

**ASIA-PACIFIC PARTNERSHIP ON CLEAN DEVELOPMENT AND CLIMATE  
ZERO ENERGY HOMES WORKSHOP**

September 22-23, 2009

Alliance to Save Energy  
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## Abbreviations

APP – Asia-Pacific Partnership on Clean Development and Climate

BATF – Buildings and Appliances Task Force of the APP

NZE – net zero energy

ZEB – zero energy building

ZEH – zero energy home

## Key Conclusions

### 1) Definition

The participants agreed that the definition of zero energy should be as simple as possible, but should be accompanied by an appendix -- to be developed by a Definitions Task Force-- with a comprehensive list of “qualifiers” and assumptions.

*Vision: A zero energy home (ZEH) is a highly energy efficient home that produces – from renewable sources -- as much energy as it uses on an annual basis.*

### 2) Key needs emerging from breakout groups and discussions:

- a. Finalize ZEH definition and page of qualifiers
- b. Define renewable energy-ready envelope metrics to standardize recognition of value in ZEH and sustainability features
- c. Develop strategies for the development and adoption of standards (new and retrofit) for ZEH infrastructure and technologies in APP countries
- d. Work with existing groups/initiatives (e.g., ASHRAE, USGBC/LEED, WGBC, IEA) to create a certification mechanism for ZEH homes
- e. Organize the various partners in the ZEH field who have an interest in widespread implementation of zero energy homes:
  - Engage industry champions or partner with organizations with large real estate portfolio
  - Engage utilities and promote business models that value energy efficiency
- f. Raise awareness and knowledge of lenders, realtors, and appraisers (e.g., involve National Institute of Appraisers)
- g. Create awareness among consumers to increase demand for zero energy homes:
  - Highlight regional success stories and demonstrations that feature innovative policy, educational or financial incentives
  - Promote homeowner education as a component of codes
- h. Recognize leaders publicly to drive awareness and adoption
- i. Address financing barriers:
  - Create recognition of the value of ZEH within financial institutions

- Develop alternative financing mechanisms (e.g., bonds, syndicated funds, national or regional scale programs, utility, community investment funds)
  - Promote local financing programs
  - Develop recommendation or policy paper for government to mandate financing
- j. Create a central information repository that includes tracking other parallel groups, information about suppliers, case studies
  - k. Carry out one or more design charrettes for the entire ZEH community
  - l. Promote job creation and training in the ZEH field

## Next Steps

### Immediate Term

- Establish an identity for the Group; form committees to operationalize goals (develop page of assumptions around definition of ZEH, plan and carry out Lenders Workshop)
- Finalize and determine fine print of ZEH definition/vision
- Set an agreement (MOU) between stakeholders in Canada and US, including short, medium, and long-term goals
- Secure a commitment of resources to ensure the sustainability of the Group and its efforts
- Make a plan for the next G8 in Ontario
- Promotion (Google, celebrity endorsement, alliances)

### Mid Term

- Develop a database of ZEH in North America
- Carry out community-scale charrettes in the US and Canada to inspire similar projects in other APP countries
- Develop a policy/position paper
- Create a World Green Building Map/World ZEH Map as a promotional and educational tool
- Promotion (Google, celebrity endorsement, alliances)

### Longer Term

- Establish targets for ZEH homes built, job creation, retraining and economic stimulus
- Develop a ZEH toolkit, targeted toward: i) builders and industry stakeholders; ii) legislators and regulators; iii) consumers and media; iv) realtors; and v) finance industry (appraisers, banks)
- Promotion (Google, celebrity endorsement, alliances)

### UPCOMING EVENTS:

- October 7-8: Results of workshop presented at APP/BATF, Tokyo
- Fall 2009: Lender consultation, Toronto (date TBD)
- March 24-26: Community scale design charrettes at GLOBE, Vancouver
- May 10-12: EE Global, Washington, DC (<http://ase.org/section/audience/events1/eeglobal>)

## MINUTES OF WORKSHOP

**Tuesday, September 22, 2009**

### Welcoming Remarks

The workshop kicked off with a welcome and acknowledgements from representatives from the Canadian and U.S. hosts. Representing Canada, Gordon Shields of the Net Zero Energy Home Coalition (NZEH) provided background on the Coalition. Mark Ginsberg of the US Department of Energy described the workshop in the context of the Asia-Pacific Partnership on Clean Development and Climate (APP), in which the US and Canada participate with five other countries (Australia, China, India, Japan, Korea). Within APP, interest in zero energy buildings (ZEBs) spans the Buildings and Appliances Task Force (BATF) and the Renewable Energy and Distributed Generation Task Force.

After opening remarks, Anthony Watanabe, the facilitator of the two-day workshop, discussed the goals of the workshop and presented the theme for the meeting: Creating meaningful impact in moving ZEH forward.

