

Thousand Home Challenge

Intro to Indicators of Performance

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Purpose of this PDF

1. Introduce the Thousand Home Challenge (THC)
2. Review the criteria for meeting the Thousand Home Challenge
3. Complement the THC Usage Reduction Spreadsheet V 1.3

The Thousand Home Challenge is designed to:

- 1. Demonstrate** the potential for 70 - 90% energy reductions of North American existing homes
- 2. Integrate** energy efficiency with on-site renewable energy sources, behavioral & lifestyle changes, & community-based solutions
- 3. Develop** indicators of home energy performance

The Thousand Home Challenge is designed to:

4. Exemplify a performance-based systems approach to design, deployment, & verification

5. Assemble local / regional centers of excellence

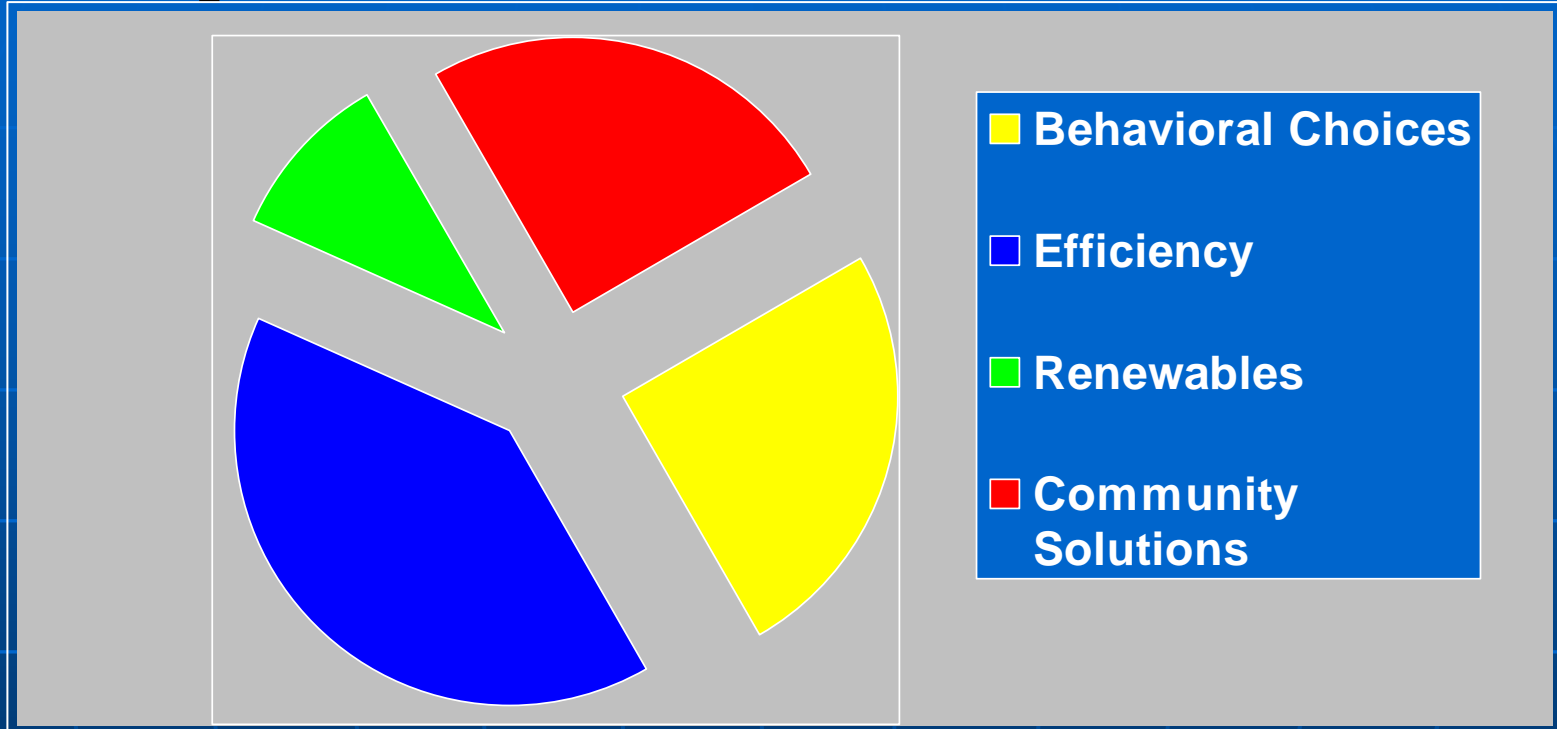
6. Stimulate collaboration, creative problem-solving, and innovative products & approaches

7. Leverage a Thousand Home Challenge multiplier

How is the Thousand Home Challenge Unique?

