Affordable, Green Homes
with DOE Zero Energy Ready Homes and Enterprise Green Communities
Green Communities Certification

Enterprise Green Communities certified projects are underway in 39 states + the District of Columbia
Programmatic Requirements

- Integrative Design
- Location + Neighborhood Fabric
- Site Improvements
- Water Conservation
- Energy Efficiency
- Materials
- Healthy Living Environment
- Operations, Maintenance + Resident Engagement

A holistic approach to building a green community
DOE Zero Energy Ready Home

Affordable, Green Homes with DOE Zero Energy Ready Homes and Enterprise Green Communities

October 27, 2017
Zero Energy Ready Home

Building Blocks
ZERH Building Blocks

Code Enclosure
ZERH Building Blocks

Optimized Enclosure
FUTURE READY
ZERH Building Blocks

- Optimized Enclosure
- Water Protection

FUTURE READY
MOISTURE READY
ZERH Building Blocks

Optimized Enclosure - FUTURE READY
Water Protection - MOISTURE READY
Advanced H+AC+H - COMFORT READY
Indoor Air Quality - HEALTH READY
ZERH Building Blocks

- Optimized Enclosure
  - FUTURE READY
- Water Protection
  - MOISTURE READY
- Advanced H+AC+H
  - COMFORT READY
- Indoor Air Quality
  - HEALTH READY
- Efficient Comps
  - TECH READY
ZERH Building Blocks

- Optimized Enclosure (FUTURE READY)
- Water Protection (MOISTURE READY)
- Advanced H+AC+H (COMFORT READY)
- Indoor Air Quality (HEALTH READY)
- Efficient Comps (TECH READY)
- Solar Ready (ZERO READY)
The home of the future…

Today
Buying a home is often the largest purchase of a lifetime with so much riding on getting it right.
This is because it’s often cost-prohibitive to make substantial changes once a home is built.
Wouldn’t it be great to know what leading experts would look for in a new home that performs to their expectations?
Well now you do.

When building performance professionals are polled,
Well now you do.

When building performance professionals are polled, they overwhelmingly choose homes that meet Department of Energy Zero Energy Ready Home specifications.
That’s because leading experts know every certified Zero Energy Ready Home includes **seven must-have systems** that help ensure a superior homeowner experience.

### Seven Must-Have Systems

<table>
<thead>
<tr>
<th></th>
<th>Optimized Thermal Protection</th>
<th>Whole-House Water Protection</th>
<th>Advanced Heating and Cooling</th>
<th>High-Efficiency Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Future Ready</td>
<td>Moisture Ready</td>
<td>Comfort Ready</td>
<td>Tech Ready</td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td>4</td>
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<tr>
<td>5</td>
<td>Comprehensive Indoor Air Quality</td>
<td>Solar Ready Construction</td>
<td>Enhanced Quality Assurance</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Health Ready</td>
<td>Zero Ready</td>
<td>Performance Ready</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
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That’s because leading experts know every certified Zero Energy Ready Home includes **seven must-have systems** that help ensure a superior homeowner experience.
Maybe most significantly, leading experts know all this added value may increase monthly mortgage expenses compared to a minimum code home, but
Maybe most significantly, leading experts know all this added value may increase monthly mortgage expenses compared to a minimum code home, but significant monthly utility bill savings can easily result in lower TRUE cost.
In other words, leading experts know buying smart is as easy as looking for the DOE Zero Energy Ready Home label.
Zero Energy Ready Home

Alignment with

Enterprise Green Communities
The Small Jump from EGC to DOE ZERH

- Energy Efficiency
- Healthy Living Env.
- Materials
- Water Conservation
  + Integrative Design
- Location
- Site Improvements

- Optimized Enclosure
- Water Protection
- Optimized Comfort
- Complete IAQ
- Efficiency Components
- Solar Ready
The Small Jump from EGC to DOE ZERH

- Energy Efficiency
- Healthy Living Env.
- Materials
- Water Conservation
  + Integrative Design
- Location
- Site Improvements

The Gap is Small!

