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SUSTAINABLE PLACES 2023

D2EPC

Digitisation of building operations and integration in the energy performance certification process: the D^2EPC framework

Nikos Katsaros
Research Associate

Centre for Research & Technology Hellas/Information Technologies Institute

nkatsaros@iti.gr

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D2EPC

Main highlights

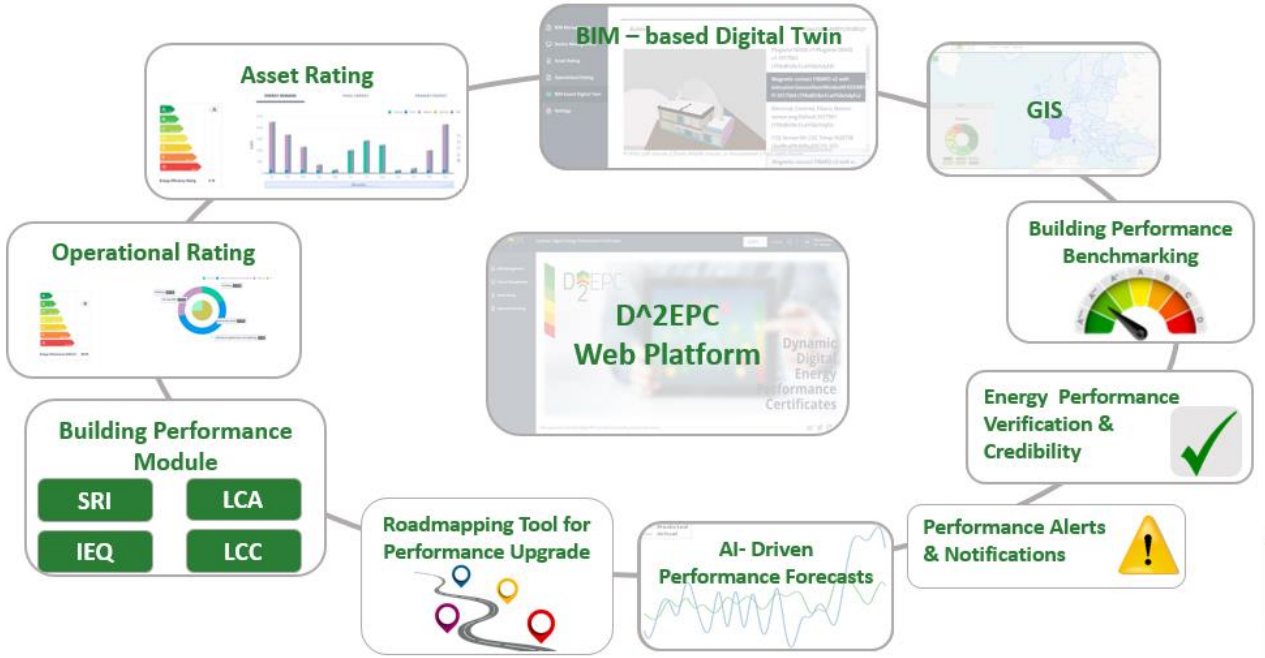
- D^2EPC in a nutshell
- The BIM-oriented and digital twin-enabled approach
- The real-data EPC calculation
- The enhancement of the EPC through the introduction of various building performance indicators
- The holistic digital solution for dynamic issuance of the next generation EPCs and the provision of added value services & tools

D^2EPC Objectives

- The introduction and establishment of the concept of the **dynamic EPC** (dEPC), an **operational certificate** to be **calculated** and **issued** on a **regular** basis.
- The definition of the **drawbacks** and **discrepancies** of the current EPC scheme, as well as the update of EU standards on the **classification** requirements of **buildings.**
- The **enhancement** of EPCs through a **novel set of indicators** which cover **environmental**, **financial**, **human** comfort and technical aspects of **new** and **existing** buildings, aiming to simplify the understanding of buildings energy performance and to present a more comprehensive overview of the **actual energy performance** of buildings.
- The integration of **actual operational data** from buildings into **the EPCs.**
- The integration of **smart readiness rationale** into the building's **energy performance assessment** and **certification.**
- Intelligent **operational digital platform** for dynamic **EPCs issuance** and actual **building performance monitoring** and improvement, **validated** and **demonstrated** under realistic conditions.

