



Building performance assessment
towards Next generation EPCs



Smart Readiness Indicators Analysis for EPCs

Christiana Panteli
CLEOPA GmbH

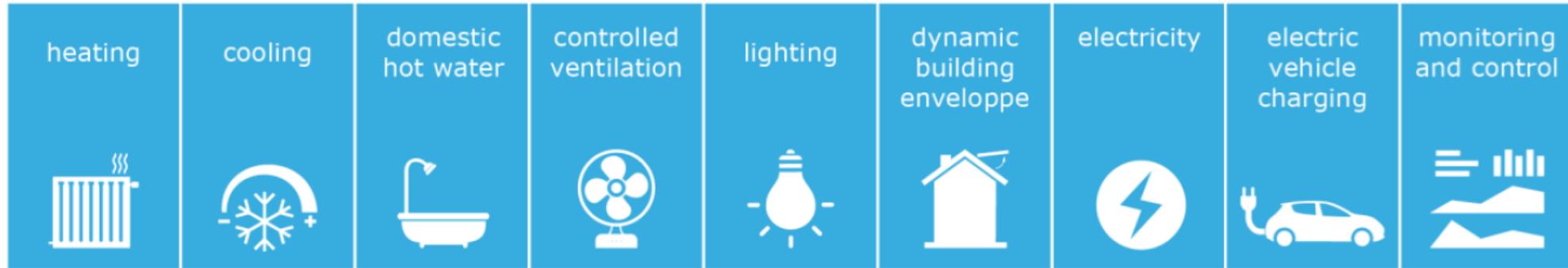


Session 1: Smart buildings and energy efficiency

Smart Readiness Indicator (SRI)

- In 2018, the European Commission adopted the Smart Readiness Indicator concept, known as SRI in the recast of the directive on the energy efficiency of buildings.
- The set of SRIs is a measure of the intelligence of buildings systems, and its promotion is expected to contribute to the energy savings of the building sector.
- These indicators are relatively new and were developed only at the beginning of last decade, within European standards.

Smart Readiness Indicators Domains and Impact Categories



Source: Final report on the technical support of the development of a Smart Readiness Indicators for buildings, Final Report (June 2020) Directorate-General for Energy, Directorate C - Renewables, Research and Innovation, Energy Efficiency, Unit C4 - Energy Efficiency: Buildings and Products

Smart Readiness Indicators – Calculation Example

| | | IMPACTS | | | | | | SRI | |
|--------------|---------------------------|-------------------|----------------------------------|------------|-------------|-----------------------|--------------------------|-----------|------------------------------|
| | | Energy efficiency | Maintenance and fault protection | Comfort | Convenience | Health and well-being | Information to occupants | | Energy flexibility & storage |
| Total | | 39% | 18% | 60% | 71% | 48% | 59% | 0% | 42% |
| DOMAINS | Heating | 32% | 18% | 62% | 55% | 24% | 74% | 0% | |
| | Sanitary hot water | 17% | 0% | 45% | 70% | 67% | 83% | 0% | |
| | Cooling | 65% | 51% | 78% | 72% | 61% | 55% | 0% | |
| | Controlled ventilation | 41% | 0% | 55% | 60% | 34% | 44% | 0% | |
| | Lighting | 85% | 14% | 90% | 100% | 83% | 15% | 0% | |
| | Dynamic building envelope | 10% | 0% | 31% | 56% | 22% | 46% | 0% | |
| | Electricity | 10% | 0% | - | - | - | 68% | 0% | |
| | Electric vehicle charging | - | 38% | - | 82% | - | 84% | 0% | |
| | Monitoring and control | 52% | 43% | 62% | 72% | 45% | 64% | 0% | |

