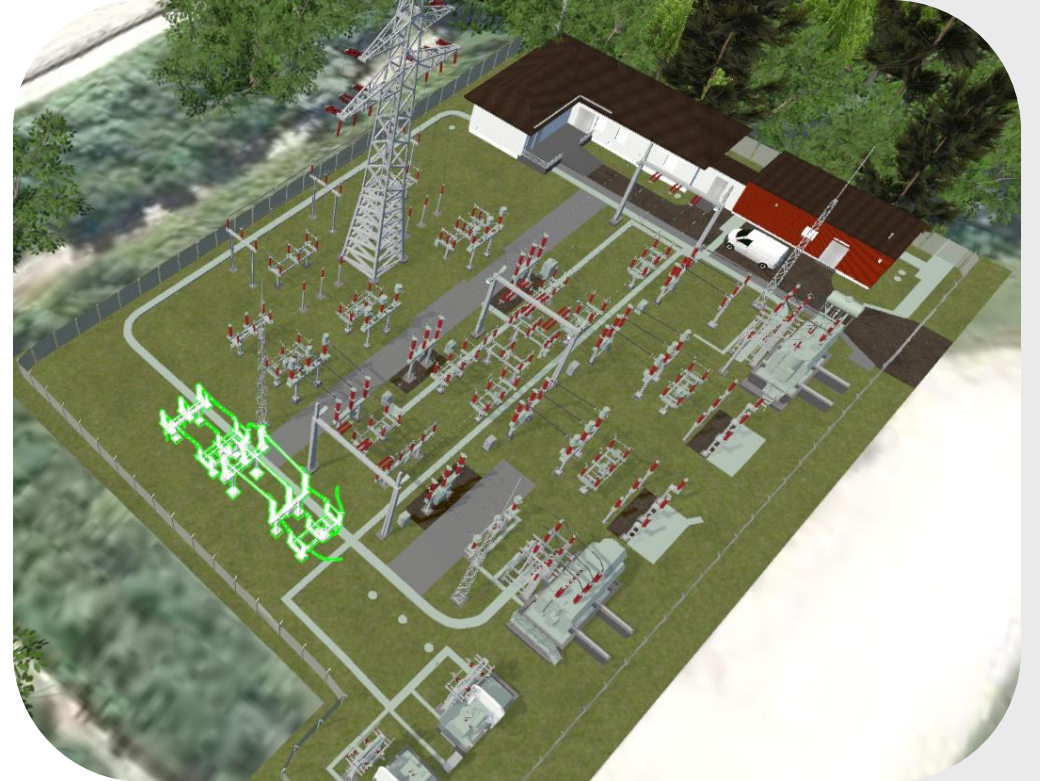




Conceptual Design in the Digital Twin

Feature description:

- Enable non-CAD users to do conceptual design in VR
- Digital end-to-end Workflow without media breaks
- Libraries and templates available
- Green & Brownfield capabilities



