

EnergyAtlas.io

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Platform: Grasshopper, Rhino3D, Unity, Cesium, ReactJS, Mapbox

EnergyAtlas is a city-scale digital twin and Urban Building Energy Modeling (UBEM) platform that integrates tax records, LiDAR scans, DOE/RECS archetypes, zoning data, and utility meter readings into an automated simulation and calibration workflow. Using reduced-order 5R1C thermal network models, it delivers computationally efficient simulations for predicting peak loads, electrification impacts, and retrofit outcomes across the building stock. Seamless visualization in Rhino, Grasshopper, Unity/Cesium, and WebApp dashboards makes insights accessible to planners, utilities, and policymakers, and the homeowners, enabling retrofit prioritization and decarbonization planning. Combining financial modeling, risk analysis and scenario explorations, EnergyAtlas empowers cities with data-driven decision-making capabilities to facilitate a sustainable and equitable energy transition.

Funding agencies



EnergyAtlas

Digital Twin Tool for Urban Energy Insight

EnergyAtlas DataConnect

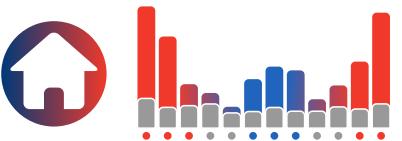
Hassle-Free Urban GIS Data Integration

Import tax records, footprints, zoning, LiDAR, and permits directly with automatic data conversion and attribute joining.



High-Fidelity Archetypes

Localized DOE and RECS building archetypes with high-fidelity usage schedules based on building metadata and demographics.



EnergyAtlas OperationalEnergy

Urban Building Energy Simulations, 150x Faster

Run hourly energy simulations with validated, code-compliant¹ models 150x faster than traditional baselines.²



EnergyAtlas Renewables

Rooftop Photovoltaics Simulation with Fast Irradiance Algorithm

Simulate PV potential with voxel shading and ray marching algorithms



EnergyAtlas RetrofitEconomics

Financial Metrics

Analyze payback periods, incentives, and lifecycle costs to support retrofit investment targeting.



EnergyAtlas Geospatial3D

Interactive Digital Twins

Visualize city-scale models with plug-and-play interfaces in Rhino, Grasshopper, and Web Platforms.



