



UML diagrams

Last updated on 28 June 2025





This work is licensed under the [Creative Commons License CC BY-NC-SA 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/) licence.

The latest version of this document can be downloaded from:
https://github.com/tudelft3d/Energy_ADE_2.0/tree/main/documentation

Author

Giorgio Agugiaro
3D Geoinformation Group
Department of Urbanism
Faculty of Architecture and Built Environment
Delft University of Technology
The Netherlands
g.agugiaro@tudelft.nl
<https://3d.bk.tudelft.nl/gagugiaro/>

Funding

Development of the Energy ADE 2.0 has started in spring 2024 within the European DigiTwins4PEDs project, as part of the Work Package 3. The project is funded by the European Commission under the Horizon Europe Partnership scheme. The DUT Call 2022 also contributes to the Urban Transition Mission of Mission Innovation as part of the MICall 2022 initiative.

Acknowledgements

The author would like to thank the following people for their suggestions and fruitful discussions that have helped design the current version of the Energy ADE 2.0:

Rushikesh Padsala and Zhihang Yao (HFT Stuttgart, Germany)

Thomas Kolbe (TU Munich, Germany)

Jérôme Kämpf (Idiap, Switzerland)

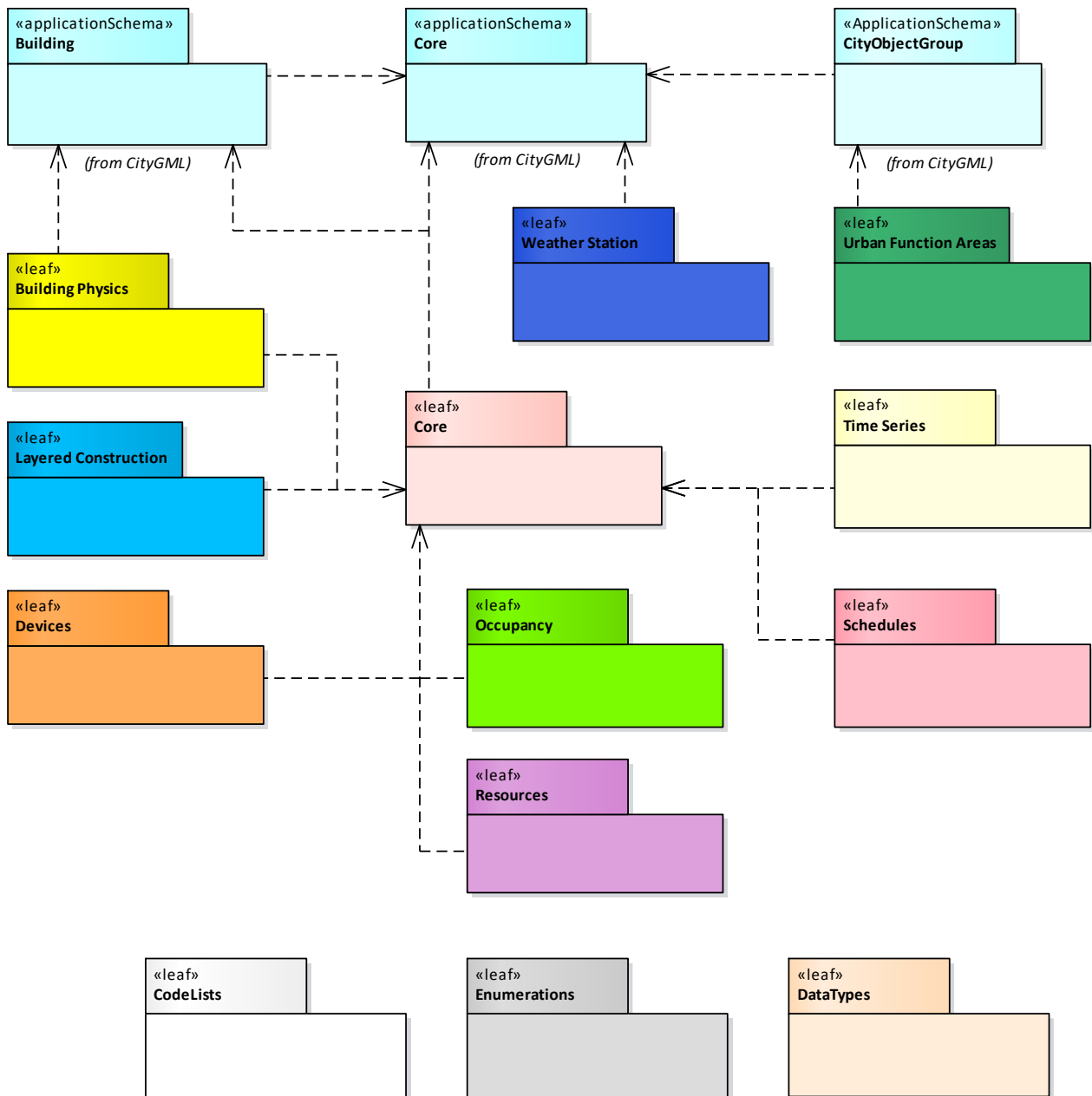
Camilo León-Sánchez (TU Delft, The Netherlands)

Particular gratitude is due to Daniele Gasparini for designing the Energy ADE 2.0 logo.

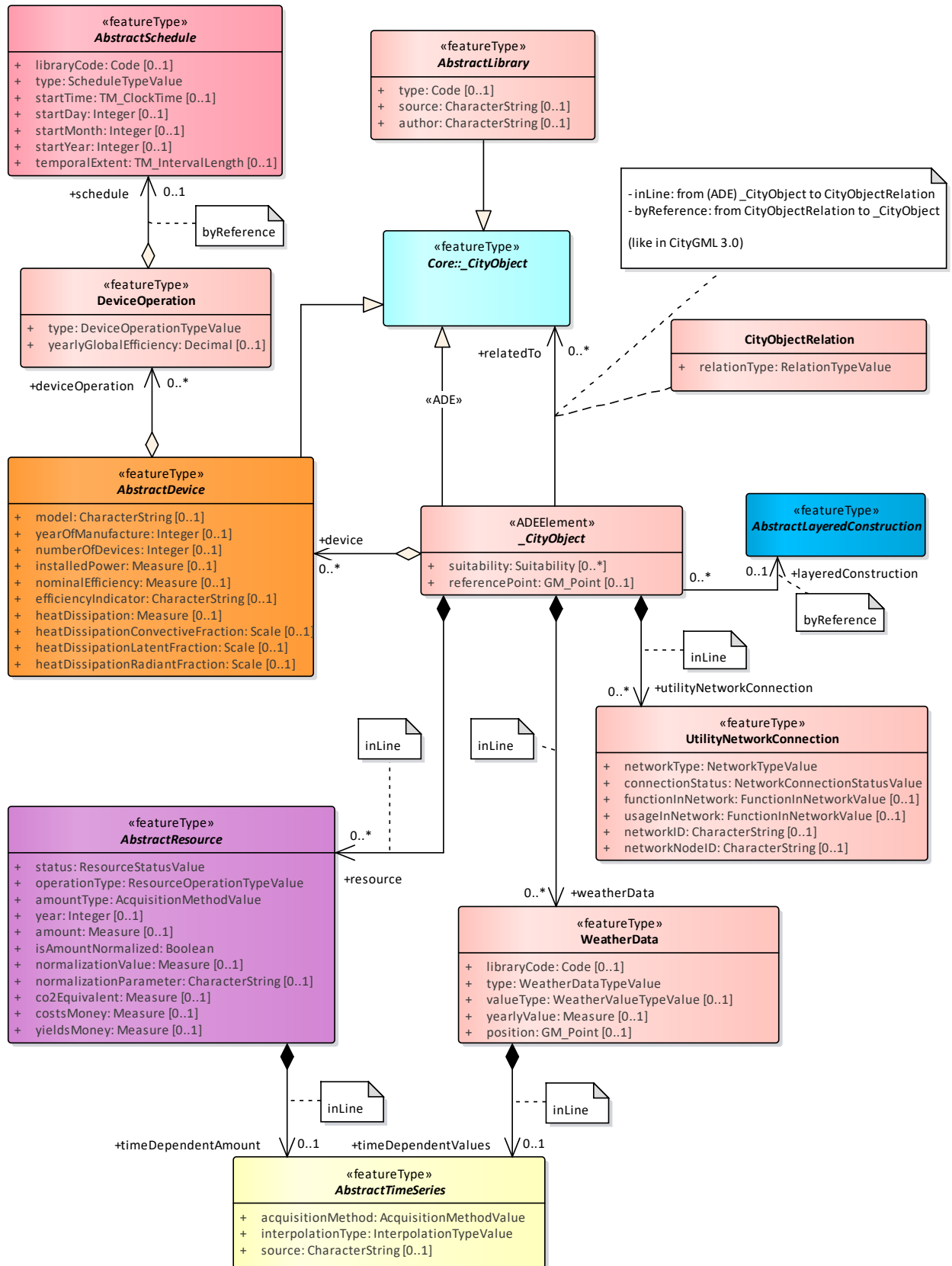
Contents

Overview of the packages.....	3
Core module.....	4
Building physics module	8
Occupancy module	9
Devices module	11
Weather station module	13
Resources module	14
Layered construction module.....	16
Schedules module	17
Time series module	18
Supporting classes: DataTypes	19
Supporting classes: Enumerations	20
Supporting classes: Codelists.....	21
Changelog	23

Overview of the packages



Core module



«codeList» CodeLists:: AcquisitionMethodValue
+ measurement + simulation + calibratedSimulation + estimation + unknown

«codeList» CodeLists:: DeviceOperationTypeValue
+ cooking + domesticHotWater + electricalAppliances + lighting + otherOrCombination + process + shading + spaceCooling + spaceHeating + ventilation + unknown

«codeList» CodeLists:: FunctionInNetworkValue
+ producing + consuming + storage + other + unknown

«codeList» CodeLists:: ScheduleTypeValue
+ hour + day + week + month + season + year + typicalDay + typicalWeek + typicalMonth + typicalSeason + typicalYear + monday + tuesday + wednesday + thursday + friday + saturday + sunday + weekday + weekendDay + beerDay + holiday + january + february + march + april + may + june + july + august + september + october + november + december + spring + summer + autumn + winter + other

«codeList» CodeLists:: NetworkTypeValue
+ data + gas + districtHeating + districtCooling + wasteWater + electricalGrid + other + unknown

