

EMERGENCY

National Consensus Climate Neutral Building Standard

Launched by the State of Illinois & City of Chicago Nov. 2005

*2015 Imperative of the American Institute of Architects To Stop
Dangerous & Irreversible Climate Change*

Approved Consensus Standard Dec. 1, 2006

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1. **Purpose:** performance specification for taking new and existing buildings and homes to zero climate energy use through efficiency and green power and be certified as climate neutral.

2. **Value Proposition & Benefits:**

- **Reduce Energy Costs & Initiate Preventative Maintenance.** Reduce substantially rising long term energy costs & price volatility. Reduce need for taxes & budget increases.
- **Create Jobs.** Renewable & energy efficiency technologies, installations & systems
- **Reduce Climate Change, Air Pollution & Acid Rain.** Reduce climate change pollutants & risk from increased intensity of extreme events such as hurricanes, droughts, fires, floods, & intense storms, and associated adverse and damaging effects to biota and the built environment within the 5-10 year window before climate change is irreversible: <http://www.ucar.edu/news/releases/2005/trenberth.shtml>. Reduce mercury emissions, toxic effects to biota, & SO_x & NO_x thus improving public health and reducing acid rain.
- **Improve Energy Security.** Reduce risks to energy security and global resource induced conflict

- **Reduce Energy Price Shock Risk.** Renewable energy systems produce energy at a stable price for decades
- **Protect Global Economy.** Reduce risks to global economy from long term rising energy costs.
- **Ameliorate Global Energy Crisis.** Will ameliorate oil & natural gas depletion energy crisis as described in the Appendix below.
- **Help Achieve Consensus US Energy Goals.** This Standard is part of the American Institute of Architects 2030 Imperative to have 60% of the building stock climate neutral by 2011-2015 and be 100% climate neutral by 2030. This consensus goal has also been adopted by US and European Mayors and is consistent with the estimates by NASA, the United Kingdom and the American Association for the Advancement of Science.

3. Scope & Definition: voluntary national standard covering all new and existing buildings and homes, requiring energy efficiency & *Green-e* onsite power generation or purchase of offsite *Green-e* power or green tags for all building or home energy, resulting in a climate neutral building on an annualized basis. For energy efficiency, the certifying professional must ensure the maximum level of energy efficiency consistent with cost effective design, local conditions, and best professional judgment. The building or home must be certified as climate neutral with a combination of efficiency and green power. Designed for adoption by governments, homes, all buildings, business and the capital markets.

Renewable Energy: solar electric (photovoltaic), solar thermal, passive solar, wind, geothermal, biogas, biomass, hydro and renewable cogeneration on site or off site, on or off grid. Off-site renewable energy can either be displaced which is renewable energy meeting *Green-e* requirements generated by the same owner on a different site, or *Green-e* power that is purchased on the open market from sources that are certified through the *Green-e* Renewable Electricity Certification Program. Contracts for purchase of *Green-e* electricity should be for a minimum of 2 years.

The non-profit organization Center for Resource Solutions established the *Green-e* Renewable Electricity Certification Program to encourage consumer confidence in buying "green" electricity. *Green-e* is the nation's first voluntary certification and verification program for "green" electricity products. The criteria require that at least 50% of the supply is generated from the sun, water, wind, burning of wastes (biomass) or geothermal heat from the earth. In addition, in the use of any traditional fuel, emissions of sulfur dioxide (which causes acid rain), nitrogen oxide (which causes smog) and carbon dioxide (which causes climate change) must be lower than average. The companies that receive the *Green-e* designation must agree to an annual audit to ensure they have purchased a satisfactory amount of "renewable" power: <http://www.green-e.org>. The *Green-e Standard* is at http://www.green-e.org/ipp/standard_for_marketers.html.

