

Drivers of Change:

**Being the Force to Achieve High Performance, Green Building Solutions
Through the Way We Approach Design, Construction, and Operations**

Thornton Tomasetti

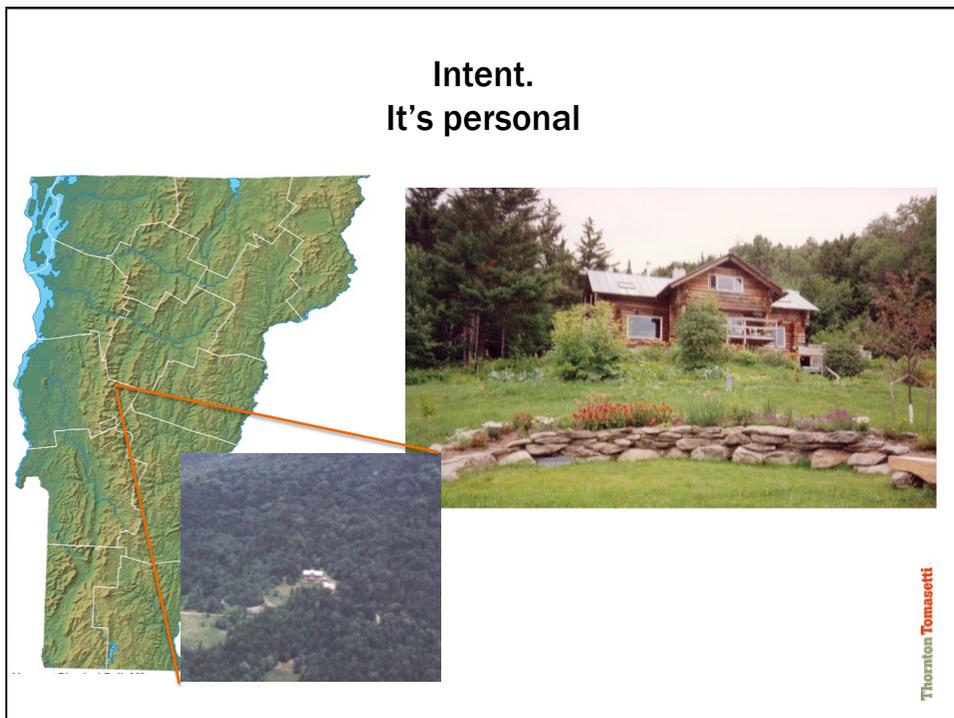
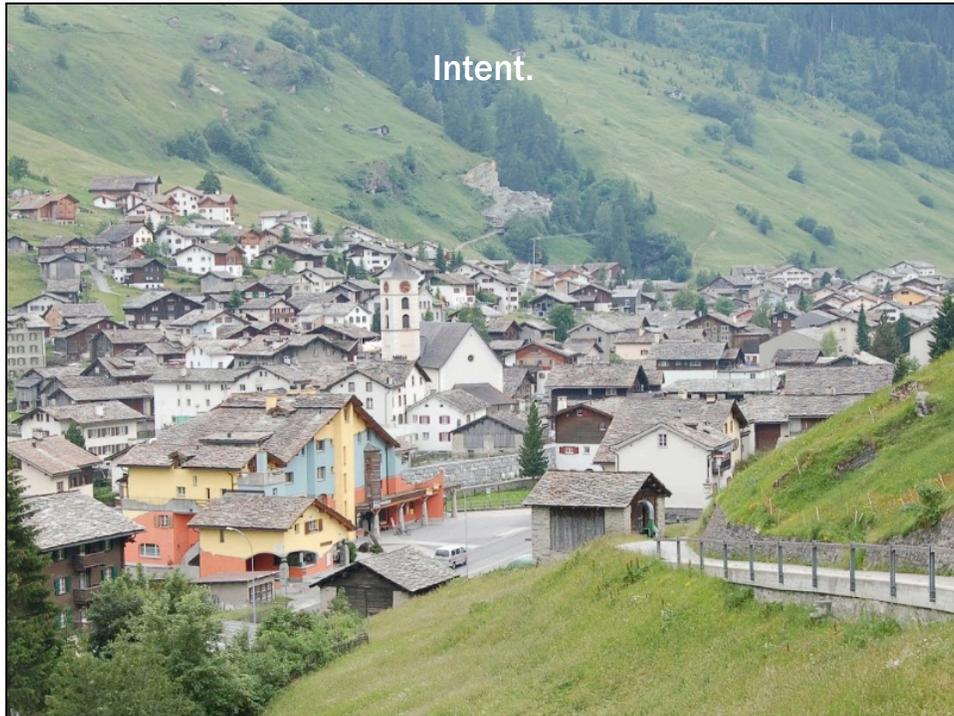
Gunnar Hubbard, FAIA, LEED Fellow

Principle and Sustainability Leader

PEDCO 4th Annual High Performance Buildings Seminar

10.01.2015

Intent.



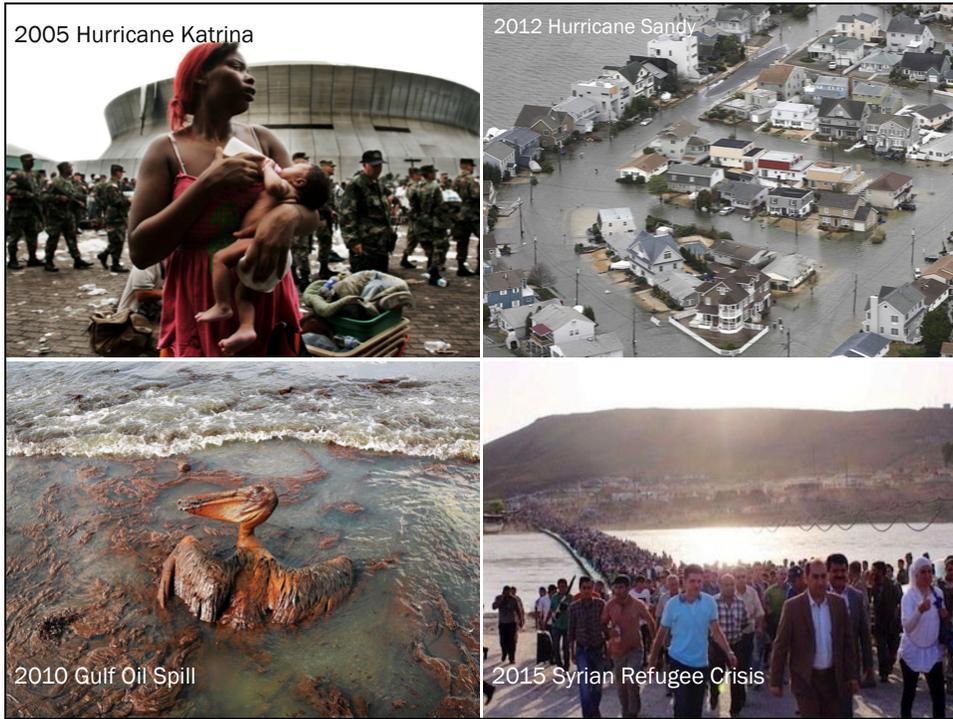
Intent.
It's a Global issue....