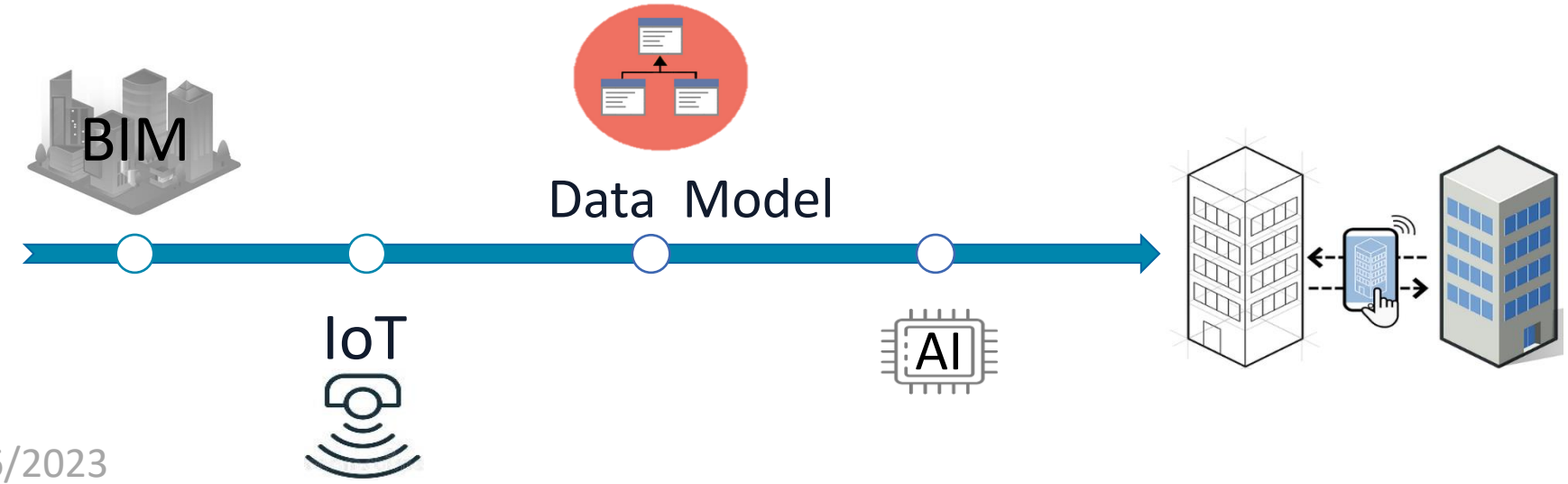
D^2EPC at a glance

- Building Documentation
  - BIM / IoT / Web APIs
- BIM-based **Digital Twin**
  - Near real time asset monitoring
  - Building info integration
- Enhanced multi-parameter assessment
  - **As-designed/ As-Operated** energy rating
  - Extended KPIs (**smartness, sustainability, human comfort, financial**)
- Improved **AI-driven** assessment recommendations and added-value services
- Delivery of **Dynamic Energy Performance Certificates**
  - Infrastructure and operational classification for buildings
  - Added value district/ neighborhood information through **GIS**

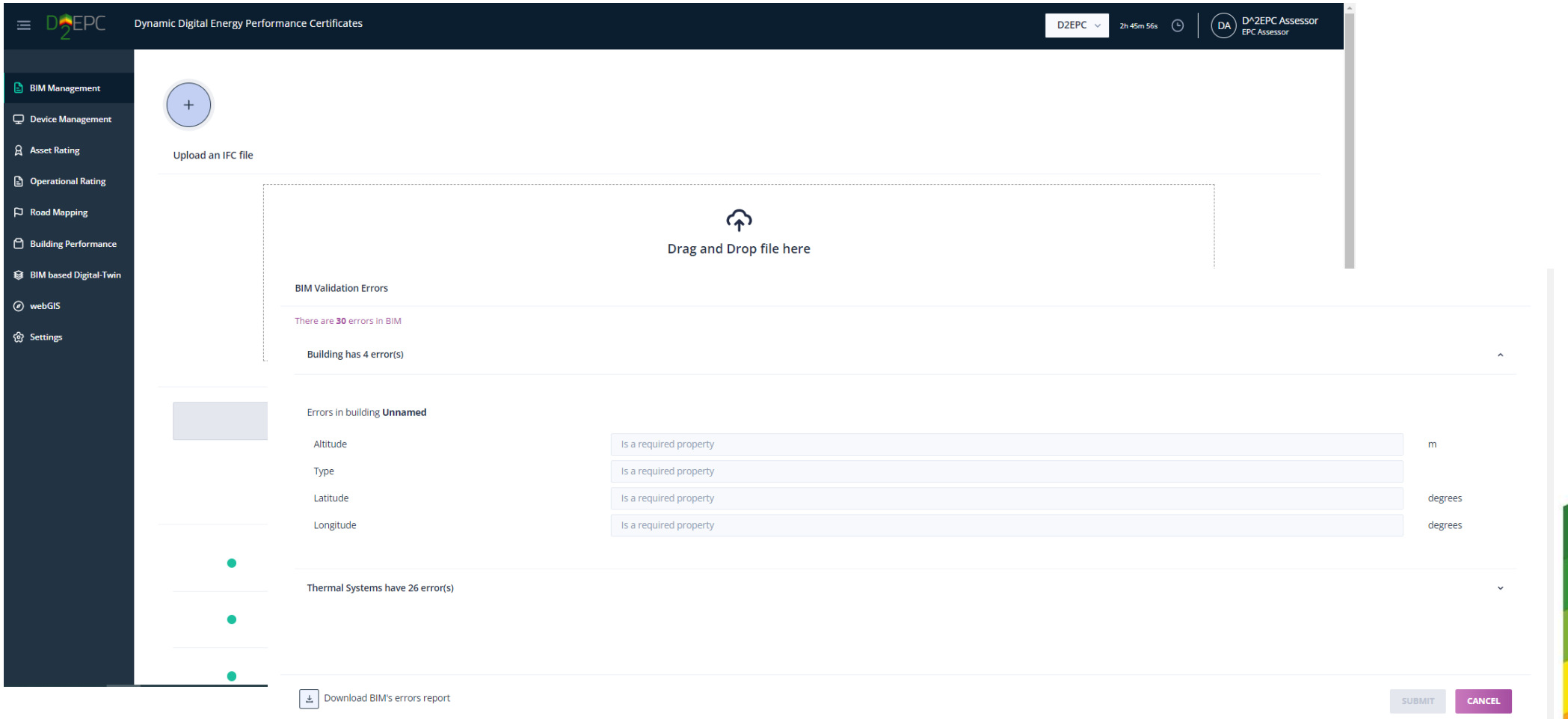


BIM-centric information extraction

- The **D^2EPC solution** leverages the utilization of **BIM files** towards simplifing the EPC-related data collection
- The extracted information is semantically enriched to consider **additional attributes** as well as **real-time data streams** for building sensing and metering equipment, defining a new **building data model**
- Coupling the data model with energy performance simulation and AI-based functionalities forms the **Building Digital Twin**



