

NASEO
*National Association of
State Energy Officials*

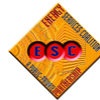
State and Local Policies and Programs to
Open the Market for Zero Net Energy
Ready Buildings

About NASEO and State Energy Offices

- NASEO represents the 56 governor-designated energy offices from each state and territory.
- State Energy Offices develop programs and policies:
 - Energy efficiency in manufacturing and residential, commercial, and public buildings
 - Renewable energy
 - Oil, gas, electricity production and distribution
 - Energy emergency preparedness and resiliency
- NASEO has collaborated with States and NASEO Affiliate Members over the past several years on zero net energy (ZNE) policies, programs, and two national forums.

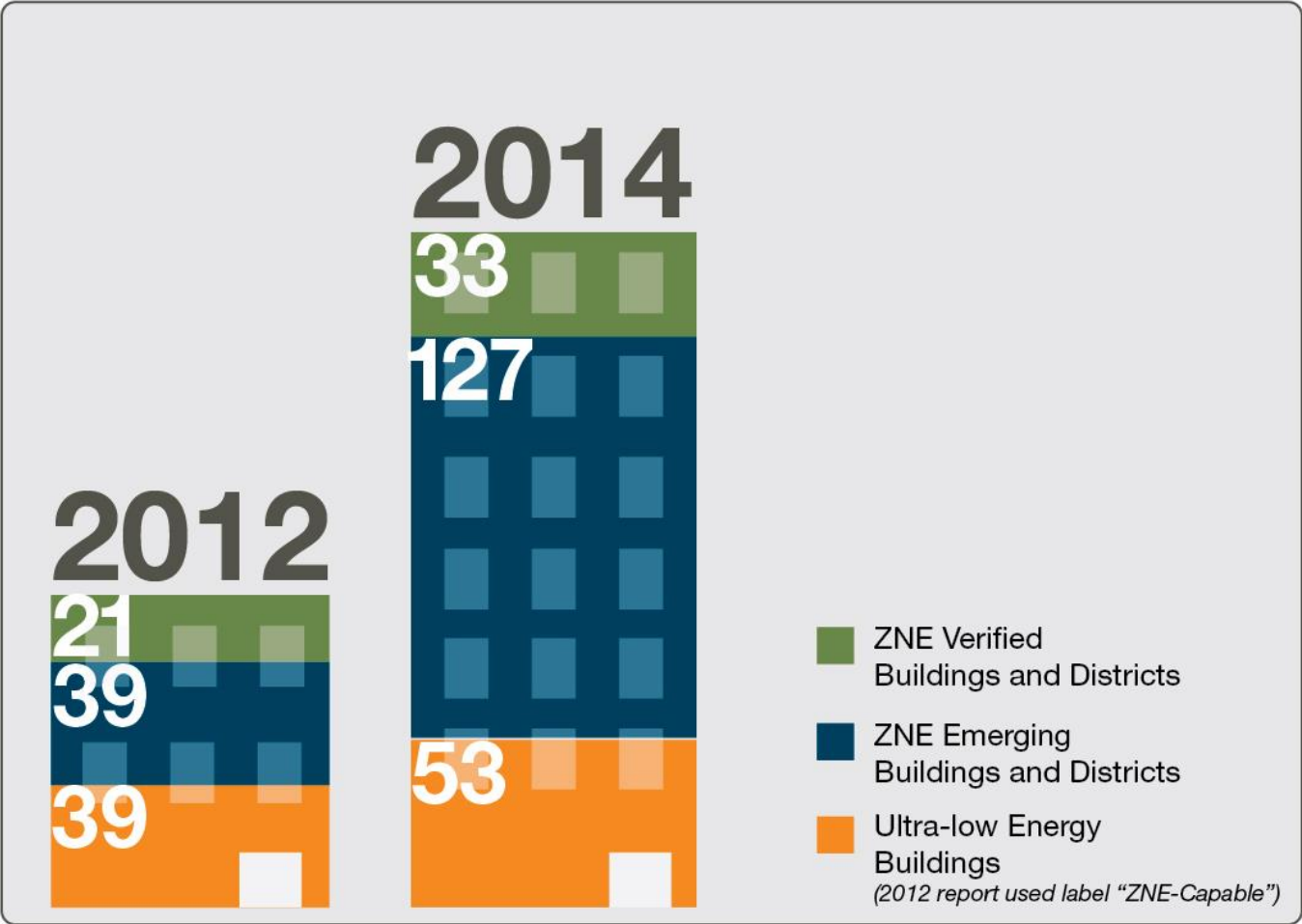
NASEO's Affiliates

A robust and engaged network of +60 private-sector partners, including representatives from business, trade associations, nonprofit organizations, educational institutions, laboratories, and government.



