

architecture 2030



Architecture 2030's mission is to rapidly transform the US and global Building Sector from the major contributor of greenhouse gas (GHG) emissions to a central part of the solution to the global-warming crisis.

Our goal is to achieve a dramatic reduction in the GHG emissions of buildings by changing the way they are designed and constructed.

"Data from the US Energy Information Administration illustrates that buildings are responsible for almost half (48%) of all energy consumption and GHG emissions annually; globally the percentage is even greater. Immediate action in the Building Sector is essential if we are to avoid hazardous climate change."

*- Edward Mazria AIA
Founder, Architecture 2030*

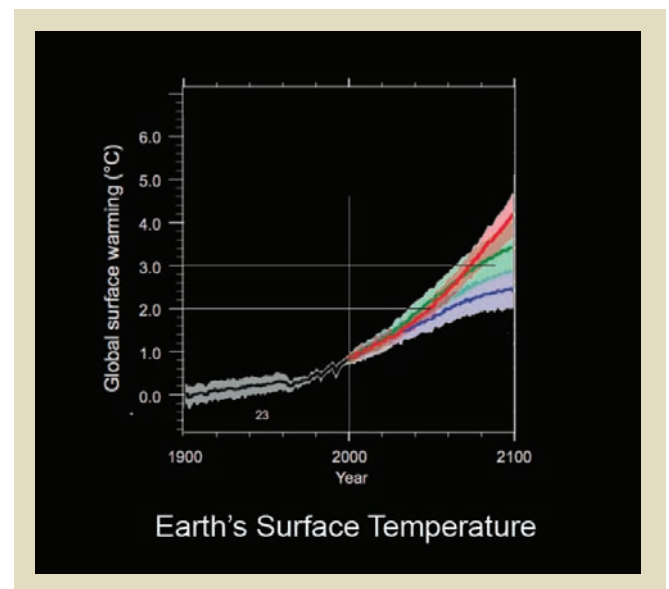
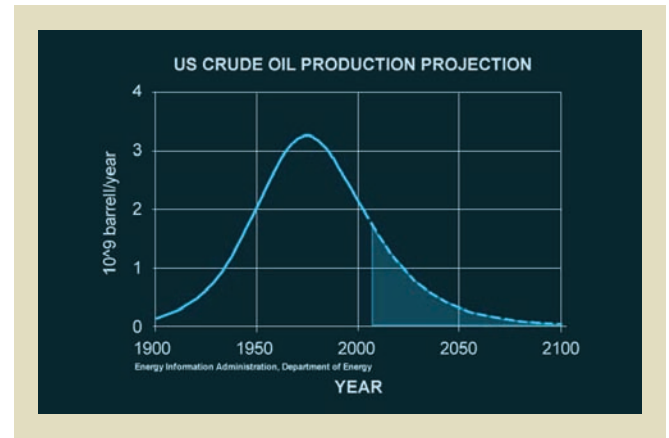
CONVERGING EVENTS

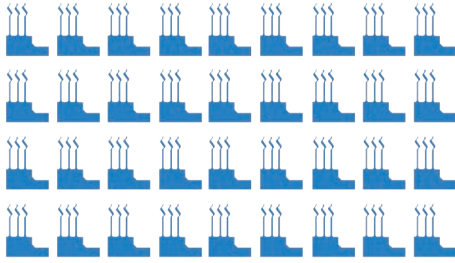
There are two global events converging to create the most significant crisis of modern times. The first of these is the escalating consumption of energy and resulting depletion of fossil-fuel resources. The second event is global warming.

The US peaked in oil production in the 1970's. We have since exhausted 75% of all the known oil reserves in the US, and we are now on our way to consuming the remaining 25%.

The US peaked in natural gas production in 1973, and in order to keep gas production steady in the US, we have had to drill thousands more wells every year. We have very little remaining oil and gas reserves.

Global warming is currently at 0.7°C above pre-industrial levels. Scientists tell us that in order to avoid dangerous climate change we must keep global warming under 2°C above pre-industrial levels. If we reach 3°C , we could potentially cause catastrophic climate change.





1 QBtu = annual energy output of 40
1,000 MW power plants

ENERGY CONSUMPTION PROJECTIONS

Energy consumption is measured in 'Quads' (Quadrillion Btus). One Quad equals the delivered energy of 40 1000-megawatt power plants, i.e. 40 large nuclear power plants, or approximately 75 500-megawatt conventional coal plants.

