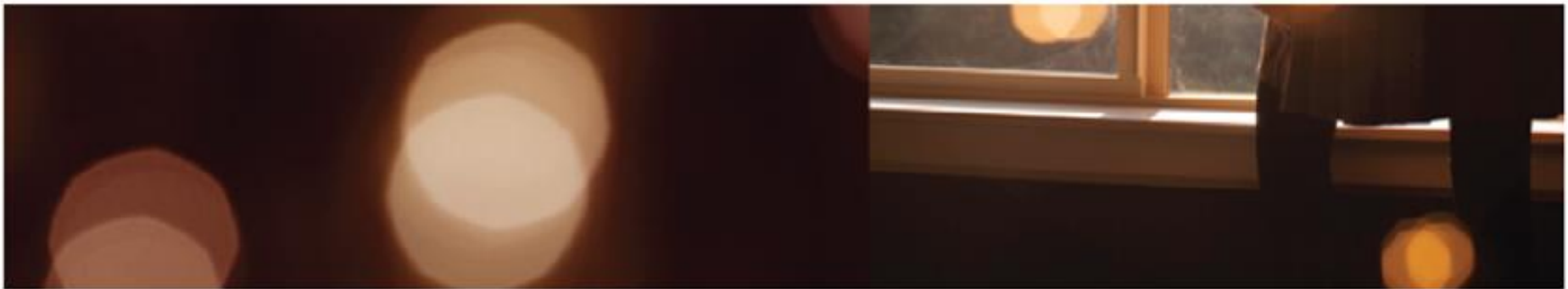




## **Pre-Construction Support: Before the Hammer Hits a Nail**

Dan Wildenhaus, Preston Kuckuck | RESNET 2016

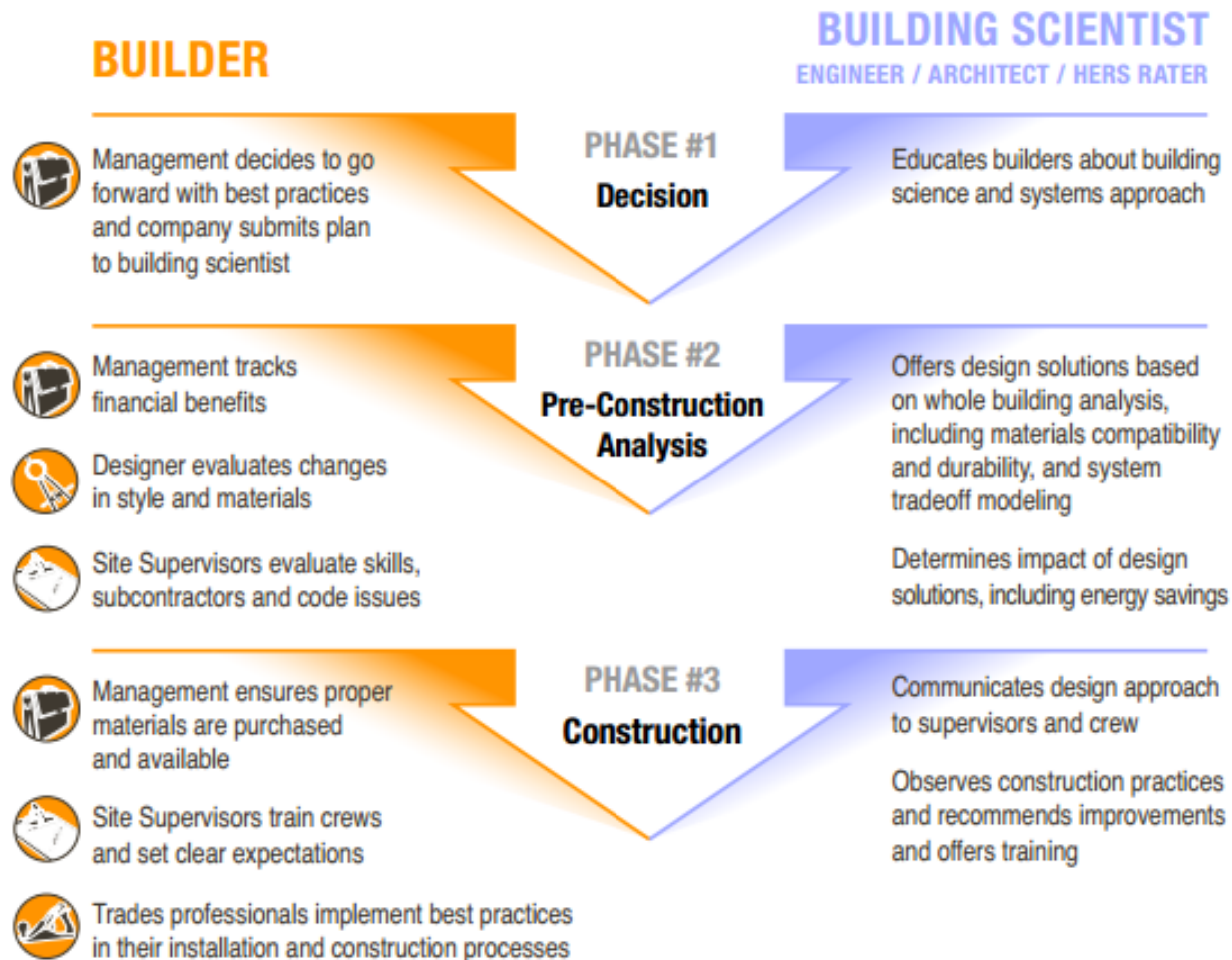


## **AGENDA**

- **Introduction to integrated design**
- **Value to Raters and builders**
- **Pre-construction support best practices**
- **Integrated design in the field**

