POLITECNICO DI MILANO



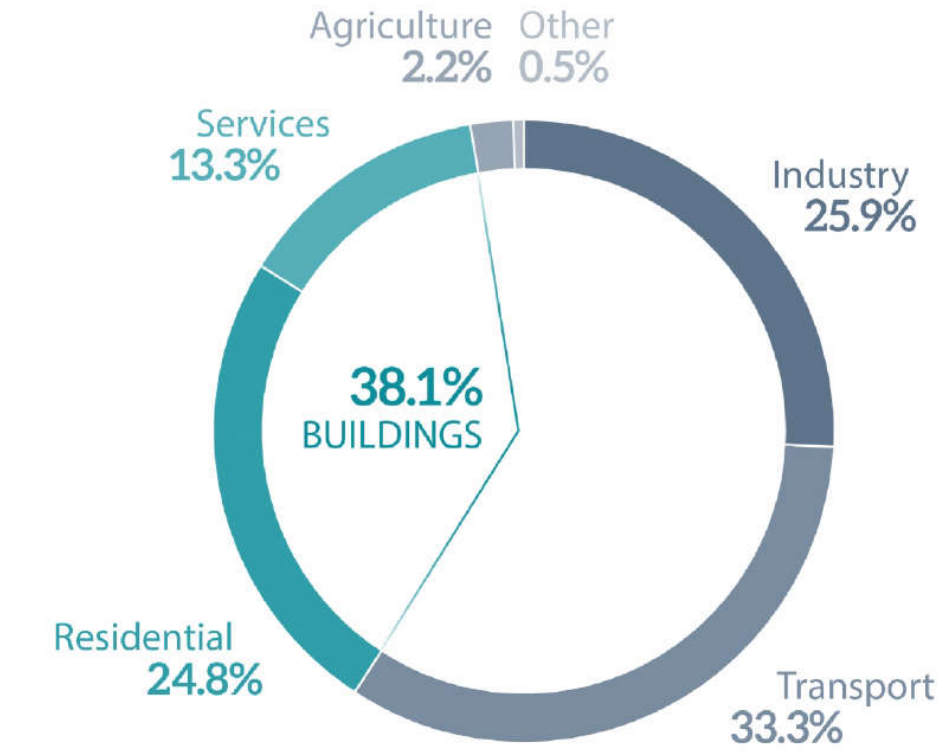


Technical Environmental System: Course Introduction

Piacenza Campus

