INTRODUCTION TO THE
1000 HOME CHALLENGE

Linda Wigington
Founder & Director
1000 Home Challenge
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www.thousandhomechallenge.org
www.ROCIS.org
Webinar - Objectives

1. Introduce the Thousand Home Challenge & new updates
2. Review the criteria for meeting the Thousand Home Challenge
3. Provide an opportunity to get your questions answered
4. Benefit from your feedback & questions
Thousand Home Challenge

PURPOSE:

To lay the foundation for transforming existing North American homes by demonstrating the potential & practicality for greater than 70% energy reductions in 1,000 homes.

Ultimately...

Many towns with 100 or 1000 Home Challenges & many 1,000s of citizens engaged
New Paradigm – New Thinking

- We see only what we perceive as possible
- We often see what we expect to see
- Our assumptions limit our vision (blinders or filters)
- Need a new mental map
The fraction of CO$_2$ remaining in the air, after emission by fossil fuel burning, declines rapidly at first, but 1/3 remains in the air after a century and 1/5 after a millennium (Atmos. Chem. Phys. 7, 2287-2312, 2007).
One Ton CO\textsubscript{2} per Capita?

Sustainability Limit for Energy Related CO\textsubscript{2}-Emissions

Global limit:
10 billion tons per year

Population 2050:
10 billion people

means

max. 1 ton

per capita and year

US per capita emissions
19 tons/year CO\textsubscript{2}

Slide credit: Dr. Bernd Steinmüller (ACI 2007 Cleveland)
The Thousand Home Challenge

Access & Integrate

- Efficiency
- Behavioral Choices
- Renewables
- Community Solutions
What Is the Value?

- **Demonstrate & Redefine What Is Possible**
  - Through *case studies* & *webinars* of deep energy reduction projects
  - Examples of *performance*-based design, deployment, verification

- **Educate & Inspire**
  - Provide resources for educating *homeowners, contractors, designers, etc.*
  - Establish *aggressive targets*
  - Encourage *on the path strategies*

- **Build Capacity & Champions**
  - Highlight local, regional, & national *expertise*
  - Stimulate *collaboration* & *innovation*
How Is the Thousand Home Challenge Unique?

- **Bottom line:** *Actual total use*, not modeled
  
  *Operational performance rather than asset performance*

- **Key metric:** Customized household energy use threshold allowance

- More dimensions: Human, social, *not just technical solutions*

- **Stimulate creative solutions:** Lots of potential paths, not prescriptive
Our projects are characterized by:

1) Continued efforts to go deeper after meeting threshold
2) Broad sustainability goals
3) High commitment to learn & share
4) Huge variety of costs & strategies
5) Significant & diverse array of non-energy benefits gained
6) Easy to get there for some; nearly impossible for others
Mobilize Passion!
Our Greatest Resource
Thousand Home Challenge
Case Studies

For Complete Case Studies…

http://thousandhomechallenge.com/case-studies

Check back for updates
Three Key Project Principles

1. Go beyond energy reductions to make a value proposition (more resilience, durability, and comfort, healthier homes, reduced water use)

2. A performance target can be a powerful & useful determinant of energy use (key criteria: fair, logical, easily verified, meaningful, within influence)

3. Rapid feedback is critical (anticipate need, compare against targets, zoom in as necessary, make mid-course correction, verify impact, learn)
1000 Home Challenge Timeline

Business Development Phase (now)
- Clarification – host & partner organizations
- Confirmation of short-term sponsors/funding
- Recruit partners for local/regional initiatives

Ongoing
- Revise guidance documents/application
- Accept projects
- Development of website & case studies
YOUR TURN
THE THOUSAND HOME CHALLENGE’S CORE METRIC: THE PROJECT THRESHOLD

How Deep Is Deep Enough?
Each household has a customized energy allowance to meet or exceed.

**Key Metric**

*Transparent & Direct*

*Include Occupants*

**Net Annual Household Site Energy**

Credits/offsets: Solar & on-site renewables

Wood counts (as energy, not free ride)!
Two Options for Qualifying

Meet or Exceed a Customized Household Energy (Site) Allowance

OPTION A

Relative, 75% reduction

Must be verified recent reduction based

OPTION B

Absolute, not relative

Most people had used OPTION B
1000 Home Challenge Threshold Calculator

http://thousandhomechallenge.com
Thousand Home Challenge Allowance Determination

**OPTION A**
- 75% verifiable reduction in actual annual site energy use

**OPTION B (developed by Michael Blasnik)**
- **Climate** (ZIP Code or best match weather station)
- **House size** (FFA), converted to surface area (5 sides)
- Detached or attached
- **Electric heat allowance** = $\frac{1}{2}$ fossil fuel or wood heat allowance
- **Number of occupants** (including partial occupancy)
OPTION B: Customized Household Energy Allowance

Estimates energy needed for a very high performance house for:

- Heating
- Cooling
- Hot Water
- Everything Else

Sum is the energy allowance that must be met or exceeded in order to meet the Thousand Home Challenge.
How Far Does OPTION B Go?

