

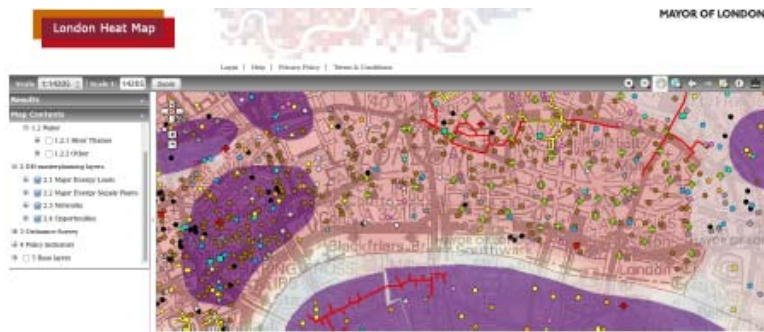
Dynamic Energy Mapping

with 4D Community Energy Demand Visualization

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Thesis Advisor: Prof. Nina Baird

Energy mapping allows planners and policy makers to **visualize** community energy planning alternatives.



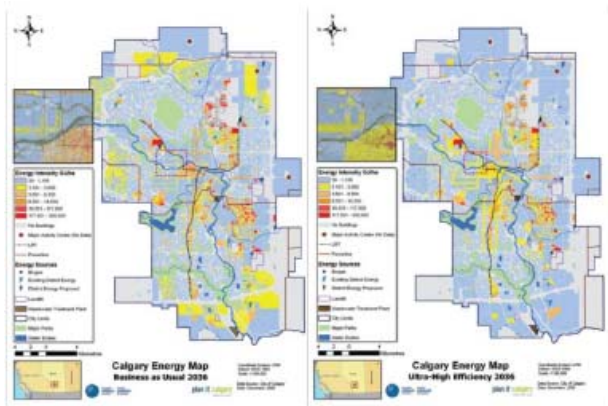