B. Najafi

Importance of Building Energy Sector

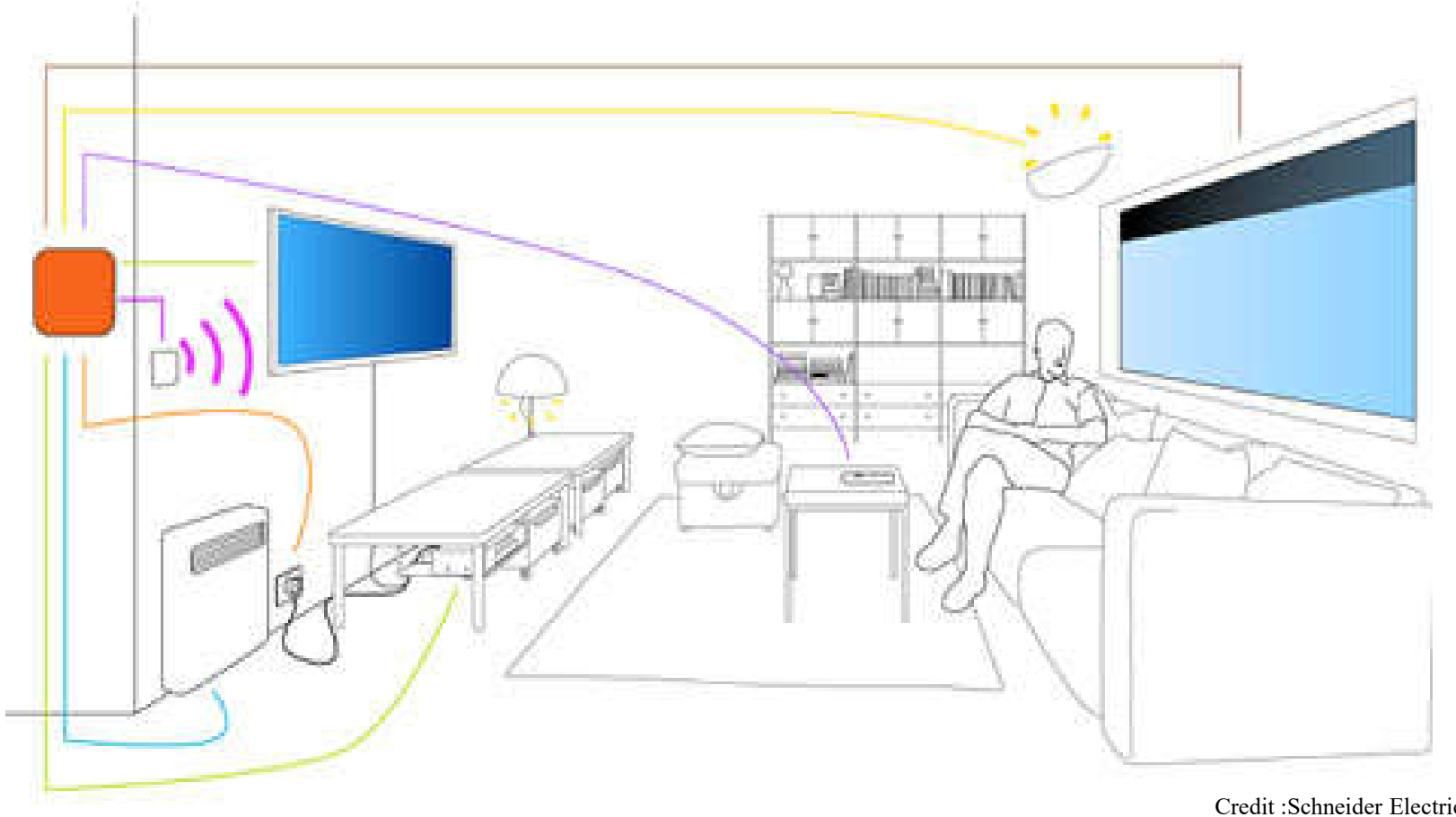


Data source: Eurostat, 2014.

