

### ASHRAE® - CENTRAL FLORIDA CHAPTER



Sustainability - Undefined Success in a Defined World 9 April 2009

E. Mitchell Swann P.E., LEED AP Partner swann@mdcsystems.com www.MDCSystems.com



# The program will address...

- o ...key 'green building' elements;
- o ...specific 'green' risks;
- o ... the source of risk;
  - ...and who is best able to handle them
- o ...management/mitigation strategies;
- o ... other industry trends.

We are all faced with a series of great opportunities brilliantly disguised as insoluble problems.

John W. Gardner

### Consider...

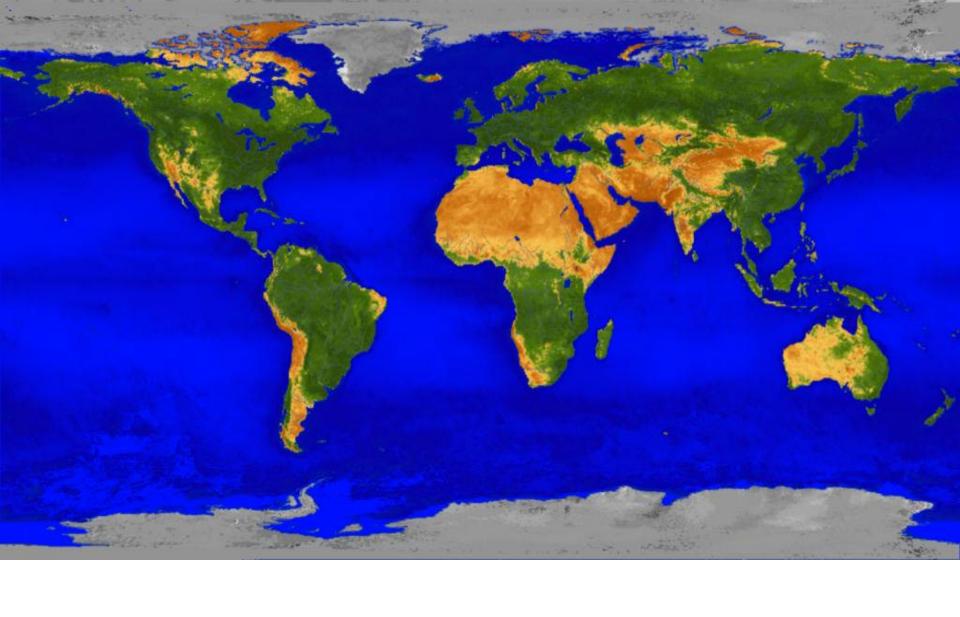
#### cli·mate

- 2 a: the average course or condition of the weather at a place usually over a period of years as exhibited by temperature, wind velocity, and precipitation
- b: the prevailing set of conditions (as of temperature and humidity) indoors
- 3: the prevailing influence or environmental conditions characterizing a group or period

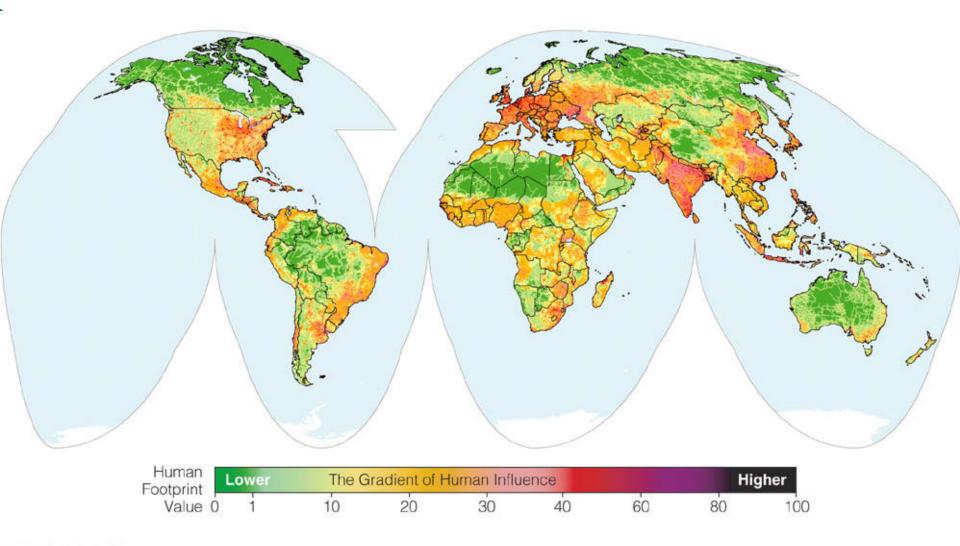
Climate - what you 'expect'.