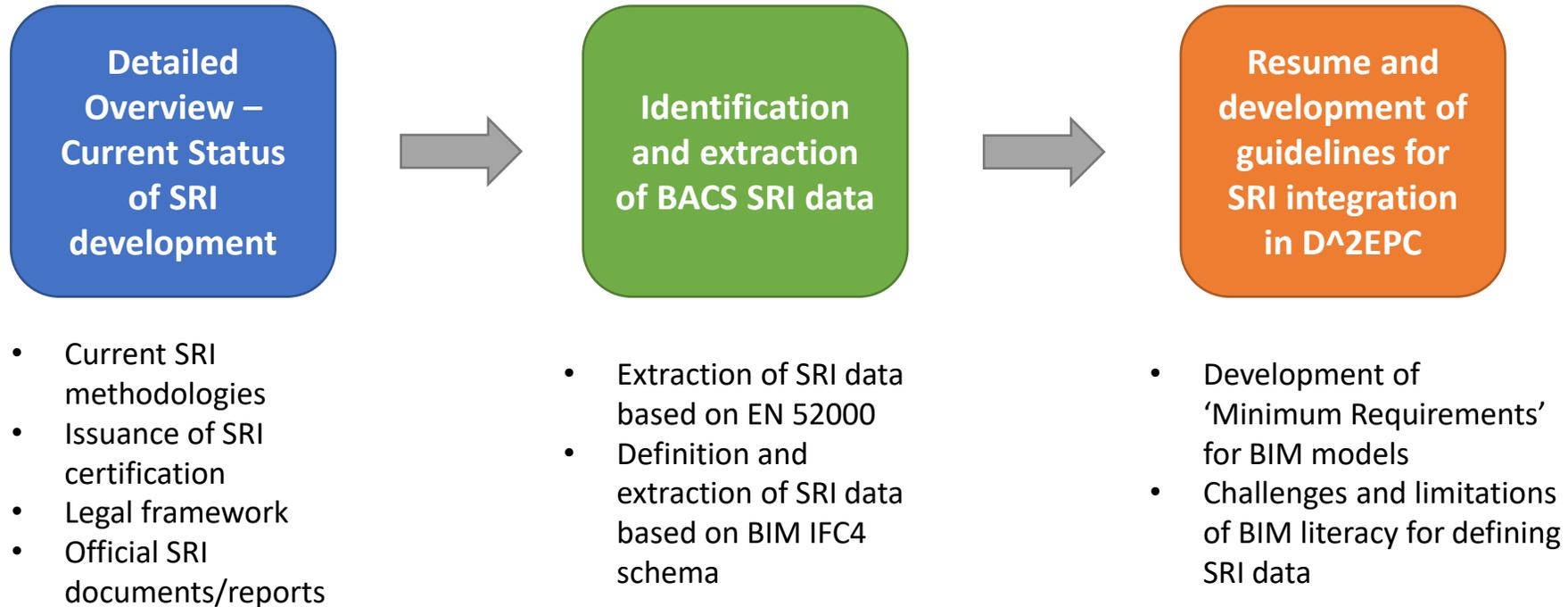
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Smart Readiness Indicators Analysis for EPCs

Objectives of SRI analysis in D²EPC:

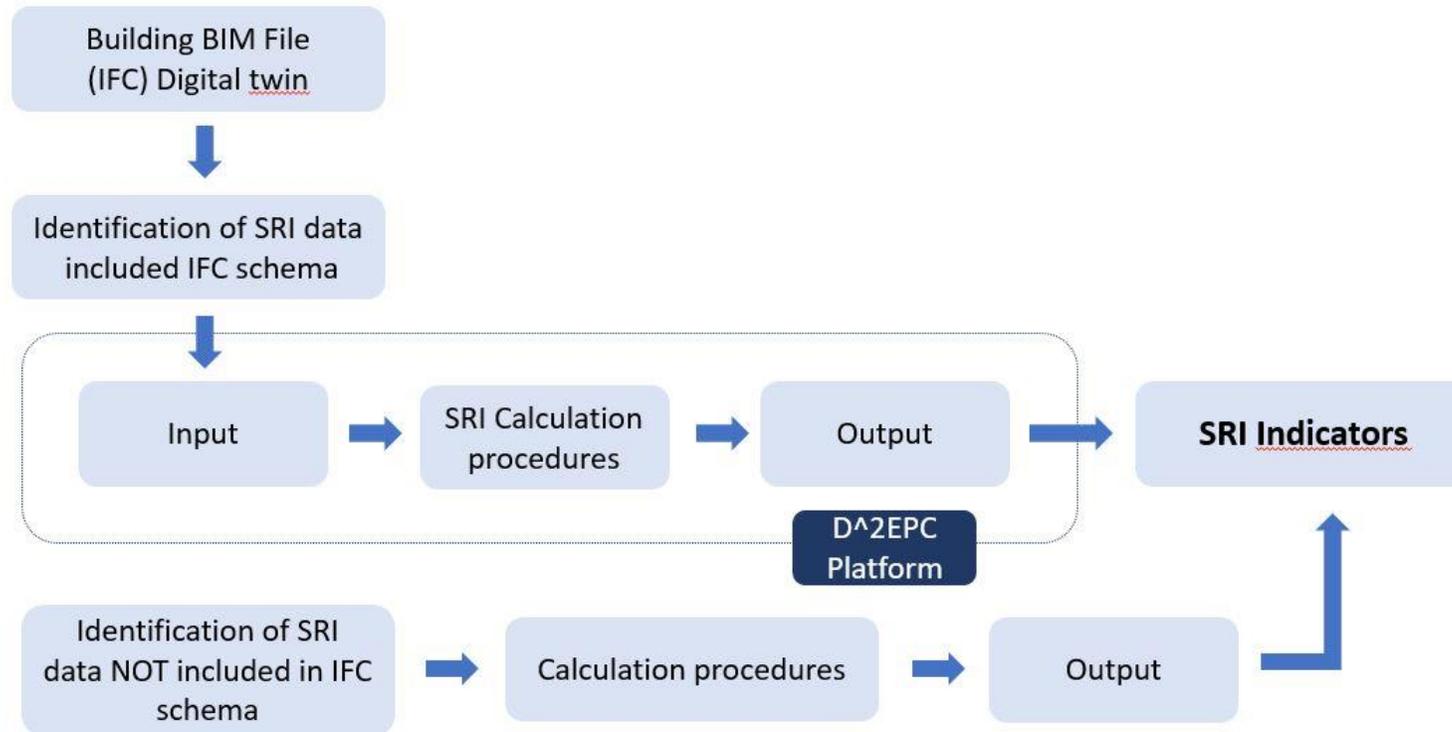
- establish the framework and scope of SRIs integration in the dynamic EPC scheme
- development of the required procedures which will define guidelines for the realization of SRI certification based on the linkage of EPC data.
- linkage of the SRI to the dynamic EPC in a mandatory way, so an assessment would be offered each time an EPC is conducted.

