

EXHIBIT E

Benchmarks

Zero net energy usage benchmark
Zero net carbon emission benchmark

Detailed Description of Benchmarks

The Zero Energy Project buildings will be designed so that occupants will need to purchase no more "standard purchased energy" (defined below) than the project will generate, and introduce onto the public electric grid via surplus "project renewable electrical sources" (defined below) over the course of one year. This will be achieved via the following:

1. Significant reduction in typical energy demand through substantial upgrades to the building envelope, HVAC systems, appliances, lighting, and plug load controls;
2. On site heating and electrical generation serving the project, such as passive solar heating, solar hot water heating, and renewable on site electrical generation; and
3. Surplus electrical generation from project owned sources placed on the public electric grid.

Similarly, all project "standard purchased energy" will be converted to their respective CO₂ emission factor(s), and balanced on an annual basis by an equal amount of avoided CO₂ emissions, in the form of surplus electricity generated by the project and reintroduced to the grid. The amount of CO₂ offset will be based on total surplus energy, converted to a CO₂ emissions offset. For all energy comparisons, all units of energy will be converted to the common unit of measure, Million British Thermal Units, using the conversion factors in Table 1. Similarly, CO₂ emissions for each energy type will be based on conversion factors in Table 1.

Because of highly variable occupant behavior and household sizes, accomplishment of these benchmarks will be based on an energy/carbon model which assumes typical household behaviors for anticipated green-oriented occupants. The Builder shall hire a qualified energy modeler to perform models, which will then be reviewed by the WSU Energy Office on behalf of the City of Issaquah. All models are subject to City approval. Modeling methodology will be jointly determined by the City and Builder. The process of modeling and construction verification for the project is outlined in Table 2. All relevant building systems described in the Final Design analysis will be detailed on the building permit documents.

All project units shall include a prominently located, digital energy use monitor, which provides occupant information about current and total energy use/generation for the unit. The long term demonstration unit shall include an energy monitoring system which provides energy use information for all outlets and energy using/generating components in the home. An energy monitor for the whole project will be provided as well, located prominently in a project common area.

The carbon emissions of the entire construction process shall be evaluated and off-set by an equal amount of carbon absorption provided by planted seedlings within the Issaquah City limits. At the time of drafting this contract, initial calculations anticipate this to be approximately 1,000 seedlings.

Definitions

Standard Purchased Energy

Purchased energy includes utility electricity, utility gas, propane, fuel oil, or other non renewable energy sources, for the purpose of serving project buildings. No credit will be given for renewable sources that are part of these purchased energy portfolios.

Project renewable electrical sources

On site electrical generation includes electrical production from wind, solar, geothermal, small hydro-electric and renewable biomass. On site generation is preferred, but if, as determined by the Project Managers, sustainability reasons make locating renewable electrical generation off-site more appropriate (for example, inadequate roof area for photovoltaics due to project density or desired green roofs, or better wind is available off-site), the electrical generation may be off-site, so long as the equipment is project owned, within a mile of the site, within the City of Issaquah, and accessible for public demonstration purposes. Any off-site power generation shall be designed into the project energy use/generation monitoring system to provide seamless, real-time information about energy use/generation to individual project units.

Table 1 Conversion Factors

	Unit	MMBtu/unit	lb CO2/MMBtu
Electricity	kWh	0.003413	322
Natural Gas	Therm	0.100000	117.080
Propane	Gallon	0.091000	139.178
Distillate Oil	Gallon	0.139000	161.386

Table 2 Modeling/Verification Process

Preliminary Schematic	Loads analysis only <i>Refine building size, shape, as well as component and systems performance criteria.</i>
Final Schematic	Detailed performance analysis of loads and project energy generation resources. <i>Demonstrate successful zero energy concept.</i>
Final Design	Detailed loads analysis based final design documents. Detailed energy generation calculations <i>Demonstrate successful zero energy project design.</i>
During Construction	Any variations in specifications from the final design require approval by the City Project Manager. Additional energy analysis may be required to evaluate the impact of the modifications to the design.
Post – Construction	A post construction analysis shall be performed documenting the project as built, including field test results. <i>Document results</i>

Commissioning

Commissioning is a systematic process of verification and documentation which ensures that the selected building systems have been designed, installed, and function properly, efficiently, and can be maintained in accordance with the contract documents in order to satisfy the building owner's design intent and operational needs.