RISE IN ACIDITY BY 30% SINCE THE INDUSTRIAL REVOLUTION
SOURCE: NOAA

Slide Credit: Jack Spengler, Harvard University

Global Tropical Storms, 1848 - 2013

Slide Credit: Jack Spengler, Harvard University

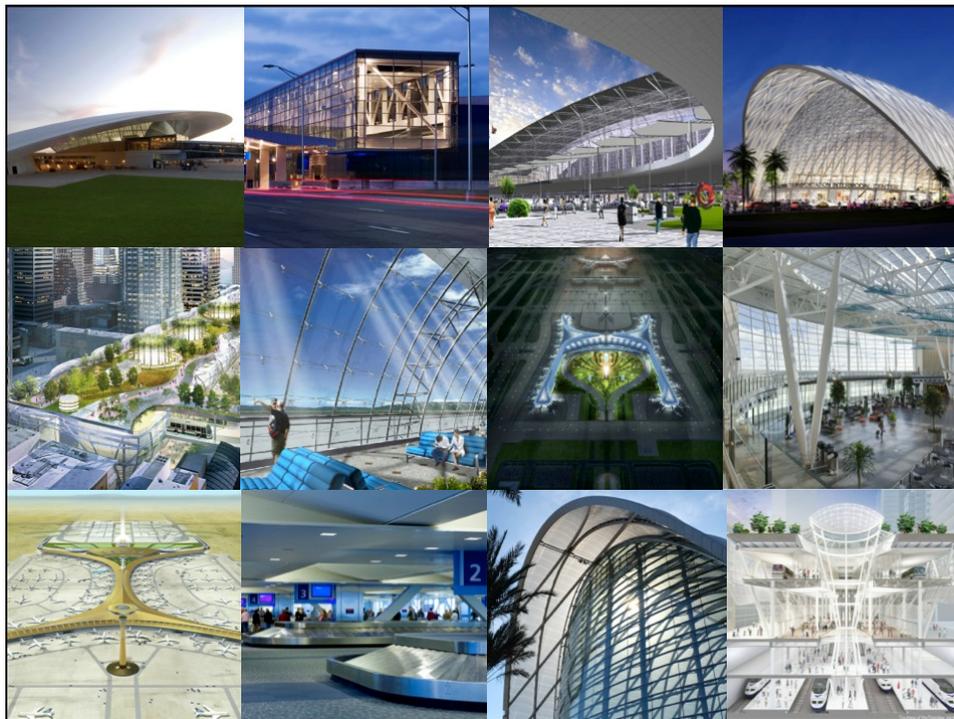
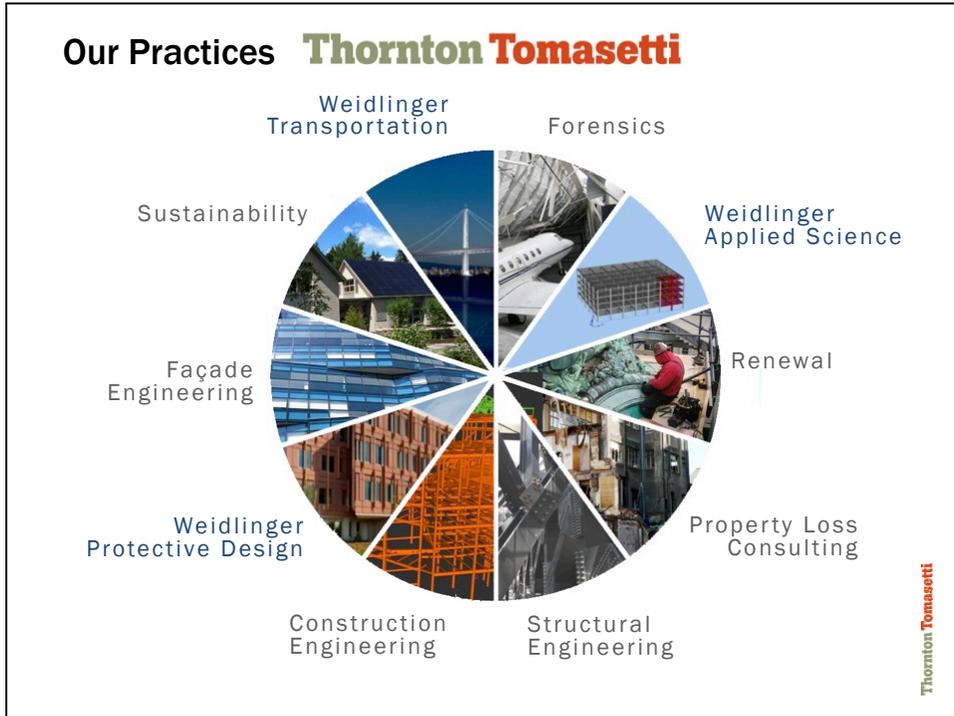


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No stranger to be problems



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Locally: Great American Tower

Structure Engineer
of Record

We also were the
structural Engineer
for the Arena at
Northern Kentucky
University



The Great American Tower at Queen City Square in Cincinnati, Ohio. Rick Mayer photo.

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Problem Solving

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Pope Francis: 'Revolution' needed to combat climate change

By Daniel Burke CNN June 18, 2015

"..the heedless worship of technology, our addiction to fossil fuels and compulsive consumerism – the Pope said humanity's "reckless" behavior has pushed the planet to a perilous "breaking point."



Slide Credit: Jack Spengler, Harvard University

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Episcopal church votes to divest from fossil fuels: 'This is a moral issue'

Suzanne Goldenberg, US environment correspondent The Guardian July 3, 2015

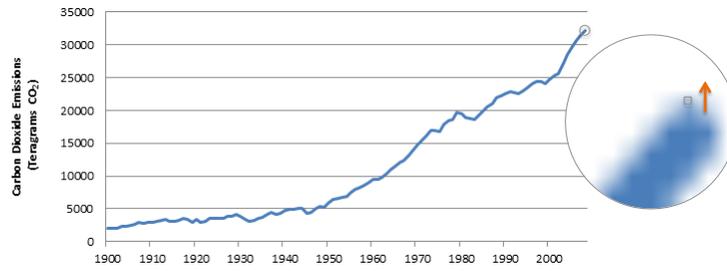


Thousands attend a church service during the General Convention of the Episcopal Church in Salt Lake City, Utah.
Photograph: Jim Urquhart/Reuters

Slide Credit: Jack Spengler, Harvard University

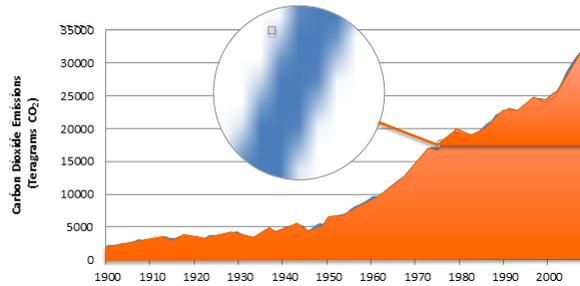
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Can a single person make a difference?