Europe's Energy consumption by Sector

Correlation with Emerging Technologies

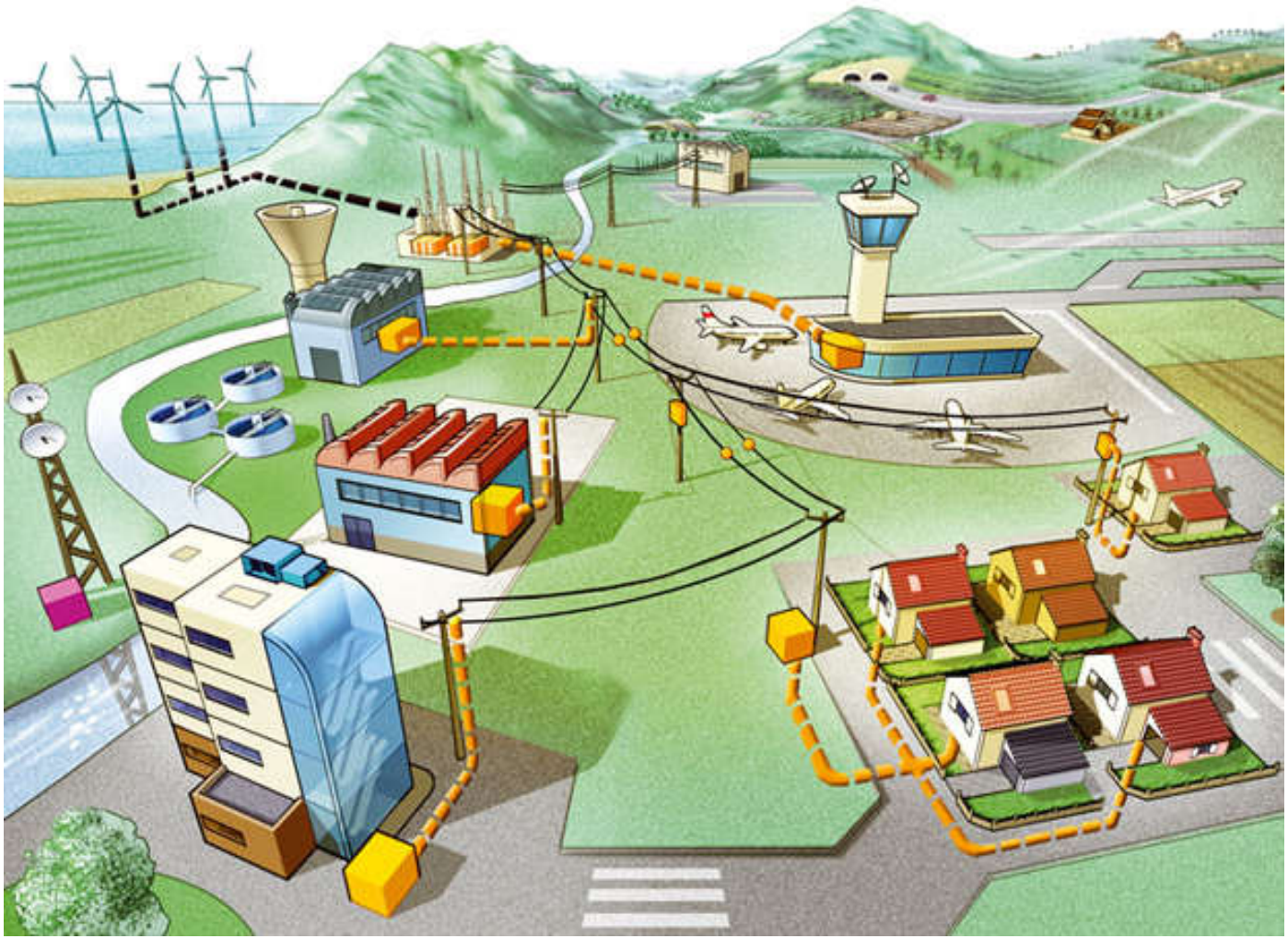
- Smart buildings can be a part of internet of things
  - ✓ Smart Homes