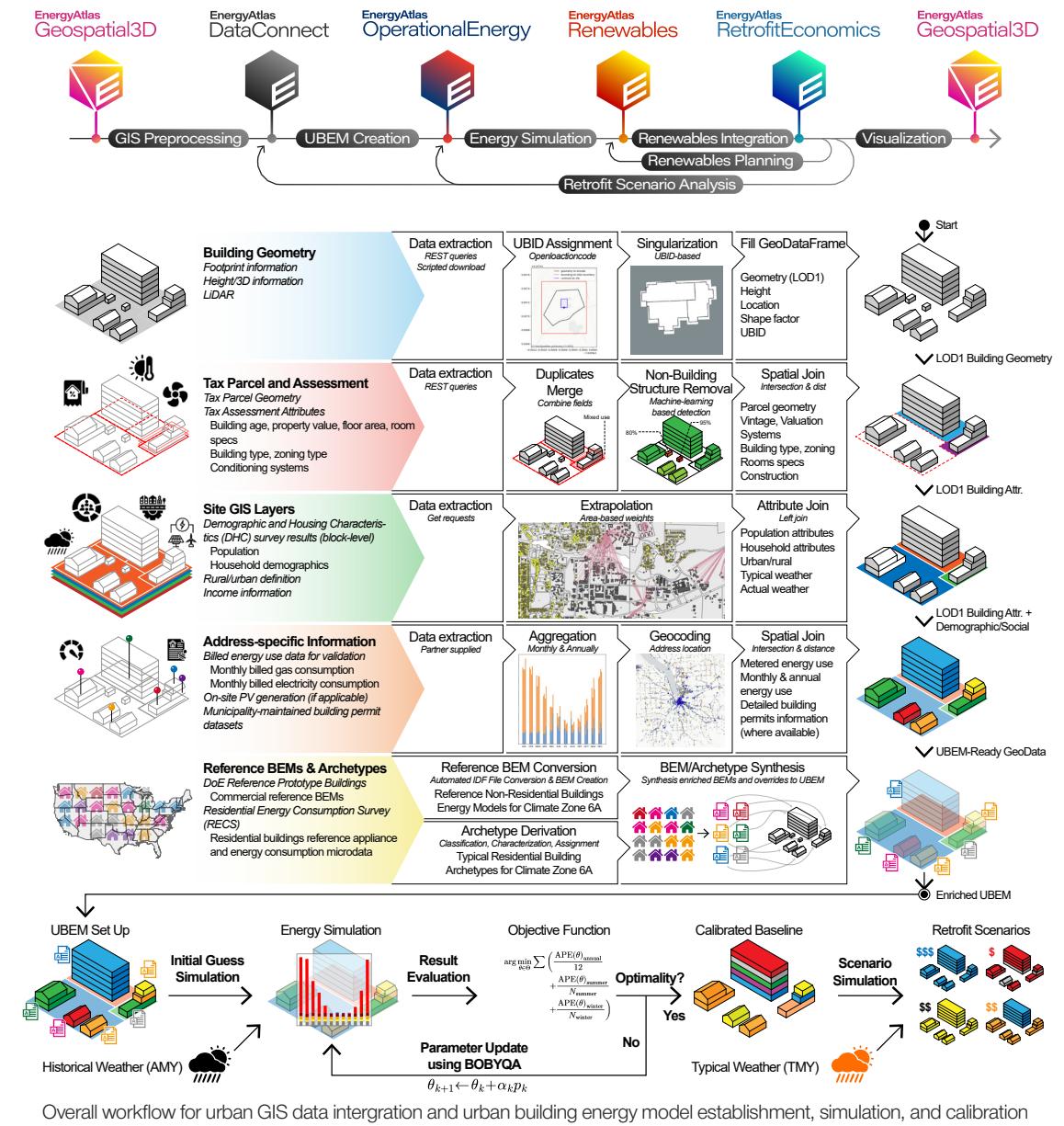
3D Reality Modeling with FacadeScanner™ Texture segmentation

Generate 3D geometries through photogrammetric reconstruction and computer vision-powered facade texture segmentation.

1. Based on ISO 52016-1:2017 *Energy performance of buildings — Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads — Part 1: Calculation procedures*; implemented with a reduced-order grey-box 5R1C schema.
2. Benchmarked on comparable UBEM tasks with single-threaded runs on personal and lab PCs (Windows), computing time normalized by zone count, 1-hour timestep.

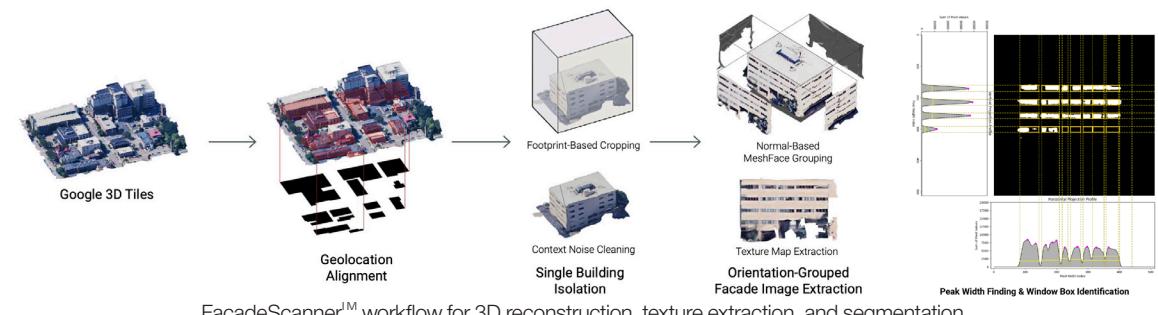
Data-Driven Urban Building Energy Simulation

EnergyAtlas integrates tax, permit, LiDAR, and smart meter data into city-scale energy models, automating simulation workflows that traditionally require expert GIS and modeling knowledge.



