iEPB Common data model

Marta Sampedro, CENER
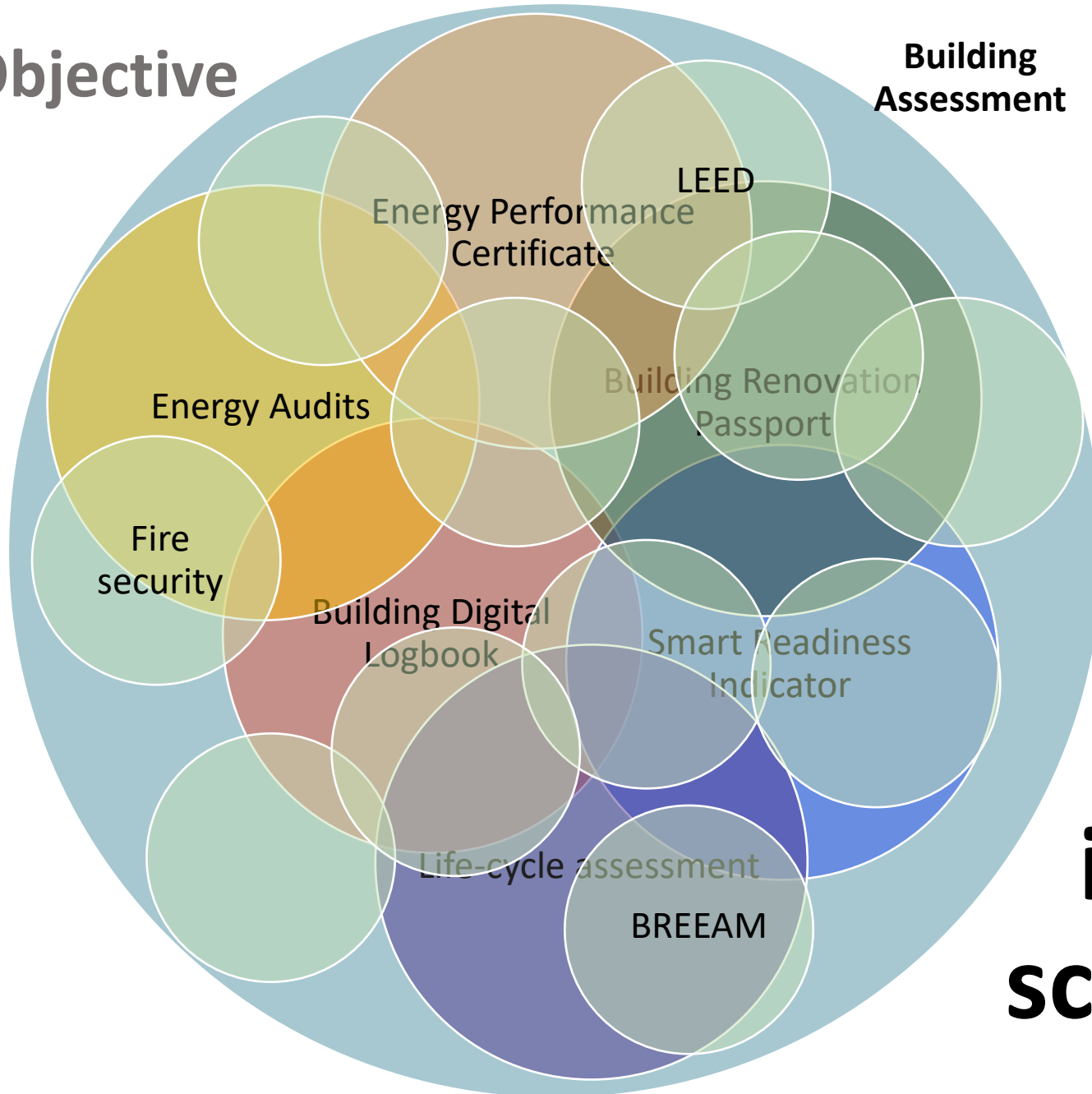
Miguel Ángel Pascual, EFINOVATIC

iEPB Objective

Building Assessment

LEED

Energy Performance Certificate

Energy Audits

Building Renovation Passport

Fire security

Building Digital Logbook
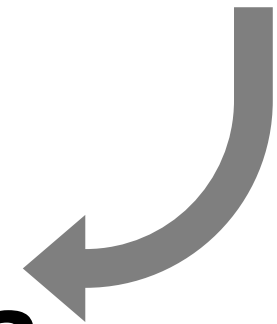
Smart Readiness Indicator

