

# ANALYZING CARBON

## INTRODUCTION

### Welcome to the first edition of the IES - US Sustainable Impact Quantification (I.Q.) GreenBrief!

Over the coming months we will be issuing Sustainable I.Q.'s on various topics to provide insight into how and what impacts can be quantified, how they can be localized, how they fit into and influence the design process, and how they can be shaped and presented. This first Sustainable I.Q. focuses on Analyzing Carbon, and the next issue will be on Passive/Hybrid Strategies. We hope you will find the information interesting and useful, and we would welcome your feedback on other topics that you would like to hear more about.

**Kevin Settlemyre, Associate Director IES**  
LEED AP, USGBC LEED Faculty

## SCENARIO:

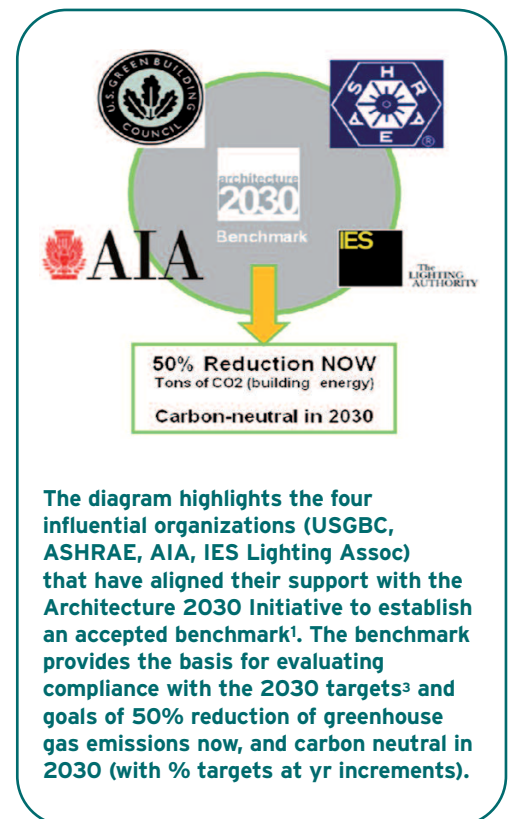
Sitting in a conference room waiting for the project team meeting to kick off the design development phase of the project, the architect reviews her notes and the results from the different cycles of analysis during schematic design. She sees that the tons of carbon have reduced at each cycle of analysis based on different measures, but the total is 44% compared to the 2030 benchmark. The project goal of 60% reduction will still need some work to reach.

Quantifying the tons of carbon is a metric that incorporates building energy, and has the capability to expand to other areas of influence of a project such as transportation and building materials. Typically when projects are referring to targeting carbon neutral, they are referring to the tons of carbon associated with building energy in terms of site energy and source energy.

As more product manufacturers begin to quantify carbon in terms of their manufacturing processes, and rating systems such as LEED evolve their frameworks to capture other parameters in terms of building materials, the influence of the carbon metric will expand. In a similar way, as transportation begins to become a parameter that becomes part of the equation for not only product selection, but also the construction process, the metric expands even further. The goal of the expanding metric is providing a recognized and clear way to quantify the impact on the environment, so that ways can be explored to reduce it.

### THE KEY PARAMETERS OF THE CARBON METRIC ARE:

- > **What is the carbon benchmark?**
- > **What emission factors are used for the resource mix of the utilities?** (source energy)
- > **How is building energy measured?** (site energy)
- > **How can it be used to inform design?** (integrated design process)



The diagram highlights the four influential organizations (USGBC, ASHRAE, AIA, IES Lighting Assoc) that have aligned their support with the Architecture 2030 Initiative to establish an accepted benchmark<sup>1</sup>. The benchmark provides the basis for evaluating compliance with the 2030 targets<sup>3</sup> and goals of 50% reduction of greenhouse gas emissions now, and carbon neutral in 2030 (with % targets at yr increments).