Smart Readiness Indicators Analysis for EPCs – 3 step methodology



Employment of SRIs in next generation BIM based EPCs – IFC schema

- Mapping of SRI input data in accordance to EPC methodology of EN 52000 standards
- Mapping of SRI BACS controls/equipment in IFC4 schema



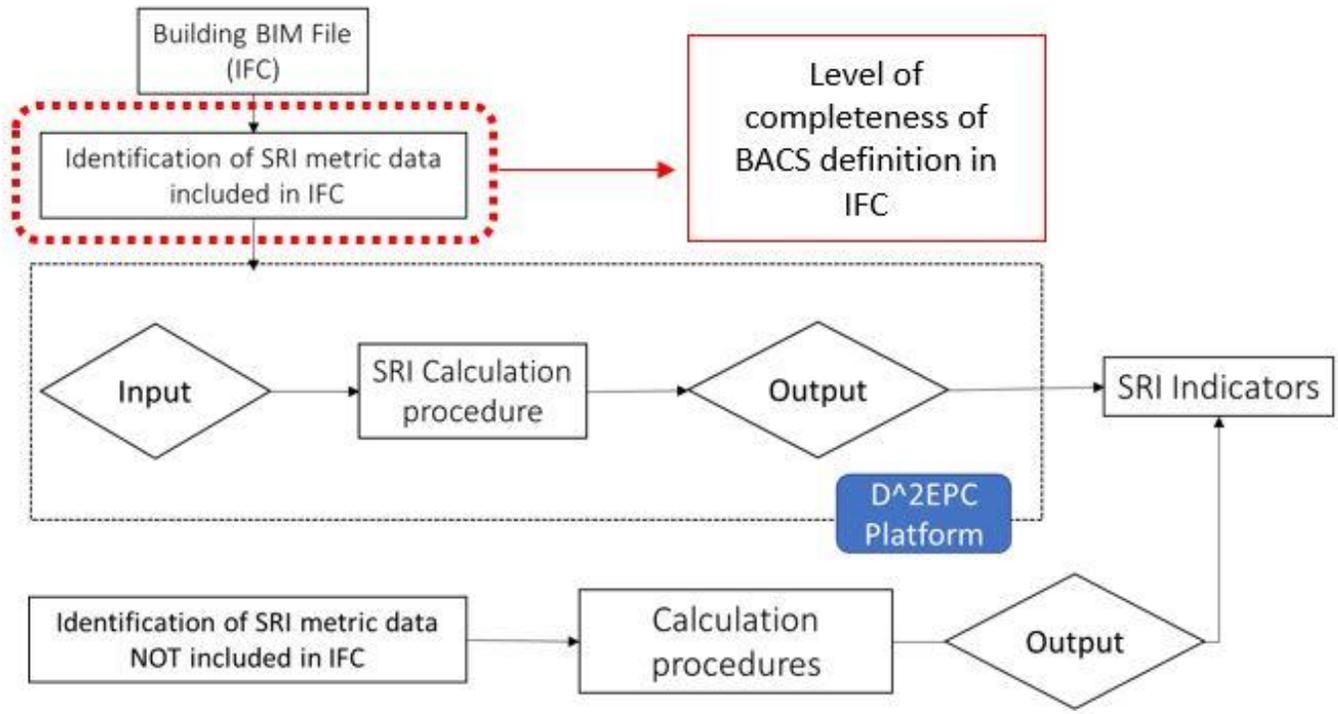
Employment of SRIs in next generation BIM based EPCs – IFC schema

