




Solving the Distributed Generation Puzzle
CHP, District Energy, Microgrids

Jeff King

Department of Environmental Programs

Metropolitan Washington Council of Governments

September 2013

Metropolitan Washington
Council of Governments

Region Forward

What is MWCOG?

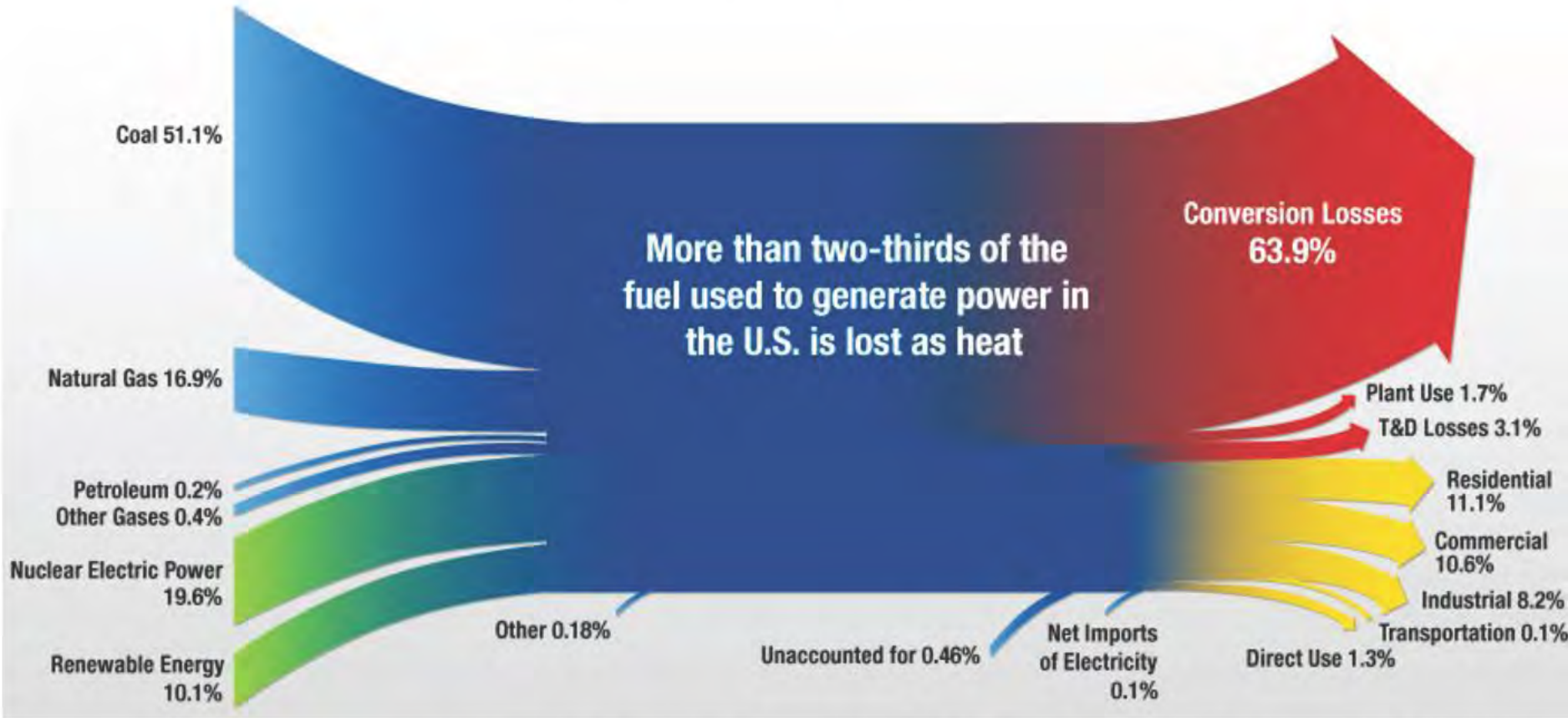
- Association of 22 local government members
- 3 States – Maryland, Virginia, District of Columbia
- Designated Regional Planning Organization
  - Air Quality
  - Climate and Energy
  - Transportation
  - Public Safety/Housing/Community Development