Commissioning Plan:

The Builder will develop a plan for inspection and/or testing of all systems that will impact the building energy use. The Builder will identify the professional responsible for preparation of the commissioning reports. The Commissioning Plan will be subject to approval by the City Project Manager prior to construction.

Example Outline of the Commissioning Plan:

Project Background

A brief history of the project including the owners' intended use.

Commissioning Objectives

A brief discussion of what was expected of the commissioning effort (primary goals), typically including:

- *Net Zero Energy Use*
- *Occupant comfort*
- *Assured systems performance*
- *Less maintenance issues*
- *Less warranty issues*
- *Less call-backs*

Commissioning Approach

A list of the steps (phases) used in the commissioning effort, which may include a timeline showing the duration of commissioning.

Results and Conclusions

A summary of the results from each step (phase) of commissioning and any conclusions drawn from the process.

Recommendations

A list of recommended follow-up procedures, from the commissioning agent to the owner, for maintaining the building's optimum performance.

Example Outline of Inspection and Functional Testing included in the Commissioning Plan:

1. Building Envelope:
 - a. Insulation
 - i. Visual inspection
 - b. Window Installation
 - i. Verification of U-factor and Solar Heat Gain
 - ii. Verification that the windows have been installed in accordance with the IRC and manufacturers instructions
 - c. Building Air leakage control
 - i. Visual Inspection
 - ii. Blower Door Testing During Construction
 - iii. Blower Door Testing at Final
2. List of Photographs
 - a. Typical installations
 - i. Foundation
 - ii. Framing
 - iii. Insulation
 - iv. Air Sealing
 - v. Drywall
 - vi. Windows
3. HVAC Equipment
 - a. System Descriptions
 - i. Equipment
 - ii. Distribution Systems
 - iii. Automated Controls
 - iv. Operating controls and sequences
4. Functions to be tested
 - a. Conditions under which the tests will be performed
 - b. Measurable criteria for acceptable performance based on modeling assumptions
5. Other
 - a. Appliances
 - b. Lighting

- c. Plug Loads
 - d. Shading
 - e. For all Other
6. Measurable criteria for acceptable performance based on modeling assumptions
 7. Verification through visual inspection
 8. Functions to be tested
 9. Conditions under which the tests will be performed

Preliminary Commissioning Report:

The Builder shall implement the commissioning plan and document implementation of all energy systems included in the commissioning plan as well as any changes to the approved design.

Based on the results of the preliminary commissioning report, prepare a list of corrections or modifications needed to meet the intent of the project as documented in the original commissioning plan.

Final Commissioning Report

The final commissioning report shall resolve all deficiencies found in the Preliminary Commissioning Report.

The final commissioning report shall include all relevant documentation in support of building and equipment warranties, operating instructions, and a recommended maintenance schedules.

WATER CONSERVATION BENCHMARK

The project shall achieve a 60% reduction in water use compared to average annual residential use within the City, or 33.4 gallons per capita per day. Verification of performance shall be based on a water use model approved by the City Project Manager.

Specific requirements include the following:

1. Toilets shall be 1.1 gpf and utilize stormwater for flushing.
2. 1.5 gpm showerheads.
3. 1.0 gpm bathroom aerators and sensor faucets.
4. 2.0 gpm kitchen aerators.
5. Water heating should be located proximate to primary points of hot water use. Where longer runs of hot water plumbing must occur, methods to minimize water loss will be provided.
6. Dishwashers using a maximum of 4.5 gallons per load.
7. Clotheswashers with a water factor of 4.5 or less.
8. A rainwater catchment system shall be provided which provides for toilet flushing.
9. No permanent irrigation (except for vegetable gardens), temporary irrigation for landscaping establishment only. Irrigation to use detained rainwater or greywater. Irrigation to be designed, installed and audited by an Irrigation Association certified irrigation professional.
10. Landscape palate designed utilizing drought-tolerant and native plants, and designed to minimize ongoing maintenance and utilizing a pesticide-free landscape design.
11. All units to be individually metered or submetered. A digital monitor providing information about water use shall be provided in conjunction with unit energy meters.