ZNE Building Progress

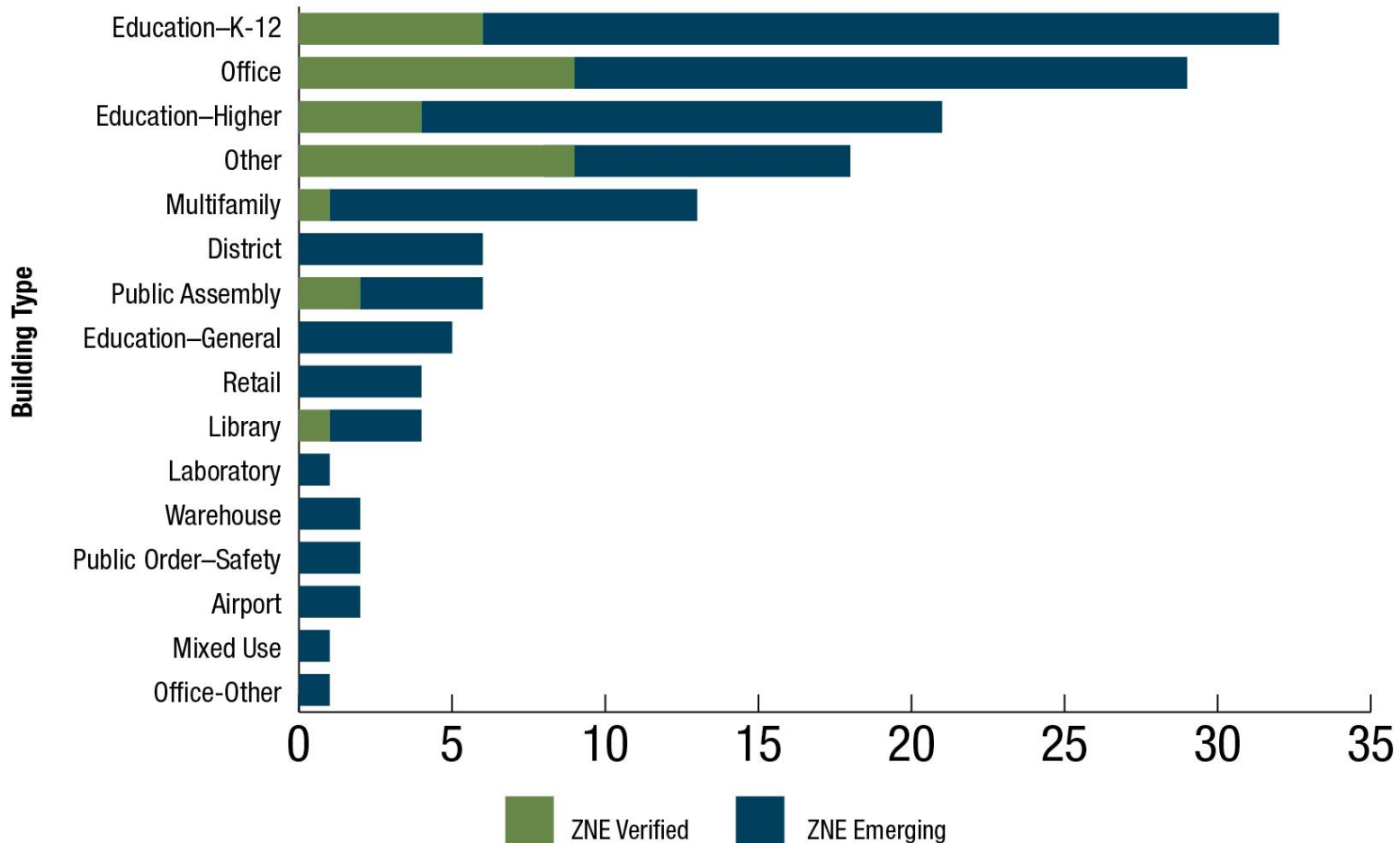
Number of ZNE Projects from 2012 to 2014



Courtesy of New Buildings Institute | newbuildings.org

ZNE by Building Type and Sector

ZNE Building by Type



Governors' Executive Orders and Actions

■ Executive Orders:

■ California Governor Brown Executive Order B-18-12:

- All new state buildings and major renovations starting design in 2025 shall be ZNE; 50% of new state facilities beginning design after 2020 shall be ZNE

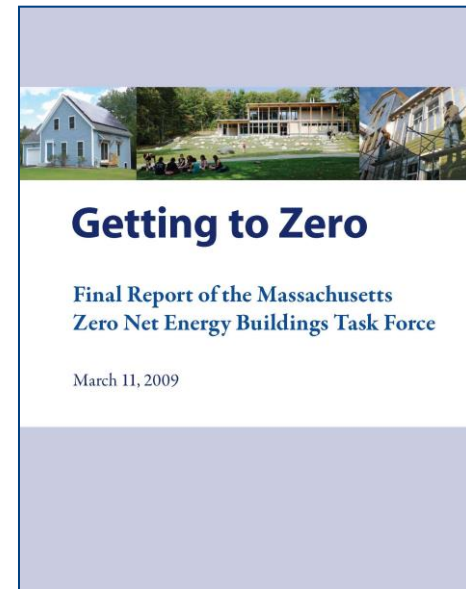
■ New Mexico: Governor Richardson Executive Order 2009-002 “Clean Energy State”

■ Governor Action:

■ Former Governor Patrick of MA formed the MA Zero Net Energy Buildings Task Force

- Final report contained 44 recommendations for advancing on path toward ZNE buildings

Links to more info on [CA](#) and [MA](#)



New Mexico Sustainable Buildings Tax Credit

- 2007 Senate Bill 463; administered by New Mexico Energy, Minerals and Natural Resources Department
- Residential:
 - Build Green NM or LEED-H Silver
 - HERS Score of 60 or lower
 - 2,000 sq. ft. home → \$10,000 tax credit
 - \$4 million annual cap (2014, 2015, 2016)
 - Over 4,000 credits to date (HERS average ~54/55)
- Commercial:
 - LEED Silver, Platinum, or Gold
 - Modeled energy reduction of 60% vs. nat' l average (EPA Target Finder)
 - Enhanced commissioning (and exploring operational tracking)
 - \$1 million annual cap (2014, 2015, 2016)



New Mexico Sustainable Buildings Tax Credit



Commercial
2013:

- 2 Macy's
- 1 Church
- 3 Offices
- 1 hotel
- 9-10 multifamily

[Link to program details and tiers](#)

Hotel Clovis: 1930-era hotel turned apartments and commercial space (Clovis, NM) – had been abandoned

ZNE Homes - Colorado Energy Saving Mortgage Incentive

- [HB 13-1105](#) – June 2013
- Grew out of previous ENERGY STAR New Homes program and Architecture 2030 research
- Administered by Colorado Energy Office (CEO)
- Provides tiered mortgage incentives for both new & existing (e.g. refinance) homes
- Homebuyers select “energy package”
- Secondary goal of training mortgage lenders/brokers
- CEO providing building science/sales training



New Town Builders Zero Energy Home

ZNE Homes Colorado – *Continued*

Incentive structure (“energy package”)

New Homes HERS	Mortgage Incentive
50 – 40	\$1,000
39 – 25	\$2,500
24 – 11	\$3,000
10 and below	\$8,000

[Link to program details and tiers for existing buildings](#)

- Non-state match of mortgage balance required: .5% for existing homes; .6% for new homes
 - Can come from lender, builder, realtor, etc.
 - \$300,000 new-home mortgage: state - \$6,200; match - \$1,800
- Approx. 300 mortgages ready to be reserved (~80% new construction)

Catalyzing the ZNE Schools Sector

- Maryland Energy Administration awarded \$9 million as part of utility merger to design and build 3 ZNE public schools
 - 2 counties have been chosen: Howard County and Baltimore City
 - Funds will provide design assistance and pay for “incremental cost”
- Kentucky: Home of two verified ZNE schools and one ZNE Emerging school (Turkey Foot Middle School)