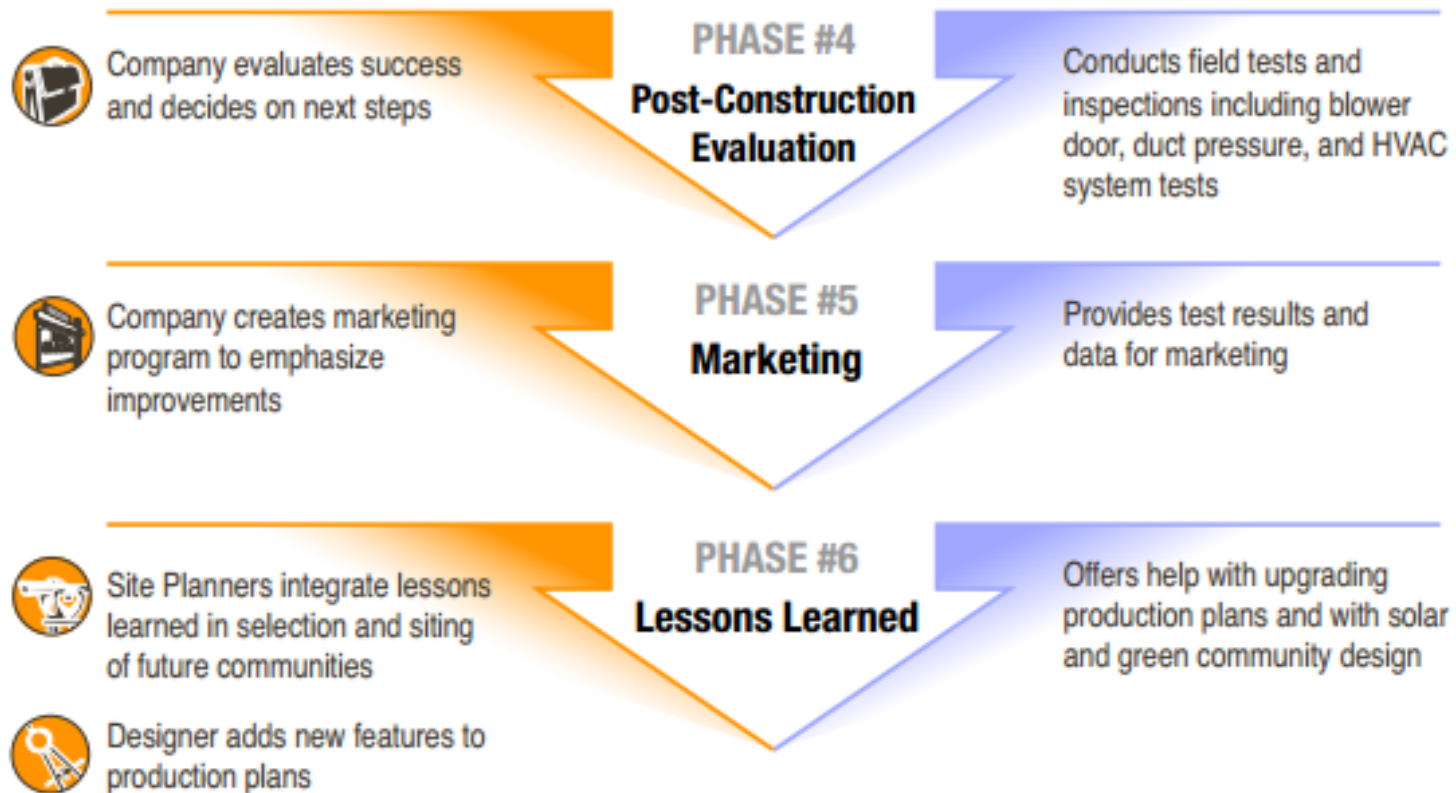
# INTEGRATED DESIGN BY THE NUMBERS

## EXAMPLE PROCESS FLOW: RATERS WORKING WITH BUILDERS



# INTEGRATED DESIGN BY THE NUMBERS

## BUILDING AMERICA'S BEST PRACTICE SERIES



# **FOUR COMMON APPROACHES**

**DESIGN MEETING**

**SCOPE OF WORK REVIEW**

**PRE-CONSTRUCTION (OR SEMI-ANNUAL) TRADES MEETINGS**

**SUPER SECRET APPROACH**

# PRE-CONSTRUCTION SUPPORT

## 1. DESIGN MEETING

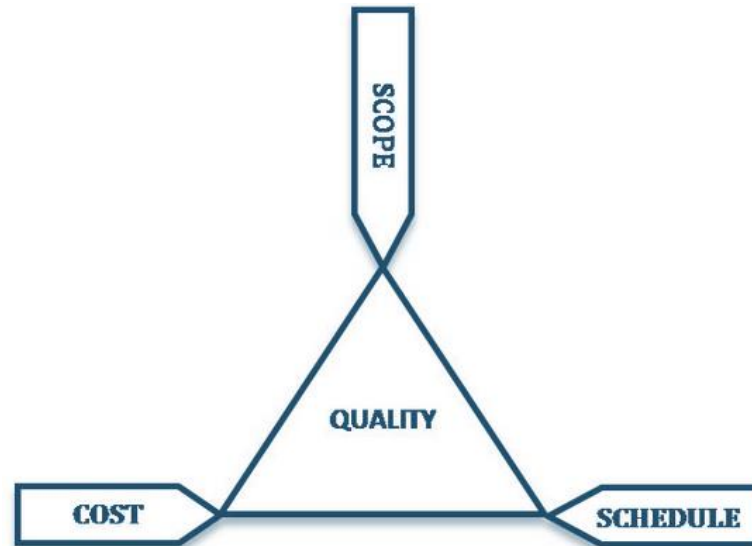
- Who has been invited to a meeting with the building designer/architect, builder and HVAC designer?
- What happens in these meetings? Does the Rater typically have a voice?



# PRE-CONSTRUCTION SUPPORT

## 2. REVIEWING/WRITING SCOPES OF WORK

- As a Rater, who has a scope of work that specifically identifies pre-construction support?