«codeList» CodeLists:: RelationTypeValue
+ adjacentTo + installedOn + sharedWith

«codeList» CodeLists:: ResourceOperationTypeValue
+ demands + has + hasBalanceOf + produces + stores

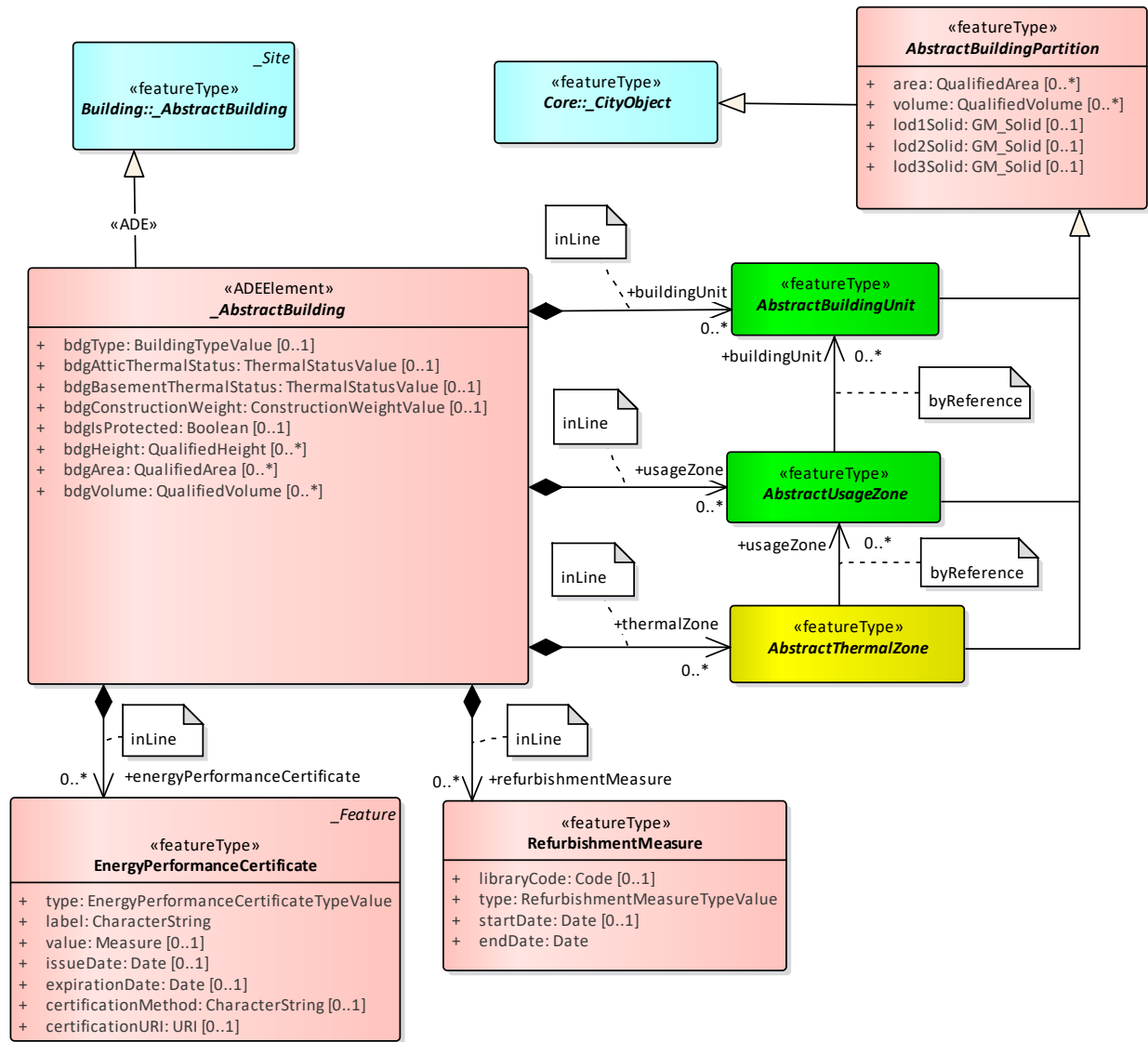
«codeList» CodeLists:: WeatherDataTypeValue
+ airTemperature + humidity + windSpeed + windDirection + cloudiness + globalSolarIrradiance + directSolarIrradiance + diffuseSolarIrradiance + terrestrialEmission + downwardTerrestrialRadiation + daylightIlluminance + shadowingFactor + precipitation

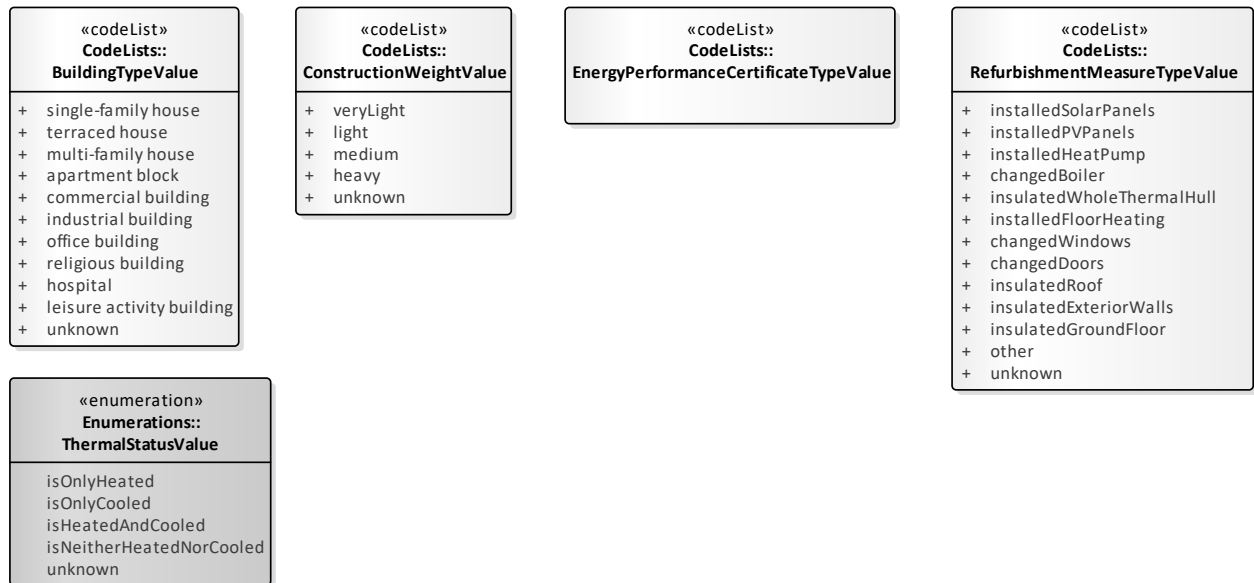
«codeList» CodeLists:: WeatherValueTypeValue
+ absolute maximum + average maximum + average + average minimum + absolute minimum + unknown

«enumeration» Enumerations:: InterpolationTypeValue
averageInPrecedingInterval averageInSucceedingInterval constantInPrecedingInterval constantInSucceedingInterval continuous discontinuous instantaneousTotal maximumInPrecedingInterval maximumInSucceedingInterval minimumInPrecedingInterval minimumInSucceedingInterval precedingTotal succeedingTotal

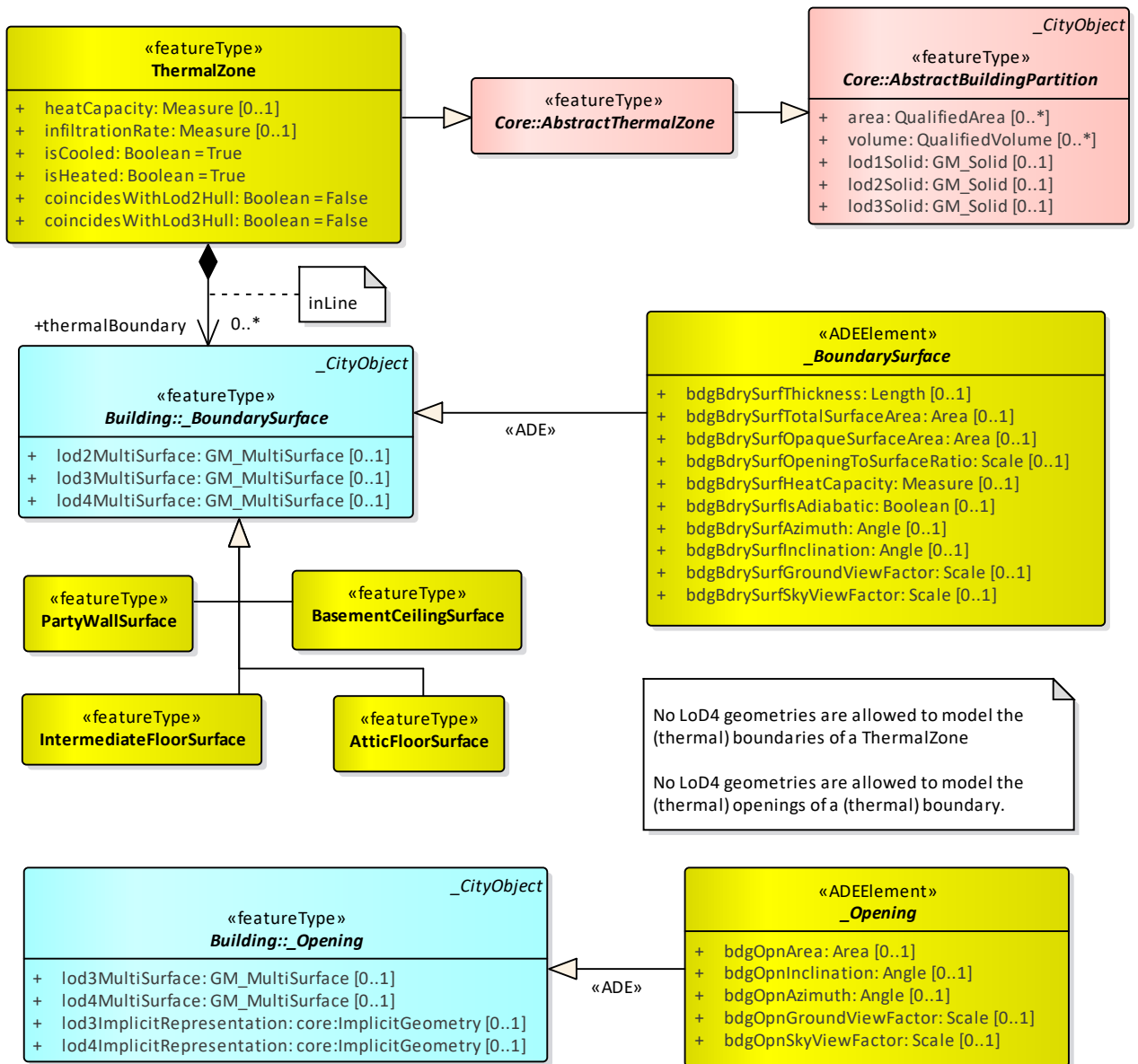
«enumeration» Enumerations:: NetworkConnectionStatusValue
connected disconnectedButConnectable disconnectedAndNotConnectable unknown