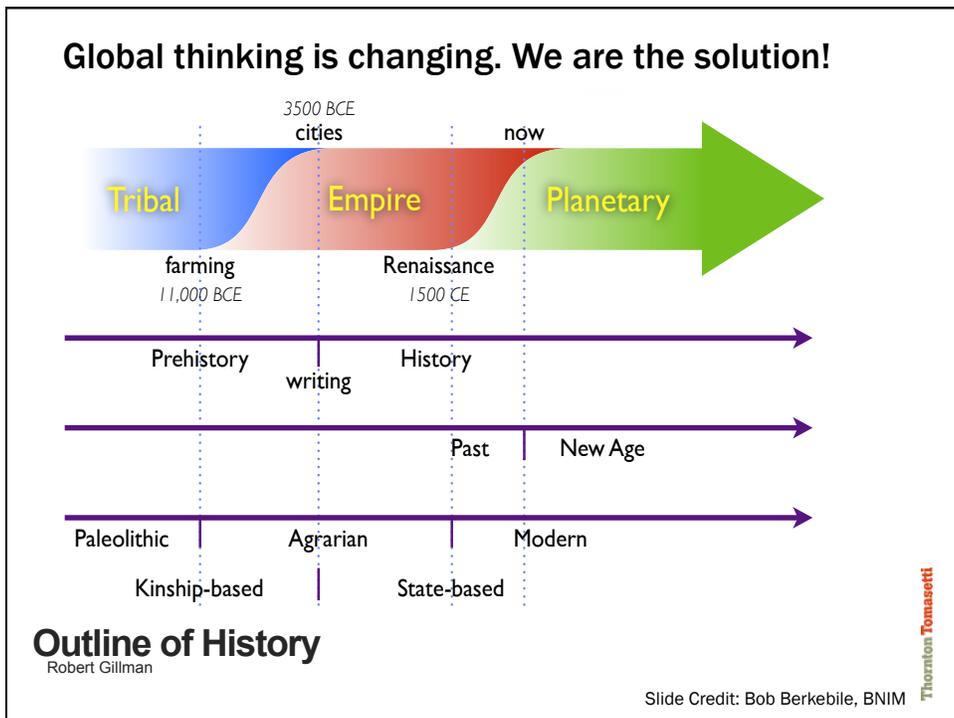
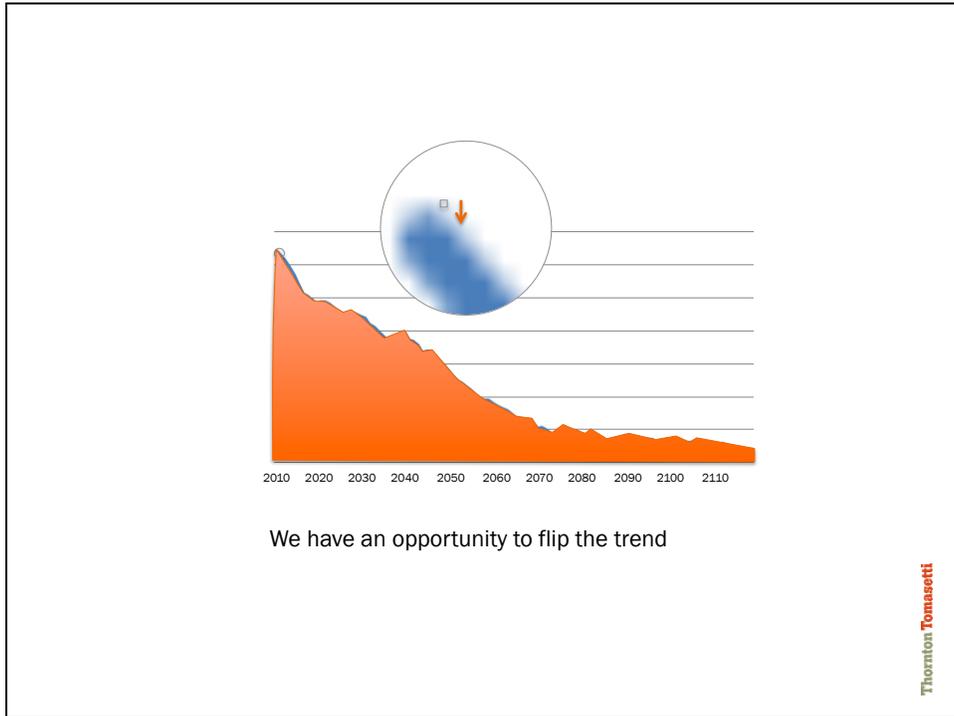
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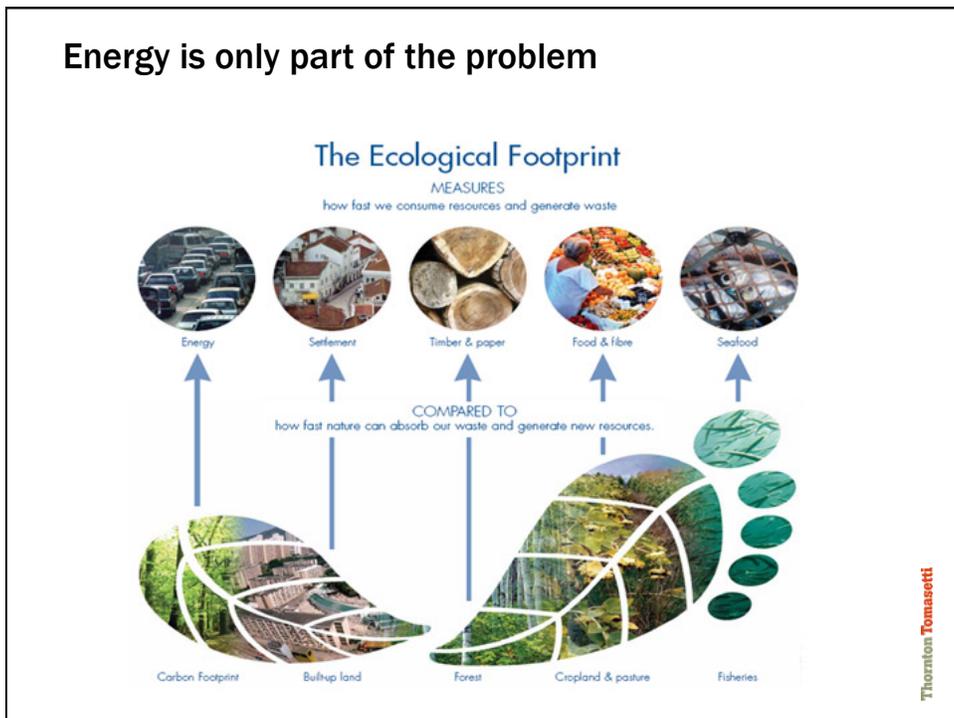
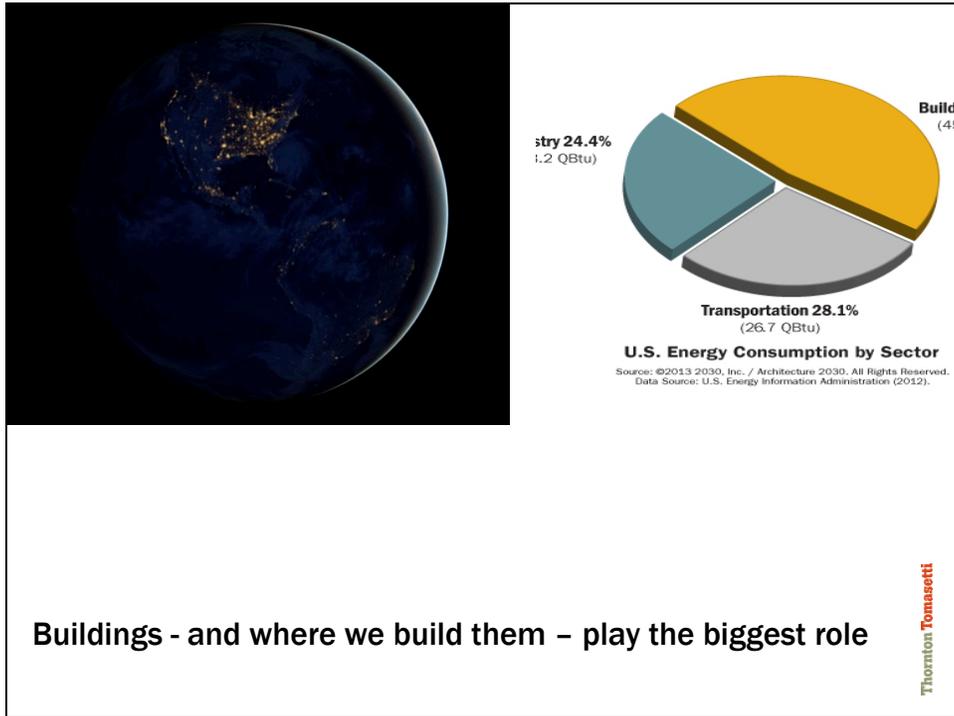
What if....?



What if it was a 100 year building

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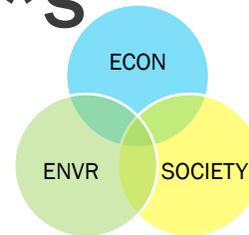




Rethinking Sustainability

$$S = f(M H N)k*s$$

Materials (manufacture capital)
 Human Capital (well-being)
 Natural Capital (eco-services +)
 Knowledge (capacity to innovate)
 Social (Integrity of Institutional structures)



Slide Credit: Jack Spengler, Harvard University

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Core stocks of assets for sustainability: *Manufactured, natural, human, social, knowledge*

Manufactured capital (Materials)

- Housing stock, electrical generating capacity, transport net...

Natural capital

- Biodiversity, soil quantity & quality, land cover
- Capacity to fix energy from sun, shield UV, regulate climate

Human capital

- Population size and distribution; its health and education

Social capital (s)

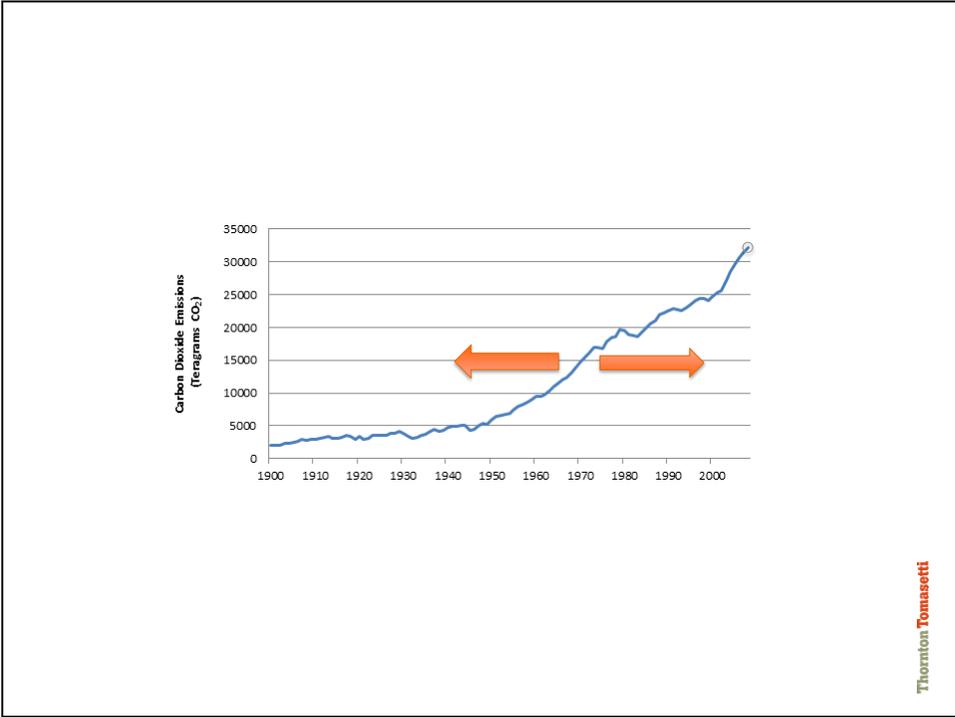
- Values, norms, laws, institutions... and trust in them

Knowledge capital(k)

- "Social" knowledge in books, patents, culture;
- Capacity to innovate

Slide Credit: Jack Spengler, Harvard University

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Its an overwhelming challenge to figure this out

Car manufacturers have it easy.....



What is our Role?

