



ASHRAE
Engineering for the World We Live In

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Sustainability: Un-definable Success in a Defined World

E. Mitchell Swann P.E., LEED AP
Principal

swann@mdcsystems.com

www.MDCSystems.com

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***So what are we talking
about?***

**Sustainability?
Green buildings?**

Definitions

- ‘Sustainable development involves...meeting the needs of the present without compromising the ability of future generations to meet their own needs.’
- Reshaping the Built Environment Ecology, Ethics and Economics - Edited by Charles J. Kilbert Island Press, Washington, D. C. USA 1999

Definitions

***Position Document approved by ASHRAE Board of Directors
June 23, 2002***

- ***ASHRAE supports building sustainability as a means to provide a safe, healthy, comfortable indoor environment while simultaneously limiting the impact on the Earth's natural resources.***
- ***ASHRAE will use its position as the technical society recognized as the global leader in HVAC&R technologies and applications to develop and disseminate technical information, standards, educational programs and research on issues of social importance to promote building sustainability.***

Definitions

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Further, ASHRAE will:

- 1. consider integrating building sustainability principles, effective practices and emerging concepts into all appropriate ASHRAE standards, guidelines, Handbook chapters and Society publications;***
- 2. actively participate with internationally recognized building sustainability groups where deemed appropriate;***
- 3. promote and provide education on building sustainability to its members and society through the ASHRAE Learning Institute and grassroots chapter activities.***

Short Form

- **Green is good.**
- **ASHRAE is good.**
- **ASHRAE likes green.**
- **ASHRAE helps green.**

The premise...

Sustainable design...

- ...is based upon traditional design and construction.
- ...is considered 'beyond' the normative design practice.
- ...goes beyond customary practices to provide a 'better' product.
- The resulting product should be a more energy efficient building with a reduced resource demand and a healthier indoor environment.

Sustainable Design

- ...requires a team commitment to a common goal;
- ...is responsible design, responsible construction, responsible ownership;
- ...yields a high(er) performance building ('better' buildings);
- ...is 'value-added';
- ...is a 'life cycle cost' based approach;
- ...is a desirable methodology

In short...

- **Green design emphasizes better or 'high performance' buildings as an outcome.**
- **Success is measured over time and the process requires greater team contribution and coordination.**

**Does green design challenge
the traditional relationships
of the team in achieving a
'successful' project?**

*How are these relationships
traditionally defined?*

By contract.

Definitions

- **Contract, *n.***
 - 1. An agreement between two or more parties creating obligations that are enforceable or otherwise recognizable at law;
 - 4. A promise or set of promises by a party to a transaction, enforceable or otherwise recognizable at law; the writing expressing that promise or set of promises.

Definitions

- **value, *n.***
 - 1. The monetary worth or price of something; the amount of goods, services or money that something will command in an exchange. Black's Law Dictionary – Abridged Seventh Edition, USA 2000
 - *The 'something' is most often tangible and the transaction is most often monetarily.*
- Thus an item only has value if there is an exchange between parties.

The Implications of 'value'

- What are the interrelationships in the value chain between design, construction and operating methodology such that an accurate picture of delivered value versus promised value can be developed for the completed project?

What's it worth?

'Value' in design/construct

An increase in the value of the services provided or the product delivered

- = an 'add' to the contract

Failure to deliver the 'product' as promised

- = diminished 'value'

Wouldn't an adjustment in the contract be expected?

Remember this?

From Definitions:

Sustainable design:

- ...The resulting product should be a **more** energy efficient building with a **reduced** resource demand and a **healthier** indoor environment.

Key words...

- *The use of the qualitative modifiers and suffixes, 'more', 'reduced' and 'healthier' imply that there is a range of performances available.*
- *If there is a 'more' there must also be a 'most' and a 'less' – even if we are not sure what that means.*
- *To do 'better' than the norm takes more than the 'normal' effort – this has a cost.*

Basic Questions

- What are the 'units' of sustainability that define its value such that it's 'worth' can be established, performance measured and contractual compliance determined?

How is delivered value compared to promised value for the completed project?

Remember...

“...more energy efficient...”, “...reduced resource demand and a healthier indoor environment.”

- *What distinguishes ‘sustainable’ from normal design?*

Performance metrics

- *Energy use, resource use, operating expenses*

Certified “better” buildings

Building ‘Certifications’

*“Valuation” = LEED Rating System
Silver, Gold, Platinum.*

Categories	Credits	Points
• Sustainable Sites,	8	14
• Water Efficiency,	3	5
• Energy & Atmosphere,	6	17
• Materials & Resources,	7	13
• Indoor Environmental Quality,	8	15
• Design Process & Innovation		4
• <i>LEED Accredited Professional</i>		<i>1</i>
<i>Think about personnel management, shop drawings, CA...</i>		

So who “owns” what?