#### weath-er

- 1: the state of the atmosphere with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness
- Weather what you 'get'.

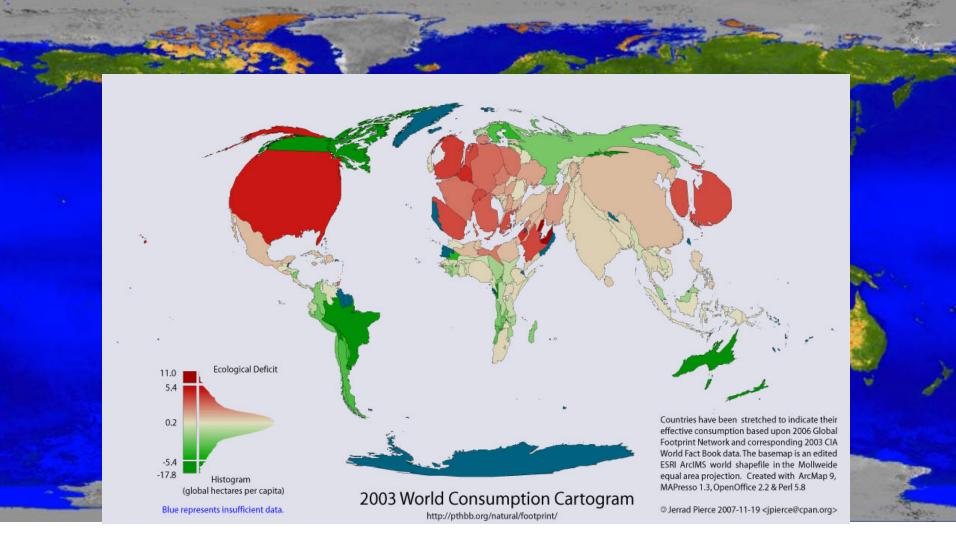


Let's look in on the big picture



@ 2005 Brooks/Cole - Thomson

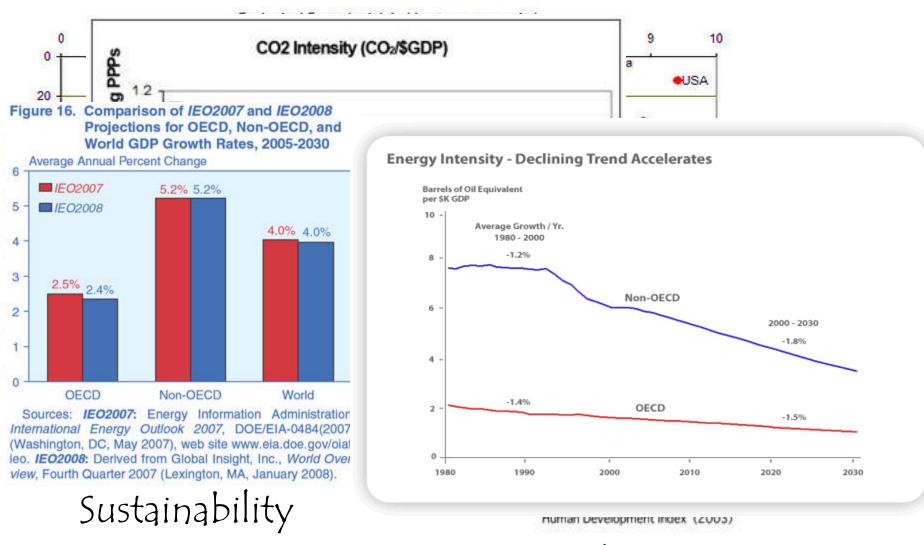
**Human Footprint** 



How it looks...