From BIM to Digital Twin: The D^2EPC approach



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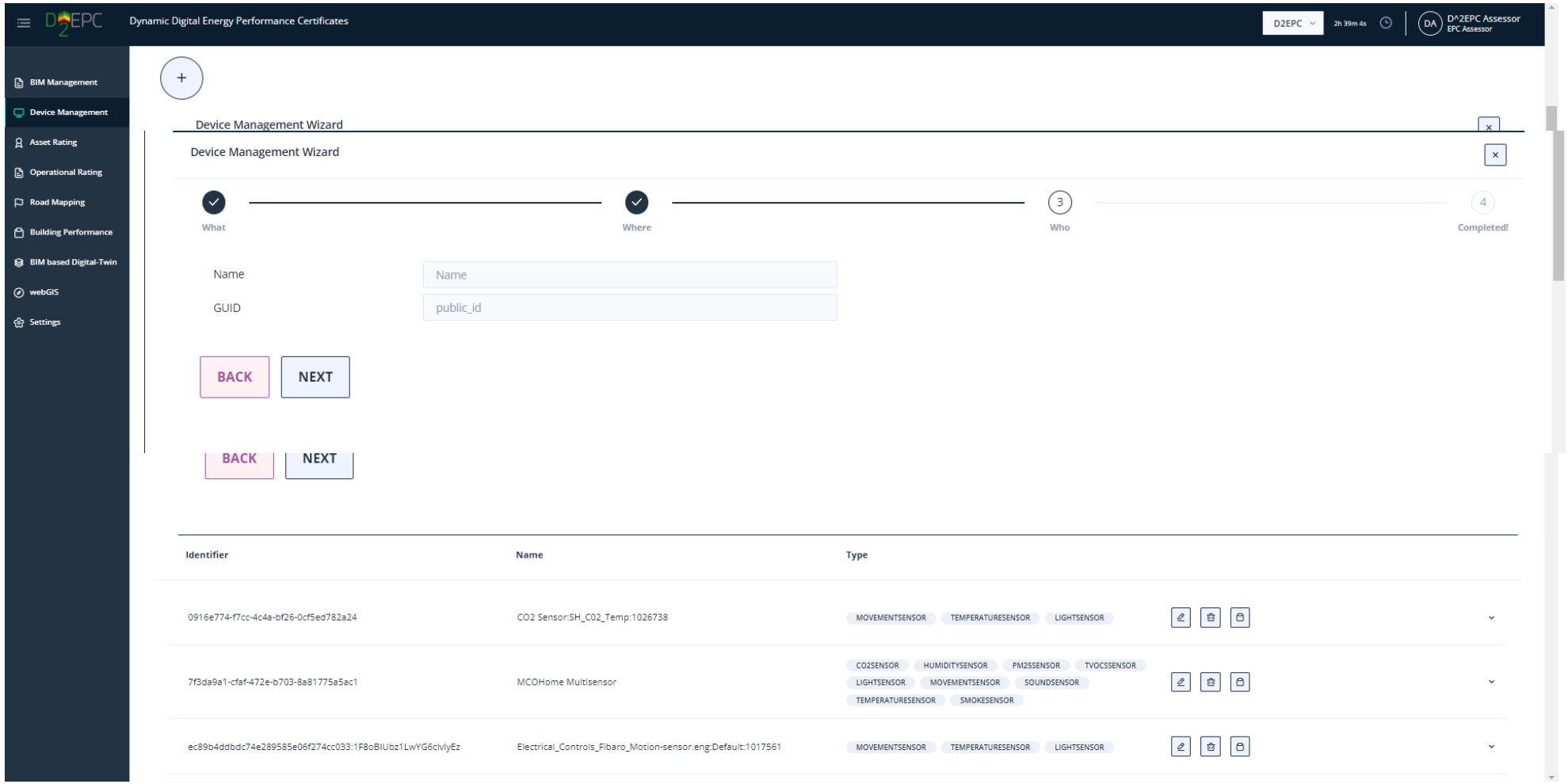