### Setting the Context: APP, Zero Energy Flagship Project, & Workshop Objectives

Amanda Kramer of Environment Canada gave an introductory presentation explaining the background of the APP and the context for this project:

- APP accelerates development of clean energy through enhanced cooperation among seven countries
- Seven member countries represent significant world population
- APP project information:
  - Each project is sponsored by a taskforce. This ZEH project is a joint effort by the BATF and the Renewable Energy and Distributed Generation Task Force.
  - Task Forces submit project proposals to the APP's Policy and Implementation Committee for endorsement.
  - In the BATF, the ZEH project is one of 53 projects, which falling under 11 themes.
  - Overall, there are 106 APP projects. Of these, 20 have been given "flagship status" – ZEH gains prominence as one of them.
  - Right now, the project is mainly a Canadian and US effort, but Australia is interested in involvement and the project team will work to engage the other countries as well.
- ZEH Project Activities:
  - Create a dialogue with US and Canada, then engage other countries (e.g., at BATF meeting in Tokyo in October).
  - Do demonstration projects and move to community scale.
  - Provide international ZEH Awards.
  - Run workshop at GLOBE conference (Vancouver) in March 2010.
  - Present ZEH at two upcoming REEEP Webinars.
  - Engage real estate stakeholders and appraisers in meetings.

Anthony Watanabe introduced the topic of defining NZEH, with the ultimate goal of achieving implementation of ZEH on a large scale. He listed the objectives of the workshop as follows:

- Follow the framework of APP
- Use pragmatic approach
- Exchange knowledge
- Discuss key challenges and next steps

### Defining Zero Energy

Jens Laustsen, International Energy Agency, presented different definitions of NZE and ZEH used by different stakeholders, in order to get the group thinking about how to define the terms. Laustsen has made recommendations on this topic to G8 countries in the last three G8 Summits. In sum, his presentation outlined different ways to define zero energy, how elements impact costs and CO<sub>2</sub>, the question of grid versus off-grid, and placing a hierarchy of elements in a pyramid.

#### Introduction

- Vision: World where buildings use no energy
- The reality is that people who live in buildings use energy. (People, not buildings, drive energy consumption.) Therefore, we need to have assumptions about people who use buildings:
  - They require stable indoor climate, i.e., Above 20C in winter and below 25C at summertime.
  - ZEBs need to provide the same comfort as buildings that are not ZEBs.

#### Definitions

- Provide normal indoor comfort and still use no energy
- Perfect ZEB would always be balanced with nature.
- Grid vs. no grid
  - One option: give as much back as you take (in – out = zero) on grid
  - Second option: ZE off grid building – no connection to grid and store energy
- Operational: NZEB is a building that over the year produces as much energy from renewable energy as it uses

#### Questions to consider

- How do we define energy balances over time?
  - Net Zero Site Energy – Building produces as much energy as it uses annually when site energy is accounted for; but how far does the site extend in order to count? (e.g., Offsite wind farm?)
- What encompasses energy use in buildings? Consider:
  - Heating only – space heating and hot water supply
  - Heating, cooling and ventilation and thermal comfort
  - Electricity for pumps, fans, and fixed installations

- Lighting
- Electric appliances
- Total energy balances

If all is included, do later appliance installations count?

Another idea: Reduce costs with zero carbon buildings and offsets.

What is included in NZEBs?

- NZ can be:
  - Energy – balance in Btu or kWh
  - Cost – balance in USD
  - Emissions – balance in CO<sub>2</sub> and other
  - GHG, primary energy use, quantity/quality in losses
- NZ Carbon: Focus on neutral CO<sub>2</sub> balance. Can include CO<sub>2</sub>-neutral energy from outside the site. To ensure neutral CO<sub>2</sub>, use separate grid (e.g., BedZet, UK Zero Carbon).
- NZE ready house: Prepare for future use of renewable energy.

Costs

- Energy efficiency is feasible and low cost, but renewable energy still has high costs<sup>1</sup>
- Secondary Demand – get demand down. Enough to set zero demand or:
  - Maximal heat loss/gains
  - Total demand of energy use
  - Quality of installations
- Demands for other elements
  - Mandating solar systems
  - Minimum efficiency for products

Examples: Laustsen cited inspirational examples:

- Sophienhof Flats, 160 dwellings in Frankfurt, Germany
- Misr University for Science and Technology in Cairo, Egypt, which adapts solar orientation in its architectural design.

ZEB Building Codes

- In order to carry out ZEB long term, mandate them in building codes
- Examples in Europe include:

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<sup>1</sup> International Energy Agency Technical Perspective 2008, McKenzie Institute's Climate Report 2007 and current IPCC support this idea.

- EU Regulations - Energy Performance Building Directive states by 2018<sup>2</sup> all new constructed buildings should be zero energy building
- UK set zero carbon building targets for 2016<sup>3</sup> for new homes and 2019 for commercial buildings
- Danish Building Codes call for reductions in energy demand 20-25% per year. By 2015 they will have minimum standards for passive houses and on new construction of ALL types.

Recommendations:

- Train architects and engineers in integrated and intelligent design.
- Philosophy: Crawl > walk > run
  - Crawl: Start with measures that create comfortable environment - heating, cooling, ventilation and hot water
  - Walk: Include major appliances
  - Run: Include all energy uses
- Measure balance of energy over year: export – import = zero in kWh or Btu
- If we can't maintain ZEBs now, make buildings ZE ready for future gains in technologies.

**Facilitated Discussion: Challenges to International Adoption of ZEH**

From the discussion the following topics emerged:

- Neighborhood scale ZEH and financing solutions
- Consumer awareness and behavioral change
- Need for involvement of utilities, appraisers, and the real estate community
- Using metrics to evaluate ZEH
- Need for an agreed definition, to facilitate standards, influence building codes, and help appraisers value buildings (i.e., compare “apples to apples”)
- A possible role for an international ZEH coalition is to work with stakeholders to mitigate risks.