- Challenging for everyone

- Developed independently of EPA Home Energy Yardstick (HEY)

- **Ballpark:** 70% to 85% less than average home with same climate, same size, & same number of occupants (~9.9999 HEY score)

- 75% = cutting use in half, % then half again!
Halfway to the Challenge

• Developed 2015
• Does not change the Challenge threshold
• 50% Milestone based on OPTION A OR B threshold
• Learn from 50% experience & engage them to participate
• Many opportunities for reductions; challenges conventional wisdom (diminishing returns)
• Only an option for funded initiatives, &/or 1000 Home Challenge candidates
to maximize potential of THC data, generate case studies, increase impact
PLANNING FOR DEEP REDUCTIONS

Combination of Intent & Epiphany
1000 Home Challenge Projects

• “All at Once” or multi-year “Phased”

• Accept projects in progress or those which have met the 1000 Home Challenge performance

NOW 3 CATEGORIES:

• Recognition for 50% Milestone

• 1,000 Home Challenge Candidate - conditional acceptance - commit to vision, actions, & process

• Officially Meet 1,000 Home Challenge: 1 year of documented energy use
Project Planning Resources

• Homeowner Priorities
• Do You Have a Plan: Health - Safety
• Ten Steps to Deep Energy Reductions
• Reduction Matrix
• Home Energy Heating Calculator
• Principles: Staged Reductions

http://thousandhomechallenge.com/resources
Exercise:
Homeowner Priorities Worksheet

1) **Complete** the worksheet for your own home

2) **Think about**…
   - What surprised you?
   - What did you learn?
   - Does this change or influence your course of action? If yes, how?
   - How would this affect a rater/designer/contractor’s advice?

(download worksheet: [http://thousandhomechallenge.com/resources](http://thousandhomechallenge.com/resources))
Value Proposition – meaning & purpose, not ROI
1000 Home Challenge Application

Excel spreadsheet Available upon request
The Reduction Matrix (following 4 slides) provides guidance & a framework to support projects in meeting their threshold.

We do not dictate how one reaches its threshold, nor do we attempt to predict measure or project performance.
## THC REDUCTION MATRIX (Moderate Climate Home)

### ANNUAL HOUSEHOLD kWh

**(Pre, Post, & Allowance)**

<table>
<thead>
<tr>
<th>Loads</th>
<th>Pre-use</th>
<th>Proposed Usage Reductions - kWh/yr</th>
<th>Target-use</th>
<th>THC Allowance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(breakout may be estimated)</td>
<td>Efficiency</td>
<td>Behavior</td>
<td>Renewables</td>
</tr>
<tr>
<td></td>
<td>(kWh/yr)</td>
<td>Building</td>
<td>Equipment</td>
<td>Choice Reductions</td>
</tr>
<tr>
<td>Heating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Hot Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Else</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Starting Place – Your annual energy use**
## THC REDUCTION MATRIX (Moderate Climate Home)
### ANNUAL HOUSEHOLD kWh
(Pre, Post, & Allowance)

<table>
<thead>
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<td></td>
<td>Building</td>
<td>Behavior</td>
<td>Renewables</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equipment</td>
<td>Choice Reductions</td>
<td>On-site Generation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating(^1)</td>
<td>24,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water</td>
<td>4,000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>All Else</td>
<td>7,600</td>
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</tr>
<tr>
<td>Total</td>
<td>36,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)~895 gallons propane, or 600 gallons #2, oil or 600 therms of natural gas

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**Break out by use or fuel**
# THC REDUCTION MATRIX (Moderate Climate Home)

## ANNUAL HOUSEHOLD kWh

(Pre, Post, & Allowance)