- Bottom line: Actual total use, not modeled
- Key metric: Customized household energy use threshold allowance
- Includes human & social dimension, not just technical solutions
- Stimulate creative solutions; Lots of potential paths; not prescriptive
- Vision for scalability

Optimize Investment



Customized based on goals, opportunity, resources, & needs

Multiple paths to get to deep reductions!

Not Included in THC but Very Important

- Embodied Energy – food, energy, consumables, waste, building materials
- Transportation Energy

THC Timeline

Pilot Phase – Right now

- Confirmation of Projects, Sponsors, & Collaborators
- Draft & Revise Guidance Documents
- Development of Organizational & Operational Structure

Launch Late Summer / Fall 2009

Thousand Home Challenge

Sponsors¹, Ring Leaders, & Collaborators²

CSG, National Grid, NYSERDA, PG&E¹

CCHRC, City of Boulder, Office of Environmental Affairs, CMHC, Community Solutions, Conservation Connection Consulting, CSG, Davis Energy Group, Inc., NAHN, National Grid, NEEP, NREL, PG&E, Sustainable Spaces

ACEEE, AO Smith, BKi, BSC, Columbia Gas of Ohio, Conservation Technologies, ConSol, Delta-T Inc., GreenHomes America, Heyoka Solutions LLC, HomeEnergy magazine, Johns Manville, KEMA Services Inc., LBNL, Metropolitan Energy Center, Minnesota Power, Oak Ridge National Labs, Passive House Institute US, PSD, SRMI, The Energy Conservatory, VEIC, WSU Energy Program

¹Guidance Document Sponsor

²Current as of 9/30/08

Criteria Meeting the THC – Core Indicator of Performance

- **Total** - inclusive of all household energy end uses
- **Annual** - to account for seasonal usage as well as baseloads
- **Transparent** - clear enough that everyone can understand and use them
- **Direct** - measured and verifiable by common methods such as utility and fuel bills
- **Proportional** - challenging yet attainable

Key Metric
Transparent & Direct
Include Occupants

Net Annual Household Site Energy
(wood included, solar is not)

However, telling the story of
a homes performance
includes many indicators of
performance including...

Direct Indicators of Performance

- Btu/kWh per Home
- Household Annual Cost (\$)
- Btu/kWh per Person
- Btu/kWh per FFA (finished floor area)
- Peak Energy (if measured)
- Water & Sewage (if measured)

Indirect Indicators of Performance

- Btu/kWh per HCDD (heating and cooling degree day)
- Tons Carbon Equivalent
- Peak Energy
- Source Energy
- Home Energy Rating

Key Metric
Transparent & Direct
Include Occupants

Net Annual Household Site Energy
(wood included, solar is not)

Two Options for Qualifying

Meet or exceed a customized household energy allowance

OPTION A

Relative, 75%
reduction

Input: Annual measured
previous energy use

For higher use
households with
measured pre-use

OPTION B

Absolute, not relative

Inputs: climate, house
size, occupants, heat
source, attached /
detached

For low use households

Option B

Proportional to the Opportunity

Responsive but not linear

- **House Size** – Thermal loads function of assumed surface area
(5 sides)
- **Occupancy** – More people use more energy, but not linear
- **Climate** – In mild climates heating & cooling loads should be eliminated; not true in Saskatoon

OPTION B: Customized Household Threshold

Estimates energy needed for a very high performance house for

- Heating
- Cooling
- Hot Water
- Everything Else

Sum is the actual site energy household threshold that must be met or exceeded in order to meet the Thousand Home Challenge

How far does OPTION B go?