3D Reconstruction and FacadeScanner™ Texture Segmentation

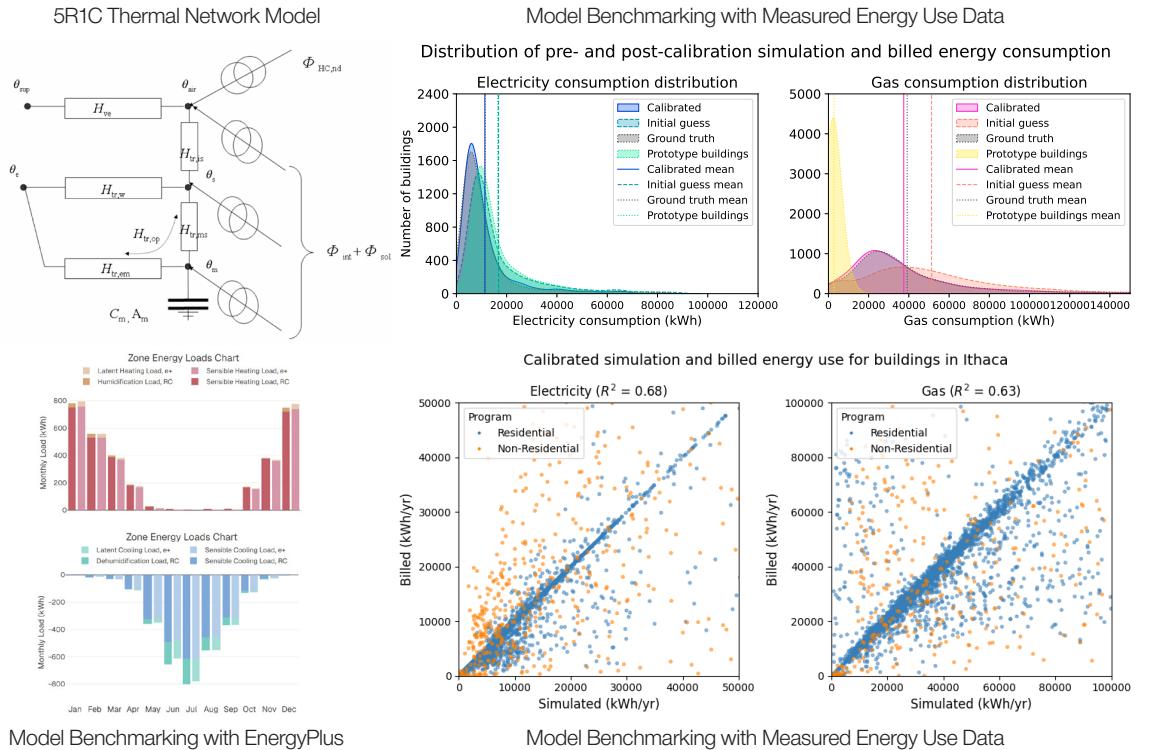
Photogrammetry, LiDAR, and computer vision are used to reconstruct 3D geometries and extract facade textures and window-to-wall ratios, enriching energy models with high fidelity envelope detail.



FacadeScanner™ workflow for 3D reconstruction, texture extraction, and segmentation