Credit :Schneider Electric

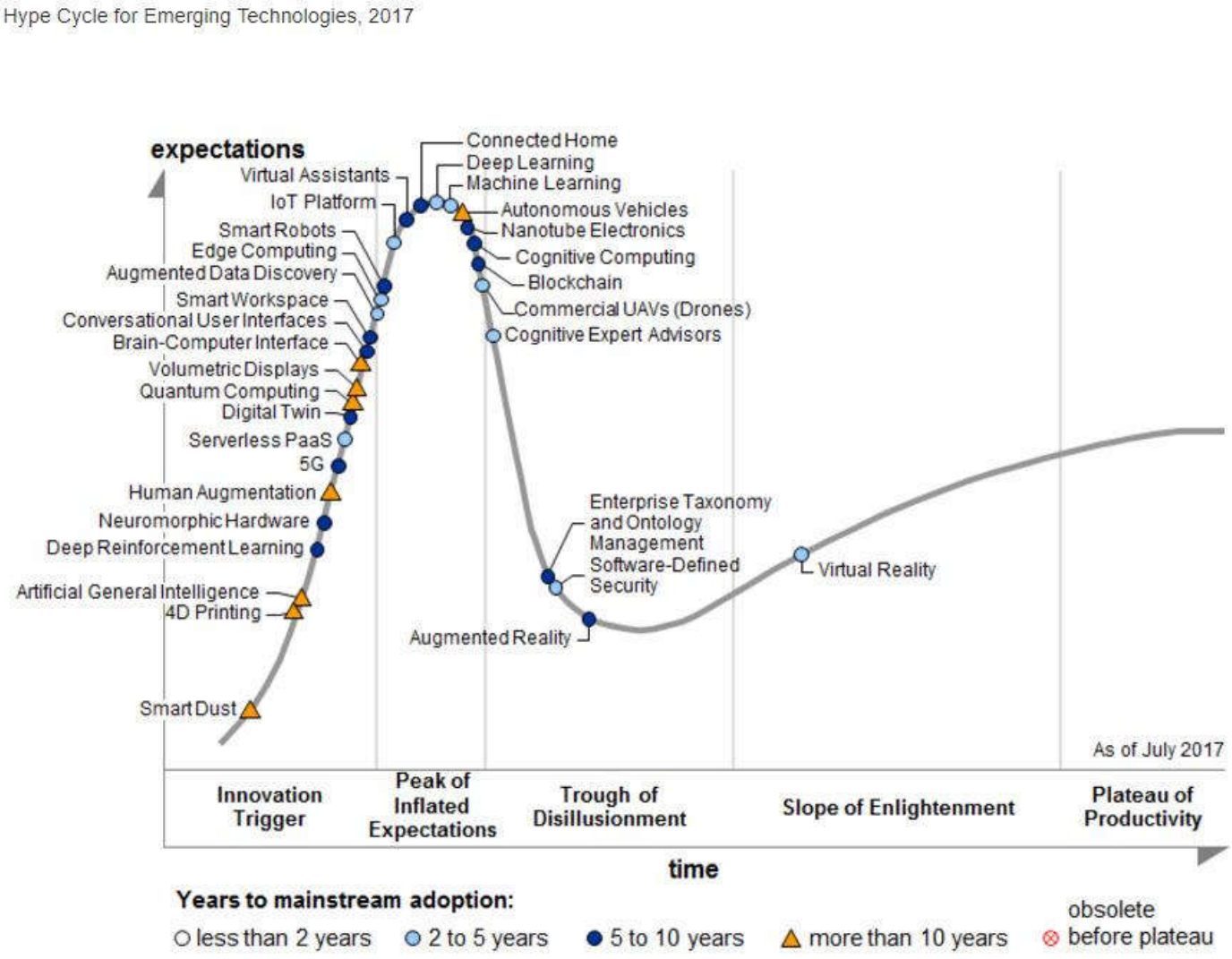
Correlation with Emerging Technologies

- Smart buildings can be a part of Smart grids



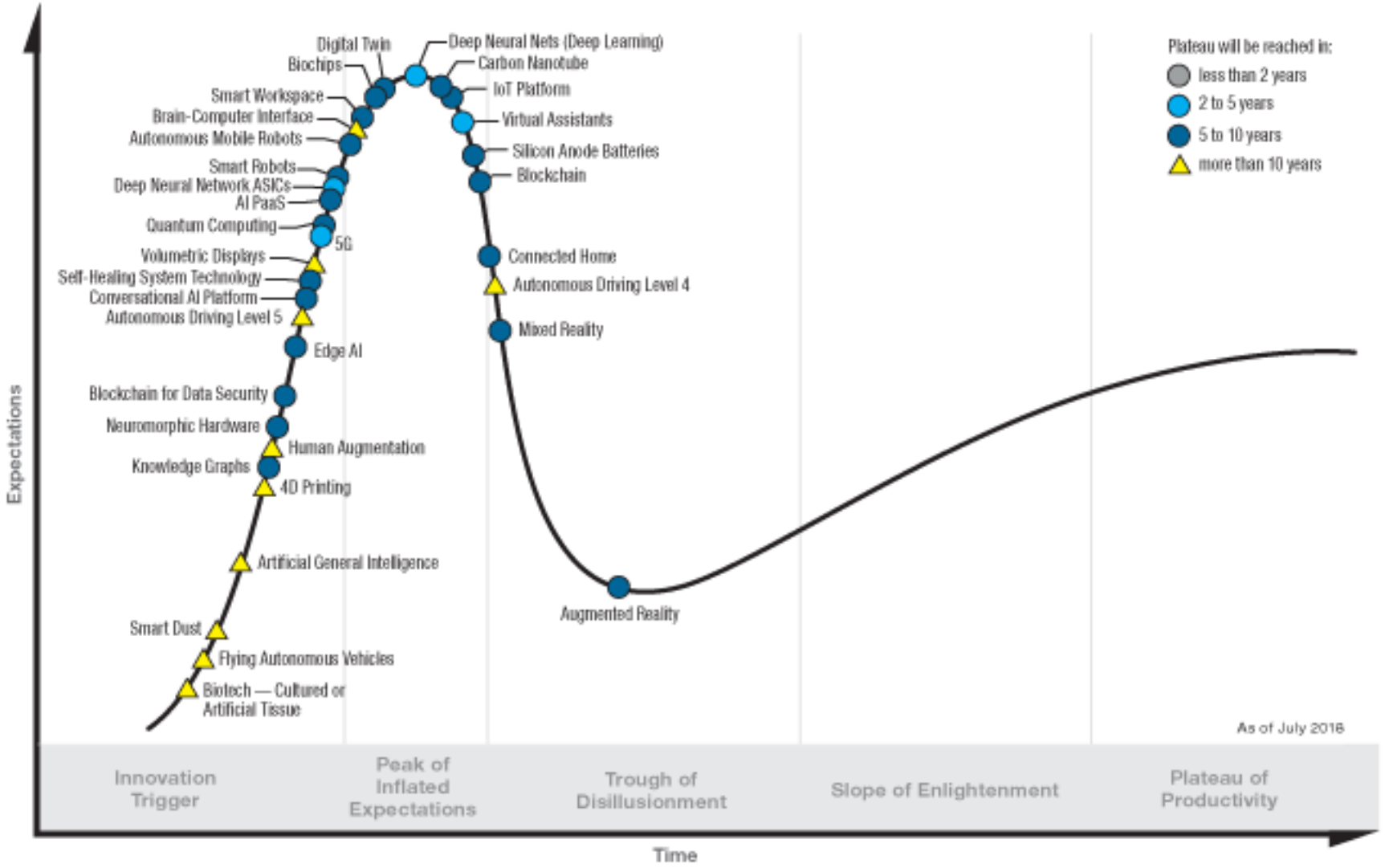
Credit :Schneider Electric

Correlation with Emerging Technologies



Gartner's diagram of emerging technologies, July 2017

Correlation with Emerging Technologies



Gartner's diagram of emerging technologies, July 2018

Career Opportunities

- Applications in Building Design and Architecture Career path:
  - ✓ Design of Nearly-zero Energy Building
  - ✓ Sustainable Building Design Considering the Energetic Behaviour Aspects

- Building System Oriented Career Perspective:
  - Current Trends
    - ✓ Energy Manager
    - ✓ Energy Audit expert and Consultant in Energy Sector
  - Emerging Trends:
    - ✓ Energy Analyst, Energy Data Analyst and Energy Data Scientist

