Integrated Project Delivery
for Passive Houses & Net-Zero Homes

Why?

- The key to energy efficiency is **INTEGRATED PROJECT DELIVERY** (IPD)
- The key to IPD is revolutionary **CHANGE** to business as usual
- All green building professionals are **AGENTS OF CHANGE**
Effecting change ... EFFECTIVELY

- **New MINDSET** – reeducate
  - Public
  - Design professionals & students
  - Building professionals & trades
  - Finance and real estate professionals
  - Educators (yes, even them)
- **New PROCESSES** – revamp
  - Goal-setting
  - Design collaboration
  - Energy modeling
  - Construction
- **New TOOLS** – reevaluate and redesign
  - Energy models
  - Collaboration tools
- **New TECHNOLOGIES** ... *maybe?*

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Defining “Integrated”

An integrated project TEAM is one that is unified by coming together to work as a whole.

*and*

In an integrated building DESIGN, the building components and their interconnections are brought together into a unified whole.

**THIS**

[Image of people working together]

**THAT**

[Image of people running in a race]

**NOT**

[Image of people working together]
Integrated Processes

- Recognize that each aspect of building design & performance influences others
  - Envelope affects HVAC sizing
  - Windows affect lighting loads
  - Lighting affects cooling loads
  - Waste heat from one process can be pre-heating for another
- And so on …

Integrated Process Principles

1. If your PROCESS IS SOUND, good outcomes will follow.

2. A sound process, carried out by the RIGHT PEOPLE, all but guarantees a good project (or product).

3. The person left out is the one who will cause trouble.
Who are the RIGHT PEOPLE?

- Owner/developer
- Architect
- Contractor/builder, subs, WORKERS!
- MEP consultant, energy analyst
- Structural, interiors, lighting, landscape ...
- Renewables consultant/vendor

EE* is a Recessive Gene

*EE = ENERGY EFFICIENCY

EE Design + EE Construction = EE Buildings

[ORDINARY] Design + EE Construction ≠ EE Buildings
EE Design + [ORDINARY] Construction ≠ EE Buildings
What’s a SOUND PROCESS?

1. Set goals – net-zero definition and project boundary or scope – and priorities.
2. Build a qualified team.
3. Engage whole team with charrette(s).
4. Promote teamwork as you work through the design.
5. Model energy use early and often.

<table>
<thead>
<tr>
<th>TYPICAL INTERACTIONS REQUIRING INTEGRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscape Architect</td>
</tr>
<tr>
<td>Landscape design/shading</td>
</tr>
<tr>
<td>Hot water distribution</td>
</tr>
<tr>
<td>Water heating system</td>
</tr>
<tr>
<td>Ventilation / air quality</td>
</tr>
<tr>
<td>Heating &amp; cooling system(s)</td>
</tr>
<tr>
<td>Materials selection</td>
</tr>
</tbody>
</table>

Based on Figure 3-6 (p. 63), Energy Free: Homes for a Small Planet

Launching an Integrated Process

- Ensure owner’s commitment to an integrated process
- Hold a charrette
- Establish communication protocols
- Meet regularly
- Identify responsibilities and interactions for all parties
The KEY to Integrated Processes is ENERGY MODELING...

WELL, OK, it’s ONE key!

Never mind code compliance – modeling is a DESIGN OPTIMIZATION tool!

Integrated Process Steps

OWNER COMMITS TO IPD → ASSEMBLE TEAM → CHARRETTE → SCHEMATIC DESIGN → ENERGY MODEL → DESIGN CHARRETTE → DEVELOPMENT → CHARRETTE
Integrated Process Benefits

“Integrated design can reduce construction cost while providing significant sustainable design benefits. On the CSU [California State University] Monterey Bay Library, by comparing a number of integrated structural, mechanical, and architectural schemes, we found that tradeoffs from one discipline more than offset added costs in another, while achieving energy savings of almost 40 percent.”