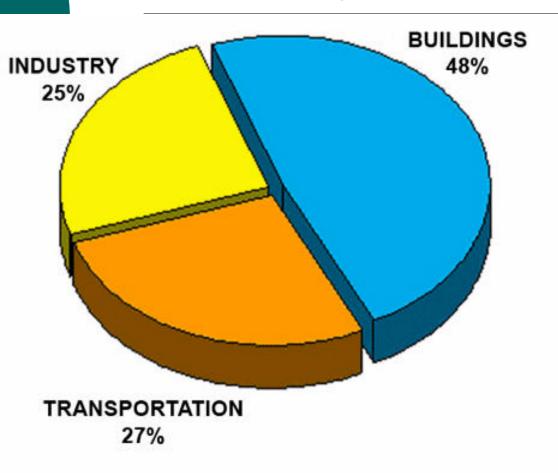
How it feels...

#### Human Welfare and Ecological Footprints compared



Development

# U.S. Energy Trends



US ENERGY CONSUMPTION

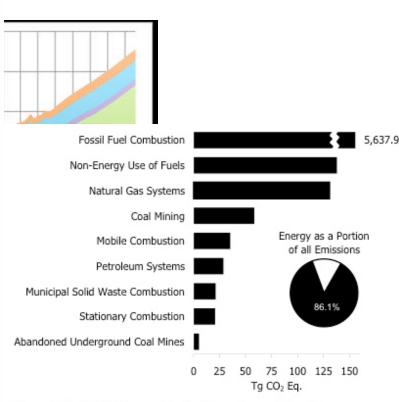
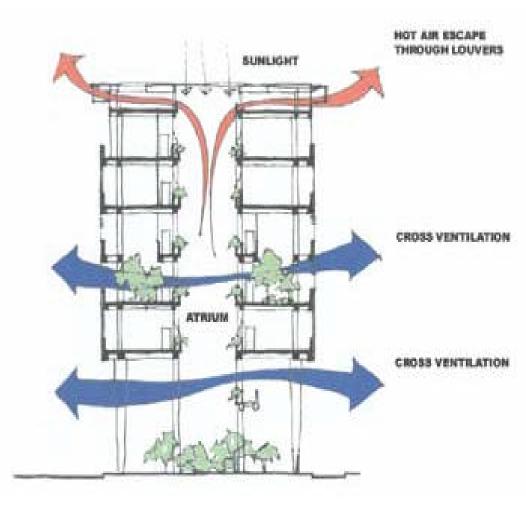


Figure 2-5: 2006 Energy Sector Greenhouse Gas Sources

# Green Building Objectives

- greater efficiency
  - Energy
  - Resources
- life cycle cost
  - Operations
  - Maintenance
  - "total cost of ownership"
  - "Cradle to grave"
- healthier environment
  - IAQ
  - IEQ
  - waste management
  - Productivity?
  - "wellness"?
- higher asset value



# "Traditional" or "sustainable" What's the difference?

### The objectives...

- ...<u>more</u> energy efficient
- ...reducedresource demand
- ...a <u>healthier</u> indoor environment

#### The metrics...

- o Energy use
- o Resource use
- Environmental Quality
- Operating expenses
- o Certifications\*

Are these all "performance"?

# The objective is

# 'high performance' buildings

lower costs, better environment, higher value

### Does 'high performance' require...

- o Additional design time and effort?
  - o ...and the impact is?
- o Specialty consultants?
  - ...and the impact is?
- o Special construction techniques?
  - o ...and the impact is?

# So what's Florida Doing?







# So what's Florida Doing?



**EnergyGauge (FlaRes)** - Florida residential building software Method A Florida Energy Efficiency Code calculations and reports. Pro version - ACCA Manual J (Version 8) calcs & economic analysis.



