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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Slide # 2

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Welcome

Who is here?

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

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What are Your Questions?

- We'll give you and idea of what we planned to present but we're interested in what you want to learn.
- We are capable of going off-script…..

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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?

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Intro (Our agenda)

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.

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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?

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Is Certification Important?

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

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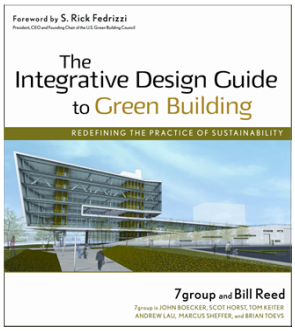
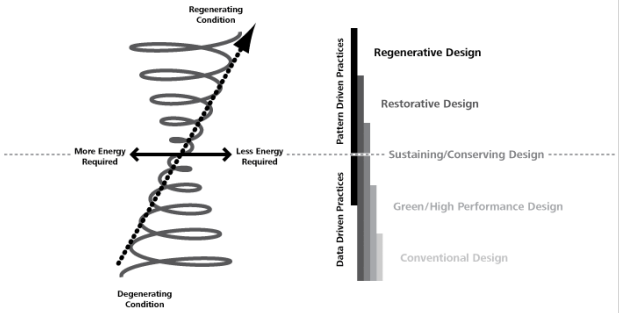
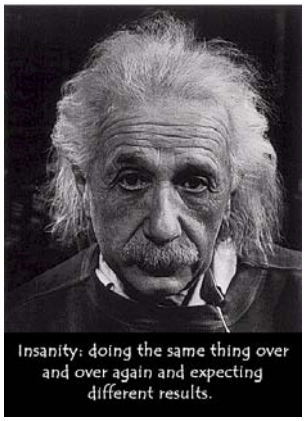
What is Integrative Design?



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

Trajectory of Integrative Thinking





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 Interations

How does your paint color selection affect HVAC costs?

Paint
Lighting
HVAC Sizing

Coefficients of Utilization PRU-9-A-04-2T8-SC-YMW-S-120
Floor effective floor cavity reflectance = .20

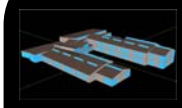
Ceiling	80				70				50			
Wall	70	50	30	10	70	50	30	10	50	30	10	
RCR 0	.72	.72	.72	.72	.62	.62	.62	.62	.43	.43	.43	
1	.66	.62	.60	.57	.56	.54	.52	.50	.37	.36	.35	
2	.60	.54	.50	.47	.51	.47	.43	.41	.33	.31	.29	
3	.54	.48	.43	.39	.46	.41	.37	.34	.29	.26	.24	
4	.49	.42	.37	.32	.42	.36	.32	.28	.25	.22	.20	
5	.45	.37	.32	.27	.39	.32	.28	.24	.23	.20	.17	
6	.41	.33	.28	.24	.35	.29	.24	.21	.20	.17	.15	
7	.38	.30	.24	.20	.33	.26	.21	.18	.18	.15	.13	
8	.35	.27	.21	.18	.30	.23	.19	.16	.16	.13	.11	
9	.33	.24	.19	.15	.28	.21	.17	.14	.15	.12	.10	
10	.30	.22	.17	.14	.26	.19	.15	.12	.13	.11	.09	