The US currently uses approximately 100 Quads of energy annually. The US Energy Information Administration (EIA) projects that, over the next 25 years, US energy consumption will increase by 34 Quads, or 34%.

The world, including the US, uses approximately 400 Quads of energy annually. EIA projects that, over the next 25 years, world energy consumption will increase by 276 Quads, or 62%.

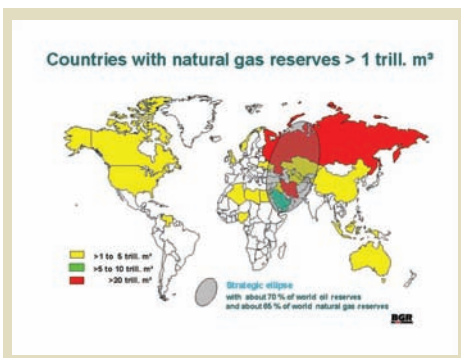
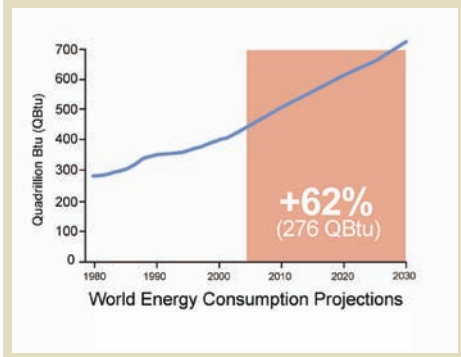
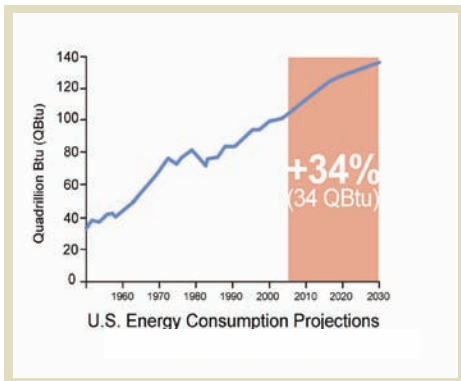
Where will all of this energy come from?

Seventy percent of the remaining global oil and gas reserves are located in what is called the strategic ellipse – an area stretching from Saudi Arabia up through Russia (see sidebar). These reserves have now become a political as well as an economic commodity, making the availability of these reserves uncertain.

So, what other energy options are available?

The US has large reserves of coal. The former Soviet Union & Russia have large reserves. Asia Pacific, China and Australia also have large reserves and are presently distributing their coal throughout Southeast Asia.

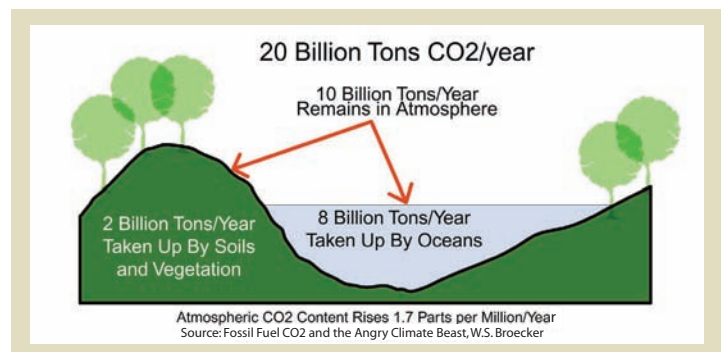
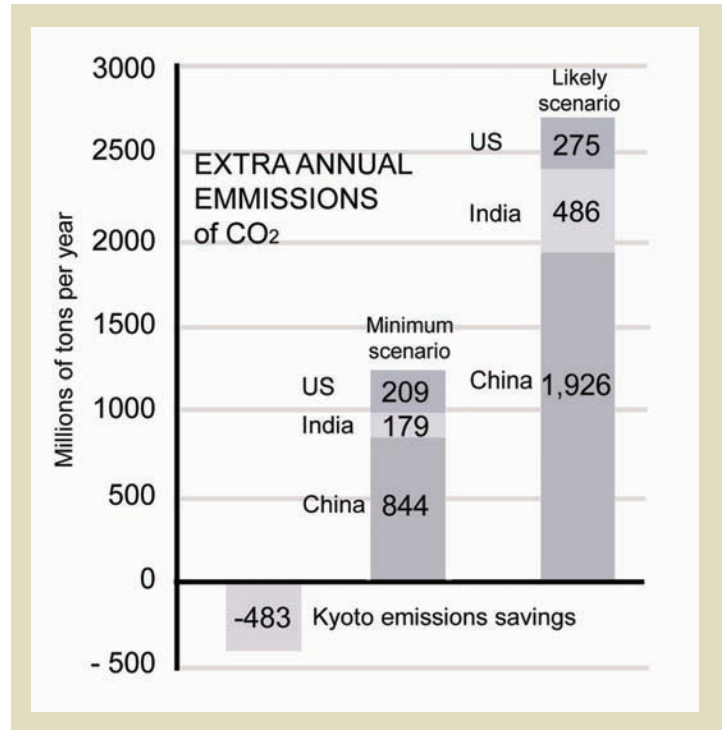
The environmental, safety, cost and security concerns associated with nuclear power plants, and the fact that conventional coal is one of the largest emitters of greenhouse gases, precludes these two methods of energy production as viable solutions in the face of global warming.