- Optimized Enclosure
- Water Protection
- Optimized Comfort
- Complete IAQ
- Efficiency Components
- Solar Ready
## From Code...to ENERGY STAR to DOE Zero Energy Ready Home

<table>
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<tr>
<th>Solar Ready</th>
<th>Eff. Comps.&amp; H₂O Distrib.</th>
<th>EPA Indoor Air Package</th>
<th>Optimized Duct Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC QI with WHV</td>
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<td></td>
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<td>Water Management</td>
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<tr>
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</tr>
<tr>
<td>HERS 70-80</td>
<td>HERS 65-75</td>
<td>HERS 55-65</td>
<td>HERS 48-55</td>
</tr>
<tr>
<td>IECC 2012</td>
<td>ENERGY STAR v3</td>
<td>ENERGY STAR v3.1</td>
<td>ZERH</td>
</tr>
</tbody>
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### ENERGY STAR Provides a Common Foundation for EGC & DOE ZERH

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<tr>
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- Solar Ready
- Eff. Comps. & H₂O Distrib.
- EPA Indoor Air Package
- Optimized Duct Location

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**IECC 2012**

- **Enclosure**
  - **HERS**
  - **Water Management**
  - **Independent Verification**
  - **HVAC QI with WHV**

**IECC 2009**

- **Enclosure**
  - **HERS**
  - **Water Management**
  - **Independent Verification**
  - **HVAC QI with WHV**

**IECC 2012/15**

- **Enclosure**
  - **HERS**
  - **Water Management**
  - **Independent Verification**
  - **HVAC QI with WHV**

**ENERGY STAR v3**

- **HERS**
  - **Water Management**
  - **Independent Verification**
  - **HVAC QI with WHV**

**ENERGY STAR v3.1**

- **HERS**
  - **Water Management**
  - **Independent Verification**
  - **HVAC QI with WHV**

**ZERH**

- **HERS**
  - **Water Management**
  - **Independent Verification**
  - **HVAC QI with WHV**

---

**Water Management**

- **Independent Verification**
- **Optimized Duct Location**

**HVAC QI with WHV**

- **Eff. Comps. & H₂O Distrib.**
- **EPA Indoor Air Package**
- **Optimized Duct Location**

---

**Solar Ready**

- **IECC 2012**
- **Enclosure**
- **HERS**
- **Water Management**
- **HVAC QI with WHV**

---

**Eff. Comps. & H₂O Distrib.**

- **IECC 2012**
- **Enclosure**
- **HERS**
- **Water Management**
- **HVAC QI with WHV**

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**EPA Indoor Air Package**

- **IECC 2012**
- **Enclosure**
- **HERS**
- **Water Management**
- **HVAC QI with WHV**

---

**Optimized Duct Location**

- **IECC 2012**
- **Enclosure**
- **HERS**
- **Water Management**
- **HVAC QI with WHV**

---

**Independent Verification**

- **IECC 2012**
- **Enclosure**
- **HERS**
- **Water Management**
- **HVAC QI with WHV**
1. Eligible Building Types

- Single-family; low-, mid-, and high-rise multi-family dwellings;
- New Construction, as well as Moderate and Substantial Rehabs;
- SFD and SFA dwellings
- Focus is New Construction; Substantial Rehabs can be qualified;
- MF buildings up to 5 stories; central HVAC and DHW is allowed
1. Eligible Building Types

- Single-family; low-, mid-, and high-rise multi-family dwellings;
- New Construction, as well as Moderate and Substantial Rehabs;

Most EGC building types will be eligible for DOE ZERH

- SFD and SFA dwellings
- Focus is New Construction; Substantial Rehabs can be qualified;
- MF buildings up to 5 stories; central HVAC and DHW is allowed
2. Energy Efficiency Threshold

- Requires ENERGY STAR Homes certification for applicable project types
- HERS value in the mid-60s.

- Qualifying HERS scores are generally in the mid- to low-50s.
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- HERS value in the mid-60s.