Topics

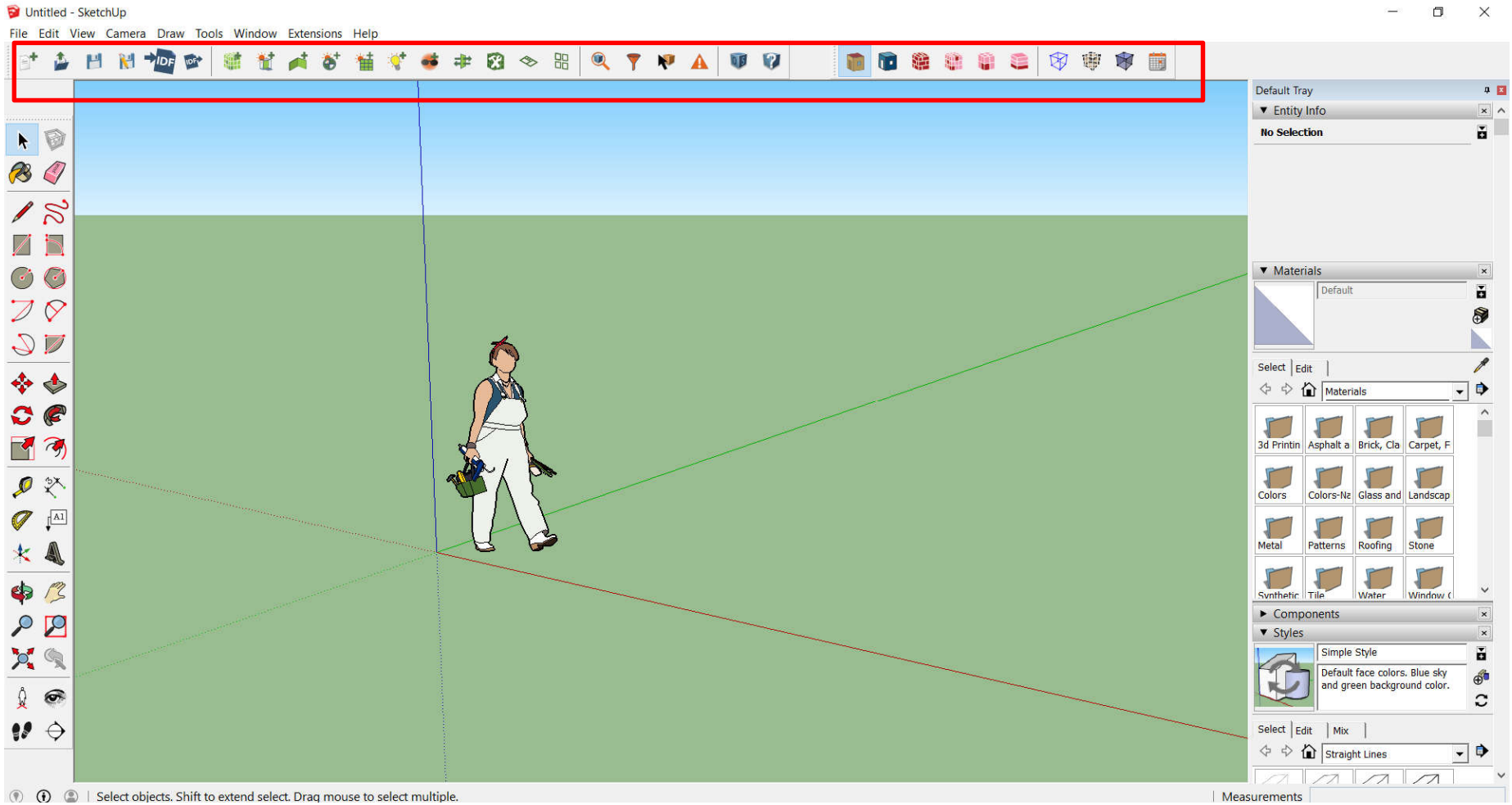
- A Brief review of principles of applied physics: Physical quantities and units of measurement
- Conductive, convective, and radiative heat transfer along with solar radiation
- Heat transfer through walls and windows: simplifications
- Thermal comfort
- Humid air (psychrometrics) fundamentals, heat gains, and infiltration
- Residential and non-Residential heating and cooling load calculation (ASHRAE RLF and Heat balance methods)
- First and second law of thermodynamics and fundamentals of refrigeration cycles
- Centralized and decentralized heating, ventilation, and air conditioning (HVAC) systems
- Fundamentals of solar thermal units, different types of cycles, categories of collectors, storage units, and integration of solar thermal systems in buildings

