This workflow is used as a proof of concept; other projects can use different measures. I expect that we will mostly want to add additional efficiency measures at the end.

* **change\_building\_location**
  + arguments
    - location\_name
  + input assumptions
    - --none—
  + building properties queried
    - --none—
  + overview
    - sets weather file, design days, and utility rates
* **urban\_geometry\_creation**
  + arguments
    - building\_id
    - database\_url
  + input assumptions
    - --none—
  + building properties queried
    - *intersecting\_building\_source\_ids*
    - *region\_ids*
    - *space\_type*
    - *number\_of\_stories*
    - *number\_of\_stories\_above\_ground*
    - *number\_of\_stories\_below\_ground*
    - *number\_of\_residential\_units*
    - *year\_built*
    - *surface\_elevation*
    - *roof\_elevation*
    - *floor\_area*
  + overview
    - This measure connects to the building database and downloads information about the building by building id. The building information includes the floorprint, height information, and space type; this information is used to generate the starting point model. Geometry is created; space type information is attached to the building object and stub space types. The measure also queries the database for surrounding buildings that it converts to shading surfaces. This measure also assigns a weather file, sets the climate zone, and adds design days; it gets these from the BCL using a location dependent query.
  + todo
    - separate core and perimeter zones
    - pitched roofs
* **urban\_building\_type**
  + arguments
    - envelope\_performance: {Standard, High Performance}
    - hvac\_performance: {Standard, High Performance}
    - internal\_gains\_performance: {Standard, High Performance}
    - cooling\_source: {Electric, Chilled Water, Ambient Water Loop}
    - heating\_source: {Gas, Electric, Hot Water, Ambient Water Loop}
  + input assumptions
    - Building geometry exists, including spaces, thermal zones, and building stories. Spaces are tagged with stub space types.
  + building properties queried
    - --none--
  + overview
    - This measure uses information in the building object and stub space types to assign default constructions, space types, and schedules to the building and spaces. This measure also assigns default HVAC systems corresponding to the cooling\_source, heating\_source, and building parameters as shown below.
* **add\_photovoltaics**
  + arguments
    - photovoltaic\_system\_size
    - solar\_cell\_efficiency
* **dencity\_reports**

urban\_building\_type – system selection rules

http://web.cecs.pdx.edu/~sailor/CoursePages/ME422\_Spr09/ASHRAE90\_1Appendix\_G.pdf

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Cooling Source | Heating Source | Residential  Less than 3 stories | Residential  More than 3 stories | Non Residential  Less than 3 floors or less  than 75,000 ft² | Non Residential  4 or 5 floors or less than  75,000 ft² or  5 floors or less and  75,000–150,000 ft² | Non Residential  More than 5 floors or  more than 150,000 ft² |
| Electric | Gas | 1—PTAC | 1—PTAC | 3-PSZ-AC | 5-PVAV w Reheat | 7-VAV w Reheat |
| Electric | Electric | 2—PTHP | 2—PTHP | 4-PSZ-HP | 6-PVAV w PFP | 8-VAV w PFP |
| Electric | District Hot Water | 1—PTAC  w hot  water coil? | 1—PTAC  w hot  water coil? | 3-PSZ-AC  w hot  water coil and reheat? | 5-PVAV w hot water reheat | 7-VAV w hot  water reheat |
| Ambient Loop | Ambient Loop | 2—PTHP w water to air HP? | 2—PTHP w water to air HP? | 4-PSZ-HP w water to air HP? | 6-PVAV w PFP  Chilled Water loop with water to water HP? Hot Water loop with water to water HP? | 8-VAV w PFP Chilled Water loop with water to water HP?  Hot Water loop with water to water HP? |
| District Chilled Water | Gas | 1—PTAC  w chilled water coil? | 1—PTAC  w chilled water coil? | 3-PSZ-AC  w chilled water coil? | 5-PVAV w Reheat | 5-PVAV w Reheat |
| District Chilled Water | Electric | 2—PTHP  w chilled water coil? | 2—PTHP  w chilled water coil? | 4-PSZ-HP  w chilled water coil? | 6-PVAV w PFP | 8-VAV w PFP |
| District Chilled Water | District Hot Water | 1—PTAC  w chilled and hot water coils? | 1—PTAC w chilled and hot water coils? | 3-PSZ-AC w chilled and hot water coils? | 5-PVAV w Reheat w chilled and hot water coils? | 7-VAV w Reheat w chilled and hot water coils? |

