

Oakland EcoBlock Zero Net Energy Master Plan

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What is EcoBlock?

An integrated systems platform:
buildings, electricity, water & mobility

1. Standardized, affordable, scalable
2. Low carbon, ZNE communities
3. Legal, finance, policy framework
4. Healthy, resilient neighborhoods



EcoBlock Motivation

Anticipate climate change-driven urban crises

- joint-compound risks (drought / earthquake / fire / rain)
- note: 80.7% of U.S., 95% of CA population lives in cities

Devise a suite of integrated technologies that plan for:

- reduction of variance (volatility + vulnerability) across urban systems
- mitigation of collateral impacts (water/food shortages, grid outages)
- disaster prevention (flashpoints, coastal retreat, vulnerability zones)
- simultaneously advancing climate protection (energy efficiency, carbon neutrality)

Whole-systems research agenda

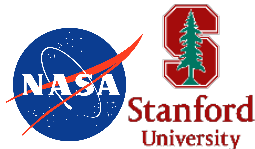
energy – water – transportation – social – policy – finance – economics

EcoBlock California Context

California, the world's fifth-largest economy.

- SB 100: Commits the state to 60% of electricity from clean sources by 2030 and 100% by 2045.
- SB 700: Extends incentives for distributed, self-generated energy (wind, biogas, and fuel cells)
- AB 2145 & 2127: Allocates funds to modernize & expand electric-vehicle (EV) charging
- AB 2061: Eases weight restrictions for commercial EVs to encourage fleet-wide adoption
- SB 237 & 1131: Fast-tracks access to energy-efficiency (EE) programs for state's largest energy consumers (agriculture and industry) and **allows more customers to purchase their power directly from independent sources rather than utilities**
- SB1339: Directs utilities to commercialize microgrids for their customers by standardizing the process to connect customers' microgrids with separate electrical rates and tariffs
- AB1796 & 957: Mandates approval (with exceptions) for the installation of EV charging access on rent-controlled properties and gives low-income drivers with low-emission vehicles preferential access to carpool lanes
- B-55-18: Executive order putting California's economy on track to be carbon neutral by 2045. California must now not just eliminate greenhouse gas emissions from its electricity sector, but zero them out across the entire economy (manufacturing, transportation, industry, etc.). The order instructs state agencies to achieve "net negative emissions" beyond 2045 by pulling carbon dioxide out of the atmosphere.

EcoBlock Team



Energy

Design-Build

Water

ciee

California Institute for
Energy and Environment



Oakland
Neighborhoods
for Equity

Additional Support



Project Management



E-Mobility



Urban Vision

Community Engagement



PERKINScoie



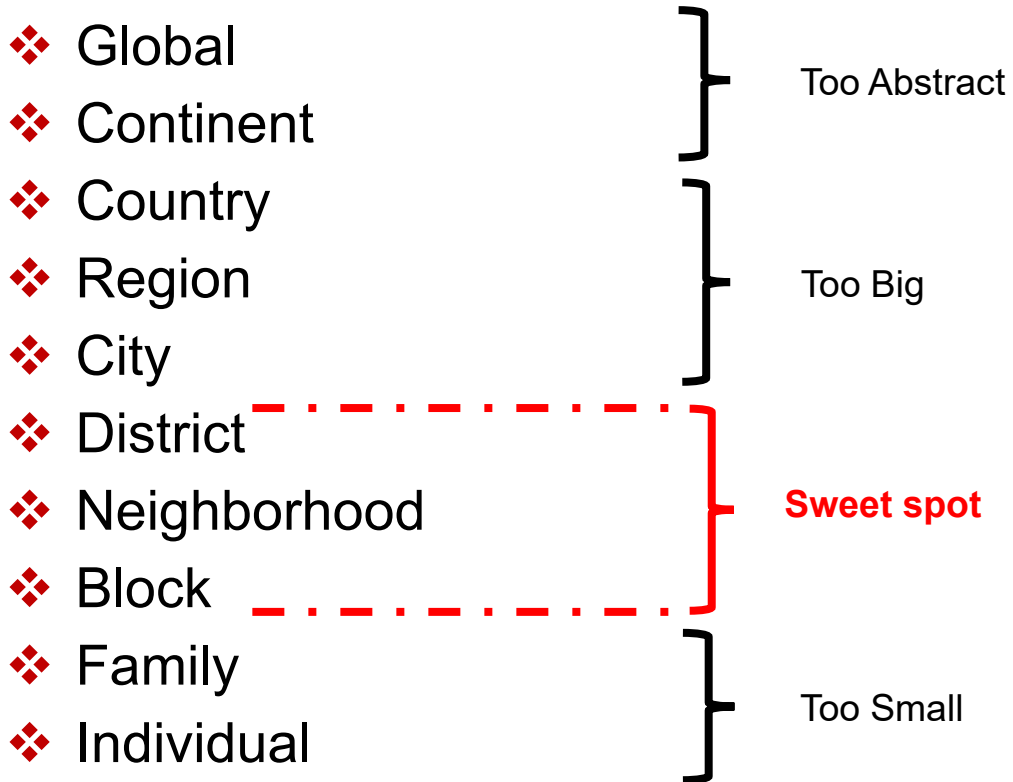
Legal, Business, Finance

EcoBlock Objectives

- >80% reduction in energy demand
- >50% lower water consumption
- Decarbonize homes & vehicles
- Reduce systems complexity
- Enable distributed energy resources
- Stronger grid reliability & resilience
- Reduce costs & risks to ratepayers



Optimal Scale



EcoBlock Hypothesis:

The most cost-effective way to drive zero-carbon energy, deep water conservation and resilient urban systems is by addressing components together, on the *district-neighborhood-block scale*.