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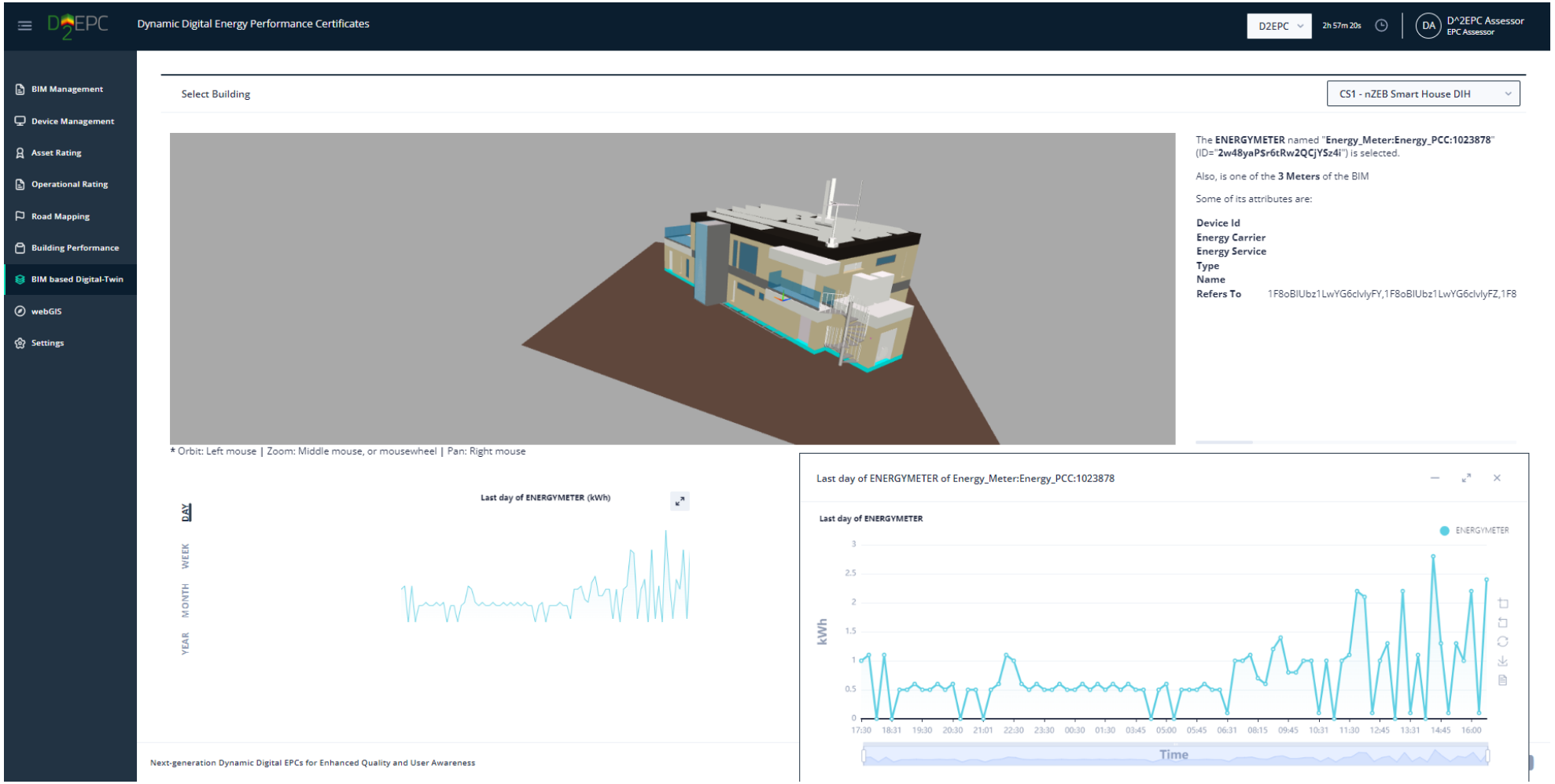
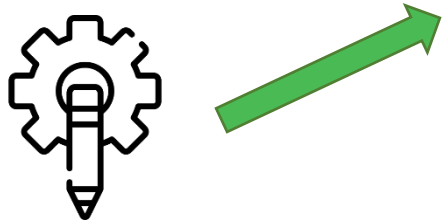


Asset & Operational Rating

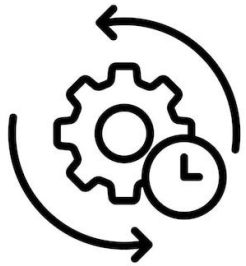
Asset Rating Module

- Based on the overarching standards:
  ISO 52000-1, 52003-1, 52010-1, 52016-1, 52018-1
- quasi-steady-state monthly calculation
  - Energy Demand → Delivered Energy → Primary Energy
- Energy performance comparison with Reference building
  - Adoption of national values