- Individual
- Firm/Company
- Community/Region
- Globally



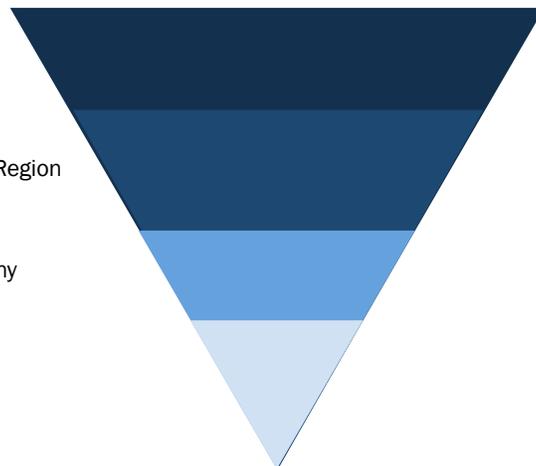
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Global

Community/Region

Firm/Company

Individual



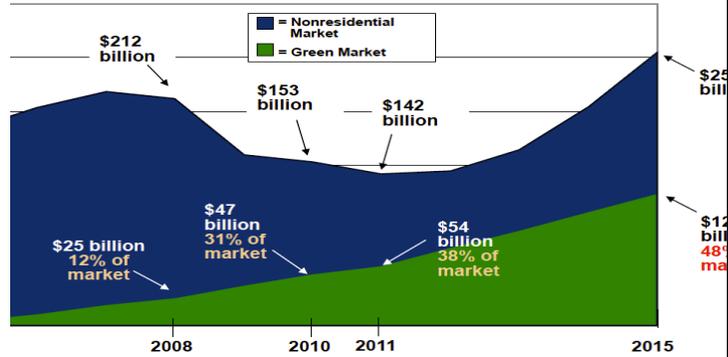
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The industry is showing the importance of Green Building

Green Market

Office - 50%
 Education - 45%
 Healthcare - 35%

Offers Significant Opportunity for Building in Nonresidential Starts



Source: McGraw-Hill Construction, 2011 Green Outlook Report, McGraw-Hill Construction; base value of construction market from McGraw-Hill Construction Market Forecasting Service, updated February 2012.
 Confidential. All information presented © McGraw-Hill Construction, 2012. All rights reserved.



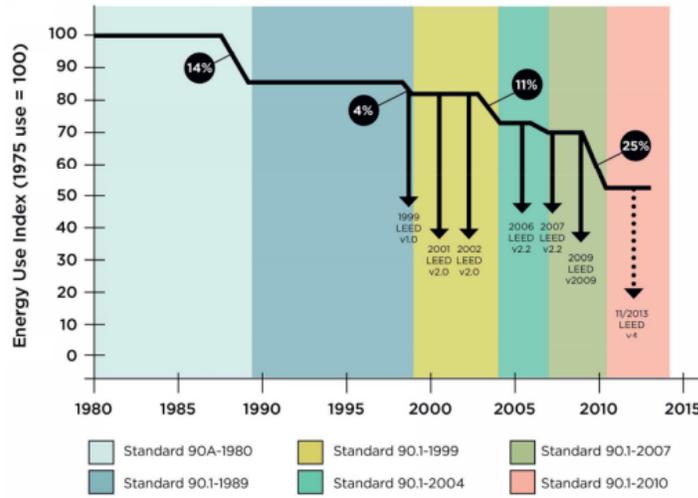
Benchmarking has played, and does play, an Important role

Codes & Building Certification



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LEED Points... and ASHRAE



Slide Credit: USGBC

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Leveraging rating systems



Very low use.

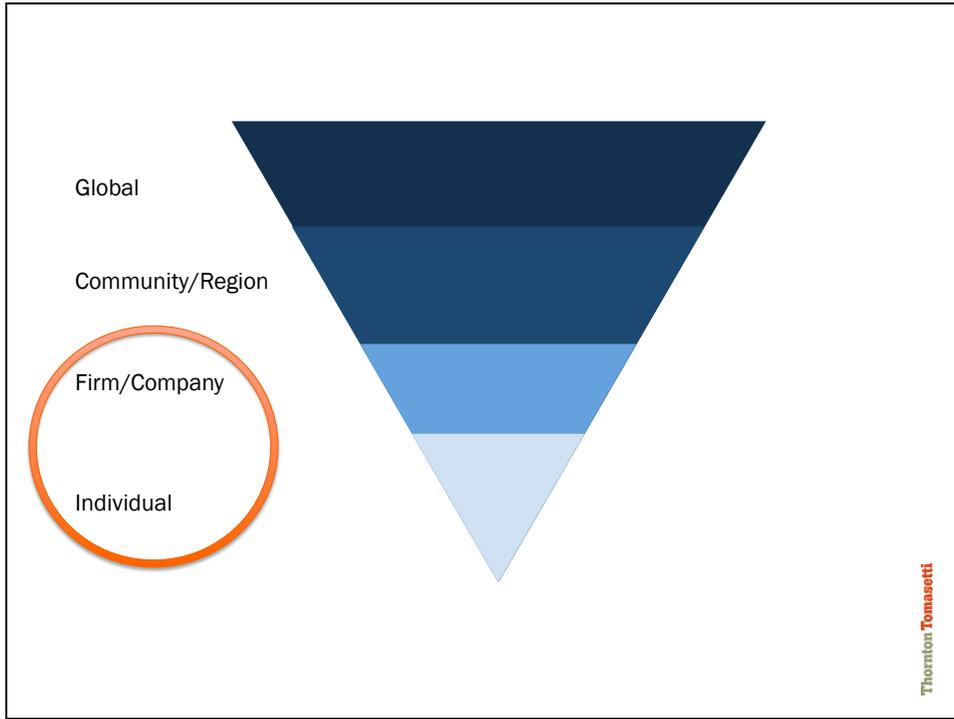


No use.



Giving.

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Brewer Village Apartments

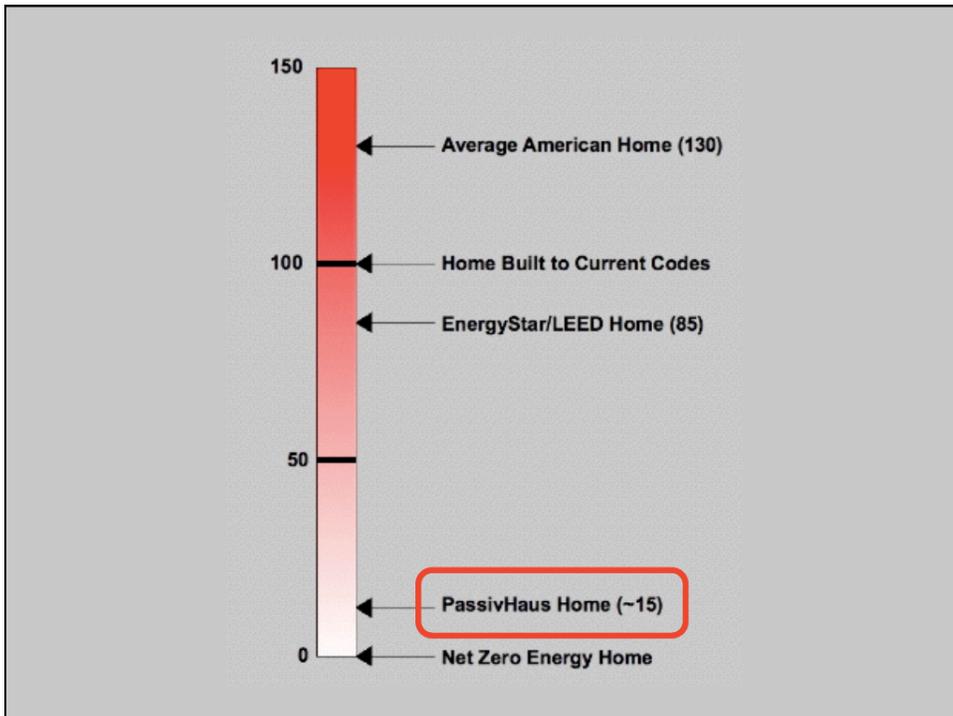
CWS Architects

Community Housing of Maine

48,000 SF

Passive House Consulting

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Passive House Criteria

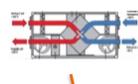
Peak Heat Load
 ≤ 3.17 BTU/hr.ft²

Primary Energy Demand
 ≤ 38 kBtu/ft²/yr
Source

Airtightness
 ≤ 0.6 ACH₅₀



Envelope



Ventilation
Heat Recovery



Geometry



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MEP Meeting # ? of 1,000



Prepared by Colin Schless

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MEP Meeting # ? of 1,000

Engineer

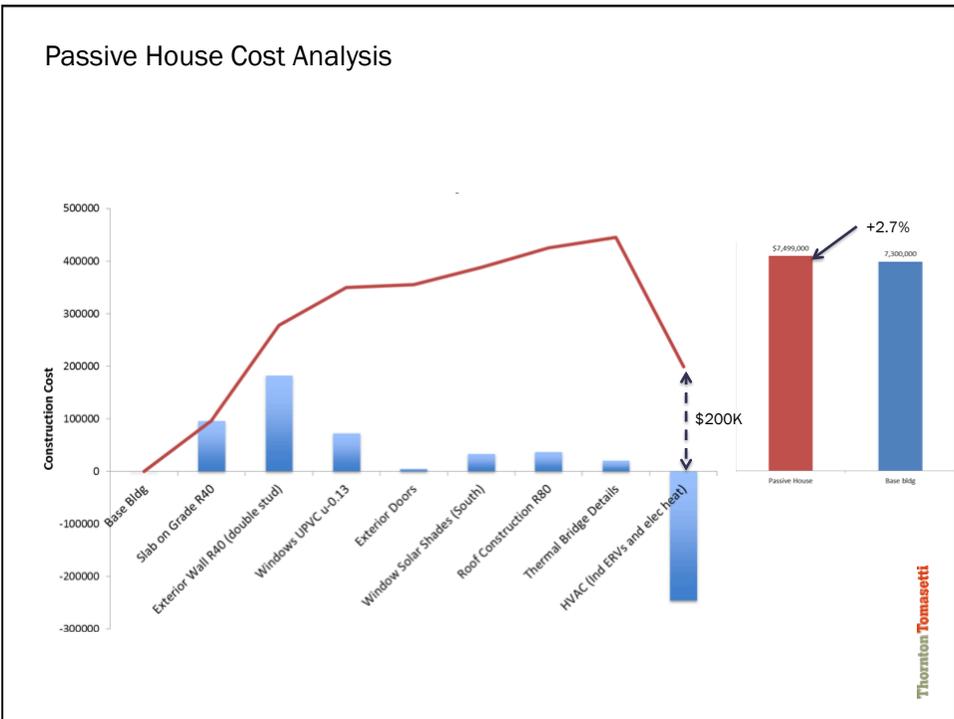
Engineer

Engineer

Engineer

Prepared by Colin Schless

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At TT, our sustainability consultants...

