Building the High Performance House

Beyond Code Programs That Give You and Your Customer The Edge

Part Three

Evaluating and Selecting a Path to Achieve a High-Performance House

- In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

- "This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors** continuing education requirements."

- For additional continuing education approvals, please see your credit tracking card.

Learning Objectives

1. Using experience from presenters and the audience, define what constitutes a standard code house compared with a house that goes beyond code.
2. Attendees will gain a good understanding of the content of programs presented.
3. Understand how the programs differ.
4. Enhance critical thinking skills to allow builders to determine which programs will further their goals.
5. Understand what overall components are necessary to achieve a high performance home.
6. Understand the overall importance of building high performance and low energy use homes.
7. Attendees will be able to define for themselves the five most important items that must be done to build a very efficient house.
8. Attendees will be able to identify upgrades that are consistent with building science principles.

Presenters

- Michael Resech
  - Residential Science Resources
- Pat Huelman
  - University of Minnesota Cold Climate Housing

Selecting a Pathway for Success

- Which program will give you the best path to where you want to go?
  - Where do you want to go?
  - Where are you starting from?

- From those answers, you can find the right path for you and your client.

Selecting a Pathway for Success

- First of all, do you need a program?

- If so, what do you need from the program …
  - design assistance?
  - technical guidance?
  - support in execution?
  - validation/certification?
  - marketing support?

General Program Considerations

- Good Design
  - Does the program provide incentives and support for good design?
  - Is the program too rigid, reducing design flexibility?
  - Does the program guard against poor design decisions?

Good Design

Utility Programs (in general)	NA
Green Path	NA
Energy Star v3	Some
DOE Zero Energy Ready Home	Some
LEED for Homes	Yes
Passive House (or PassivHaus)	Yes
DIY	???

General Program Considerations

- Levels of Affordability (for builder/owner)
  - Direct Program Costs
    - registration, documentation, and certification
  - Cost of Compliance (initial costs)
  - Cost of Operation (ongoing costs)
  - Cost of Ownership (life-cycle costs)

Direct Program Costs
Utility Programs

- HERS Rating
  - Builder contracts with a participating Rater
  - Performs 2 on-site inspections
  - Models predicted energy savings
  - Submits to Utility
- Rebates paid based on modeled results
  - In most cases will cover the cost of the rating
- Initial cost: $400-$650 for Rating
  - Typically results in a net benefit after rebate

Direct Program Costs
Green Path

- HERS Rating
  - Builder contracts with a participating Rater
  - Performance testing
  - Models HERS Index Score
- Certified Levels (Advanced and Master)
  - Rater completes checklists with Builder
- Initial cost: $650-$850 for Certified Levels

Direct Program Costs
ENERGY STAR

- Builder must become and ENERGY STAR partner
- HERS Rating
  - Additional Testing
    - Duct Leakage (Total)
    - Pressure Balancing
    - HVAC flows and pressure
- Credentialed HVAC Contractor
  - Online Orientation and Test
  - Certification: $600-$800 / Year

Direct Program Costs
ENERGY STAR

- Checklists
  - Rater Checklist
  - HVAC Checklist
- Initial cost: $750-$1200

Direct Program Costs
DOE Zero Energy Ready

- HERS Rating
- ENERGY STAR Certification
- Indoor airPLUS Certification
  - Additional Checklist
- PV Ready Checklist
- Initial cost: $950-$1500

Direct Program Costs
LEED for Homes

- “Energy Rater” inspections and testing
- 4 Certification levels
- Checklist based
  - Varies by level
- Data submission
- Initial cost: $3000-$7000
  - Can vary with required submittals

Direct Program Costs
PHIUS

- May enlist PH consultant
- ENERGY STAR Certification
- Additional site inspections
  - Multiple blower door tests
- Data submission
- Initial cost: $3000-$7000
  - Modeling and design assistance can add up

General Program Considerations

- Levels of Affordability (for builder/owner)
  - Direct Program Costs
    - registration, documentation, and certification
  - Cost of Compliance (initial costs)
  - Cost of Operation (ongoing costs)
  - Cost of Ownership (life-cycle costs)

Additional Cost for Compliance

- Utility Programs (in general) Low
- Green Path Low
- Energy Star v3 Low
- DOE Zero Energy Ready Home Medium
- LEED for Homes High
- Passive House (or PassivHaus) High
- DIY ???

Cost of Operation & Maintenance

- Utility Programs (in general)
  Medium
- Green Path — Medium
- Energy Star v3 — Medium
- DOE Zero Energy Ready Home — Low
- LEED for Homes — Low-Med
- Passive House (or PassivHaus) — Very Low
- DIY — ???

General Cost of Ownership

Utility Programs (in general)	Medium
Green Path	Medium
Energy Star v3	Medium
DOE Zero Energy Ready Home	Low - Med
LEED for Homes	???
Passive House (or PassivHaus)	???
DIY	???

Broad Technical Comparisons

- Broad Technical Requirements/Support
  - Systems-Guided
  - Solid Building Science Basis
  - Performance-Based
  - Documentation/Verification

Systems-Guided View

- Is the program grounded in a systems view?
- Can the program manage multiple criteria and trade-offs?
- Does it support an integrated design process?

Systems-Guided View

- Utility Programs (in general) No
- Green Path No
- Energy Star v3 Some
- DOE Zero Energy Ready Home Yes
- LEED for Homes Some
- Passive House (or PassivHaus) Yes
- DIY ???

Solid Building Science Basis

- Are program goals and targets based on solid building science principles?
- Do the steps and analysis assure positive and robust solutions?
- Does the program guard against poor building science decisions?