**RESIDENTIAL**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sources | | Plant Loops | | | Supply | | Demand | | Equip |
| Cooling Source | Heating Source | Chilled Water Plant Loop | Hot Water Plant Loop | Heat Pump Loop | Cooling Loop Supply | Heating Loop Supply | Cooling Coil | Heating Coil | Zone Equip |
| Electric | Gas |  | 1 |  |  | Boiler | DX 1spd | Water | PTAC |
| Electric | Electric |  |  |  |  |  | DX 1spd | DX 1spd | PTHP |
| Electric | District Hot Water |  | 1 |  |  | District | DX 1spd | Water | PTAC |
| District Ambient Water | District Ambient Water |  |  | 1 | District | District | Water-to-air HP Eqn Fit | Water-to-air HP Eqn Fit | Water-to-air HP |
| District Chilled Water | Gas | 1 | 1 |  | District | Boiler | Water | Water | DOAS |
| District Chilled Water | Electric | 1 |  |  | District |  | Water | Electric | PSZ-AC |
| District Chilled Water | District Hot Water | 1 | 1 |  | District | District | Water | Water | DOAS |

**COMMERCIAL, num\_floors < 3 or floor\_area < 75000**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sources | | Plant Loops | | | Supply | | Demand | | Equip |
| Cooling Source | Heating Source | Chilled Water Plant Loop | Hot Water Plant Loop | Heat Pump Loop | Cooling Loop Supply | Heating Loop Supply | Cooling Coil | Heating Coil | Zone Equip |
| Electric | Gas |  |  |  |  |  | DX 1spd | Gas | PSZ-AC |
| Electric | Electric |  |  |  |  |  | DX 1spd | DX 1spd | PSZ-AC |
| Electric | District Hot Water |  | 1 |  |  | District | DX 2spd | Water | PVAV w/reheat |
| District Ambient Water | District Ambient Water |  |  | 1 | District | District | Water-to-air HP Eqn Fit | Water-to-air HP Eqn Fit | PSZ-AC |
| District Chilled Water | Gas | 1 | 1 |  | District | Boiler | Water | Water | PSZ-AC |
| District Chilled Water | Electric | 1 |  |  | District |  | Water | DX 1spd | PSZ-AC |
| District Chilled Water | District Hot Water | 1 | 1 |  | District | District | Water | Water | PSZ-AC |

**COMMERCIAL, num\_floors == 4 or num\_floors == 5 or (floor\_area >= 75000 and floor\_area <= 150000)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sources | | Plant Loops | | | Supply | | Demand | | Equip |
| Cooling Source | Heating Source | Chilled Water Plant Loop | Hot Water Plant Loop | Heat Pump Loop | Cooling Loop Supply | Heating Loop Supply | Cooling Coil | Heating Coil | Zone Equip |
| Electric | Gas |  | 1 |  |  | Boiler | DX 2spd | Water | PVAV w/reheat |
| Electric | Electric |  |  |  |  |  | DX 2spd | Electric | PVAV w/PFP |
| Electric | District Hot Water |  | 1 |  |  | District | DX 2spd | Water | PVAV w/reheat |
| District Ambient Water | District Ambient Water |  |  |  |  |  |  |  |  |
| District Chilled Water | Gas | 1 | 1 |  | District | Boiler | Water | Water | VAV w/reheat |
| District Chilled Water | Electric | 1 |  |  | District |  | Water | Electric | VAV w/PFP |
| District Chilled Water | District Hot Water | 1 | 1 |  | District | District | Water | Water | VAV w/reheat |

**COMMERCIAL, num\_floors > 5 or floor\_area > 150000**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sources | | Plant Loops | | | Supply | | Demand | | Equip |
| Cooling Source | Heating Source | Chilled Water Plant Loop | Hot Water Plant Loop | Heat Pump Loop | Cooling Loop Supply | Heating Loop Supply | Cooling Coil | Heating Coil | Zone Equip |
| Electric | Gas | 1 | 1 |  | Chiller | Boiler | Water | Water | VAV w/reheat |
| Electric | Electric | 1 |  |  | Chiller |  | Water | Electric | VAV w/PFP |
| Electric | District Hot Water | 1 | 1 |  | Chiller | District | Water | Water | VAV w/reheat |
| District Ambient Water | District Ambient Water |  |  |  |  |  |  |  |  |
| District Chilled Water | Gas | 1 | 1 |  | District | Boiler | Water | Water | VAV w/reheat |
| District Chilled Water | Electric | 1 |  |  | District |  | Water | Electric | VAV w/PFP |
| District Chilled Water | District Hot Water | 1 | 1 |  | District | District | Water | Water | VAV w/reheat |