Simulation Tools

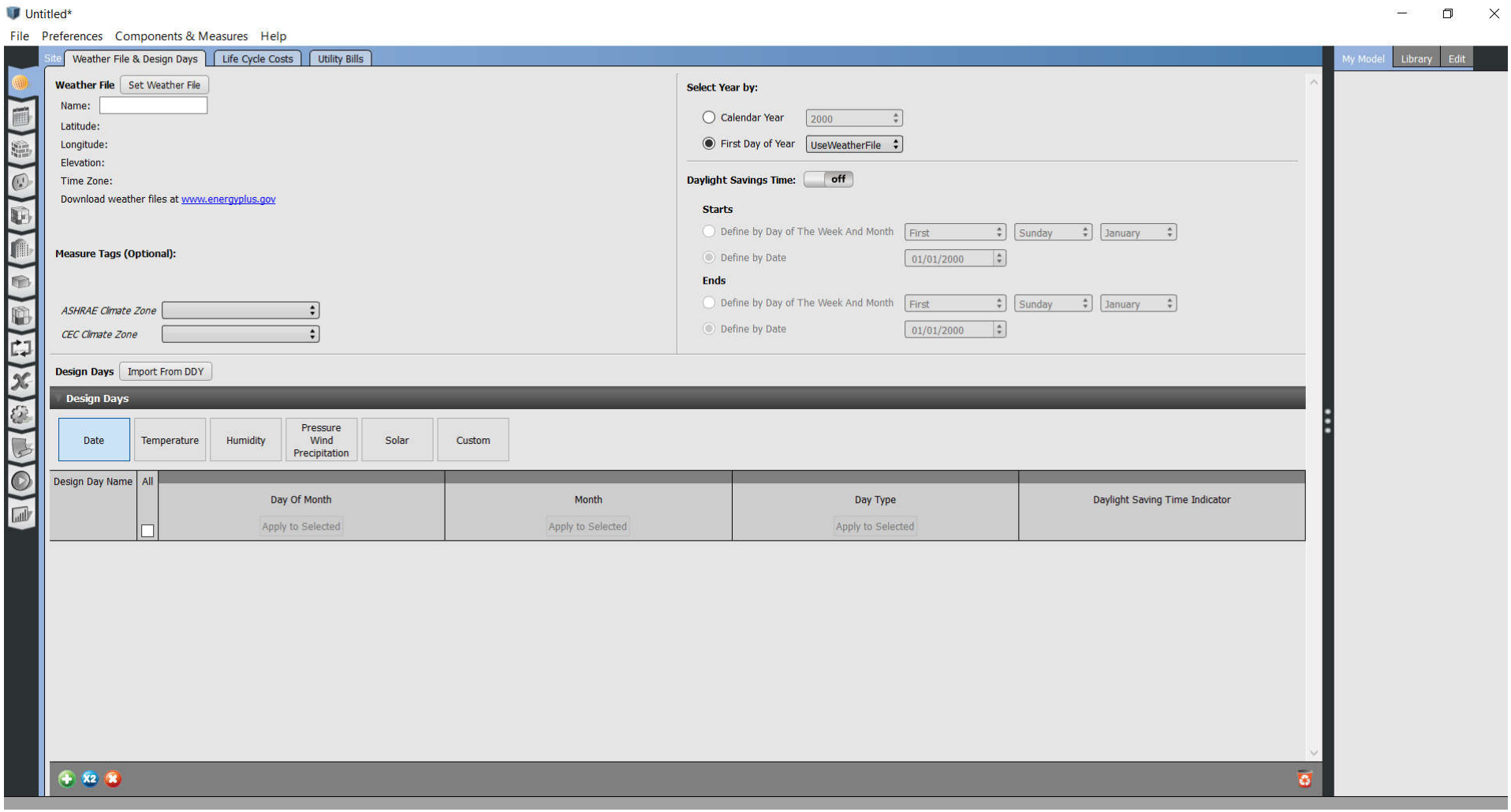
- EnergyPlus:
  - ✓Open-Souce tool developed by the Department of Energy, US
  - ✓Employed for simulating both Building performance and HVAC system
- OpenStudio interface is employed in this course
- OpenStudio creates an add-on over SketchUp, Hence the design can be made in SketchUp

- GitHub Platform utilized for submission:

SketchUp with OpenStudio Extension



OpenStudio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Life Cycle Costs
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Download weather files at www.energyplus.gov
Measure Tags (Optional):
ASHRAE Climate Zone
CEC Climate Zone
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Pressure
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Solar
Custom
Design Day Name
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Day Of Month
Apply to Selected
Month
Apply to Selected
Day Type
Apply to Selected
Daylight Saving Time Indicator

Weather Data

EnergyPlus Downloads Documentation Support & Training Licensing Extras Weather Feedback Log in

Weather Data

Weather data for more than 2100 locations are now available in EnergyPlus weather format — 1042 locations in the USA, 71 locations in Canada, and more than 1000 locations in 10(other countries throughout the world. The weather data are arranged by World Meteorological Organization region and Country.

View Weather Data

Select a region below to view weather data.