### IES HEADQUARTERS

Helix Building,  
West of Scotland Science Park  
Glasgow, G20 OSP, UK

T +44 (0)141 945 8500  
E enquiries@iesve.com

### BOSTON

43 Kingston Street,  
Fifth Floor,  
Boston,  
MA 02111-2241,  
USA

T +1 617 426 1890

### SAN FRANCISCO

100 Bush Street,  
Suite 1500,  
San Francisco,  
California, CA 94104  
USA

T +1 415 983 0603

### IRELAND

Fifth Floor,  
Castleforbes House,  
Castleforbes Road,  
Dublin 1,  
Ireland

T +353 (1) 875 0104

### AUSTRALIA

Level 1,  
123 Camberwell Road,  
Hawthorn East,  
Melbourne,  
Vic 3123, Australia

T +61 (0)3 9808 8431

## 2030 BENCHMARK

Over the past months the alignment of different organizations and initiatives around an accepted baseline for comparison has been progressing, primarily based on the growing interest around the Architecture 2030 Initiative. The diagram expresses four key organizations that have put their support behind the 2030 benchmark. The benchmark is based on the descriptions taken from valid building activities, outlined by the Energy Information Administration in the Commercial Building Energy Use Survey (CBECS), conducted in 2003.

## SITE ENERGY

he amount of energy that the building consumes.

A typical energy metric that is used to allow quick comparisons among building types is "kbtu/s.f./yr", which stands for thousands of Btus, per square foot that are consumed in a year. The lower the number is, the more energy efficient the project is.

## SOURCE ENERGY

The actual energy required to generate the energy to be consumed by the project (site energy) that is provided by nearby utilities is the source energy. The amount of energy it takes to generate the required site energy and the associated greenhouse gas emissions varies based on the resource fuel mix at the utility. Therefore to quantify the correct greenhouse gas emissions and carbon footprint, the source utility and the associated resource fuel mix needs to be identified.

For the sake of demonstration, imagine a project that utilizes 60,000 kbtu/s.f. is located in New York, NY and Providence, R.I. The table shows that the resource fuel mix can play a significant factor in the amount of emissions associated with a project, and it also demonstrates the significant role that on-site renewable energy and co-generation can play in the amount of source energy that is required.

## INTEGRATIVE DESIGN PROCESS

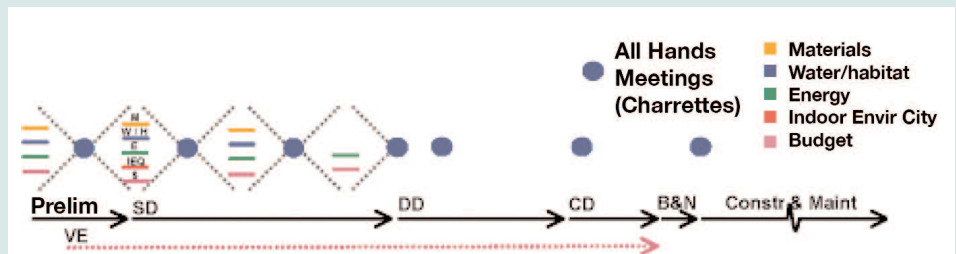
The following excerpts are taken from a document that IES assisted in the development of, the ANSI/MTS 1.0 Whole Systems Integrated Process Guide (WSIP)-2007 for Sustainable Buildings & Communities.

The purpose of Integrative Design is to effectively manage the optimization of complex systems in the effort to realize sustainable practices in design and construction. To achieve cost effective and increasingly more effective environmental performance, it is necessary to shift from conventional linear design and delivery processes to the practice of interrelated systems integration.

The diagram provides the basis of the framework that the national committee developing an ANSI/MTS Standard on Whole System Integration Process<sup>2</sup> is using.

The proposed framework outlined in the standard describes a route where the schematic design process is expanded allowing parallel, multi-disciplinary investigations while compressing the construction documentation stage.

In addition "all hands meetings" provide the necessary milestones at earlier stages in the process for issues to be communicated, reported on and discussed by the overall project team. The initial diagram is credited to Bill Reed, also one of the chairs for the ANSI Standard committee.

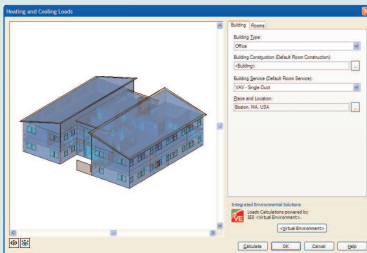


The diagram provides the basis of the framework that the national committee developing an ANSI/MTS Standard on Whole System Integration Process<sup>2</sup> is using.