Conceptual design in the Digital Twin



As-built Verification

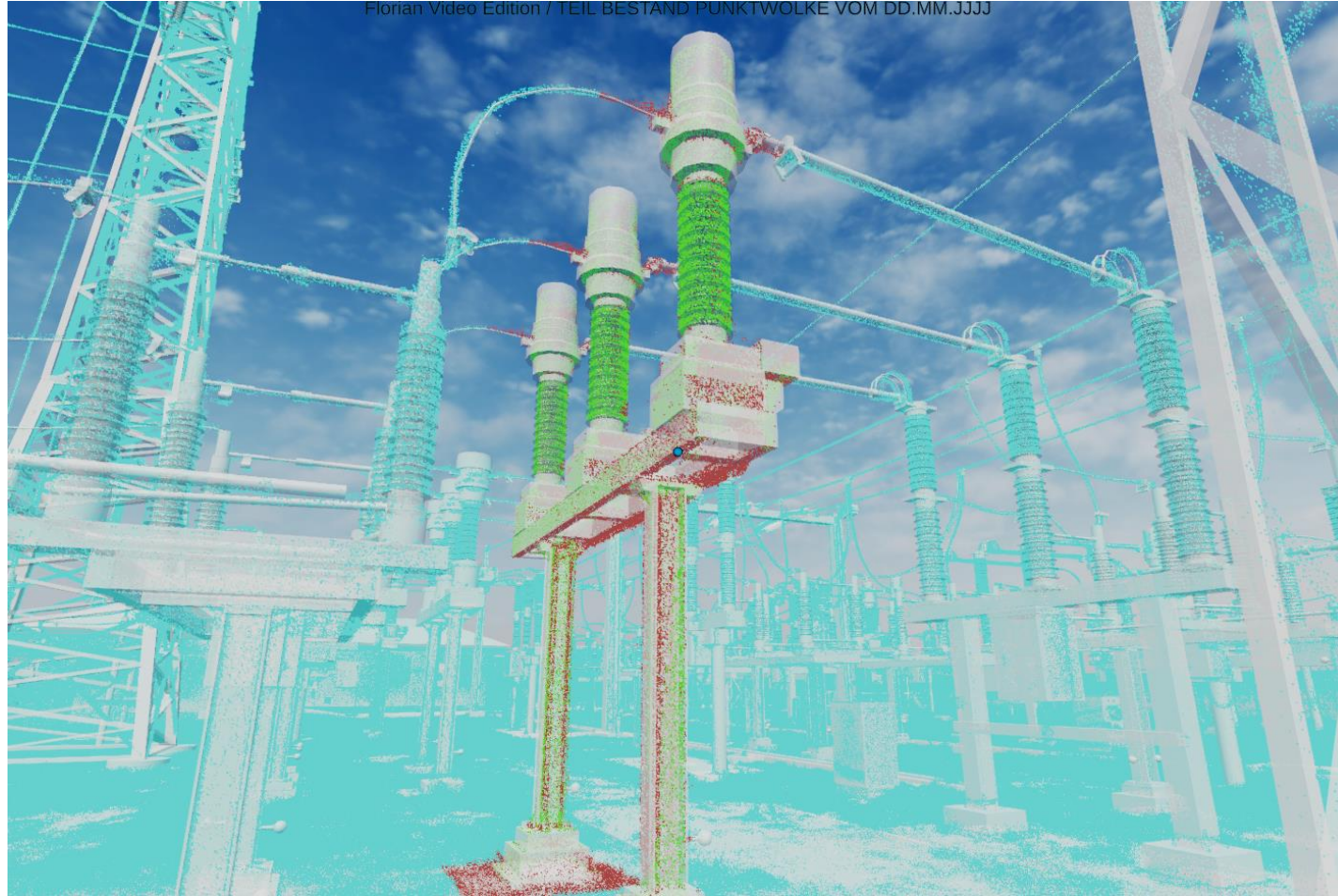
Feature description:

- Compare construction against model with 3D point clouds
- Identify compliance issues
- Use the BCA (BIM Collaboration Assistant) to manage issues
- For greenfield and brownfield projects

