Strategies for Greening Affordable Housing Projects and Programs

Arriving at common sense and financially responsible design choices that are sustainable, resilient and possibly regenerative

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Welcome

Who is here?
- Nonprofit Developers?
- For-Profit Developers?
- Local Government Staff?
- Codes & Zoning Officials?
- Lenders?
- Other Funders?
- Others?

What are Your Questions?

- We’ll give you an idea of what we planned to present but we’re interested in what you want to learn.
- We are capable of going off-script.....
**Intro (Our agenda)**

So we asked ourselves…… what should we talk about?

• What are the benefits to Sustainability?
• What’s the worst thing that could happen going Green?
• What is Green / Sustainable / Resilient / Regenerative / etc?
• Is it worth the trouble?

Then we decided……..

• To assume that the participants will be intelligent and highly informed humans that know quite a bit about all of the catchwords like Green.
• To talk about something that may be less obvious.

**Intro (Our agenda)**

Here’s the question that we hope to answer.

• Is there a Design Process that is more likely to succeed if Green or Sustainability is your goal?

**Is Certification Important?**

• LEED
• Enterprise Green Communities (EGC)
• Others?
• LEED & EGC think Integrative Design is Important
  – IP Credit
  – Charrette Grants
What is Integrative Design?

... the key to cost-effective high performance green buildings

Problem: Buildings do not perform well for the occupants or the environment.

In order to change the outcome you need to change the process.

Integrative Design Process

Systems Integration:
- Holistic, non-linear
- Systems Thinking
- Focus on system interactions
- Emulate living systems
- Analysis/research driven design
  - Energy modeling
  - Daylighting modeling
  - Materials analysis and impacts
  - Green Building Rating Systems
Integrative Design Process

- System Interactions

How does your paint color selection affect HVAC costs?

Paint
Lighting
HVAC Sizing

Coefficients of Performance (HPH-08-259-EC VM Sep 2010)

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# of light fixtures = \( \text{footcandles x area x lumens} \times \text{LLF} \times \text{CU} \)

\( \cdot \) System Interactions

Reduction = 25%

Understanding the Parameters

Set a Goal

Analyze Design – Evaluate Options

Estimate Performance

Monitor/Benchmark Performance

Create Feedback Loops

Integrative Design Elements

Everybody Engaging Everything Early

Integrative Design Elements

Design Cost-Savings Opportunities

Costs rise if Ecological Design Solutions are addressed later in the Design Process

Slide by William G. Reed, AIA
Overview slide for this section

J. Poole, 5/23/2011
Integrative Design Elements

**MENTAL MODEL**
client, design and building team mindset, attitude and will

**PROCESS**
integrated, all parties engaged—system optimization through iterative analysis

**TOOLS**
metrics, benchmarks, modeling programs, analytical methods for materials and costing

**PRODUCTS/TECHNOLOGIES**
things and stuff - technologies and techniques

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**Nested Systems**

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**Systems Thinking**

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**Project aspirations and Alignment around purpose**

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**Conventional Team**  
**Integrative Team**
Integrative Design Elements

A process for discovering the mutually beneficial interrelationships between:

- Habitat
- Water
- Energy
- Materials

... for the purpose of participating in the health of the place

The Basic Elements of Integrative Design

- Fully engage Client in the design process
- Assemble the right team
- Facilitate co-learning

Part A: Discovery
- Align team around Purpose, Aspirations, Process
- Identify key systems / patterns of interrelationships
- Commit to specific, measurable goals
- Map the Integration Process

Part B: Design & Construction
- Iterate for synergy – workshops / research & analysis
- Conceptualize system designs – before Schematic Design begins
- Optimize components as interrelated systems
- Document system stories – BOD, OPR...Commissioning
- Partner with Builders

Part C: Occupancy & Operations
- Maintain, Monitor, and Measure systems performance – FOREVER
- Respond to feedback - adjust key aspects of systems
Greening a Housing Program

- Programs that include a pipeline of homes are different from a discrete "Project"
- Programs can benefit from standardization and more prescriptive approaches, especially if there are similarities in the housing stock

Integrative Design for Programs

As with Projects, it is all about planning

Ask yourself:
- Is the entire team engaged & committed?
- What are your program goals?
- What are the needs of your customers?
- Which Green methods and materials have the best cost/benefit ratio?
2 Examples of Green “Programs”

- Rochester NY
  - Greater Rochester Housing Partnership
- Los Angeles CA
  - Rebuilding Neighborhoods Los Angeles
- Both:
  - Relatively high-volume (100 to 300 projects)
  - Desired Green Communities Certification
  - Experienced a Charrette Process
  - Modeled “Typical” housing stock
  - Standardized their approaches and specifications with prescriptive Green measures
2 Examples of Green “Programs”

Green Communities Criteria is Comprehensive
1. Green Development Plan, (Integrative Design)
2. Site, Location & Neighborhood Fabric
3. Site Improvements
4. Water Conservation
5. Energy Efficiency
6. Materials Beneficial to the Environment
7. Healthy Living Environment
8. Operations and Maintenance

Rochester NY’s - Typical Houses

Rochester’s Key Strategies
The 4 strategies that always make sense regardless of the building type:
1. Air sealing
2. Duct sealing
3. Dense packing side walls with cellulose
4. Insulating the rim joist in the basement

Rochester’s Key Strategies
Examples of specialized strategies based the “Cape” building type:
1. Air sealing at the base of the knee wall
2. Containing the insulation in the vertical knee wall
3. Carefully insulating and ventilating the sloped portion of the ceiling
Los Angeles

- Had very similar housing stock in its target neighborhoods (1 story bungalows)
- Two Climate Zones
- Modelled two standard size bungalows in each of the climate zones

ACT² Homes Davis, CA

“...tunneling through the cost barrier”

- Add better insulation
- Add high performance windows
- Delete perimeter registers & horizontal ductwork
- Delete separate heating system
- Add heat recovery ventilation
- Add quick recovery hot water heater

Net Cost

Less than conventional first cost yet 60% more energy savings

$1.8K

$3.5K

$4K

$3.6K

$1.8K

$2K

Not Cost

$5K
Early Energy Modeling For the City-wide Programs

• The Rochester Program used the State’s approved Weatherization Program software
• We ran models for each of the building types with different combinations of treatments

Early Energy Modeling For the City-wide Programs

• The Los Angeles Program used REMRate the software used for ENERGY STAR certification
• Again, we ran models for each of the building types with different combinations of treatments

Los Angeles
Energy Modeling:
REMRate
Input Screen for Windows and Glass Doors

BEopt by National Renewable Energy Laboratory (NREL)

• 3D Modeling
• Fairly user friendly
• Free
• http://beopt.nrel.gov/
• Uses either DOE 2.2 or EnergyPlus as simulation engines
Mount Pleasant Net Zero Home

• 1,675 sf townhome
• 3 bedrooms, 1 full & 2 half baths
• Passive solar with slab
• R33 walls, R49 ceiling
• Super windows
• Tight with Ventilation Air Heat Recovery
• Ground-source heat pump
• 5.8 kilowatt PV system

• For sale at $159,900
System Operating Costs:

Ground-source Heat Pump:
- Non-HVAC electric: $335
- A/C: $43
- Fan: $20
- GSHP: $94
- TOTAL: $492

Gas-Fired Furnace:
- Base electric: $173
- A/C: $43
- Fan: $20
- Gas range/dryer: $65
- Furnace: $167
- TOTAL: $468

Floor plans of the Mt. Pleasant townhome
Mount Pleasant Net Zero Energy Home

Case Study – Petersburg Commons