CO2 LEVELS

Meeting our current and future energy needs by continuing to burn fossil fuels will lead to further global warming. Assuming all the countries that signed the Kyoto Protocol met their commitments by 2012, the vast number of additional coal plants now being planned for the US, India and China, and their consequent emissions, completely negate the gains that might have been made by the treaty.

Additionally, substantial amounts of CO₂ released into the atmosphere have long-term consequences. The planet can only absorb a finite amount of CO₂. Of the 20 billion tons of CO₂ currently being released into the atmosphere, approximately 10 billion tons can be absorbed by the planet. The additional 10 billion tons released into the atmosphere remains there, and fuels global warming. Continuing to increase the amount of CO₂ in the atmosphere is a huge experiment by the human race on our planet.



CO2 AND TEMPERATURE

Until modern industrial times, the earth's surface temperature approximately followed atmospheric CO₂ levels. Today, this is no longer the case. Surface temperatures are lagging behind CO₂ increases, as can be seen in the accompanying graph.

This sudden and dramatic increase in atmospheric CO₂ levels cannot be attributed to natural phenomena, such as solar and volcanic activity, and is therefore a cause for serious concern. There is currently a 0.7°C (approx.) rise in temperatures above pre-industrial levels, and if surface temperatures continue to follow CO₂ emissions, temperatures will likely continue to rise.

Assuming a business-as-usual scenario, scientists' predictions indicate a roughly 50% probability that global surface temperatures will rise relative to increasing CO₂ levels and we will reach warming of 2°C above pre-industrial levels by 2050, and 3 degrees by 2100. If we do not make the necessary CO₂ and other greenhouse gas reductions quickly, this warmer planet will be the world our children and grandchildren will inherit.

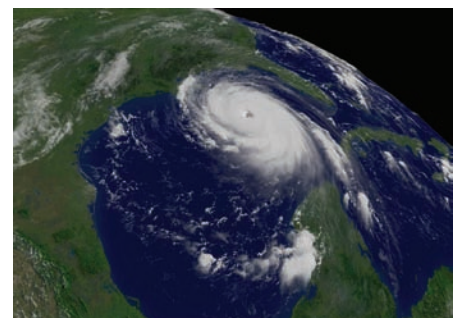
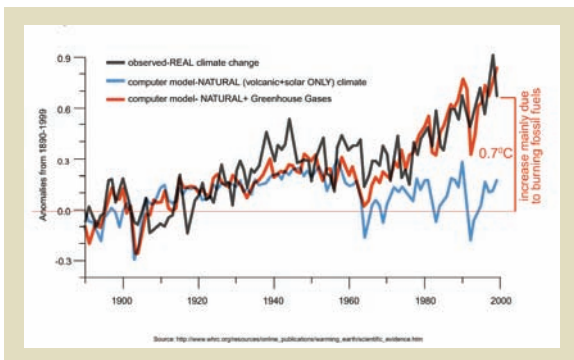
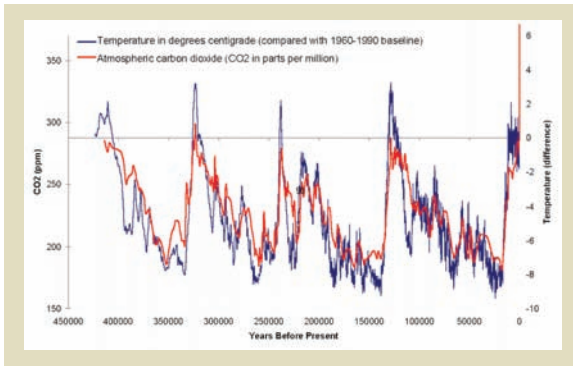
Dr. James Hansen has stated:

"Warming of more than 1 degree Celsius above today's level will make the Earth warmer than it has been in a million years.