Locust Trace AgriScience High School Campus



Richardsville Elementary

Catalyzing the ZNE Schools Sector

- Bertschi School Living Science Building, Seattle, WA
 - 1,421 sq. ft
 - First building to achieve the Living Building Challenge v2.0
- Hood River Middle School Music & Science Building
 - 6,878 sq. ft
 - Hood River, OR



Hood River Middle School



Bertschi School

ZNE in State and Local Office Buildings

- Alfred A. Arraj U.S. Courthouse, Denver, CO
 - 318,837 sq. ft
 - Meeting energy targets and security needs
- Iowa Utilities Board & Office of Consumer Advocate, Des Moines, IA
 - 44,638 sq. ft
 - Zero energy & cost effective, even with a limited budget



IUB-OCA Building



Alfred A. Arraj U.S. Courthouse

Courtesy of New Buildings Institute

ZNE in the Multifamily Sector

La Valentina North Townhome Project, Sacramento, CA



- Public-Private Partnership
 - Sacramento Municipal Utility District (SMUD)
 - Domus Development, LC

Strategies to Advance ZNE

- Develop Federal-State Collaborative ZNE Program
- Support State and Local ZNE Policies and Programs
- Develop and Coordinate Sector-Specific Task Forces
- Publish Case Studies and Best Practices
- Recognize ZNE and ZNE-Ready Accomplishments
- Ensure Communications & Market Motivations
- Create incentives for ZNE at the state or local level

Strategies to Advance ZNE (cont' d)

- Set voluntary ZNE goals for government buildings
- Identify and support target sector efforts (e.g., schools)
- Encourage district or community-scale planning and infrastructure for renewable and alt-energy systems
- Improve appliance standards to reduce energy use outside the scope of building energy codes
- Address existing building stock by leveraging renewal cycles and adopting performance tracking requirements
- Encourage greater federal leadership and collaborative efforts with states, builders, and building product manufacturers

NASEO-NBI ZNE National Conferences



- NASEO and NBI collaborated to hold the nation's first Getting to Zero national conference in September 2014
- NASEO, NBI, and RMI collaborated to hold the second Getting to Zero Forum in February 2015
- <http://gettingtozeroforum.org>
- ZNE Pathways Discussion at the NASEO Annual Meeting September 2015



Zero Net Energy Buildings

Jennifer Thorne Amann

Buildings Program Director

American Council for an Energy-Efficient Economy

Staffer Briefing

June 4, 2015

The American Council for an Energy-Efficient Economy (ACEEE)

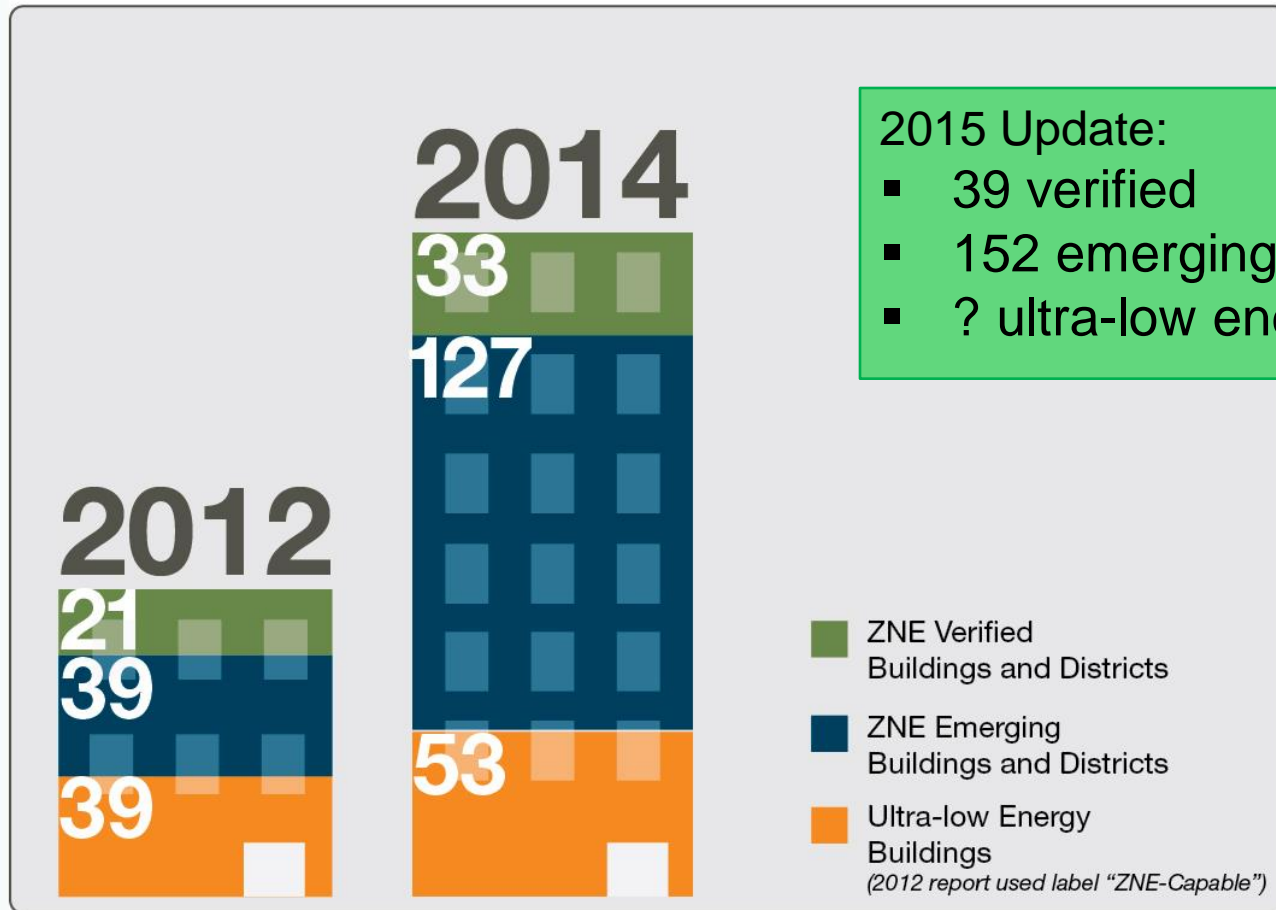
- ACEEE is a 501(c)(3) nonprofit that acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, & behaviors
- 50 staff; headquarters in Washington, D.C.
- Focus on end-use efficiency in industry, buildings, & transportation
- Other research in economic analysis; behavior; energy efficiency programs; national policy; utilities, state, & local policy
- Funding:
 - Foundation Grants (52%)
 - Contract Work & Gov' t. Grants (20%)
 - Conferences & Publications (20%)
 - Contributions & Other (8%)

