FINAL RESULTS AND OUTCOMES OF THE PROJECT

D2EPC

NEXT-GENERATION DYNAMIC DIGITAL EPCS FOR ENHANCED QUALITY AND USER AWARENESS

D^2EPC

Start date: 01-09-2020
End date: 31-08-2023
Duration: 36 months

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This is the second brochure of the D^2EPC project. The first one, related to framework architecture can be found on project's website or through this **link**

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ABOUT

D^2EPC ambitiously aims to set the grounds for the next generation of dynamic Energy Performance Certificates (EPCs) for buildings.

The delivered framework sets its foundations on the smart-readiness level of the buildings and the corresponding data collection infrastructure and management systems. It is fed by operational data and adopts the 'digital twin' concept to advance Building Information Modelling, calculate a novel set of energy, environmental, financial, and human comfort/well-being indicators, and through them the EPC classification of the building in question. The additional indicators render dynamic EPCs a realistic, accurate, and comprehensive tool that can lead the transformation of the European building stock into zero-energy buildings and stimulate an energy-efficient behavioural change in the building occupants.

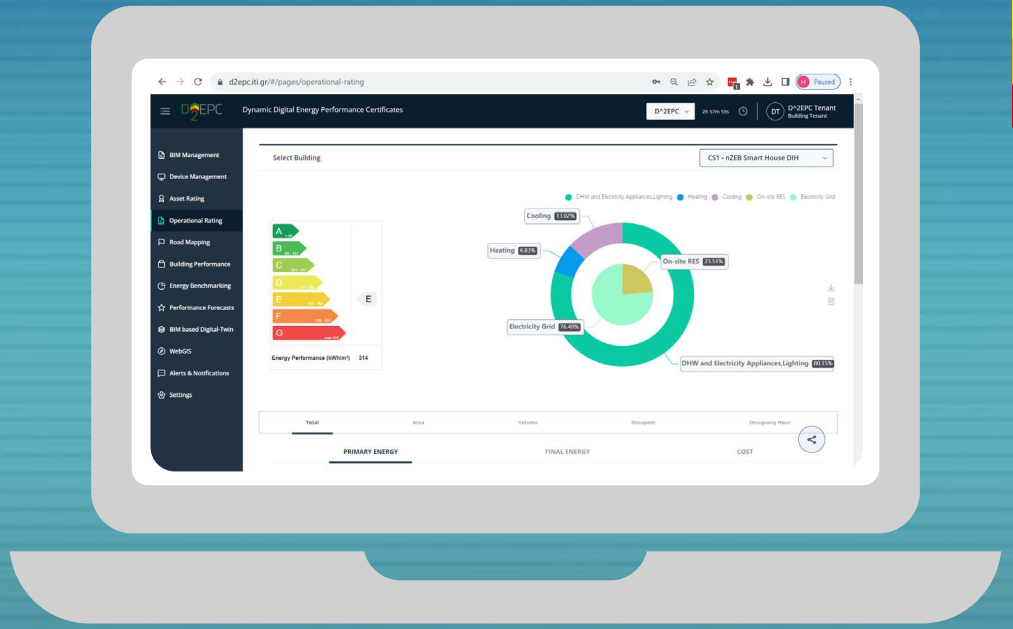
D^2EPC proposed a digital platform that enables the issuance and update of new EPCs on a regular basis, integrates a GIS environment, and provides, added value services including user-centred recommendations for energy renovation, benchmarking, and forecasting of buildings' performance as well as performance verification services.

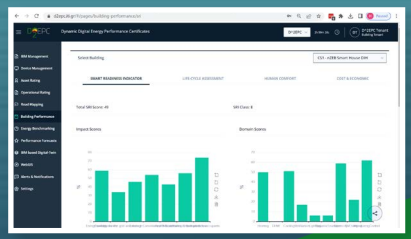
Within the D^2EPC project, an initiative was formed for the redefinition of EPC-related policies, namely by proposing a new standardization for the operational rating.

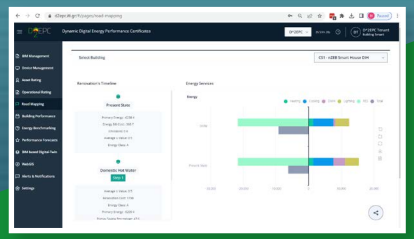
The D^2EPC framework was demonstrated in 6 sites, while its 12 partners coming from 7 European countries collaborated and provided their expertise and resources within the 36 months of the project's lifetime.