- Africa (WMO Region 1)
- Asia (WMO Region 2)
- South America (WMO Region 3)
- North and Central America (WMO Region 4)
- Southwest Pacific (WMO Region 5)
- Europe (WMO Region 6)

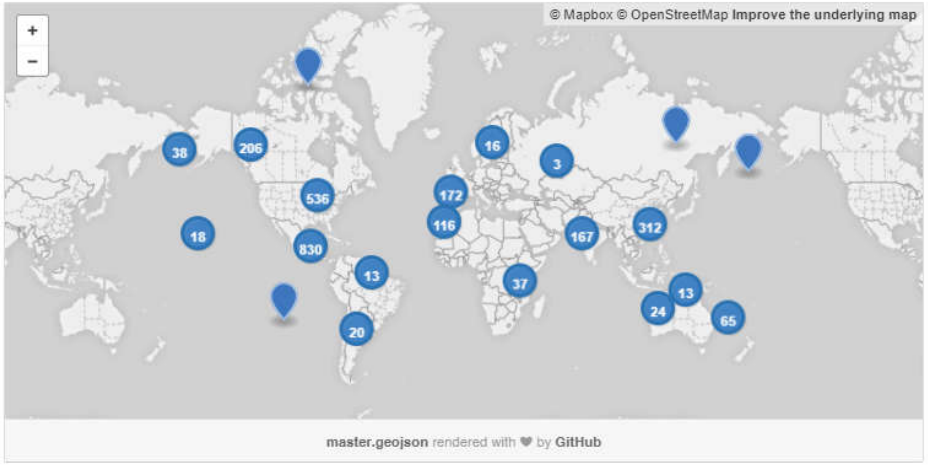
Search Weather Data

Keyword Search

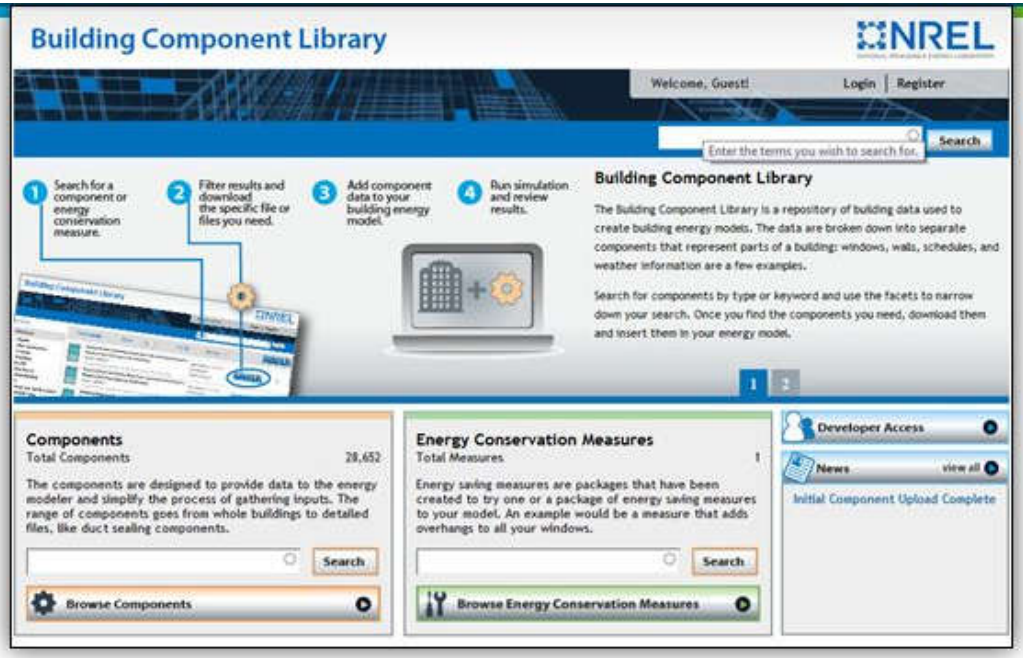
Search

Browse Weather Data

Click on the markers in the map below to access weather data.



Building Component Library



- An Internet-connected source of building energy modeling data:
  - Enables drag-and-drop modeling for **quick** technology evaluation
  - Provides **consistent**, detailed inputs to drive decision-making
  - **Searchable** readily available within applications
  - The BCL is key to OpenStudio's **extensibility**

Evaluation Details

- The evaluation is based on the marks obtained in 3 different parts as follows:

- Written Exam: 15 marks
- Continuous Assessment (weekly submissions): 10 marks
- Final Project (presented as a group): 5 marks

- ✓ In order to receive a mark, the student should pass the written exam (18/30)