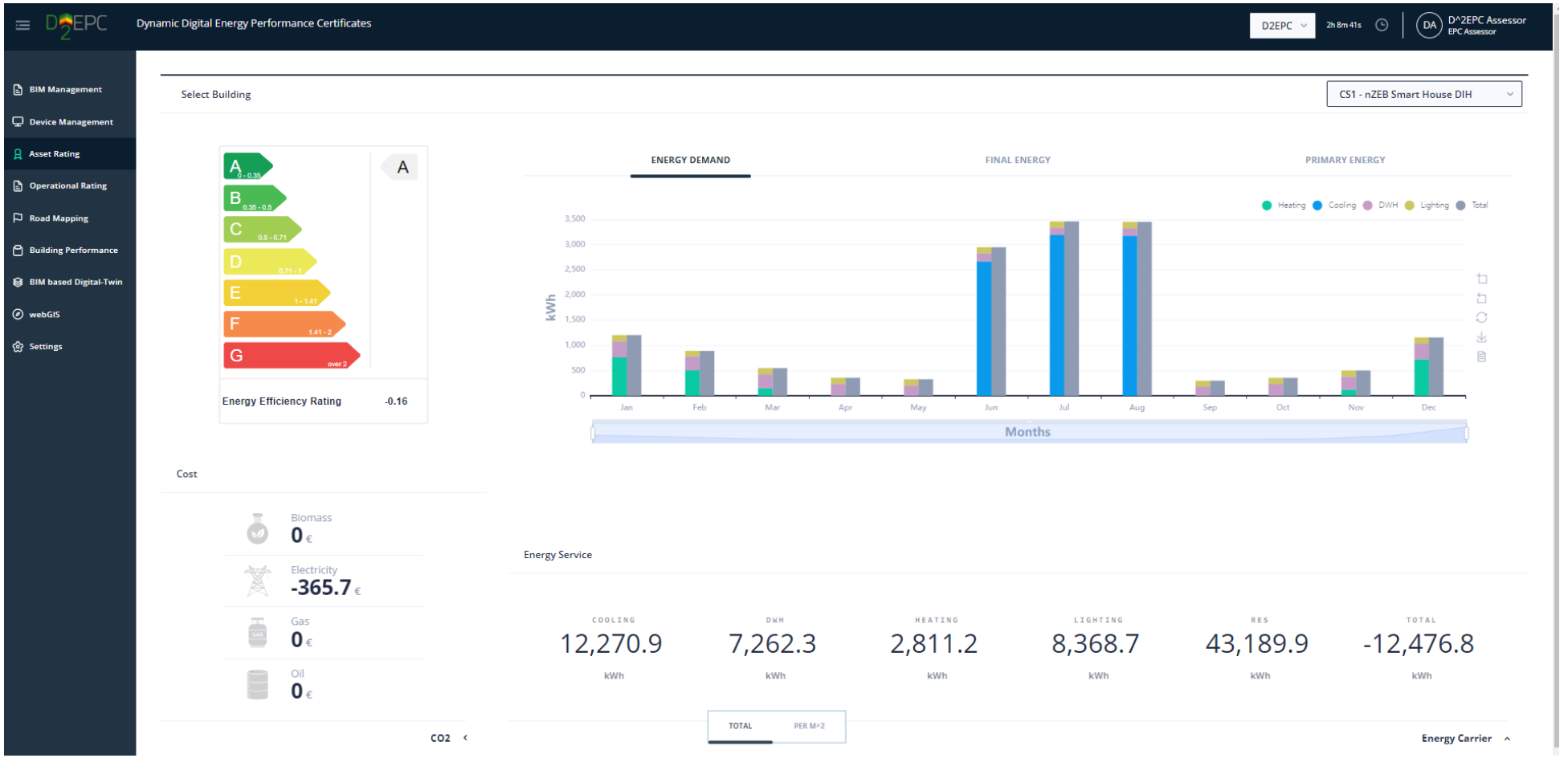


Operational Rating Module

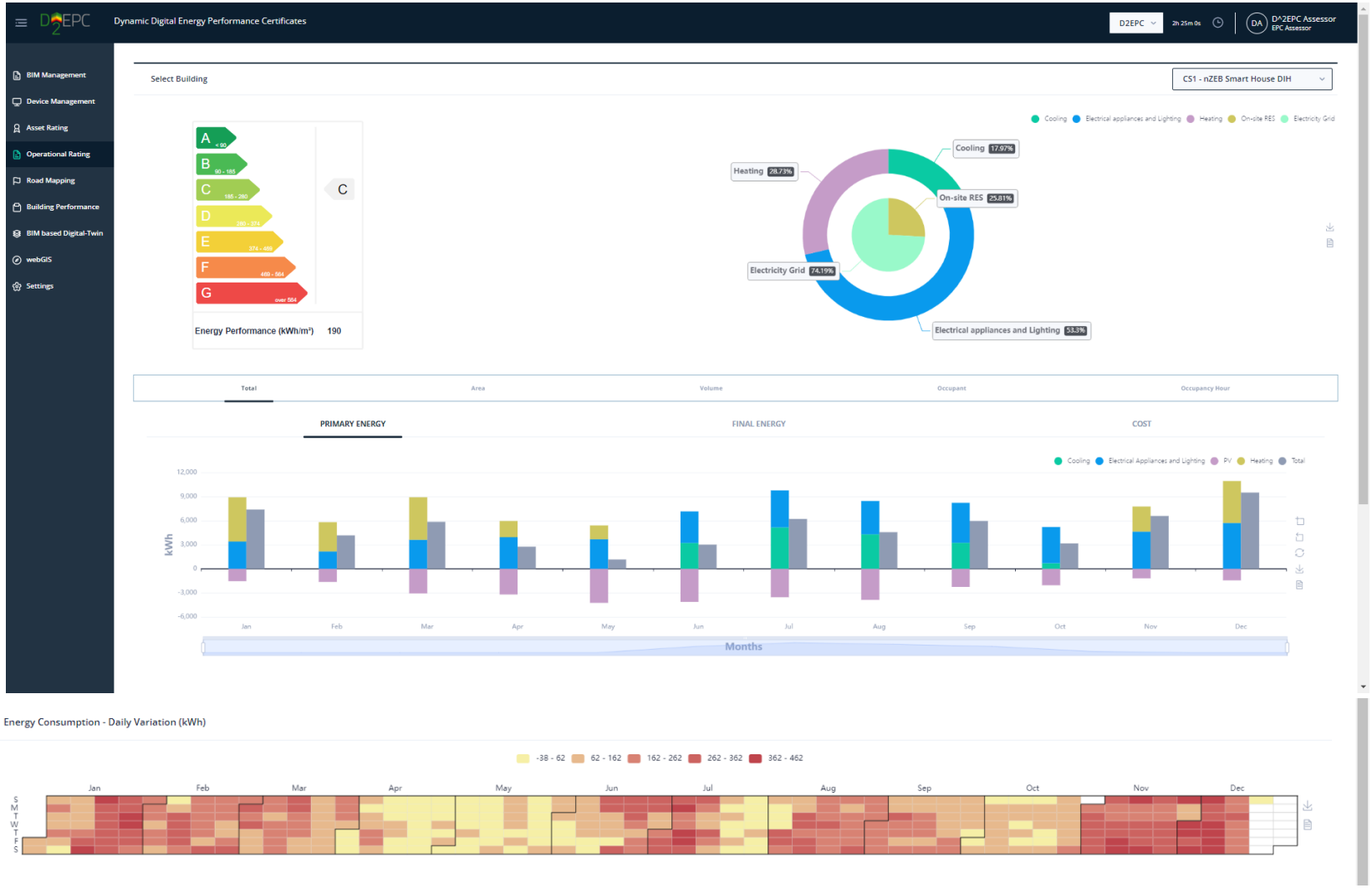
- Lack of a Common EU- based approach
  - ➢ D^2EPC proposed methodology
- Total indicators: 26
- Operational Rating Indicators:
  - Delivered Energy / Primary Energy
  - Cost (calculated)
  - CO_2 emissions
  - Energy Class [A-G]