Issue with choosing a definition – is it a continuum or prescriptive? Where do you stop? Ideas included:

- Offer several definitions or a certification process like LEED with different levels of achievement
- Two phases: Reduce demand first and then provide RE sources.
- Include a financial metric in the definition to quantify greenhouse carbon emissions. Tie the carbon market and economic drivers to the environment to make it attractive.

Neighborhood Scale

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<sup>2</sup> Energy Performance Building Directive, <http://www.estif.org/policies/epbd0/>

<sup>3</sup> <http://www.communities.gov.uk/planningandbuilding/theenvironment/zerocarbonhomes/>

- It is very difficult to achieve zero energy in individual buildings, particularly commercial buildings 10 stories or higher, but it might be achievable with mixed use or on neighborhood scale (e.g., with heat integration).
- Optimize systems engineering in ZEH communities.

#### Financing

- From the builder point of view, the biggest challenge is financing ZEH. There is no system for valuing efficiency, so consumers do not have a measuring stick.
- Developers who build large scale residential developments find it is hard to commit to ZEH unless homebuyers can find financing to lower the price of premium homes. The reality is that developers will not commit to building more energy efficient than code unless homebuyers can pay for the extra cost.
- Defining NZE/ZEH is important so lending institutions can evaluate its worth. Government support will more likely influence lending institutions.
- If not banks, local municipal financing is another trend. While many municipalities have loan programs, some recent financing streams include bonds. They are attractive because they draw on the local economy and local buyers.
  - Boulder County, Colorado floated a \$40 million bond
  - Berkeley, California offers low interest rates loans to homeowners
- Issue with local financing: In the US, for example, national builders work with a patchwork of policies and regions so it is very challenging to keep up with each city program.
- One idea for the group was to put together recommendations or a policy paper for government to mandate financing.

#### Consumer Awareness/Behavioral Change

- Occupant behavior
  - Code compliance should ensure ZEH performance, but in reality, compliance may be low
  - Compared to owners of new cars, consumers receive little or no orientation on how to operate a new house. When high-tech houses “break down” it’s not always clear whom to call for help.
- Idea: Institute homeowner education in codes, e.g., One of the six compliance codes for receiving a Certificate of Occupancy under Santa Fe, New Mexico’s voluntary Green Building Program, involves educating the consumer.
- Fundamental need for definition – Consumers are confused by continual revisions to terminology.

#### Utility role

- Utilities need to be at the table and they need an economic incentive.
- Answer: Zero peak communities -- Install thermal storage, net or low load, so utilities can be supportive and own generators in community

- Smart Grid!

#### Appraisers

- Appraisers are not properly valuing ZEH features. Developers sell if for comps, but there are no comps available because there is no set model .
- Educating appraisers hinges on defining ZEH. Involve National Institute of Appraisers
- Another idea is to make the Home Energy Rating System (HERS) (in Canada it would be the EnerGuide System) score part of multiple listing service (MLS) ratings used by real estate professionals.
- How to value ZEH components? Some organizations estimate their own value: e.g., Ladera Ranch, a development in California, found that homes with Photovoltaics had increased values and resale. SunPower also collects data on its projects.

#### Labels

- Labeling homes may help appraisers value homes, but in Canada, which just instituted a metering act, appraisers and some builders push back on labeling of homes.

#### Moving toward NZE through Codes

- Issues:
  - Codes do not discuss how to achieve ZEH.
  - Make sure infrastructure is there to build to code. Many developing countries do not have builders who can build to ZEH or have the technologies in country.
  - Get it right the first time: If government legislates a code and it fails, they will be more reluctant to support the activity again.
- One idea: under Jens' philosophy, use codes at the crawl stage with products that already exist in the market.
- Example: Movement in Ontario to get government to commit to ZEH through codes.
- Example: Santa Fe, New Mexico: Stakeholders (builders and policymakers) came together in a Summit to write new code. Now statewide certification program (must meet threshold of one accreditation, e.g., with solar – 40% can come back to home owner, 30% Fed, 10%NM). This has gotten traction by involving finance and appraisal. The city of Santa Fe is taking on the 2030 Challenge (build at HERS 70, meet zero by 2030).

#### Metrics

- The lender community is risk adverse so there is a need to connect investment to performance. Building envelope measures are low risk to lenders and easier to engage financiers on, if they can accept risk on the last 15 – 30 HERS points. [On performance, better to focus on permanent parts of the building versus installed appliances.]

- Location efficiency: Anticipate and include water use, transportation, solid waste, and off site dimensions that relate to density. Most indices are for low density, ZE-ready homes. Easier to follow footprint of energy use at broader consumption scale.
- eSmart scale
- Plug load – to include or not to include?
  - Consumers are confused by modeling numbers; just use actuals because modeling software can overstate home energy consumption.
  - Is it possible to exclude plug load?
  - If you focus on consumer behavior in the energy mix, then plug load is important. We need to change the individual energy consumer paradigm. Enable homes and ultimately communities to become part of energy mix – a whole new way of looking at the housing sector.