- Does your scope of work allow you to review and write other trade scopes of work?



# PRE-CONSTRUCTION SUPPORT

## 3. PRE-CONSTRUCTION ON-SITE MEETING

- When and where do these meetings typically take place?
- What types of builders do you work with that have pre-construction on-site meetings for every project?





# RATER VALUE PROPOSITION

## **Reinforces your role as a technical consultant for the builder and subs**

- Unique opportunities to provide the builder with valuable feedback
- Identify process improvements and help avoid future warranty issues
- Central point of contact for the subs to communicate with each other and the builder



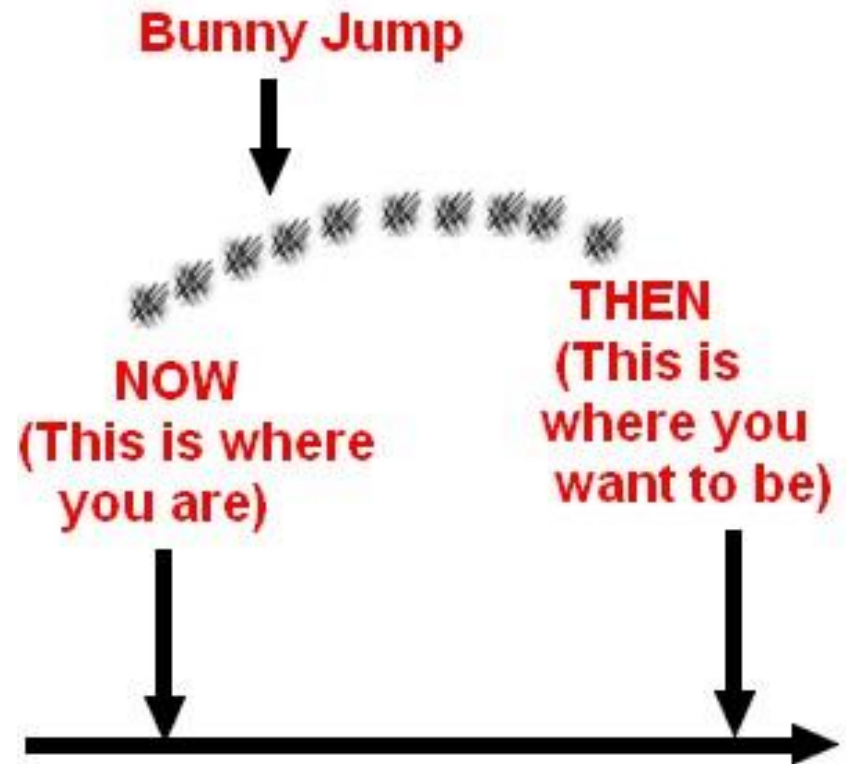
## BRAINSTORM!