«enumeration» Enumerations:: ResourceStatusValue
actual potential unknown

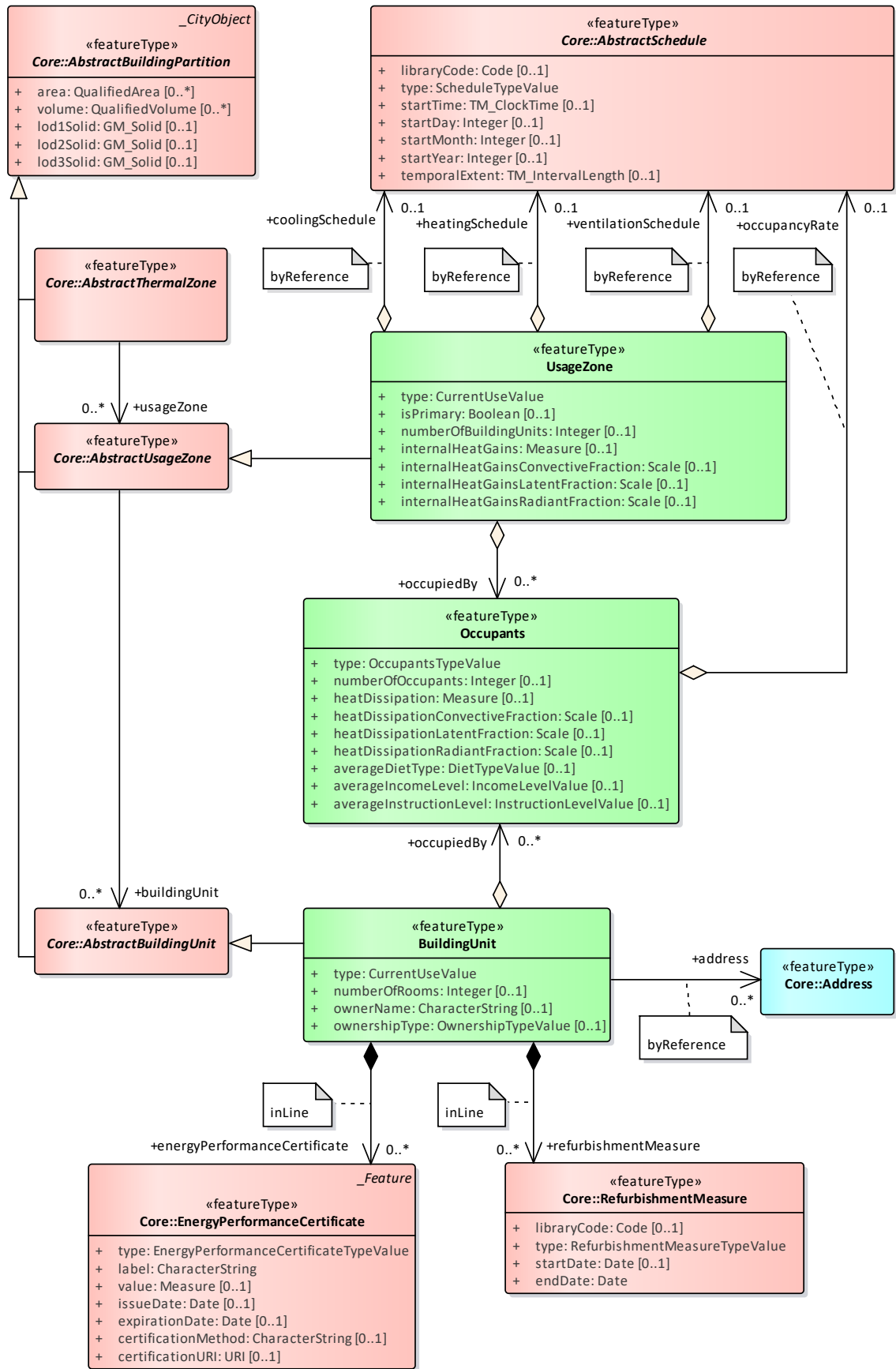


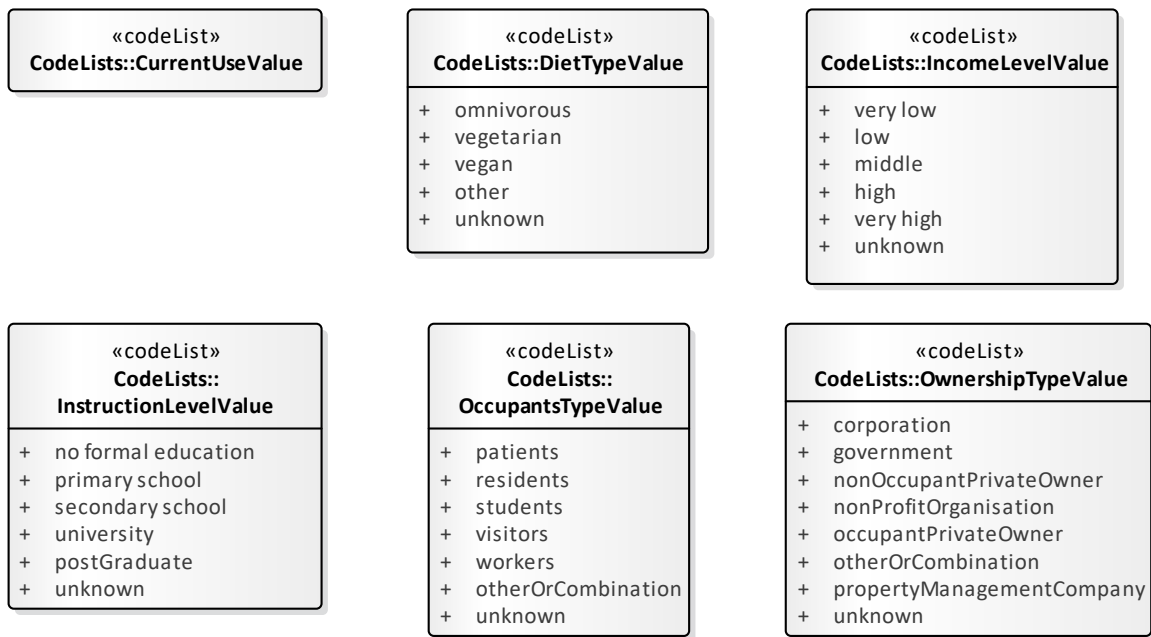


Building physics module

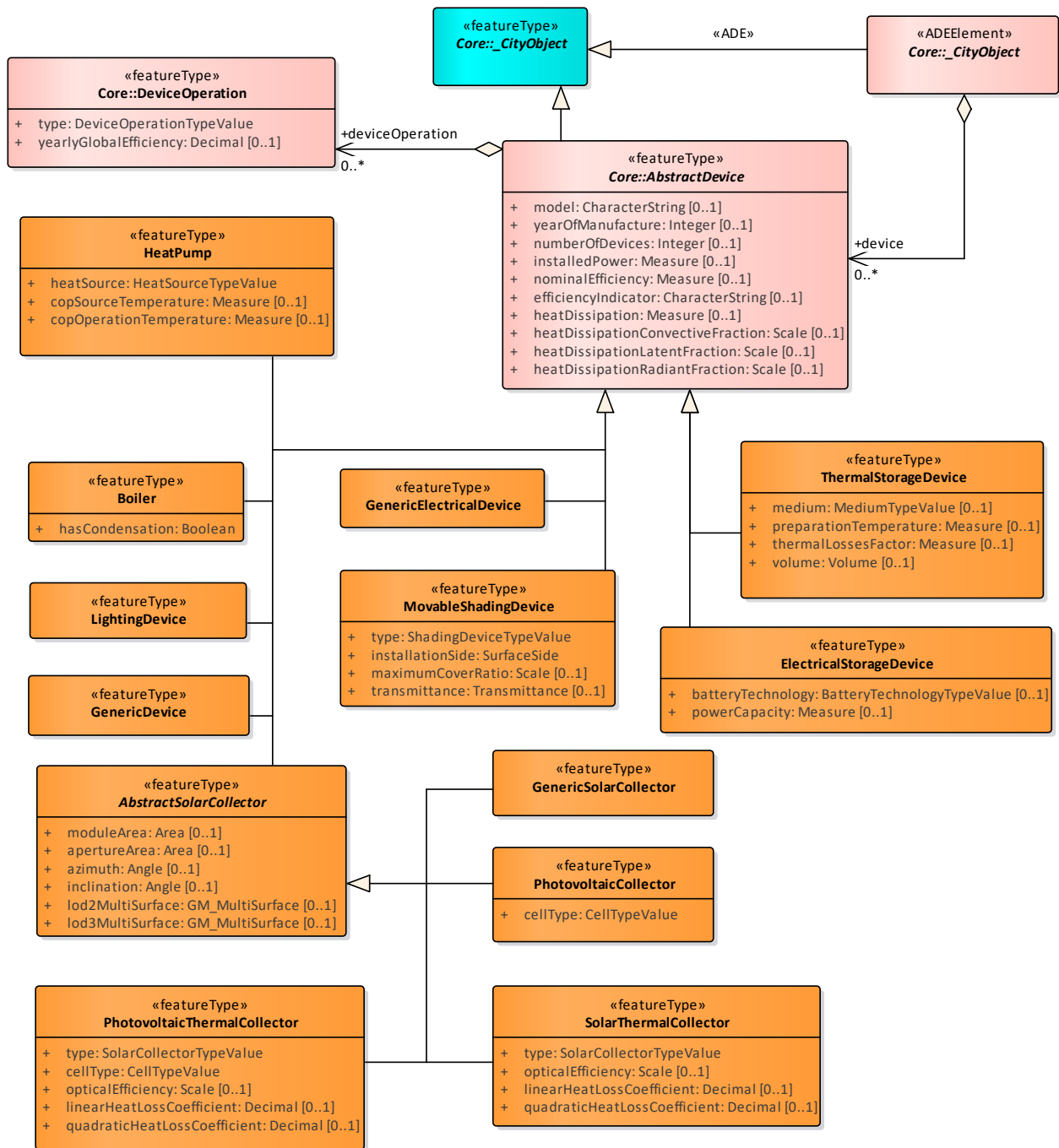


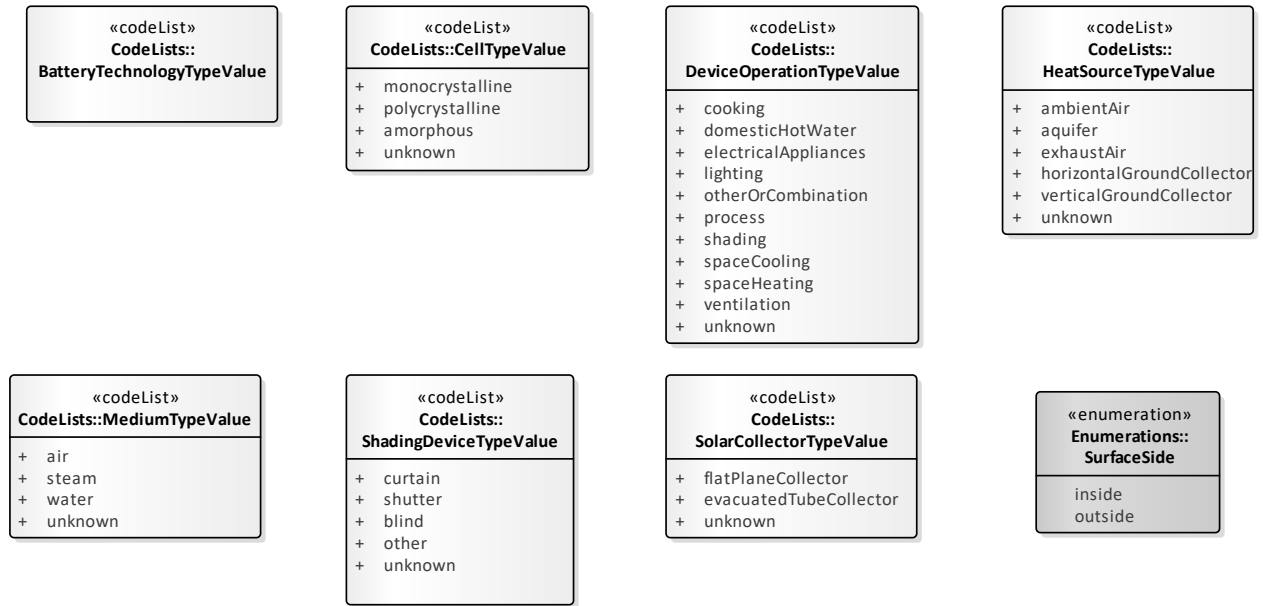