London Heat Map



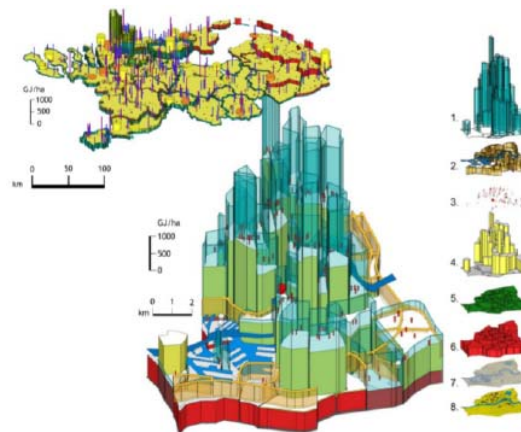
National Heat Map



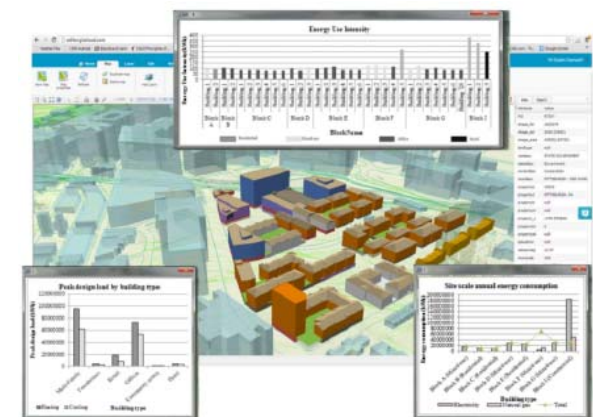
Water Source Heat Map



Calgary Heat Map



Netherlands Heat Map



Lower Hill District Energy Map

What is missing?
The **time dimension**

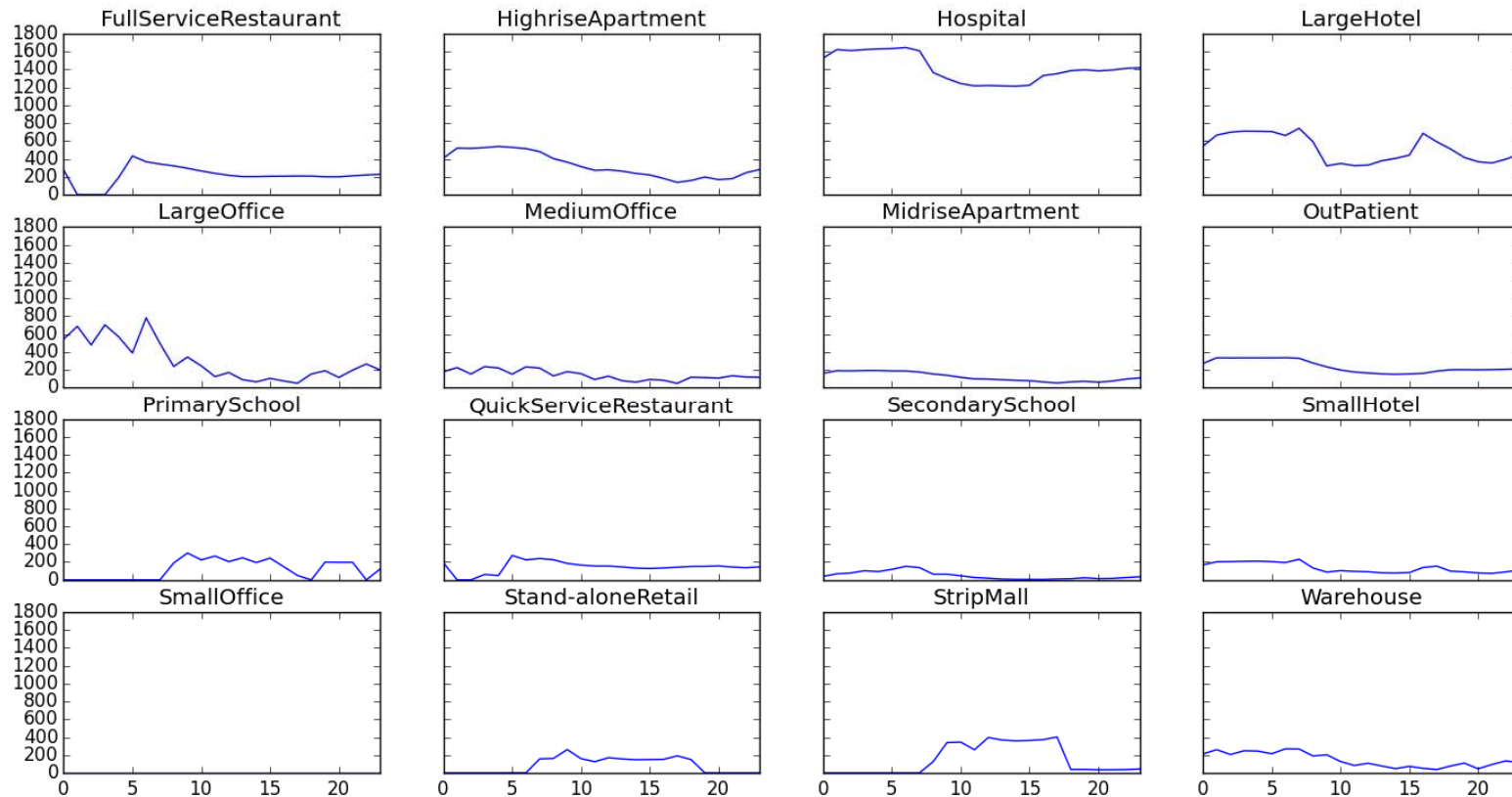
Why is time important?

