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
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

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<thead>
<tr>
<th>Energy</th>
<th>Design-Build</th>
<th>Water</th>
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<td>ciee California Institute for Energy and Environment</td>
<td><a href="#">Oakland Neighborhoods for Equity</a></td>
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### Additional Support
- spie batignolles
- **VEOLIA**
- **RAMBÖLL ENVIRON**
- **REXEL**
- **ENERGY SOLUTIONS**

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<th>Project Management</th>
<th>Community Engagement</th>
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<td><a href="#">Transportation Sustainability Research Center</a></td>
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<td><strong>Page/Peckham</strong></td>
<td><a href="#">TAUSIG &amp; ASSOCIATES</a></td>
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### E-Mobility
- [NASA](#)

### Urban Vision
- [Stanford University](#)

### Legal, Business, Finance
- [Sherwood Design Engineers](#)
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
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

Barcelona
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
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.
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<th>Microgrid</th>
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<td>• General Plan land use update (potential)</td>
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<td>• Easy to use forms for swapping appliances</td>
<td>• Zoning code update</td>
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<td>• Joint trenching/easement/ROW process &amp; standards</td>
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<td>Water Efficiency Improvements</td>
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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

**Planning and Design**
- Permitting and Documents
- Construction
- Close Out
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.