<table>
<thead>
<tr>
<th>Loads</th>
<th>Pre-use (breakout may be estimated)</th>
<th>Efficiency</th>
<th>Behavior Choice Reductions</th>
<th>Renewables On-site Generation</th>
<th>Community Solutions (kWh/yr)</th>
<th>Target-use (kWh/yr)</th>
<th>THC Allowance (Option B – Electric Heat)</th>
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</thead>
<tbody>
<tr>
<td>Heating</td>
<td>24,000 (kWh/yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2,324</td>
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<tr>
<td>Cooling</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>193</td>
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<tr>
<td>Hot Water</td>
<td>5,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2,051</td>
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<td>All Else</td>
<td>6,600</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>2,120</td>
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<tr>
<td>Total</td>
<td>36,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>6,688</td>
</tr>
</tbody>
</table>

**Enter Threshold**

Option A – 75% measured reduction

OPTION B THC Threshold = 6,688 kWh w electric heat; 9,012 kWh w/ fossil or wood heat

(Assumptions: 1,600 ft² FFA, 5,660 Heating Degree Days, Household of 4)
## THC REDUCTION MATRIX (Moderate Climate Home)

### ANNUAL HOUSEHOLD kWh (Pre, Post, & Allowance)

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<td>(kWh/yr)</td>
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<td>Equipment</td>
<td></td>
</tr>
<tr>
<td>Heating</td>
<td>24,000</td>
<td>8,000</td>
<td>12,000</td>
<td></td>
</tr>
<tr>
<td>Cooling</td>
<td>400</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Hot Water</td>
<td>5,000</td>
<td>500</td>
<td>2,500</td>
<td></td>
</tr>
<tr>
<td>All Else</td>
<td>6,600</td>
<td>1,400</td>
<td>1,000</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>36,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Many ways to get from here to there!

**OPTION B THC Threshold** = 6,688 kWh w electric heat; 9,012 kWh w/ fossil or wood heat

(Assumptions: 1,600 ft² FFA, 5,660 Heating Degree Days, Household of 4)

Target: 5,300 kWh/yr. Reduction: 30,700 kWh!
THOUSAND HOME CHALLENGE
RESULTS TO DATE

Will be reviewed as time permits
Including Results From First 31 Official Thousand Home Challenge Projects
Older homes from New England to California
Newer homes from Pennsylvania to New Mexico
31 Projects Officially Meet the 1000 Home Challenge

Project Characteristics

- (8) Net zero or better (site energy)
- (7) Also charge electric vehicles (EV)
- (27) Have PV (solar electricity)
- (11 of 31) Projects met the Thousand Home Challenge without PV (based on extrapolated, not measured data)
- (143 kW) Total installed PV capacity
Thousand Home Challenge
Project Summary (03-2019)

Active Projects, All Phases (105)
Meet THC Threshold (No App Yet or In Review) (24)
Officially Meet THC (31)
Official THC Candidates (Project In Progress) (12)

- Rest of US & CAN
- California
- Massachusetts

31 down only 969 to go!
1st 31 House & Household Characteristics

- 1869 Oldest home; 2008 Newest home
- Year Built: (16%) 1850-1899; (32%) 1900-1930; (13%) 1931-1960; (32%) 1961-2000; (6%) 2001-2010
- Correlation between indicators of energy performance and age: None!
- 576 Ft² Smallest home; 3,650 Ft² Biggest single family home
- 2,245 Ft² Average house size (FFA) (per household)
- 2.62 Occupants: Average household size
- (28) Single-family homes; (3) Duplexes
Notes: 1000 Home Challenge – 31 House Summary Energy Use Graphs

- All energy use is reflected as site energy
- KWh does not just include household electrical use; total household energy is converted to kWh
- PV production is included in project energy use, or noted otherwise
- Energy use shown is verified 1 yr. household performance; not reduction from base year
- Household energy use is shown on left-hand axis
- Vertical bars show completed THC project energy use
- THC avg. & mean reflect 31 projects; bars reflect sampling of early projects
- US & California avg. shown for comparison
Threshold Vs. Actual (kWh/Yr)  
Annual Net Site Project Energy Use of Project Participants

US single fam. avg. 36,065 kWh/yr. (2009 EIA); CA:20,000 kWh/yr.
Household Site Net Energy (kWh/Yr)

US Single Family avg. **36,065 kWh/yr.** (EIA 2009)

**88% Reduction**

THC avg. **4,180 kWh/yr.**

THC: 32 households (31 projects)

NOTE: CA avg. single-family energy use: 20,000 kWh/yr.
US single-family detached (2009 EIA) = 12,965 kWh/year/occupant

THC average 1,712 kWh/occupant
THC median 1,956 kWh/occupant

77% Reduction
Energy Use Index (EUI) KBtu/Ft²
Net Annual Energy Use (including renewables)