The Earth's history suggests that with warming of 2-3°C the new equilibrium sea level will include not only most of the ice from Greenland and West Antarctica, but a portion of East Antarctica, raising sea level of the order of 25 meters (80 feet)... real world data suggest substantial ice sheet and sea level change in centuries, not millennia.

Action must be prompt, otherwise CO₂-producing infrastructure that may be built within a decade will make it impractical to keep further global warming under 1°C."

Dr. Hansen has set a timeline of ten years. We have ten years to make the changes necessary to keep warming from reaching 2°C above pre-industrial levels.



A 2°C WORLD

A 2 to 3°C warmer world will look significantly different from the world we see around us today. With this level of warming, there will be no more polar bears and some species of arctic seals will disappear.

In a 2 to 3°C warmer world there will be 30% less snow pack in the Rocky Mountains and 60% less water content in that snowpack. The Maple forests of New England will move into northern Maine and Southern Canada.

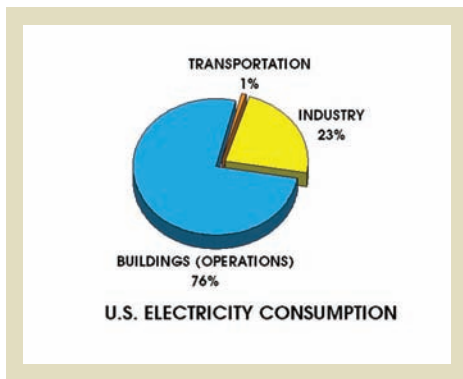
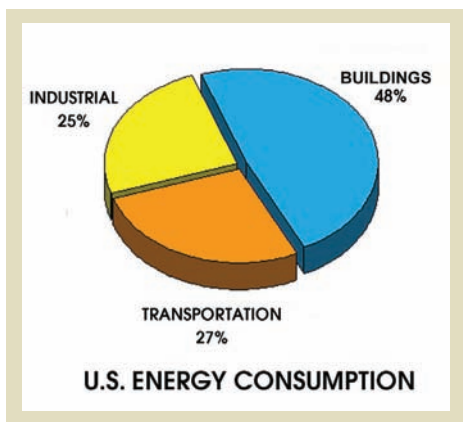
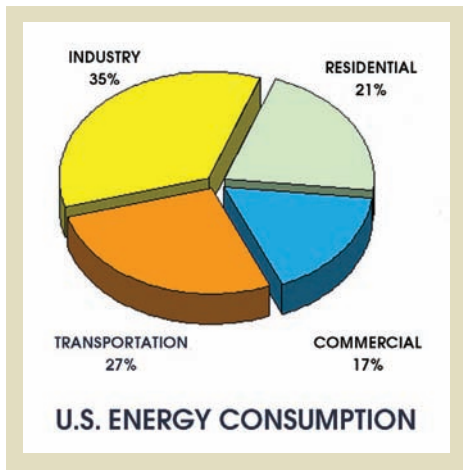
Scientists are also linking hurricane intensity and water content to climate change. Forest fires in the west are expected to double or even quadruple the number of acres burned between these two temperatures, as soils dry out more quickly.

Coral Reefs, home to 25% of all marine species, will begin to disappear with temperature increases between 2 and 3°C. Two recent studies project that by 2050, 25% of all plant and animal species on earth will become extinct.

Huge coastal population centers may also be affected in the US and around the world. We know that during the last interglacial period (approximately 125,000 years ago), on a 3°C warmer planet, it took Greenland approximately 120 years to melt, raising sea levels 4 to 6 meters.

Just a one meter rise would displace millions of people living along coastlines across the globe. In New Orleans, where we are spending 200 – 300 billion dollars putting the city back together, a 1-meter sea level rise would be catastrophic.





THE BUILDING SECTOR: A Hidden Culprit

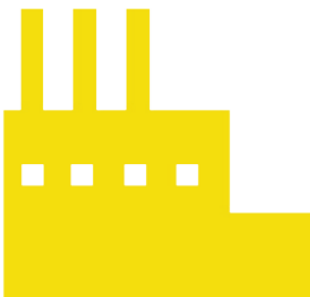
With so much attention given to transportation emissions, many people are surprised to learn that buildings are the single largest contributor to global warming. In order to clarify this misconception, Architecture 2030 has reshaped the debate surrounding climate change and GHG emissions to define and include a Building Sector.