Asset rating: BIM-based EPC assessment

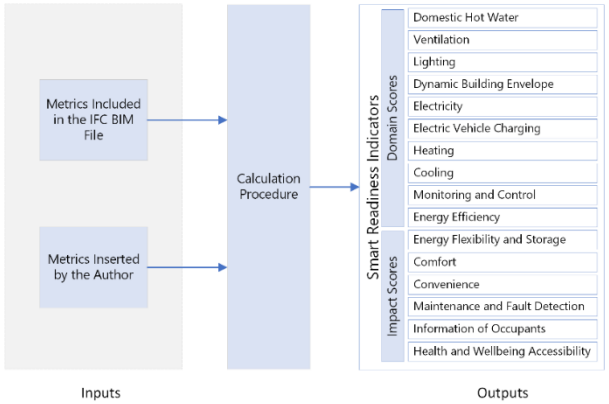


Operational rating: real data-based EPC assessment

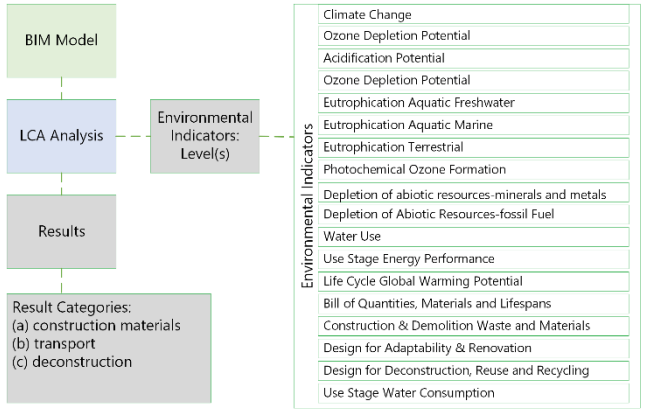


Enhancing the EPC: set of indicators

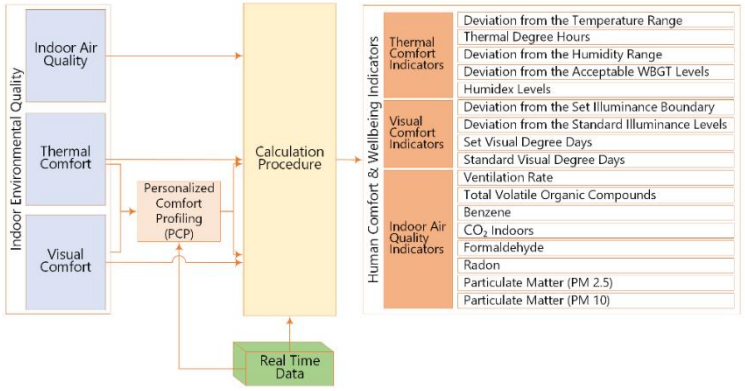
Smart Readiness Indicator



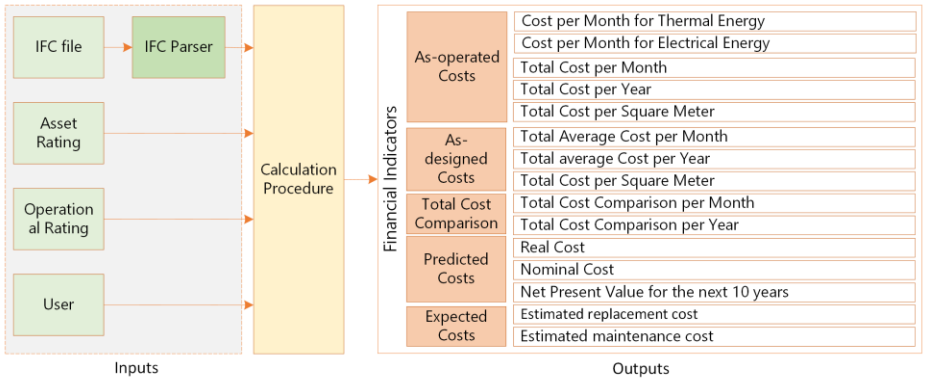