### **Lunch Speaker: Mark Ginsberg, USDOE**

Mr. Ginsberg discussed general adoption and trends of ZEH around the world. Main points included:

- Existing U.S. targets for 2020 and 2025 need to be accelerated to reflect the increased investment in the industry.
  - The investment can be attributed to and accelerated by the fact that efficient homes (with a HERS score of 50 or better) always sell faster than conventional homes.
- Definition, while important, shouldn't be a limiting factor to action on advocacy and planning for lower energy buildings, whether NZE, net zero carbon, zero energy, etc.
- Begin to plan for ZEH communities—employing the mindset that every building can be a power plant and every “waste” can be a resource.
  - Communities can partner with utilities to reduce peak loads
- Existing homes should be included in plans to implement wide-scale ZEH by creating a “Net-zero Energy Retrofit”
- Countries around the world are investing in energy efficient buildings as part of their economic recovery plans, with investment projects to increase even further.
  - The APP can benefit from these investments
  - Promising activity is occurring in China and India, which are huge emerging markets for ZEH and ZEBs
- The industry needs:
  - A consolidation of common goals
  - A labeling system (LEED? HERS?)
  - A collective force to demonstrate the business case for ZEH
  - A place in the international buildings, energy, and climate framework

### **Discussion: Working Definition**

Among the definitions discussed, there was some support for the following two:

1. NZE homes are highly efficient structures where the annual energy use is equal to or less than the energy production resulting from onsite renewable energy sources.
2. NZEH Coalition Definition: A net-zero energy home is capable of producing, at minimum, an annual output of renewable energy that is equal to the total amount of its annual consumed/purchased energy from energy utilities.

Agreement was also reached that any agreed definition:

- Should be kept as simple as possible, and thus should focus on “Zero Energy” rather than NZE; and
- Should be accompanied by an appendix with a comprehensive list of “qualifiers”, definitions, and assumptions.

Considerations were:

- The definition should take into account all of the following:
  - The building envelope, energy efficiency, and renewable production of energy
    - First the home energy use is optimized by an energy efficient building envelope and use of efficient appliances, then renewable energy is used to offset the fossil energy use that remains
  - How the consumer will save money (so the purpose of ZEHs will be understood)
  - The inclusion of ONLY homes, not commercial buildings
  - The audience: the “lowest common denominator”
- Qualifiers on the definitions page will include:
  - The significance of primary energy consumption versus site energy consumption to the general definition
    - While using cost as a measure of energy consumption accounts for the primary source, it leaves out externalities that lead to energy waste. Cost also fluctuates greatly, and thus shouldn’t be the only way to measure.
    - Offsets must take into account the primary source.

## **Case Study: Artistic Homes**

### **Tom Wade, Artistic Homes**

Types of homes built by Artistic Homes (AH):

1. Energy Efficient (EE) Homes: Homes with scores of 57 or better on the [EnergySmart Home Scale](#), built to LEED silver or higher  
Note: EE Homes with LEED certification also conserve water and work toward healthy indoor air quality

2. True Net Zero Energy (TNZE) Homes: All electric, efficient homes offset with PV, an optional upgrade to every house built by AH  
     Note: 10-15 have been sold
3. Net Zero Energy (NZE) Homes: Efficient homes whose PV offsets cover gas consumption only.  
     Note: Although these are cheaper than the TNZE Homes, none have been sold.

Other information about AH:

- AH builds homes in three climate zones -- dry hot to cold -- with large variations in elevation.
- Part of building custom EE, NZE, and TNZE homes includes educating consumers about a lifestyle of conservation (e.g., no hot tubs).
- AH experiences show that education is greatly needed for consumers, realtors, banks and financiers, and construction workers.

Business Model and Economic Considerations:

- By building higher quality homes, AH is more competitive than other builders who are skimping on quality in the current difficult economy.
  - The key to staying competitive is to lower costs by not turning a profit on PV and NZE installation and by removing commissions for realtors.
- In most markets AH serves, EE Homes (and NZE Homes in 2 markets) are below the market price
  - In other markets, AH is working to educate appraisers to include federal and local tax incentives, especially in New Mexico.
- More AH customers would have closed deals on homes if they had qualified for loans.
  - Education is needed for banks to help customers qualify for loans based on energy savings.
- Combination of Federal and New Mexico tax credits is enough to offset the cost of an upgrade from EE home to NZE Home (\$40-50K), although these offsets are paid back over 12 years.

Credits included are:

- New Mexico Renewable Energy Credit
- New Mexico Sustainable Energy Building Tax Credit
- Federal PV Tax Credit
- Federal Solar-thermal Tax-Credit

**Facilitated Discussion: Overcoming the Challenges**

How to Build a “Toolkit of Best Practices”

The following summarizes the discussion facilitated by Anthony Watanabe in which possible elements for inclusion in a “Toolkit of Best Practices”<sup>4</sup> were discussed.