- Goal to be challenging for everyone
- Developed independently of EPA Home Energy Yardstick
- Spreadsheet shows Yardstick estimate of average US energy for same household
(Usually 15% to 30% of Yardstick average estimation fossil heat; 40% if electric heat)
- Ballpark: 70% to 85% less than average home in same climate, same size, & number of occupants

THC Threshold Calculator

Spreadsheet has 3 tabs

- User Interface
- Threshold Calculator
- Weather Data

1st Tab - User Interface

- Calculates both Option A and B
- User inputs - yellow shaded cells
(Option B does not need current consumption)
- Zip code selects nearest weather station (if Cell F8 = Use Zip Code)
- User option to override weather station (use Cell F8 to select weather station)

2nd Tab – Threshold Allowance

- Use to interpret and understand Option B
- Includes unit conversion SI & metric [D8:D9]
- Summarizes outputs – heat, cool, hot water, and everything else [C25:D28]
- What If table – Set F12 = selected cell; User option to change weather stations and house size
- Assumptions for formulas [F29:G27]
- Benchmarks – purple cells [B31:C37]

3rd Tab – Weather

- Lists TMY-3 weather stations
- TMY-3 vs TMY-2? (TMY -3 Many more weather stations (1023!); reflects recent warmer weather trends)
- Provides output by station for
 - HDD65 = Heating Degree-Days Base 65
 - CDP65 = Cooling Dew Point Degree Hours Base 65
 - CDH74 = Cooling Degree Hours Base 74
- Weather stations linked to zip code by proximity (NOTE: Nearest weather station is not always best to use -- especially in Western coastal areas)

Finished Floor Area (FFA)

- Easier to define and interpret consistently than Conditioned Floor Area (CFA)
- Used to calculate shell area assumption (five sides) [Tab2 C22]
- Shell area input for "Heating" and "Cooling" allowance
- FFA input for "Everything Else"

Fossil - Wood vs Electric Heat

- Based on technical potential – Electrically heated home needs $\frac{1}{2}$ as many BTUs than Fossil or Wood heat (assuming the same enclosure)
- Electrically heated homes $\frac{1}{2}$ allowance than fossil – wood (affects heating only)
- Prevents THC from being easier to meet with electric heat

How is Wood Counted?

- Wood and Wood Pellets: counted as part of household energy use
- Due to outdoor pollution, wood use faces constraints in many places
- When wood is used it should be used efficiently
- For THC – Ideally use alternate fuel (not wood) to establish performance – or track by weighing not cord measurement
- Difficult to accurately predict energy input even with consistently dry wood unless weighed

How is Solar Counted?

- Passive solar & active solar thermal systems offset energy use
- Solar PV, wind, and hydro may need to be calculated as a credit, depending on how output is metered

Occupants

- Pro-rate for partial occupancy (3+ weeks absence is a partial occupant)
- Not intended to adjust for 24-7 vs daytime occupancy
- Impacts “Water Heating” and “Everything Else”
- Smaller added allowance per person after first two occupants
- Considers # of households as well

Attached and Multis¹

- Can calculate for either one unit or by building (choose one, not both)
- One unit - Use "% attached" for common surface area [C11]
- Building – Change households for number of units [C10]
- Enter # of occupants by unit or building [C9]
- If "household" > 1, then outputs are by building not household

¹ 1st Tab - User interface – [C19:C11]

Special Cases

- Keeping tool simple is a priority
- Special cases (handicapped, home office, inaccurate shell area prediction) handled on an exception basis
- Home offices do not necessarily add load, but some do
- Handicapped / health issues do not necessarily use more energy, but some do (respirator, increased laundry)

You are encouraged...

- Plug in some houses and calculate house specific thresholds
- Give us your feedback (Cite the version)
- Is the threshold allowance challenging enough to be meaningful, but possible to obtain?
- Updates will be made & posted on ACI's website/ACI Initiatives/Thousand Home Challenge

Thanks to...

- ***Pacific Gas & Electric*** for their financial and in-kind support of the process for developing and getting input to the indicators of performance for the Thousand Home Challenge.
- ***Michael Blasnik*** for developing & refining the Threshold Calculator
michael.blasnik@verizon.net
- The many people & organizations who provided insight and feedback to support this effort.

Feedback Welcome!

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Select ACI Initiatives

<http://www.affordablecomfort.org/initiatives.php?PageID=16>

Deep Energy Reduction Resources

ACI White Paper - One Year Later

Thousand Home Challenge