We are building analysts, architects, engineers, building scientists, material specialists, facilitators.

Who makes up your team?

How do you approach projects?

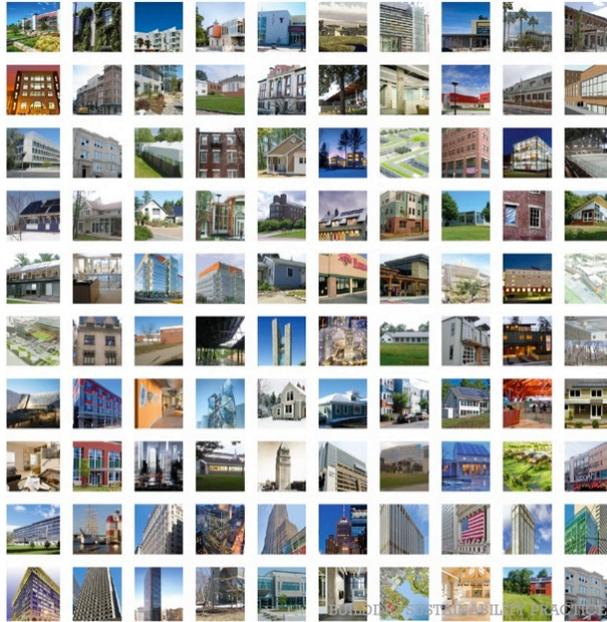


Top left: CityCenter Las Vegas, MGM MIRAGE; Top Right, MOBE, FxFlow; Bottom Right, Bigelow Labs, Perkins + Will; Bottom Left, SF Airport, Gensler.

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TT Experience

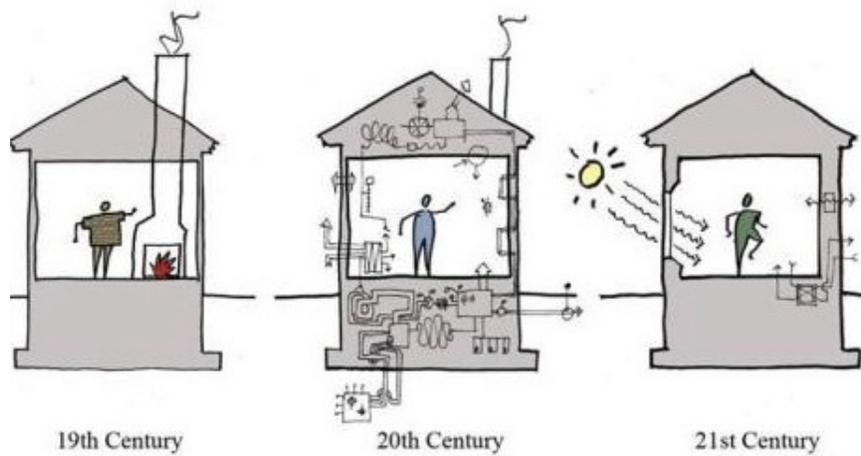


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Our purpose

is to help design teams and owners achieve high performance buildings

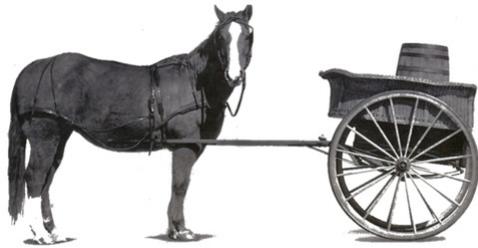
Everyone is an analyst and part of solving the problem



AR&T Arch

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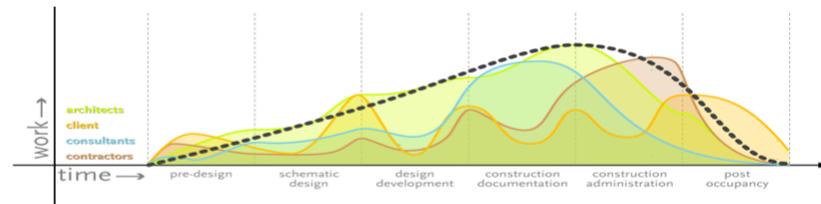
Reality of the typical design process



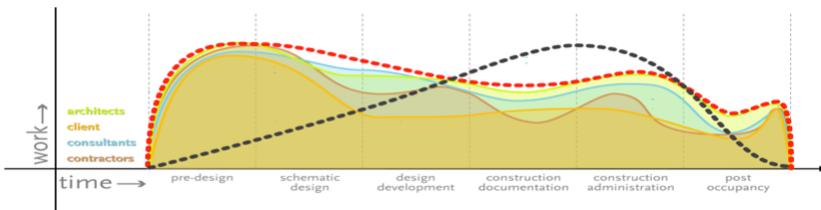
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Our Role is to be a Driver of Change The approach is important

“Traditional” Design Process

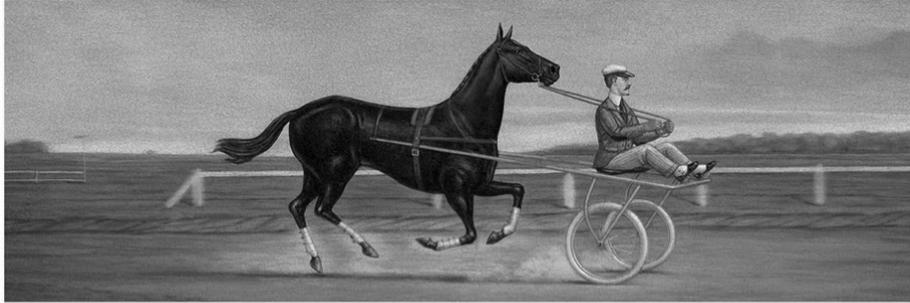


Integrated Design Process



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Collectively we have made progress...
But there is more work to do...



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Case Studies

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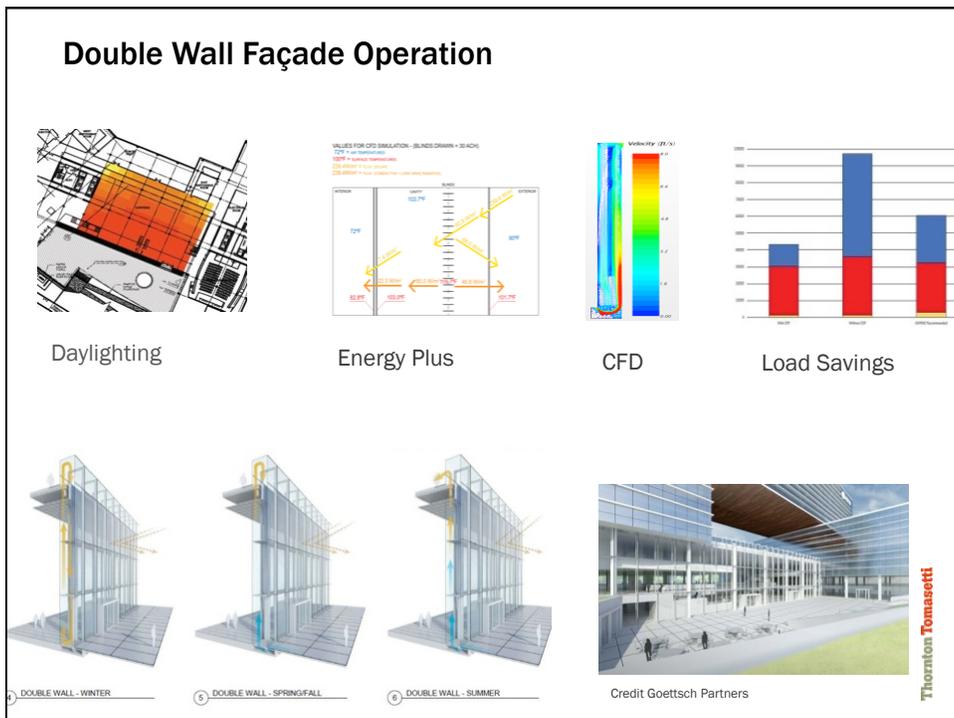
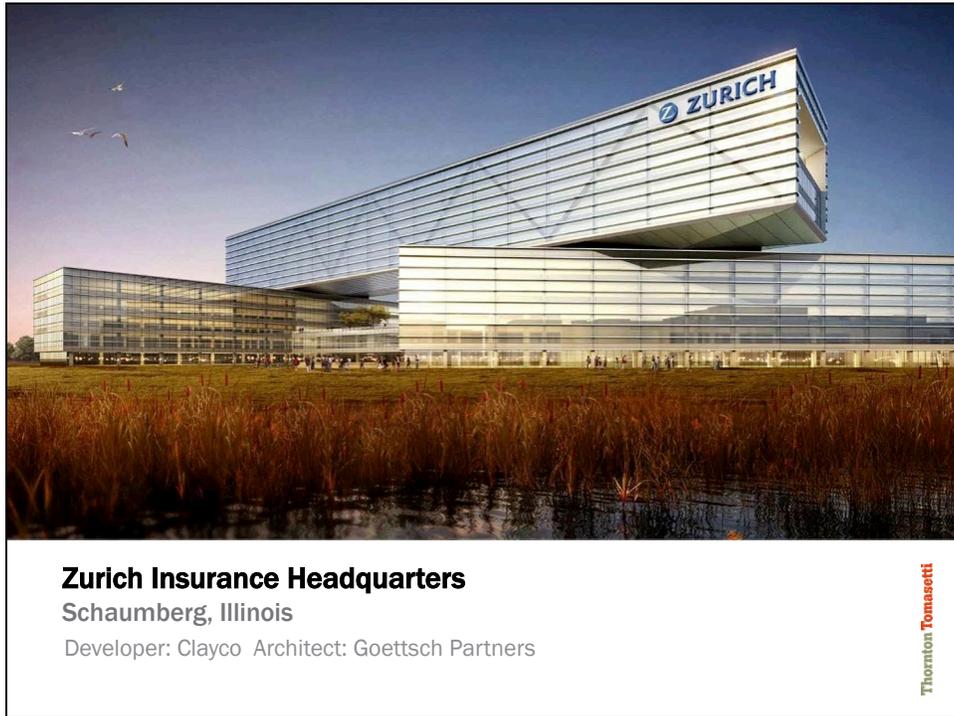
Coastal Maine Botanical Gardens: Bosarge Education Center
Boothbay, Maine