The Primary Unit of City Making

An aerial photograph of a dense urban grid in Barcelona, Spain. The image shows a repeating pattern of blocks and streets, illustrating the primary unit of city making. The blocks are generally rectangular and arranged in a grid-like fashion, with narrow streets separating them. The buildings are mostly multi-story and have a reddish-brown roof color. There are some green spaces and parks interspersed within the grid. The overall appearance is that of a highly organized and compact urban environment.

Barcelona



Hamburg



Houston



London



Lyon



Paris



Rome



Stockholm

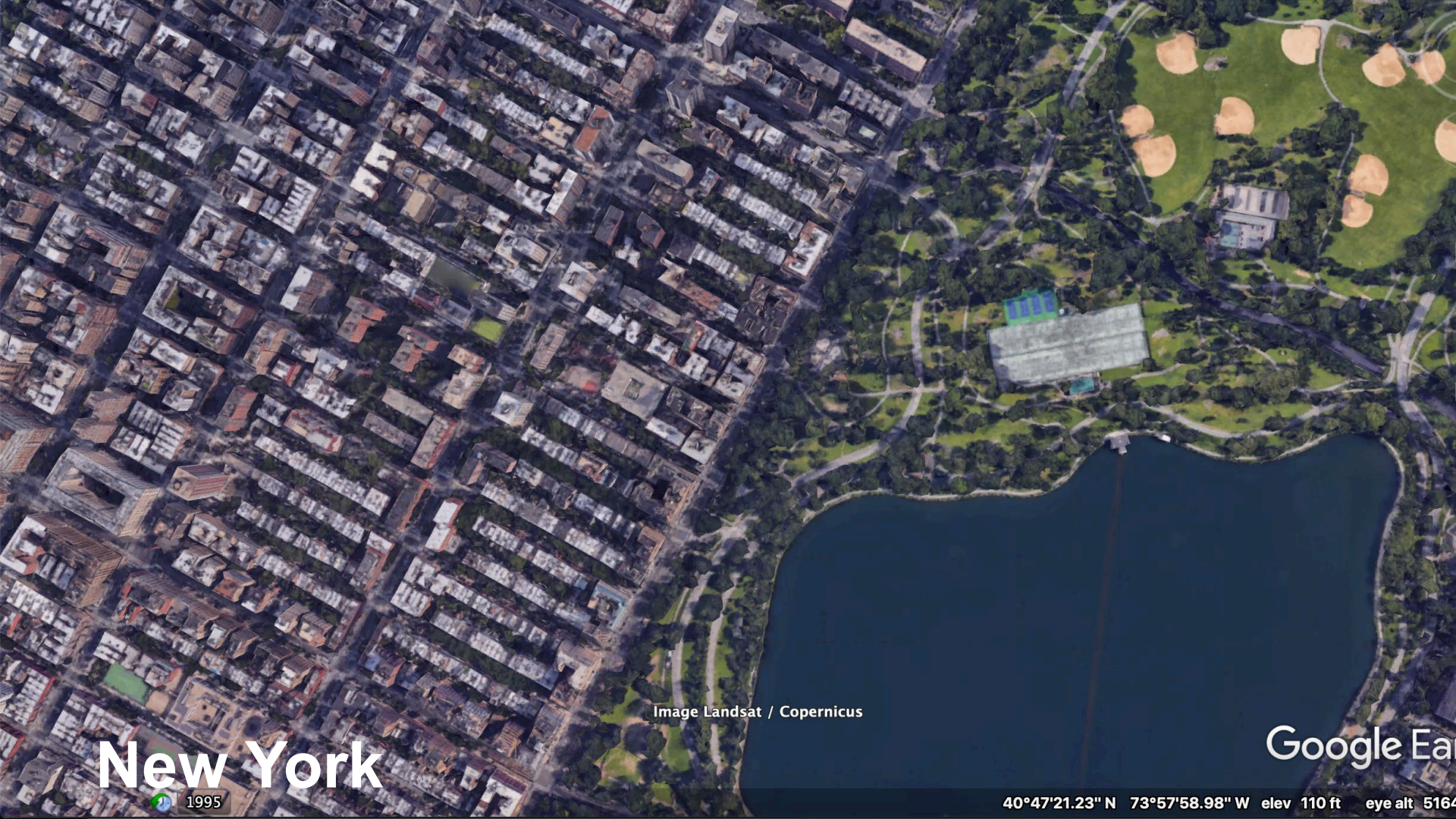



Image Landsat / Copernicus

New York

 1995

Google Earth

40°47'21.23" N 73°57'58.98" W elev 110 ft eye alt 5164

Why Existing Buildings?