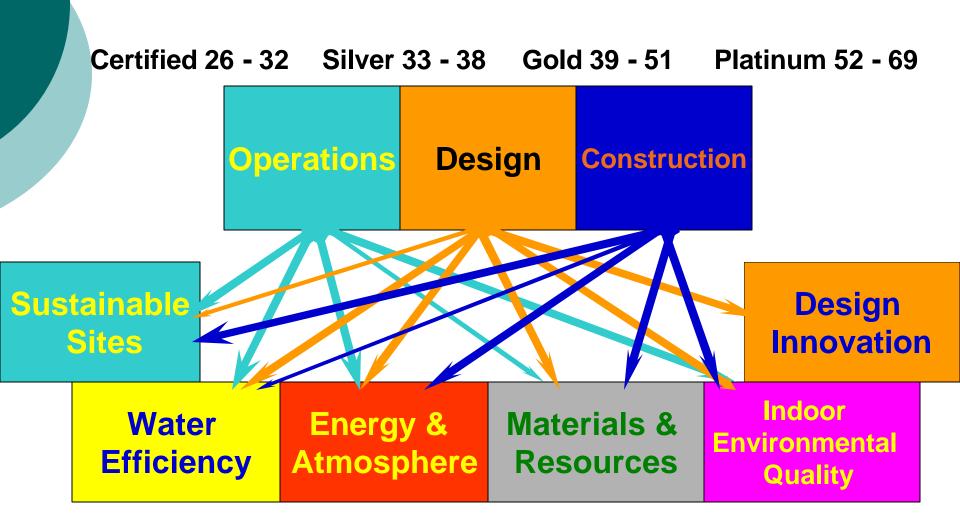
**EnergyGauge Summit Premier** – USA commercial & public buildings federal tax deduction,

LEED NC 2.1 & 2.2 energy optimization point calculation, LEED 2.2 EA credit 1 template completion, ASHRAE 90.1 calculations, including 2004 Appendix G. Method A Florida Energy Efficiency Code calculations and reports.



The USA residential software product, **EnergyGauge** USA, provides residential building annual energy use and IECC code calculations and reports for the entire nation. A Pro version of the software includes pollution analysis and tax credit qualification reports, and a rater version includes HERS ratings (Available to certified energy raters and qualified government program energy analysts only).

### In the LEED® Context



<sup>\* &</sup>quot;Operations" is assumed to be 'by Owner'

# The implications of 'performance' Nature of Risk - Nature of Damages

#### Energy & Resource use – governed by...

- Design? Construction? Operations?
- o "A consequence..." or "A direct result of..."?
  - Standard of Care"
  - Defective Workmanship
  - Operations?

#### Building Certification/Rating – a requirement by..

- ...contract (a "guarantee"?)
- ...statute (a mandate)
- o "failure to achieve"?

What does this do to liability insurance?

## The implications of 'performance' Nature of Risk - Nature of Damages

### **Green Building Tax Credits...**

- o Who benefits...?
- o Who commits...?
- o Who is responsible...?
  - ...and to whom?
- o If no cert obtained is the credit rescinded?
  - is that 'foreseeable'?

What does this do to liability insurance?

## What about the contractor?

#### Materials, means & methods...

- Product substitutions
  - pricing, delivery, interruption
- Product "compatibility"
  - defective workmanship?
- [Sub]contractor Defaults
  - "suitable replacement"
    - Failure to replace in a "timely fashion"
    - o Potential delay or LD costs.

## What about the Owner

some new considerations

# Does the Owner impact performance? How?

How is that mitigated?

Guidelines or criteria for "proper" operation & use?

An Owner's Manual?

# Establishing Performance Targets

#### Establishing 'reasonable' performance targets:

10,000 sr 2 WMT 1 KW 12 M 6 DW 52 WK 1 17488

#### o ...establish targets which accommodate some "misbehavior".

THEREFORE LIGHTING COSTS ABOUT ". 75/SE FER YEAR

### OTOTAL Flearn what is io. "customary" based on industry 'norms'

\*1.80 - 1.76 SF/YR ON 10,500/YEMR

EXAMPLE OF ENERGY USE FOR A 10,000 SF OFFICE BLDG

#### Summary of building heating and cooling performance.

1. General Summary

2. System: VAVSingleDuct

2.1 Heating Loads

2.2 Cooling Loads and Airflow Rates

3. System: Constant/blum oF ked0.4

3.1 Heating Loads

3.2 Cooling Loads and Airfow Rates

#### 1. General Summary

Model Data

Project No: "SampleModeLmit" Model total foor area = 3500.3 m\* Model total volume = 5869.4 m<sup>3</sup>

**Heating Calculation Data** Heating results fie:

"SampleModel.htg" Calculated at 13:43 on 12/Feb/07 Calc Period January

Cooling Calculation Data Cooling results file: "Sample Model olg" Calculated at 13:43 on 12/Feb/07 Calc. Period: May - Sep.