THE D^2EPC ECOSYSTEM

D^2EPC Web Platform





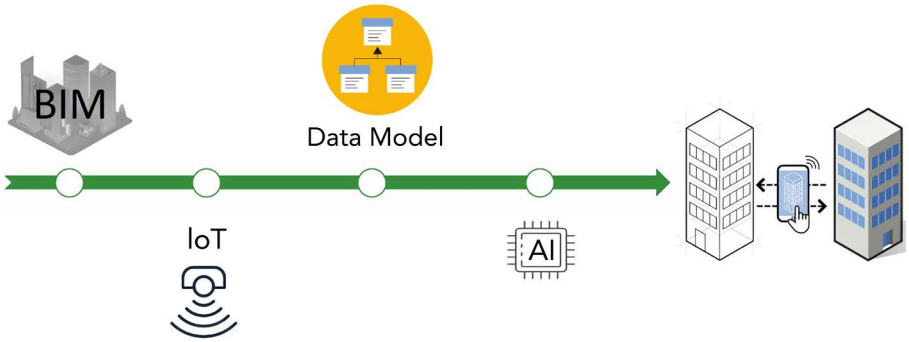


Next-generation Dynamic Digital EPCs for Enhanced Quality and User Awareness

BIM-BASED DIGITAL TWIN

The D^2EPC BIM-based Digital Twin serves as a core component, which enables the unification of various forms of user-provided data with dynamic information collected from the building's field devices, under a common, digital building model.

Static building information may be provided through the D^2EPC User Interface by uploading the BIM file in IFC format and manually adding information if needed. BIM Parser, a specifically designed tool is utilized to extract any available data from the file and store them in the D^2EPC Repository, a common database that is designed to securely contain the provided information. **Dynamic building information**, which is collected by field-level devices and sensors, is also stored in the D^2EPC Repository, after pre-processing for cleansing and structuring purposes. Static and dynamic data together are forming the building's Digital Twin which is used to perform the required calculations regarding the asset and operational ratings, as well as the desired set of indicators.



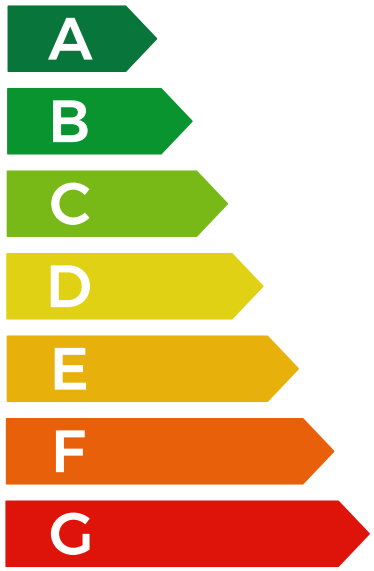
ASSET & OPERATIONAL RATING

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 a Reference building
- Adoption of national values

Operational Rating Module

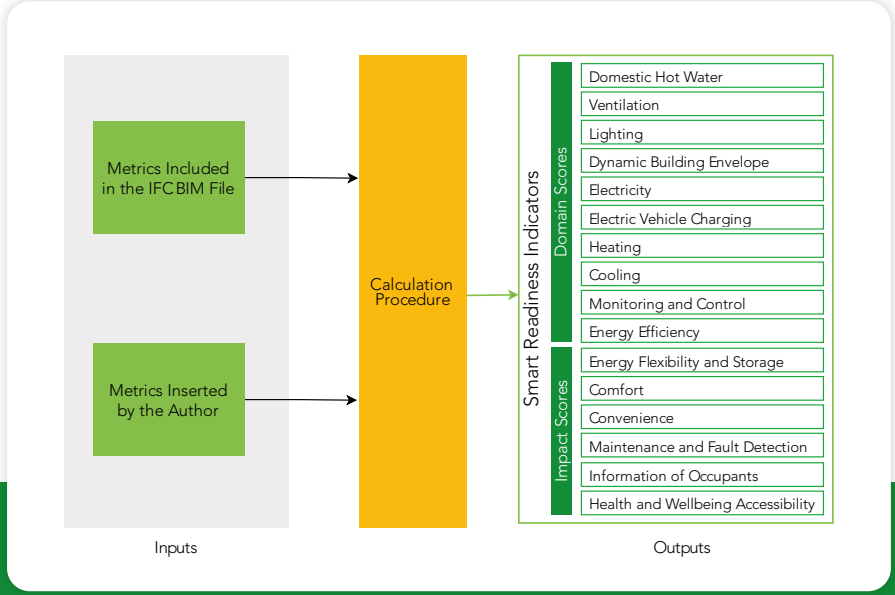
- Lack of a Common EU- based approach
  - D^2EPC proposed methodology
- Total indicators: 26
- Operational Rating Indicators:
  - Delivered Energy / Primary Energy
  - Cost (calculated)
  - CO_2 emissions
  - Energy Class [A-G]