Life-cycle assessment

BREEAM

Let'S Make It Easy

Common data model

iEPB schema

2

iEPB schema

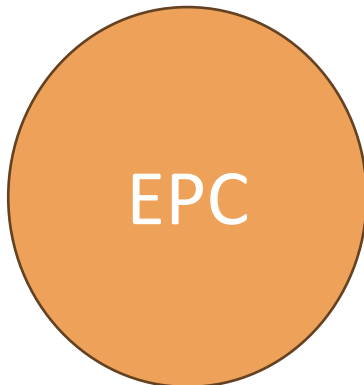Let's work towards a common data model format

Existing formats

Green Building XML Schema

gbXML

Purpose exchange information in ~~BIM~~ BEM models

gbXML is funded by organizations such as the U.S. Department of Energy, the National Renewable Energy Lab (NREL), Autodesk, ASHRAE, Bentley Systems
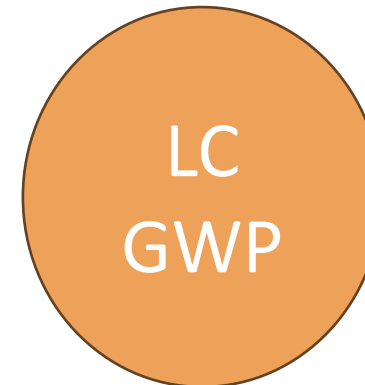
International Reference Life Cycle Data System ILCD XML
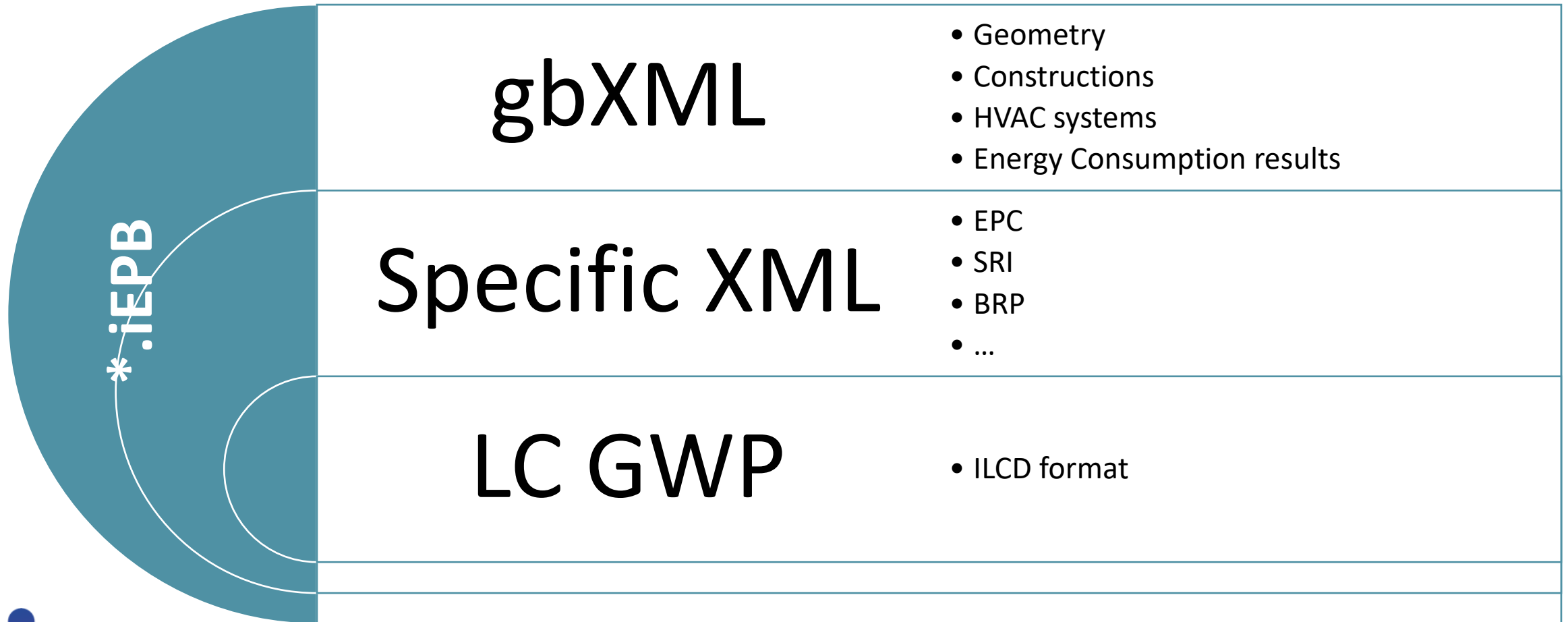provide guidance and standards for greater consistency and quality assurance in applying LCA