Achieving the extra ~3-10 HERS points needed for DOE ZERH earns 12 additional EE points (EGC 5.2b)

- Qualifying HERS scores are generally in the mid- to low-50s.
3. ENERGY STAR for Homes Baseline

- Requires ENERGY STAR Homes certification for applicable project types
- Requires projects to be certified to ENERGY STAR Homes
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- Requires ENERGY STAR Homes certification for applicable project types
  
  **Programs are fully aligned.**

- Requires projects to be certified to ENERGY STAR Homes
4. Building Envelope

- Meets ENERGY STAR Homes requirements
- Envelope opaque areas meet 2012/2015 IECC insulation levels
- Windows meet ENERGY STAR requirements.
4. Building Envelope

EGC projects will need to meet the 2012/15 envelope insulation levels and achieve ZERH window specs.

This will earn additional EE points under either EGC 5.2a or 5.2b.

• Meets ENERGY STAR Homes requirements

• Envelope opaque areas meet 2012/2015 IECC insulation levels

• Windows meet ENERGY STAR requirements.
## ZERH Window Specs

<table>
<thead>
<tr>
<th>Window Specs Required for DOE Zero Energy Ready Home Projects</th>
<th>Hot Climates IECC CZ 1-2</th>
<th>Mixed Climates IECC CZ 3-4 except Marine</th>
<th>Cold Climates IECC CZ 5-8 and 4 Marine</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Value</td>
<td>SHGC</td>
<td>U-value</td>
<td>SHGC</td>
</tr>
<tr>
<td>0.40</td>
<td>0.25</td>
<td>[CZ 3] 0.30</td>
<td>[CZ 3] 0.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[CZ 4] 0.30</td>
<td>[CZ 4] 0.40</td>
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</tbody>
</table>
5. Duct System

- Located ducts within conditioned spaces recommended
- Duct systems required to be located in optimized locations
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- Located ducts within conditioned spaces recommended

When EGC projects use optimized duct location for ZERH, improves HERS score and earns points under EGC 5.2a/5.2b.

Optimized ducts (or ductless systems) also offer comfort and IAQ benefits.

- Duct systems required to be located in optimized locations
6. Hot Water Distribution

- **Optional EGC 4.4** calls for the same WaterSense hot water distribution provision referenced in DOE ZERH.

- Requires efficient hot water delivery systems, meaning the use of on-demand recirculation, compact layouts, or structured plumbing.

- ZERH also has modified provisions for CDHW systems in MF buildings.
6. Hot Water Distribution

- **Optional EGC 4.4** calls for the same WaterSense hot water distribution provision referenced in DOE ZERH.

EGC projects meeting ZERH efficient hot water distribution earn 4 additional points under optional EGC 4.4.

Much faster water delivery and 1000s of gallons saved/year.

- Requires efficient hot water delivery systems, meaning the use of on-demand recirculation, compact layouts, or structured plumbing.

- ZERH also has modified provisions for CDHW systems in MF buildings.
7. Lighting & Appliances

- EGC 5.4 (mand.) requires builder-supplied CW, DW, and refrigerators to be ENERGY STAR.
- EGC 5.5 (mand.) requires all lighting fixtures to have efficacy of at least 40 to 60 lumens per watt.
- EGC 7.1 (mand. for all new construction and substantial rehab) requires bath fans to be ENERGY STAR, wired to turn on with light switch, equipped with a humidistat sensor, timer or other control.

- EGC Criterion 5.4 satisfies the ZERH requirement for ENERGY STAR appliances.
- 80% of lighting fixtures are required to be ENERGY STAR qualified or ENERGY STAR lamps in minimum 80% of sockets under ZERH. This is substantially met by EGC Criterion 5.5.
- ZERH requires ENERGY STAR bath ventilation and ceiling fans, which is satisfied by EGC Criterion 7.1.
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Full alignment, as long as lighting is ENERGY STAR labeled.

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- ZERH requires ENERGY STAR bath ventilation and ceiling fans, which is satisfied by EGC Criterion 7.1.
8. IAQ – Moisture Control

- EGC 7.5 (Mandatory) Vapor Retarder Strategies addresses sub-slab capillary breaks consistently with the IAP provisions.

- ZERH’s Moisture Control provisions including foundation drainage, sub-slab capillary break, and Moisture Resistant Materials (IAP) are satisfied by EGC Mandatory Criteria 7.5 Vapor Retarder Strategies, and 6.8 Mold Prevention: Surfaces.
8. IAQ – Moisture Control

- EGC 7.5 (Mandatory) Vapor Retarder Strategies addresses sub-slab capillary breaks consistently with the IAP provisions. ZERH requires a few additional moisture protection measures: sump pump in basements or crawls; splash protection for homes w/o gutters; and insulating basements & crawls at the perimeter walls (in moist climates).