# of light fixtures = $\frac{\text{footcandles x area}}{\text{lumens x LLF x CU}}$

= 25% Reduction

JP1

Performance Based Integrative Process



Understand the Parameters

Set a Goal

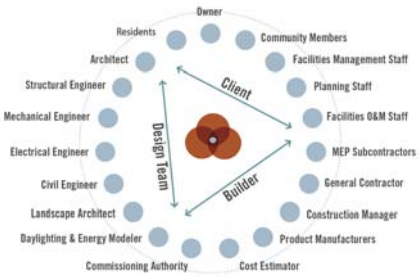
Analyze Design – Evaluate Options

Estimate Performance

Monitor/Benchmark Performance

Create Feedback Loops

Integrative Design Elements



Everybody

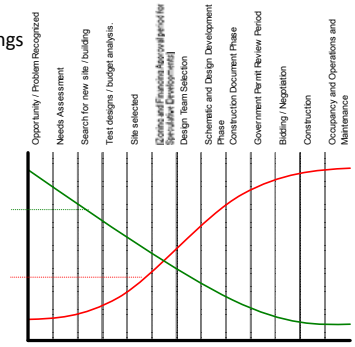
Engaging

Everything

Early

Integrative Design Elements

Design Cost-Savings Opportunities

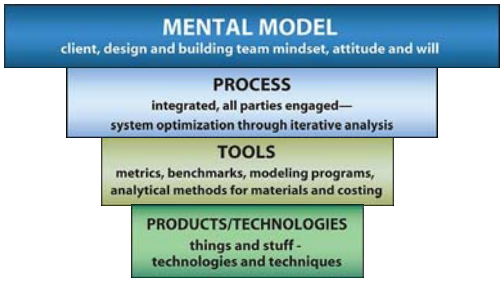


Slide by William G. Reed, AIA

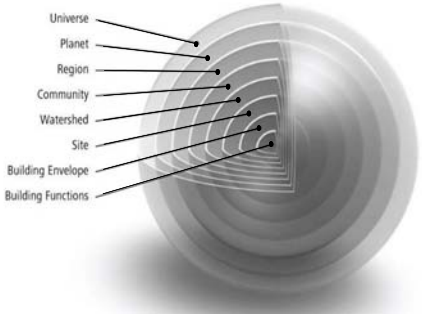
Slide 14

JP1 Overview slide for this section
J. Poole, 5/23/2011

Integrative Design Elements

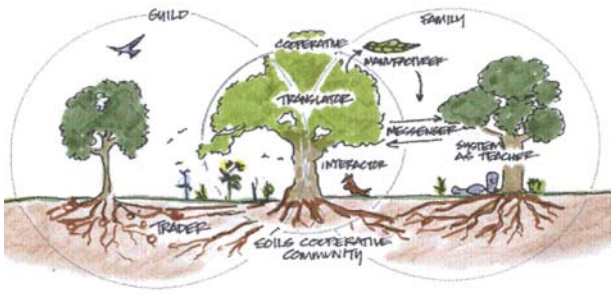


Integrative Design Elements



Nested Systems

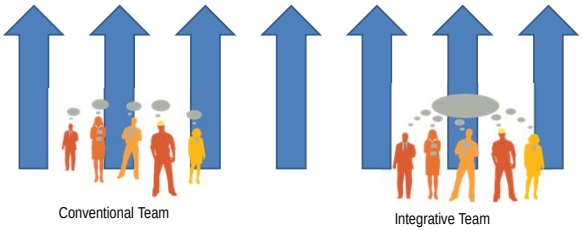
Integrative Design Elements



Systems Thinking

Integrative Design Elements

Project aspirations and Alignment around purpose



Conventional Team

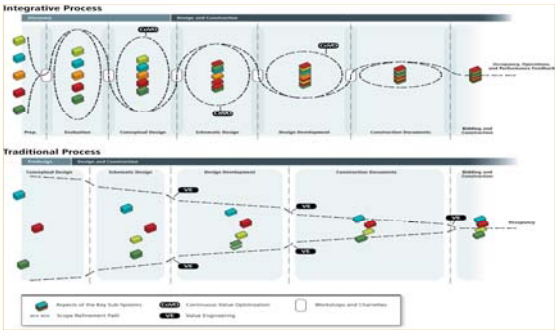
Integrative Team

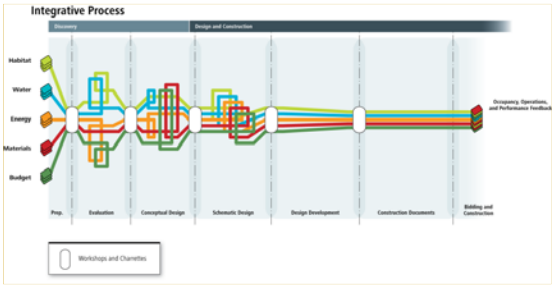
Integrative Design Elements

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

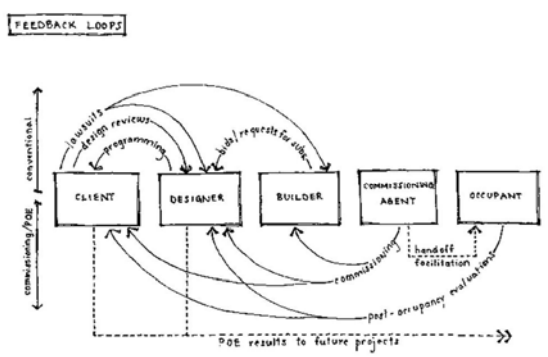
- Align team around Purpose, Aspirations, Process
- Identify key systems / patterns of interrelationships
- Commit to specific measurable goals
- Map the Integration Process

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