ENHANCED SET OF INDICATORS

Smart Readiness Indicator

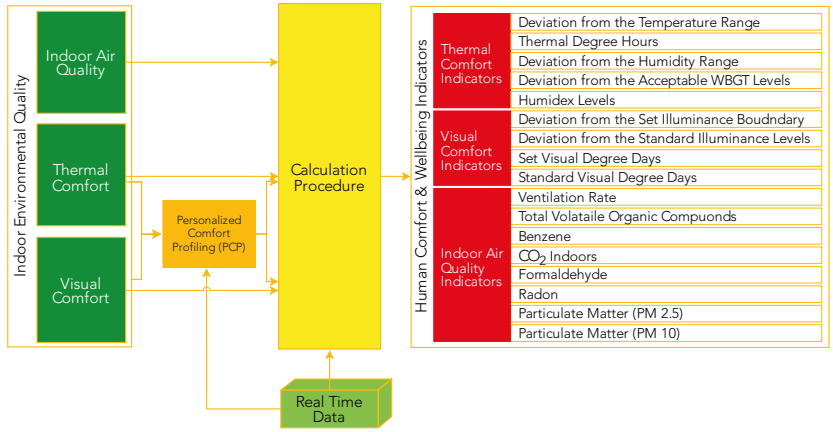
The development of SRI aligns with the EU energy transition 2030 targets and supports the provisions of EPBD recast for the energy transformation of EU building stock. The SRI scheme measures the 'intelligence' of a building by evaluating the extent to which a building can adapt its operation to the needs of its occupants, the energy grid while maintaining energy efficiency and operation. Consequently, the main purpose of the SRI is to increase the awareness of the benefits of smart technologies and increase the adoption of Information and communication technology (ICT)-based products for monitoring and control of building energy use.



Indoor Environmental Quality

The Human Comfort and Wellbeing indicators developed within the project step on three pillars of indoor environmental quality.

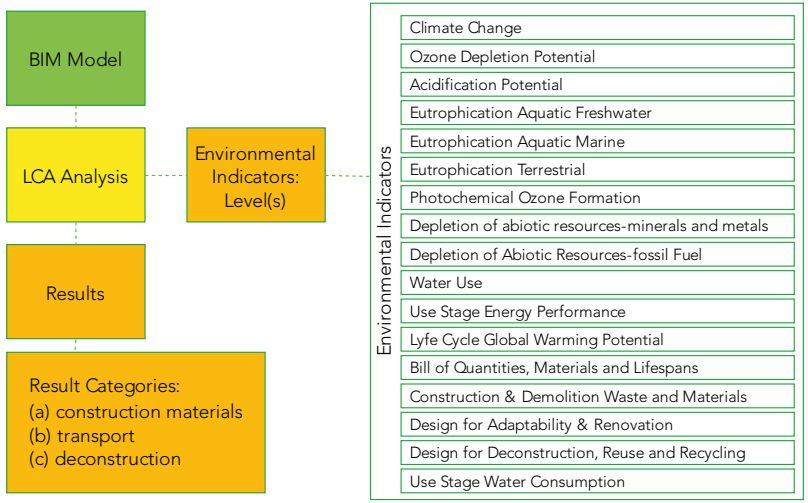
- The thermal comfort, which corresponds to level of satisfaction of the occupant with the thermal environment.
- The visual comfort, which relates to the quantity and quality of light offered to the occupant.
- The indoor air quality which examines the amount of fresh air provided within a space in order to guarantee the proper functioning of the human respiratory system.



