Getting to Net Zero Energy and Water Use and Beyond In Existing Multifamily Buildings

Amy Dryden
October 29, 2015
Agenda

• Framework for Thinking about ZNE, ZNW, ZNC…
  – Amy Dryden
• Near Zero Net Energy and Water Rehab Projects
  – Sean Armstrong
• Planning for ZNE over Time
  – Nick Young
• Workshop questions- what is needed to support ZNE?
  – Group
Build It Green

• A non-profit with mission to achieve healthy & resource efficient homes
  – Establish and promote an attainable and credible green building program
  – Train professionals in green building
  – Work with local governments to create green building policy
Framework for Thinking about ZNE
Define Your ZNE Lens

What Metric?

- Site: Produces as much energy as it consumes over the course of a year using site energy as a metric or utility bills. All fuel types converted to kBTUs.
- Site and all electric: Produces as much energy as it consumes over the course of a year using site energy as a metric or utility bills. The home is all electric as all onsite energy is offset.
- Source to Site: Produces as much energy as it uses annually when accounted for at the source. Fuel types have energy factor accounting for transmission losses.
- Cost: energy use is evaluated from annual cost of utilities to income generated from sale of surplus energy.
- Emissions: Produces as many carbon emission offsets through renewable energy as total carbon emissions generated from other sources.
Define Your ANE Lens

What End uses?
- Heating and Cooling
- Tenant Loads
- Common Area Loads
- Lighting
- Laundry
- Cooking
- Plug loads
How do we create framework for decision making?

• Define it

• Understand is it aspirational or mandatory

• Timeframe for implementation
  – New Construction
  – Gut Rehab
  – Improvements over time
Opportunities

• Nationwide:
  – > 70% of MF housing units constructed before established building energy efficiency codes
• In California:
  – 2/3 of all buildings that will exist in 2050 already exist
  – >2.4 million existing multifamily dwelling units
  – 70% constructed before 1980
• 15% market penetration would be ~336,000 Dwellings
  – A 25% energy upgrade of 336,000 dwellings =
    • 533,971 megawatt-hours (MWh) of electricity
    • 37 million therms of natural gas
    • Avoided GHG = 430,245 MTCO2E annually
Getting to 2050 goals- 80% below

On Average Residential homes and account for 18% of GHG

1990 level

BAU: Business as Usual
California’s Energy Future – The View to 2050
California Council on Science and Technology
CA Policies and Programs to get to ZNE

- Statewide efforts
  - Strategic plan
  - Code and standards
  - Programs
- Local government efforts
  - Reach Codes
  - Climate Action Plans
- Certification efforts
CA Policies – supporting AB 32

• State plan to GHGs to 1990 levels by 2020, 80% below by 2050
• SB 375 – ties regional transportation to housing
• SB 350 – 50% renewables, 50% increase efficiency, EV
• SB 32 – enshrines goals and sets interim targets
Shift in Metrics

• AB 32 and supporting legislation
• SB 375/350
• Program using GHG metric – not kWh/therms
  – AHSC and CSD MF weatherization
• Tax Credit Allocation Committee – Net Zero Energy option
• GPR ZNE – all electric with GHG output
Shift in Metrics

Priority of interventions
• Energy efficiency first and foremost
• Water efficiency
• Renewable offset
• Indoor air quality

Programs and metrics
• Energy efficiency- % improvement and % better than code
GreenPoint Rated Approach

• Support State goals
• Near Zero Energy
  – 80% offset
  – Pathway to ZNE
• Zero Net Energy
  – 100% offset
  – All electric
  – Using Carbon as metric
• Create baseline for California home and National Homes
Framework for Discussion

- Appliances, Laundry and cooking
- Heating and Cooling
- Total Energy Use of Home/Unit
- DHW and Distribution
- Indoor Water Use
- Lighting – interior and exterior
- Plug loads
Heritage Square

- **Heritage Square** by BRIDGE Housing
- New construction
- Pasadena
- 70 units
- Senior project
- Affordable