4. Climate Neutral Building Process

a. **Siting and Design** are considered since they are important to optimize building energy efficiency and renewable energy use.

b. **Baseline Building Energy Audit:** calculations are needed to determine needed energy efficiency actions including building Load factor, load needed from onsite and offsite *Green-e* renewable power, and renewable options & cost. Takes into account building, site, climate, orientation.

c. **Prerequisite Efficiency Energy Reductions:** A minimum level of energy efficiency measures are needed evaluating windows, doors, insulation, envelope, lighting, equipment, appliances, improved ventilation, HVAC, etc. Minimum energy load reduction first is the most cost effective approach before selecting the appropriate renewable power options.

d. **Ensuring fresh air flow is required** to ensure healthy air since energy efficiency improvements substantially limits fresh air inflow. Air to air heat exchangers/heat/energy recovery ventilators or equivalent are required.

e. **Selecting Best Green-e Renewable Options** for commercial & residential: passive solar, daylighting, solar thermal, solar electric, high and low temperature geothermal, wind, biomass, low impact hydro, biogas. Extra credit/recognition is available as an option for transitional organic biogas with EPA best management practices as defined in the SMART© sustainable product standards which is recognized in the certification in subsection "n" below as Renewable Plus due to added environmental benefits over the life cycle especially at the extractive and manufacturing stages for biogas. The SMART© standard is at <http://mts.sustainableproducts.com/standards.htm>

Certified Green-e power is the renewable power required. For homes, Green-e power must be used but onsite (not offsite or green tags) renewable power Green-e certification for homes is only required for new home developments with 10 or more homes. Green-e green tags used in achieving a climate neutral building or home must be permanently retired and committed to Green-e power purchase and registered with the green-e provider.

Special Recognition for Offsets of all pollution. The annual emissions caused by energy use associated with the building/home operation shall be calculated according to the requirements of the Cleaner and Greener Program® or equivalent: <http://www.cleanerandgreener.org> These annual emissions calculations shall include all significant types of environmental emissions resulting from energy use including electricity purchases and all other energy uses of the building or home. Emission reductions documented shall include carbon dioxide (CO₂), sulfur dioxide (SO₂), nitrogen oxides (NO_x), mercury (Hg), small particulates (PM_{2.5}), large particulates (PM₁₀) and volatile organic compounds (VOCs). 120% of each type of these calculated emissions shall be offset with offsets from GreenE® certified electricity or the equivalent or that are on the Cleaner and Greener Program® approved offsets list for the homes program. The impact of offsets on each emission type shall be calculated according to the requirements of the Cleaner and Greener Program® or the equivalent. All emissions offsets shall be retired through a third-party voluntary offset retirement program like the Cleaner and Greener Program® or the equivalent using Green-e Power.

f. **Grid Connected** is encouraged but not required, to help recoup investment allowing sale of power back to the grid and lessening load on the grid.

g. **SMART® Climate Neutral Building & Home Option** is one that is labeled and certified as such after incorporating into the building or home 5% of all total products and materials by weight as certified sustainable products pursuant to approved SMART® Consensus Sustainable Product Standards for Fabric, Flooring, Building Products and/or California Gold Sustainable Carpet Standard. The 5% level will be increased to 15% at the mandatory Climate Neutral Building 3 yr. amendment. There are two certification options for this Standard: Climate Neutral Building or Home, and SMART® Climate Neutral Building or Home. See certification section.

h. **Distributed Energy Storage** should be used where needed to achieve climate neutral energy.

i. **Accredited Professionals Shall be Used** to conduct quality audit, design, and systems construction and installation. Accredited professionals are licensed architects or professional engineers who are qualified in building and home energy assessment, and must certify the home or building as climate neutral energy pursuant to subsection "n" below.

j. **Energy Renovation** for existing buildings. Existing homes and buildings are the most important buildings to be certified because they constitute the greatest use of energy for buildings and homes.

k. **Integrative Design Process for New Construction or Renovation.** See MTS *Integrative Design Guide for Sustainable Buildings and Communities*. Integrative design changes the linear building process to one that integrates upfront all relevant professionals involved in the entire building process which creates substantial efficiencies and cost savings.

l. **Sustainable Maintenance:** Systems & equipment must be designed & built to be easily maintained and accessible by the inhouse building personnel and homeowners. All moving parts must be positioned in centralized equipment rooms which can include roof systems and equipment. This substantially improves capability for total preventive and cost effective maintenance thus saving energy, improving comfort and reducing maintenance costs over the life cycle by over 60% (S. Brand, How Buildings Learn 1994). See attached Annex.

m. **Education of Building Staff, Occupants & the Public** is encouraged for proper use of building energy systems to reduce energy usage, ongoing education.

n. **Certification, Recertification, Decertification & Auditing** Certification is by accredited building and design professionals as defined in subsection "i" above. The certification process including fees, registry and interaction with accredited professionals is maintained by the third party independent, nonprofit Climate Neutral Building entity with mandatory auditing and decertification procedures for noncompliance. Climate Neutral certification is compatible but not equivalent with consensus green and energy standards including LEED and Energy Star for buildings and homes.