ZNE Terms and Definitions

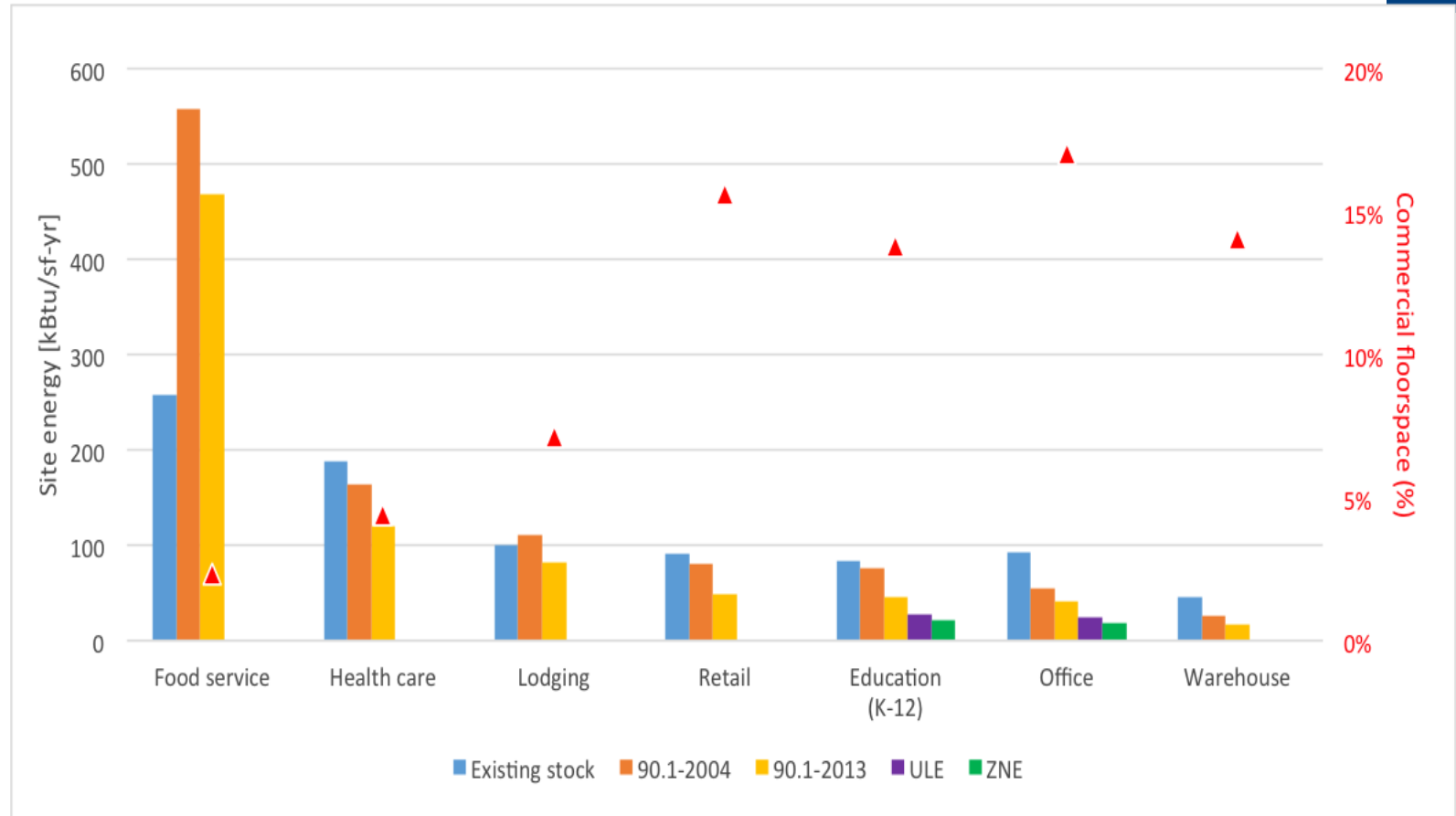
Term	Definition
<i>Net zero site energy</i>	A building that produces as much energy as it uses in a year, when accounted for at the site
<i>Net zero source energy</i>	A building that produces as much energy as it uses in a year, as measured at the source (i.e., accounting for energy used to generate and deliver the energy to the site)
Net zero energy equivalent, or off-site zero energy	A building that produces as much energy as it uses in a year, with consideration of off-site renewable energy sources
Net zero energy emissions, or zero carbon	A building that produces at least as much emissions-free renewable energy as it uses from emissions-producing energy sources
Net zero energy ready, net zero capable, or <i>ultra low energy</i>	A highly efficient building that could meet its energy needs with the addition of onsite renewables

State of ZNE Construction commercial and multifamily

Number of ZNE Projects from 2012 to 2014



Commercial building EUI: existing stock vs. recent code and ULE/ZNE construction



ZNE can be cost-effective



■ Several studies on cost-effectiveness have found:

- Project costs fall within the same range as conventional construction projects for a diverse set of building types
- Incremental costs difficult to tease out because of design and technology tradeoffs
- Demonstration projects skew costs upwards relative to mainstream projects
- Commercial efficiency measures add 1-6% to project costs; efficiency + renewables add 5-10%; ROI ~9%
- Residential efficiency measures cost only 20-50% of

Saving 50+% in Commercial Buildings

- Reduce lighting and “other” loads to downsize HVAC
- Install and commission enhanced controls including algorithms to spot problems
- Use air for ventilation, *not* for distribution of heating and cooling.
- Address specific challenges with cooling and miscellaneous end uses
 - Alternatives to “weatherized” roof-top units
- Match water heating service to demand for hot water