Let's
Clear
the
Air
DISTRICT
BUILDING
DISTRICT
BUILDING

Morgantown Coal Plant and New SO2 Scrubber

Traditional Power is VERY Inefficient

CHP more efficient + less emission



Source: DOE Energy Information Administration Annual Energy Review 2005
Combined Heat and Power, Oak Ridge National Laboratory

"Clean Energy" Technologies

CHP

The sequential production of electric and thermal power from a single dedicated fuel source

Waste Heat Recovery

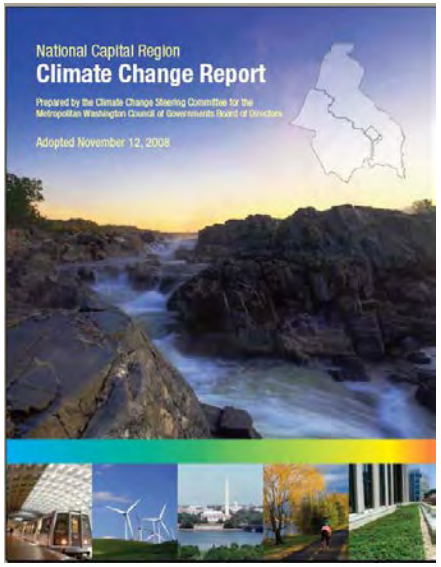
Captures heat otherwise wasted in an industrial process and utilizes it to produce electric power. These systems may or may not produce additional thermal energy

District Energy

Central heating & cooling plants that incorporate electricity generation along with thermal distribution piping networks for multiple buildings (campus / downtown area)

COG's Climate and Energy Programs

- **Directive from the COG Board of Directors**
  - **COG Board comprised of local elected officials (County Council & Supervisors, City Mayors)**
- **Established formal policy committee with supporting advisory subcommittees.**
  - **Climate, Energy and Environment Policy Committee (CEEPC)**
  - **Subcommittees – Energy, Recycling, Climate Adaptation, Green Buildings, Electric Vehicles**
- **Wide range of stakeholders involved – elected officials, academic, environmental organizations, business sector, transportation agencies, energy utilities.**
- **Adopted Climate Change Report November 2008**
- **Adopted Climate and Energy Action Plan in January 2010**
  - **Includes 2012 Goals for Government, COG, and Community/Businesses**



Examples of COG Support of State and Local Programs

- **Critical Infrastructure Protection**
- **Energy Security**
- **Collaborative Solar PV Procurement**
- **Rooftop Solar Challenge**
- **Electric Vehicle Task Force**
- **Green Building Group**
- **Recycling Committee**
- **Community Energy Task Force**

CLEAN ENERGY COLLABORATIVE
Procurement Initiative

ACCESSIBLE
SUSTAINABLE
PROSPEROUS
LIVABLE

Area of Growing Interest

- **Power Infrastructure Modernization**
  - **Distributed generation with CHP**
  - **Advanced microgrids**
  - **Micro District Systems**
  - **Integration of renewables**
- **Energy Surety**
- **Community Resilience**

Exploration of Opportunities

- **COG and its members are exploring opportunities for energy collaboration**
  - **Sandia and Army Corps CERL**
    - **Demonstration of Advanced Microgrids on the Civilian Grid in the National Capital Region (NCR)**
- **Potential Sites and Partners**
  - **DC Water Bryant Street Pumphouse**
    - **Howard Univ**
    - **Washington Medical Center**
    - **McMillan Reservoir**
  - **WSSC Water Facilities**
  - **NIH Campus**
  - **National Airport**
  - **SW Ecodistrict/GSA Central Plant**
  - **Walter Reed/St. Elizabeth Campus**
  - **County Public Safety Facilities**

CLEAN ENERGY COLLABORATIVE
Procurement Initiative

More Opportunities

- **DC Water**
  - **Net-Zero at Blue Plains**
- **Arlington County**
  - **Crystal City District System**
- **Loudoun County**
  - **Microgrid for Government Facility**
- **Fairfax County**
  - **Fort Belvoir Microgrid**
- **Frederick County**
  - **Fort Detrick – Net Zero Base**
- **Charles County**
  - **Large Solar on Electric Distribution Grid**

Game Changers?