For certification to be effective, the certification document and fee must be submitted to the Climate Neutral Building entity for inclusion in the certification registry which is used as a basis for auditing. Auditing may be random. Decertification with appeal rights will occur based on a fraudulent or materially inaccurate or misrepresented certification.

Timeframe. Climate Neutral buildings and homes must be recertified every three years. Any offsite Green-e power or Green-e TAG or emission offset used for achieving compliance with this Standard to certify a building or home as climate neutral, must be contracted for the full three year certification period.

o. Special Recognition for Monitoring Consumption and Changing Behaviors. A platform shall be implemented for measuring household or building energy/CO2 consumption, and monitoring savings over time and comparing to other building and homes. This option allows energy partners to provide home and building owners with incentives for monitored energy savings.

5. Financing Metrics. This Standard encourages involving financial institutions to develop special home equity/refinance programs, special commercial programs, and State & City renewable power grants & incentives.

Based on historical energy price increases (see Annex Slides) and projected future increases based on actual and validated energy supply data (Simmons & Co. & other energy investment banks), the expected 10 year increase in energy costs for energy efficiency and renewable capital improvements & life cycle cost & payback is 20%/yr. Energy costs are expected to keep increasing annually at 2005-2006 rates or greater for many years. See Appendix.

7. Financial Benefits of Climate Neutral Buildings & Homes. Securing increased appraised value for building and better mortgage terms from low operating costs. For financial markets & developers: improved credit ratings, cheaper cost of capital & green mortgage backed securities from *Green Building Finance Summit*: http://mts.sustainableproducts.com/Green_MBS/Finance_Summit. Over \$100B in real estate investment participated in the Summit and based on debt and equity sessions with investors and many case studies, green and c Climate neutral buildings and homes certified to consensus standards were concluded as more valuable.

8. Resources:

a. DOE & Canadian Zero Energy Building Programs & Demonstrations:

http://www.eere.energy.gov/buildings/building_america/about.html
<http://72.14.203.104/search?q=cache:izRKL7lwikJ:www.eere.energy.gov/buildings/info/documents/pdfs/35317.pdf+doe+zero+energy+homes&hl=en&gl=us&ct=clnk&cd=1>
<http://www.cmhc-schl.gc.ca/en/inpr/su/nezoe/>

a. American Institute of Architects & Conference of Mayors 2030 Imperative:

http://www.aia.org/sustainability_test
http://72.14.203.104/search?q=cache:1CokxnfFo94J:www.mayors.org/74thannualmeeting/resolutions/proposedresolutions_energy.pdf+mayors+2030&hl=en&gl=us&ct=clnk&cd=5

c. Historical & Projected Energy Price Increase Data See attached Evolution Partners Slides in Annex 1.

d. Energy Load Tools for New Construction:

DOE/LBL: <http://www.eere.energy.gov/buildings/energyplus/>
http://www.scitechresources.gov/Results/show_result.php?rec=1825

ToolBase Services: <http://www.toolbase.org/Home-Building-Topics/Energy-Efficiency/building-efficient-homes>

NREL: <http://72.14.209.104/search?q=cache:djFNu3yARYYJ:www.nrel.gov/docs/fy03osti/33622.pdf+calculating+energy+loads+for+new+homes+%26+buildings&hl=en&gl=us&ct=clnk&cd=9>
http://www.eere.energy.gov/buildings/building_america/pdfs/36920_residential_system_strategies.pdf

Google: http://www.google.com/Top/Home/Home_Improvement/Energy_Efficiency

Smart Communities: <http://www.smartcommunities.ncat.org/toolkit/buildings.shtml>

9. Mandatory Amendment of this Standard is every three years.

ANNEX 1: Slides of Historical Energy Cost Increases: http://mt.sustainableproducts.com/Zero_Energy

ANNEX 2: Energy Systems Logbook

Logbook Contents

The logbook should be written in a clear and simple language by either the lead designer or preferably by the lead commissioning consultant. Information included is the original client brief, the detailed client brief, basis of design, design intent, detailed design intent, commissioning documentation and handover conditions, post occupancy evaluation, and any other information deemed relevant by the owner and/or design team.