Life Cycle Assessment



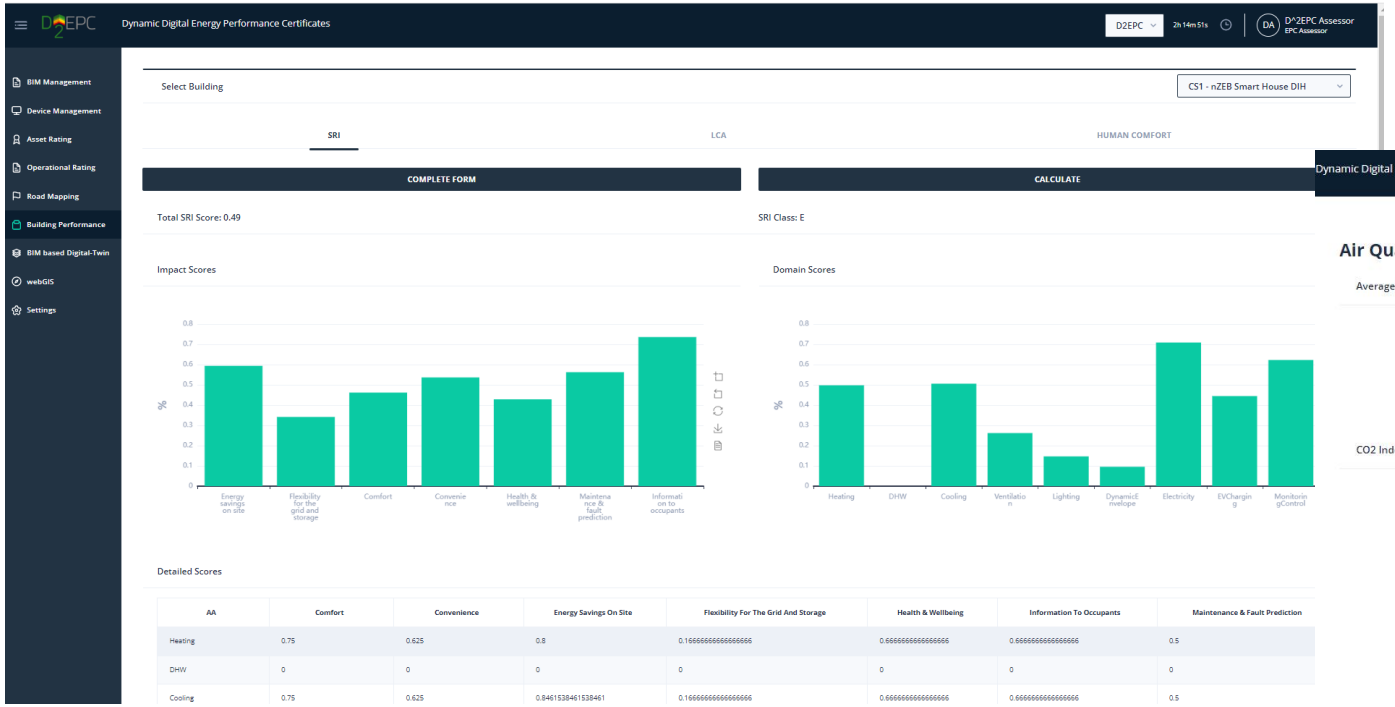
Indoor Environmental Quality

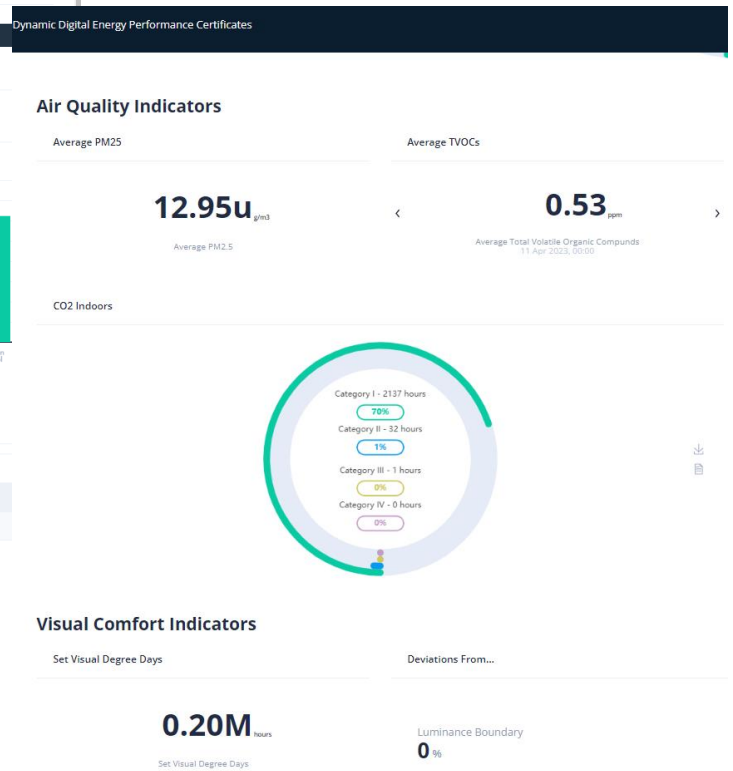


Life Cycle Cost



Enhancing the EPC: set of indicators





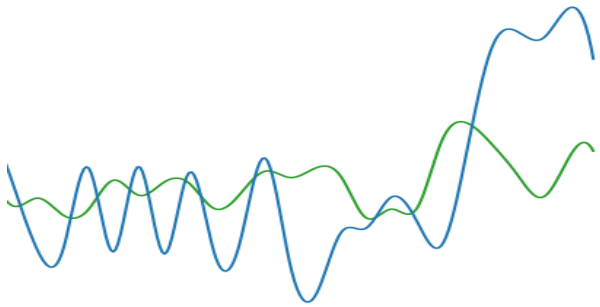
Enhancing the EPC: added-value services suite