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<sup>4</sup> Different from but complementary to the [“Building America Toolkit”](#)

### Three Levels of Implementation:

1. For Developed Economies (such as United States and Canada)
2. For Economies in Transition
  - a. To include information to match local needs (may be different than single-family detached)
3. For Developing Economies
  - a. To include basic information such as introduction of technology, capacity building and training
  - b. To address different financing processes
  - c. Onsite power is important when local utilities and infrastructure are unreliable

### Proposed Audiences:<sup>5</sup>

The toolkit should include the education and rationale for ZEH, targeted toward:

1. Builders and industry stakeholders
2. Legislators and regulators
3. Consumers, media and the general public
4. Realtors
  - a. Continued education required of realtors should include NZE education.
  - b. Realtor education is key to market adoption and implementation.
5. Finance Industry: appraisers, banks

### Important Components of Toolkit:

- Education
  - For consumers, builders, policymakers, utilities, banks, realtors, appraisers, etc
  - Include ZEH in engineering curricula (example of E-Learning project in India)
  - Development of trade industry infrastructure
    - Mentoring program similar to union apprenticeship programs
    - Classes do not work for many tradesmen
- Type of homes included
- Climate considerations
- A consistent performance standard, with an accompanying support association made up of builders, suppliers, and legislators
  - Could include a “renewable ready” efficiency requirement for renewable installation, since PV drives interest in EE and conservation for consumers, builders and government
  - Outline for compliance

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<sup>5</sup> Gordon Shields noted that the Net Zero Energy Homes Coalition Toolkit includes a consideration of different audiences, and that the NZEH Coalition has composed a strategy document to address this issue.

- Tie-in and differentiation between renewable, energy efficiency, and conservation measures
  - Renewables are “sexy” but don’t make sense without EE and conservation
  - Financing must reflect the prerequisite for EE before RE, as should the appraisal system
- A 3-D design tool to optimize building envelope
  - Should be easy to understand among architects and engineers
    - Engineers, architects, and design professionals should generally be more involved in the building process
  - Such a tool would help develop a “language” of energy values in NZE homes
  - A design tool is in development at the National Renewable Energy Laboratory (NREL)
    - No need for duplication, but a need for industry input exists
- Universities should create centers of excellence, possibly with help from the National Labs, to study market implementation of ZEH. Universities can serve as a resource and continuing forum for development of the toolkit<sup>6</sup>.
- Duplication should be avoided. Look to:
  - California Roadmap
  - NREL design tool
  - Building America toolkit
- Outline for government organization of an expo of ZEH technologies (similar to the [Solar Decathlon](#) organized by DOE).
- A specific lending mechanism
  - This will unlock the market and lead to adoption by the 2020 (market-acceptable) and 2030 (market-ready) goals
  - This could work like financing for hybrid automobiles—with the value allocated in the appraisal process.

Other Comments:

- The National Association of Homebuilders’ [National Housing Endowment](#) offers grants focused on EE and green buildings, and could be a possible funder for the creation of a toolkit. (Information to be on NAHB website, [www.nahb.org](http://www.nahb.org), soon.)
- Local markets could serve as a place to solve the communication breakdown between building scientists and architects, the remodeling industry, and HVAC and other industry manufacturers to come together on toolkit practices.
  - Regional versions of toolkits make sense for APP member countries and even further to respect climate and economic differences within these countries.

**Metrics**

Bruce Ringrose, ClimateCHECK

Main points:

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<sup>6</sup> Robin Sinha noted that this “Center of Excellence” model is already in progress at [Canmet Energy](#).

- When the economic metrics are worked out, the environmental benefits follow naturally.
  - Therefore, a quantification framework is needed for clean technologies and their carbon offsets—compare “apples to apples.”
- Once savings potential of a product (like a home) can be evaluated, the savings can be aggregated and sold in carbon markets to make a meaningful price reduction in that product.
- Key elements to engagement on climate investment:
  1. Governance and policies (currently mainly voluntary)
  2. Identification of opportunities (Beware of “Green-washing”!)
  3. Development of management systems by building capacity based on current knowledge
  4. Monitor, measure, manage and document
  5. New products and opportunities, carbon returns!
- Measurement:
  - Compare GHG performance in all kinds of different homes of various designs, uses, and location
  - Develop analysis of systems within a house, adding value by productizing, which adds more security for lending
  - Current methodologies include: Alberta Environment (draft process), Clean Development Mechanism
  - Couple these metrics with a financial indicator
    - Builder, contractor or bank can act as an aggregator, so there can be an immediate rebate for the consumer
    - Metrics can be based on “business as usual” (BAU), which may shift as NZE occupies X% of market share (needs to be decided)
    - Documentation is essential!
  - Metric Options
    - Tons CO<sub>2</sub> per occupant? Per family? Per ft<sup>2</sup>?
    - Account for external variables such as heating and cooling degree days
    - There must be a baseline, benchmark, or average for comparison
- Carbon Roadmap for ZEH
  - What are the standards of practice?
    - Qualifiers for transparency, accountability
  - Industry Standards
  - Certified by governing body (not necessarily government)
  - GHG/Carbon quantification protocol
  - Acceptance by all stakeholders!

#### Other Comments:

- An E-Learning Platform for these metrics (based in DC) has been accessed by many North American and international stakeholders.
- The Securities and Exchange Commission (SEC) is considering mandating carbon disclosure in company reports.

- The question of the inclusion of embodied energy in these carbon metrics highlights the need to define the boundaries; however, embodied energy is so small next to the actual energy use until zero is achieved, that it could be worth ignoring at first, so it doesn't become a barrier.