#### 2. System: VAV SingleDuct

#### 2.1 Heating Loads

Number of rooms = 62

#### System Heating Loads

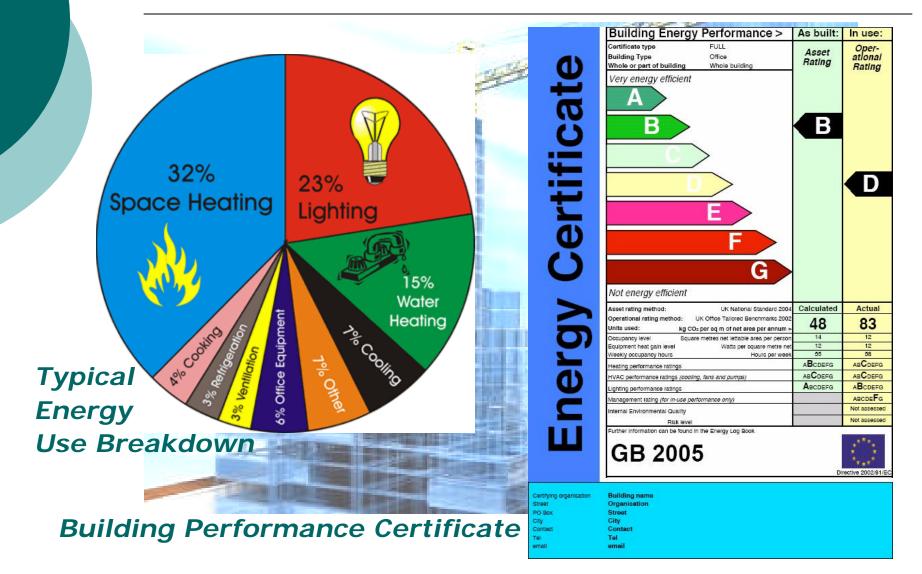
Room heating load (kW)		Outdoor air prim	ary load (MV)	DHW (k)	Plant load*		
Sensible	Humid Fication	Mech vent	Auxvent	Heating demand	Plant load*	(MW)	(Wim')
90.09	21.10	0.00	0.00	0.00	0.00	144.25	45.15

includes sipe & duct heat losses

#### Room Heating Plant Loads

	Air temp. (* C)	Conduct		Ventilation sensible gain (kW)				Sens	DHW heating
Room Name		External	Internal	Mech vent (outdoor air)	Aux verit gain	Infiltration	Matural went	(kW)	demand (kW)
19 Office	21.00	0.60	0.04	-0.67	0.00	-0.09	0.00	1.23	0.00
11 Office	21 00	+1.04	40.13	-0.70	0.00	-0.12	0.00	1.99	0.00
12 Office	21 00	-0.72	-0.08	-0.73	0.00	-0.12	0.00	1.00	0.00
13 Office	21 00	-0.53	-0.03	-0.63	0.00	-0.10	0.00	1.29	0.00
14 Office	21.00	-0.74	0.04	-0.77	0.00	-0.13	0.00	1.00	0.00
15 Stairmell	24.00	-0.67	0.22	-0.34	0.00	-0.14	0.00	1.37	0.00
16 Office	21 00	-1.15	0.02	-0.69	0.00	-0.12	0.00	1.54	0.00
17 Office	21 00	-0.67	-0.10	-0.09	0.00	-0.12	0.00	1.58	0.00

### Can you spot the high performance building?



### Some Tools...

### Performance... original input, assumptions & criteria... Statement of criteria Basis of design Ethernet LAN o include weather data 'basis' with some acceptable deviation Documentation... Intent – design o 'what did I say'... Expectation\Understanding - operations o 'what did I mean'... Modeling, monitoring & optimi

## In Design...

## Monitoring and Measurement

- o Audit & Verification Clause
  - "notice"
  - opportunity to "cure"
  - 3<sup>rd</sup> Party Auditor
- o Building Automation Systems
  - Data Monitoring, Retention and Trending
  - Use the BAS to facilitate audit & verification o mitigate operational damages



### In Construction ...

### Delays, Defaults, Substitutions, etc.

- o 'time is of the essence' ...
  - a waiver of certification requirements
    - "EB" instead of "NC"
    - <u>extended duration</u>!