## REFERENCE SOURCES

- 1) **Basis for the diagram - The 2030 Challenge Benchmark Set**  
- Building Design Leaders Unite on Energy Reduction Targets  
[www.architecture2030.org/news/Press\\_Release\\_5\\_4\\_07.pdf](http://www.architecture2030.org/news/Press_Release_5_4_07.pdf)
- 2) **ANSI/MTS 1.0 - Whole System Integration Process (WSIP) Guide**  
for Sustainable Buildings & Communities  
<http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI%2FMTS+1.0+WSIP+Guide-2007>
- 3) **Architecture 2030 Challenge Targets**  
<http://www.architecture2030.org/news/targets.html>

## IES/REVIT LINK TIP:



**Coloring your floor plans based on heating, cooling or ventilation loads.**

### STEP 1

In Revit MEP go to Mech. Tab - IES Htg/Clg loads

### STEP 2

Verify building and room types

### STEP 3

Calculate and review results (set ranges)

### STEP 4

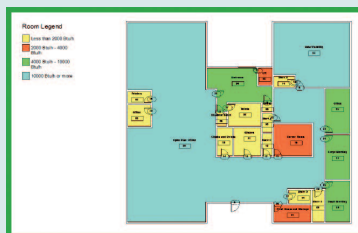
Go to floor plan in Revit tree, highlight right click - properties

### STEP 5

Color scheme - rooms

### STEP 6

Establish ranges for display based on results - apply



Floor plan will graphically identify where the rooms fall within the ranges selected based on the parameter selected (heating or cooling). Another benefit of the IES/Revit link.

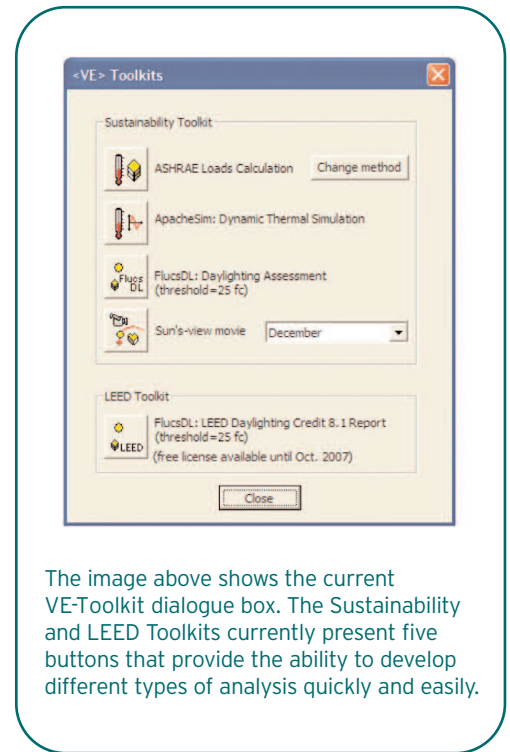
### PROVIDING SOLUTIONS - THE <VE> NOW:

The VE-Toolkits provide the ability to calculate the tons of carbon a project is responsible for. The result is based on the Building Information Model (BIM) that can be exported from Google SketchUp™ and Revit or imported directly into the <VE>. This functionality allows a project team the ability to provide performance analysis at the very early stage of the design process.

In the near term, a continued component of the IES approach is to enhance the VE-Toolkit early stage analysis tools to quantify impacts and to ease the process (interaction with BIM) to encourage multiple cycles. A current development project at IES is a free tool that will allow people to assess the site and source energy for the building as well as what the carbon footprint for the building is and how it compares to the Architecture 2030 benchmark.

Analyzing carbon during the course of a project is not a difficult thing to do. As more project teams begin to do it, we will begin to see very different results in the built environment, because traditional approaches and strategies will not provide the % reduction results that are needed to meet the Architecture 2030 Challenge. The key is to identify the parameters of the context, assess how it maps to the design process, and utilize tools that simplify the calculations and the effort, so that the project team's discussions can focus on the strategies that can reduce the impact. So, make analyzing carbon a part of your projects, and get out there and quantify impacts!

**➤ DISCOVER HOW TO ASSESS AND IMPLEMENT PASSIVE/HYBRID VENTILATION STRATEGIES IN IQ2**



The image above shows the current VE-Toolkit dialogue box. The Sustainability and LEED Toolkits currently present five buttons that provide the ability to develop different types of analysis quickly and easily.

## IES TRAINING OPTIONS

### Live e-training

We have released a new training schedule and <VE> demo schedule for the fall offering a flexible range of web based training courses for our modelbuilder, thermal, solar and daylighting tools, these take the form of live training sessions hosted by IES.

Please contact [training@iesve.com](mailto:training@iesve.com) for a schedule and to book your place.

**AUGUST 2008**  
**IES VE SketchUp Plug in**  
**Now Available**