- 1 Strong Temporal Variation of Energy Profile

Strong **Daily** Energy Profile Difference

space heating energy consumption of the 16 ASHRAE 90.1 2013 commercial building profiles,

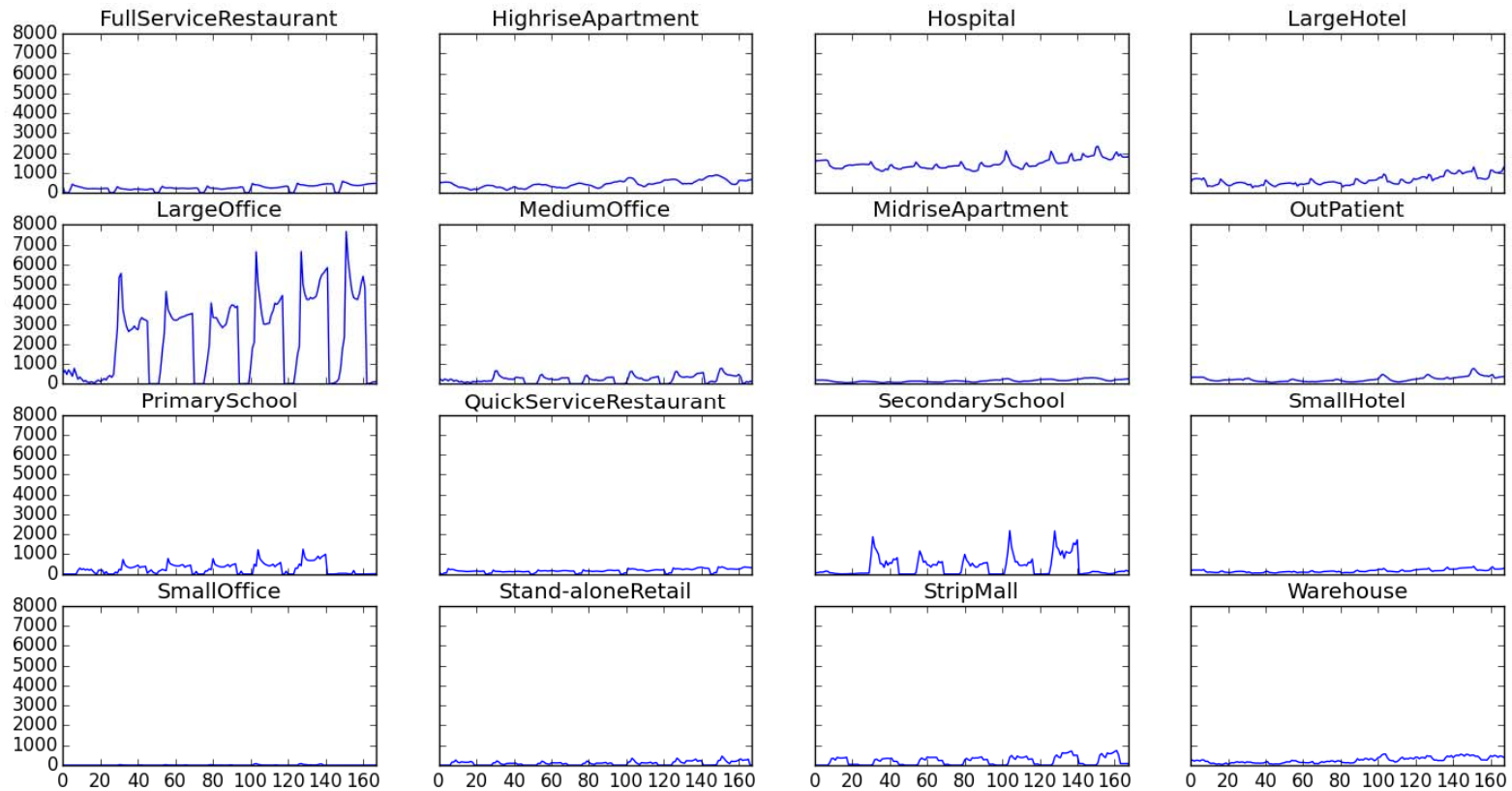
Jan. 1 00:00:00 to Jan. 1 23:00:00, step = 1h, duration = 1 day



