The Risky Business of Integrative Pre-Design

Friday, March 9th, Session 4

John Beeson, RA, NCARB, LEED-AP BD+C, EBOM
LEED Certified Reviewer, BREEAM In-Use Assessor,
Green Mystic in Residence

john@catalyst-partners.com
Our mission is simple:

*We are committed to the creation of places where all species can flourish.*
Learning Objectives:

1. Identify challenges caused by the traditional design process and ways to move past them with a whole systems thinking approach.

2. Meet these challenges by implementing an IDP mindset for the project team by applying the framework of the ANSI Standard for IDP and ASHRAE Standard 209.

3. Describe WHAT Integrative Pre-Design is, WHY it is vital to the overall Integrative Design Process, WHO the key team members and roles are, HOW it can solidify the project team’s ability to successfully deliver high performance buildings.

4. Identify the benefits of implementing Integrative Pre-Design on projects and the risks of not making mistakes fast enough.
OUR TIME:

1. BACKGROUND: HOW ARE WE WORKING NOW?
2. CHALLENGES
3. THE PLAN FOR ACTION: IDP & ASHRAE 209
4. INTEGRATIVE PRE-DESIGN
HOW ARE WE WORKING NOW?

All values $\times 10^{15}$ Btu ($2.12 \times 10^{15}$ Btu = $10^6$ bbl/day oil)

Total energy consumption $= 67.5 \times 10^{15}$ Btu
Estimated U.S. Energy Consumption in 2016: 97.3 Quads

Solar 0.587
Nuclear 8.42
Hydro 2.48
Wind 2.11
Geothermal 0.23
Natural Gas 26.5
Coal 14.2
Biomass 4.75
Petroleum 36.9

Electricity Generation 37.6
Net Electricity Impacts 0.08

Residential 11.0
Commercial 9.02
Industrial 24.5
Transportation 27.9

Rejected Energy 66.4

Energy Services 30.0

Sources: LLNL March, 2017. Data is based on DOE/EIA NER (2016). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. This chart was revised in 2017 to reflect changes made in mid-2016 to the Energy Information Administration's analysis methodology and reporting. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 21% for the transportation sector, and 49% for the industrial sector which was updated in 2017 to reflect DOE’s analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LLNL-EL-410557
U.S. Building Industry Impacts

U.S. Building Impacts:

- 12% water use
- 39% CO₂ emissions
- 65% waste output
- 71% electricity consumption

United States Green Building Council (USGBC)
YOU WANT COAL? WE OWN THE MINES.

YOU WANT OIL AND GAS?

WE OWN THE WELLS.

YOU WANT NUCLEAR ENERGY?

BIG OIL

WE OWN THE URANIUM.

YOU WANT SOLAR POWER?

WE OWN THE ER...AH...

SOLAR POWER ISN'T FEASIBLE.

Cartoon from about 1979...
LISA, IF WE START CONSERVING THE ENVIRONMENTALISTS WIN.
So, what is really going on here and what does this have to do with us?

Everything!
TRADITIONAL PROJECT DELIVERY

> Timeline <
WORK PLANNING IN THE COMPUTER AGE: DECISION-MAKING AND TEAM FOCUSED

Pro-action

Work Distribution

Reaction

TRADITIONAL WORK PLANNING: TASK FOCUSED

- Decision-Making Focused
- Task Focused
- Often . . . Reality (Human Nature)
grape-nuts
TRADITIONAL PROJECT DELIVERY

> Challenges <

• Assumes all buildings are roughly equal in complexity and technical challenge
• Assumes that the team will self organize and do that multiple times
• Design, Construction, and Ownership are separated and segregated
• The players are motivated to ‘perfect’ their area of expertise
• True / Total ‘Costs’ identified late –especially energy

RESULT: Missed schedules, Busted budgets, LEED/green too costly
Not an option?
Addressing these Challenges
HOW THE WORLD HAS CHANGED
“In this current economy, the winners will be the re-thinkers, not the re-trenchers.”

- Roger Martin, Dean of the Rotman School of Management
Contractor sued us

Choose between
- Quality
- Budget
- Schedule

Managers
Directed by fear and resentment

OLD WORLD

Everyone in the food chain is going to sue us
You get all three
Managers (Leaders)
- Teach
- Enable
- Coach

NEW WORLD
OLD WORLD

Discipline silos
- What is most important for me and my discipline?

