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## Integration/Testing of CityBEM with EnergyADE 0.8 DB schema



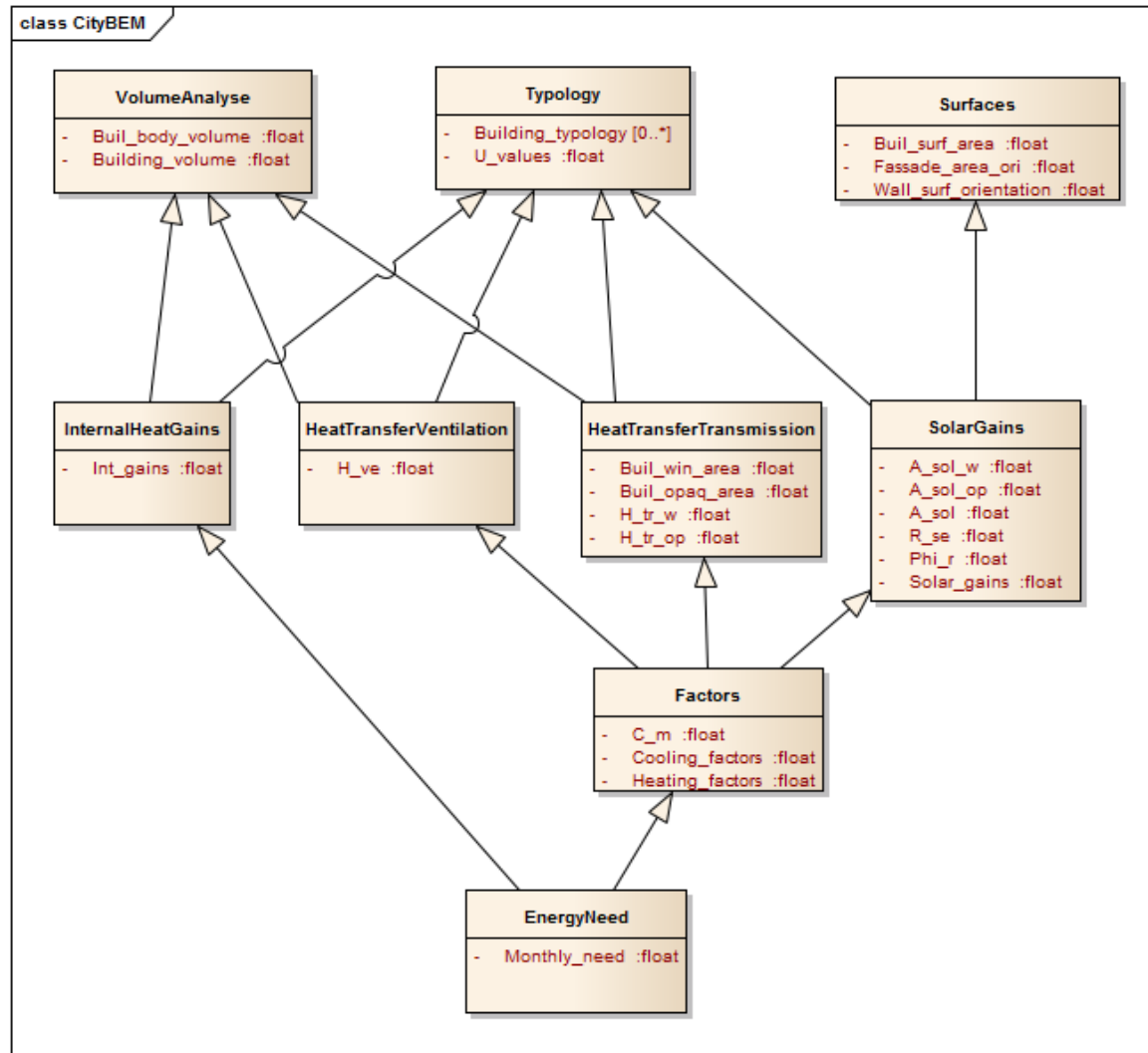
EIFER

Energy ADE workshop, Karlsruhe  
06.12.2017