- Definition of KPIs for 9 SRI domains and 54 services included in SRI scheme to be used in D²EPC calculation platform
 - Identification of input data (metrics) required for SRI assessment through the D²EPC platform
- ✓ Lighting – 2 services
 - ✓ Electricity – 7 services
 - ✓ EV Charging – 3 services
 - ✓ Monitoring and Control – 8 services
 - ✓ Dynamic Envelope – 3 services
 - ✓ Ventilation – 6 services
 - ✓ Cooling – 10 services
 - ✓ Heating – 10 services
 - ✓ Domestic Hot water (DHW) – 5 services



Employment of SRIs in next generation BIM based EPCs – IFC schema

- Investigation whether sufficient information on BACS is currently available in BIM practices for extraction of SRIs



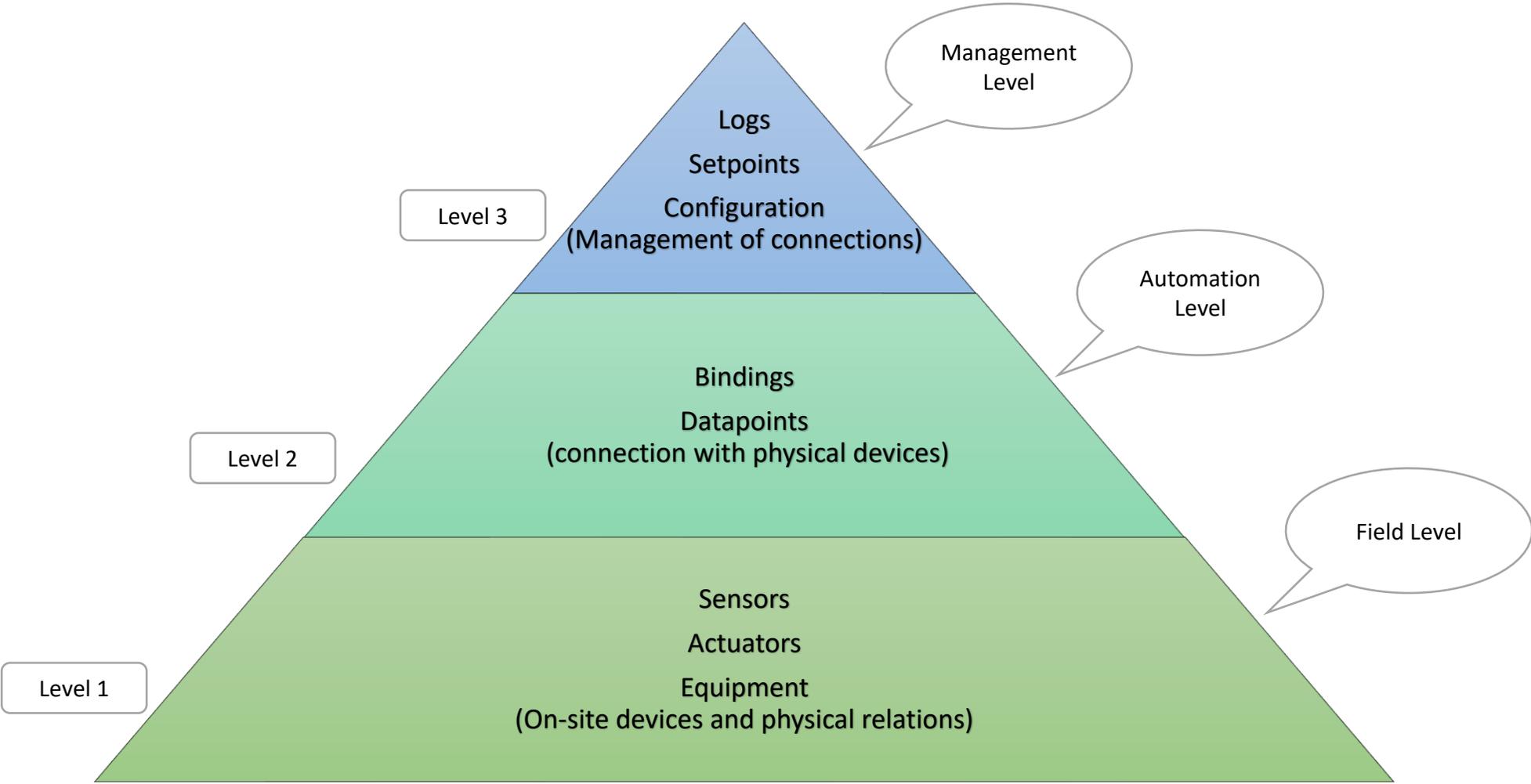
Definition of three categories to describe level of completeness:

Complete: Equipment and controls and Relationships can be adequately defined in IFC schema

Partial: Partial definition of equipment and/or relationships of SRI data

Not Supported: SRI data cannot be defined in IFC schema (no entities/data outside of modelling processes)

Staging of hierarchical levels of BACS



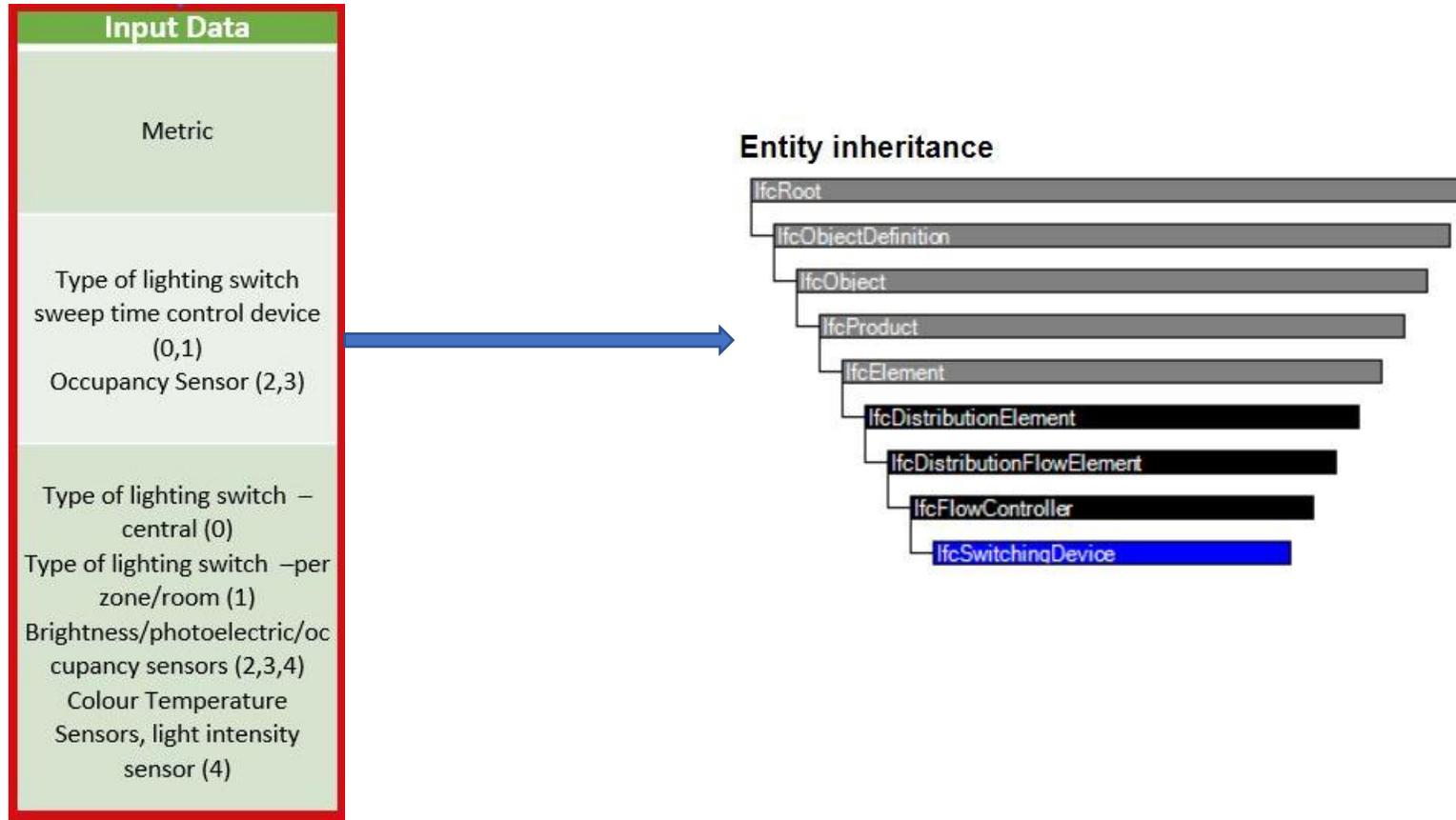
Definition of SRI metrics – Lighting example