- ZERH’s Moisture Control provisions including foundation drainage, sub-slab capillary break, and Moisture Resistant Materials (IAP) are satisfied by EGC Mandatory Criteria 7.5 Vapor Retarder Strategies, and 6.8 Mold Prevention: Surfaces.
8. IAQ – Radon

- EGC 7.8 (Mandatory) requires radon resistant construction in Radon Zone 1 per ANSI-AARST Standard: Reducing Radon in New Construction: 1 & 2 Family Dwellings and Townhouses.

- IAP Requires radon Resistant Features installed in Radon Zone 1 conforming to one of several standards - including the AARST Standard for 1 & 2 Family Dwellings and Townhouses.
8. IAQ – Radon

- EGC 7.8 (Mandatory) requires radon resistant construction in Radon Zone 1 per ANSI-AARST Standard: Reducing Radon in New Construction: 1 & 2 Family Dwellings and Townhouses.

Projects meeting mandatory EGC 7.8 will meet ZERH.

- IAP Requires radon Resistant Features installed in Radon Zone 1 conforming to one of several standards - including the AARST Standard for 1 & 2 Family Dwellings and Townhouses.

Note: IAP may soon also reference AARST CC-1000 which covers MF buildings.
8. IAQ – Pest Control

- EGC 7.10 (Mandatory) Integrated Pest Management requires corrosion-proof rodent/bird screens to seal off openings larger than ¼”.

- EGC 7.10 satisfies Pest Control at building openings required by ZERH/ IAP.
8. IAQ – Pest Control

• EGC 7.10 (mand.)
  Integrated Pest Management
  requires corrosion-proof rodent/bird
  screens to seal off openings larger
  than ¼”.

  Full alignment.

• EGC 7.10 satisfies Pest Control at building
  openings required by ZERH/ IAP.
8. IAQ – HVAC System

- EGC 7.9 (mand.)
  Garage Isolation requires a continuous air barrier b/w house & garage; no ducts or HVAC in garage.
- EGC 7.2 (mand.)
  requires venting dryers to outdoors
- Supplemental dehumidification in hot-humid climates is recommended under Criterion 7.1 Ventilation.

- IAP Requires HVAC System measures for humidity control; duct debris; avoidance of garage locations; clothes dryer venting; and minimum MERV 8 filtration.
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  requires venting dryers to outdoors
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**ZERH requires a few additional HVAC performance measures:**
- protecting ducts from construction debris;
- disallowing building cavity ducts; & MERV 8 filter.

**In hot/humid climates, dehumidification.**

- **IAP Requires HVAC System measures for humidity control; duct debris; avoidance of garage locations; clothes dryer venting; and minimum MERV 8 filtration.**
8. IAQ – Combustion Safety

- EGC 7.3 (mand.) specifies venting requirements of combustion equipment, and requiring CO alarm in each sleeping zone (NFPA 720)
- Optional EGC 7.16 calls for a no-smoking policy in all common and individual living areas, and within a 25’ perimeter around the exterior of all residential projects

- ZERH requires a few additional measures which will already be met (or not applicable) in most EGC projects:
  - no unvented combustion space-heating appliances
  - fireplace venting and combustion air
  - automatic door closers on garage-to-house doors
- If a home has exhaust WHMV and an attached garage, then garage exhaust fan or blower door test to demonstrate IEQ...
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ZERH requires a few additional protective measures addressing venting; smoking policy for common spaces in MF buildings; and isolation of attached garages.

- ZERH requires a few additional measures which will already be met (or not applicable) in most EGC projects:
  - no unvented combustion space-heating appliances
  - fireplace venting and combustion air
  - automatic door closers on garage-to-house doors
- If a home has exhaust WHMV and an attached garage, then garage exhaust fan or blower door test to demonstrate TIECC.
8. IAQ – Low Emission Materials

- EGC 6.1 (mand.): VOC limits on paints, coatings, and primers as specified by SCAQMD.
- EGC 6.6 (mand.): Composite Wood Products are Low / No Formaldehyde, certified under CA 93120 Phase 2, or all exposed edges and sides must be sealed with low-VOC sealants, per Criterion 6.2.
- EGC 6.7 (mand.) requires that all carpet meets CRI Green Label Plus (for padding).