Strong **Weekly** Energy Profile Difference

space heating energy consumption of the 16 ASHRAE 90.1 2013 commercial building profiles,

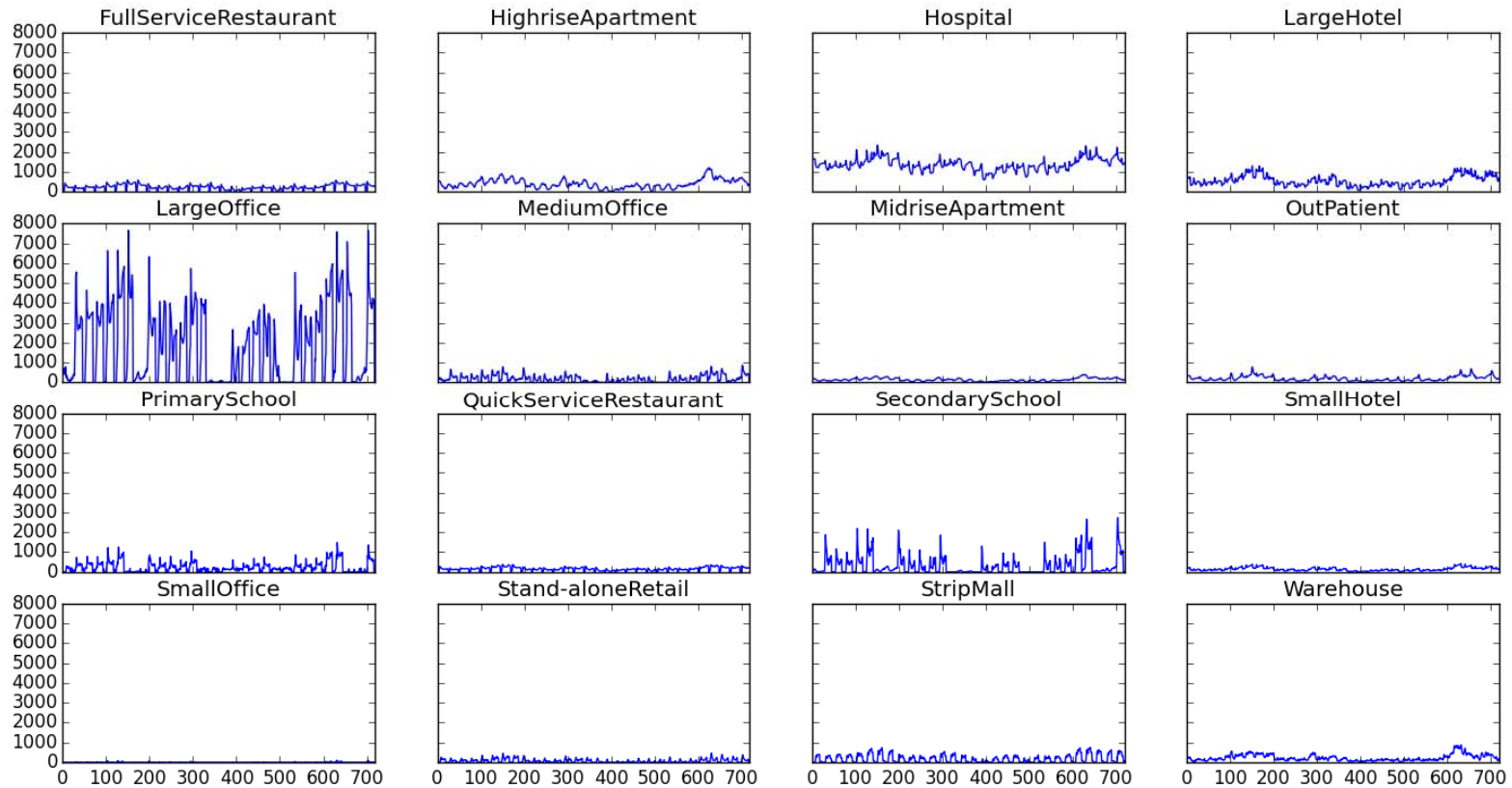
Jan. 1 00:00:00 to Jan. 6 23:00:00, step = 1h, duration = 1 week