# HISTORICAL RATER PERSPECTIVE

## LESSONS LEARNED

- Builders and consumers have access to more information than ever before.
- Working with builders can be a simple and short process when only peripherally involved with high-performance homes...
- Or it can take years of work, with constantly evolving relationships and contracts, to achieve consistent performance.



# THAT SUPER SECRET APPROACH...

**Sales team, design team, build team, purchasing team...who do you want to work with**





# BUILDER VALUE PROPOSITION

- Offers your learned solutions for their use
- Supports the builder in implementing a new product and/or process
- Gives the builder access to incentive programs, rebates, credits, product buy-downs, technical support, training and program resources



# HOW TO DELIVER ON BUILDER VALUE PROPOSITION

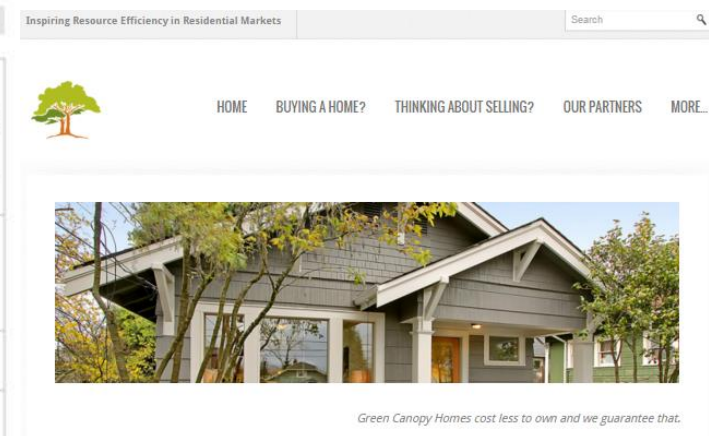
- Come prepared
  - Initial Model completed
  - Early Checklist completed
    - Includes questions to be answered
    - Opportunities to improve
    - Instances where possible conflicts lie
- Come ready to discuss incentives
  - Utility
  - Code
  - Tax credits
  - Labels and the MLS
  - What else?
- Request to have plans available
  - Consider lessons learned with previous builds that pertain to these designs

# INTEGRATED DESIGN: VALUE TO THE BUILDER

- Can reduce costs
- Minimal change and increased oversight of construction schedule and quality of work
- Provides the builder with post-construction cost and performance data

## A CHECKLIST FOR CHECKLISTS

Development	Drafting	Validation
<p><input type="checkbox"/> Do you have clear, concise objectives for your checklist?</p> <p><b>Is each item:</b></p> <ul style="list-style-type: none"><li><input type="checkbox"/> A critical safety step and in great danger of being missed?</li><li><input type="checkbox"/> Not adequately checked by other mechanisms?</li><li><input type="checkbox"/> Actionable, with a specific response required for each item?</li><li><input type="checkbox"/> Designed to be read aloud as a verbal check?</li><li><input type="checkbox"/> One that can be affected by the use of a checklist?</li></ul> <p><b>Have you considered:</b></p> <ul style="list-style-type: none"><li><input type="checkbox"/> Adding items that will improve communication among team members?</li><li><input type="checkbox"/> Involving all members of the team in the checklist creation process?</li></ul>	<p><b>Does the Checklist:</b></p> <ul style="list-style-type: none"><li><input type="checkbox"/> Utilize natural breaks in workflow (pause points)?</li><li><input type="checkbox"/> Use simple sentence structure and basic language?</li><li><input type="checkbox"/> Have a title that reflects its objectives?</li><li><input type="checkbox"/> Have a simple, uncluttered, and logical format?</li><li><input type="checkbox"/> Fit on one page?</li><li><input type="checkbox"/> Minimize the use of color?</li></ul> <p><b>Is the font:</b></p> <ul style="list-style-type: none"><li><input type="checkbox"/> Sans serif?</li><li><input type="checkbox"/> Upper and lower case text?</li><li><input type="checkbox"/> Large enough to be read easily?</li><li><input type="checkbox"/> Dark on a light background?</li></ul> <p><input type="checkbox"/> Are there fewer than 10 items per pause point?</p> <p><input type="checkbox"/> Is the date of creation (or revision) clearly marked?</p>	<p><b>Have you:</b></p> <ul style="list-style-type: none"><li><input type="checkbox"/> Tried the checklist with front line users (either in a real or simulated situation)?</li><li><input type="checkbox"/> Modified the checklist in response to repeated trials?</li></ul> <p><b>Does the checklist:</b></p> <ul style="list-style-type: none"><li><input type="checkbox"/> Fit the flow of work?</li><li><input type="checkbox"/> Detect errors at a time when they can still be corrected?</li><li><input type="checkbox"/> Can the checklist be completed in a reasonably brief period of time?</li><li><input type="checkbox"/> Have you made plans for future review and revision of the checklist?</li></ul>