Occupancy module



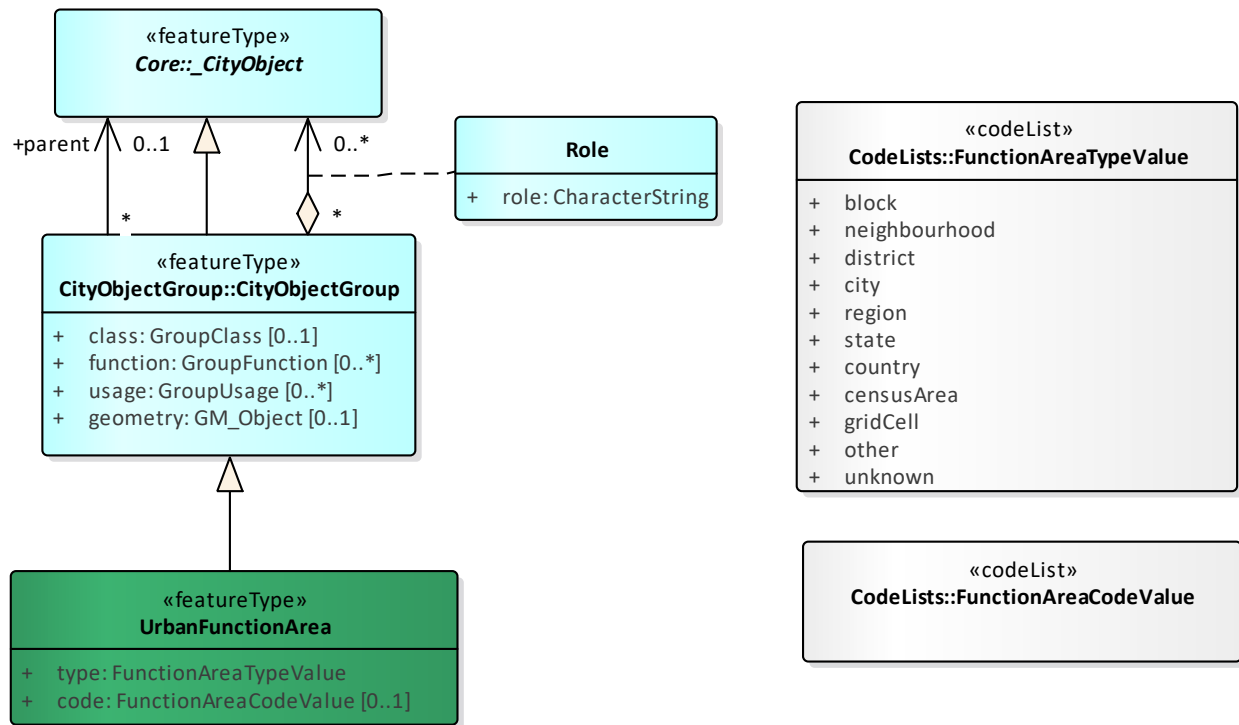


Devices module

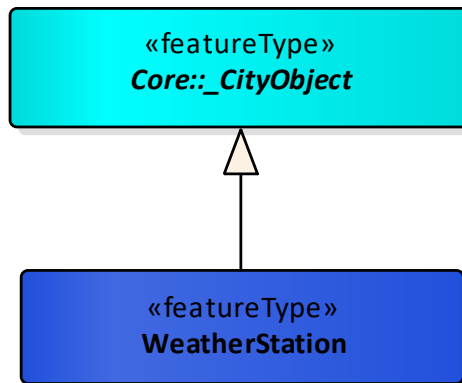




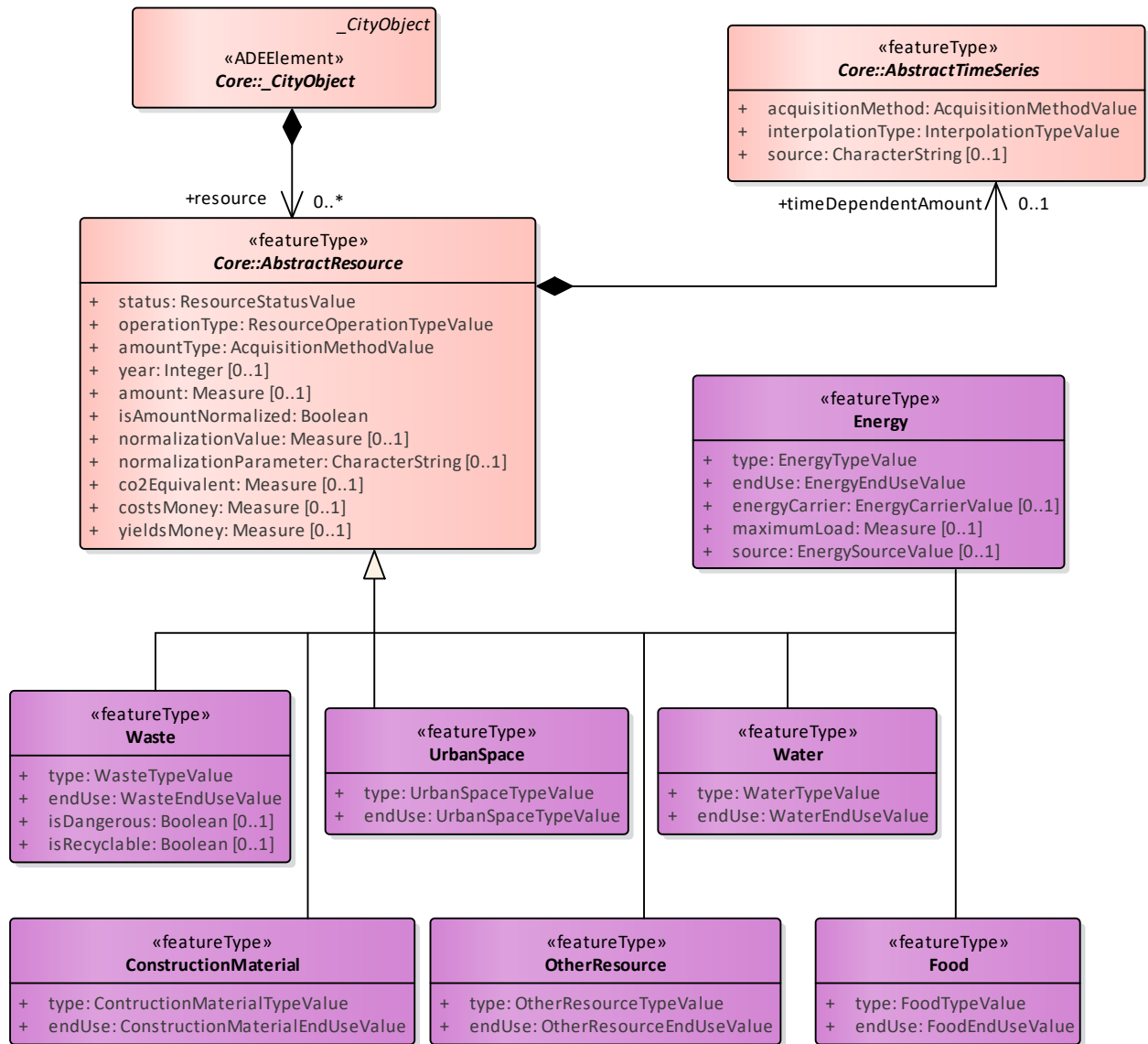
Urban function areas module

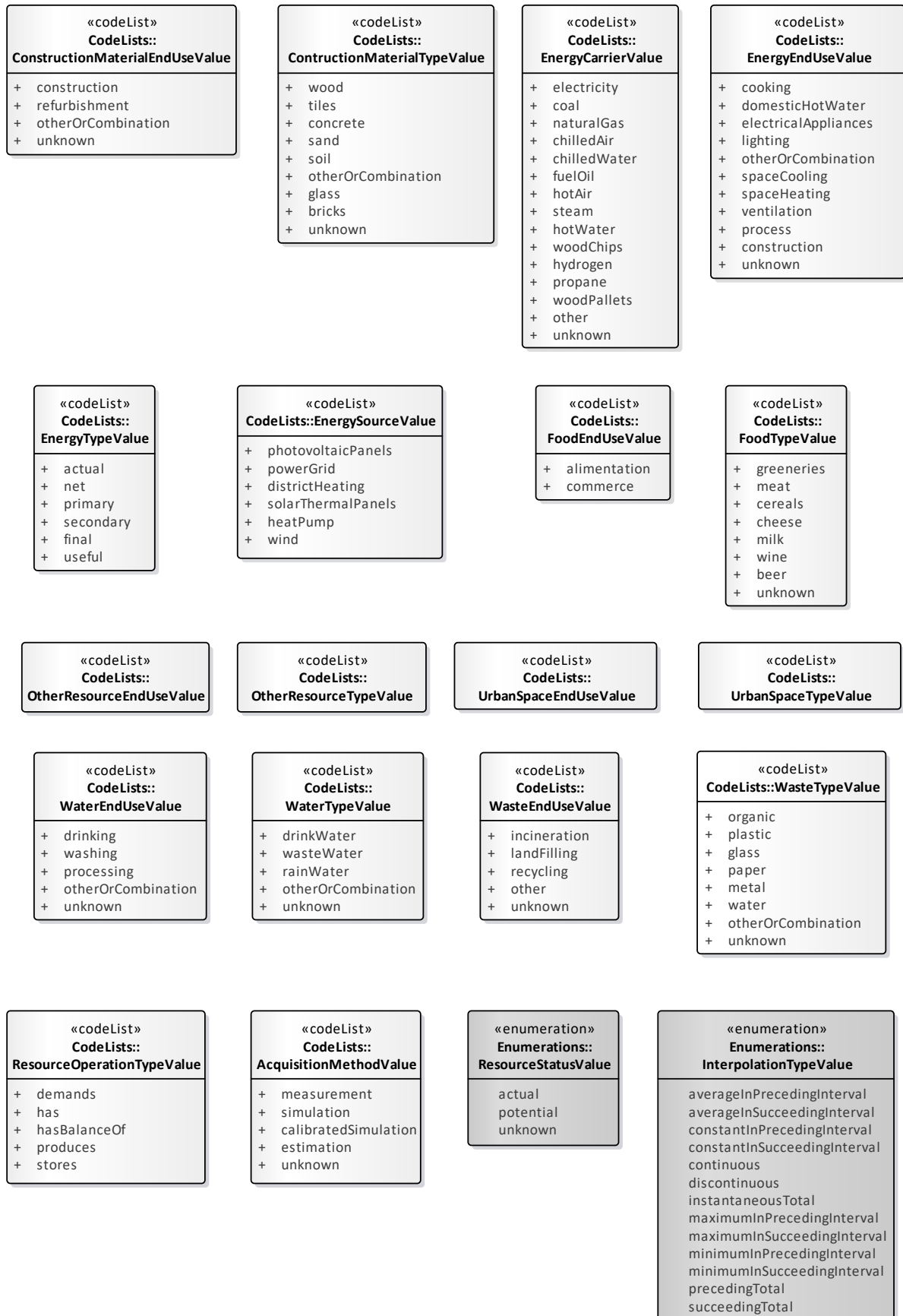