Strong **Monthly** Energy Profile Difference

space heating energy consumption of the 16 ASHRAE 90.1 2013 commercial building profiles,

Jan. 1 00:00:00 to Jan. 31 23:00:00, step = 1h, duration = 1 month



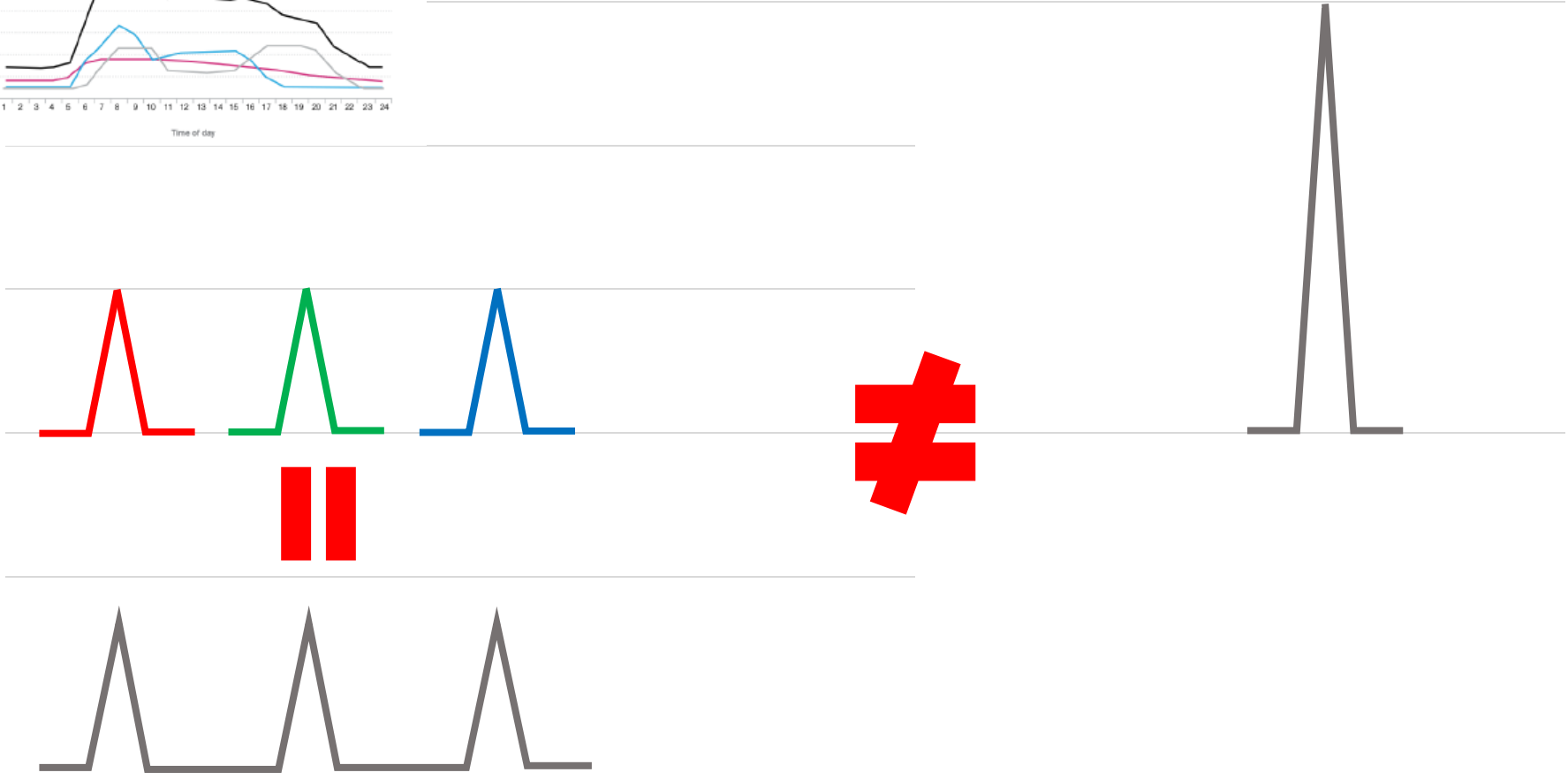
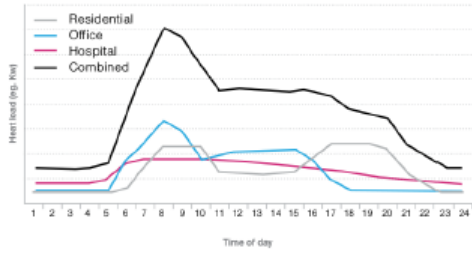
Why is time important?