MATERIALS BENCHMARK

General

The project shall be designed to minimize materials use wherever possible. For example, in many cases interior walls are unnecessary, and their avoided use saves materials. Alternatively, using structural elements as the finish surface without additional casing can reduce overall materials used.

Recycled materials

The project shall include a minimum of 15 separate components that include recycled materials.

Local materials

Five of the following eight materials shall be manufactured from within 500 miles of the project, and of those at least four must be extracted/harvested from within 500 miles of the project (must include at least 80% of a material by cost to qualify):

1. Sheathing
2. Framing
3. Roofing
4. Sheetrock
5. Concrete
6. Siding
7. Cabinets
8. Flooring

Wood

A minimum of 25% of all wood materials (by cost) shall be FSC certified. 75% of all wood materials (by cost) shall be either:

1. FSC certified
2. Reclaimed/salvaged (as defined in Built Green item 5-33), or
3. Contain recycled materials (minimum recycled content of 75%)

Sheetrock

Sheetrock shall contain a minimum of 50% recycled content.

Concrete

If locally available at reasonably cost competitive rates, 25% of all cementitious material shall be flyash or blast furnace slag (Built Green credit 5-53), not including any insulated concrete forms or concrete/styrofoam material.

Siding

Use 50 year warranted siding product (Built Green credit 5-77) containing 50% recycled material.

Cabinets and casework

Cabinets and casework shall be built of materials which at a minimum are one of the following:

1. FSC certified
2. Contain 50% recycled content, and/or
3. Are rapidly renewable, with a maximum harvest cycle of 10 years

Flooring and counters

Flooring and counters shall be either:

1. FSC certified
2. Contain 50% recycled content
3. Rapidly renewable, with a maximum harvest cycle of 10 years, or
4. Concrete with 25% flyash.

Roofing

Roofing with a 40 year warranty shall be provided (Built Green credit 5-96).

Roofing shall contain a minimum of 25% recycled material (Built Green credit 5-94).

Framing

On site framing cut waste shall not exceed 10% of total framing material by board foot.

Vinyl

No vinyl to be used in homes except for electrical/communications wiring and incidental items such as weatherstripping, cabinet bushings, etc.

Deconstruction

The building shall be designed to facilitate deconstruction. See King County GreenTools Design for Disassembly Guide.

CONSTRUCTION WASTE RECYCLING BENCHMARK

Builder will ensure a minimum 90% diversion by weight of all construction related debris through reuse and recycling.

Definitions

Source-separated recycling is the process of separating recyclable materials in separate containers as they are generated on the job-site. The separated materials are hauled directly to a recycling facility or transfer station that accepts the specific separated materials.

Co-mingled recycling is the process of collecting mixed recyclable materials in one container on-site. The container is taken to a material recovery facility where materials are separated for recycling.

Recycling Methods - requirements

At a minimum, builder will source-separate the following materials for recycling:

- ❖ Clean wood
- ❖ Metal
- ❖ Clean drywall scraps
- ❖ Cardboard
- ❖ Rock and soil
- ❖ Concrete
- ❖ Plastic film
- ❖ Field office waste (paper, aluminum cans, plastics, glass and cardboard)

Remaining construction materials cannot be separated and instead co-mingled for recycling must be taken to a material recovery facility with at least a 75% diversion/recycling rate. An updated list of facilities and their diversion/recycling rates is located at:

www.metrokc.gov/dnrp/swd/greenbuilding/construction-recycling/rates.asp

All non-recyclable waste must be placed in a separate disposal container on-site to eliminate contamination of recycling containers.

Local recycling of materials should be emphasized, for example, local reuse of soil or concrete, or cardboard recycling with local recyclers.

Submittal Requirements

Prior to construction commencement, builder will submit for approval a waste management plan achieving the 90% diversion benchmark by identifying expected diversion/recycling and waste streams (quantified by weight), recycling and waste haulers to be used, and facilities where materials will be taken for both recycling and disposal.