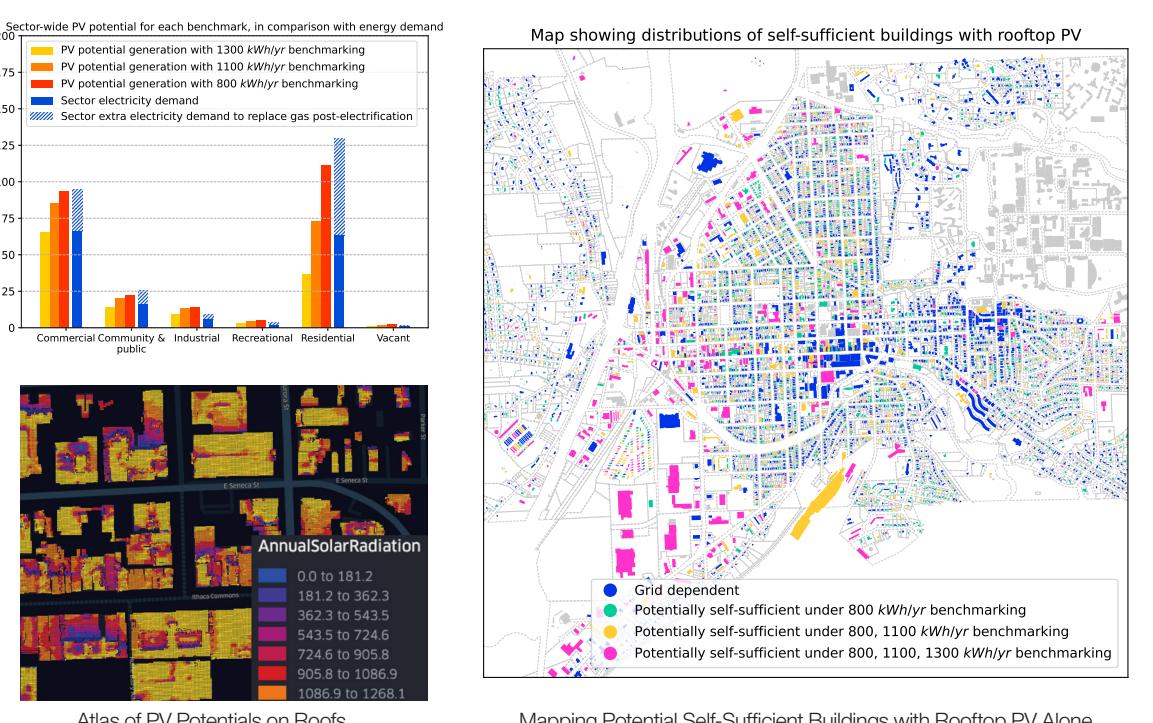
Validated, ISO-Compliant Building Energy Models

Reduced-order 5R1C models follow ISO 52016-1:2017 procedures, delivering energy simulations that are up to 150x faster than traditional tools while maintaining accuracy and code compliance.



Modeling Renewable Energy Systems

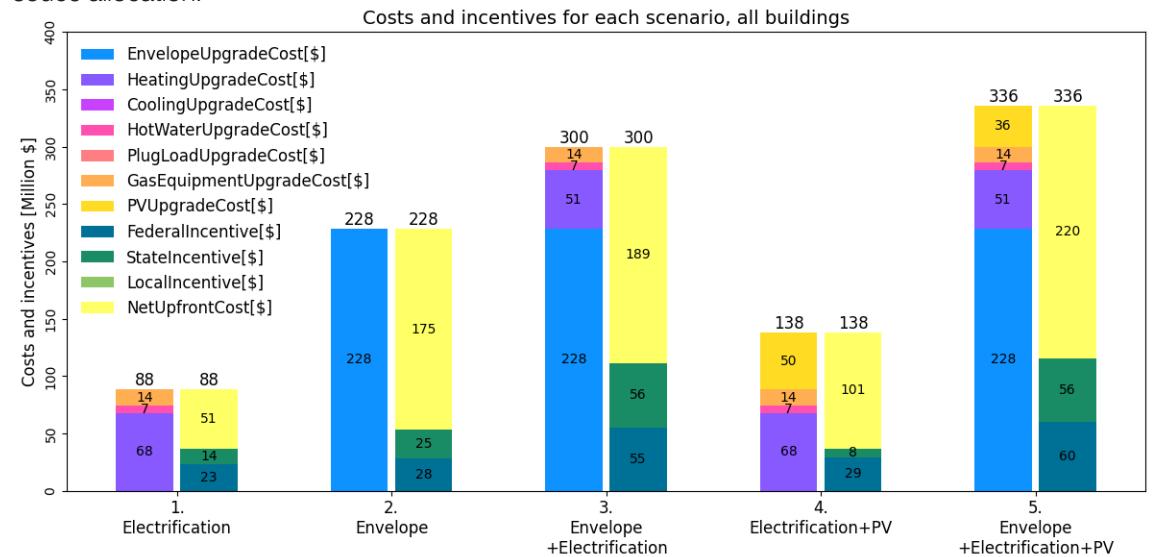
Simulate rooftop photovoltaics potential with fast voxel-based shading analysis; evaluate the effectiveness of geothermal and district systems for renewables integration.