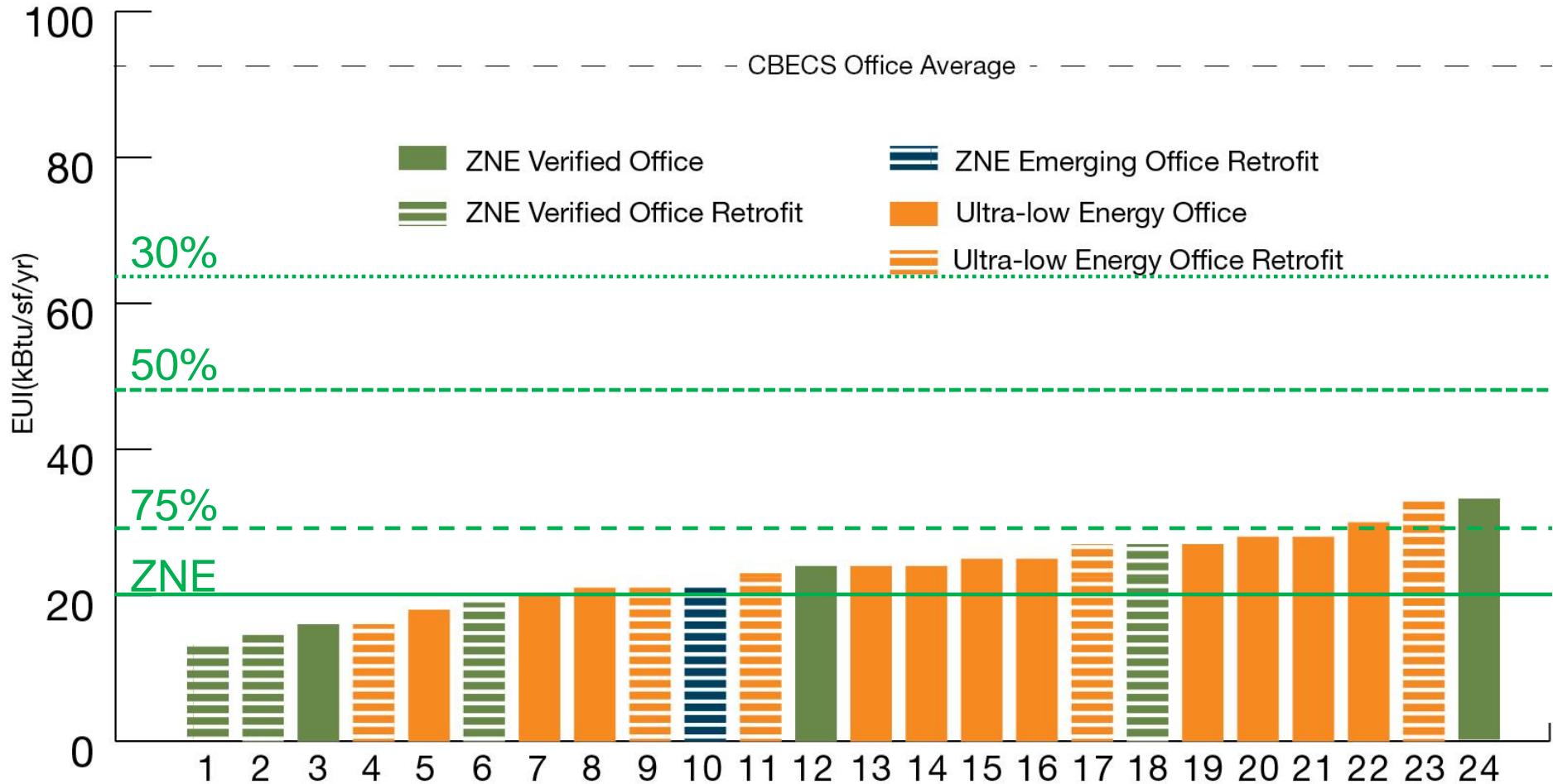
Moving the needle towards ZNE

- Early adopters see ZNE as inevitable
 - - want to be ahead of the curve
 - - willing to try new ideas
 - - motivations are inherently different than rest of market
- Essential challenge is to move to the broader construction industry
 - - industry is tradition bound and resistant to changes to standard practice
- Market transformation efforts can accelerate the change
- Ultimately codes are needed to bring the entire industry





Measured EUI of Offices



Supportive policies and programs



■ **Complementary policies**

- Building labeling and disclosure
- Stretch codes and green codes
- Financing mechanisms
- Public sector leadership

■ **Coordination and advocacy activities**

- Code development, adoption, implementation
- Reform of cost-effectiveness methods
- Appliance and equipment standards

■ Program approaches

- Promote integrated design for variety of building types
- Build capacity in design community, building trades, operations
- Collect data for code development and implementation
- Couple with demand response and peak reduction
- Encourage district-scale projects
- Leverage existing building programs (e.g., whole building performance/retrofits)
- Incorporate behavioral strategies



Thank You!

- Jennifer Thorne Amann, LC

- Buildings Program Director

- ACEEE

- 529 14th Street, NW, Suite 600

- Washington, D.C. 20045

- 202-507-4015

- jamann@aceee.org

- Web: aceee.org

- Twitter: ACEEEDC

- Facebook: American Council for an Energy-Efficient Economy





Zero Net Energy Buildings

**High Performance Schools
The Kentucky Experience**

Congressional Staffer Briefing
June 4, 2015

Greg Guess, Director
Division of Efficiency and Conservation
Kentucky Department for Energy Development and Independence

What is a High Performance School?