Previous pie charts distributed the various elements of the Building Sector into several sectors; i.e. industry, commercial, residential and transportation. To determine the real energy impact of buildings, Architecture 2030 combined these various elements into a single sector called Buildings.*

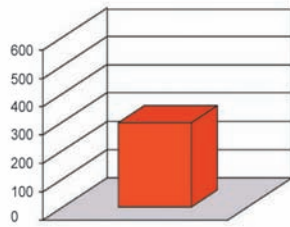
Data from the US Energy Information Administration illustrates that buildings are responsible for almost half (48%) of all energy consumption and GHG emissions annually; globally the percentage is even greater. Seventy-six percent (76%) of all power plant-generated electricity is used just to operate buildings. Clearly, immediate action in the Building Sector is essential if we are to avoid hazardous climate change.

*To create a US Building Sector percentage for the year 2000, the Residential buildings (operations) sector (20.4 QBtu), Commercial buildings (operations) sector (17.2 QBtu), Industrial sector - buildings operations (2.0 QBtu) and the Industrial sector - annual building construction and materials embodied energy estimate (8.57 QBtu) were combined. Total annual 2000 Building Sector consumption was 48.17 QBtu and the total annual 2000 US Energy consumption was 99.38 QBtu. Source: US Energy Information Administration (consumption numbers vary slightly depending on the EIA table used. To be conservative, Architecture 2030 rounded down).

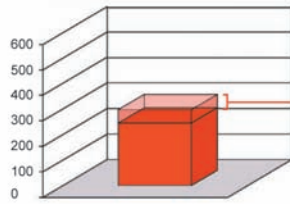
The annual embodied energy of building materials and the energy used to construct buildings is estimated at 1.146 MBtu/sf of building for new construction and half of this for renovation. Source: US Energy Research and Development Administration. At the current rate of construction in the US of approx. 5 Bsf of new building and 5 Bsf of renovation (EIA and Dodge), the total annual energy consumed is approx. 8.6 QBtu, or 8.6% of total US annual energy consumption.



Billion Square Feet (sf)
Source: AIA Research Corporation

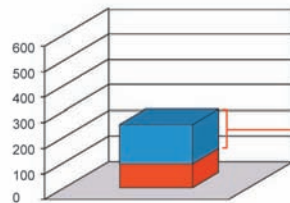


Currently the US building stock is approx. 300 billion sf.

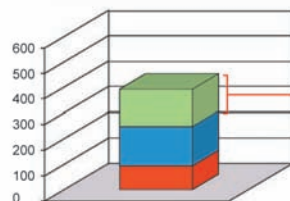


Over the next 30 years:

52 billion sf will be demolished



150 billion sf will be remodeled



150 billion sf will be new construction

Therefore, by the year 2035 three-quarters of the building stock will be new or renovated.

THE BUILDING SECTOR: A Historic Opportunity

The total US building stock equals approximately 300 billion square feet.

In the US every year, we tear down approximately 1.75 billion square feet of buildings.

Every year, we renovate approximately 5 billion square feet.

Every year, we build new approximately 5 billion square feet.

Herein lies the hope. By the year 2035, approximately **three-quarters** (75%) of the built environment will be either new or renovated.

This transformation over the next 30 years represents a historic opportunity for the architecture and building community to make the changes necessary to avoid dangerous climate change.



THE 2030 °C CHALLENGE

As Architecture 2030 has shown, buildings are the major source of demand for energy and materials that produce by-product greenhouse gases (GHG). Slowing the growth rate of GHG emissions and then reversing it over the next ten years is the key to keeping global warming under approximately one degree centigrade (°C) above today's level. It will require immediate action and a concerted global effort.

To accomplish this, Architecture 2030 has issued **The 2030 °C Challenge** asking the global architecture and building community to adopt the following targets:

The 2030 °C Challenge is supported by:



RAIC



LEED

- All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.
- At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.
- The fossil fuel reduction standard for all new buildings shall be increased to:
 - 60% in 2010
 - 70% in 2015
 - 80% in 2020
 - 90% in 2025
 - Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate).

These targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20% maximum) renewable energy and/or certified renewable energy credits.

ACTIONS

As a firm/organization:

Adopt **The 2030 °C Challenge** for your firm/organization. Choose to have your firm/organization listed at www.architecture2030.org as an official adopter.

Educate your clients about the benefits of energy-efficient buildings and recommend that their projects meet **The 2030 °C Challenge**.

As an individual:

Advocate for the adoption of **The 2030 °C Challenge** at your firm or organization. Register your support of the °C Challenge at www.architecture2030.org.