Mapping Potential Self-Sufficient Buildings with Rooftop PV Alone

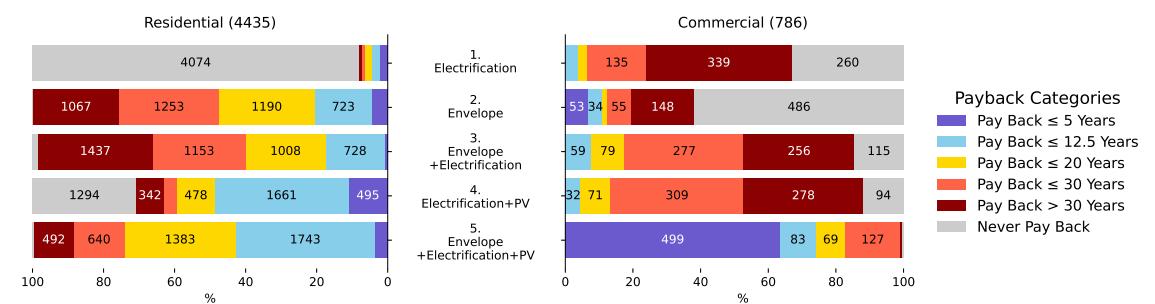
Retrofit Scenario Analysis

Evaluate carbon reduction pathways, electrification measures, and envelope upgrades at building or neighborhood scales, with payback and incentive calculations supporting retrofit targeting and resource allocation.



Retrofit cost and incentives per each scenario modeled

Payback (ROI = 20%) Period Distribution for Each Scenario

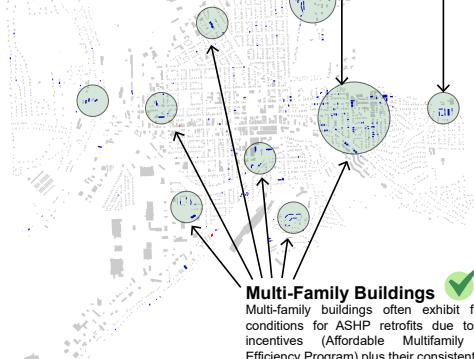


Payback period distribution for all buildings, showcasing the financial feasibility of each retrofit scenario

Buildings with Acceptable Payback (ROI = 20%) Periods
Scenario 1: All Electrification



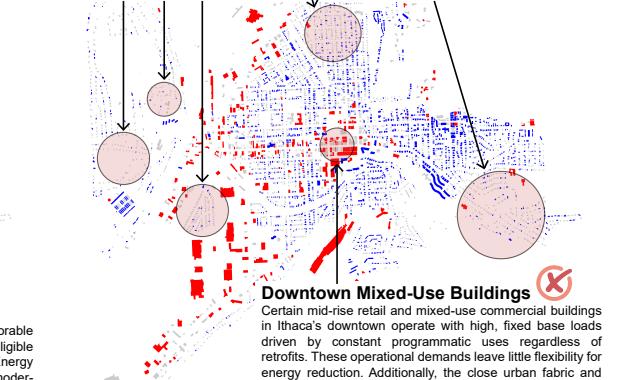
Student Accommodation
Dormitories typically operate on fixed academic schedules with year-round occupancy, ensuring high and stable system utilization (low redundant ASHP sizing). Many existing heating systems in dorms are aging and centralized, offering a substantial efficiency gap when replaced with modern ASHP systems.



Buildings with Acceptable Payback (ROI = 20%) Periods
Scenario 5: Envelope + Electrification + PV



Tree-Shaded Single Family Homes
These single-family homes situated under dense tree canopy or on slopes with poor solar orientation face limited potential for PV, reducing their ability to pay back for retrofits. These homes are often high-income and already feature well-maintained envelopes and efficient heating systems, leaving minimal room for performance gains. With few incentives available and high upfront costs, retrofits in these cases rarely yield sufficient savings to achieve payback.



Atlas of buildings with high and low financial feasibility for retrofit in the city of Ithaca. This tool maps out the "lower-hanging fruits" for retrofit prioritization and assists local authorities in effectively allocating resources and fundings.