# BUT I'M NOT PART OF THE DESIGN TEAM!

## Don't be afraid to offer "design" to the process

*(This is integrative "design" after all.)*

- Energy modeling changes the building. It's easier earlier in design.
- Know the team's goals at the start, or better yet, help set them!
- The more you interact with field personnel, the more valuable you are to the design team. You have seen what works and what doesn't.
- Help the trades have a voice at the table... What would the HVAC team say if they could be there?
- **KEY: Bundle your services. (And charge enough!)**



# PRE-CONSTRUCTION BEST PRACTICES

## TECHNICAL CONSULTING

- Where is the best place to focus limited resources?
- Review builder's scope of work with individual trades to make sure key items are included



## **BUT I'M NOT PART OF THE DESIGN TEAM!**

**What are builders struggling with? What was the most challenging part of their last home?**

- Ventilation: The codes are confusing and the options are diverse
- Heating for low loads: Get estimated peak load early and help right-size the system approaches
- Water heating: Get the design team focused on location early

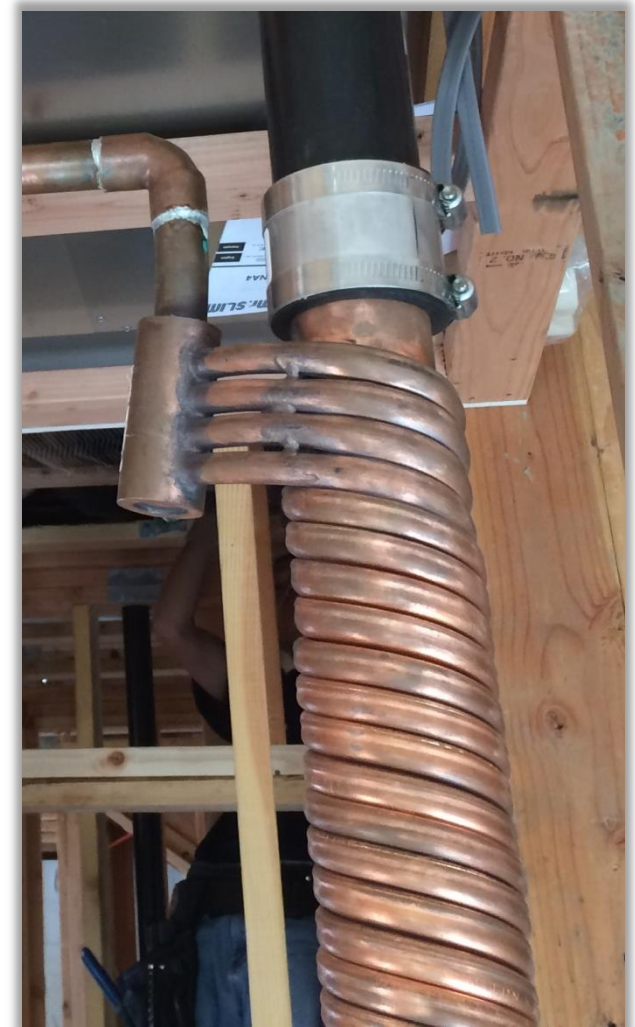
# HOT WATER EXAMPLES

## TIER 3 HEAT PUMP WATER HEATERS

- Where can I get them?
- Are rebates available?
- Are they ductable?

## DRAIN WASTE HEAT RECOVERY

- Is this a good alternative?
- How should I plumb this in?



# CASE STUDY HOT WATER DISTRIBUTION

## HOT WATER DISTRIBUTION

- Was the hot water system planned out?
- How much water is okay to waste?
- How long must Ms. Johnson wait for hot water?
- How much heat energy does that timered or constant recirculation system cost?

Pipe size	Gal per ft	Gal in 25'
3/8	0.006	0.15
1/2	0.010	0.25
3/4	0.023	0.58
1	0.041	1.025

## DEMAND-BASED RECIRCULATION

- When should you consider this system?
- Should I put in a dedicated return line as a backup?
- What are the best systems and plumbing strategies?