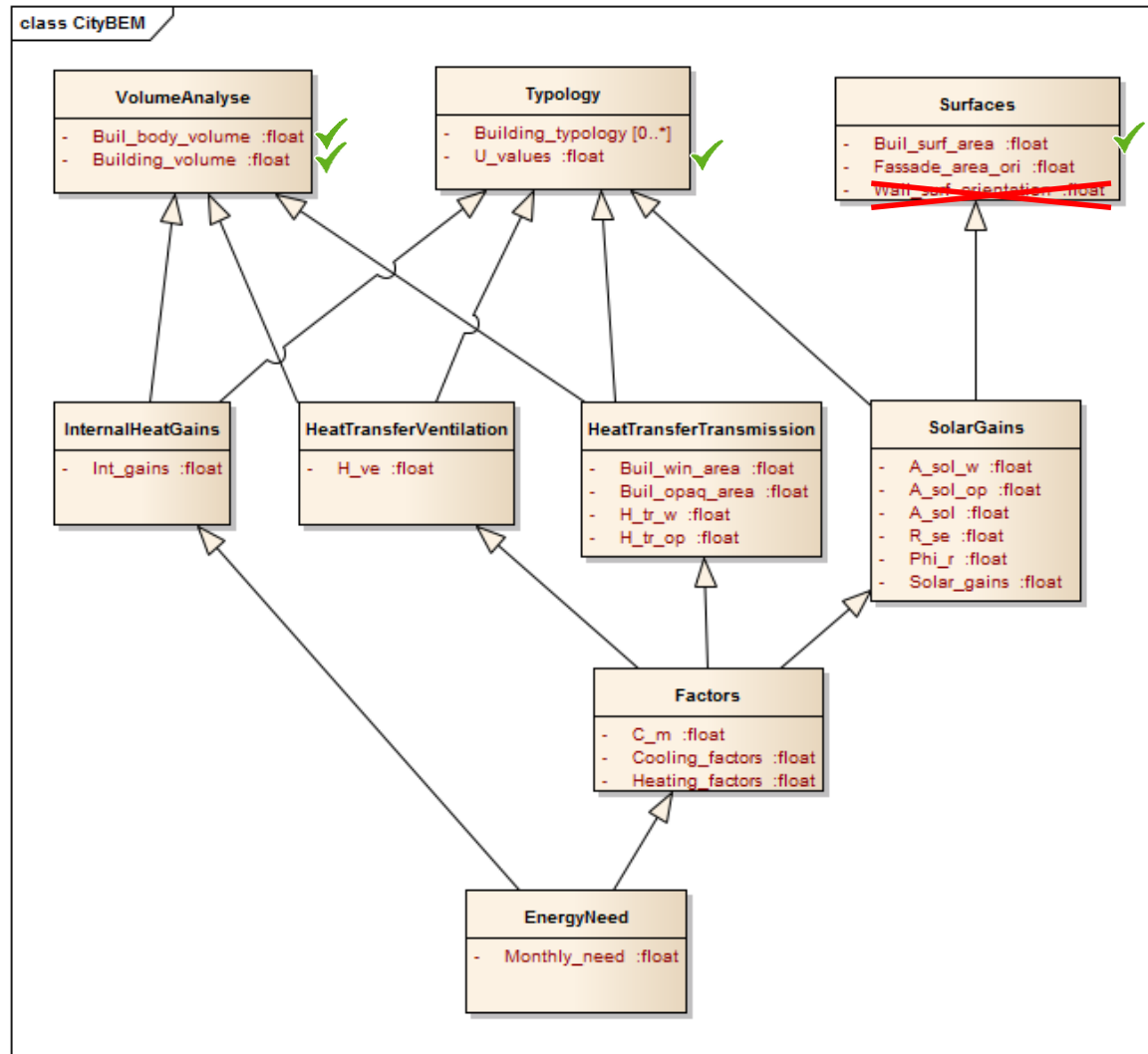


- Previous Structure of CityBEM
- Structure of EnergyADE for 3DCityDB Implementation (v0.8)
- Progress of EnergyADE Conversion So Far
- Issues
- Future Work
- Conclusion