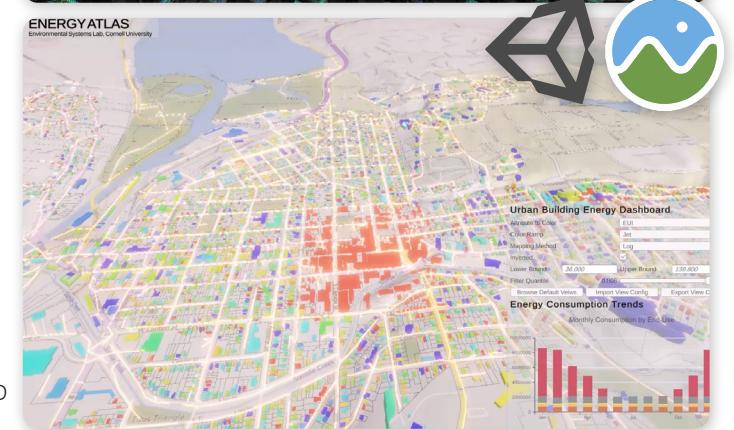
Cross-Platform Applications

EnergyAtlas connects seamlessly with Rhino, Grasshopper, Unity&Cesium, CAD, and GIS workflows. It also comes with a EnergyAtlas Viewer Web App to facilitate access to building energy use insights and retrofit options.



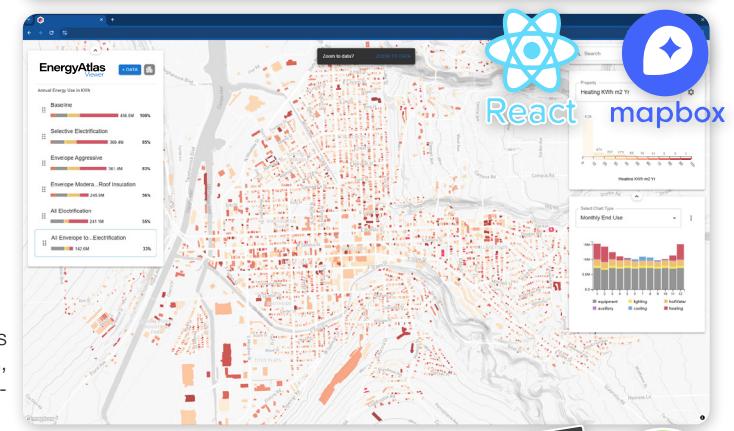
Bentley iTwin

Connect photogrammetry and point-cloud workflows with Bentley iTwin for 3D reconstruction and facade texture segmentation within EnergyAtlas.



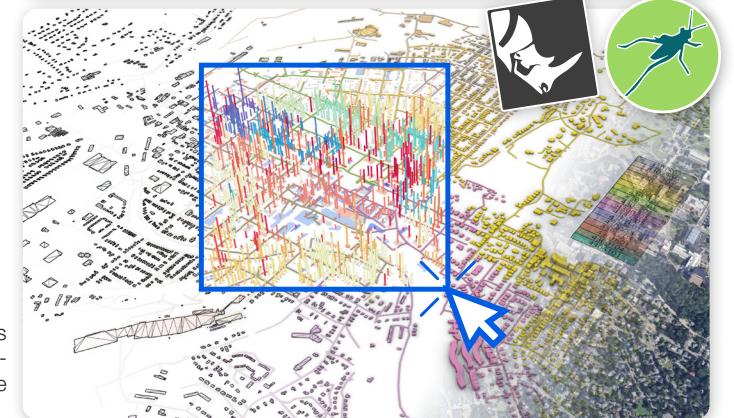
Unity + Cesium

Stream large-scale digital twins into interactive 3D environments for simulation and visualization.



ReactJS + Mapbox WebApp

Deliver browser-based city energy dashboards without licensing or installation requirements, making energy insights and retrofit impacts accessible to all.



Rhinoceros3D + Grasshopper

Import, generate and edit urban energy models directly in Rhinoceros 3D and Grasshopper components with built-in templates, simulation engine and visualizer.