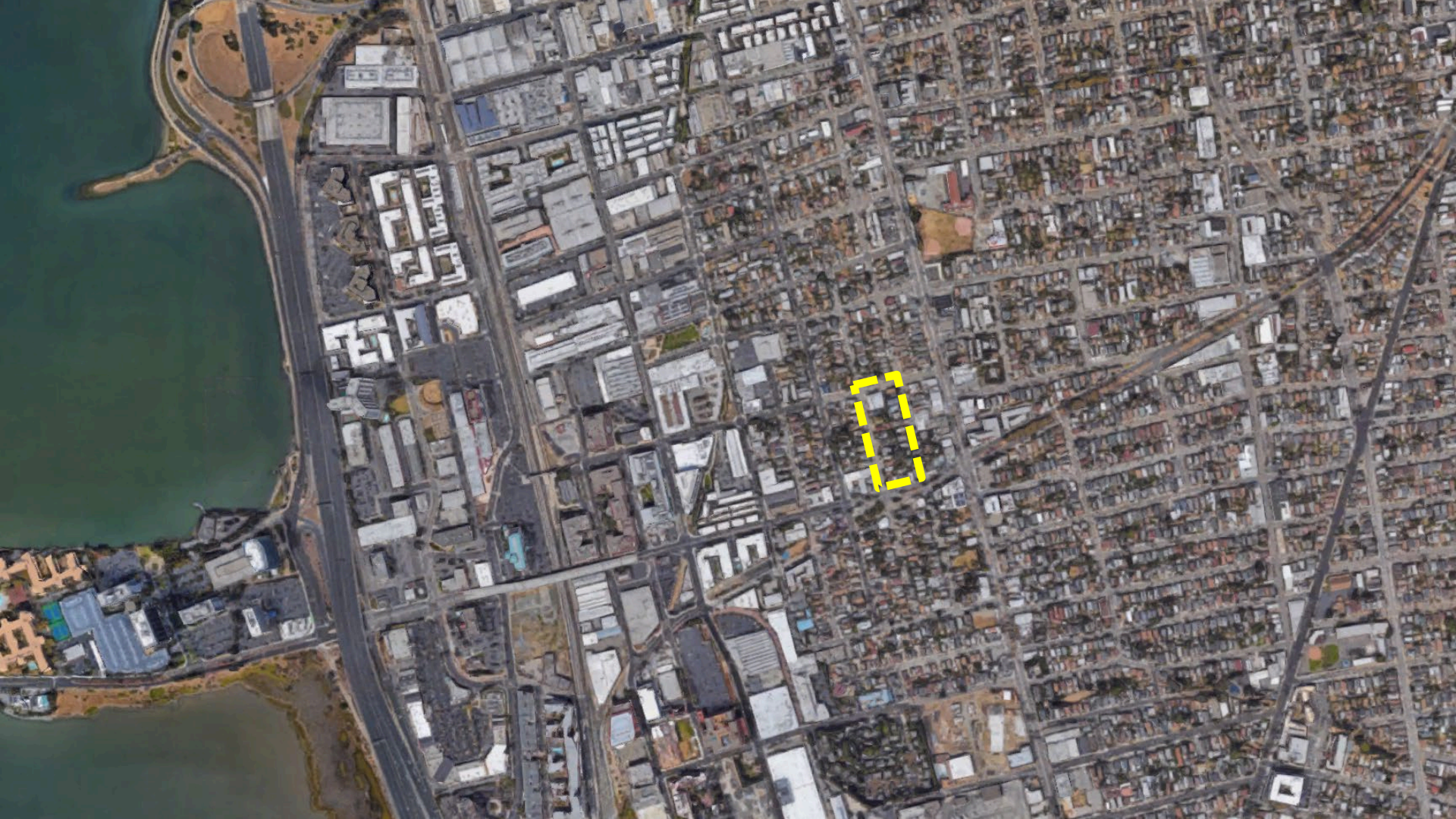
Retrofit challenge: final frontier of energy, water, materials savings.

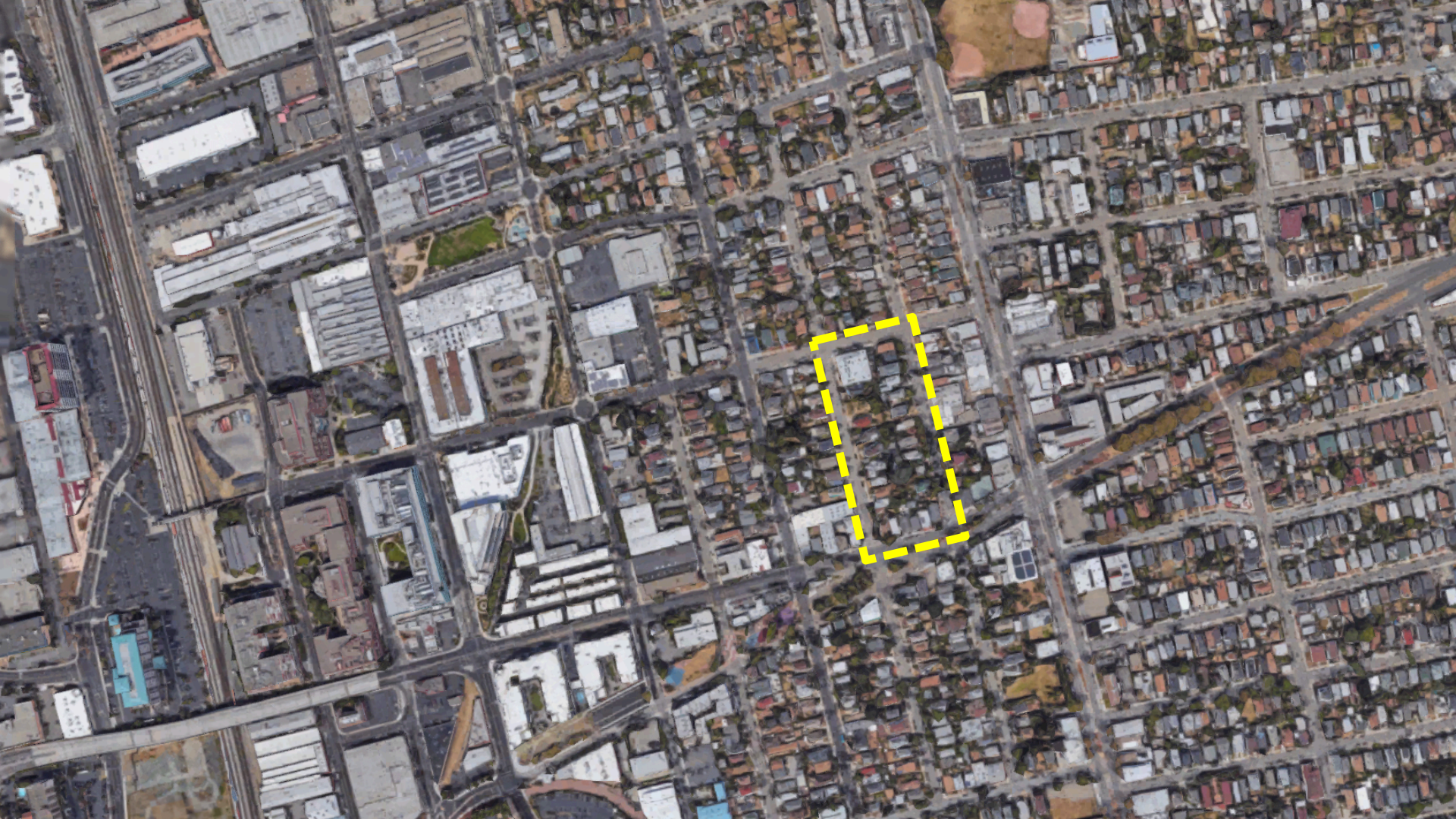
- Suite of retrofit measures
- Improve performance, reduce costs, aggregate benefits
- Immediate impact on livability