European Commision (JRC)

EPC

LC
GWP

Zip file with a renamed extension to .iEPB

*.iEPB

gbXML
- Geometry
- Constructions
- HVAC systems
- Energy Consumption results

Specific XML
- EPC
- SRI
- BRP
- …

LC GWP
- ILCD format

Similar to Microsoft documents

iEPB schema>Format design

- Will be based on the gbXML format

The purpose of using the gbXML format is to **reuse an already standardized format** in order to be able to **share data**, NOT among different countries, but **among different types of building assessments** at European or even worldwide level.

```
C: > Users > msampedro > VisualStudioCode > iEPBschema >  iEPBschema.xml > ...
    1      <?xml version="1.0" encoding="UTF-8"?>
    2  >  <gbXML xmlns="http://www.gbxml.org/schema" xmlns:xhtml="http://www.w3.org/1999/xhtml" ···
 1518      </gbXML>
 1519      <Spain>
 1520  >        <BuildingData> ···
 1535          </BuildingData>
 1536          <SRI></SRI>
 1537  >        <EPC> ···
 1613          </EPC>
 1614          <ImprovementEnergyMeasures></ImprovementEnergyMeasures>
 1615      </Spain>
 1616      <Netherlands>
 1617          <EPC></EPC>
 1618          <SRI></SRI>
 1619      </Netherlands>
 1620      <Austria>
 1621          <EPC></EPC>
 1622          <SRI></SRI>
 1623      </Austria>
```

iEPB schema>Format design

- Use as much as possible the original gbXML elements:

    - Location

    - Envelop geometry

    - Constructions, layers, materials

    - Spaces/Thermal Zones/Building Stories

    - Internal heat gains: people, lighting, equipment, infiltration, schedules

    - HVAC equipment, Air Loops, Hydronic Loops

iEPB schema

- Example of materials


```xml
<Material id="Gypsum_Plasterboard__750_&lt;_d_&lt;_900__espesor=0.015">
  <Name>Gypsum Plasterboard [750 &lt; d &lt; 900]_espesor=0.015</Name>
  <Reflectance unit="Fraction" type="ExtIR" surfaceType="Both">0.40000000000000002</Reflectance>
  <Reflectance unit="Fraction" type="IntIR" surfaceType="Both">0.40000000000000002</Reflectance>
  <Reflectance unit="Fraction" type="ExtSolar" surfaceType="Both">0.30000000000000004</Reflectance>
  <Reflectance unit="Fraction" type="IntSolar" surfaceType="Both">0.30000000000000004</Reflectance>
  <Reflectance unit="Fraction" type="ExtVisible" surfaceType="Both">0.40000000000000002</Reflectance>
  <Reflectance unit="Fraction" type="IntVisible" surfaceType="Both">0.40000000000000002</Reflectance>
  <Roughness value="Smooth" />
  <Thickness unit="Meters">0.014999999999999999</Thickness>
  <Conductivity unit="WPerMeterK">0.25</Conductivity>
  <Density unit="KgPerCubicM">825</Density>
  <SpecificHeat unit="JPerKgK">1000</SpecificHeat>
  <Absorptance unit="Fraction" type="ExtIR">0.5999999999999998</Absorptance>
  <Absorptance unit="Fraction" type="IntIR">0.5999999999999998</Absorptance>
  <Absorptance unit="Fraction" type="ExtSolar">0.6999999999999996</Absorptance>
  <Absorptance unit="Fraction" type="IntSolar">0.6999999999999996</Absorptance>
  <Absorptance unit="Fraction" type="ExtVisible">0.5999999999999998</Absorptance>
  <Absorptance unit="Fraction" type="IntVisible">0.5999999999999998</Absorptance>
</Material>
```
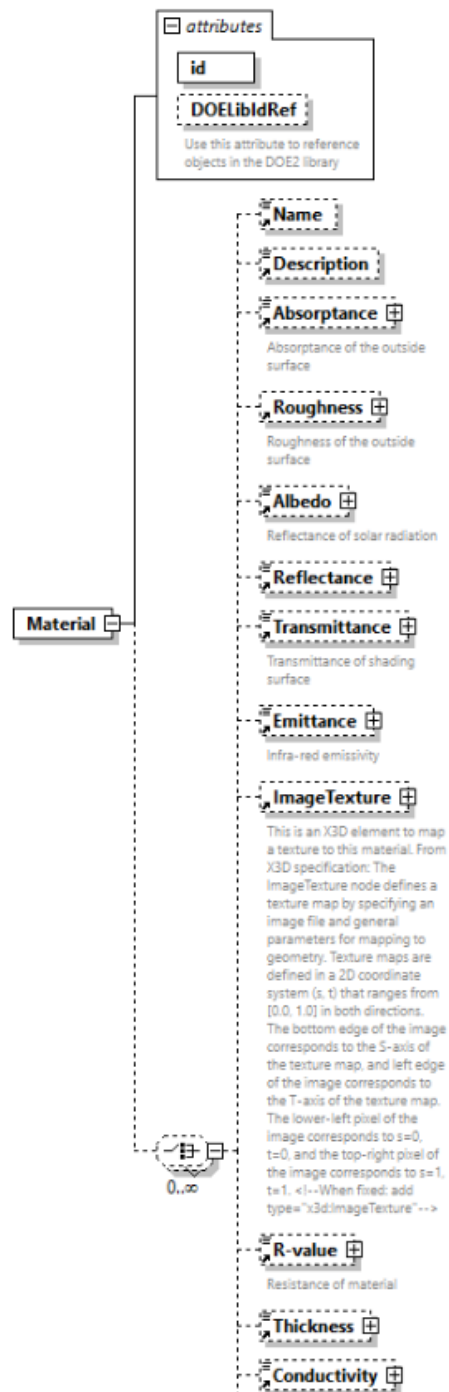
element **Material**

diagram

attributes
- id
- DOELibIdRef
  Use this attribute to reference objects in the DOE2 library

Material
- **Name**
- **Description**
- **Absorptance**
  Absorptance of the outside surface
- **Roughness**
  Roughness of the outside surface
- **Albedo**
  Reflectance of solar radiation
- **Reflectance**
- **Transmittance**
  Transmittance of shading surface
- **Emittance**
  Infra-red emissivity
- **ImageTexture**
  This is an X3D element to map a texture to this material. From X3D specification: The ImageTexture node defines a texture map by specifying an image file and general parameters for mapping to geometry. Texture maps are defined in a 2D coordinate system (s, t) that ranges from [0.0, 1.0] in both directions. The bottom edge of the image corresponds to the S-axis of the texture map, and left edge of the image corresponds to the T-axis of the texture map. The lower-left pixel of the image corresponds to s=0, t=0, and the top-right pixel of the image corresponds to s=1, t=1. <!--When fixed: add type="x3d:ImageTexture"-->