Intended Accomplishment – permits pulled
- 90% energy offset
- GreenPoint Rated 125+ points - Platinum
# Heritage Square - Standard and GHG lens

<table>
<thead>
<tr>
<th>Feature</th>
<th>Standard options</th>
<th>Options with GHG lens for this project</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Unit Heating</td>
<td>• Electric resistance</td>
<td>• Ducted heat pumps</td>
</tr>
<tr>
<td></td>
<td>• Radiator</td>
<td>• Hydronic coil</td>
</tr>
<tr>
<td></td>
<td>• Wall furnace</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Gas furnace</td>
<td></td>
</tr>
<tr>
<td>In Unit Cooling</td>
<td>SEER 13</td>
<td>Heat pump</td>
</tr>
<tr>
<td>Central Water Heating</td>
<td>• Gas boiler</td>
<td>• Modulating condensing boiler with solar</td>
</tr>
<tr>
<td></td>
<td>• Condensing boiler</td>
<td>• Central Heat pump boiler</td>
</tr>
<tr>
<td></td>
<td>• Pipes insulated</td>
<td>• All pipes insulated</td>
</tr>
<tr>
<td>Windows</td>
<td>U factor - .30</td>
<td>U factor - .30</td>
</tr>
<tr>
<td></td>
<td>SHGC: 3.0</td>
<td>SHGC: .28</td>
</tr>
</tbody>
</table>
## Heritage Square – Standard and GHG lens

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<tr>
<th>Feature</th>
<th>Standard</th>
<th>Options with GHG lens for this project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab/ Foundation</td>
<td>Non insulated slab</td>
<td>Insulated slab R-5 (as if it was heated slab)</td>
</tr>
<tr>
<td>Wall/ Attic/ Floor Insulation</td>
<td>R-15, R-30-38</td>
<td>R-21 (2x6 framing), R-49</td>
</tr>
<tr>
<td>Appliances</td>
<td>Non Energy Star</td>
<td>High performing Energy Star</td>
</tr>
<tr>
<td></td>
<td>Energy Star</td>
<td></td>
</tr>
<tr>
<td>Laundry</td>
<td>In unit laundry</td>
<td>Energy Star - CEE tier 2 or 3</td>
</tr>
<tr>
<td></td>
<td>Non Energy Star</td>
<td>Common Area Laundry</td>
</tr>
<tr>
<td></td>
<td>Central Laundry – standard machines</td>
<td>Solar Laundry Dryer</td>
</tr>
<tr>
<td>Cooking</td>
<td>Standard range- often gas</td>
<td>Electric</td>
</tr>
<tr>
<td>Plug Loads</td>
<td>Not Addressed</td>
<td>Not addressed</td>
</tr>
<tr>
<td>Water Use &amp; Distribution</td>
<td>Not Addressed</td>
<td>Designed system</td>
</tr>
</tbody>
</table>
Heritage Square Considerations

• Known equipment from engineer vs. alternative equipment
• Costs for new equipment includes infrastructure and solar impacts
• Community benefits can impact decisions
• Simple solutions can save a project
• Historical patterns of developer
Rio Vista

- Rehab Project
- San Ysidro
- 160 units – 2 bedroom and 3 bedroom
- 2 story
- Desire to be 100% electric and solar powered
- Affordable
- Accomplishment
  - 100% electric offset
  - Increased efficiency of gas
  - 70% outdoor water reduction
## Rio Vista – Standard and GHG lens

<table>
<thead>
<tr>
<th>Feature</th>
<th>Standard options</th>
<th>Options with GHG lens for this project</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Unit Heating</td>
<td>Electric Resistance</td>
<td>Electric Resistance</td>
</tr>
<tr>
<td>In Unit Cooling</td>
<td>None</td>
<td>Ceiling fans</td>
</tr>
</tbody>
</table>
| In Unit Water Heating    | .58 Atmospheric water heater | EF .70  
All pipes insulated |
## Rio Vista – Standard and GHG lens