**EcoBlock is a
functional superimposition on
existing city topology**

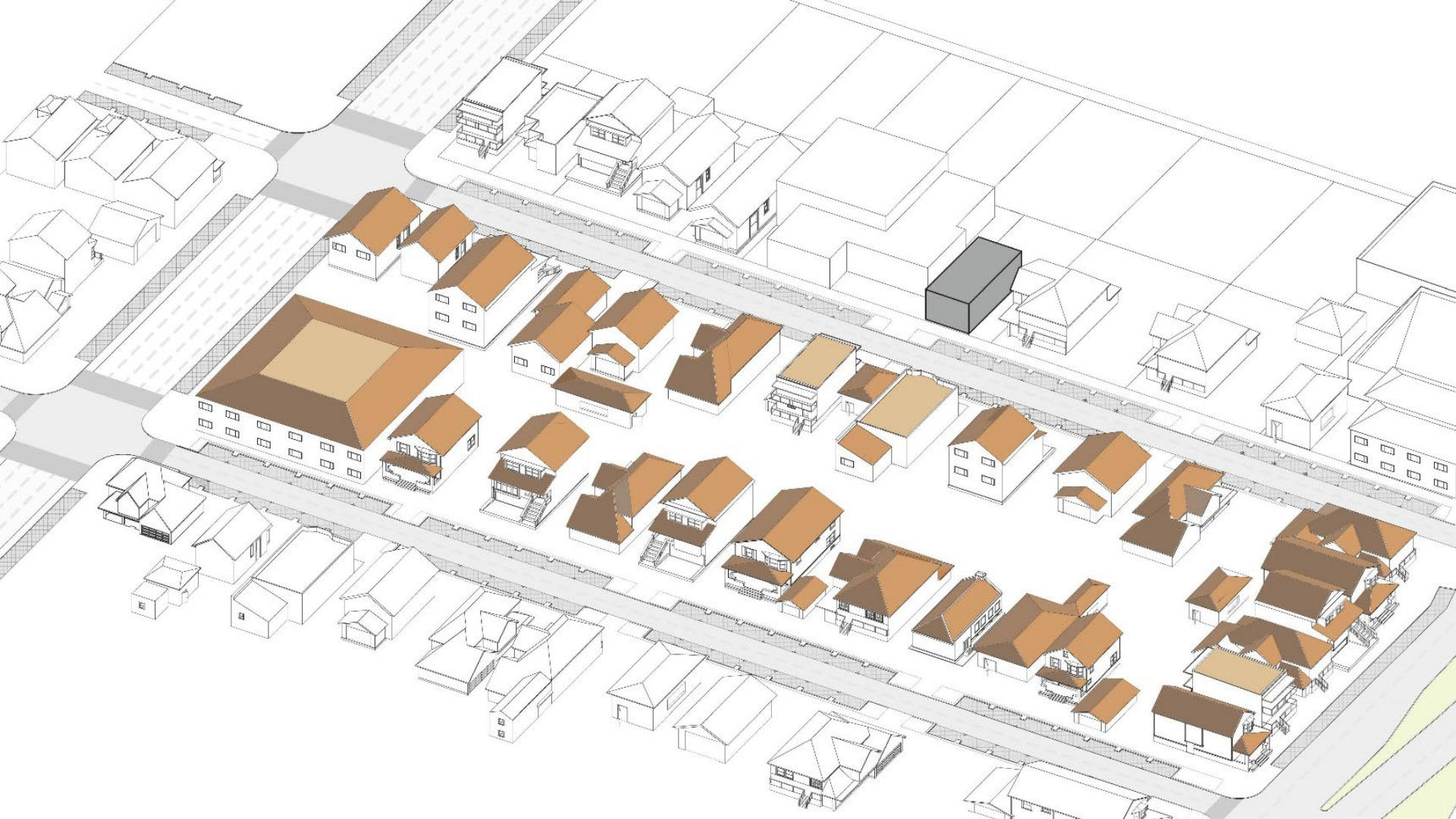










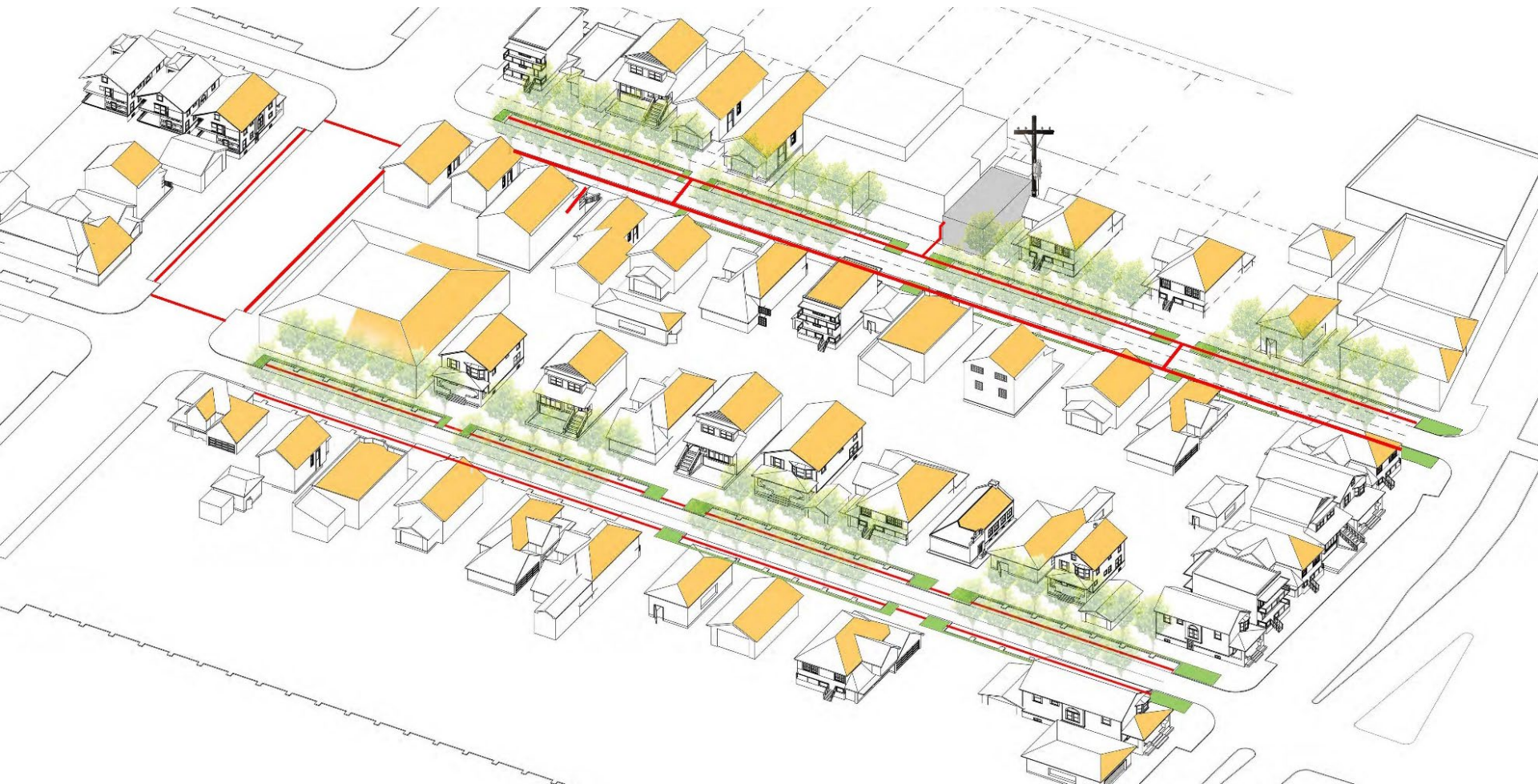