#### **Defaults**

 Surety: 'qualified' replacement contractors

#### Certification 'failure'

o Performance bonds



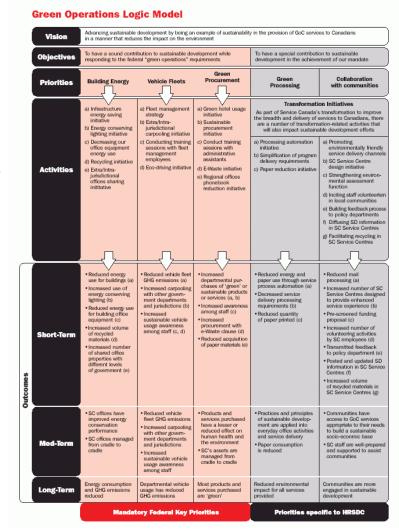
## In Operations...

# More than traditional operating manuals.

- Training Programs
  - include methods, modes and schedules of operation;
  - maintenance guidelines.
  - integral with project execution
  - require sign-off

#### Consider...

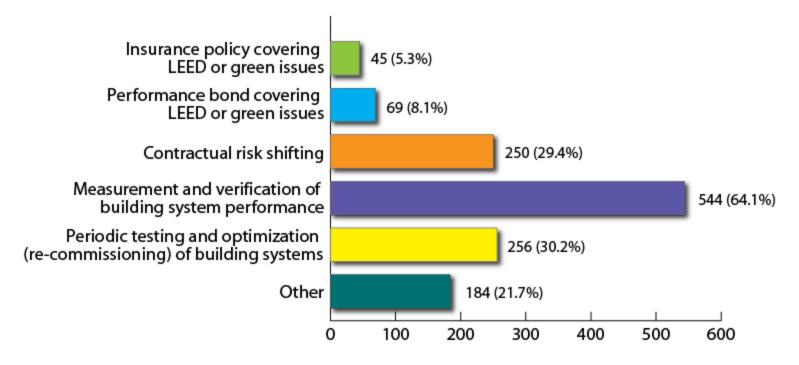
- Videotaping
- 'fault-tree' studies and analysis (up front!)



# SECOND ANNUAL GREEN BUILDING SURVEY: GREEN GOES FROM TREND TO MAINSTREAM

publication date: Mar 17, 2008

Green Building Insider, Allen Matkins and CTG Energetics

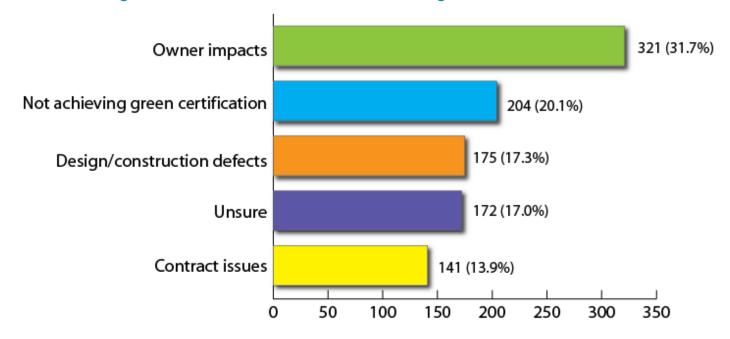


Tools to Address Risk Issues

# SECOND ANNUAL GREEN BUILDING SURVEY: GREEN GOES FROM TREND TO MAINSTREAM

publication date: Mar 17, 2008

Green Building Insider, Allen Matkins and CTG Energetics



What are the biggest risks in Green Building projects?

How do they compare to traditional projects?

# Is a new framework required?

Indemnification

- Limits of Liability
- PLI for 'specialty' consultants
  - "Green" Consultants
  - Energy modelers
  - Commissioning Agents

# Other Impacts on the Practice

# IPD/IDP - Integrated Project Delivery/Design Process

- binds participants 'together'
  - (i.e. AGC Consensus Docs, AIA 295/195 Series, Project Alliance agreements)
- BIM execution
  - Integrated documentation and delivery?
  - Integrated responsibilities?
  - Integrated Risks? Integrated capacity?
- Net Zero Buildings/"Carbon 2030 Challenge"
   "Zero Energy 60% reduction in carbon Buildings" footprint by 2010.