~ Scott Shell, EHDD Architects

Integrated Processes
Save time and money

INTEGRATED DESIGN ACCORDING TO IBACOS

INTEGRATED DESIGN SAVINGS

Figure 3.7 (p. 69), Energy Free: Homes for a Small Planet
Why Integration Works
Common understanding develops EARLY!

Business as usual

Integrated project delivery

Figure 3-1 (p. 48), Energy Free Homes for a Small Planet
Original graphs courtesy of Will Lichtig

Another Perspective

Ability to influence design & construction performance is a function of:

- Degree of integration (i.e., when involvement starts)
- Ownership structure
Conventional Process

- ** Developer-driven (owner ≠ occupant) **
- ** Occupant-driven (owner = occupant) **

Integrated Process

**Problem:** Contractors are not involved until late in the process

**Problem:** Contractors are pressured for lowest bid

**What's the Solution?**

- How can contractors get involved early?
- How do we get past design-bid-build?
Integrated Design

- Develop a design concept
- Test alternatives using parametric analysis – evaluate effect of one variable at a time on:
  - energy performance
  - constructability & cost
  - other aspects of design
- Test different combinations

Integrated Design

Save time and money – optimize PACKAGES

“Tunnel through the Cost Barrier”

Figure 2.1 (p. 21), Energy Free: Homes for a Small Planet
## Information Resources

### Use research to MAXIMIZE VALUE

<table>
<thead>
<tr>
<th>BUILDING AMERICA 50% Savings Packages</th>
<th>MARINE CLIMATE (Seattle, San Francisco)</th>
<th>HOT/MIXED DRY (Phoenix, Palm Desert)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDD / CDD</td>
<td>4,854 / 191</td>
<td>1,117 / 3,886</td>
</tr>
<tr>
<td>Wall assembly</td>
<td>2x6, R-21 cavity + 1.5&quot; continuous insulation</td>
<td>2x6, R-21 cavity</td>
</tr>
<tr>
<td>Ceiling assembly</td>
<td>R-50</td>
<td>R-30</td>
</tr>
<tr>
<td>SLA / ACH50</td>
<td>.00015 / 2.6</td>
<td>.0003 / 5.3</td>
</tr>
<tr>
<td>Glazing</td>
<td>Low-E, standard SHGC, argon fill (U-0.29, SHGC 0.30)</td>
<td>Low-E, standard SHGC (U-0.30, SHGC 0.26)</td>
</tr>
<tr>
<td>Air conditioning</td>
<td>SEER 15+</td>
<td>SEER 13</td>
</tr>
<tr>
<td>Heating</td>
<td>AFUE 90+ furnace or HSPF 8.8+ heat pump</td>
<td>AFUE 80 furnace or HSPF 8.1 heat pump</td>
</tr>
<tr>
<td>Water heating</td>
<td>gas tankless EF 0.8+ or premium electric EF 0.95+ 64-sf closed-loop solar thermal system</td>
<td>gas tankless EF 0.8+ or electric EF 0.9+</td>
</tr>
</tbody>
</table>

Excerpted from Figure 2-17 (p. 43), Energy Free: Homes for a Small Planet

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## Information Resources

### Save $, don’t reinvent the wheel!

- Building America (50% savings packages)
- BuildingGreen.com
- GreenBuildingAdvisor.com
- National Renewable Energy Laboratory (NREL.gov)
- Florida Solar Energy Center (FSEC.ucf.edu)
- BuildingScience.com
Collaboration Tools

- MindManager
- BASECAMP
- CENTRAL DESKTOP

Meeting Resources

- Scheduling
  - Doodle.com
- Calling + remote desktop sharing
  - Skype
- Web-based meetings
  - Webex
  - GoToMeeting
  - Adobe Connect
Financial Resources

Charrette incentive: 50% up to $5,000 (10+ units)

Roundtable facilitated by program staff

$5,000 charrette grant for affordable housing

Database of State Incentives for Renewables and Efficiency

Thank you!

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