Rooftop rainwater harvesting + groundwater recharge

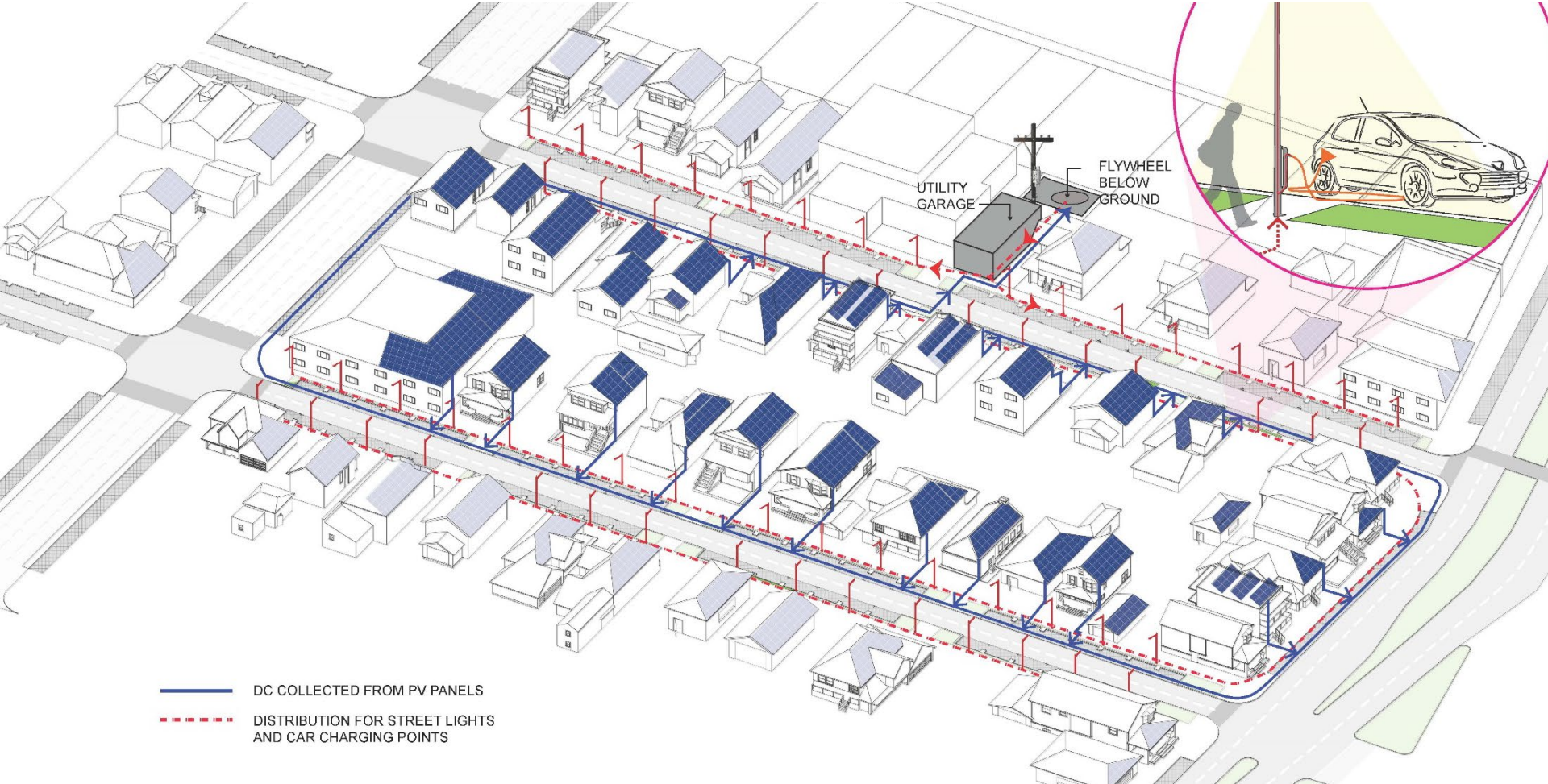


- ROOF TOP WATER
- SEWAGE WATER

Electricity: communal, solar rooftop microgrid system