- **What are the barriers to more CHP, District Energy, and Microgrids in the District?**
- **What will it take to modernize our power infrastructure?**
- **What is the role of biomass/biogas?**
- **Can we re-envision new utility collaborative approach?**
  - **WMATA, DC Water, Pepco, Washington Gas**
- **What infrastructure investments are needed?**
- **Can we capitalize on new types of innovative financing?**
- **How can we better support the District's Clean Energy Leadership?**
- **How can we better partner with the federal government?**
  - **Clean Energy Applications Center/FEMP/DOE/Sandia/Army Corps/DoD**

Energy Networking

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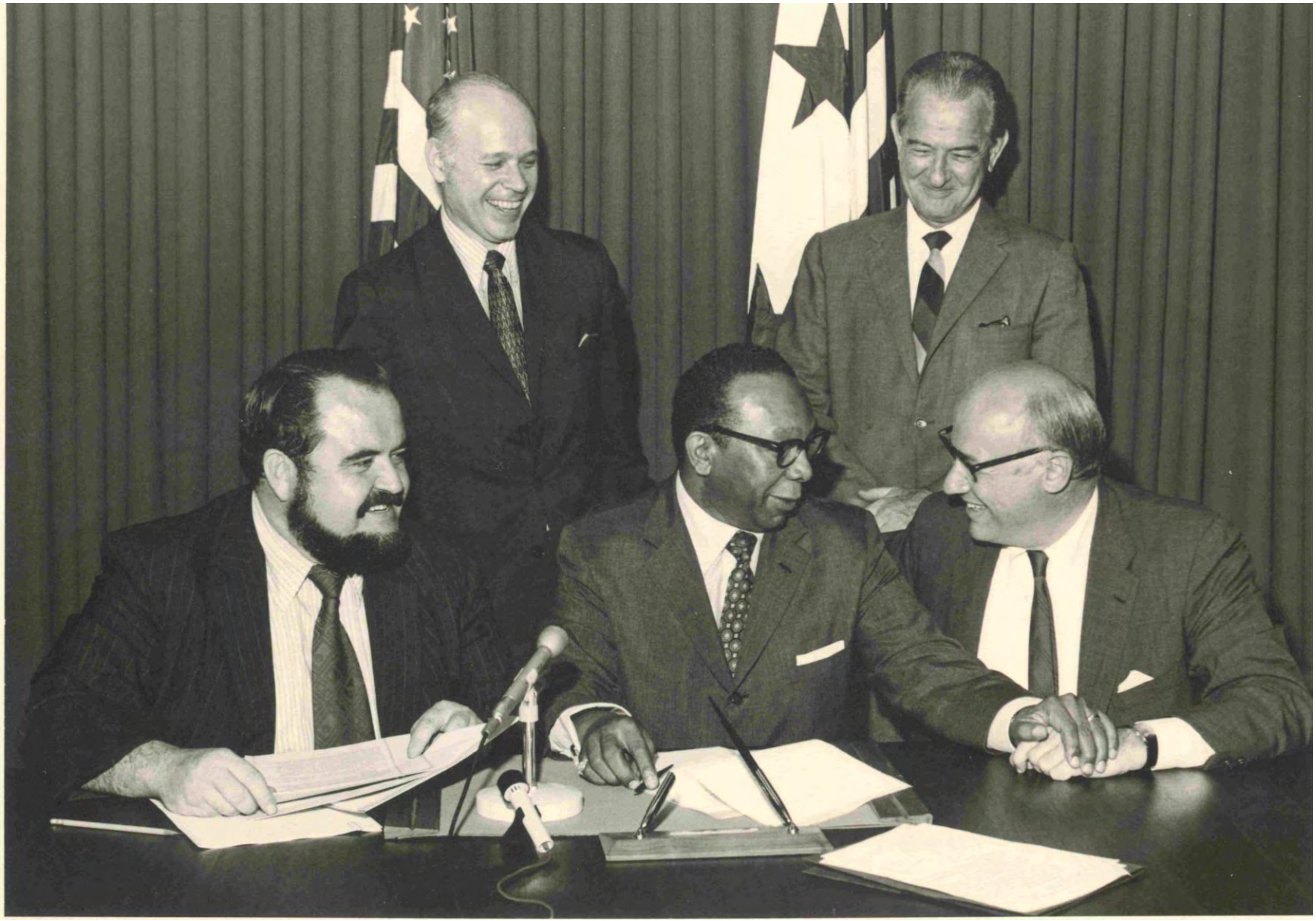
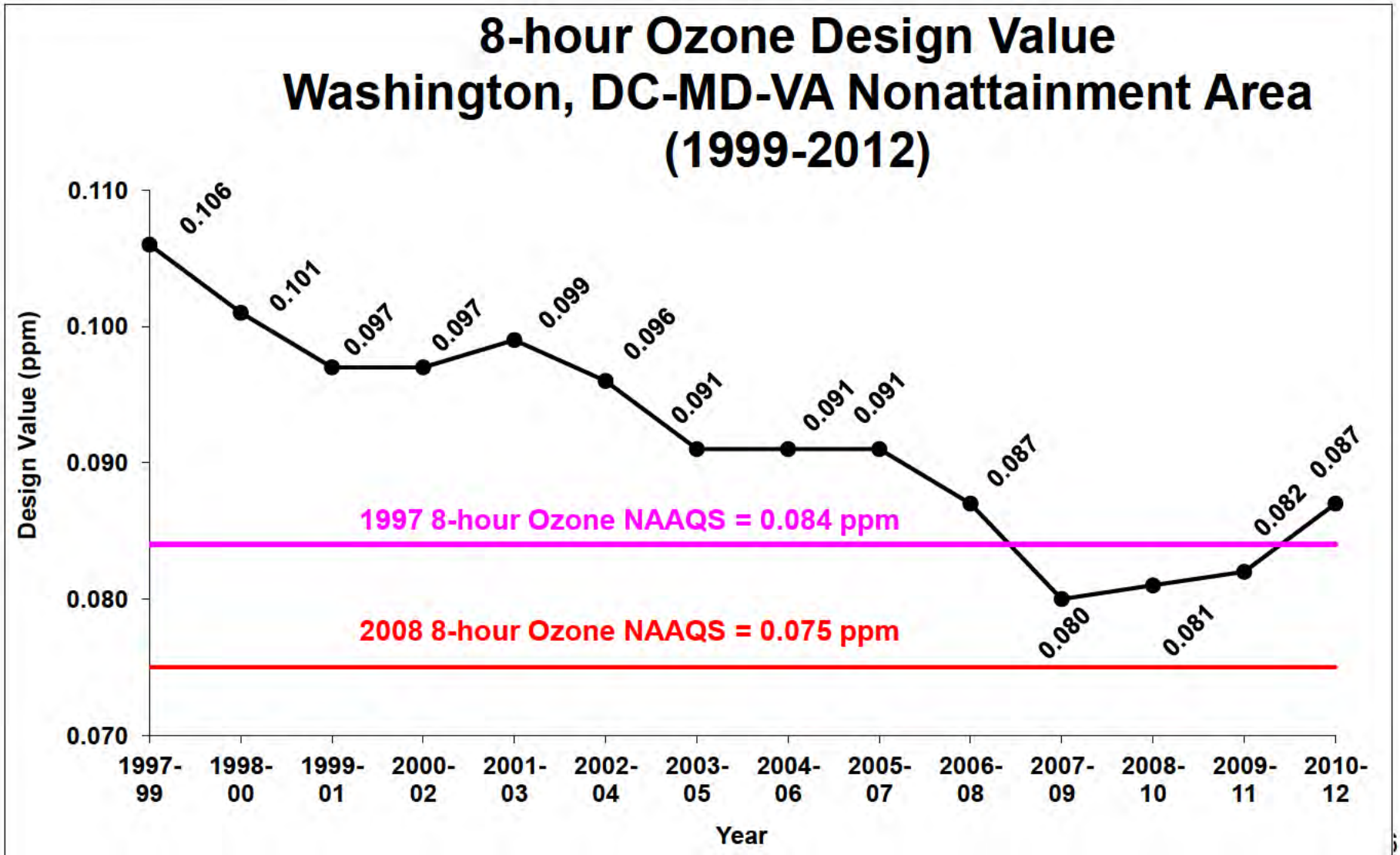
xtra slides