Benchmark against competition
- We’re no worse than the other guy
- Why should we work to improve

Blame people

NEW WORLD

Interdisciplinary teams
- What is most efficient for the project?

Benchmark against perfection
- Continual improvement strategy

Root cause analysis
- The power of 5 whys
OLD WORLD

We’ll let the checker pick it up
We’ll get it in the addendum
We’ll pick it up in a bulletin
We’ll answer the RFI
We’ll get it right during the claim

NEW WORLD

We don’t move on until it is right
The checker’s role is perfunctory
I can’t remember the last addendum
What’s a claim?
OLD WORLD

Well, we had a seminar on quality

I sent an e-mail about quality

We threw a party and talked about quality

I do want better quality

How do we measure quality?

There is a quality guru

NEW WORLD

I talk to my staff everyday about quality

I search out those who exhibit the behaviors on quality I want

I continually search for ways to improve

Everyday I provide feedback

I can see improvement in quality

We are all responsible for quality
It's a Trap
Natural Systems as Our Model

Image from Biohabitats, Inc.
“Design is not a plan for decoration. Design is a plan for action.”

-Brian Collins, executive creative, Ogilvy and Mather
THE PLAN FOR ACTION
WHY THE IDP?
“When just 1 percent of a project's up front costs are spent... up to 70 percent of its life cycle costs may already be committed.”

—Joseph Romm
ADDRESSING THESE CHALLENGES
THE INTEGRATIVE PROCESS
+
ASHRAE STANDARD 209
THE INTEGRATIVE PROCESS
+
ASHRAE STANDARD 209
INTEGRATIVE PROCESS

> ANSI Standard <

**Key Components:**

- Building the Appropriate Team
- Early Effort
- Whole Systems Thinking
- Make Mistakes Faster
- Iterative
- Appropriate & Timely Engagement
- Mindset
INTEGRATIVE PROCESS

noun.
1. an iterative, collaborative approach that involves a project's stakeholders in the process from visioning through completion of construction and throughout building operation.
WHAT IS THE INTEGRATIVE PROCESS? ... begin with definitions

Integrate:
to make into a whole by bringing all parts together; unify

Whole:
containing all components;
complete; not injured

Heal:
to make whole*

Are we healing?
Are we wholing?

** from the Proto-Germanic khailaz, meaning “to make whole,” which is the source of the Old English haelan, meaning “make whole, sound, and well.”
*** attributed to John Boecker, 7Group
“Value engineering” performed here

Integrative Design or IPD moves the decision earlier when the matter the most

Ability to impact project
Cost, function, and performance

Cost of design changes

IPD Effort

Typical Effort

“Traditional”
WHAT IS THE STYLE OF YOUR CLIENT & HOW DO YOU BUILD YOUR TEAM?
A WHOLE BUILDING/SYSTEM MINDSET
Buildings are not a set of unrelated components; buildings are similar to living organisms with multiple systems that work together.

Using a holistic approach we can optimize and possibly even eliminate entire systems.
THE INTEGRATIVE DESIGN PROCESS

> as much a Mindset as it is a Process <

Get engaged.  
Don’t be afraid.  
Unlearn to learn.  
Change is possible.  
Stay flexible.  
Pay out.  
Not for everybody.
## THE INTEGRATIVE DESIGN PROCESS

> as much a Mindset as it is a Process <

<table>
<thead>
<tr>
<th>Mindset</th>
<th>Principle</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclusion and collaboration</td>
<td>Broad collaborative team</td>
<td>Careful team formation</td>
</tr>
<tr>
<td>Outcome oriented</td>
<td>Well-defined scope, vision, goals, and objectives</td>
<td>Team building</td>
</tr>
<tr>
<td>Trust and transparency</td>
<td>Effective and open communication</td>
<td>Facilitation training for team</td>
</tr>
<tr>
<td>Open-mindedness and creativity</td>
<td>Innovation and synthesis</td>
<td>Expert facilitation</td>
</tr>
<tr>
<td>Rigour and attention to detail</td>
<td>Systematic decision making</td>
<td>Visioning charrettes (with comprehensive preparation)</td>
</tr>
<tr>
<td>Continuous learning and improvement</td>
<td>Iterative process with feedback cycles</td>
<td>Brainstorming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goals and targets matrix</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decision-making tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-occupancy evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Comprehensive commissioning</td>
</tr>
</tbody>
</table>
Accountability:

An attitude of continually asking “what else can I do to rise above my circumstances and achieve the results I desire?”