Weather station module

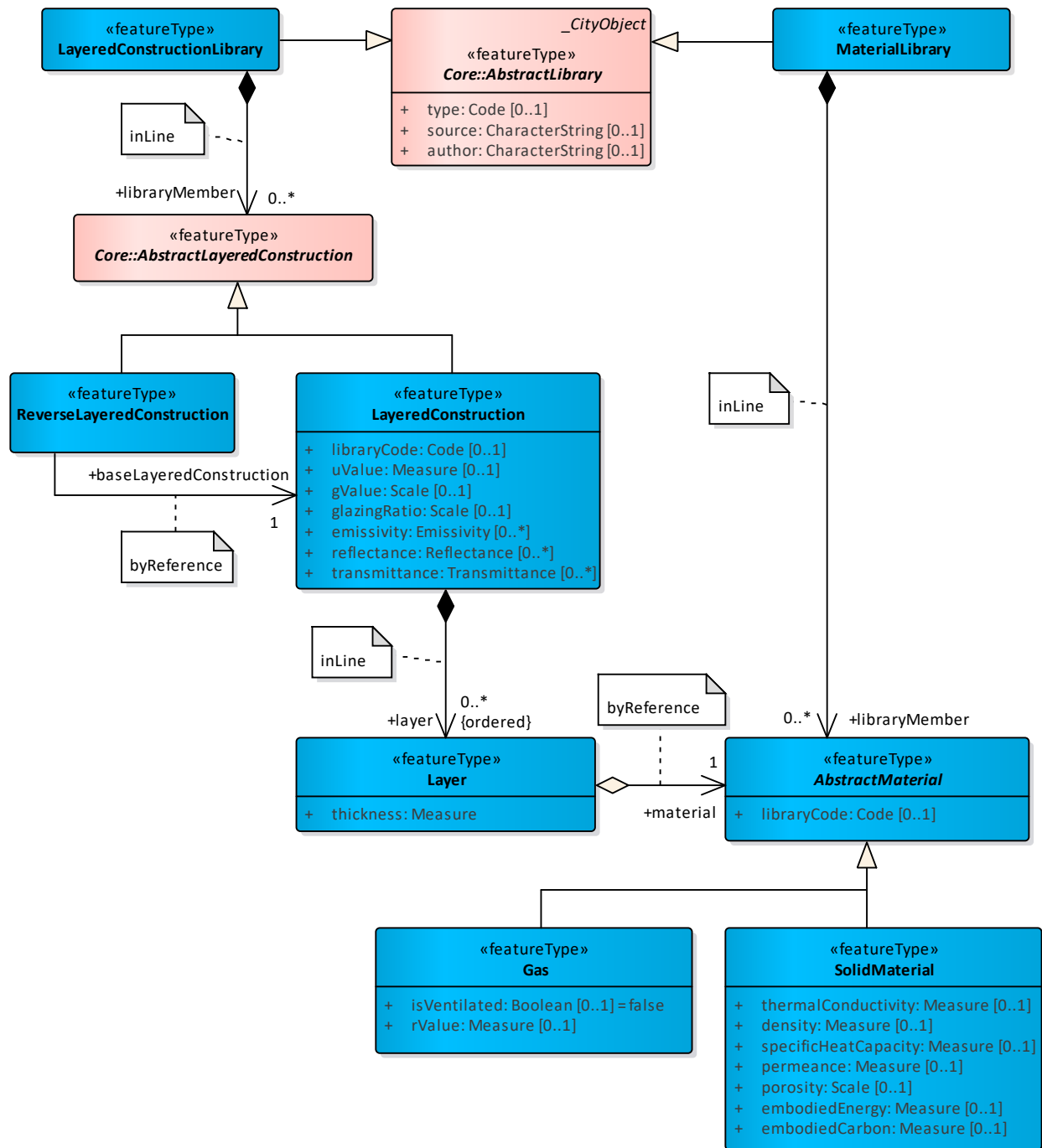


Resources module

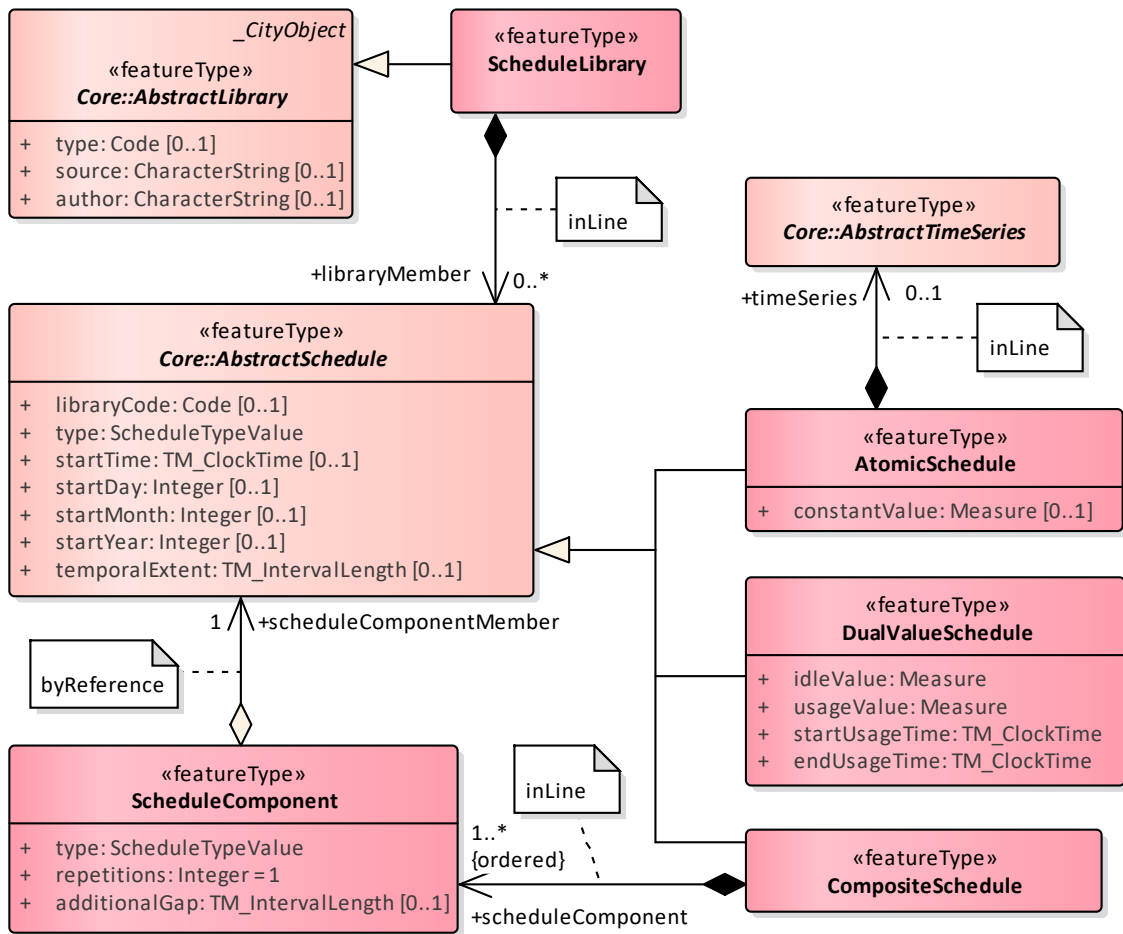




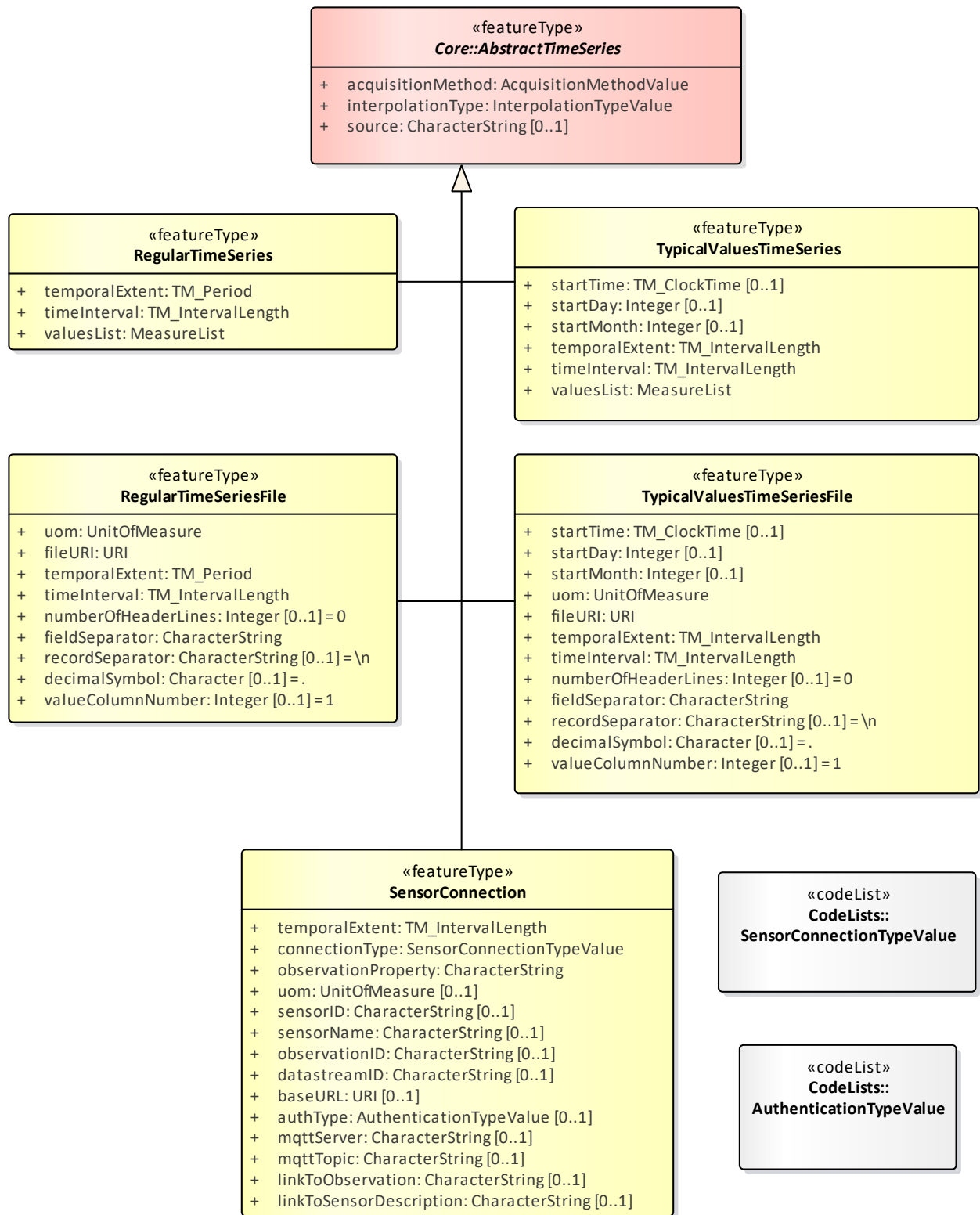
Layered construction module



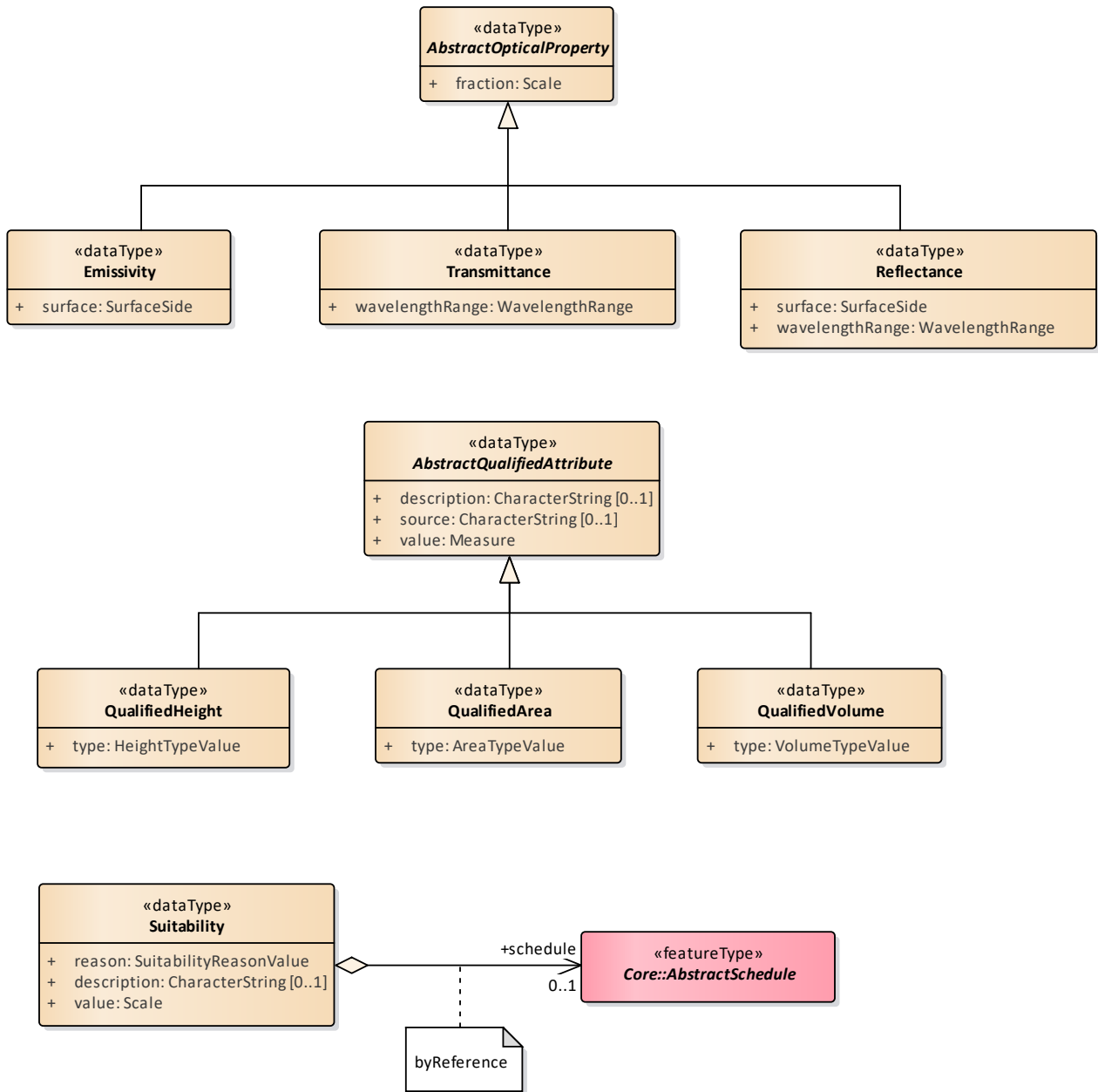
Schedules module