<table>
<thead>
<tr>
<th>Feature</th>
<th>BAU options</th>
<th>Options with GHG lens for this Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall/ Attic/ Floor Insulation</td>
<td>R-13 wall and R-30 attic</td>
<td>R-13 wall and R-30 attic</td>
</tr>
<tr>
<td>Appliances</td>
<td>Standard Refrigerator &gt; 10 years old</td>
<td>High performing Energy Star</td>
</tr>
<tr>
<td>Laundry</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Cooking</td>
<td>Gas range</td>
<td>Kept gas range but ideal is Electric range</td>
</tr>
<tr>
<td>Plug Loads</td>
<td>Not Addressed</td>
<td>Tenant Education In unit monitors (not for this project)</td>
</tr>
<tr>
<td>Lighting</td>
<td>Incandescent</td>
<td>Energy Star</td>
</tr>
<tr>
<td>Water Use &amp; Distribution</td>
<td>Not Addressed</td>
<td>Evolve showerheads &amp; Low flow fixtures</td>
</tr>
</tbody>
</table>
Rio Vista Considerations

• Electric load increased
  – Heat pump for heating and cooling
  – Stoves
• Requires 200 amp electric panel and service is undersized
• Tenant engagement strategy to meet utility goals
• Water – outdoor landscape design did not balance tenant goals and uses
Considerations

• Infrastructure
  – Electrical Panel
  – Gas line
  – New construction factored into design
  – Existing Home/Building a barrier

• Equipment
  – Coupling solar and electric appliances
  – Business as usual specifications or operations

• Community and Tenants
Low Energy and Low Carbon

• New Construction
  – Great opportunity to avoid GHG
  – Easier to integrate into design
  – More time for decision making
  – Barriers through code compliance

• Existing Construction
  – Great opportunity to reduce GHG
  – Limitations due to current maintenance comfort and infrastructure
  – Opportunities to funding infrastructure improvements
  – Recommendation to be phased in over time
Zero Net Water

• Water budget is based on annual rainfall on site
  – OR?? Something else
Low Water Use / Zero Net Water

Wastewater from toilets, dishwashers, kitchen sinks, and utility sinks

Wastewater from clothes washers, bathtubs, showers, and bathroom sinks

Precipitation collected from roofs and above-grade surfaces

Precipitation collected at or below grade

Nuisance groundwater from dewatering operations
What is included in Sphere?

Source

Water Conveyance

Water Treatment

Water Distribution

End-Use
- Agricultural
- Residential
- Commercial
- Industrial

Recycled Water Treatment

Recycled Water Distribution

Wastewater Discharge

Wastewater Treatment

Wastewater Collection

Outside the retail meter

Source
Cost Effective?

- Evaluation by UC Davis – only included water efficiency and gray water for landscape only.
- Blackwater vs. Gray water
- Payback with water efficiency + hot water energy + water energy + ghg emissions = 1.0 - 8.0

<table>
<thead>
<tr>
<th>Location</th>
<th>Gallons of Water</th>
<th>CO2e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oakland</td>
<td>166,647</td>
<td>.0463</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>166,647</td>
<td>.1856</td>
</tr>
</tbody>
</table>
What is GreenPoint Rated

• Green home certification system - New & Existing
• Third-party verified
• Awards points across 5 areas:
  – energy, water, resources, indoor air quality, community
• 50 point minimum

• Over 38,000 Rated projects completed,
  17,000 more in the pipeline
Green Building Benefits

- Environmental savings from Climate Calculator

![Greenpoint Rating](image)

**YOUR HOME'S SAVINGS**

<table>
<thead>
<tr>
<th>Environmental Savings</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>85% water saved per year</td>
<td>filling 3,474 bathtubs</td>
</tr>
<tr>
<td>103% energy saved per year</td>
<td>turning off 213,153 lightbulbs</td>
</tr>
<tr>
<td>9 tons of solid waste avoided</td>
<td>eliminating 38 cans of trash</td>
</tr>
<tr>
<td>3 tons of carbon emissions avoided</td>
<td>taking 1 cars off the road</td>
</tr>
</tbody>
</table>

Version: New Home Single Family v6
RATED ON: 4/21/2015
Thank you!

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GreenPoint Rated
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