- Low VOC Paints and Finishes: IAP references 6 different 3rd-party standards/labels but not SCAQMD.
- Low Formaldehyde Wood Products: IAP references a broader set of product certification programs than EGC, likely overlap of listed products.
- Carpets: references CRI Green Label or Green Label Plus (for padding).
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- EGC 6.7 (mand.) requires that all carpet meets CRI Green Label.

EGC projects should cross-reference product certifications to ensure that low emission products also have the labels required for ZERH.

There should be significant overlap for most projects.

- Low VOC Paints and Finishes: IAP references 6 different 3rd-party standards/labels but not SCAQMD.
- Low Formaldehyde Wood Products: IAP references a broader set of product certification programs than EGC. Likely overlap of listed products.
- Carpets: references CRI Green Label or Green Label Plus (for padding)
8. IAQ – Home Commissioning

- EGC 8.1 (mand.) O&M Manual provides guidance for all electrical and mechanical equipment, including HVAC.

- EGC 8.3 (mand.) Resident Manual provides homeowners information on maintenance and benefits of home green features and best practices.

- ZERH requires a few additional commissioning measures:
  - duct inspection at the completion of construction
  - making sure filters are clean/new
  - providing post-construction ventilation

- IAP-required resident information kit can be met through EGC’s Resident Manual & O&M Manual.
8. IAQ – Home Commissioning

EGC Manuals meet ZERH resident information provision.

3 basic commissioning items are also needed.

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9. Renewable Ready

- EGC 5.7a (optional) Photovoltaic/Solar Hot Water Ready (Optional – 4 points) calls for orienting, designing, engineering, and wiring the development to accommodate installation of PV in the future.

- DOE’s PV-ready provisions require installing conduit from attic space to service panel area; documenting roof load ratings; and establishing a space for system components.

- Adjusted requirements for MF buildings.
9. Renewable Ready

- **EGC 5.7a (optional)** Photovoltaic/Solar Hot Water Ready (Optional – 4 points) calls for orienting, designing, engineering, and wiring the development to accommodate installation of PV in the future.

- Integrating a PV ready design in a fashion which satisfies both programs gains 4 points within EGC

- DOE’s PV-ready provisions require installing conduit from attic space to service panel area; documenting roof load ratings; and establishing a space for system components.

- Adjusted requirements for MF buildings.
**Documentation** of the maximum allowable dead load and live load ratings of the existing roof (Rec DL.: 6 lbs./sq. ft.)

**Conduit** to run DC wire from roof to inverter

**Dedicated Area** for installing inverter and balance of system

**Conduit** to run AC wire from inverter location to electric panel

**Circuit Breaker** designated and/or installed for use by the PV system in the electric panel
PV-Ready Allowances

Not required in areas lacking access to significant solar resources:

- Tree Shading
- Tall Buildings
- Available South Facing Roof

Multifamily Building Allowances:

- PV-ready features may be provided for the common space instead of at the dwelling level
Zero Energy Ready Home
Getting Started
ENERGY STAR & DOE ZERH

- Same rater network
- Same modeling software (at least 3 different options)
- Same plan review & site inspection protocol
Getting Started with Zero Energy Ready

Process:
• Become a Builder partner (online)
• No need to pre-register projects
• Recommend integrated design process (MEPs)
• Rater: plan review & site inspections
  • Sampling available for MF projects
• Project Certification
  • Rater sends compliance report (generated by modeling software) to DOE or RESNET Registry
Resources & Next Steps

www.buildings.energy.gov/zero/

- Become a Partner
- Program Specs
- DOE Tour of Zero
- 24+ Recorded Webinars
- Marketing Took Kit
- Building America Solution Center

NEW: Gap Analysis of EGC & ZERH (by 12/1/2017)
Affordable, Green Homes
with DOE Zero Energy Ready Homes and Enterprise Green Communities
Q + A