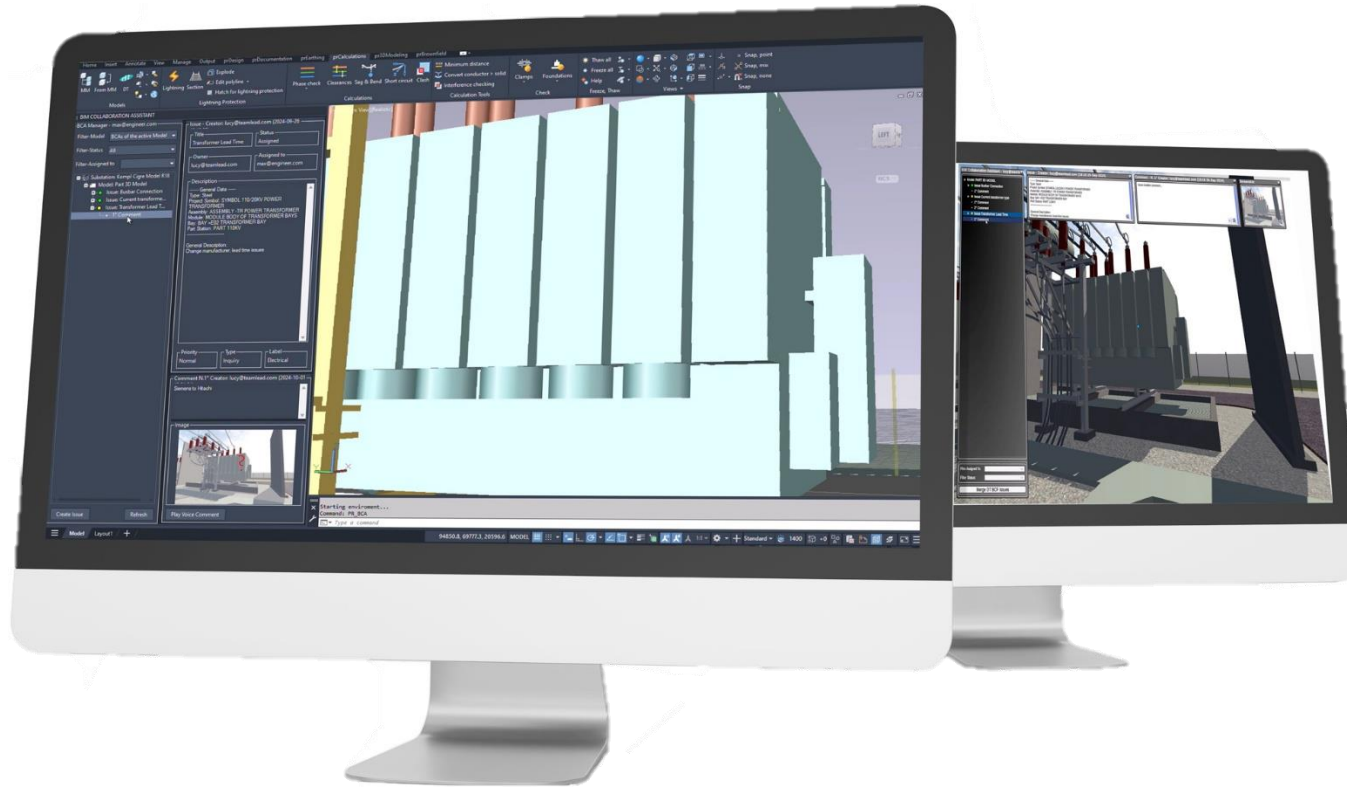


As-built Verification - Automation

Outlook



BIM Collaboration Workflow



Feature description:

- Design review in modern 3D VR environment
- Collaboration & Issue Management between software
- Open BIM standard BCF (BIM Collaboration Format)
- Clear responsibility assignment and tracking
- Replaces traditional redlining processes

Stakeholder Communication

Feature description:

- Decorate the substation with terrain, vegetation, cars, people, ...
- Create guided tours in VR with POI and action elements
- Present substation to non-technical experts (neighbors, politicians, regulators, ...)
- Reduce construction project objections