0..∞

- **R-value**
  Resistance of material
- **Thickness**
- **Conductivity**

iEPB schema

- Example of constructions


```xml
<Construction id="SP1_Interior_Ceiling">
<Construction id="SP1_Ground_Floor">
<Construction id="Low_insulated_Wall_Double_brick_cavity">
    <Name>Low insulated Wall_Double brick cavity</Name>
    <LayerId layerIdRef="Half_Brick_Thickness_Medium_Brick_Masonry__60_mm_&lt;_G_&lt;_80_mm__espesor=0.115_Layer" />
    <LayerId layerIdRef="Cement_or_Lime_Mortar_for_masonry_and_plastering__1450_&lt;_density_&lt;_1600__espesor=0.01_Layer" />
    <LayerId layerIdRef="id_5_cm__Vertical_Air_Gap_espesor=0.05_Layer" />
    <LayerId layerIdRef="Mineral_Wool__0.04_W__mK___espesor=0.04_Layer" />
    <LayerId layerIdRef="id_6-hole_Hollow_Clay_Brick_HP_Partition__60_mm_&lt;_thickness_&lt;_90_mm__espesor=0.07_Layer" />
    <LayerId layerIdRef="Gypsum_Plaster___1000_&lt;_density_&lt;_1300__espesor=0.02_Layer" />
</Construction>
<Construction id="Low_insulated_Floor_Concrete_Slab">
<Construction id="Low_insulated_Roof_Flat">
```

iEPB schema>Format design

- Specific information should be in the specific file

- Information that is not related to energy should be included in the specific file (for example: SRI).

- Information that is partially included in the gbXML and partially not, should be distributed in both files, using a heritance squema.

- *Information in the specific file, should be classified by country, assessment and software.*

iEPB schema

- **Particular data regarding national assessment** methods will be allocated in the respective country's block

iEPB schema

Each country block will have (at least):

- a common section for all the "BuildingData" that aren't included in the gbXML and are shared by all the national assessments.


```
C: > Users > msampedro > VisualStudioCode > iEPBschema > ⟩ iEPBschema.xml > …
   1     <?xml version="1.0" encoding="UTF-8"?>
   2  >  <gbXML xmlns="http://www.gbxml.org/schema" xmlns:xhtml="http://www.w3.org/1999/xhtml" …
1518     </gbXML>
1519     <Spain>
1520         <BuildingData>
1521             <ConstructionYear>2009</ConstructionYear>
1522             <ApplicableLegislation>CTE2006</ApplicableLegislation>
1523             <BuildingType>TertiaryBuilding</BuildingType>
1524             <UsageProfile>LowIntensity8hours</UsageProfile>
1525             <ClimaticZoneHE1>ClimaticZoneHE1Enum</ClimaticZoneHE1>
1526             <ClimaticZoneHE4>ClimaticZoneHE4Enum</ClimaticZoneHE4>
1527             <NominalFloorToCeilingHeight>3.15</NominalFloorToCeilingHeight>
1528             <Volume>1260</Volume>
1529             <NumberOfStoreis>2</NumberOfStoreis>
1530             <AirChangesPerHour>0.56</AirChangesPerHour>
1531             <DHWDailyDemand>0</DHWDailyDemand>
1532             <InternalPartitionMass></InternalPartitionMass>
1533             <LocationImage></LocationImage>
1534             <BuildingImage></BuildingImage>
1535         </BuildingData>
1536         <SRI></SRI>
1537  >      <EPC>···
1613         </EPC>
1614         <ImprovementEnergyMeasures></ImprovementEnergyMeasures>
1615     </Spain>
1616     <Netherlands>
1617         <EPC></EPC>
1618         <SRI></SRI>
1619     </Netherlands>
1620     <Austria>
1621         <EPC></EPC>
1622         <SRI></SRI>
1623     </Austria>
```

iEPB schema

Each country block will have (at least):

- a common section for all the "BuildingData" that aren't included in the gbXML and are shared by all the national assessments.