The logbook begins at the start of the design process so that it moves along smoothly with the design. The owner, lead designer, sub designer, commissioning consultant, contractor and suppliers should not be released until they have completed their respective portions of the logbook.

Logbook performance information includes:

- a description of the whole building, its intended short-term and long-term use, the sustainable design philosophy and the intended purpose and performance goals of the individual building services systems
- a Detailed Design Intent document
- a schedule of the floor areas of each of the building zones categorized by environmental servicing type
- schematics of the infrastructure systems, piping and ducting systems, power wiring and control wiring, plumbing, etc.
- location of the relevant plant and equipment, including simplified schematic diagrams
- the installed capacity of the services plant
- simple descriptions of the operational and control strategies of the energy consuming services to the building
- confirmation of completed commissioning
- evacuation, emergency, health and safety plan outlines

- operating and maintenance instructions, including provisions enabling
- the specified performance to be sustained throughout whole life cycle
- post occupancy evaluation report
- annual occupancy performance report
- energy metering tables and information
- an annual energy systems assessment
- summary of results of energy baseline and use from energy analysis including the whole building environment such as site considerations.

It is a living document in the sense that every major and minor modification should be noted and integrated within the logbook. And, once a year, it will be updated to document current energy, maintenance and comfort performance, together with any improvements. Any degradation in any area of performance must be analyzed, corrected and recorded. Any building alterations must be included and the performance recorded fully.

The annual review is to ensure that the logbook is up to date. The review will include all changes, updates and assessments of the maintenance performance, energy performance and occupant comfort performance of the building. It considers all aspects including:

Architectural
 Building services, including controls
 Energy performance
 Occupancy and use
 Building maintenance
 Maintenance

It will also include any other relevant information to allow a comprehensive understanding of the building energy systems and how they are functioning.

The Detailed Design Intent Document

The logbook includes the Detailed Design Intent (DDI) document that explains in detail how and why the systems, equipment and components were selected and sized to be able to achieve sustainable, high performance systems.

The DDI is a combination of the detailed client brief, basis of design, the EMP, and the design intent along with detailed explanations of how and why the systems were selected and sized.

This most important part of the logbook explains in detail how the energy systems have been designed and developed to be sustainable and high performing. DDI allows everyone to understand the decisions made in the design from day one. It allows all involved in the design, construction, operation, remodeling and resale to understand exactly how and why the building was developed and is intended to continue to operate.

The DDI begins by detailing the client's whole life cycle detailed goals and objectives for the energy systems. The goals and objectives may not begin with the EMP end goals, but they must clearly define how the systems can be developed toward the end goals. The DDI

continues by answering how the design achieves the detailed goals and objectives, and the numerous strategies, systems, equipment and components used to achieve them.

The DDI should be between 3 pages for a residence/small building to between 15 to 30 pages for a large/complex building.

Background

Prelude

The UK and EU are introducing building logbooks for Mechanical, Electrical and Plumbing (MEP) systems as a mandatory part of their building regulations. The logbooks assist in improving long-term energy reduction and building operation.

The EU/UK logbook, current design methods, BIM, commissioning and validation documentation for MEP systems, including the best documentation for labs and clean room applications, do not include detailed life cycle performance analysis, documentation and verification. This is the main reason current MEP systems cannot maintain their initial efficiency and effectiveness, let alone move steadily to higher performance.

Owners must demand that their building energy systems move unerringly toward sustainable, high performance and the current acceptance that building energy systems' performance inevitably degrades over time must cease.

The sustainable building energy systems logbook is developed to assist building MEP systems move to and maintain sustainable, high performance. This logbook provides a consistent document to assist and record initial building energy systems' performance and the continued performance improvements throughout the life cycle of the systems.

Introduction

The Sustainable Building Logbook is a testament and diary that substantiates the performance of the building energy systems. It is set up to assist in the realization of sustainable, high performance building energy systems in new construction or renovations of existing buildings. It allows a clear understanding, by the building owner, facility manager, and everyone else, of the design and operation of the building to achieve and maintain sustainable, high performance building energy systems. The logbook is a valuable tool in the sale, resale or rental of properties as a provenance for the building energy systems performance.