Utilize energy-efficient design strategies and technologies in your projects and promote energy efficiency in your office.

Everyone:

Support the modification of building energy codes to first establish a 50% benchmark for each building type, and then use the performance path of the code for compliance.

Support a five-year minimum extension of the Energy Policy Act, doubling of the tax credits for energy conservation measures and removal of the residential tax-credit cap for solar-thermal and photovoltaic systems.

Support the requirement of *all* government-funded buildings to meet **The 2030 °C Challenge** 50% target, and *all* government-owned buildings to meet LEED Silver (or equivalent standard) with a 60% energy reduction target.

THE 2010 IMPERATIVE



Adam Joseph Lewis Center for
Environmental Studies, Oberlin College
Architect: William McDonough + Partners

THE 2010 IMPERATIVE

To successfully impact global warming and world resource depletion, it is imperative that ecological literacy become a central tenet of design education. Yet today, the interdependent relationship between ecology and design is virtually absent in many professional curricula. To meet the immediate and future challenges facing our professions, a major transformation of the academic design community must begin today.

To accomplish this, Architecture 2030 has issued The 2010 Imperative which calls upon the academic design community to adopt the following:

- Beginning in 2007, add to all design studio projects the following requirement:
"All design projects should engage the environment in a way that dramatically reduces or eliminates the need for fossil fuel."
- By 2010, achieve complete ecological literacy in design education, including the following areas of study:
 - design / studio
 - history / theory
 - materials / technology
 - structures / construction
 - professional practice / ethics
- By 2010, achieve a carbon-neutral design school campus.
This may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20% maximum) renewable energy and/or certified renewable energy credits.

ACTIONS

As a school:

Adopt **The 2010 Imperative** for your school. Choose to have your school listed at www.2010imperative.org as an official adopter.

Achieve LEED Platinum Carbon Neutral for your design school campus.

Advocate for a certification of ecologically-literate design programs.

Advocate for the rest of your campus to adopt **The 2010 Imperative** and become carbon neutral.

As an individual:

Advocate for the adoption of **The 2010 Imperative** at your school or alma mater. Register your support of the Imperative at www.2010imperative.org.

If you are faculty, incorporate energy-efficient design practices into your courses.

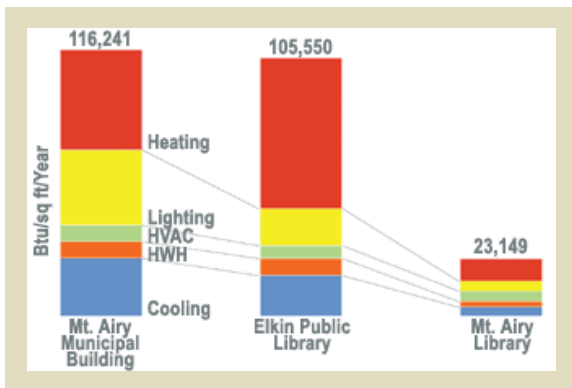
If you are a student, utilize energy efficient design strategies in your studio projects.

Everyone:

Participate in the online forum at www.2010imperative.org to stay informed, inform others of your initiatives and progress, swap ideas and more.



Mazria, Inc. Photo: Gordon Schenck



CASE STUDIES: 50-80% Reductions

It was demonstrated in the 1980's by government funded projects across the U.S. that building energy consumption reductions of 50% to 80% can readily be achieved through design at little or no additional cost. Since then, countless buildings have been designed and built both in the U.S. and abroad that confirm this.

MT. AIRY PUBLIC LIBRARY

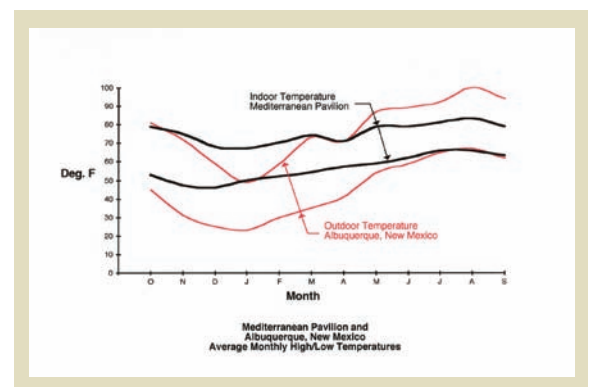
The design of the Mt. Airy Public Library successfully applies sustainable design strategies in a facility that calls for high illumination levels and humidity control in a region with hot, humid summers and cool winters. A saw-tooth clerestory above the structural bays provides daylight over the circulation desk, reading areas and reference stacks. A butterfly roof configuration with glazed ends and a central elongated light well provides illumination for the open stacks area. Passive cooling in the building is achieved in a number ways. Shade trees and a light-colored roof membrane reduce the impact of solar radiation in summer. Operable windows allow for natural ventilation when the weather permits, and thick white colored masonry exterior walls provide the thermal lag necessary to delay the effect of the summer sun on the interior until the evening hours when the library is closed. Passive heating in winter is accomplished by storing the heat gained through south facing windows and clerestories in CMU walls, the concrete structural elements and the tiled concrete floor slab. Computerized monitoring equipment has shown that the total energy use of the library is 23,149 Btu/sq ft/year. The library uses about one sixth as much energy per square foot as a nearby