Nighttime storage for homes, EVs, smart street lighting



EcoBlock electric resources

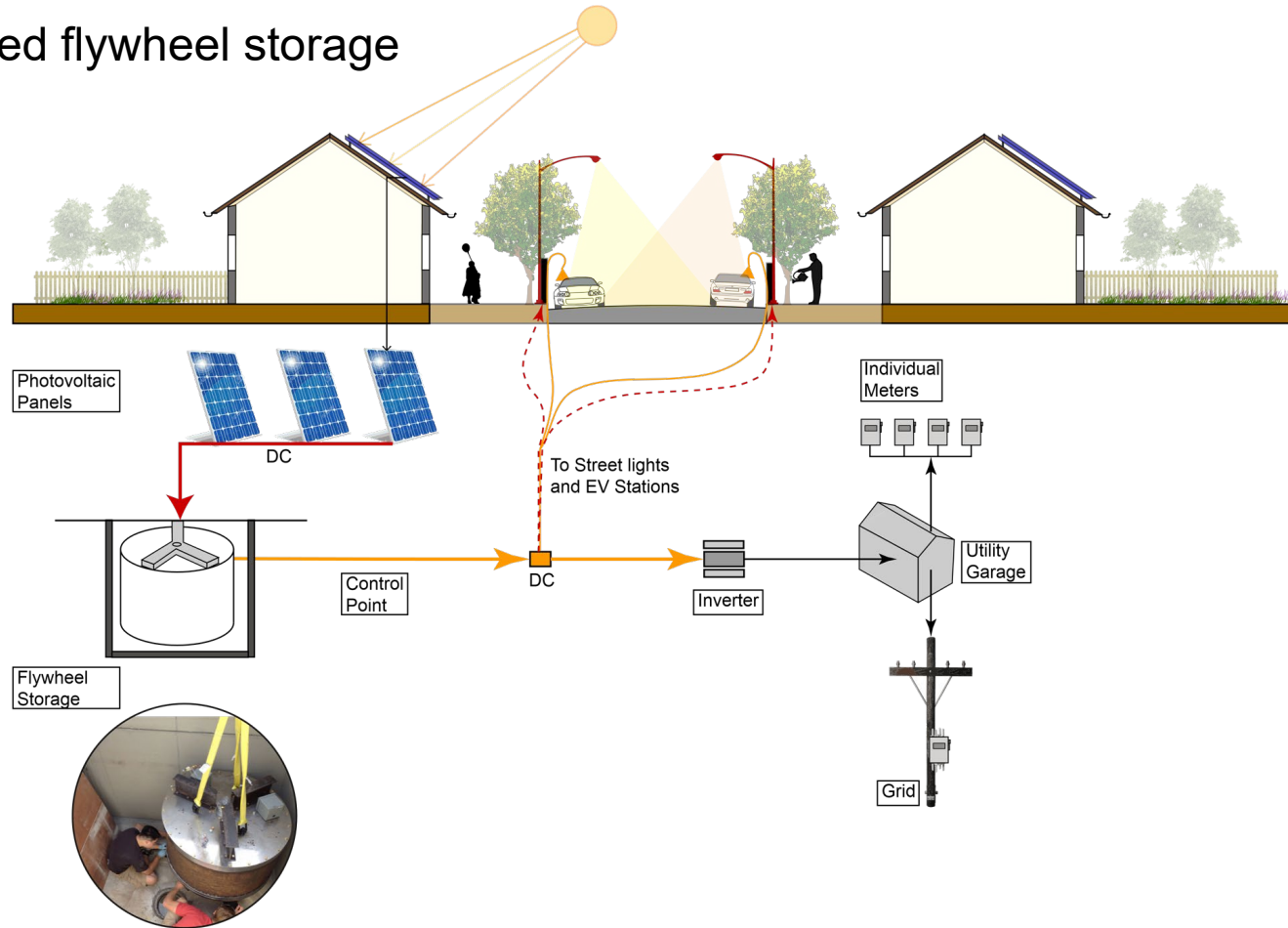
Communal, on-site advanced flywheel storage