Builder will submit monthly updates on construction waste diversion and recycling performance and provide a final analysis demonstrating that the 90% diversion rate has been met upon project completion. Final report shall include:

- ❖ A record of the type and quantity, by weight, of each material salvaged, reused, recycled or disposed. This shall include all source separated materials as well as commingled recycling.
- ❖ Total quantity of waste diverted/recycled as a percentage of total waste.
- ❖ Disposal and recycling receipts issued by facilities accepting the materials.
- ❖ Salvaged materials documentation including types and quantities, by weight, for materials salvaged for reuse on site, sold or donated

Quality Assurance

Conduct construction waste management activities in accordance with State of Washington RCW 70.95.240 and all other applicable laws and ordinances.

Recycling and diversion requirements shall be included in all subcontracts. Conduct a pre-construction conference with subcontractors to review methods and procedures related to waste management and recycling. Identify a construction waste coordinator responsible for tracking performance and communicating to all subcontractors expectations for recycling and waste prevention.

All on-site recycling and disposal containers must be clearly labeled with signs showing graphically what is to be placed in the container. Assistance in sign development is available through King County GreenTools.

Include a King County GreenTools Construction Recycling Specialist in pre-construction meetings. Contact Kinley Deller at 206-296-4434 or Kinley.deller@metrokc.gov

Sample Construction Waste Recycling Specification, management plan, and progress report available at:

www.metrokc.gov/dnrp/swd/greenbuilding/documents/Sect01505_const_waste-mgmt.pdf

INDOOR ENVIRONMENTAL QUALITY BENCHMARK

The project shall incorporate materials of extreme low toxicity, provide for a healthy interior environment, and be properly ventilated, including the following:

1. Achieve all Built Green 5 star IAQ prerequisites (attached), including all four 4 star IAQ options.
2. No wall to wall carpet is allowed (removable carpet only is permitted).
3. Any garages shall either be detached from the homes, or if attached, semi-open to the outside (allowing passive ventilation) and sealed from the homes.
4. A community sealed storage unit which is designed to maintain an adequate minimum temperature to prevent materials freezing, but sealed from dwelling spaces, shall be provided for materials such as paint, cleaners, etc.
5. Plant-based or Greenseal certified adhesives, floor finishes, caulks, and sealants (Built Green credit 4-24 a-g).
6. Greenseal certified paints (Built Green credit 4-32).
7. No urea formaldehyde products may used in the interior spaces.
8. Provide actively ventilated home via an air to air heat exchange type system. Ventilation rate shall be based on State code.
9. Any duct openings shall be covered during construction. Thorough cleaning of any ducting shall occur prior to occupancy. Ventilate house continuously for a period of one week after final finishes are applied and prior to occupancy.

10. Recognizing potential positioning of windows based on passive solar benefit, and glazing limitations for energy reasons, attention shall also be paid to window positioning to maximize daylighting/view opportunities.
11. Careful metal flashing/waterproofing details to ensure water intrusion is minimized. Use appropriate vapor barriers, and design the wall system to minimize water intrusion and dry out if necessary.
12. All wood products stored on site are to be protected from rainfall by providing covered storage or by being covered by tarps.
13. During construction, measures will be taken to assure there is no significant standing water on wood products.
14. Prior to the installation of insulation or interior coverings, all wood products shall be inspected for mold or fungus. If mold or fungus is identified it shall be removed using a wet vacuum in the affected area, wiping or scrubbing the mold with detergent and water and, after drying, vacuuming with a high-efficiency particulate air (HEPA) vacuum.
15. Prior to the installation of insulation or interior coverings, a moisture meter shall be used to determine the moisture content of the wood products. Based on a representative sampling of wood moisture content measurement, insulation or interior coverings shall not be installed until the wood moisture content is less than 17% by weight.
16. No wood burning fireplaces are allowed.
17. Air intakes shall be located a minimum of 15' from exhaust locations and away from automobile parking.
18. Capillary breaks shall be provided at any building junctions with concrete.