Controls a single (X1) load or pump  
model TLC-X1-115



# WHICH EXAMPLE IS BEST FOR PLUMBING DISCUSSION?

**DESIGN MEETING**

**SALES TEAM BUY IN**

**SCOPE OF WORK REVIEW**

**PRE-CONSTRUCTION (OR SEMI-ANNUAL) TRADES MEETINGS**

## OTHER COMMON EXAMPLES

### SPACE CONDITIONING FOR LOW-LOAD HOMES

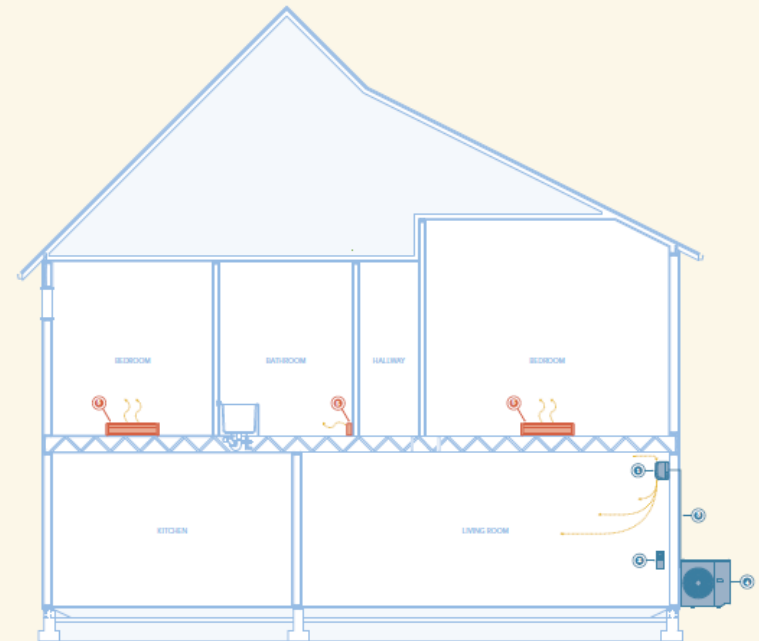
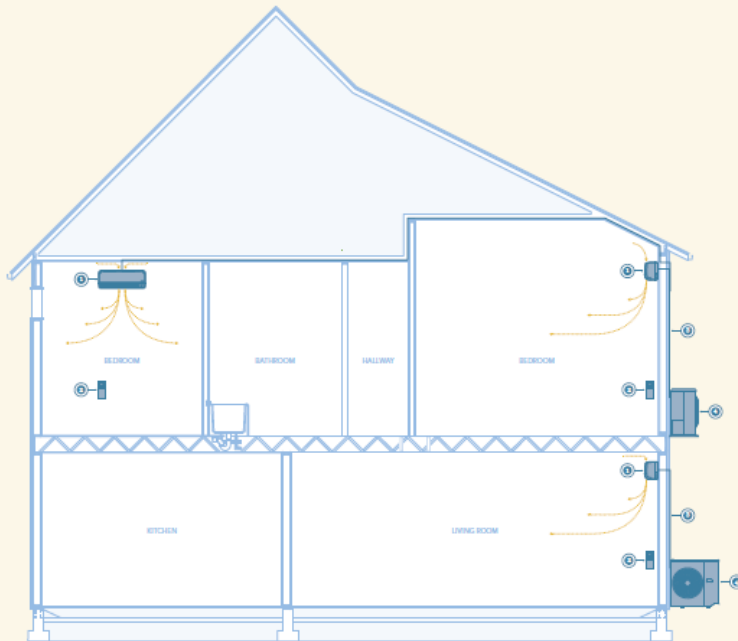
- Ducted or ductless mini-splits?
- What should I consider when going ductless?
- Should I pre-wire for backup heat?
- Are gas boilers and gas furnaces on the table?



# PROGRAM RESOURCES

Mini-split technology offers a new range of efficiency and comfort—benefits that previously required higher cost or added complexity. To help you determine which mini-split system is most appropriate for your efficient-home construction project, this guide presents four system options and their respective benefits and challenges.

## MINI-SPLIT TECHNOLOGY IN NEW CONSTRUCTION



### Thermal Penetration

Requiring special consideration when selecting the right heating and cooling system, a thermal peninsula is any room or extension of the home that has at least five sides facing the exterior. A thermal peninsula may require more heating or more cooling depending on which direction it faces.

To ensure thermal comfort, your system decisions must address special cases. For instance, rooms facing southeast may need increased cooling capacity, while rooms facing northeast will likely have greater heating capacity needs. Some rooms may require an additional ductless head or greater ducted capacity, depending on the system chosen.