Seeing it, owning it, solving it and doing it.
The Benefits

- Hear from all voices
- Map the process with milestones
- Add value in process
- Benefit all phases with life cycle approach
- Use resources efficiently (energy/water)
- Achieve higher value building
- Reduce costs
- Reduce change orders
THE INTEGRATIVE DESIGN PROCESS

> key principles <

• Mutual Respect & Trust
• Mutual Benefit & Reward
• Collaborative Innovation & Decision Making
• Early Involvement of Key Participants
• Early Goal Definition
• Intensified Planning
• Open Communication
• Appropriate Technology
• Organization & Leadership
THE INTEGRATIVE PROCESS
+
ASHRAE STANDARD 209
THE INTEGRATIVE PROCESS

+

ASHRAE STANDARD 209
A Brief History of Energy Modeling

- **Mechanical System Sizing (Peak Loads)**
  - How big are loads?
  - Do I need 4 tons or 8 tons of cooling?
- **Comparing strategies, (Energy Conservation Measures, EEM/ECMs)**
  - Is it better to insulate more or upgrade the boiler efficiency?
- **Compliance**
  - Is my building at least as good as a prescriptive code building??
- **Prediction**
  - Will the design and operations be able to meet 40 kBtu/sf/year?
- **Design**
  - What quality/quantity of daylight does each space have?
  - Do I need more shading?

- **Late in Design Phase**
- **Middle of Design Phase**
- **Approved**
- **ASHRAE 90.1 LEED Energy Code**
  - Usually late in Design Phase
- **Throughout Design Phases**
- **Early Design Phase, Testing Geometry**

This is the only one that typically addresses/compares geometry and passive systems.
ASHRAE Proposed Standard 209

Key Components:

- Informative Modeling
- Upfront Effort
- Alignment with IDP
- Early Problem Solving related to Cost Impacts
- Keep pace with energy efficiency demands
Why Create Standard 209?

- Until recently, new technologies have allowed new building designs to keep up with current energy standards, codes, and rating systems with *minimal effort or expertise*; e.g. LED lighting and auto dealerships, chilled beams, GSHP, etc.

- However, new technologies are no longer keeping pace with demands for increased energy efficiency in buildings; e.g., ASHRAE 90.1, LEED v4, Architecture 2030, LBC, etc.

<table>
<thead>
<tr>
<th>Location</th>
<th>Annual Energy use (kBTu - per LEED submittal)</th>
<th>Modeled Area (sf - per LEED submittal)</th>
<th>Site EUI (kbtu/sf)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamilton SC</td>
<td>1891070</td>
<td>23053</td>
<td>82</td>
</tr>
<tr>
<td>Livonia SC</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Bad Axe SC</td>
<td>424,000</td>
<td>7,131</td>
<td>48</td>
</tr>
<tr>
<td>Jackson Innovation Center</td>
<td>1,254,000</td>
<td>26,249</td>
<td>50</td>
</tr>
<tr>
<td>Clare SC</td>
<td>866,440</td>
<td>17,199</td>
<td>50</td>
</tr>
<tr>
<td>Employee Development Center</td>
<td>2,221,000</td>
<td>31,385</td>
<td>70</td>
</tr>
</tbody>
</table>

*The form states EUI of 76.05, but that was based on 24,866 sf.*

*The form states EUI of 45.7, but that was based on 18,948 sf.*
Current Practices/Future Needs

- Most projects do NO energy modeling; e.g., strip malls, design/build, small, etc.
- Most projects that DO include energy modeling include only compliance models.
- Energy models cost about the same, whether for compliance or to inform design.*
- Energy models are more valuable the earlier they are included in the design.

*If done wisely. While costs are similar, some costs are incurred earlier in the process.
According to the AIA's presentation on the Integrative Project Delivery Process, the Orcutt-Wislow Partnership reported the following:

“We have found that when we've completed the design development phase, we're already close to 60% finished with construction documentation.”