Stakeholder Communication

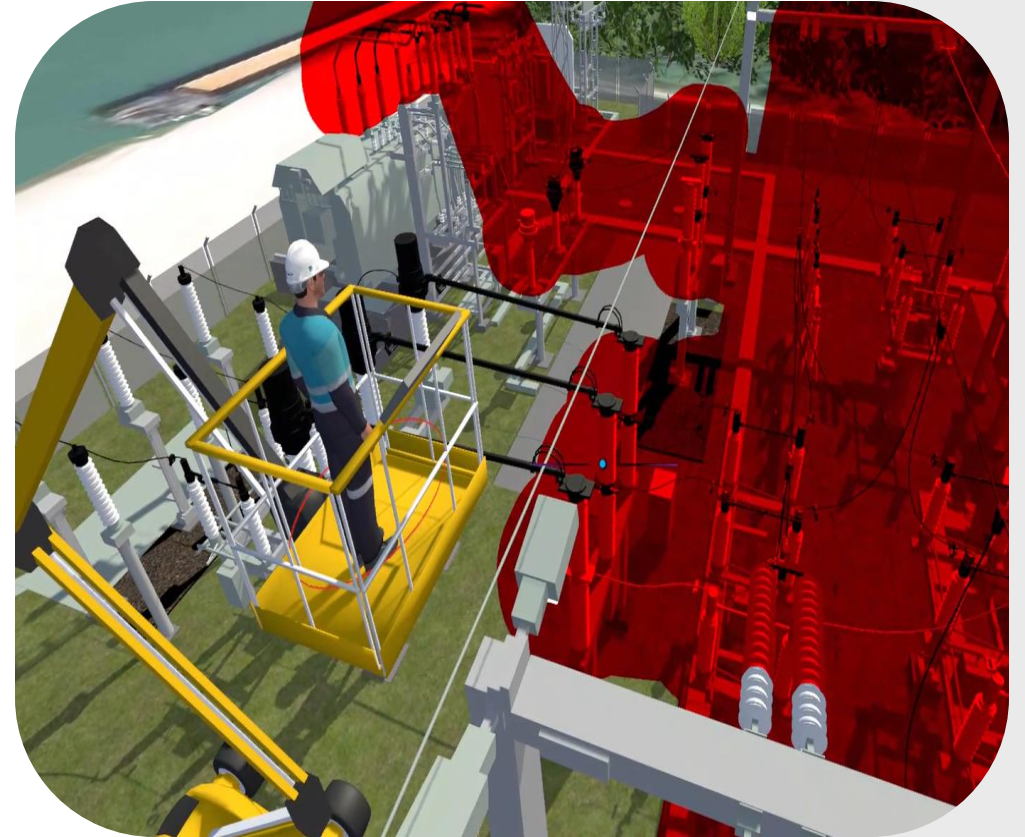


Safety Training and Simulations

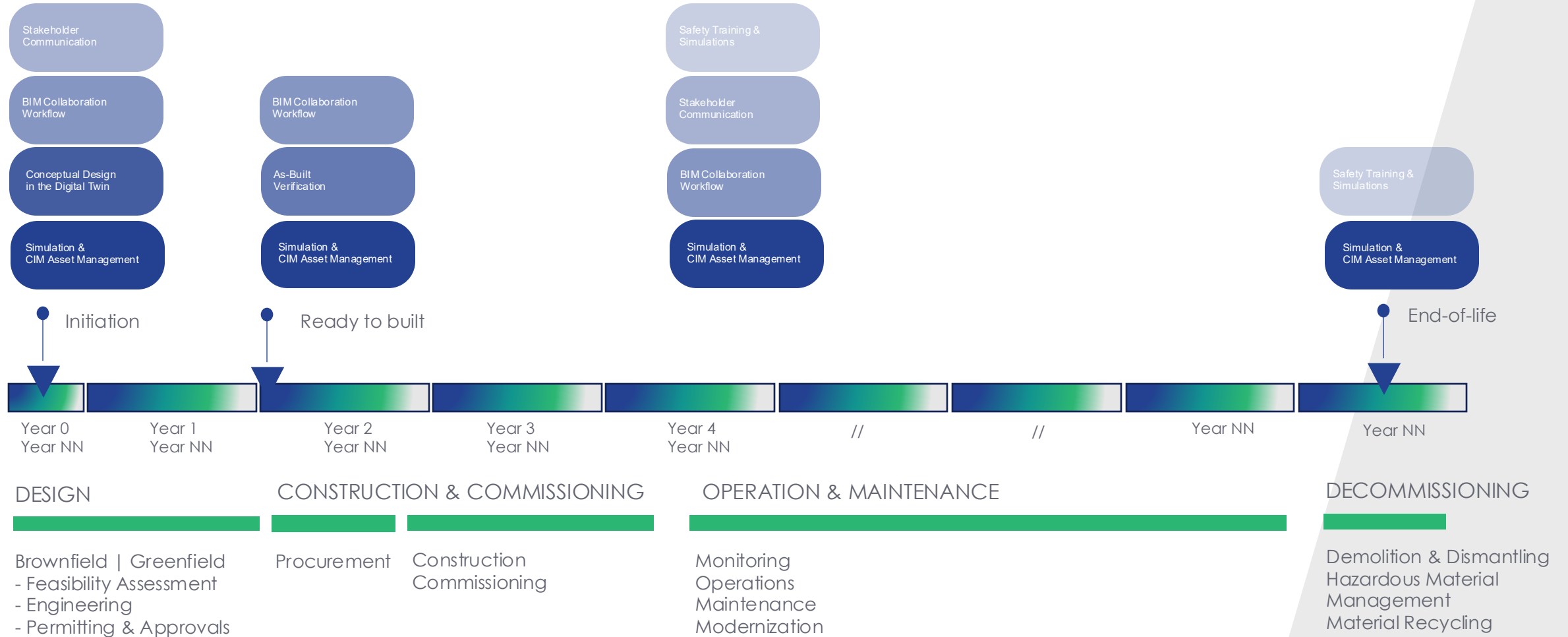
Outlook

Feature description:

- Create and configure training procedures
- Integrate switchgear panels with functionality
- Train on-site situations and pass the training
- Get on Personal Protective Equipment (PPE)
- Simulate dangerous zones based on switching scenario



Use Cases in a Life-Cycle



Legal and regulatory aspects

Digital Twin / SSOT

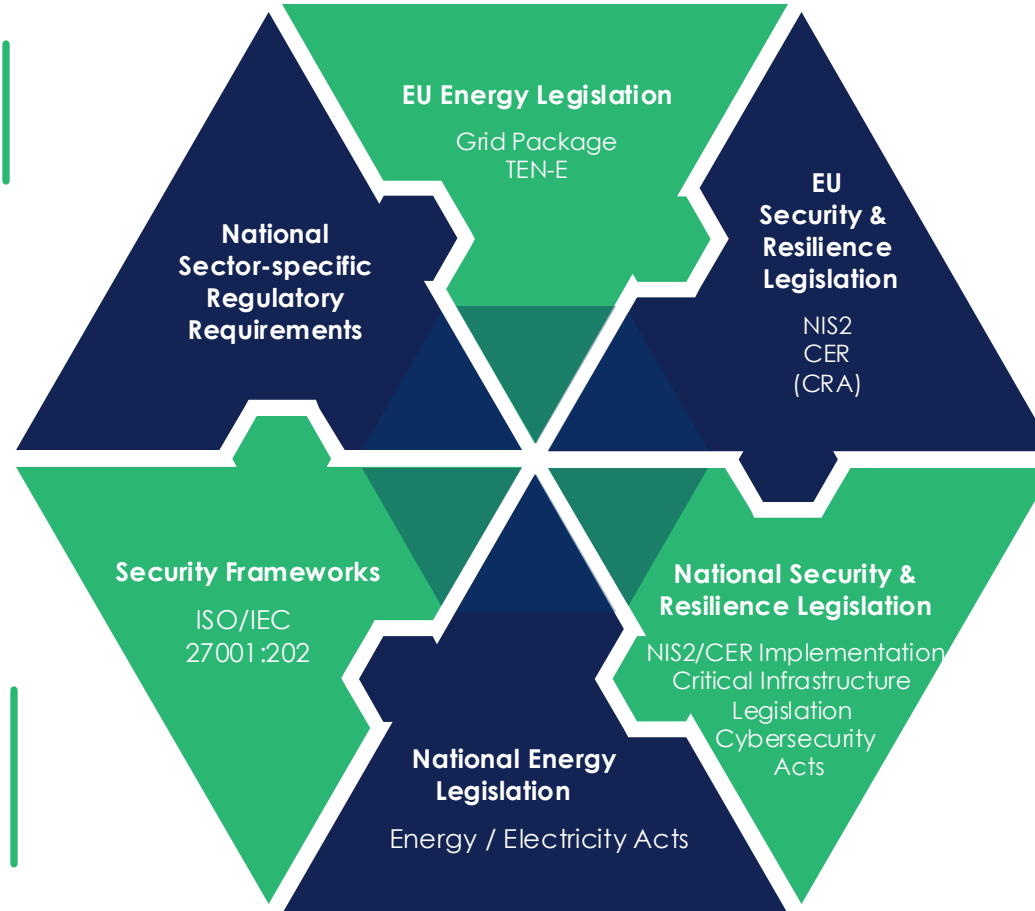
Consistent foundation for scenario analyses, risk and resilience processes
All-hazards approach

Physical Security

Visualization of protection against physical and environmental hazards in the BIM model
Planning support

Crisis Management / Emergency Planning

Rapid provision of asset-related information for authorities and emergency response centers



Single Source of Truth (SSoT)

Digital inventory of all assets and components for a consistent data basis (topologies, assets, scenarios)

Documentation & Lifecycle

Lifecycle documentation including brownfield/modification history
"State of the art"

Inspection & Audit Documentation

Tamper-proof history, export for ISMS, BSI and auditors

Recommendations for action



Collaboration of Digital System

- Break down silos
- Single Source of Truth
- Digital Data inventory



Develop use-cases driven not technological driven



Prioritization use cases and define migration path



Creating Acceptance

Questions and Discussion

END