System architecture:

- ~250 kW PV, DC microgrid
- up to 28 EV charging stations with parking
- utility loop under the sidewalk
- single inverter connection to grid
- utility garage houses power electronics

Estimated PV system output:

- 450 MWh/year
- 80% lower electricity usage
- removes natural gas in homes
- CO2 reduction 90%



EcoBlock electrical systems - EVs

The EV-home DER integration of smart appliances

- ❖ **Current** - residential homes & private automotive transportation are separate...
- ❖ **Future** - shared, sustainable mobility will be an extension of the house, part of an integrated system of solar-powered smart appliances.



Regulatory Highlights for Cities

Energy Upgrades

- Building inspector/plan checker training on electric technologies
- Easy to use forms for swapping appliances

Energy Storage

- Zoning code update
- Plan check training
- Building inspector training

Electric Vehicle Charging

- Curbside parking
- EV standards

Microgrid

- General Plan land use update (potential)
- Zoning code update
- Joint trenching/easement/ROW process & standards

Water Efficiency Improvements

- General Plan land use update (potential)
- Zoning code update
- Easement & ROW regulations review
- Laundry to landscape regulations

Potential – Scaling Up to Oakland

- Average Oakland block = 40 homes
- 40 homes can produce = 400MWh/year
- Oakland has 3,500 potential ecoblocks
- 400MWh/block/year x 3,500 blocks = **1,400 GWh/year**

In a given year EcoBlocks could supply 60% of Oakland's electricity demand.

Future EcoBlocks can include:

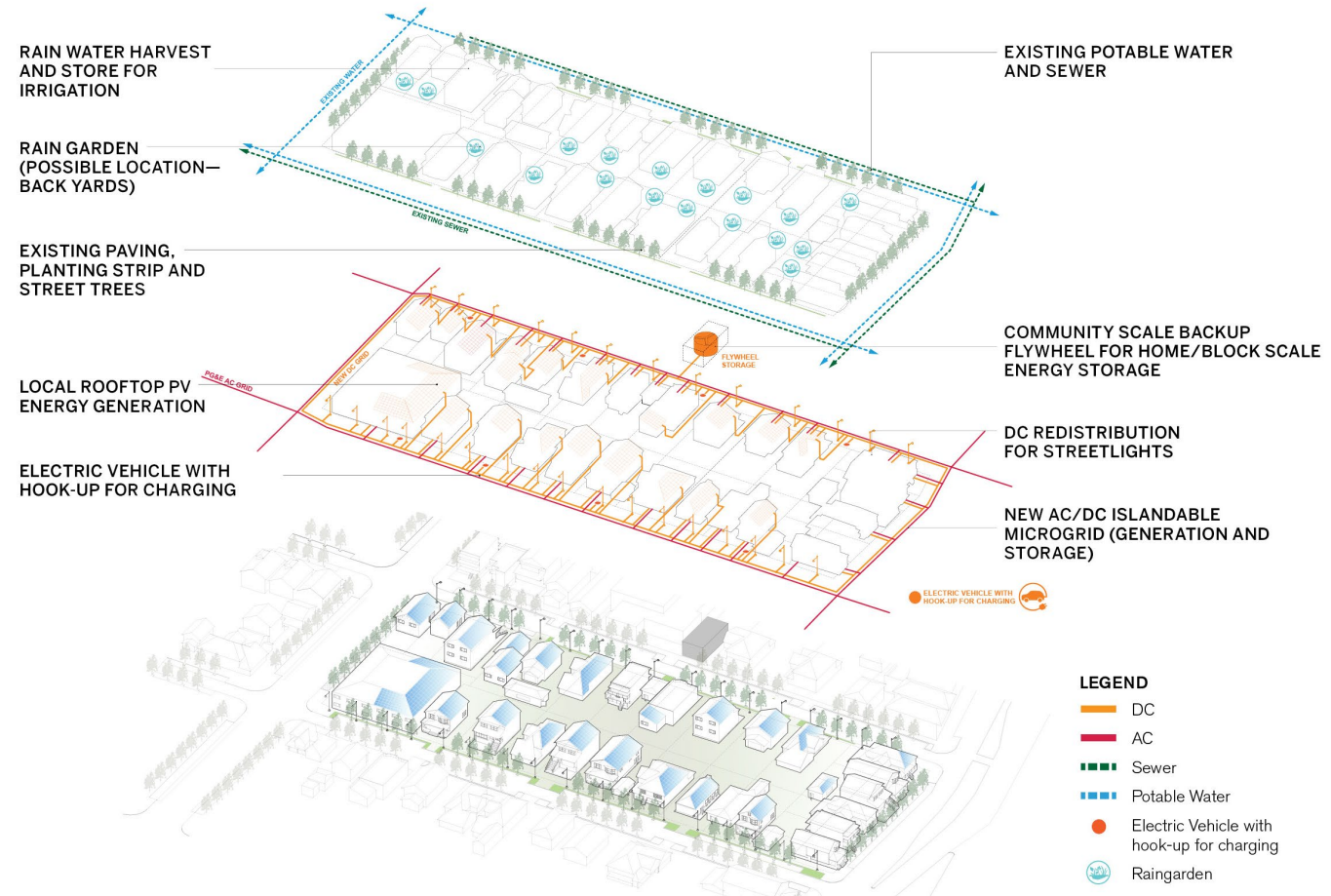
- Seismic safety
- Fiber optics / communications capacity
- Urban food production / community gardens
- Next generation sidewalks (multi-modal)