Sustainable Sites

- Erosion & Sedimentation Control
- Site Selection
- Urban Redevelopment
- Brownfield Development
- Alternative Transportation
- Reduced Site Disturbance
- Stormwater Management
- Reduce ‘Heat Island’ Effect
- Light Pollution Reduction
- Design & Construct
- Owner
- Owner
- Owner
- Owner & Design
- Construct & Design
- Design & Construct
- Design
- Design

So who “owns” what?

Water Efficiency

- Water Efficient Landscaping
- Innovative Wastewater Technologies
- Water Use Reduction
- Design
- Design
- Design
- ...and
- **CODE!!!!!!!!!!!!!!**

So who “owns” what??

Now the ‘ASHRAE’ stuff!

Energy & Atmosphere

- Prereq. 1 - Fundamental Building Commissioning (and a good idea!)
- *“Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended.”*
- *For 3rd Party Cx*
 - *...’ensure...design [and] install[ation]...intent’*

???

So who “owns” what??

Now the ‘ASHRAE’ stuff!

Energy & Atmosphere

- Prereq. 2 – Energy Performance – iaw 90.1
 - *What about the bonus points?*
- *“Achieve increasing levels of performance...”*
 - *Better energy performance = more points!*

Keys to performance:

- *Design Construction Operations*

Provisions to

- *monitor and track performance?*
- *Audit?*
operations vs. construction vs. design

So who “owns” what??

Now the ‘ASHRAE’ stuff!

Energy & Atmosphere

- Energy Utilization\Conservation,
- Indoor Air Quality,
- Water Management,
- Waste Management
- Rating\Certification level impacts on operating costs and (potential) market value.
- *Often ‘productivity improvements’ are attributed to higher ‘ratings’ too.*

Performance Metrics and Certification

Energy

- **Prerequisite – Compliance with ASHRAE 90.1**
- **Additional points – improved energy performance (by percentage)**

Water Management

- **Points for reduced use (by percentage)**

IAQ

- **Prerequisite – compliance with ASHRAE 62**
- **Additional points – CO₂ monitoring**

Operations

- **Prerequisite – basic commissioning**
- **Additional points for enhanced commissioning**

To satisfy those performance metrics

- ...requires additional time and effort and sometimes special consultants and construction techniques.
 - i.e. Energy Modeling to 'beat' 90.1

The implications of 'performance'

- 'Points' awarded based on modeled energy use are only 'valid' if actual energy use matches the model.

Guarantee of performance or Implied Warranty?

- If 'certification' is a requirement of the contract, then would failure to achieve certification imply an 'error' or 'omission' by the designer?

What does this do to liability insurance?

So who “owns” what??

More ‘ASHRAE’ stuff!

Indoor Environmental Quality

- Prerequisite 1 & 2
 - Meet Code (Std. 62) & Obey the Law (No Smoking)
- *Carbon Dioxide Monitoring (Design)*
 - *demand side ventilation control*
- *Increase Ventilation Effectiveness (Design)*
- *Construction IAQ Plan (Construct & Design)*
- *Low Emitting Materials (Design & Construct)*
- *Potential impacts on delivery (schedule) and price*
 - *compliance could conflict with other contract provisions*

So who “owns” what??

More ‘ASHRAE’ stuff!

Indoor Environmental Quality (cont.)

- Indoor Chemical & Pollutant Source Control
 - Design and Owner (Operations)
- Controllability of Systems
 - Design but...
- Controls cost money...big money.
- Thermal Comfort – Design & Operation
- Daylight & Views – Design & Owner (Site Selection)
 - Preservation of ‘air rights\sun rights’?
- *Innovation in Design ?????*
- *LEED Accredited Professional*
 - *Practice management*

“Innovation in Design” and “The Standard of Care”

- A traditional standard for a practitioner is to "exercise the average degree of skill, care, and diligence exercised by members of the same profession (or specialty within that profession), practicing in the same or a similar locality in light of the present state of the profession"
- (Gillette v. Tucker). See Black's Law Dictionary, 6th edition. 1404-5.

The Standard of Care

If a firm is a 'green' firm and

green = better buildings...