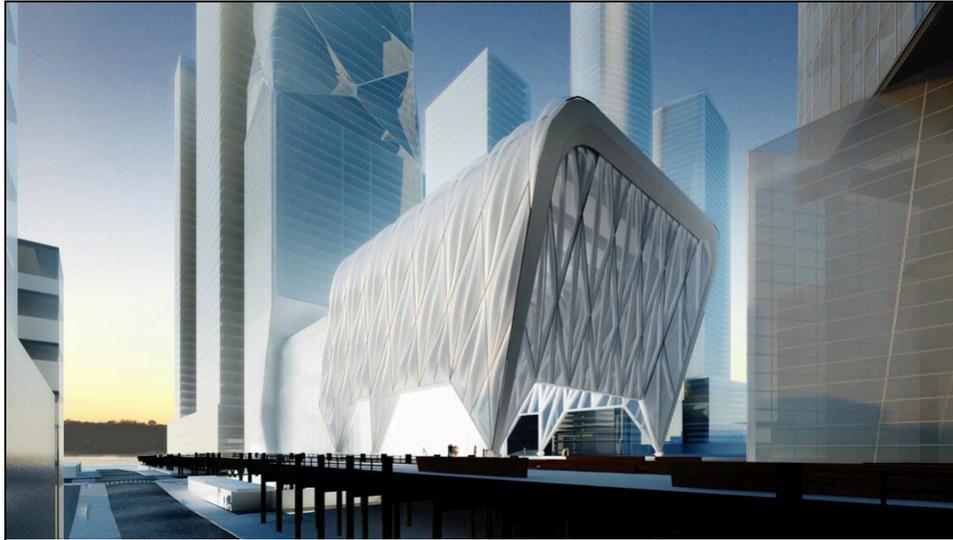
Architects: Scott Simons Architects and William Maclay Architects

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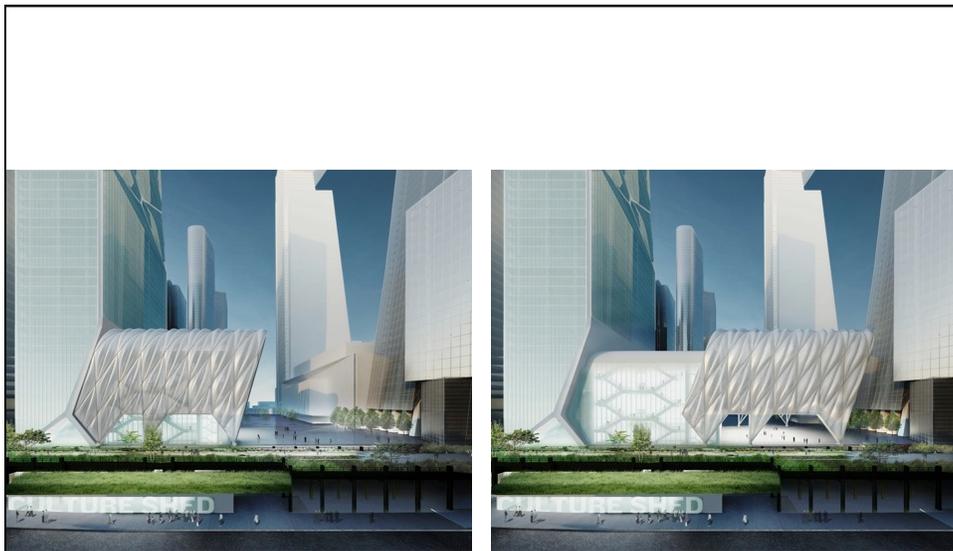
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Culture Shed
New York
Diller Scofidio + Renfro

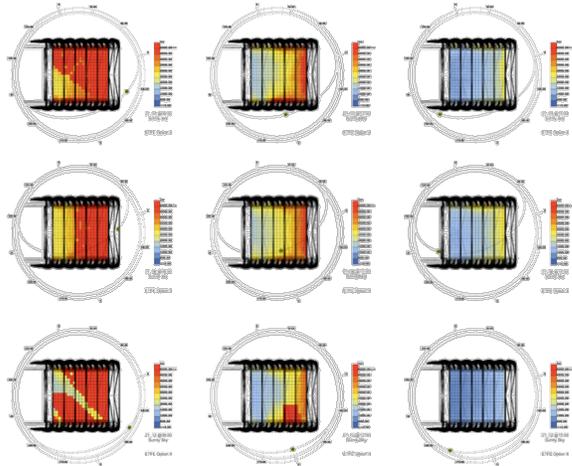
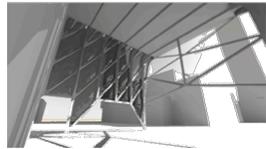
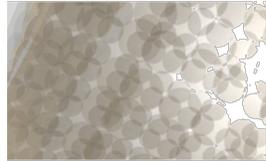
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Effect of Frit Pattern on Daylight

Culture Shed

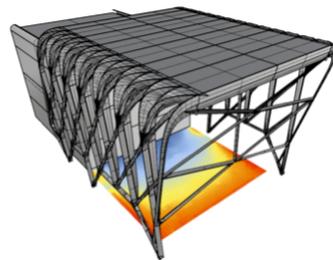
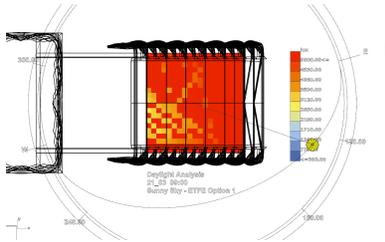
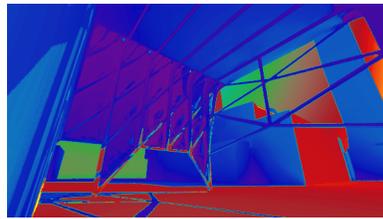
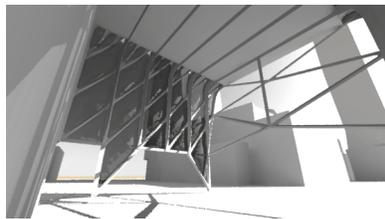