### **Facilitated Discussion: ZEH Roadmap/Workshop Modules**

#### Mini Goals for Advancing ZEH Agenda:

- Set a goal in codes—"All new homes will be zero energy by \_\_\_\_ (2030?)."
  - No need for extensive detail or standard, since this measurement is performance based
  - Prescriptive energy use measurement is more complicated
- Standards/Labeling
  - Integrate with current labels (LEED, GBC)
  - Consider Austin code amendments from 2008— these happen incrementally (not just new construction but when a home is sold)
- Provision to avoid incrementalism
  - Make changes that matter now, without making further steps impossible or improbable later
- Make products easy to upgrade and replace
- Assemble the toolkit
- Recognize leaders to drive awareness and adoption (as publicly as possible)
- Compendium of case studies between US and Canada
- Develop a website
  - Information about suppliers
  - Case studies
  - Knowledge base
- Verification and visibility (actual buildings and metrics)
- Develop a North American approach to ZEH:
  - Show what industry must get done
  - Eventually make a case for financing
  - Collaborate on a demonstration project—make it real

#### Can we create an organization to qualify/rate ZEBs? Is there one in existence already?

- ASHRAE green building standards for commercial buildings (RESNET—for residential)
- World GBC (interest)
- National Labs
- Governments
- National Green Building Standard
- LEED Homes – weak in energy measurements
- IEA (database of case studies of homes and buildings)

**Wednesday, September 23, 2009**

### **Discussion: Working Definition**

The second day began with discussion on three definitions introduced the first day and key words and language to include.

1. NZE homes are highly efficient structures where annual energy use is equal to or less than the energy production resulting from onsite RE sources.
2. NZE Homes Coalition definition: A NZEH is capable of producing, at minimum, an annual output of renewable energy that is equal to the total amount of its annual consumed/purchased energy from energy utilities.
3. A ZEH is a highly energy efficient home that produces as much energy as it uses on an annual basis “from renewable sources.”

Discussion:

- Inclusion of renewable energy gets people interested because it is well known with consumers. People pay a premium for renewable energy.
- Shorter definitions are clearer
  - From developer point of view - sales staff sells the house. They do not have technical experience.
  - Consumers don't understand net – keep message high level with 10 to 15 words. Suggest using page of qualifiers to explain ZEH in detail (including discussions of the “net” concept).
- No room for silver, gold, platinum status to be part of definition?
  - Define acceptable plug load – maybe that is when you put together categories.

To further inspire discussion, Mark Ginsberg of the USDOE opened the day reinforcing that this is too big to do alone and the coalition is charged with how to scale up ZEH substantially. Following the opening, five panelists each made short presentations: Lew Pratsch and Ed Pollock of USDOE, Ren Anderson of NREL, Peter Amerongen of Habitat Studio and Design, and Gordon Shields of the NZEH Coalition.

### **DISCUSSION PANEL**

#### ***ZEH for New and Existing Homes***

Lew Pratsch, US Department of Energy

Takeaways:

- Simple things: marketing
  - Document good projects
  - Lower foreclosures

- E-Scale
- Focus on existing homes too. Retrofit R&D is complimentary
- USDOE's Residential Retrofit Challenge
- Value of utilities
  - Promote energy audits
  - Utilities respected, have financial resources
  - Energy efficiency and demand reduction are easier and lower cost than "building" new plants, shave peak loads
- Goal: Work together to develop roadmap

After Pratsch's presentation participants discussed use of renewable energy, solar, smart meters and utility regulation on ZEH for new and existing homes. One challenge in the United States is the lack of a national portfolio of standards on these issues. One idea for the role of the coalition is to play an advocacy role with utilities, steering the conversation toward supporting energy efficiency rather than building power plants.

### *Building America*

Ed Pollock, US Department of Energy

- Lower peak demand, reduce CO<sub>2</sub>, cost increment
- Cold climate is difficult – US needs to learn from Canada
- Easy measures: Seal air leaks and add insulation, ducts, improve heating and cooling systems, replace windows, upgrade lighting, appliances, water heating, install RE.
- In the US, each state has rights to determine codes. Stimulus funding provides carrot and stick opportunity: Only make it available to states that have adopted the latest model code.
- Resources:
  - Research reports and best practices available
  - Home Performance with EnergyStar, joint EPA and DOE effort – need to get to bigger numbers.
- Builder's Challenge – way for builders to distinguish themselves from others who were building better than EnergyStar.
  - 2030 goal: Builders in US will be comfortable with and able to build ZEH
- EnergySmart Home Scale – Used HERS score in order to ensure 3<sup>rd</sup> party verification.
- What is right analysis/ right label? Feedback from group:
  - Asset based – and ability to verify asset rating
  - National system
  - Uniform metrics to compare one rating method to another
  - Accuracy
  - Identify most cost effective improvements, paybacks
    - High confidence in numbers to predict savings
    - Skills training for professionals

- Rating tools from broad to detailed, data from one level feeds to next, consistent and compatible software (so as not to confuse public). E.g., Best Test (NREL developed) for NC – looks at combination of assets and utility bills.
  - Utility data
  - In-Home Survey
  - Diagnostic home
  - RESNET HERS Rating
  - Comprehensive Energy Audit

### *BeOPT Software*

Ren Anderson, National Renewable Energy Laboratory

- NREL focuses on field studies for ZEH as an integrated product: Business processes, technical systems, logistical supply chain for delivery of energy on site and construction, based on locality, mix of energy supply
- R&D Phasing
  - Start with Prototype house
  - System Evaluation, e.g., BEopt System – predict performance > analysis and report
  - Lab Tests, Lab Houses, R&D Partner data
  - Community Scale Evaluation
- Evaluating ZEH option cost/performance benefits
  - Inputs: choose ones applicable to project using BEopt
  - Average costs used from publicly available utility information, replacement costs also analyzed