# Previous Structure of CityBEM



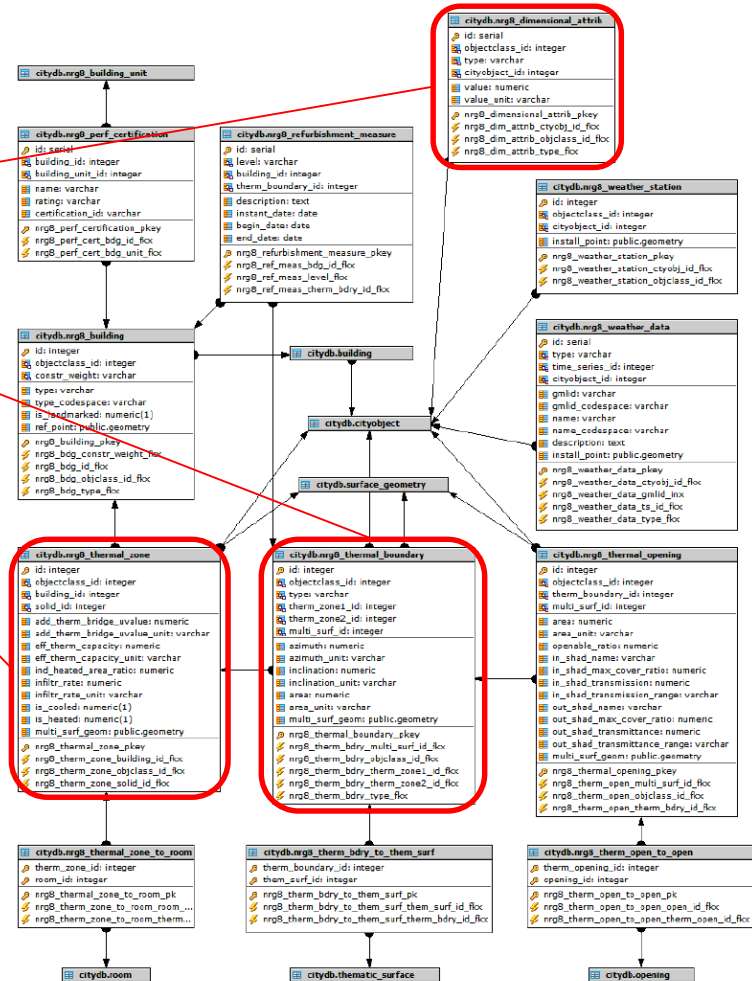
# Previous Structure of CityBEM





## Building Physics module

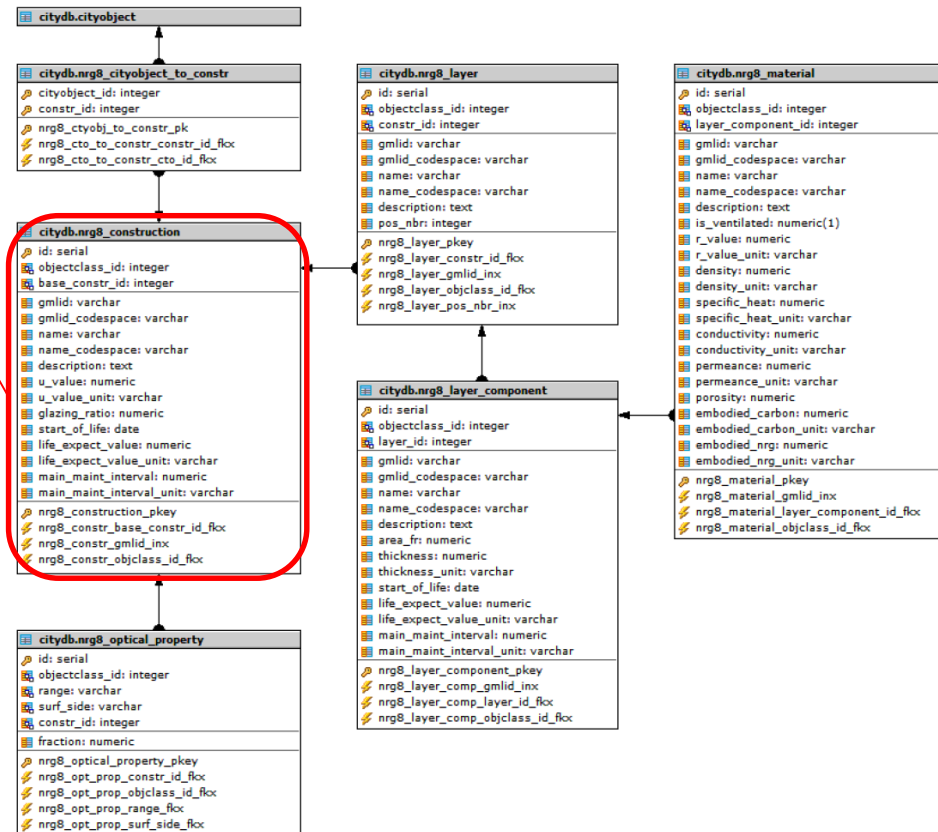
- Utilized by CityBEM for:
  - nrg8\_dimensional\_attrib* → Building volume
  - nrg8\_thermal\_boundary* → Surface area
  - nrg8\_thermal\_zone* → Infiltration