Credit: Thornton Tomasetti's CORE studio <http://core.thorntontomasetti.com/>

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Illuminance Values

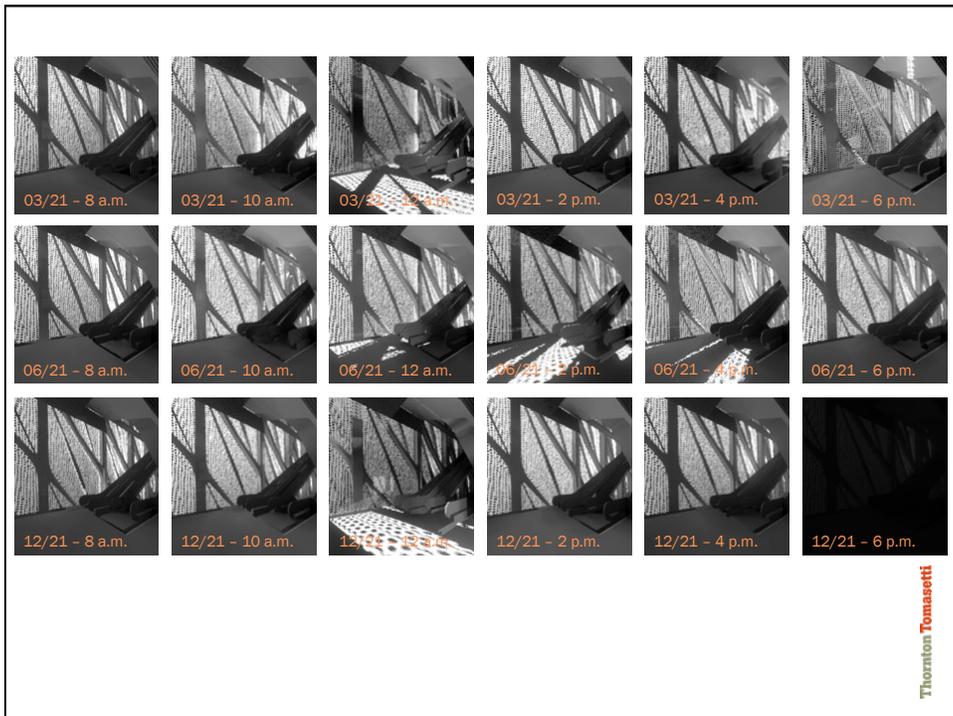
Culture Shed

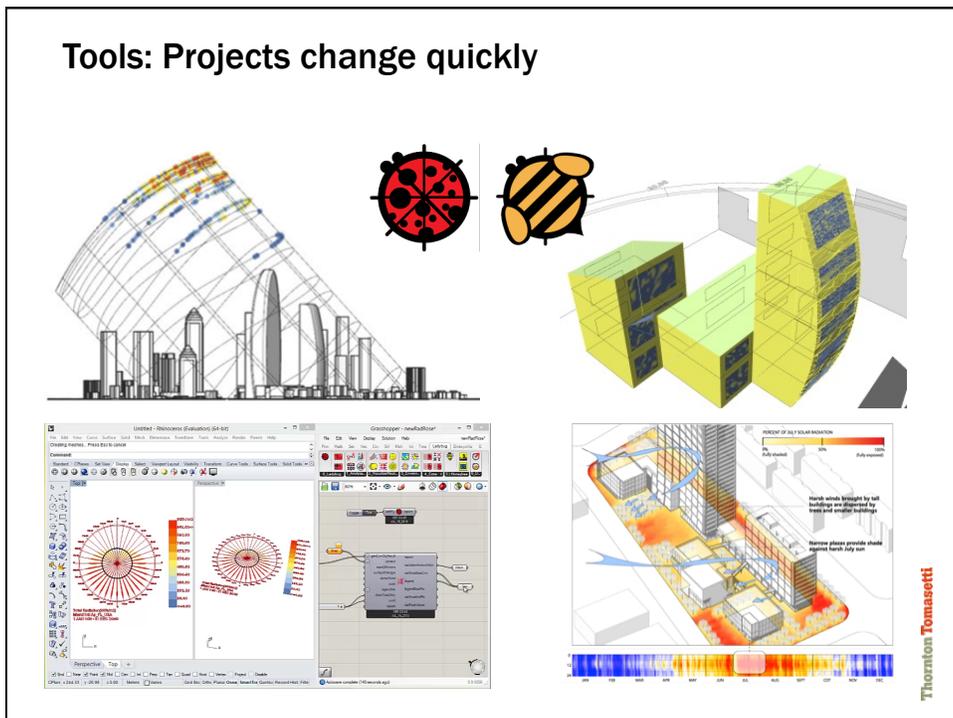
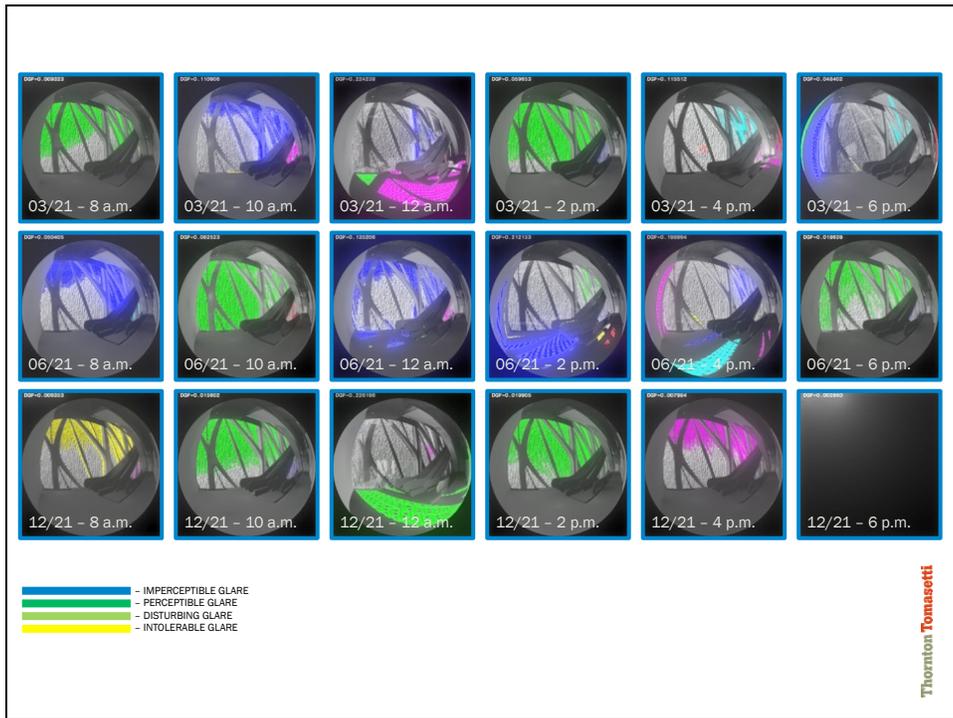


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Interior Model

Culture Shed





Vasakronan – largest property owner in Sweden



Kista Entré
LEED Gold



Lilla Bommen
LEED Gold



Klara Zenit
LEED Gold

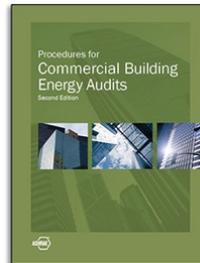
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Vasakronan: 48 buildings. 12 Million Sq.ft.



Problem Solving

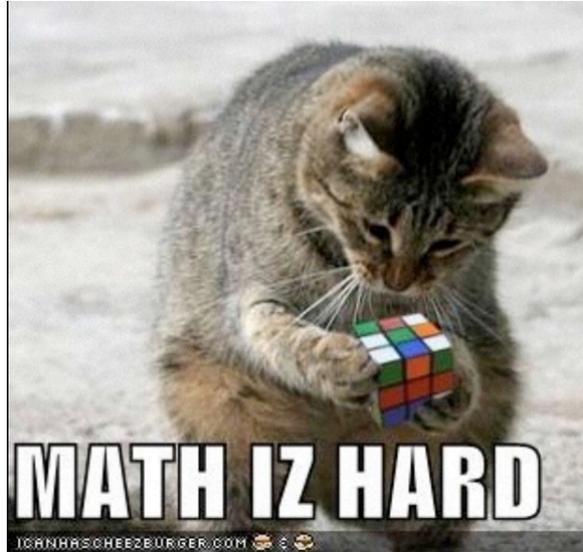


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Intent: Clear Data

Its our intention to work with the team to reduce the environmental footprint as much as possible, and while doing so, make sure the project team, and owner, understands it



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How to impact change: What is your role?

2030 Commitment

2030 Districts



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Northern New England AIA COTE Event

We are on the threshold of the most significant change known to human history.
- Bob Berkebile

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City of Stockholm, 2006

Hammarby Model

Hammarby Sjöstad Case Study | CP 249 Urban Design In Planning 2007

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2030 Districts

District Wide Environmental Programs

Living Community Challenge

Living community challenge projects have their own 'utility,' generating their own energy and processing their own waste.

LEED for Neighborhood Development

Focuses on high levels of walkability, a sense of place, and social cohesion. It encourages strategies that conserve resources, protecting natural areas, and facilitate connections to the surrounding community.

Sustainable SITES Initiative

Foster a transformation in land design and development practices to bring the essential importance of ecosystem services to the forefront of decision-making and implementation.

EcoDistricts

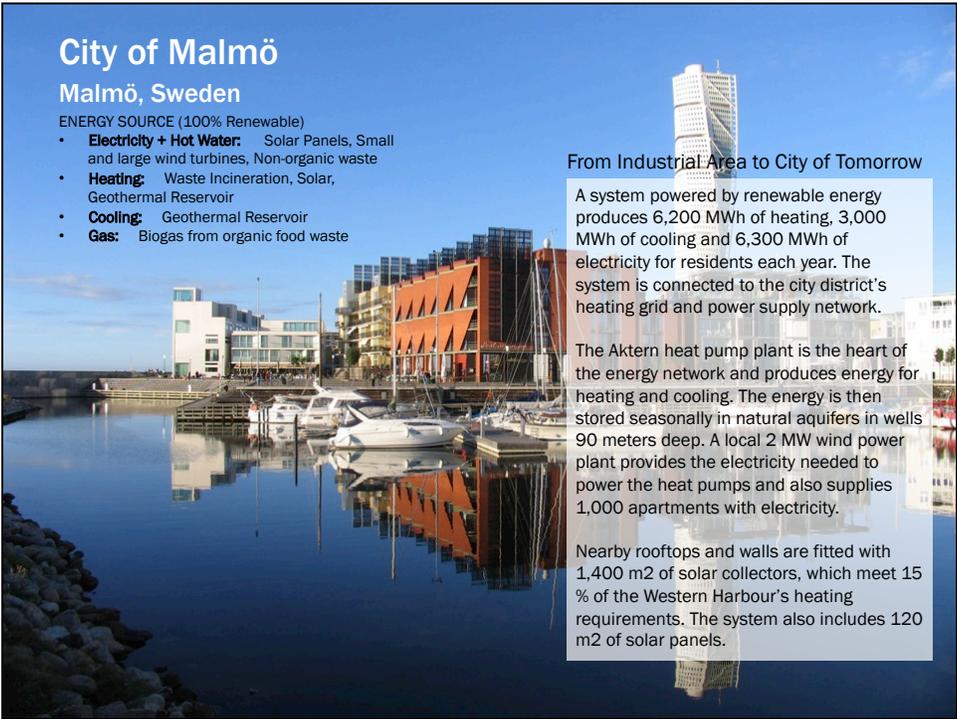
A new model of public-private partnership that emphasizes innovation and deployment of district-scale best practices to create the neighborhoods of the future - resilient, vibrant, resource efficient and just.