### *Riverdale Project* (under EQUilibrium program of the Canada Mortgage and Housing Corporation (CMHC))

Peter Amerongen, Habitat Studio of Canada

- Most of Habitat Studio's houses are reasonably efficient, typical R20, R50 – clients are no problem. Previewing three sites: Riverdale, Mill Creek, Belgravia
- Objectives:
  - Needed to recover hard costs from purchasers – NZE at lowest possible incremental costs
  - NZE annually
  - Any energy you don't save in energy conservation measures, you have to make up in RE
    - Envelope modeling/optimization – able to do modeling in house
- Observations from building homes:
  - RE Collection – biggest cost
  - Use passive solar in design, e.g., Mill Creek
  - NZE heating schematic can be very complicated
- Designing for NZE
  - Site assessment

- Preliminary design
- Modeling
- Optimizing envelope

### ***Leveraging Efforts Toward ZEH***

Gordon Shields, NZEH Coalition

- NZEH Coalition: Have a common vision and strength in numbers; recognize that the private sector has to solve the problem to the best of their ability and respond to the marketplace (with some government involvement).
- On-site generation is missing, so the envelope is the key EE lynchpin leading to ZEH.
- Drivers:
  - Environment – footprint
  - Increase economic development
  - Energy supply cost and diversity – growth at consumer level
  - Changing builder marketplace – lots of labels, need to differentiate itself
  - Consumer awareness – links to prices
- NZEH Coalition has coordinated strategy, moving down the green building continuum (ZEH is on this continuum).
  - Joint effort is essential- taking it to decision makers and public level
  - Build a Common Vision
  - Involve US and other APP countries
- Priming the marketplace: ZEH public and private sector support
  - Focus on certain projects
  - Address issues e.g., different jurisdictions, different environments

### **Facilitated Discussion: Establishing an International Industry Community for ZEH**

Key points in discussion

1. Moving best practices to standard practices
  - Demonstrations assuage risk across sectors
  - Engage industry champions or partner with organizations with large real estate portfolio e.g., US Department of Defense engaged in base realignment (lots of housing and opportunities for building energy efficiency).
2. Define parameters
  - A home is complex system, with many different manufacturers involved. Need to define parameters for each (e.g., HVAC), and communications are needed to integrate w/utilities (inputs and outputs for each segment).
3. Communicate with utilities
4. Consumers and financing
  - Need to change perceptions of consumers to increase demand for ZEH.
  - If funding is available, consumers will respond appropriately. The number 1 priority should be developing alternative financing mechanisms (e.g., bonds, syndicated funds,

national or regional scale programs, utility, community investment funds); traditional banks, insurers, appraisals will not get us there.

5. Local Financing Programs and policy leadership needed to get local programs off the ground.
  - Examples of property tax assessments include legislation in Santa Fe, New Mexico. Maryland also considering one.
6. Utilities
  - Utilities have different business models; ZEH is not attractive. Maybe socialize utility grid?
  - Direct interface: Control how utilities operate in future (e.g., Whirlpool will make appliances that can talk directly to the grid. Siemens is also working on this technology). Opportunity: they would be interested in how to integrate this into buildings. Companies are showing they are willing to invest in R&D and should be included in the group.
  - Some utilities in US and Canada already have decoupled profits from energy sales (e.g., in Canada they are required to do conservation). What about other countries?
7. Limitations of ZEH: Unless off grid, optimization has to be beyond one building, community, maybe grid. Keep the peak demand down (complicated optimization with peak).
8. Operationalize efforts – This coalition should form committees.

### Lunch Speaker: Harry Wingo, Google

Harry Wingo, a Policy Counsel for Google's DC office, discussed Google's implementation of a real-time digital meter for home energy usage.

- Smartgrid technologies empower consumers by helping them better understand their energy use and the associated costs; they also can help consumers set and reach energy goals.
- Utilities can and want to use energy information to interface with consumers, especially to deal with peak power demands.
- There need to be open protocols and standards for Smart Grid technologies.
- Opportunities:
  - Improving real-time information only: Saves 5-15%
  - Efficiency investments: Save 20-40%
  - Demand response: Unknown (Smart appliances, smart meters – or fuse box device available for \$100)
- Google Power Meter
  - Works with fuse box or utility meter “gadget”
  - Tracks specific information about how households use energy and what they can do to be more efficient
  - Reduces energy use by helping consumers make smart decisions
  - Shares information
- Google is currently working with eight utilities across the US (the largest of which are Encore in TX and San Diego Gas and Electric) as well as one each in Canada, Germany, and India.
  - Google is also open to working with other utilities, co-ops, and municipal energy service providers

- Privacy is protected under this technology, however it allows for features to compare among houses, communities, and utilities.
- Currently, only about 5% of homes could implement this technology without an upgrade, so work needs to be done with utilities to install new meters or connect the existing smart meters.
- The Google software could be easily adapted to measure for gas and water consumption.

### **Discussion: Community Scale Demonstrations**

Goal: Have one ZEH community scale demonstration in both the US and Canada ready for GLOBE 2010 (March 24-26, 2010, Vancouver)<sup>7</sup>

### **Breakout Groups: Specific Goals and Actions for Advancing ZEH**

#### **GROUP 1:**

**What is your action?** Develop a strategy for development and adaptation of a standard for NZE retrofits and related technologies in APP countries. This strategy will facilitate the removal of code barriers.