Environmental Building News graphic – buildinggreen.com

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, <u>especially</u> if there are similarities in the housing stock

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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?

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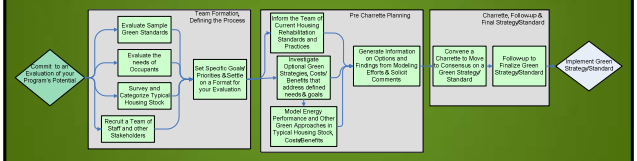
An Integrated Design Process for Housing Rehabilitation Programs



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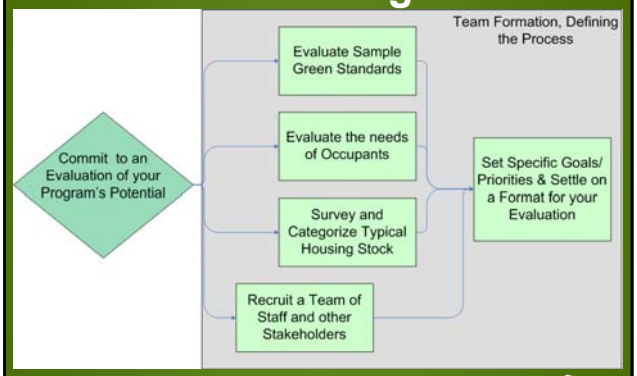
Initial Stage



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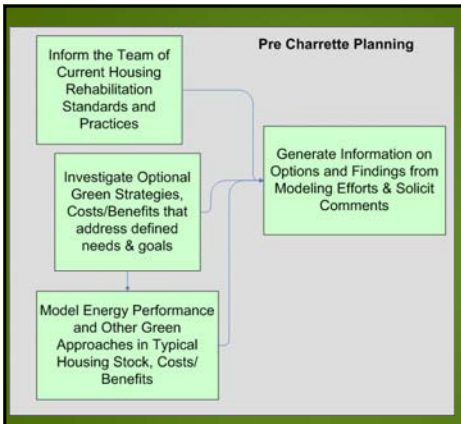
Mid-Stage Planning



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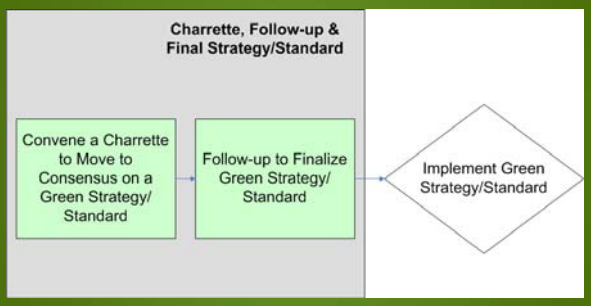
Charrette Stage



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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

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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

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Rochester NY's - Typical Houses

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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

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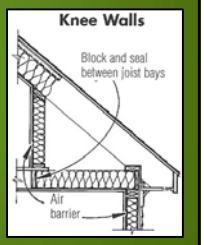
Rochester's Key Strategies

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



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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