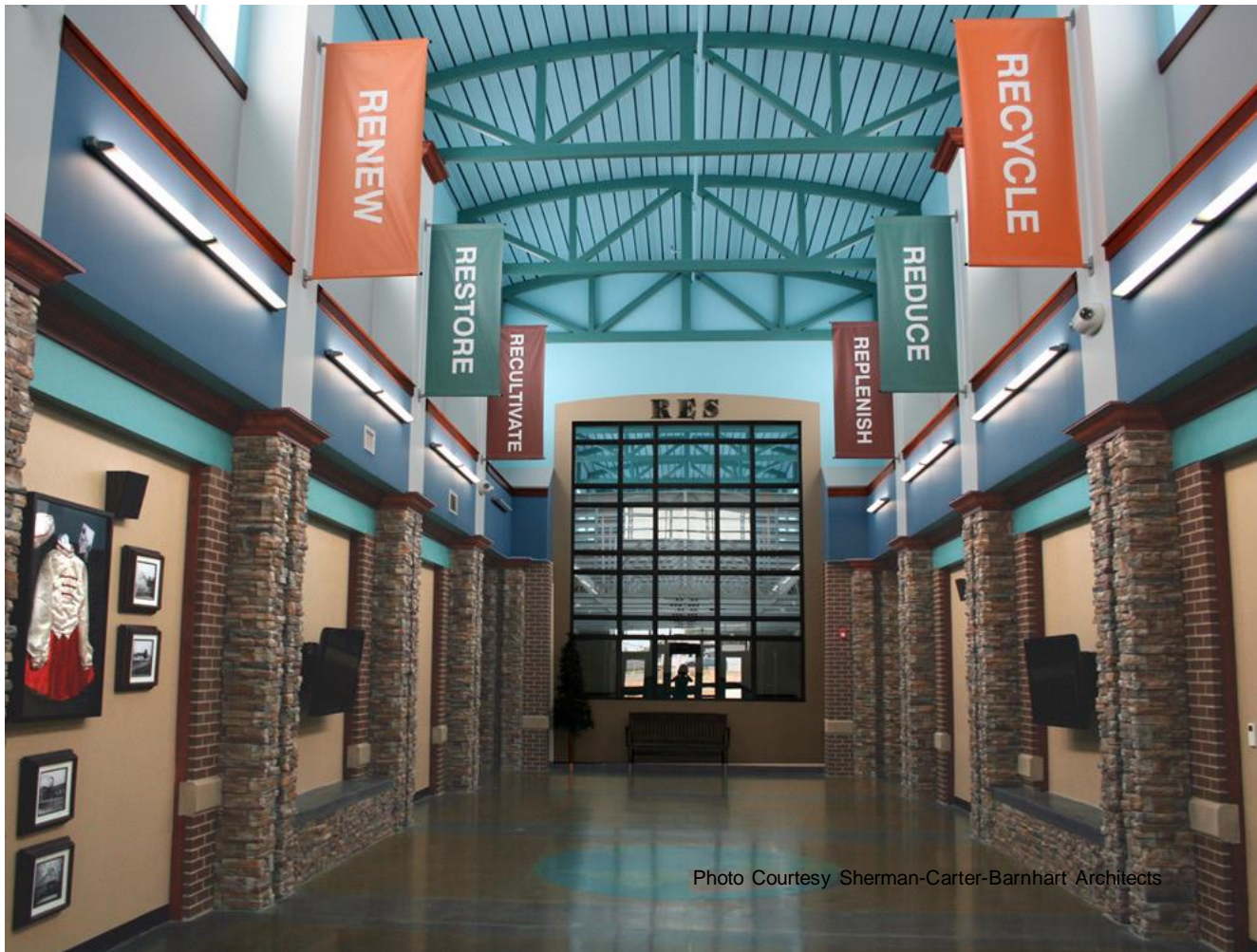


Photo Courtesy Sherman-Carter-Barnhart Architects

Characteristics



Photo courtesy Sherman-Carter-Barnhart Architects

- Healthy and Productive Environment
- Cost Effective to Operate and Maintain
- Sustainability
- Reduced energy consumption saves districts money
- School Facility as 3-D Classroom

Integrated Design Process

Creating a school with these characteristics is not difficult, but does require an integrated, whole-building approach to the design process.

Engage all stakeholders in:

- Design
- Construction
- Operation



Building Blocks

Acoustic Comfort
Commissioning
Day lighting
Durability
Energy Analysis Tools
Energy-Efficient Building Shell
Environmentally Preferable
Materials and Products
Environmentally Responsive Site
Planning

High-Performance HVAC &
Electric Lighting
Life Cycle Cost Analysis
Renewable Energy
Safety and Security
Superior Indoor Air Quality
Thermal Comfort
Visual Comfort
Water Efficiency



- LEED, Leadership in Energy and Environmental Design.
- Developed by U.S. Green Building Council to provide building owners and operators a concise framework for identify and implementing practical and measurable green building design, construction, operations and maintenance solutions.

New Construction and Major Renovations

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design Process

Partnering With ENERGY STAR®

- U.S. Environmental Protection Agency national energy performance rating system.
- Facilities among the top 25 percent of all comparable buildings.
- Measure a year's worth of energy-use data.
- ENERGY STAR buildings must receive at least 75 out of 100 points in EPA's rating system.



The Net Zero Concept – the Next Step

Questions:

- Could we create a building that **consumes a minimal amount of energy**?
- Could we then offset that by allowing it to **produce clean energy**?

Net Zero

Net Zero is defined by the Kentucky Department of Education as a facility that, although connected to the power grid, would produce as much energy as it would use annually.

This means, on average, generates enough energy to meet its annual energy demands.

These facilities are typically extremely efficient, to the point that the addition of renewable energy sources to meet the energy needs become cost effective.

Net-Zero Ready

Net-Zero Ready Schools – defined as one that is designed with components and building strategies integrated into the design process to achieve state-of-the art energy efficiency – operation at or below 25 kBtus/sf/yr, with hardware and engineering in place to readily accept renewable energy installations at a later date.

Kentucky Department of Education reports 14 Net-Zero ready school projects completed or initiated.

Designed Net-Zero Ready

Turkey Foot Middle School Kenton County School District

Year School Built 2010

School Building Size 133,000 sf

PV installation completed April 2012

Consuming 25 kBtu/sf/yr before solar

443 kW solar PV

Construction Cost - \$200/sf with solar PV

Architects: PCA Architecture

Engineer: CMTA Consulting Engineers

Building Performance - 13 kBtu/sf
(May 2012-April 2013)



Turkey Foot Savings Comparison



Photo courtesy Kenton County School District

New vs. Old Turkey Foot Middle School Comparison

2011-2012 Savings of \$56,395

	Old TF School	New TF School	% Difference
Square Footage	66,523	133,000	199.9% increase
Annual Energy Cost	\$94,954	\$38,558	59.4% decrease
EUI (kBtu/sf)	79.2	13.6	82.8% decrease

Net-Zero Energy



Richardsville Elementary School is the first net-zero energy public school in the United States.

Building is 72,285 sf and serves over 500 students

Uses 75% less energy than the average American school.

Produces as much clean energy as it consumes by converting solar power to electricity with a 349 kW solar panel array.