THE RIO GRANDE CONSERVATORY

The conservatory at the Rio Grande Botanic Garden is the centerpiece of the Albuquerque Biological Park. It is comprised of two large glass pavilions: one features a Sonoran desert climate and the other features a Mediterranean climate. Computer modeling determined the necessary solar and thermal properties of glazing for each side of the building to provide the proper balance of heat and light to the plants inside. Plans called for a 7,500 square foot building, but due to the efficiency and lower cost for the building's environmental control systems, a 10,000 square foot structure was provided for the same cost. The conservatory has been open to the public and monitored for more than two years and the results are impressive. Each pavilion sustains winter temperatures 20 to 30 degrees above outdoor lows and maintains the internal conditions that are required for desert and mediterranean plant growth with little or no outside energy input.



Mazria, Inc Photo: Craig Campbell

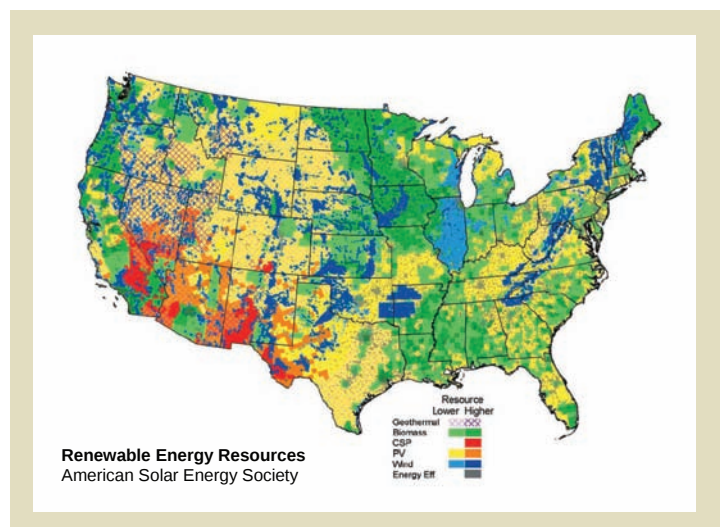
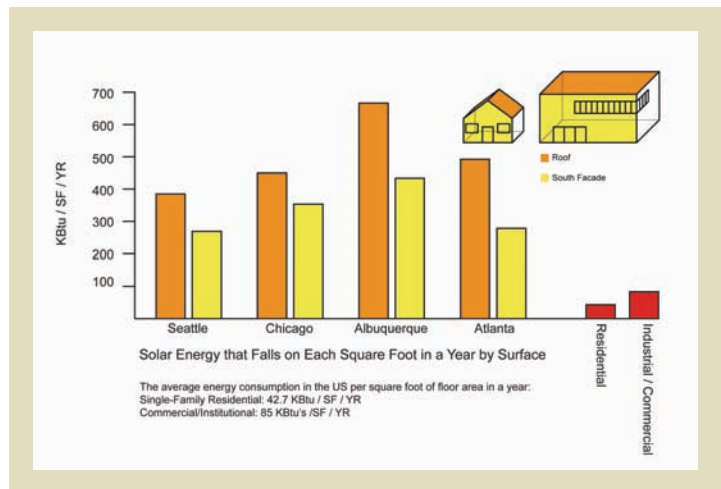