## Materials module

- Utilized by CityBEM for:
  - nrg8\_construction*  
→ Surface U Value



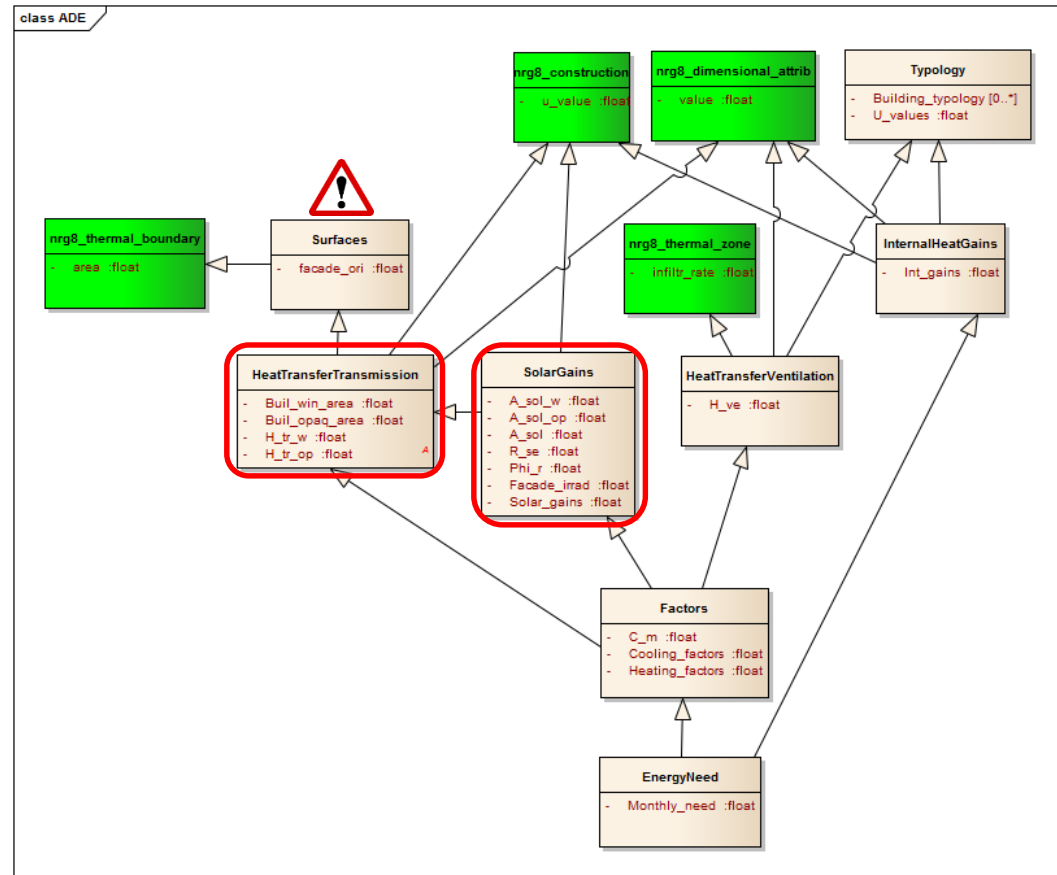
# Progress of EnergyADE Conversion So Far



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Modules not fully supported by EnergyADE 0.8 DB schema:

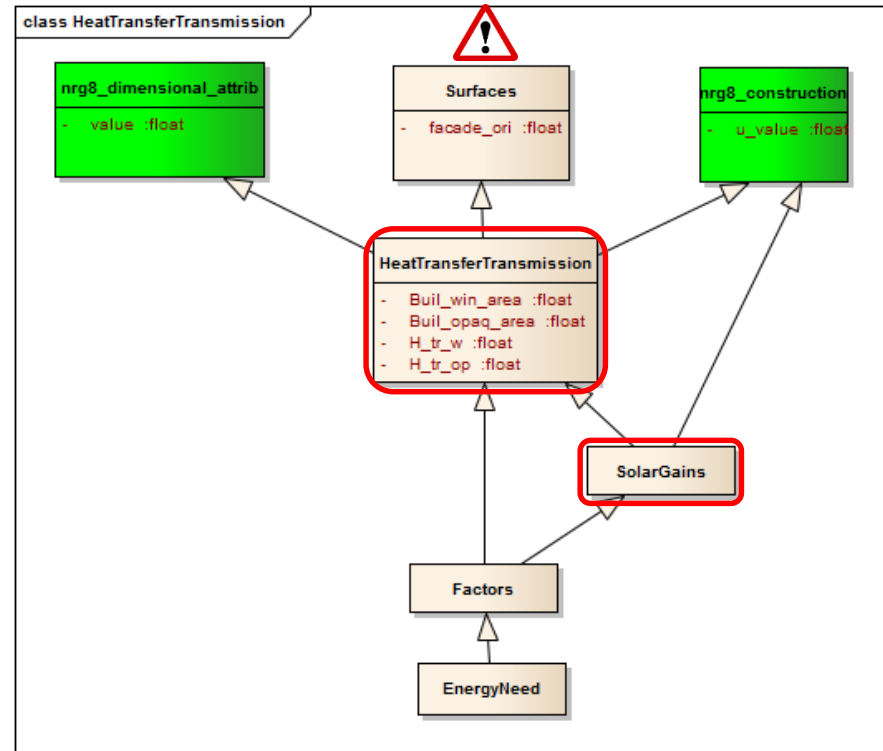
## 1. HeatTransferTransmission





## HeatTransferTransmission & Solar Gains

- Now use “façade\_ori” table
- “façade\_ori” used for LOD2 data to:
  - Calculate average window area for each NESW facing façade
  - Typology then assigns estimated window U-Value based on structure age and class.
- Problem could be resolved by upgrading model to LOD3
- Statistical information not currently supported by EnergyADE

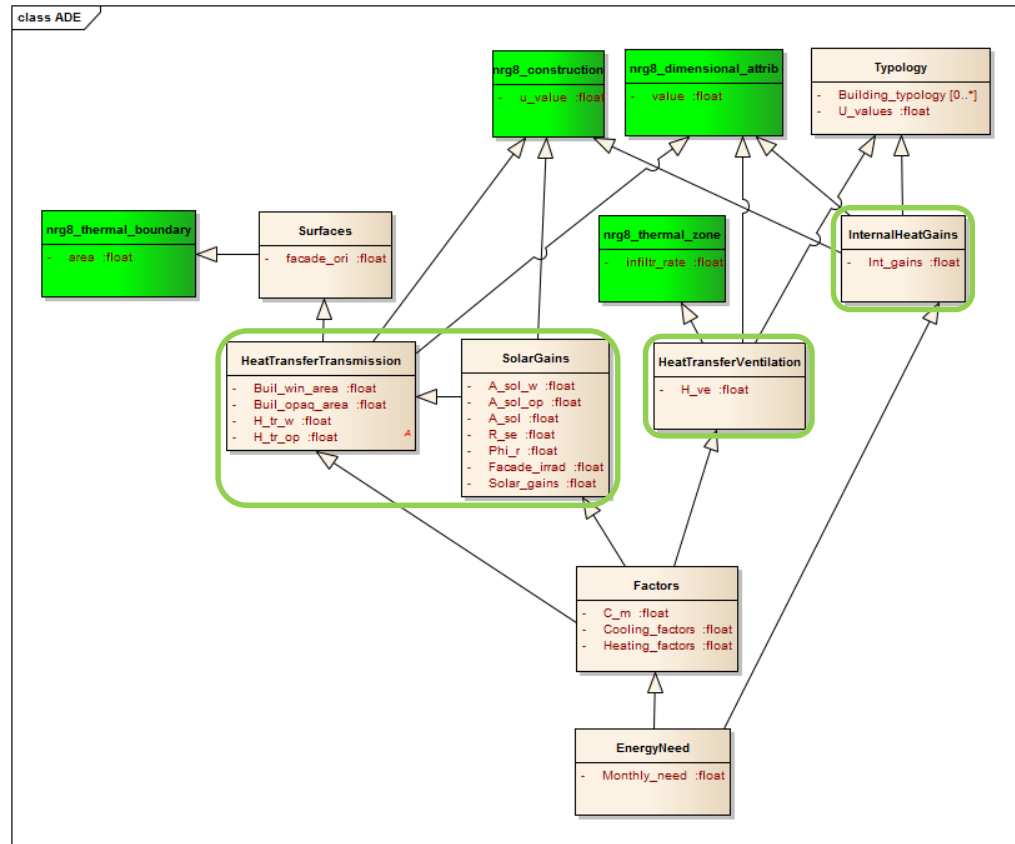






Still need to implement:

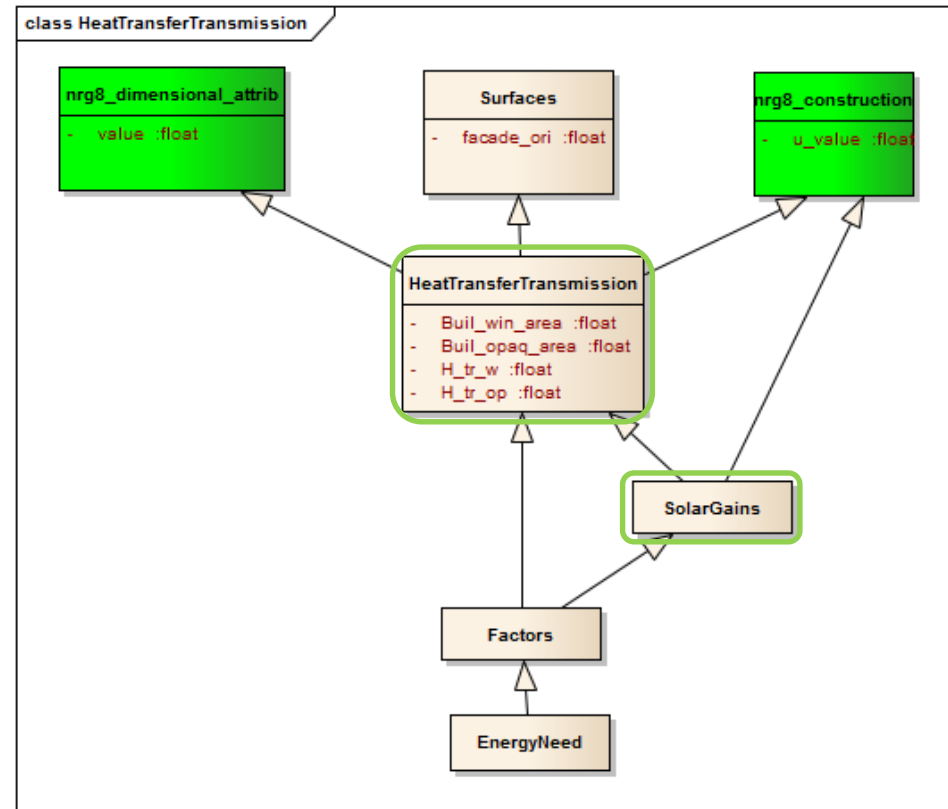
1. Weather data input for HeatTransferTransmission and SolarGains  
→ *TimeSeries*
2. InternalHeatGains  
→ *TimeSeries* and *Occupancy*
3. HeatTransferVentilation  
→ *TimeSeries* and *Building Physics*





## Weather Data Input

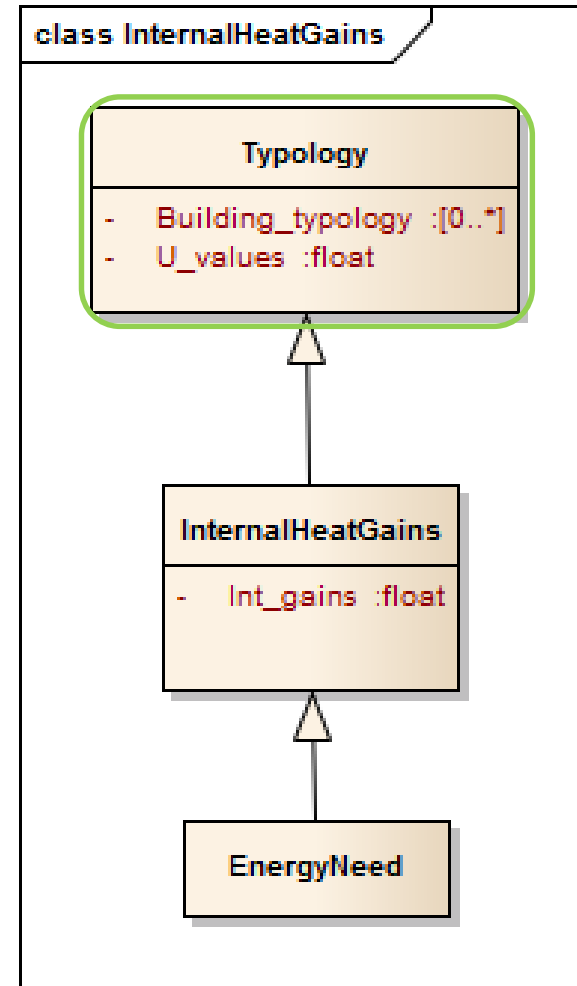
- *HeatTransferTransmission* and *SolarGains* use TMY3 formatted .csv file for temperature and irradiance input for incoming solar radiation calculation
- *TimeSeries* feature of EnergyADE will be used to store this data
- Compatibility would therefore be improved