- ...what is the Standard of Care for a green project?
- ...what is the Standard of Care for other projects at that firm?
 - 'A' projects and 'B' projects?
- As 'green' spreads in an area, what is the Standard of Care for other firms in that area?
 - What happens to 'non-green' firms?

Other Impacts on the Standard of Care

LEED Accredited Professionals:

- 2001 - 527
- 2002 - 1916
- 2003 - 3535
- 2004 – 6279

(Statistics courtesy of the USGBC.)

- Remember – “average” skill... ”by members of the same profession” “...practicing in the same or a similar locality”

The Energy thing

- *STANDARDS - Standard 90.1 Energy Standard for Buildings*
- *“The Standard specifies reasonable design practices and technologies that minimize energy consumption without sacrificing either the comfort or productivity of the occupants.” (Std. 90.1 – 2001 Overview pg. 1-1)*

Approaches

- *Prescriptive,*
- *Building Trade-off,*
- *Energy Cost Budget Method*

Is it applicable to Sustainable Design?

- *“Standard 90.1 provides minimum requirements for the energy-efficient design of buildings and building systems.”*
- *“...an appropriate set of minimum requirements for energy-efficient design and construction.”*

Where 90.1 fades...

- *Overall resource utilization*
- *Industrial processes - process utility demands*
 - *Compressed air*
 - *process water*
 - *process gases*
 - *steam*
- *How does this compare to the objective of providing 'better' buildings?*

Implications to the Contract

- *Resource utilization targets require 'better' performance in design*
- *Higher performance levels = higher Risk.*

Mitigation of Risk is done at a cost

- *design fees due to the additional analysis and investigation*
- *construction costs due to the use of better materials, new technologies and new techniques*

Risk – Transfer and Mitigation

- *‘Contractual’ performance targets introduce risk.*
- *Failure to meet the targets triggers financial liability.*
- *Sustainability = performance over time*
How does the design\construction team mitigate the impact of owner performance?

Risk – Transfer and Mitigation

- *If the owner has a legal recourse within the contract to evaluate the building's 'performance' relative to the targets, the design and construction parties must establish some guidelines or criteria for operation to verify proper usage.*

Establishing Performance Targets

To establish 'reasonable' performance targets...

- ...the prudent engineer would want to establish targets which 'accommodate' some owner 'misbehavior'.*
- ...the prudent owner would want to know what is customary for such projects based on industry 'norms' including first cost.*

Finding a baseline

What if the owner has no such knowledge?

Options??? Consider a 2 step process.

1. Perform an analysis (on a 'T & M' basis)
 - *use an investigatory project to research the 'typical', the 'possible' and the 'probable'*
2. Once determined, shift to a fixed fee or lump sum contract once the scope and targets have been set.

What about the contractor?

Generally, little change.

- **The *Spearin* Doctrine, as it is frequently called provides the following:**

"If [a] contractor is bound to build according to plans and specifications prepared by the owner, the contractor will not be responsible for the consequences of defects in the plans and specifications." *United States v. Spearin, 248 U.S. 132, 39 S.Ct. (1918).*

"Suitable for the intended purpose"

But what about...

Product substitutions

- **Due to pricing, availability, interruption...**
- **New products must be 'suitable' or certification could be compromised.**
- **Defective workmanship claim**

Subcontractor defaults and replacement contractors

- **Must be properly skilled or experienced in necessary construction techniques**
- **Failure to replace in a timely fashion could result in LDs or other damages; uncompensated delay.**

So who “owns” what?

Materials and Resources

- Storage & Collection of Recyclables
- Building Reuse
- Materials Reuse
- Recycled Content
- Regional Materials
- Rapidly Renewable Materials
- Certified Wood
- Construct
- Owner & Design
- Design & Construct
- Design & Construct
- Construct & Design
- Design & Construct
- Construct & Design

Certification 'troubles'

- Any 'action' by either the designer or the contractor that results in lower or non-certification of the building could be seen as a 'diminished value' claim by the Owner.
 - On-going operating costs
 - Market value
 - *Is this akin to consequential damages?*

The Owner and Sustainability

(OR, 'YOUR MILEAGE MAY VARY')

Success depends upon three items:

- *the quality of design*
 - *selecting the 'right' answer to the 'right' question*
- *the quality of construction*
 - *the proper tool in its proper place*
- *the quality of operation*
 - *the correct use of the correct tool at the correct time and the commitment to maintain that tool in the correct manner*

What about the Owner?

Historically..

- **No Standard of Care**
- **No ‘custom and practice’**
- **No ‘workmanlike manner’**

But...