Life Cycle Assessment

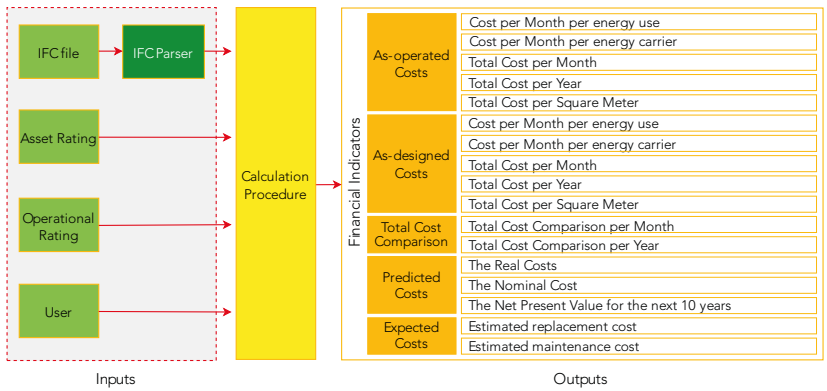
The development of the D^2EPC environmental indicators is based on the Level(s) scheme, the EU sustainability assessment for construction outline. Simplified energy indicators, such as total energy over area per annum, cannot describe thoroughly the energy performance of a building adequately.

Thus the D^2EPC energy indicators are intended to cover present gaps in building performance indicators that can be utilized in conjunction with the increasingly accessible system-level data from the growing use of sensors and meters in buildings to quantify and analyse energy performance. The methodology used for creating energy indicators values is the operational rating, and the calculations are based on the data retrieved by the building's regular measurements, where these are available.



Life Cycle Cost

The approach of financial indicators is to monetize the energy consumption, which means that the energy consumption is translated to EUR. Users will be able to see how much money they are spending on energy and compare it with different scenarios. Such indicators are expected to enable the financial assessment of the building and thus provide additional information to the user.



The development of financial indicators is based on the well-established concept of whole life cycle costing (LCC). The idea of financial indicators is based on the comparison of the current state (as-operated) with different scenarios, for example the as-designed state, the as-operated state at a different (past) time, the predicted model, and the building stock.

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 operational conditions forecasting
- Pattern identification
- Recommendations:
  - Energy efficiency
  - Human comfort

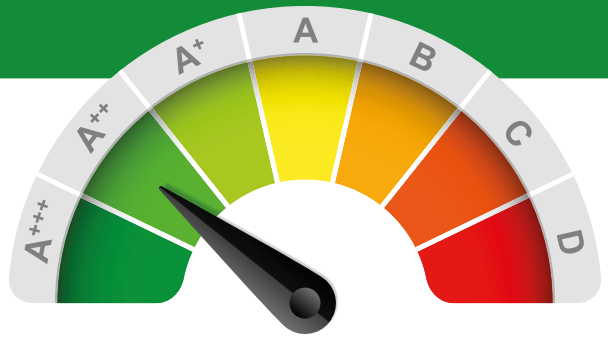
Performance Alerts & Notifications

A customizable, constant feed of notifications is provided through the Web Platform. By using the outputs of the AI Performance Forecasts module and the monitored data from the on-site sensors, any expected performance downgrade will be communicated to the user.

EXTENDED DEPCS APPLICATION TOOLKIT

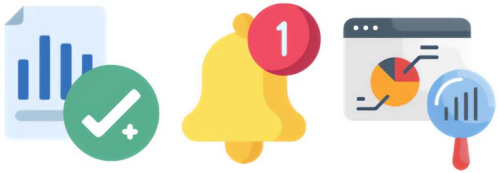
Building Performance Benchmarking

- 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



D^2EPC WEBGIS TOOL

The D^2EPC WebGIS Tool is an independent sub-component of the D^2EPC Platform. The WebGIS introduces an added value service and a potential revenue stream to the D^2EPC project.

Third party platform end users such as authorities, public or standardisation bodies and others are empowered with useful tools such as enriched analytics, comparisons and visualisations of dEPC statistics across EU countries and regions. Furthermore, the users can visualise the buildings in 3D mode through the enriched BIM on the same platform.

- Produce regional EPC related statistics
- Visualize regional statistics with charts and plots
- Provide attribute and spatial querying capabilities
- Provide an endpoint for data dissemination using OGC services

D^2EPC WEB PLATFORM

The D^2EPC Web Platform, along with the integrated additional services, comprise an intuitive user interface, where the distinct D^2EPC developed functionalities are accessible by users with different roles, mainly as an EPC assessor or as a building tenant/owner or manager.

D^2EPC services that the user can choose from the menu:

- BIM Management
- Device Management
- Asset Rating
- Operational Rating
- Road Mapping
- Building Performance
- Energy Benchmarking
- Performance Forecast
- BIM based Digital-Twin
- WebGIS
- Alerts & Notifications
- Settings

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