## Internal Heat Gains

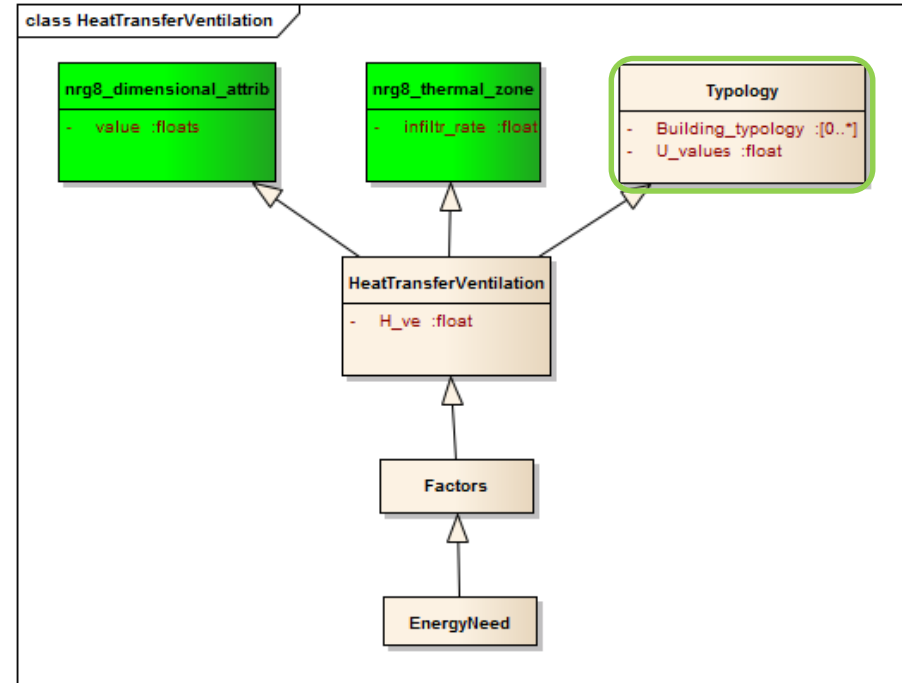
- *Typology* still needed to provide estimated internal heat gain data on occupants and equipment, due to structure age and building type
- Could use EnergyADE's *Occupancy* and *TimeSeries* module to provide this data
- Accuracy of model would be increased
- Data could be automatically collected by smart meters





## HeatTransferVentilation

- Still needs “Typology”:
  - Ventilation attribute
- Will be implemented by *TimeSeries* and *Building Physics* modules
- Required by ISO 13790:2008





## Issues

1. No support of statistical data

## Conclusion

1. Energy ADE covers **most** attributes required by CityBEM
2. Coming from different perspectives we achieve **more or less** the same result

## Wishlist

1. Statistical data support – most datasets in LOD2



1. G. Agugiaro, 2017 - 3D City Database extension for the CityGML Energy ADE 0.8 PostgreSQL Version.
2. Murshed, S. M., et al. (2017). "CITYBEM: AN OPEN SOURCE IMPLEMENTATION AND VALIDATION OF MONTHLY HEATING AND COOLING ENERGY NEEDS FOR 3D BUILDINGS IN CITIES." ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci. IV-4/W5: 83-90.
3. ISO. 2008. Energy performance of buildings - Calculation of energy use for space heating and cooling. In *ISO 13970:2008*, 162. Geneva, Switzerland: ISO/TC 163/SC 2 Calculation methods.



# Thank you

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