US 2009 Single-family det. household avg. EUI: 42.6 KBtu/Ft²

84% Reduction

21 Completed 1000 Home Challenge Projects by EUI With Estimated Project Cost (H,M, or L)

H (High), M (Medium), & L (Low) reflects estimate of project cost to reach THC

UPDATE: 1000 Home Challenge 31 project avg.: 6.5 EUI
House Age & Project $$
by Net Site kWh/Yr (21 initial projects)

<table>
<thead>
<tr>
<th>Age</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>145</td>
<td>H</td>
</tr>
<tr>
<td>134</td>
<td>L</td>
</tr>
<tr>
<td>133</td>
<td>H</td>
</tr>
<tr>
<td>112</td>
<td>H</td>
</tr>
<tr>
<td>112</td>
<td>H</td>
</tr>
<tr>
<td>109</td>
<td>M</td>
</tr>
<tr>
<td>107</td>
<td>M</td>
</tr>
<tr>
<td>102</td>
<td>L</td>
</tr>
<tr>
<td>96</td>
<td>H</td>
</tr>
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<td>89</td>
<td>H</td>
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<td>74</td>
<td>M</td>
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<td>64</td>
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<td>64</td>
<td>M</td>
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<td>51</td>
<td>H</td>
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<tr>
<td>41</td>
<td>H</td>
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<td>36</td>
<td>M</td>
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<td>L</td>
</tr>
<tr>
<td>9</td>
<td>L</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
</tr>
</tbody>
</table>
Conclusions

1) Deep reductions of energy use (70%+) in existing homes are possible, & in many cases, practical

2) Doing so requires turning barriers into opportunities & telling the story

3) New paradigm is essential
Find Your Voice, and Inspire Others to Find Theirs

Stephen Covey – “The 8th Habit”
Online Resources
(Many Paths to Deep Energy Reductions)

www.ThousandHomeChallenge.org
www.ThousandHomeChallenge.net
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www.1000HomeChallenge.com

Threshold Calculator

✓ Deep Energy Reduction Case Studies
✓ Thousand Home Challenge Project Planning Resources
✓ Access to Resources/Links

Home Energy Pros THC Group
http://homeenergypros.lbl.gov/
Webinar - Objectives

1. Introduce the Thousand Home Challenge & new updates
2. Review the criteria for meeting the Thousand Home Challenge
3. Provide an opportunity to get your questions answered
4. Benefit from your feedback & questions
Feedback, Case Studies, & Projects Welcome!

Links to Linda Wigington video interview:

Part 1
Part 2

www.1000HomeChallenge.org

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724-852-3085
lwigington1@outlook.com

THC Threshold Calculator
Deep Energy Reductions Resources
DER Case Studies
EXTRAS

Additional info on deep energy reductions & the 1000 Home Challenge
Best Practices for Going Deep

1) CREATE A NEW PARADIGM

*What is possible; What is the vision?*

• Set **bold goals**
• **Differentiate** from business as usual (BAU)
• Use **vision as frame of reference** not BAU
• Re-examine what it means to **live well**
• Generate tangible **examples**
• Clarify **value** proposition (project, community, region, & beyond)
Going Deep (cont’d)

2) ACCELERATE LEARNING CURVE & CAPACITY BUILDING  
   * How do we do it?*

- Stimulate & leverage **innovation** - products, systems, & processes
- Develop & empower **champions**
- Stimulate **sharing** of ideas, knowledge, & experience
- Verify **performance** through monitoring & energy bill analysis
- Clarify **gaps, needs, & lessons learned**
3) DEMONSTRATE the PROCESS

*How do we bring it to scale?*

- Community engagement!!
- Commit to **continual improvement** through feedback
- Clarify “**On the Path**” opportunities
- Reduce **cost, complexity**, & need for customization
- Build **partnerships & alliances** beyond energy
- Tell the **story**
THC Option B Allowance (kWh/yr) by Household Size

OPTION B INPUTS: Detached, fossil or wood heat, 1,200 ft² finished floor area (FFA), not conditioned floor area (CFA)

US single family average site energy consumption 36,065 kWh/yr. (EIA 2009)
THC Option B Allowance (kWh/yr) by Ft\(^2\) (1,200 or 3,600) & Occupants (1 or 3) (rounded)

**NOTE:** 7,500 kWh = 25 MMBtu, or \(~250\) therms of natural gas

**INPUTS:** detached, fossil or wood heat, finished floor area (FFA), not conditioned floor area (CFA)
Option B Threshold Allowance
kWh/Ft$^2$ (net site energy)