Roadmapping Tool for Performance Upgrade

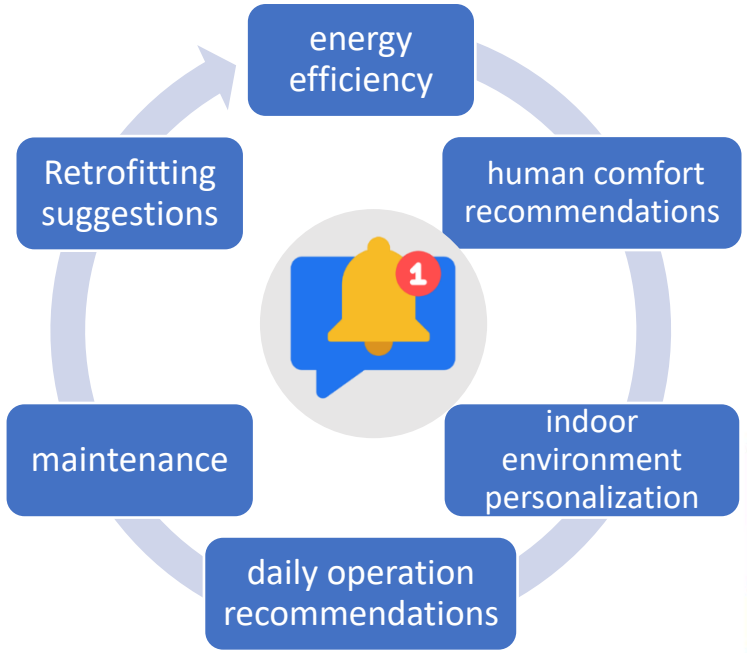
- Asset Diagnosis
  - Envelope
  - Technical Systems
- Multiple strategic scenarios generation
- Result: “Building Renovation Roadmap”

AI- Driven Performance Forecasts

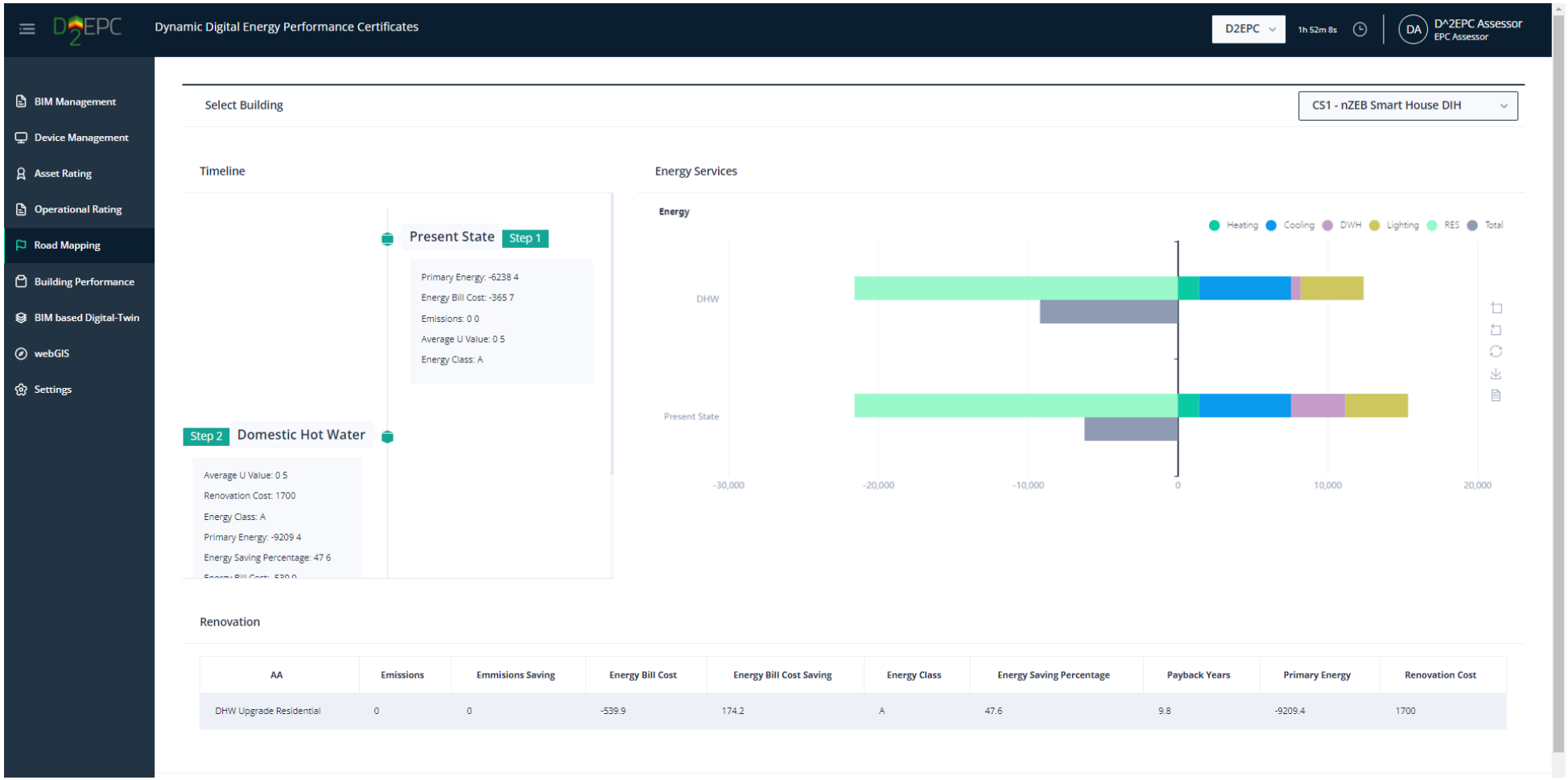
- Building long-term energy consumption forecasting
- Pattern identification
- Recommendations:
  - Energy efficiency
  - Human comfort



Performance Alerts & Notifications



Supporting the decision-making on building renovation: Roadmapping tool



Extended dEPCs Applications Toolkit

Building Performance Benchmarking

- Infrastructure and operational classification for buildings
- Percentile ranking within specified groups (e.g. location, building type)
- Insight extraction from D^2EPC certification results correlation
- Path indication for performance improvements

Energy Performance Verification & Credibility

- Data stream reliability insurance
  - series of quality checks
  - overall quality monitoring with a set of performance indicators
- Status monitoring of the deployed IoT infrastructure
- Alerting mechanism for device malfunctions or poor data quality
- Credibility user interface

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