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Los Angeles

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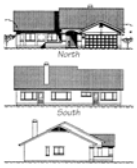
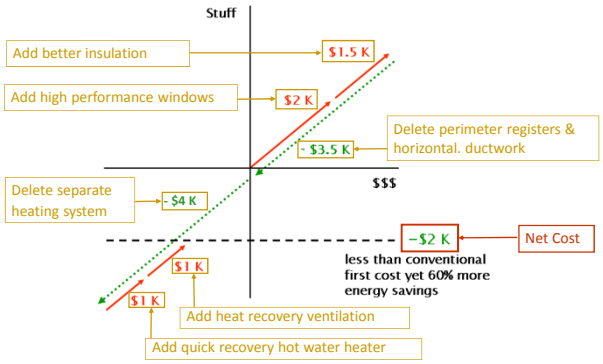
ACT^2 Homes Davis, CA



“. . . tunneling through the cost barrier”



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

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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

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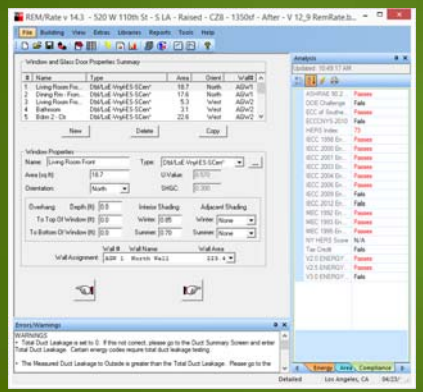
Los Angeles



Energy Modeling:

REMRate Input Screen for Windows and Glass Doors

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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

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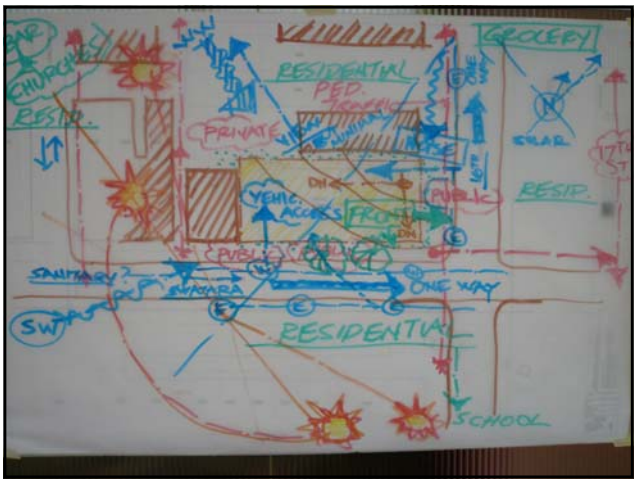
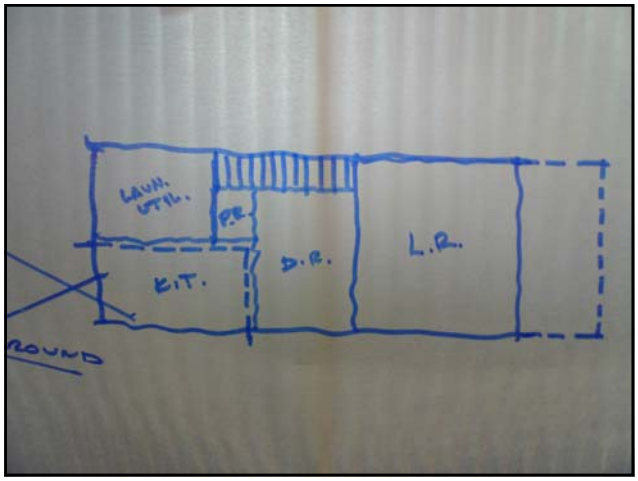
Mount Pleasant Net Zero Home

- 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



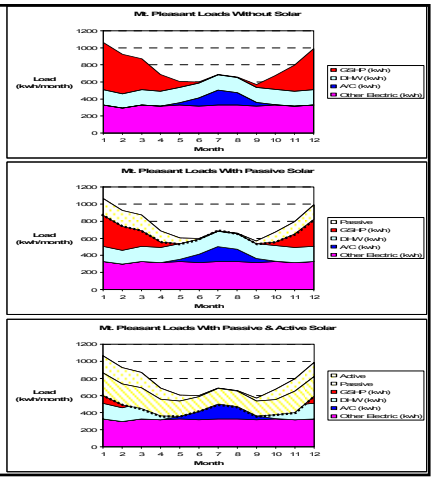


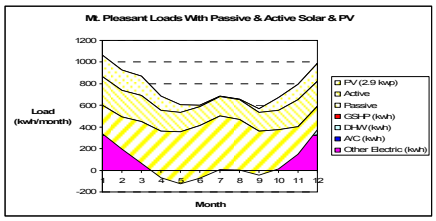
Mt. Pleasant Homes

Results 5/17/07

Zero-Energy Challenges:

1. Base load is significant, 320 kwh/month
2. Passive solar reduces space heat by 47%.
3. Active solar further reduces space heat and DHW load by 52%.
4. Total load reduction with solar thermal is 41%.
5. Daily load profiles affect PV buy-sell amounts.
6. A 3.8 kwp PV array will balance the electricity of the all-electric GSHP case. Cost ~$30,400. Area ~310 sq.ft.





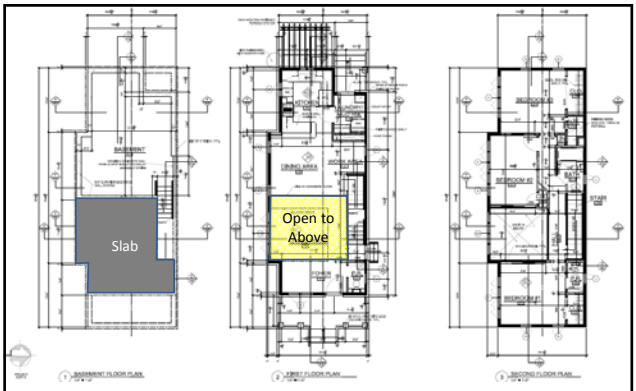
System Operating Costs:

Ground-source Heat Pump:

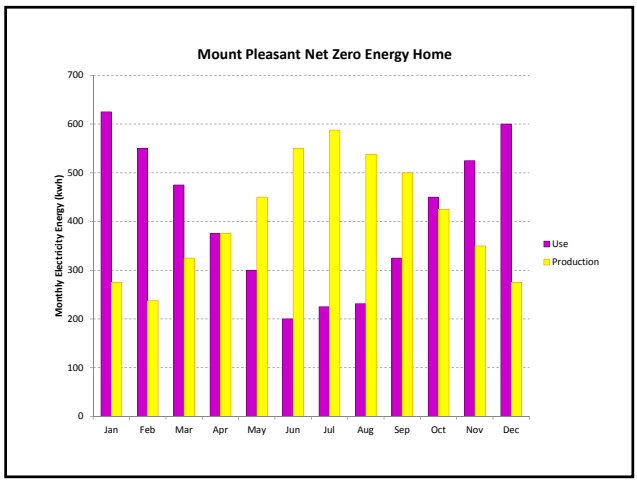
Non-HVAC electric:	$335
A/C	$ 43
Fan	$ 20
GSHP	$ 94
TOTAL	**$492**

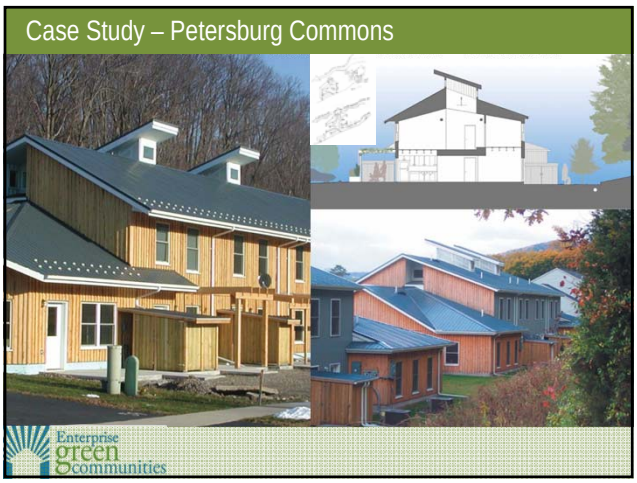
Gas-fired Furnace:

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
Monthly Electricity Energy (kwh)
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Use
Production


Case Study – Petersburg Commons
Enterprise
green
communities