- **Green performance has ‘operational’ considerations, and**
- **Operations belong to the Owner (typically)**

How is the impact of the Owner accounted for in the Contract?

- ‘Role reversal’ in sustainable design:
 - operation and maintenance overtake design and construction.
- An owner’s ‘failure’ to meet operations and maintenance goals would not necessarily open the door for the design or construction team to make a claim for damages.
- ***It could negate a claim by the owner that the facility did not meet the expected performance.***

The Impact of Operational Changes

Driven by business conditions?

- What tools are available to evaluate variations from the expected operational theme?
- IF the new conditions are an 'extension' or variation on the 'baseline' condition – adapt the model.
- Differences between the predicted and actual performance = evaluation basis for contract compliance.
- The effect of time on performance must be considered. (Things fall apart – C. Achebe)

How is the impact of the Owner accounted for in the Contract?

- *Given the significant impact of how a facility is operated on its overall environmental impact, how should this impact be accounted for within the contract?*

Some Tools...

Performance

- *Original input, assumptions and criteria determine the final design solutions*
 - *can be used as a basis to measure operations performance.*
 - *Include some weather data 'basis' and acceptable deviation*
 - *The translation of the 'what did I say' aspects of the design, and the 'what did I mean' aspects as well.*
- *Design to facilitate monitoring, modeling and optimization.*

More tools...

- *Beyond traditional operating manuals.*
 - *includes methods, modes and schedules of operation*
 - *Develop maintenance guidelines.*
 - Require training, re-training and sign-off
- If a dispute arises, allow design\construct team to monitor operation and review data history.
 - Use the BAS to track compliance

On Construction issues...

Defaults, Substitutions, etc.

- *If 'time is of the essence' consider a waiver of certification requirements ...*
- *If not consider built-in compensation for 'extended duration' project costs..*
- *Surety obligation to find 'qualified ' replacement contractors*

Certification 'failure'

- *Look at obtaining/requiring/revising performance bonds to cover remedial work*
- *Certification is a performance issue!*

For Owners...

On 'green' certification...

- *Make it a condition of the contract and indicate the level*
- *Require performance bond for remedial or corrective work relative to certification*
- *Establish performance targets*
- *Get your people trained!*

New Approaches are Required

- Develop project specific targets and over a set time period.
- Use 'reasonable' goals relative to projected costs and currently available technologies;
- Goals should include criteria for on-going operations and maintenance - facilitate 'best use';
- Performance evaluations must be conducted over time;
- The evaluation of the impact of operation relative to design relative to construction on the overall achievement of the sustainability targets will be critical to evaluating the long term performance.

Performance measurements will control 'value' perception.

Summary and Conclusions

What becomes of Sustainability?

- value will increase as resource demand increases;
- integration into 'the custom and practice';
- contract evaluation in the context of the new 'custom and practice'.
- Differences in execution, delivery and evaluation of sustainable projects will require new approaches to defining a successful project...

... and evaluating contract compliance.

The End

E. Mitchell Swann, PE, LEED AP

swann@mdcsystems.com

MDC Systems, LLC

(www.MDCSystems.com)

- Mr. Swann is a Principal and Partner at MDC Systems, LLC. He has over 25 years of experience in design, management, construction, forensics and dispute resolution. His background includes work for pharmaceutical, health care, commercial, industrial, semiconductor, institutional and residential clients and owners. He has served as liaison between the design and construction team during multiple projects and has had leadership roles in commissioning, validation and critical systems testing assignments. He is well versed in the various types of project execution approaches from traditional bid\spec to design\build and has prepared packages and scope documents for all types of projects.
- Mr. Swann has authored several articles on issues in professional practice including the Green Building Issues, Standard of Care and Consequential Damages and is a co-author of the ASHRAE Survival Guide to Design\Build. Mr. Swann is the two-term former chair of ASHRAE TC 9.11 (Cleanrooms) and active in several other Technical Committees including TC 1.7 General Business, Management and Legal Education, TC 2.8 Sustainable Design and TC 9.10 Laboratory Systems.
- He is also a member of ISPE where he was part of the original development teams for the Baseline Design Guides for both Bulk Pharmaceutical Chemicals (APIs) and Oral Solid Dosage Forms and a member of the American Bar Association where he is vice-chair of the Alternative Dispute Resolution Section Committee on Construction.
- MDC Systems is a project management, engineering and construction consultancy serving clients in North America and around the globe. MDC's primary services include forensic and predictive engineering analyses, strategic and project management consulting, dispute resolution services and support and expert witness litigation support and testimony.