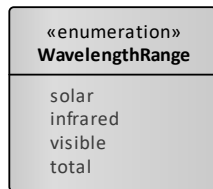
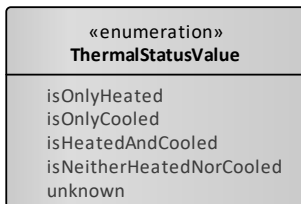
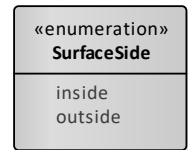
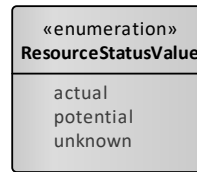
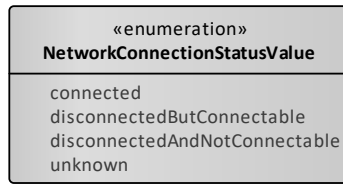
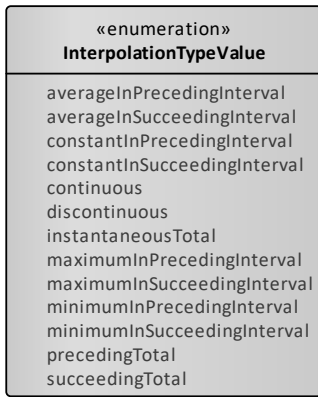
Time series module