INTEGRATING ENERGY MODELING IN THE DESIGN PROCESS
Modeling Cycles of Standard 209

Design-Phase Modeling Cycles

- Conceptual Design
  - Simple Box Modeling
  - Conceptual Design Modeling

- Schematic Design
  - Load Reduction Modeling
  - HVAC System Selection

- Design Development
  - Design Refinement
  - Integration & Optimization

- Construction Documents
  - Energy-Simulation-Aided Value Engineering
TYPICAL TIME (FEE) SPEND WITHIN THE TYPICAL PHASES OF THE DESIGN PROCESS

USE OF ‘ENERGY’ (PERFORMANCE) MODELING AS PART OF THE DESIGN PROCESS
HOW DO YOU DELIVER?
<table>
<thead>
<tr>
<th>Discovery</th>
<th>Design and Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep.</td>
<td>Conceptual Design</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Schematic Design</td>
</tr>
<tr>
<td></td>
<td>Design Development</td>
</tr>
<tr>
<td></td>
<td>Construction Documents</td>
</tr>
<tr>
<td></td>
<td>Bidding and Construction</td>
</tr>
</tbody>
</table>

- **Aspects of the Key Sub-Systems**
- **CoVo**: Continuous Value Optimization
- **Scope Refinement Path**
- **Workshops and Charrettes**

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**Occupy, Operations, and Performance Feedback**
Phase One: Pre-Design
DELIVERING AN INTEGRATIVE PROJECT:

DISCOVERY

- Proposal
- Phase One: Pre-Design
- Phase Two: Schematic Design

Phase Three: Design Development
Phase Four: Construction Documentation
Phase Five: Bidding, Construction, Commissioning
Phase Six: Building Operation
Phase Seven: Post-Occupancy Tools
DELIVERING AN INTEGRATIVE PROJECT:

Proposal
Phase One: Pre-Design
Phase Two: Schematic Design

DESIGN & CONSTRUCTION

Phase Three: Design Development
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DELIVERING AN INTEGRATIVE PROJECT:

Proposal
Phase One: Pre-Design
Phase Two: Schematic Design

Phase Three: Design Development
Phase Four: Construction Documentation
Phase Five: Bidding, Construction, Commissioning

OCCUPANCY (OPERATIONS)

Phase Six: Building Operation
Phase Seven: Post-Occupancy Tools
DISCOVERY
(PRE-DESIGN)
(Schematic Design)
Integrative Pre-Design
DELIVERING AN INTEGRATIVE PROJECT:

DISCOVERY

Proposal

Phase One: Pre-Design
Phase Two: Schematic Design

Phase Three: Design Development
Phase Four: Construction Documentation
Phase Five: Bidding, Construction, Commissioning
Phase Six: Building Operation
Phase Seven: Post-Occupancy Tools
In cost, function, and performance, "Value engineering" performed here.

Integrative Design or IPD moves the decision earlier when it matters the most.

Cost of design changes increases as the project progresses through construction documents, tendering, and construction.

IPD Effort and Typical Effort are depicted in the diagram with different effort levels at various stages of the project lifecycle.
**PHASE ONE: PRE-DESIGN**

> Conceptualization [expanded programming] <

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vision statement, goals and targets matrix</td>
<td>Coordinate the team:</td>
</tr>
<tr>
<td>• Pre-design report including charrette synopsis</td>
<td>• Bring together a diverse and knowledgeable team</td>
</tr>
<tr>
<td>• Preliminary budget including cost of IDP activities such as energy modeling</td>
<td>• Appoint an IDP Facilitator and/or Champion</td>
</tr>
<tr>
<td>• Established communication pathways</td>
<td>Establish a foundation:</td>
</tr>
<tr>
<td></td>
<td>• Set fees to provide appropriate incentives to the design team</td>
</tr>
<tr>
<td></td>
<td>Plan key meetings:</td>
</tr>
<tr>
<td></td>
<td>• Charrette preparation</td>
</tr>
<tr>
<td></td>
<td>• Host visioning charrette or workshop</td>
</tr>
<tr>
<td></td>
<td>• Programming meeting</td>
</tr>
<tr>
<td></td>
<td>• Facilities management meeting</td>
</tr>
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<td></td>
<td>• Partnership meetings</td>
</tr>
</tbody>
</table>
## PHASE TWO: SCHEMATIC DESIGN