| Indicator Name | Indicator Description | Units | Static/ Dynamic | Category | Calculation Procedure | Input Data |
|-----------------|--|-------|--------------------|----------|--|---|
| | | | | | | Metric |
| SRI-Lighting 1a | Occupancy control for indoor lighting | N/A | Static | SRI | level 0 Manual on/off switch level 1 Manual on/off switch + additional sweeping extinction signal level 2 Automatic detection (auto on / dimmed or auto off) level 3 Automatic detection (manual on / dimmed or auto off) | Manual on/off switch (0) sweep time control device with real time clock (1) Occupancy Sensor, automatic switch (2) Manual on/off switch, occupancy sensor or timer (3) |
| SRI-Lighting 2 | Control artificial lighting power based on daylight levels | N/A | Static | SRI | level 0 Manual (central) level 1 Manual (per room/zone) level 2 Automatic switching level 3 Automatic dimming level 4 Scene-based light control (during time intervals, dynamic and adapted lighting scenes are set, for example, in terms of illuminance level, different correlated colour temperature (CCT) and the possibility to change the light distribution within the space according to e.g., design, human needs, visual tasks) | Type of lighting switch – central (0) Type of lighting switch –per zone/room (1) Brightness/photoelectric/occupancy sensors (2,3,4) Colour Temperature Sensors, light intensity sensor (4) |



SRI Metrics – IFC entities & enumerations

Mapping of SRI metric data with IFC entities and enumerations



Conclusions of EPC/IFC-based SRI analysis

- ✓ It was found that the **current status of data for EPC assessment does not allow the extraction of the SRI.**
- ✓ Some screening information for the SRI may be extracted, however, this information is not sufficient to extract the SRI indicator of the building. The information which can be extracted from EPC is namely:
 - Heating type, emission type
 - Cooling type, emission type
 - Ventilation type
 - Domestic hot water system type
 - Presence of renewable energy
- ✓ In this current stage, a **significant number of functionality levels are not addressed in IFC schema.** This constitutes a major drawback, which does not allow the development of a comprehensive approach for extracting the SRI indicator from an IFC document.
- ✓ **The information supported by the current IFC format** is mainly limited to the:
 - field level supporting the definition of devices and wiring relations,
 - disregarding the logical and operational aspects, such as control loops, bindings, or configuration management.

Conclusions of IFC-based SRI analysis

- ✓ The features which can be defined in IFC for the purpose of the SRI screening questions are the following:
 - Heating: Presence of Heating system, Emission Type, Production Type
 - Domestic Hot Water (DHW): Presence of Domestic Hot water, Production Type, Solar Collector
 - Cooling: Presence of cooling system, Emission Type
 - Controlled Ventilation: Presence of controlled ventilation system, System type, Heat Recovery
 - Dynamic Envelope: Presence of dynamic Envelope system
 - Electricity: Renewables & Storage: Presence of Renewables, On-site renewable electricity generation, Storage of on-site generated renewable electricity, CHP (Combined Heat and Power)
 - Electric Vehicle Charging: Not supported
- ✓ **Minimum modelling requirements** were presented for specifying the 1st SRI level of information.
- ✓ The use of IFC for automating the screening questions of the SRI **still needs some user specified inputs** since not all features can be defined in the model.

Thank you!

Presenter: Christiana Panteli
Contact: cpanteli@cleopa.de