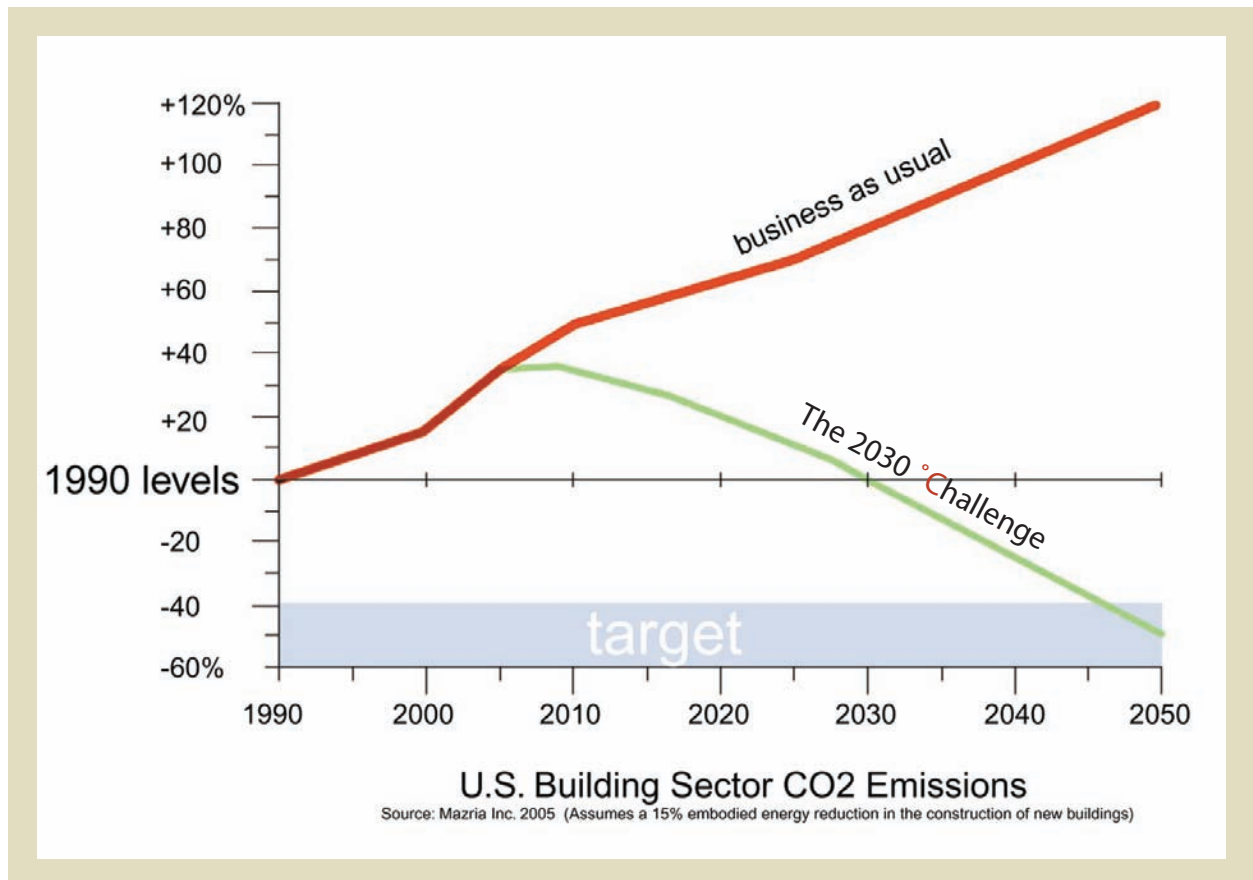
CLEAN ENERGY SOLUTIONS

In the US, the average energy consumption of a residence per square foot of floor area in a year is 42.7 KBtu/SF/YR. The average energy consumption of a commercial or institutional building is 85 KBtu/SF/YR.

The amount of solar energy available at the site far exceeds the energy needs of the average residential, commercial or institutional building, regardless of location in the US. In Seattle, known for its cloudy days, approximately 380 KBtus falls on each square foot of roof in a year and 275 KBtus fall on each square foot of south-facing walls in a year, for a total of 655 KBtu/SF/YR. This is more than **15 times** the energy needs of the average residence, and almost **8 times** the energy needs of the average commercial or institutional building.

In addition to solar energy, there are several other renewable energy sources that have yet to be fully explored. Given the huge technological strides made in numerous industries over the last 50 years, it is clear that we are capable of developing viable methods for harnessing this energy; we simply have not put the necessary financial and intellectual resources towards developing these technologies.





The graph above illustrates two possible scenarios. The red line indicates what is projected for the Building Sector - that we will fuel global warming.

The yellow line follows **The 2030 °Challenge** path. By following this path, we dramatically reduce the GHG emissions of buildings, meet **The °Challenge** targets and avert dangerous climate change.

Join us.

www.architecture2030.org
www.2010imperative.org