2

Average demand isn't enough

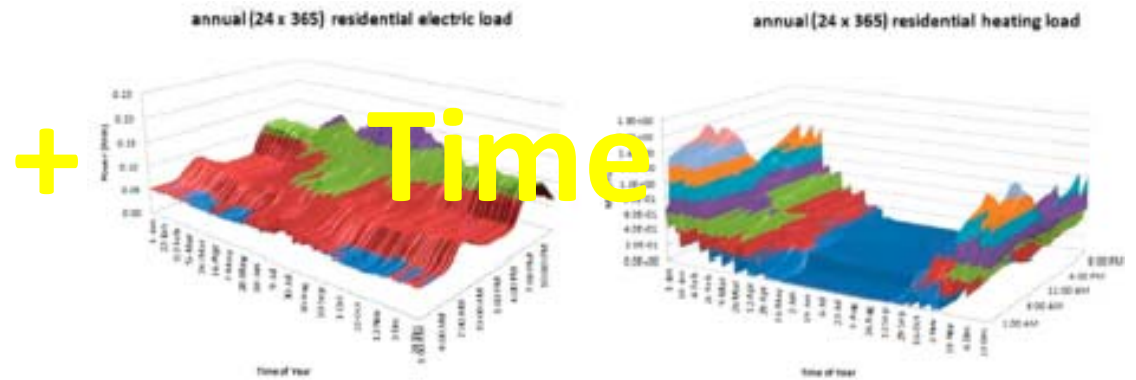
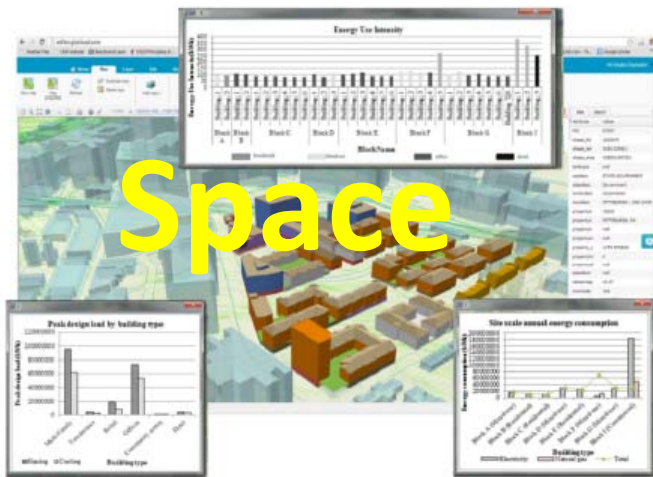
Why is time important?