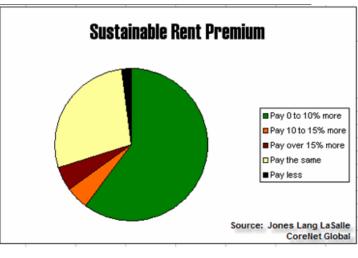
# What becomes of Sustainability?

- value will increase as demand increases;
  - Both 'resource' driven and 'market' driven

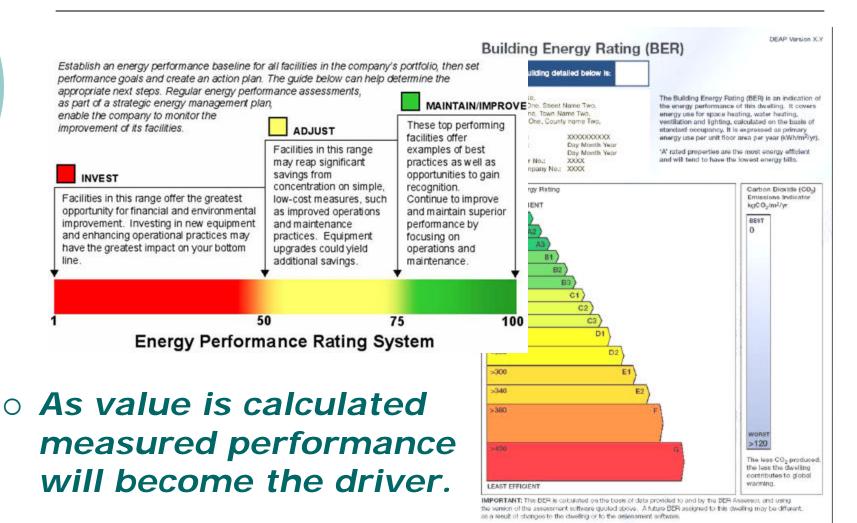


- New contractual context for new 'custom and practice'.
- Differences in execution, delivery and evaluation of sustainable projects will require new approaches to defining a successful project...

... and evaluating contract compliance.



# What becomes of Sustainability?



# closing thoughts

Climate is what you expect.

Weather is what you get.

Move for the climate but dress for the weather.



Thank you!

ASHRAE - Central Florida Chapter April 2009

# E. Mitchell Swann, P.E., LEED AP swann@mdcsystems.com Principal and Partner MDC Systems, LLC

#### Licensed Professional Engineer:

Pennsylvania, New Jersey, New York, Connecticut, California, Michigan, Illinois, Georgia, Kentucky US Green Building Council LEED Accredited Professional

Mr. Swann has over 20 years of extensive experience on both domestic and international projects in the areas of management consulting and problem solving, engineering design, project and construction management, forensic engineering and construction claims analysis. Mr. Swann's career includes the analysis, evaluation and design of complex systems across a wide range of industries and buildings types including commercial, institutional and industrial facilities, hospitals laboratories, pharmaceutical manufacturing, microelectronic operations and data centers. Mr. Swann has chaired technical committee within national and international organizations and been a contributing author and editor for a number of technical publications and journals. He is a frequent speaker both nationally and internationally and is a listed member of the speakers' bureau in the Distinguished Lecturer program of ASHRAE. He has recently presented on Green Building issues in Abu Dhabi, Dubai, Delhi, Detroit, Chicago, Seattle, New York City, Indianapolis, Kansas City, Virginia and Delaware. He is a contributing author to the ASHRAE "Green Guide – The Design, Construction and Operation of Sustainable Buildings" and co-author of the ASHRAE Survival Guide to Design|Build Project Execution.

#### **Professional Affiliations:**

American Bar Association, American Society of Heating, Refrigeration, and Air Conditioning Engineers, International Society of Pharmaceutical Engineering, US Green Building Council, Defense Research Institute

#### Other Activities:

Pennsylvania Environmental Council - Board
The Engineer's Club of Philadelphia - Board of Directors
Enterprise Heights CDC - Board Chair
Drexel University - Alumni Board of Governors
National Association of Asian American Professionals (Philadelphia Chapter) - Board of Directors
National Society of Black Engineers Greater Philadelphia Chapter - President Emeritus

## **MDC**Systems®

### Providing Expert Project Delivery Solutions Worldwide

**MDC** Systems is a project and construction management consultancy with over 40 years of experience serving a wide array of clients and industries both nationally and around the globe.