Richardsville Elementary



**Cost - \$15.2 million (with solar)
\$12.4 million (without solar)**



**349 kW solar
panel array**

Richardsville Elementary

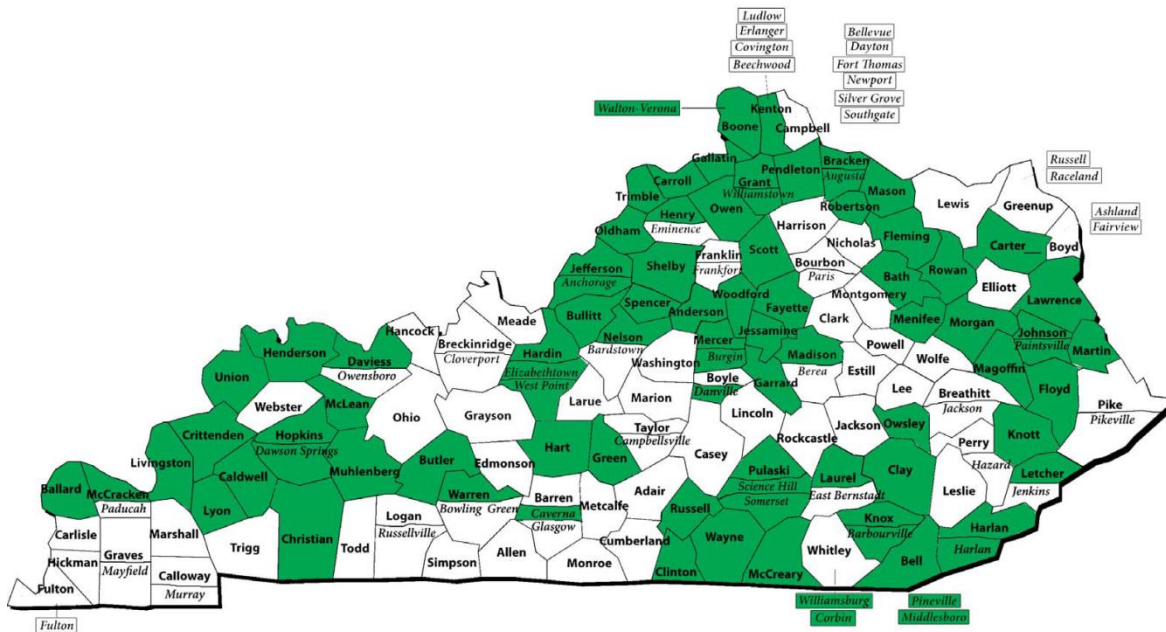
- ✓ Registered as a LEED Gold School with the USGBC, making it as environmentally friendly as it is energy efficient.
- ✓ Constructed at a cost equal to a conventional school.
- ✓ Teaches students environmental stewardship by involving them in monitoring the building's performance.
 - Student energy teams analyze the school's plug-in devices and lighting.
 - Student monitored recycling program.
 - The weather station, part of the outdoor classroom, helps students monitor solar panel efficiency.

Strategies

- ✓ High Performance Building Envelope
- ✓ Active Day lighting
- ✓ Geothermal HVAC
- ✓ Monitoring Controls
- ✓ Dedicated Outside Air System with Energy Recovery and CO2 Sensors
- ✓ Alternative Renewable Energy Source
- ✓ Green Kitchen Strategies
- ✓ Operations and Maintenance Plan
- ✓ Wireless Computer Technology

Kentucky School Energy Managers

School Energy Managers



41 School Energy Managers
serving 81 districts

Energy managers and
districts expected to
increase in FY 2015

Kentucky Accomplishments

- 70% increase in ENERGY STAR schools in less than 3 years.
- Places 4th nationally in percentage of schools ranked ENERGY STAR.
- 13% of Kentucky's ENERGY STAR schools have scores above 95.

Among these schools, eight have scored a near-perfect 99, and ten schools are among the most efficient schools in the nation with a score of 100.

- Two districts out of seven nationwide received the 2014 ENERGY STAR Partner of the Year Award for energy management
- 11 districts recognized as ENERGY STAR Leaders for portfolio-wide energy efficiency improvements of 10%, 20% or 30% or more on organization-wide baseline.
- First Net-Zero Energy K-12 School in USA, located in Richardsville, KY

Take-Aways

- You can do this!
- Challenge design team – efficiency does not have to cost more.
- Do design charette – know what you want.
- Don't be afraid to set ambitious goals.
- Do building commissioning.
- Market transformation is evolutionary.



www.energy.ky.gov

KY Energy and Environment Cabinet

Greg.Guess@ky.gov

502 – 564-7192



Kentucky Accomplishments

- 70% increase in ENERGY STAR schools in less than 3 years.
- Places 5th nationally in percentage of schools ranked ENERGY STAR.
- 15% of Kentucky's ENERGY STAR schools have scores above 95.

Among these schools, eight have scored a near-perfect 99, and ten schools are among the most efficient schools in the nation with a score of 100.

- Two districts out of four nationwide received the 2013 ENERGY STAR Partner of the Year Award for energy management
- 12 districts recognized as ENERGY STAR Leaders for portfolio-wide energy efficiency improvements of 10%, 20% or 30% or more on organization-wide baseline.
- Six schools received US Green Ribbon Awards, 2012 and 2013 combined.



Zero Net Energy Communities

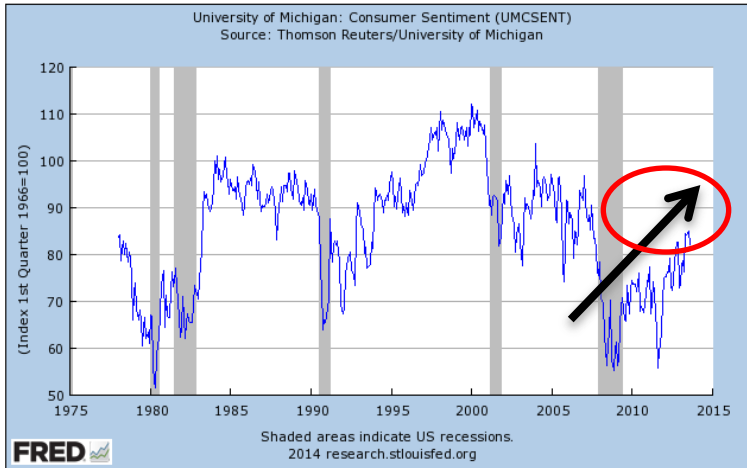
Leading the Way for Sustainable Development