2030 Districts

Designated urban areas committed to meeting the energy, water, and transportation emissions reduction targets of the 2030 Challenge for Planning.

Uptown EcoInnovation District

A Plan that is environmentally and economically innovative and enhance equitable land use, mobility, energy, and infrastructure that will embody sustainability in all aspects of development; both people and place.



City of Malmö

Malmö, Sweden

ENERGY SOURCE (100% Renewable)

- **Electricity + Hot Water:** Solar Panels, Small and large wind turbines, Non-organic waste
- **Heating:** Waste Incineration, Solar, Geothermal Reservoir
- **Cooling:** Geothermal Reservoir
- **Gas:** Biogas from organic food waste

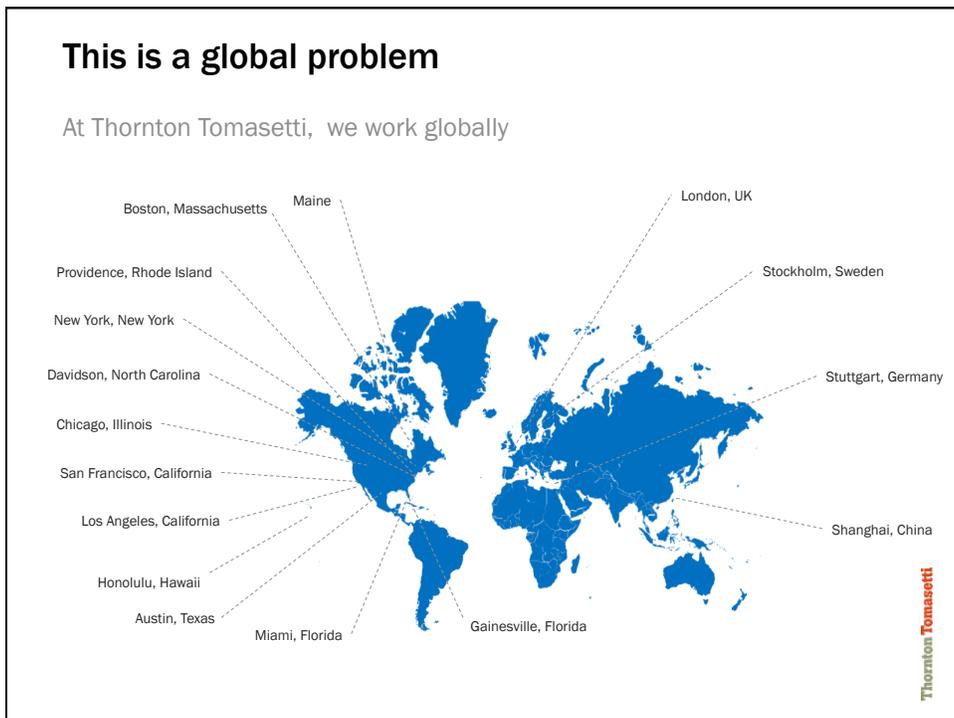
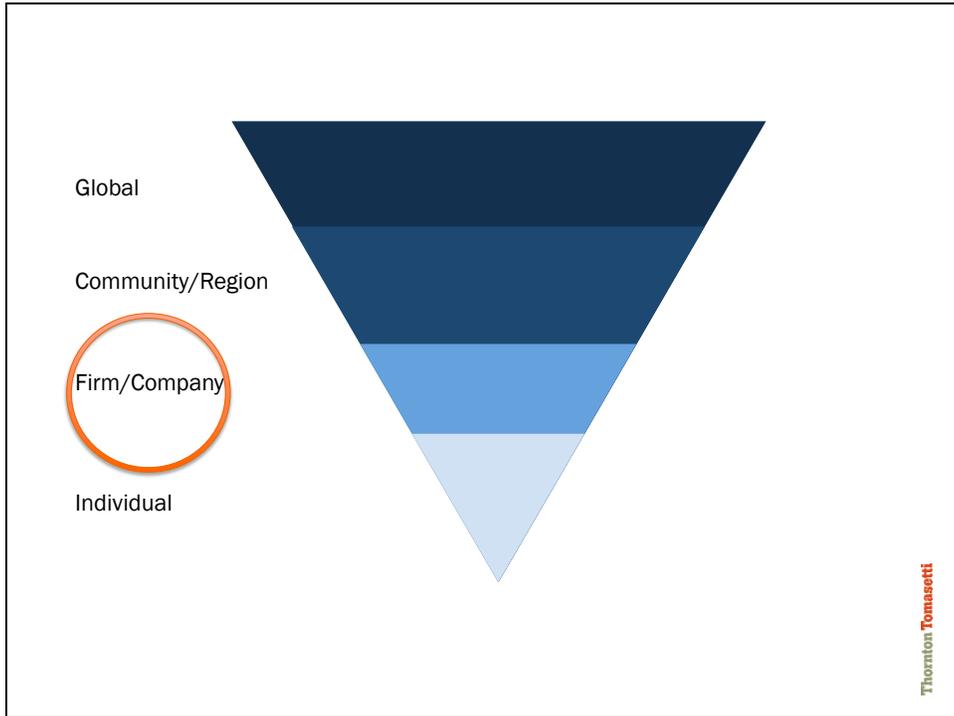
From Industrial Area to City of Tomorrow

A system powered by renewable energy produces 6,200 MWh of heating, 3,000 MWh of cooling and 6,300 MWh of electricity for residents each year. The system is connected to the city district's heating grid and power supply network.

The Aktern heat pump plant is the heart of the energy network and produces energy for heating and cooling. The energy is then stored seasonally in natural aquifers in wells 90 meters deep. A local 2 MW wind power plant provides the electricity needed to power the heat pumps and also supplies 1,000 apartments with electricity.

Nearby rooftops and walls are fitted with 1,400 m² of solar collectors, which meet 15 % of the Western Harbour's heating requirements. The system also includes 120 m² of solar panels.

Intent.





2014 Sustainability Report

Thornton Tomasetti

Our Work

Progress Report Card

Our sustainability consulting projects achieved several awards in 2014, including the Overall Sustainable Design Award for San Diego State University's Arts District Office, presented at the California Higher Education Sustainability Conference.

Ranking by *Engineer News-Record* among "Top Green Design Firms":

2013: #34 among the top 100	↑	2014: #16 among the top 100
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Lifecycle (Embodied) Carbon in our Structural Projects:

2012/2013 Average of: 40 kgCO ₂ e per sq. ft.	↓	2013/2014 Average of: 32 kgCO ₂ e per sq. ft.
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Number of Hours Provided for Building Energy Analysis:

2013: 3,971 hours	↑	2014: 6,223 hours
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Number of LEED Projects on Which We Provided Sustainability Consulting:

2013: 100 projects	↑	2014: 122 projects
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Number of Employees with LEED Accreditations:

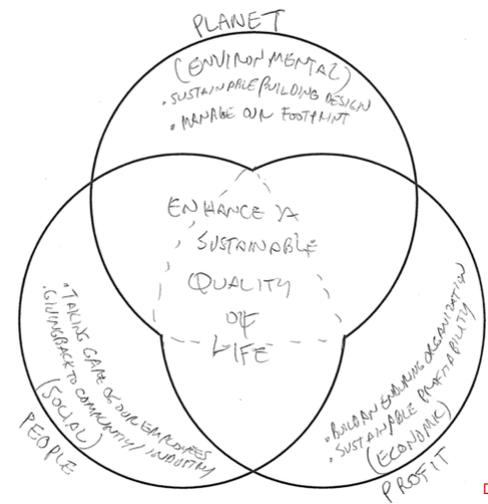
2013: 188	↓	2014: 171
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Triple Bottom Line



Drawing by Robert DeScenza

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Our role is....

To minimize and eliminate our impact....

...And move as quickly as we can to:

- Create Net Positive Buildings
- Create Net Positive Water
- Net Positive Waste
- Understand Embodied Carbon and Embodied Energy
- Create Healthy Environments



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“There is no power greater than a community discovering what it cares about.”

Margaret J Wheatley



Slide Credit: Bob Berkebile, BNIM

THANK YOU PEDCO!

Thornton Tomasetti

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www.ThorntonTomasetti.com