Solid Building Science Basis

- Utility Programs (in general) NA
- Green Path Some
- Energy Star v3 Some
- DOE Zero Energy Ready Home Yes
- LEED for Homes ???
- Passive House (or PassivHaus) Yes
- DIY ???

Performance-Based Approach

- Is the program primarily driven by overarching performance outcomes?

- Does the program incentivize performance targets and verification processes?

Performance-Based Approach

- Utility Programs (in general) Some
- Green Path Some
- Energy Star v3 Partially
- DOE Zero Energy Ready Home Mostly
- LEED for Homes Some
- Passive House (or PassivHaus) Yes

Documentation/Verification

- Document Verification
  - Design/Specification reviews
  - HERS Rating, etc.
  - Construction photo documentation
  - Certification by
    - Self-verification
    - Third party oversight

Documentation/Verification

- Performance Verification
  - Enclosure airtightness
  - HVAC testing
    - Heating
    - Cooling
    - Ventilation
  - Certification & Commissioning
    - Self-verification
    - Third party oversight

Documentation/Verification

- Utility Programs (in general) Low
- Green Path Low
- Energy Star v3 Low
- DOE Zero Energy Ready Home Medium
- LEED for Homes High
- Passive House (or PassivHaus) High
- DIY NA

Specific Technical Comparisons

- Structural Integrity
- Indoor Environmental Quality
- Building Durability/Longevity
- Resource Efficiency (energy & water)
- Material Resource Responsibility
- Disaster Resistance/Resiliency
- Adaptability

Structural Integrity

- Most of these programs don't go there!
- If your design, systems, and materials are within traditional boundaries, this is generally handled by code requirements
  - If not, engage a consultant/architect/engineer

Indoor Environmental Quality

- Does the program have a focus on pollutant avoidance?
- Does the program ensure a solid ventilation strategy with verification?
- Is proper operation and maintenance guidance provided to the occupant?

Indoor Environmental Quality

- Utility Programs (in general) NA
- Green Path Limited
- Energy Star v3 Some
- DOE Zero Energy Ready Home Yes
- LEED for Homes Some
- Passive House (or PassivHaus) Yes
- DIY No

Building Durability/Longevity

- Does the program provide guidance on robust building enclosures?
- Does the program support robust building systems?
- Does the program recognize robust components and equipment?

Building Durability/Longevity

- Utility Programs (in general) No
- Green Path Some
- Energy Star v3 Some
- DOE Zero Energy Ready Home Yes
- LEED for Homes Some
- Passive House (or PassivHaus) Some
- DIY ???

Resource Efficiency: Energy

- How strong is the emphasis on absolute energy reduction?
- Does the program guide you towards cost-effective energy strategies?

Resource Efficiency: Energy

- Utility Programs (in general) Low-Med
- Green Path Low-Med
- Energy Star v3 Low-Med
- DOE ZERH Med-High
- LEED for Homes Low-Med
- Passive House (or PassivHaus) High
- DIY ???

Resource Efficiency: Water

- Is water consumption and efficiency explicitly addressed?
- Does the program look at both indoor and outdoor water resources?

Resource Efficiency: Water

- Utility Programs (in general) — No
- Green Path — Some
- Energy Star v3 — No
- DOE Zero Energy Ready Home — Some
- LEED for Homes — Some
- Passive House (or PassivHaus) — Some
- DIY — ???

Material Responsibility

- How much focus is there on the specific products and materials used?
- Does the program explicitly evaluate the environmental impacts of material choices?
- Is there a cradle to grave approach to the material life cycle?

Material Responsibility

- Utility Programs (in general) No
- Green Path Limited
- Energy Star v3 No
- DOE Zero Energy Ready Home Some
- LEED for Homes Yes
- Passive House (or PassivHaus) Some
- DIY NA

Disaster Resistance/Resiliency

- Does the program encourage materials and systems that can go beyond typical or average conditions?
- Is it looking at how materials and systems can rebound from extreme events?
- What happens if the home loses key enclosure or mechanical systems?

Disaster Resistance/Resiliency

- Utility Programs (in general) No
- Green Path No
- Energy Star v3 No
- DOE Zero Energy Ready Home Some
- LEED for Homes Some
- Passive House (or PassivHaus) Some
- DIY ???

Adaptability

- Will the home be readily adaptable to future changes …
  - Occupant demands
  - Shifts in technology
- Does the program acknowledge the rate of change of critical components?
- Is long-term building flexibility encouraged?

Adaptability

- Utility Programs (in general) No
- Green Path No
- Energy Star v3 No
- DOE Zero Energy Ready Home No
- LEED for Homes Some
- Passive House (or PassivHaus) No
- DIY ???

In Review

- General Program Comparisons
  - Design
  - Affordability

In Review

- Broad Technical Comparison
  - Systems-Guided View
  - Solid Building Science Basis
  - Performance-Based
  - Documentation/Verification

In Review

- Specific Technical Comparisons
  - Structural Integrity
  - Indoor Environmental Quality
  - Building Durability/Longevity
  - Resource Efficiency (energy & water)
  - Material Resource Responsibility
  - Disaster Resistance/Resiliency
  - Adaptability

Any Clear Winners or Losers???

- No! They all have a place and can play a role in your move towards robust, high-performance homes.
- You must decide which one will help you successfully meet your needs and the needs of your clients.
  - The final choice will require additional critical thinking and education on your part.
  - But there is a large community that can help!

Contact Information

- Rachel Wagner
  - Wagner Zaun Architecture
  - http://www.wagnerzaun.com/
- Michael Resech
  - Residential Science Resources
  - Michael.Resech@residentialscience.com
- Pat Huelman
  - University of Minnesota Cold Climate Housing
  - phuelman@umn.edu
- Marilou Cheple
  - University of Minnesota Cold Climate Housing
  - mcheple@umn.edu