Assumptions: fossil/wood heat; single-family detached
EUI (KBtu/Ft$^2$ = kWh/Ft$^2$ * 3.412); US res. avg. EUI is 44.8 KBtu/Ft$^2$
OPTION B THRESHOLD ALLOWANCE

kWh/Ft$^2$ (net site energy)

**Most initiatives – easier for larger homes**

**So What??**

1000 Home Challenge does not penalize small homes

The 1000 Home Challenge provides a customized, deep reduction target that is not biased by house size!!
Thousand Home Challenge
Everything Else Allowance –
(Probably Toughest to Meet without PV)

OPTION B (includes gas cooking, clothes drying)
- 400 kWh/yr.: Base/home
- + .2 kWh/yr.: Per ft\(^2\) (FFA)
- + 500 kWh/yr.: Persons 1 & 2
- + 200 kWh/yr.: Persons 3+

Annual Everything Else Threshold Allowance

<table>
<thead>
<tr>
<th>House Size</th>
<th>1,200 Ft(^2)</th>
<th>1,200 Ft(^2)</th>
<th>3,600 Ft(^2)</th>
<th>3,600 Ft(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupants</td>
<td>kWh/year</td>
<td>kWh/day</td>
<td>kWh/year</td>
<td>kWh/day</td>
</tr>
<tr>
<td>1</td>
<td>1,140</td>
<td>3.1</td>
<td>1,620</td>
<td>4.4</td>
</tr>
<tr>
<td>2</td>
<td>1,640</td>
<td>4.5</td>
<td>2,120</td>
<td>5.8</td>
</tr>
<tr>
<td>4</td>
<td>2,040</td>
<td>5.6</td>
<td>2,520</td>
<td>6.9</td>
</tr>
</tbody>
</table>
# Turn Barriers into Opportunities

<table>
<thead>
<tr>
<th>BARRIER</th>
<th>OPPORTUNITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Energy use does not matter &amp;/or is <strong>not cost-effective</strong>, or costs too much</td>
<td>1. Focus on <strong>value</strong> proposition – resilience, health, comfort, purpose, adaptability</td>
</tr>
<tr>
<td>2. <strong>Occupants!</strong> &amp; their behavior “I am not willing to sacrifice comfort”</td>
<td>2. Comfort ≠ T-stat set-point – <strong>creative comfort</strong></td>
</tr>
<tr>
<td>3. Good enough – <strong>Nothing left to do</strong> “newer home, efficient HVAC, etc.”</td>
<td>3. <strong>Monitor</strong> &amp;/or track to confirm performance</td>
</tr>
<tr>
<td>4. This (deep energy reductions) is too expensive &amp; <strong>complicated</strong></td>
<td>4. <strong>Simplify</strong> &amp; develop capacity, standards, protocols, <strong>performance metrics</strong>, workforce development!</td>
</tr>
</tbody>
</table>
RESOURCES
1000 Home Challenge Resources

PLANNING TOOLS FOR POTENTIAL THC PROJECTS

http://thousandhomechallenge.com/resources

➢ Homeowner Priorities Worksheet (worksheet)
➢ Health, Safety, and Durability Plan (worksheet)
➢ Principles for Smart Staging
➢ Access to Resources: Ductless Heat Pumps
➢ Resources on Superinsulation
➢ Cost of Heating Energy (worksheet)

Slide decks & audio from PG&E webinar series

http://thousandhomechallenge.com/case-studies
HeatSpring Online Courses - Webinars

**Deep Energy Retrofits / Online / Anytime**
Online 10 week Course by HeatSpring

- Instructor: Marc Rosenbaum

**Plus 6 free on demand courses by Marc Rosenbaum**
- [The Ins and Outs of Selecting Cold Climate Minisplit Heat Pumps / Online / Anytime](#)
- [Understanding and Calculating Building Heat Loss to the Ground / Online / Anytime](#)
- [Introduction to Zero Net Energy Homes / Online / Anytime](#)
- [Deep Energy Retrofit Case Study / Online / Anytime](#)
- [Beyond Zero Net Energy: PV + Storage / Online / Anytime](#)
Resources on Comfort

http://healthyheating.com
• You could spend weeks on this website!

http://smap.cbe.berkeley.edu/comforttool
• Free comfort calculator (based on ASHRAE)

http://thousandhomechallenge.com/resources Handouts!
  ▪ THC Principles for Smart Staging
  ▪ Paths to Thermal Comfort