The initial size of the book depends on the size of the building, residences and buildings/tenancies less than 2,000ft² may be 5-10 pages, small/simple buildings 2,000ft² to 20,000ft² may be 20 to 40 pages and large/complex buildings over 20,000ft² may be 40 to 60 pages.

The logbook does not take the place of other documents such as the O & M manual, record drawings, specifications, BIM, etc, but instead, it acts as a summary of the key performance information from all the relevant documents and manuals. Comfort and productivity, maintenance and operations, and energy generation and use are the three primary performance qualities analyzed and recorded in detail.

The central idea behind the logbook is to create a detailed, clear and transparent understanding of how the building is required to perform and how and why it has been designed and constructed to achieve the required performance. The owner and facility manager are able to easily maintain the energy systems and create the optimum indoor environment with the minimum energy use for the whole building life cycle.

It is the responsibility of the owner to see that a sustainable logbook is included in the process. He must budget for and include it in the scope of work. However, the owner cannot abdicate his responsibility, and must be prepared to assist in the development of the logbook, particularly by detailing the whole life cycle performance requirements of the building.

Logbooks detail the building performance in maintenance, comfort and energy as well as bridging the gap between design documents and operation and maintenance manuals.

Goals, Objectives and Sustainability Strategies

Sustainable buildings must have sustainable goals and objectives. There also needs to be a clear path to sustainable, high performance if the building systems are not required to perform at this level initially. The most common end goals and objectives are:

- Net zero energy use, either operating or including embedded energy
- Minimum, easily accomplished, preventive maintenance, a 75% cost reduction
- Optimum comfort and maximum productivity, a 25% productivity improvement

A common method to achieve the performance is to create an Energy Master Plan (EMP) that develops a plan for the new or existing facility energy systems to move toward a sustainable, high performance future.

A common tool used to develop sustainable plans is The Natural Step (TNS). TNS is the framework for setting the sustainable end goals. It uses backcasting as a method to ensure each step moves steadily towards all the end goals and is not sidelined or allowed to drift down a blind alley to non-sustainability. The EMP then becomes part of the Detailed Design Intent.

Maintenance

It must be clearly understood that a building must have a comprehensive preventive maintenance program for the building to be a sustainable, high performance building. Any lapse into a deferred maintenance condition will automatically mean the building is no longer able to perform up to its required level. There is a direct connection between the design and

the maintenance of the systems chosen. Designers must detail their chosen system's maintenance requirements and take responsibility for the required maintainability of the systems. Designers cannot abandon their responsibility by stating that maintenance is a maintenance problem alone. They should choose the systems in collaboration with the maintenance or facility personnel, and must state clearly, in the logbook, what the preventive maintenance requirements of the systems are and how they may easily be achieved.

Metering

Because the logbook includes energy assessment, energy monitoring must be set up, generally using a metering strategy and reading schedule. This information, noted clearly and concisely in the logbook, will be compared with benchmarks and the designer's calculations of what and how the building should consume. This information aids the building owner and the facility manager in understanding where the energy is being used so that any adjustments and alterations can be made to optimize energy conservation (moving to climate neutral or net zero energy).

Conclusion

Moving to sustainable, high performance building energy systems should be the urgent goal of every building owner.

Detailed performance documentation and validation is a critical piece missing from the current building design, construction and operation process. The sustainable building energy systems logbook has been developed, in part, to provide the missing documentation.

Reference

The Sustainable Building Energy Systems Logbook, Maisey & Milestone, Building Services Consultants (Sept. 2006).

Appendix

Global Energy Supply

Houston investment banker for energy industry since 1970's, Simmons & Company, & only oil depletion/energy crisis leader with impeccable experience, credibility & actual validated data: <http://www.simmonsco-intl.com>. These data have been validated by communications with oil producing entities including ARAMCO Chief Engineer and Petroleum Engineers.