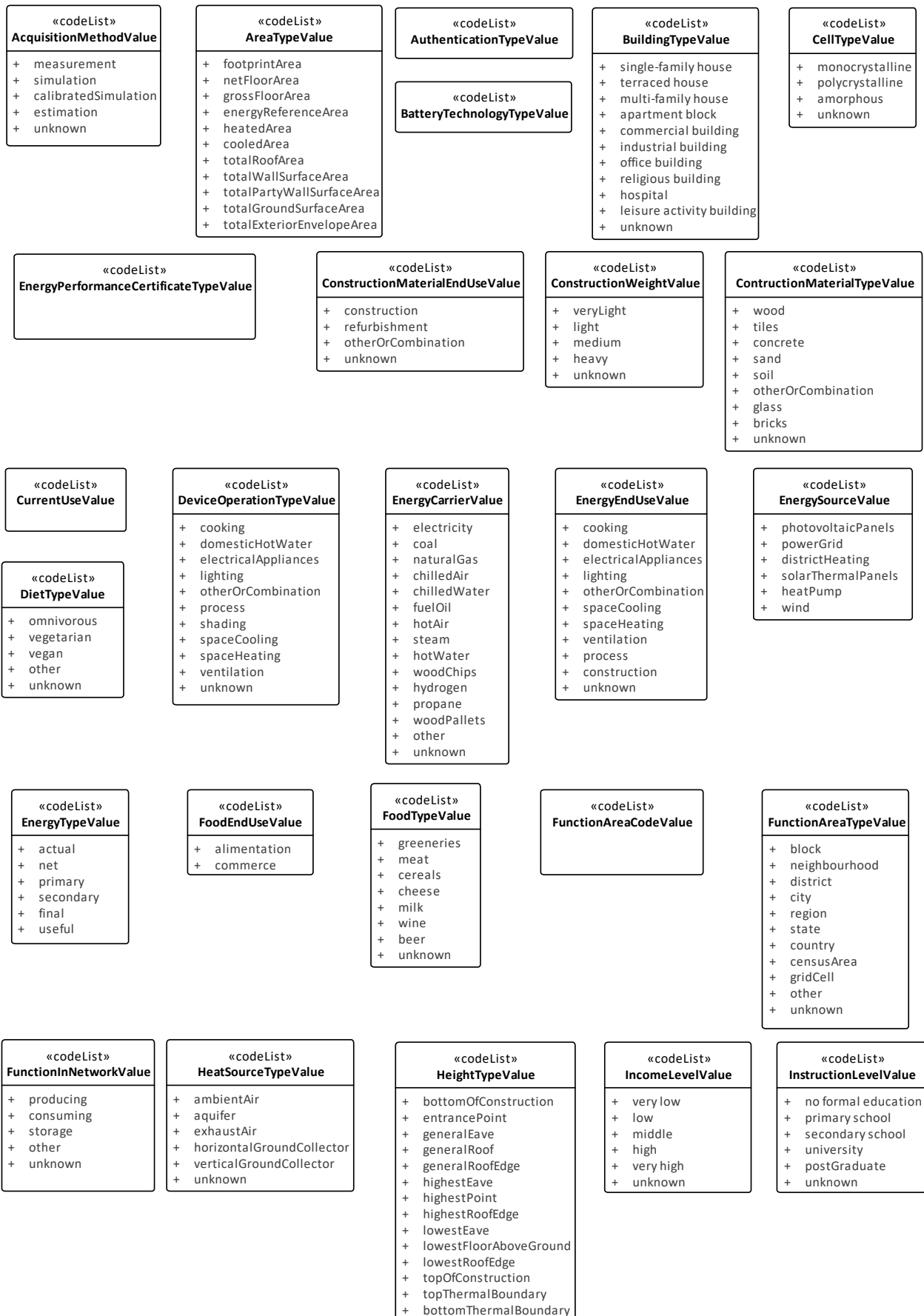
Supporting classes: DataTypes



Supporting classes: Enumerations



Supporting classes: Codelists



«codeList» OccupantsTypeValue
+ patients
+ residents
+ students
+ visitors
+ workers
+ otherOrCombination
+ unknown

«codeList» OtherResourceEndUseValue
--

«codeList» OtherResourceTypeValue

«codeList» MediumTypeValue
+ air
+ steam
+ water
+ unknown

«codeList» NetworkTypeValue
+ data
+ gas
+ districtHeating
+ districtCooling
+ wasteWater
+ electricalGrid
+ other
+ unknown

«codeList» OwnershipTypeValue
+ corporation
+ government
+ nonOccupantPrivateOwner
+ nonProfitOrganisation
+ occupantPrivateOwner
+ otherOrCombination
+ propertyManagementCompany
+ unknown

«codeList» RefurbishmentMeasureTypeValue
+ installedSolarPanels
+ installedPVPanels
+ installedHeatPump
+ changedBoiler
+ insulatedWholeThermalHull
+ installedFloorHeating
+ changedWindows
+ changedDoors
+ insulatedRoof
+ insulatedExteriorWalls
+ insulatedGroundFloor
+ other
+ unknown

«codeList» RelationTypeValue
+ adjacentTo
+ installedOn
+ sharedWith

«codeList» ScheduleTypeValue
+ hour
+ day
+ week
+ month
+ season
+ year
+ typicalDay
+ typicalWeek
+ typicalMonth
+ typicalSeason
+ typicalYear
+ monday
+ tuesday
+ wednesday
+ thursday
+ friday
+ saturday
+ sunday
+ weekDay
+ weekendDay
+ beerDay
+ holiday
+ january
+ february
+ march
+ april
+ may
+ june
+ july
+ august
+ september
+ october
+ november
+ december
+ spring
+ summer
+ autumn
+ winter
+ other

«codeList» ResourceOperationTypeValue
+ demands
+ has
+ hasBalanceOf
+ produces
+ stores

«codeList» SensorConnectionTypeValue

«codeList» ShadingDeviceTypeValue
+ curtain
+ shutter
+ blind
+ other
+ unknown

«codeList» SolarCollectorTypeValue
+ flatPlaneCollector
+ evacuatedTubeCollector
+ unknown

«codeList» SuitabilityReasonValue

«codeList» UrbanSpaceEndUseValue

«codeList» UrbanSpaceTypeValue

«codeList» VolumeTypeValue
+ netVolume
+ grossVolume
+ energyReferenceVolume
+ heatedVolume
+ cooledVolume

«codeList» WasteTypeValue
+ organic
+ plastic
+ glass
+ paper
+ metal
+ water
+ otherOrCombination
+ unknown

«codeList» WasteEndUseValue
+ incineration
+ landFilling
+ recycling
+ other
+ unknown

«codeList» WaterEndUseValue
+ drinking
+ washing
+ processing
+ otherOrCombination
+ unknown

«codeList» WaterTypeValue
+ drinkWater
+ wasteWater
+ rainWater
+ otherOrCombination
+ unknown

«codeList» WeatherDataTypeValue
+ airTemperature
+ humidity
+ windSpeed
+ windDirection
+ cloudiness
+ globalSolarIrradiance
+ directSolarIrradiance
+ diffuseSolarIrradiance
+ terrestrialEmission
+ downwardTerrestrialRadiation
+ daylightIlluminance
+ shadowingFactor
+ precipitation

«codeList» WeatherValueTypeValue
+ absolute maximum
+ average maximum
+ average
+ average minimum
+ absolute minimum
+ unknown

Changelog

Version 2.0 beta 7

2025-06-25

Schedules package:

- Class **ScheduleLibrary**
 - Changed relation type of *libraryMember* to composition

Layered Construction package:

- Class **LayeredConstructionLibrary**
 - Changed relation type of *libraryMember* to composition
- Class **LayeredConstruction**
 - Added property *gValue*
- Class **MaterialLibrary**
 - Changed relation type of *libraryMember* to composition

2025-05-30

Schedules package:

- Class **AtomicSchedule**
 - Changed multiplicity of relation *timeSeries* to [0..1]
 - Added property *constantValue*

2025-05-13

Building physics package:

- Class **ThermalZone**
 - Changed relation type of *thermalBoundary* to composition

2025-05-07

Core package:

- Class **ADE_CityObject**
 - Changed relation type of *device* to aggregation
 - Changed relation type of *weatherData* to composition
- Class **AbstractThermalZone**
 - Changed relation type of *usageZone* to association
- Class **AbstractUsageZone**
 - Changed relation type of *buildingUnit* to association
- Class **AbstractResource**
 - Made relation to **AbstractTimeSeries** explicit and set to composition
- Class **DeviceOperation**
 - Made relation to **AbstractSchedule** explicit and set to aggregation
- Class **WeatherData**
 - Made relation to **AbstractTimeSeries** explicit and set to composition

Occupancy package:

- Class **UsageZone**
 - Changed relation type of *occupiedBy* to aggregation
 - Made all relations to **AbstractSchedule** explicit and set to aggregation
- Class **BuildingUnit**
 - Changed relation type of *occupiedBy* to aggregation
- Class **Occupants**
 - Made relation to **AbstractSchedule** explicit and set to aggregation

Layered Construction package:

- Class **LayeredConstruction**
 - Changed relation type of *layer* to composition
- Class **Layer**
 - Changed relation type of *material* to aggregation

Schedules package:

- Class **ScheduleComponent**
 - Changed relation type of *scheduleComponentMember* to aggregation

2025-05-01**Core package:**

- Class **ADE _AbstractSchedule**
 - Moved from package Schedules to Core
- Class **ADE _AbstractTimeSeries**
 - Moved from package Time Series to Core

Occupancy package:

- Class **Occupants:**
 - Added property *averageDietType*
 - Added property *averageIncomeLevel*
 - Added property *averageInstructionLevel*

CodeLists package:

- Added class **DietTypeValue**
- Added class **InstructionLevelValue**
- Added class **IncomeLevelValue**

2025-04-23**CodeLists package:**

- Added values to class **AreaTypeValue**
- Renamed class **HeightReferenceValue** to **HeightTypeValue**
- Added class **SuitabilityReasonValue**
- Added class **UrbanSpaceTypeValue**
- Added class **UrbanSpaceEndUseValue**

DataTypes package:

- Added class **Suitability**

Core package:

- Class **ADE _CityObject**
 - Added property *suitability*
- Class **ADE _AbstractBuilding**
 - Renamed property *bdgFloorArea* to *bdgArea*
 - Renamed property *bdgHeightAboveGround* to *bdgHeight*
- Class **AbstractBuildingPartition**
 - Renamed property *floorArea* to *area*

Resources package:

- Added class **UrbanSpace**

2025-04-12**Core package:**

- Added class **AbstractLibrary**

Layered Construction package:

- Added class **LayeredConstructionLibrary**
- Added class **MaterialLibrary**

Schedules package:

- Added class **ScheduleLibrary**

CodeLists package:

- Class **FunctionInNetwork** renamed to **FunctionInNetworkValue**

Version 2.0 beta 6

2025-02-06

DataTypes package:

- Dropped class **HeatExchangeType**
- Dropped class **OpticalProperties**

Core package:

- Class **ADE_CityObject**:
 - Renamed property from *operationSchedule* to *deviceOperation*
- Class **AbstractDevice**:
 - Changed type of property *heatDissipation* to gml:Measure
 - Added property *heatDissipationConvectiveFraction*
 - Added property *heatDissipationLatentFraction*
 - Added property *heatDissipationRadiantFraction*

Occupancy package:

- Class **UsageZone**:
 - Renamed property *averageInternalGains* to *internalGains* and changed type to gml:Measure
 - Added property *internalGainsConvectiveFraction*
 - Added property *internalGainsLatentFraction*
 - Added property *internalGainsRadiantFraction*
- Class **Occupants**:
 - Changed type of property *heatDissipation* to gml:Measure
 - Added property *heatDissipationConvectiveFraction*
 - Added property *heatDissipationLatentFraction*
 - Added property *heatDissipationRadiantFraction*

Layered Construction package:

- Class **LayeredConstruction**:
 - Dropped property *opticalProperties*
 - Added property *glazingRatio*
 - Added property *emissivity*
 - Added property *reflectance*
 - Added property *transmittance*
- Class **Layer**:
 - Changed multiplicity of property *thickness* to [1]
- Class **AbstractMaterial**:
 - Added property *libraryCode*

Version 2.0 beta 5

Resources package:

No changes since beta 4

Weather Station package:

No changes since beta 4

2025-01-30

Packages

- Created TimeSeries package and moved all related classes into it
- Created Schedule package and moved all related classes into it
- Dropped Supporting classes package

CodeLists package:

- Class **CertificateTypeValue** renamed to **EnergyPerformanceCertificateTypeValue**

2025-01-28

CodeLists package:

- Added class **ScheduleTypeValue**

Enumerations package:

- Dropped class **DayTypeValue**

Supporting classes package:

- Dropped class **TimeSeriesSchedule**
- Dropped class **DailyPatternSchedule**
- Dropped class **PeriodOfYear**
- Dropped class **DailySchedule**
- Added class **AtomicSchedule**
- Added class **CompositeSchedule**
- Added class **ScheduleComponent**
- Class **AbstractSchedule**:
 - Added properties *type*, *startTime*, *startDay*, *startMonth*, *startYear*, *temporalExtent*

2025-01-22

Devices package:

- Class **AbstractSolarCollector**:
 - Added properties *azimuth* and *inclination*
 - Dropped property *surfaceGeometry*
 - Added properties *lod2MultiSurface* and *lod3MultiSurface*

2025-01-13

CodeLists package:

- Dropped class **ThermalBoundaryTypeValue**
- Added class **ShadingDeviceTypeValue**
- Added class **WeatherValueTypeValue**

DataTypes package:

- Moved class **PeriodOfYear** from package DataTypes to Supporting classes
- Moved class **DailySchedule** from package DataTypes to Supporting classes
- Class **AbstractQualifiedAttribute**:
 - Added properties *source* and *value*
- Classes **QualifiedHeight**, **QualifiedArea**, **QualifiedVolume**:
 - Dropped property *value*

Supporting classes package:

- Class **AbstractTimeSeries**:

- Moved back from package Core to Supporting classes
- Changed multiplicity of property *acquisitionMethod* to [1]
- Changed multiplicity of property *interpolationType* to [1]
- Class **TypicalValuesTimeSeries**:
 - Added properties *startTime*, *startDay*, *startMonth*
- Class **TypicalValuesTimeSeriesFile**:
 - Added properties *startTime*, *startDay*, *startMonth*
- Added class **DualValueSchedule**:
- Class **PeriodOfYear**:
 - Changed stereotype from *dataType* to *featureType*
 - Added properties *startDay*, *startMonth*, *endDay*, *endMonth*
 - Dropped property *period*
- Class **DailySchedule**:
 - Changed stereotype from *dataType* to *featureType*
 - Added property *repetition*
 - Renamed property from *schedule* to *timeSeries*

Layered Construction package:

- Added class **ReverseLayeredConstruction**
- Dropped class **LayerComponent**
- Class **Layer**:
 - Removed property *layerComponent*
 - Added property *thickness*
 - Added property *material*
- Class **SolidMaterial**:
 - Renamed property from *specificHeat* to *specificHeatCapacity*
 - (Re)added and renamed property from *conductivity* to *thermalConductivity*
 - (Re)added property *embodiedEnergy*
 - (Re)added property *embodiedCarbon*
 - (Re)added property *porosity*

Core package:

- Class **AbstractDevice**:
 - Class is renamed from **AbstractEnergySystem** to **AbstractDevice**
 - Added property *heatDissipation*
 - Added property *operationSchedule*
 - Added property *efficiencyIndicator*
 - Added property *installedPower*
 - Added property *nominalEfficiency*
- Class **AbstractTimeSeries**:
 - Moved back from package Core to Supporting classes
- Class (ADE) **_CityObject**:
 - Renamed property from *energySystem* to *device*
- Class **OperationSchedule**:
 - Moved from package Devices to Core
- Class **WeatherData**:
 - Renamed property from *timeseries* to *timeDependentValues*
 - Renamed property from *singleValue* to *yearlyValue*
 - Renamed property from *singleValueType* to *valueType*
 - Changed type of property *valueType* from *CharacterString* to *CodeList*
- Added class **AbstractBuildingPartition**
- Classes **AbstractBuildingUnit**, **AbstractUsageZone**, **AbstractThermalZone**
 - Changed parent class

Building physics package:

- Dropped class **ThermalBoundary**
- Dropped class **ThermalOpening**
- Class **ThermalZone**
 - Removed property *floorArea* (now inherited via **AbstractBuildingPartition**)

- Removed property *volume* (now inherited via **AbstractBuildingPartition**)
- Removed property *volumeGeometry* (now inherited via **AbstractBuildingPartition**)
- Removed property *boundedBy*
- Added property *heatCapacity*
- Added property *coincidesWithLod2Hull*
- Added property *coincidesWithLod3Hull*
- Added property *thermalBoundary*
- Added class **PartyWallSurface**
- Added class **BasementCeilingSurface**
- Added class **IntermediateFloorSurface**
- Added class **AtticFloorSurface**
- Class (ADE) **_BoundarySurface**:
 - Renamed property from *bdgBdrySrfWindowToWallRatio* to *bdgBdrySrfOpeningToSurfaceRatio*
 - Renamed property from *bdgBdrySrfArea* to *bdgBdryTotalSurfaceArea*
 - Added property *bdgBdryOpaqueSurfaceArea*
 - Added property *bdgBdrySrfThickness*
 - Added property *bdgBdrySrfHeatCapacity*

Occupancy package:

- Dropped class **AbstractFacilities**
- Dropped class **DHWFacilities**
- Dropped class **LightingFacilities**
- Dropped class **ElectricalAppliances**
- Dropped class **GenericFacilities**
- Class **BuildingUnit**:
 - Removed property *floorArea* (now inherited via **AbstractBuildingPartition**)
 - Removed property *volume* (now inherited via **AbstractBuildingPartition**)
 - Removed property *equippedWith*
- Class **UsageZone**:
 - Removed property *floorArea* (now inherited via **AbstractBuildingPartition**)
 - Removed property *volume* (now inherited via **AbstractBuildingPartition**)
 - Removed property *volumeGeometry* (now inherited via **AbstractBuildingPartition**)
 - Removed property *equippedWith*

Devices package:

The former EnergySystems package is renamed to Devices package

- Class **OperationSchedule**:
 - Moved from package Devices to Core
- Dropped class **AbstractEnergyConversionSystem**
 - Now all subclasses are derived directly from **AbstractDevice**
- Dropped class **AbstractStorageSystem**
 - Now all subclasses are derived directly from **AbstractDevice**
- Class **GenericDevice**:
 - Renamed from class **GenericEnergyConversionSystem**
- Class **ElectricalStorageDevice**:
 - Renamed from class **PowerStorageSystem**
- Class **ThermalStorageDevice**:
 - Renamed from class **ThermalStorageSystem**
- Class **AbstractSolarCollector**:
 - Renamed from class **AbstractSolarEnergySystem**
- Class **PhotovoltaicThermalCollector**:
 - Renamed from class **PhotovoltaicThermalSystem**
- Class **PhotovoltaicCollector**:
 - Renamed from class **PhotovoltaicSystem**
- Class **SolarThermalCollector**:
 - Renamed from class **SolarThermalSystem**
- Class **GenericSolarCollector**:
 - Renamed from class **GenericSolarEnergySystem**
- Added class **LightingDevice**

- Added class **GenericElectricalDevice**
- Added class **MovableShadingDevice**

Urban Function Areas package:

- Class **UrbanFunctionArea**:
 - Removed property *rank*

Version 2.0 beta 4

2024-09-25

- Codelist **ThermalBoundaryTypeValue**
 - Renamed *outerWall* to *exteriorWall*
 - Renamed *intermediaryFloor* to *intermediateFloor*

2024-09-20

- Minor edits to the layout of the UML diagrams
- Polished Codelist **ThermalBoundaryTypeValue**

2024-08-12

- Class **ADE CityObject**:
 - Renamed association *connectedTo* to *utilityNetworkConnection*
 - Remodelled association class **CityObjectRelation**
- Class **AbstractTimeSeries**:
 - Moved to Core module
- Class **WeatherData**:
 - renamed property *valuesList* to *timeSeries*
 - made the association to **AbstractTimeSeries** explicit
- Added some values to codelist **RelationTypeValue**
- Class **TimeSeriesSchedule**:
 - Changed association to **AbstractTimeSeries** to Composition
- Class **DailySchedule**:
 - Changed association to **AbstractTimeSeries** to Composition
- Class **SensorConnection**:
 - Changed type of *uom* to *UnitOfMeasure*
 - Renamed *linkToSensortDescription* to *linkToSensorDescription*
- Class **AbstractSolarEnergySystem**:
 - Removed association *installedOn* (now taken over by **CityObjectRelation**)
- Class **Energy**:
 - Changed multiplicity of *EnergyCarrier* to [0..1]
- Class **Waste**:
 - Changed multiplicity of *isDanerous* and *isRecyclable* to [0..1]