### Thermal peninsulas may include:



L or T shaped house



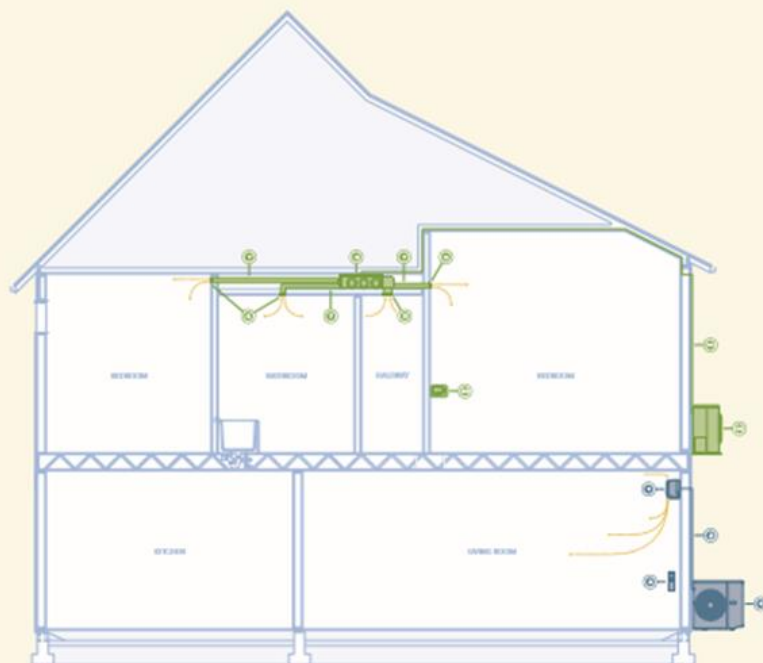
Corner rooms facing northeast or southeast



Room extension or finished room over garage



Extension or porch with 4 or 5 sides facing unconditioned space



### Ductless and Ducted Mini-Split Hybrid

#### ADVANTAGES

- Heating and cooling available in every room
- More energy efficient than most standard central heat pumps
- For more precise control, systems may run an separate outdoor unit, for more simplicity, systems may run on the same outdoor unit
- In ductless/ducted technology "heat faster"
- Unlike central/heating systems, ducted mini-splits can run easily in unconditioned spaces (including between floors, attics and basements)

#### CHALLENGES

- Higher installation cost
- More (less well-tuned) ducted technology
- Multiple systems on each floor may create a larger (than necessary) overall system and add complexity to controls
- Space needs and duct design for interior units and ducts in unconditioned spaces require very thorough planning during the design phase



### Ducted Mini-Split Only

#### ADVANTAGES

- Heating and cooling available in every room
- More energy efficient than most standard central heat pumps
- No visible units on heads
- Operates effectively in homes with complex, segmented and sloped floor plans
- Unlike central/heating systems, ducted mini-splits can run easily in unconditioned spaces (including between floors, attics and basements)

#### CHALLENGES

- Higher installation cost
- More (less well-tuned) ducted technology
- Air leakage and heat loss can result if ducts are located in unconditioned spaces
- Multiple systems on each floor may create a larger (than necessary) overall system and add complexity to controls
- Space needs and duct design for interior units and ducts in unconditioned spaces require very thorough planning during the design phase



# WHICH EXAMPLE IS BEST FOR DHP DISCUSSION?

**DESIGN MEETING**

**SALES TEAM BUY IN**

**SCOPE OF WORK REVIEW**

**PRE-CONSTRUCTION (OR SEMI-ANNUAL) TRADES MEETINGS**

# CASE STUDY: RANGE EXHAUST

## RANGE EXHAUST MAKE-UP AIR

Do yourself (and the fan) a favor and add some pressure relief.

- How will I predict the pressure effects of the range exhaust?
- How well will the hood function?
- Active or passive make-up air system?
- How do I temper the incoming air?

# RESOURCES

The NEEA Range Exhaust Calculator is used to compute the necessary amount of make-up air needed when a range exhaust is installed in the home and is vented to the outside

## How the calculator works:

- Enter values in the yellow cells only
- Enter total volume of conditioned space, ACH<sub>50</sub> target, and manufacturer's rated CFM of range exhaust
- The calculator will automatically de-rate manufacturer's rated flow rates to reflect impacts of static pressure
- The calculator will call out make-up air once pressure differential exceeds -15 Pa WRT outside. Required make-up air is based on returning the house to a pressure differential of <-10 Pa WRT outside
- Where the make-up air flow required is <10% of the range exhaust's rated flow, no make-up air provision is required