Simmons' slides, based on Simmons' 5/05 Book "*Twilight in the Desert: THE COMING SAUDI OIL SHOCK & THE WORLD ECONOMY*," show for the first time **(1)** worldwide oil discoveries have been rapidly declining since 1960s, **(2)** discoveries today are at level of discoveries in 1930s, **(3)** actual data that Saudi oil fields and all other major global production are declining in oil output: *peaked* & growth is over, **(4)** all other prior & recent assumptions/projections are based on very limited or no data and almost all claim this wouldn't occur for 20-60 more years:

<http://www.simmonsco-intl.com/files/Capitol%20Hill%20-%20Depletion%20&%20Peak%20oil.pdf>
<http://www.simmonsco-intl.com/files/AAPL%20Talk%20Banff%20-%20July%20201.pdf>
<http://www.simmonsco-intl.com/files/Twilight%20in%20the%20Desert%20Presentation.pdf>
<http://www.simmonsco-intl.com/files/OTC%202005%20The%20Big%20Energy%20Surprise.pdf>
<http://www.simmonsco-intl.com/files/Hudson%20Institute%20September.pdf>
<http://www.simmonsco-intl.com/files/ENERGY%202005%20Policy%20Briefing.pdf>
<http://www.simmonsco-intl.com/files/Oil%20&%20Money%20Conference.pdf>
<http://www.odac-info.org>

Simmons & Co. US Senate 2003 testimony about problem of near term oil demand outstripping supply: http://energy.senate.gov/hearings/testimony.cfm?id=590&wit_id=1600

DOE concludes that waiting until world oil production peaks before taking crash program action leaves the world with a significant liquid/natural gas fuel deficit for more than two decades (*Peaking of World Oil Production: Impacts, Mitigation, & Risk Management 2005*).

Recent leading Simmons' interviews and articles based on "*Twilight*" book showing that existing/new production & discoveries needed to meet rapidly increasing global demand aren't there, & he believes oil/gasoline/natural gas costs will likely go ten times higher soon and keep rising:

<http://www.time.com/time/globalbusiness/article/0,9171,1106299,00.html>
<http://www.financialsense.com/transcriptions/Simmons.html>
<http://www.eande.tv/transcripts/?date=061505#transcript>
<http://www.washingtonpost.com/wp-dyn/content/discussion/2005/07/26/DI2005072601004.html>
<http://www.sundayherald.com/49438>
<http://www.msnbc.msn.com/id/8217587/>
<http://www.abc.net.au/rn/talks/natint/stories/s1388742.htm>
<http://www.foxnews.com/story/0,2933,166510,00.html>
<http://www.resourceinvestor.com/pebble.asp?relid=9692>
<http://www.resourceinvestor.com/pebble.asp?relid=12316>
<http://www.emagazine.com/view/?2574>
<http://english.aljazeera.net/NR/exeres/05670D19-AF77-4F7C-AE27-53FAD722FE5E.htm>
http://www.foreignpolicy.com/story/cms.php?story_id=3233
<http://www.prudentbear.com/internationalperspective.asp>
<http://www.chron.com/cs/CDA/ssistory.mpl/editorial/3337757>
<http://www.iht.com/articles/2005/09/09/yourmoney/mjoe10.php>
http://www.gold-eagle.com/editorials_05/hommelberg081805.html

Simmons says the President is encouraging his communications and work on Oil Depletion. T. Boone Pickens, founder/former head of Mesa Petroleum, growing it to one of the world's largest independent oil & natural gas producers, and a large petroleum hedge fund manager, explains why there is very limited national public discussion of this crisis ([EV World May 3, 2005](#), presentation at the 11th National Clean Cities Conference):

"The majors, they talk about plenty of oil and that they can produce more, but if you look at ExxonMobil, ChevronTexaco, BP (British Petroleum), all the production (is) going down every year. They don't replace and they don't add to production, but they say there's plenty of oil around.

"Now why would they say that? One of the chief economists with one of the major oil companies... I was at a conference where he was... we were talking and I asked, why do they say that? And he said, can you imagine what would happen if one of these major oil company's CEO's got up and made a speech and he said, 'We're running out of oil'? I said there'd be panic and he said, 'That's right. They're not going to make the statement. They're going to say there's plenty of oil around'".

"I know that sounds rather simple, but that's the best answer I've had... why they keep saying that there's plenty of oil around"

French Prime Minister Dominique de Villepin emphasizes: "We have entered the post-oil era. I want to draw all the consequences of this and give a real impulse to energy savings and to the use of renewable energies (Reuters, Paris, Sept. 1, 2005)."

Oil depletion/energy crisis is real, & will have immediate & longer term substantial affect on the global economy, social order, green buildings & sustainable/EPP products, but how????