**MDC** has worked on projects as diverse as residential property developments to pharmaceutical plants to highway excavation and construction.

MDC concentrates its services in primarily four areas:

program management, project management consulting, forensic engineering and construction claims consulting.

One of the key facets of **MDC's** professional staff is our expertise in the technology driven issues that are so frequently at the heart of today's complex projects.

MDC's construction claims consulting practice combines all of the skills inherent to our other service offerings and deploys it for our clients when and where projects don't go quite as smoothly as everyone had hoped. MDC is an industry leader in the area of construction schedule development and analysis including delay, acceleration, interruption and extended duration. MDC pioneered the court tested and approved Time Impact Analysis methodology for scientifically analyzing construction schedules and the impact of events upon their execution and completion.

www.MDCSystems.com

## MDCSystems® Summary of Services

### <u>Program & Project Development</u> including...

Performance Assessment & Benchmarking

#### **Project Modeling including...**

- "What if..." Scenario Analyses
- Variability/Sensitivity Analyses
- Out of Bounds'/"Go No Go" Limits

#### Project Planning including...

- Feasibility Studies
- Master Scheduling including...
  - Resource & Constraint Analysis

#### **Project Monitoring including...**

- Schedule Compliance
- Cash Flow & "Burn rate" projections
- Resource Utilization

#### **Consulting Services including...**

- Sustainability/Green Buildings
- Peer Review
- Practice Management

#### **Forensic Analyses including:**

- Building Systems:
  - Architectural incl. Building Envelope
  - HVAC/Mechanical, Electrical & Piping
  - Structural
  - Instrumentation & Controls
- Design Errors & Omissions (Standard of Care)
- Differing Site Conditions

#### Forensic Project Management®

- Schedule Analysis
  - Delay, Disruption, Suspension & Acceleration
- Labor Productivity & Inefficiency
- Scope Definition and Change
- Termination Default or Convenience
- Procurement Bid/Award Transparency

#### Forensic Accounting including...

- Valuation of Damages
  - Overhead & General Conditions
- Business Interruption & Lost Profit

### **Selected Recent Assignments**

### Engineering Consulting and Technical Analyses:

- Analysis of Moisture Migration and RH Control in a Microelectronics Product R&D Facility (Colorado).
- Analysis and Improvement of Energy Consumption at a "Green" School (Pennsylvania)
- Peer Review & Design Supervision for a Radiant Heating/Cooling Floor System (New Jersey)
- Peer Review of Schematic Engineering
   Design Effort for Hospital Complex
   (Qatar)
- Analysis of Formaldehyde Outgassing from Construction Materials (Pennsylvania)
- HVAC System Failures in Pharmaceutical Packaging Facility (New Jersey)
- Analysis of Process Technology Failure at Waste Treatment Plant (New Jersey)
- Analysis of Piping System Joint Failures at a Hospital central Plant (New Jersey)
- Analysis of Destructive Vibration\
   Harmonics on Large Industrial
   Compressors at a Chemical Plant
   (Louisiana)

### Project Management, Execution & Construction Claims:

- Excess Rock Excavation Claim on a Highway Project - Unforeseen Conditions (New Jersey)
- Electrical Contractor Inefficiency Claim on Multi-Prime Project (New Jersey)
- Electrical Usage Charge Dispute Between Landlord & Tenant (New York)
- Schedule Delays and Change Orders on multiple Airport Projects for Major Equipment Supplier (various)
- Schedule Delays and Associated Cost
   Overruns for Underwater Pipeline Project
   (Ireland)
- "Standard of Care" Defense Design of a Food Processing Facility (Pennsylvania)
- "Custom & Practice" Specifications
   Development and Bid Transparency Issues
   (California)
- "Standard of Care" Defense Design and Documentation of a Pharmaceutical Plant using 3D Modeling (Texas)
- "Standard of Care" Plaintiff Delay and Cost Overruns for a Pharmaceutical Plant using 3D Modeling (Singapore)