*Criteria Design [Expanded Schematic Design]*

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>- Goals and targets matrix</td>
<td>Coordinate the team:</td>
</tr>
<tr>
<td>- Preliminary energy analysis</td>
<td>- Enhance team cohesiveness and confirm team values</td>
</tr>
<tr>
<td>- Preliminary financial estimate</td>
<td>- Encourage a team mindset supporting creativity and systems thinking</td>
</tr>
<tr>
<td>- Schematic Design report</td>
<td>Establish a foundation:</td>
</tr>
<tr>
<td>- Roles and responsibilities matrix</td>
<td>- Keep the project’s vision and goals at hand</td>
</tr>
<tr>
<td></td>
<td>- Have a clear understanding of site challenges and opportunities</td>
</tr>
<tr>
<td></td>
<td>- Ensure the functional program requirements and its implications for</td>
</tr>
<tr>
<td></td>
<td>all disciplines are understood</td>
</tr>
<tr>
<td></td>
<td>Plan key meetings:</td>
</tr>
<tr>
<td></td>
<td>- Host design charrettes and workshops to brainstorm ideas, develop</td>
</tr>
<tr>
<td></td>
<td>concepts, evaluate strategies, and refine options</td>
</tr>
<tr>
<td></td>
<td>- Evaluate feasibility and energy impact of technologies and</td>
</tr>
<tr>
<td></td>
<td>strategies</td>
</tr>
<tr>
<td></td>
<td>- Report on opportunities</td>
</tr>
</tbody>
</table>
INTEGRATIVE PRE-DESIGN

> Pulling it all together now <

**WHY IDP?** (necessity of PRE Design and ASHRAE STANDARD 209)

**TEAM ENGAGEMENT MODEL**

**MISSION/VISION/GOALS**

**OPR DRAFTING - CAPTURING**

**WORKSHOP PREP:** Modeling, Plans

**IDP WORKSHOP:** Concepts, KPIs, ECMs, Time

**OPR FINAL DRAFTING**

**CONTINUING WITH THE REST OF IDP —>**
OPR, ECMs, Focus Groups, Milestone Reviews
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**OPR FINAL DRAFTING**

**CONTINUING WITH THE REST OF IDP —>**
OPR, ECMs, Focus Groups, Milestone Reviews
MISSION
VISION
Project Principles:

- Thinking like an old growth fog
- Adaptive - systems thinking of the project
- Local source - advantage of the local strengths
- Open sourced - check in / check out
- Fit with the ecological and human heritage of the site
- Spatial/Spacious - freedom of movement
- Accommodate intimacy
- Public of Priorities
- Diversity of uses - harvest the synergies of use
- Accessibility (both physical and social equity)
- Congestion - inspire movement
- Flexible - sustainability (thrivability)
- Giving back - become welcome from the broader community
- Inclusion & collaboration
- Trust & transparency
- Open-mindedness
- Continuous learning & improvement
Preparation
TOOLS LEVEL - ABCD PLANNING PROCESS

Does it move us in the right direction?
Is it a flexible platform?
Is it a good return on investment?
INTEGRATIVE PRE-DESIGN

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**OPR FINAL DRAFTING**

**CONTINUING WITH THE REST OF IDP ->**

OPR, ECMs, Focus Groups, Milestone Reviews
ENERGY CONSERVATION MEASURES (ECMs)

> Moving into more iterations <

- Building orientation/massing
- Percent Glazing/Layouts
- Glazing Frame/Glass
- Roof/Wall/Floor Insulation
- Lighting Power Densities
- Lighting/Daylight Controls
- Exterior Lighting Alternatives
- Mechanical System Types
- Mechanical Efficiencies
- Motor Efficiencies
- Variable Speed Drives
- Energy Recovery
- Ventilation Alternatives
- Thermal Storage
- On-site Renewable Energy
- Green Power
- Utility Types, Fuels, Rates, District Energy, etc.
Integrative Pre-Design
OBSTACLES

A few things that have come up that the students are interested in—overcoming barriers to clients going green, how you market green building (particularly concerns about up front costs), where is the market going, how to justify potential and actual savings, and what are other barriers/obstacles for clients.
OBSTACLES
ARE PUT IN
YOUR WAY TO
SEE IF WHAT
YOU WANT IS
REALLY WORTH
FIGHTING FOR
"I believe that it is perfectly possible for an individual to adopt the way of life of the future...without having to wait for others to do so. And if an individual can observe a certain rule of conduct, cannot a group of individuals do the same? Cannot whole groups of peoples - whole nations? No one need wait for anyone else to adopt a humane and enlightened course of action." ~M.K. Gandhi
Today’s buildings must do more! & the Change Agents must lead
The Risky Business of Integrative Pre-Design

THANK YOU!

John Beeson, RA, NCARB, LEED-AP BD+C, EBOM
LEED Certified Reviewer, BREEAM In-Use Assessor,
Green Mystic in Residence
john@catalyst-partners.com