EcoBlock Transformation

Block-scale

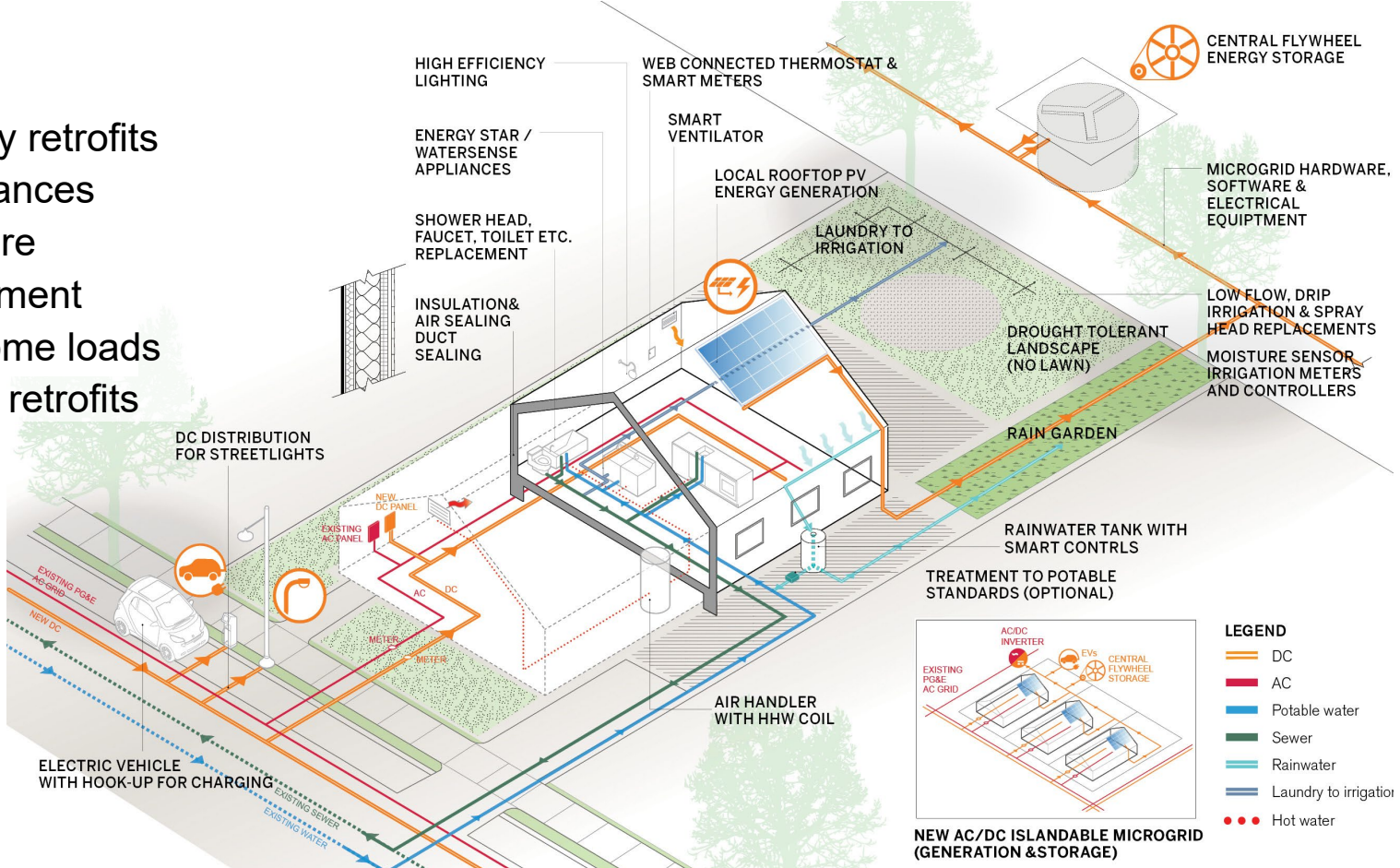
- Solar farm
- Energy storage
- Microgrid + smart controls
- Electric vehicle chargers
- Water storage
- Non-potable water treatment and reuse



EcoBlock Transformation

House-scale

- PV generation
- Energy efficiency retrofits
- All electric appliances
- Rainwater capture
- Energy management
- DC power for some loads
- Water efficiency retrofits



Third Party Verification:

Improved comfort | energy, water & bill savings | resilience

Identify



Evaluate
Define Goals

Prioritize



Coordinate
Collaborate

Specify



Document
Set
Expectations
Standards

Verify



Inspections
Performance
Testing
Achieve Goals



EcoBlock - Conclusions

- Overall, the [EcoBlock](#) is trying to prove a new business, legal, and social model that will spur investment in local energy infrastructure and systems design.
- We have chosen certain technologies for the initial demonstration, but ultimately the choices for future [EcoBlocks](#) will depend on local circumstances.
- The technology integration is an important enabler for the [EcoBlock](#) model, but it's only part of what we are trying to demonstrate in the pilot project.
- As market demand for distributed, renewable energy systems continues to grow exponentially, the commercial applications for [EcoBlocks](#) will expand enormously.