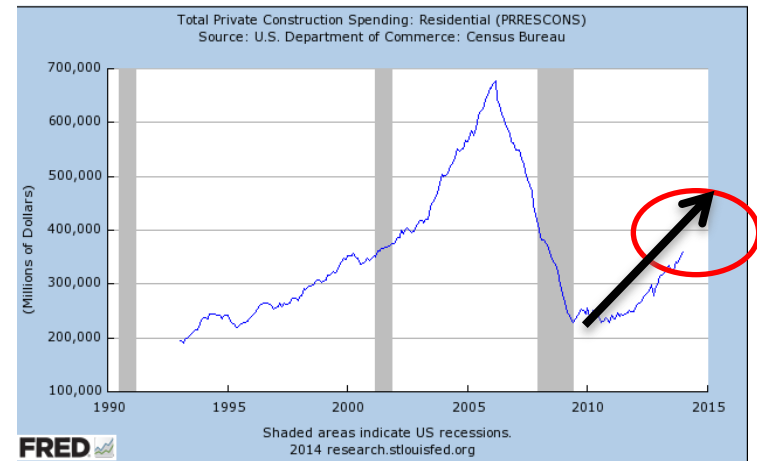
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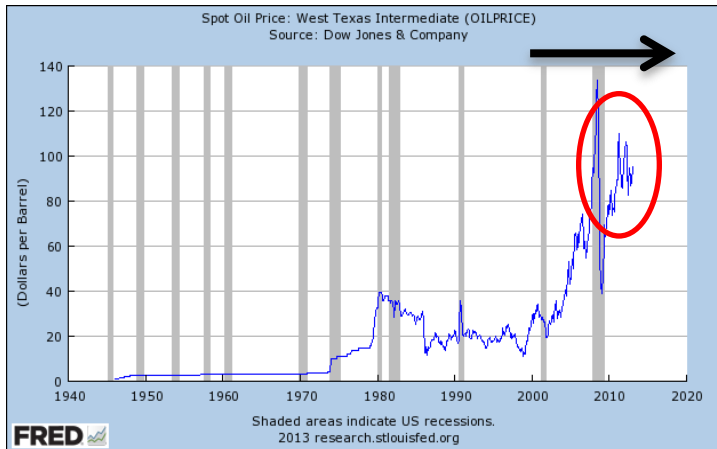
Market: Consumer Sentiment



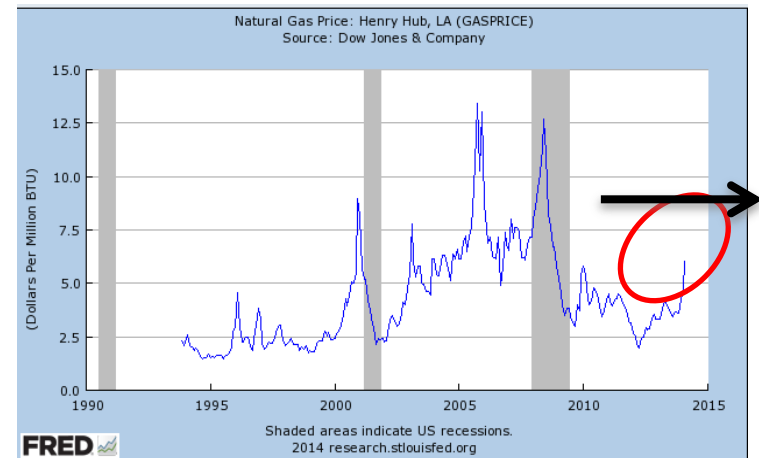
Market: Residential Construction



Market: Oil Price



Market: Natural Gas Price



Market Drivers



Economic



Energy Efficiency



Policy



Energy & Utilities



Demographics

Drivers

- Housing market shows signs of recovery
- Master Planned communities

- ➔ Increased awareness
- ➔ DOE Performance Rulings.

- ➔ Investment Tax Credit
- ➔ Local state and utility rebates
- ➔ ZNE building codes
- ➔ Reduction in GHG Emissions

- ➔ Manage Peak Load
- ➔ Aging infrastructure
- ➔ EPA 111D – Clean Power Plan
- ➔ Renewable Portfolio Standard

- ➔ Baby Boomers – Fixed Income
- ➔ Millennials –educated consumer
- ➔ Federal Gov't – largest building owner

Factors

- ➔ 'Green" Loan Programs
- ➔ 3rd party financing

- ➔ Higher Efficiency product range
- ➔ Savings as a Solution

- ➔ Technology eligibility for incentives
- ➔ CA Title 24

- ➔ Managing distributed e power generation
- ➔ Growing use of renewables

- ➔ Comfort and health
- ➔ Sustainability
- ➔ Buying Green

Market drivers and

Source: TTNA

Breaking Down the Hurdles for Adoption



Home Owner

Thermal Energy Service Charge

Facility Charge
On-Bill Financing

Maintains Loop

System Sale



Utility

Maintenance Contract



Geothermal Contractor



Loop Contractor

Thermal Service Provider Public Utility Model

Breaking Down the Hurdles for Adoption



100% of the cost at commissioning

Incentives



- Tax Credits
- Rebates
- REC Issuance

Fixed Monthly Loop Access Fee



Geothermal Contractor



Thermal Service Provider



Home Owner

Monthly Energy Savings

System Sale




Renewable Energy Credits

Thermal Service Provider Private Utility Model



Sales of RECs to Market

Geothermal Master Planned Communities

Name	Serenbe, Georgia
Overview 	<ul style="list-style-type: none">• New Urban village based on English hamlets• High density clusters with green space and agriculture• > 400 residents, retail, food services, hospitality
Design	Building Technology – <ul style="list-style-type: none">• Geothermal heating and cooling system• Heat pump water heater• Solar photovoltaic system• Energy efficient home appliances• Controls
Success factors	Private thermal service provider concept adopted by master developer



Geothermal Master Planned Communities

Name	Badger Mountain South, Richland, WA
Overview  	<ul style="list-style-type: none"> • Master planned community. • 1,500 acres • 5,000 new homes planned • major retail center, four sites for neighborhood schools • over 400 acres of parks, trails and green spaces. • 20 yr build out
Design	Building Technology – <ul style="list-style-type: none"> • Geothermal HVAC • PV ready • EV Charging Stations • Smart Home Security
Success factors	<ul style="list-style-type: none"> • ORCA Energy Master Service Agreement • Geothermal loop utility removes initial cost barrier for home owners.



Geothermal Master Planned Communities

Name

Whisper Valley, Austin, Texas

Overview



- 2,063-acre, mixed-use planned community
- 7,500 single and multi-family homes
- 2 million square feet of retail and office space.
- 15 year Build Out

Design

- Zero Net energy Ready construction
- Geothermal community loop
- PV ready
- Energy efficient appliances

Success factors

EcoSmart Solution

- develops and implements alternative energy structure programs in large-scale real estate projects.
- Aggregation of technology, construction, communications and finance companies,



BOSCH



Thank you!