- 3 Aggregation of peak values is tricky for data with time variation

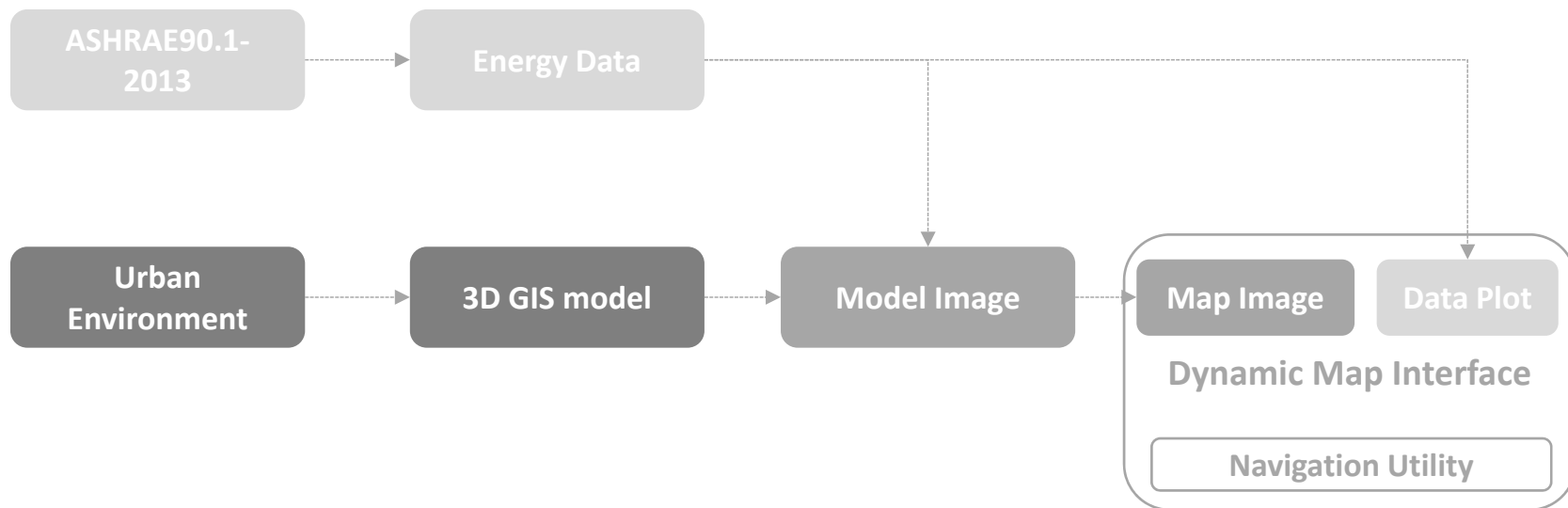


Objective of the project

high-resolution space-time visualization



Work Flow

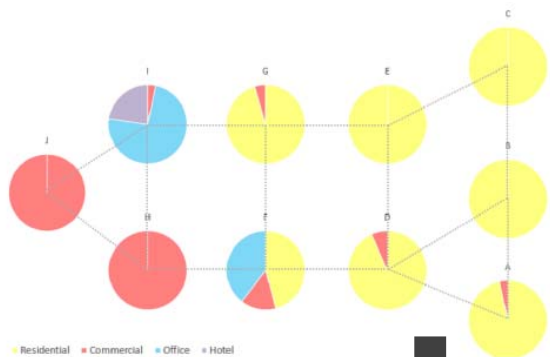


Input

Energy Data

Urban Environment

| EnergyPlus Output | Meaning |
|--------------------------------------|---|
| Heating:Gas | Total gas for space heating |
| Heating:Electricity | Total electricity for space heating |
| Water Heater:WaterSystem:Gas | Total gas for service hot water |
| Water Heater:WaterSystem:Electricity | Total Electricity for service hot water |
| Cooling:Electricity | Total electricity for space cooling |
| Electricity:Facility | Total electricity |



- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- RETAIL AND MIXED-USE*
- ANCHOR OFFICE BUILDINGS
- HOTEL
- COMMUNITY CENTER
- STRUCTURED PARKING
- SURFACE PARKING

Demo

3D GIS model



Thank you for your attention