## Pilot requirements for range exhaust make-up air:

- Make-up air requirements specified by the Range Exhaust Calculator shall be installed in Phase III projects that are:
  - Building to the minimum requirements and installing a range exhaust with a rated flow  $\geq 400$  CFM
  - Building to the "Reach" specifications
  - Achieving an infiltration rate of  $\leq 2.0\text{ACH}_{50}$
- All range exhaust creating a pressure differential  $> -15$  Pa WRT outside require tempered (heated) make-up air as needed to reduce pressure differential to  $< -10$  Pa WRT outside
- Make-up air shall be interlocked with the range exhaust fan and have a motorized, gasketed damper to tightly seal when not in use
- Passive make-up systems delivering un-tempered air are allowed only in climate zone 4
- In climate zones 5 and 6, a thermostatically controlled electric resistance duct heater, with sufficient capacity to deliver air no cooler than 60°F at winter design conditions, shall be provided and set to temper incoming make-up air when outdoor ambient air temperature is below 45°F unless other means of tempering are available. These systems will likely require powered air delivery via a fan to operate.
- Make-up air shall be delivered to an area of the main body of the home that is not a high-occupancy area (kitchen, living room, rec room or similar) with sufficient distance from the range exhaust to prevent short circuiting
- The homeowner's operations manual will provide information on the make-up air system and the need to periodically examine and clean, as necessary, the inlet air screens for

### Enter values in yellow cells only

House Volume:	16000
ACH50 target:	2
Rated CFM of range exhaust:	400
Estimated CFM50 of house:	533
Resulting depressurization (Pa) when range exhaust is operating without makeup air:	11
Minimum makeup air require (CFM)*:	0

*\*This calculator is not intended to determine code compliance in your area. When makeup air is required by code in excess of amounts calculated here, code must be satisfied*

# WHICH EXAMPLE IS BEST FOR DHP DISCUSSION?

**DESIGN MEETING**

**SALES TEAM BUY IN**

**SCOPE OF WORK REVIEW**

**PRE-CONSTRUCTION (OR SEMI-ANNUAL) TRADES MEETINGS**

# WHOSE SCOPE ARE WE TALKING ABOUT?

- What's in ***your*** scope?
- Does the builder present you:
  - as an enforcement arm?
  - as a resource?
  - as a bridge to trades?
- What should be in your scope of work in order to do your job the best way possible?



# EXAMPLE: WHAT TO CONSIDER IN MAKING SURE YOUR SCOPE COVERS YOUR WORK

## PROCESS

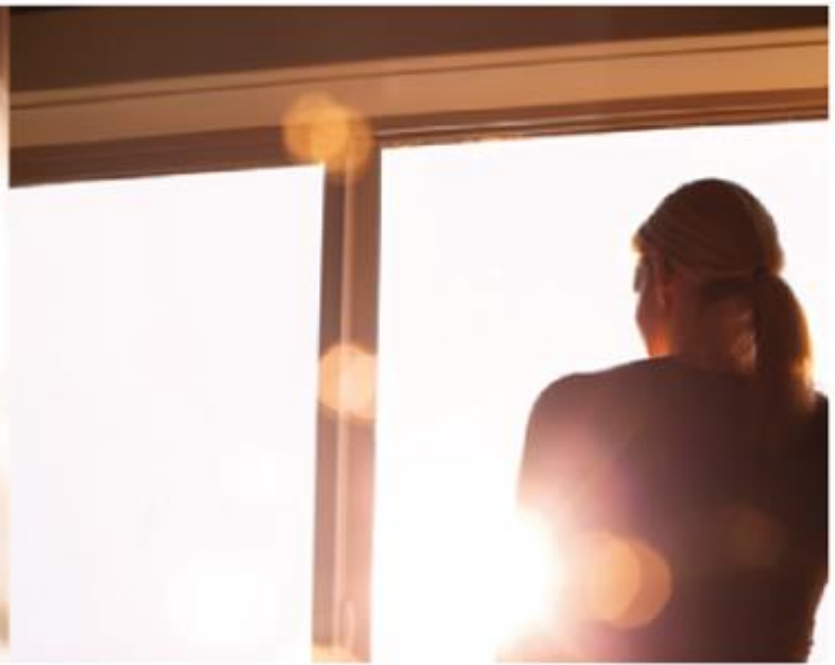
- Initial modeling
- Can you get the sales team on board?
- Blueprint phase
  - Envelope
  - Space conditioning and ventilation
- Pathways for certifications
  - Set up specific pathways
  - Manage choices and trade minimum requirements
- After construction completion—feedback loops
  - Cost data
  - Performance/billing data



# RESOURCES

## **BE THE EXPERT, OR FIND SOMEONE WHO IS**

- Somewhere, someone has done it. Call them.
- Partnerships with trades and manufacturers.
- Program and/or provider resources.
- [Building America Solution Center](#)



**Thank you!**

**Look for Dan and Preston on LinkedIn**