**How does this support our goals?** Facilitates wide-scale use of standards in industry; involves policy-makers; mitigates the risk for builders and lenders.

**What resources are required to make it happen?** DOE/EERE and NRCAN certification/support, high-level “champion” to promote activities, collaboration between organizations now working on standards (CA, Austin, TX).

**What stakeholder(s) & channel(s) are you targeting?** Code bodies, Government, Manufacturers’ associations, Builders, Buyers, perhaps Utilities

**What are the success measure(s)?** Have standards widely adopted, Stimulate buy-in from stakeholders, Ultimately have the standards employed in many homes.

#### **GROUP 2:**

1. **What is your action?** Determine fine print of definition of NZE homes (standards, etc.).

**How does this support our goals?** Assists in promotion of NZE.

**What resources are required to make it happen?** Meetings and collaboration between various parties

**What stakeholder(s) & channel(s) are you targeting?** All interested parties, public and private

**What are the success measure(s)?** Have the definition widely recognized and adopted

2. **What is your action?:** Create a central depository of information for all stakeholder groups.

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<sup>7</sup> Interested parties include Minto in Canada and Artistic Homes in the US.

**How does this support our goals?** Avoids redundancy, saves time, provides forum for outreach to other groups

**What resources are required to make it happen?** Identification and consolidation of existing information, acquisition of contacts in other groups

**What stakeholder(s) & channel(s) are you targeting?** Universities

**What are the success measure(s)?** Have a website and managing body for information and storage

### **GROUP 3:**

**What is your action?** Organizing the various partners in the field who have an interest in widespread implementation of NZE homes; Certification mechanism for NZE homes, Carbon zero or energy plus homes (involves definition)

**How does this support our goals?** Provides a database, website, forum, and education to group members and potential partners, students, and professionals

**What resources are required to make it happen?** Software tool for managing NZEH environments in all eight climate zones with tools to optimize cost and energy, vision for a new grid (utilities)

**What stakeholder(s) & channel(s) are you targeting?** Utilities, Homeowners, Builders, Municipalities, APP Countries

**What are the success measure(s)?** Establish a baseline from current levels of NZEH implementation, then set goals for percent market penetration goal and schedule (with new goals set to reflect the upward curve in implementation); Metrics that don't "police" every home, but rather allow for global calculations and averages

### **GROUP 4:**

**What is your action?** Charette for entire community:

- Involve stakeholders to design and build
- Make it replicable
- Use consumer focus groups during the design and implementation process for the Charette—one in each of the major policy centers in Canada and US (Ottawa, DC)

**How does this support our goals?** Stimulates demand for NZE, makes it accessible to media, could stimulate the creation of an "Eco-Brokers" program

**What resources are required to make it happen?** Financing for renewable components (current high cost), Technical expertise, Resources for dissemination of information through marketing

**What stakeholder(s) & channel(s) are you targeting?** ALL

**What are the success measure(s)?** Number of consumers reached, Number of politicians brought on board

#### **GROUP 5:**

**What is your action?** Create recognition of the value of NZE within financial institutions

**How does this support our goals?** Enables buyers, Educates financial institutions and consumers to benefits of NZE homes

**What resources are required to make it happen?** Lending forum, Big name “champion” for the financial initiatives (high level politician?), Steering committee, Secretariat to drive forward progress (homework!), White paper (from the commercial sector?), Policy incentives to lower bank risk

**What stakeholder(s) & channel(s) are you targeting?** Banks, large and small (using the smaller local banks as success stories)

**What are the success measure(s)?** Mortgage projects, Guidelines for appraisers, Big (500 homes) pilot in the next 2 years to show the economic viability of zero energy homes.

#### **GROUP 6:**

**What is your action?** Education at a high level, using local success stories to inform lessons in policy and financial incentives

**How does this support our goals?** Spreads knowledge of current NZE homes, Field-tests prototype ideas (for financial incentives, etc), Generates competition between countries, cities, and regions

**What resources are required to make it happen?** Local champions, public figures, coordinating entity—universities and colleges, funding!!

**What stakeholder(s) & channel(s) are you targeting?** Local homebuilder associations, utilities, financial institutions

**What are the success measure(s)?** Extent of Replication nationally and internationally

#### **Discussion: Next Steps**

What is missing from our breakout group actions list?

- Job creation and training
- Specific policy advocacy action
- Off-grid homes (this group to focus on more mainstream opportunities with mass deployment potential)

#### **What are the immediate next steps for this group?**

1. First: Agree on a definition of the group and its roles, purpose

2. Set goals
  - Include World Business Council
  - Base on the upcoming international recommendations for EE policies (5 of which are about buildings) mentioned by Joseph Ayoub—get developed and developing nation sign-on
3. Get a publicist (Google?)
4. Make a plan for the next G8 in Ontario, a city currently reviewing their building codes
5. Begin charettes in the US and Canada to inspire similar projects in other APP countries
6. Create a World Green Building Map/World ZEH Map as a promotional and educational tool
7. Make a plan to mitigate the risk of financing, buying, and building ZEH
8. Work with “This New House” (from producers of “This Old House”) to promote energy efficiency and renewable energy technologies and implementation.