- An EPC block containing data only related to the requirements of the EPC assessments of the buildings in your country.

```xml
1    <?xml version="1.0" encoding="UTF-8"?>
2
3    <Spain>
4  >     <BuildingData>...
20        </BuildingData>
21        <SRI></SRI>
22        <EPC>
23            <Name></Name>
24            <InspectionData></InspectionData>
25            <PersonInfoEPC>
26                <FirstName></FirstName>
27                <NIF>Variable not included into PersonInfo data of gbXML</NIF>
28                <CompanyName></CompanyName>
29                <CIF>Variable not included into PersonInfo data of gbXML</CIF>
30                <Address1></Address1>
31                <State></State>
32                <City></City>
33                <ZipcodeOrPostalCode></ZipcodeOrPostalCode>
34                <PhoneNumber></PhoneNumber>
35                <Email1Address></Email1Address>
36                <QualifyingDegree>Variable not included into PersonInfo data of gbXML</QualifyingDegree>
37            </PersonInfoEPC>
38  >         <CE3X>...
88            </CE3X>
89            <CERMA></CERMA>
90        </EPC>
91        <ImprovementEnergyMeasures></ImprovementEnergyMeasures>
92    </Spain>
93    <Netherlands>
94        <BuildingData></BuildingData>
95        <EPC></EPC>
96        <SRI></SRI>
97    </Netherlands>
98    <Austria>
99        <BuildingData></BuildingData>
100       <EPC></EPC>
101       <SRI></SRI>
102   </Austria>
```

iEPB schema

Each country block will have (at least):

- a common section for all the "BuildingData" that aren't included in the gbXML and are shared by all the national assessments.

- An EPC block containing data only related to the requirements of the EPC assessments of the buildings in your country.

    - A block for each certification tool with the specific data

```xml
 2    <Spain>
 3  >     <Building id="Building1">…
23      </Building>
24      <SRI></SRI>
25      <EPC>
26          <PersonInfo id="certificadorEnergeticoID">
27              <Cif>B71107734</Cif>
28              <Nif></Nif>
29              <QualifyingDegree>Arquitecta</QualifyingDegree>
30          </PersonInfo>
31
32          <CE3X order = "0">
33
34              <CustomerData>
35                  <Name>Javier González</Name>
36                  <Address>Plaza del Castillo</Address>
37                  <State>Navarra</State>
38                  <City>Pamplona</City>
39                  <ZipcodeOrPostalCode>31001</ZipcodeOrPostalCode>
40                  <PhoneNumber>666123456</PhoneNumber>
41                  <e-mail>cliente@ce3x.com</e-mail>
42              </CustomerData>
43
44              <Construction id="EstimatedWallConstruction_1" calculationType="FachadaExteriorEstimada">
45                  <ConstructionType>Una hoja</ConstructionType>
46                  <WallComposition>1 pie de fábrica de ladrillo</WallComposition>
47                  <AirCavityType></AirCavityType>
48                  <InsulationIsPresent>True</InsulationIsPresent>
49                  <InsulationPosition>Por el exterior</InsulationPosition>
50                  <InsulationType>MW</InsulationType>
51                  <Thickness unit="Meters">0.04</Thickness>
52                  <R-value unit="SquareMeterKPerW"></R-value>
53              </Construction>
54
55              <Construction id="EstimatedWallConstruction_2" calculationType="FachadaExteriorEstimada">
56                  <ConstructionType>Doble hoja con cámara</ConstructionType>
57                  <WallComposition></WallComposition>
58                  <AirCavityType>No ventilada</AirCavityType>
```

iEPB schema

Each country block will have (at least):

● a common section for all the "BuildingData" that aren't included in the gbXML and are shared by all the national assessments.

● An EPC block containing data only related to the requirements of the EPC assessments of the buildings in your country.

   ▪ A block for each certification tool with the specific data

● An SRI block


```
 1      <?xml version="1.0" encoding="UTF-8"?>
 2
 3      <Spain>
 4  >       <BuildingData>…
20          </BuildingData>
21          <SRI></SRI>
22  >       <EPC>…
98          </EPC>
99          <ImprovementEnergyMeasures></ImprovementEnergyMeasures>
100     </Spain>
101     <Netherlands>
102         <BuildingData></BuildingData>
103         <EPC></EPC>
104         <SRI></SRI>
105     </Netherlands>
106     <Austria>
107         <BuildingData></BuildingData>
108         <EPC></EPC>
109         <SRI></SRI>
110     </Austria>
```