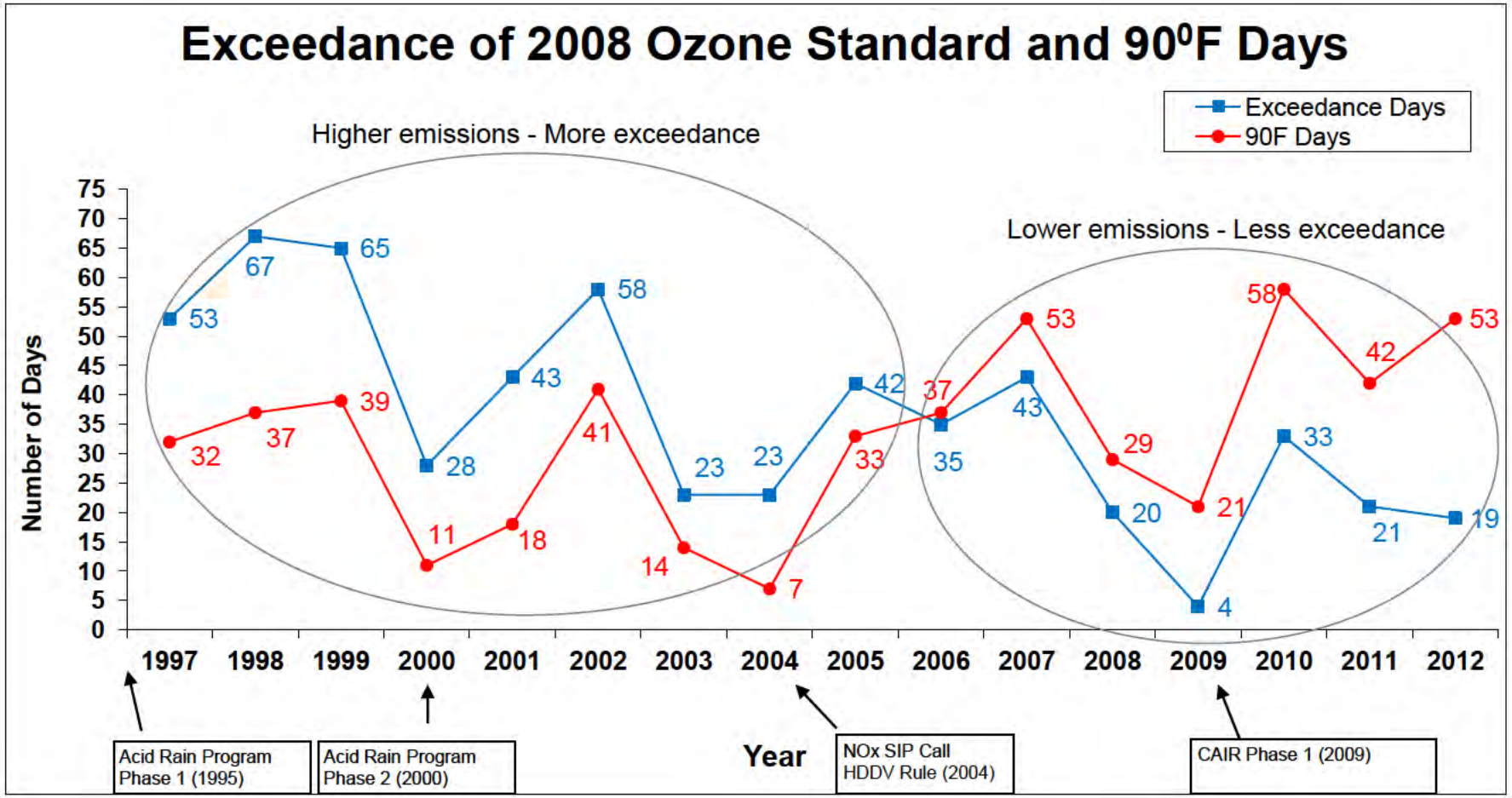


Ozone Design Value Trend



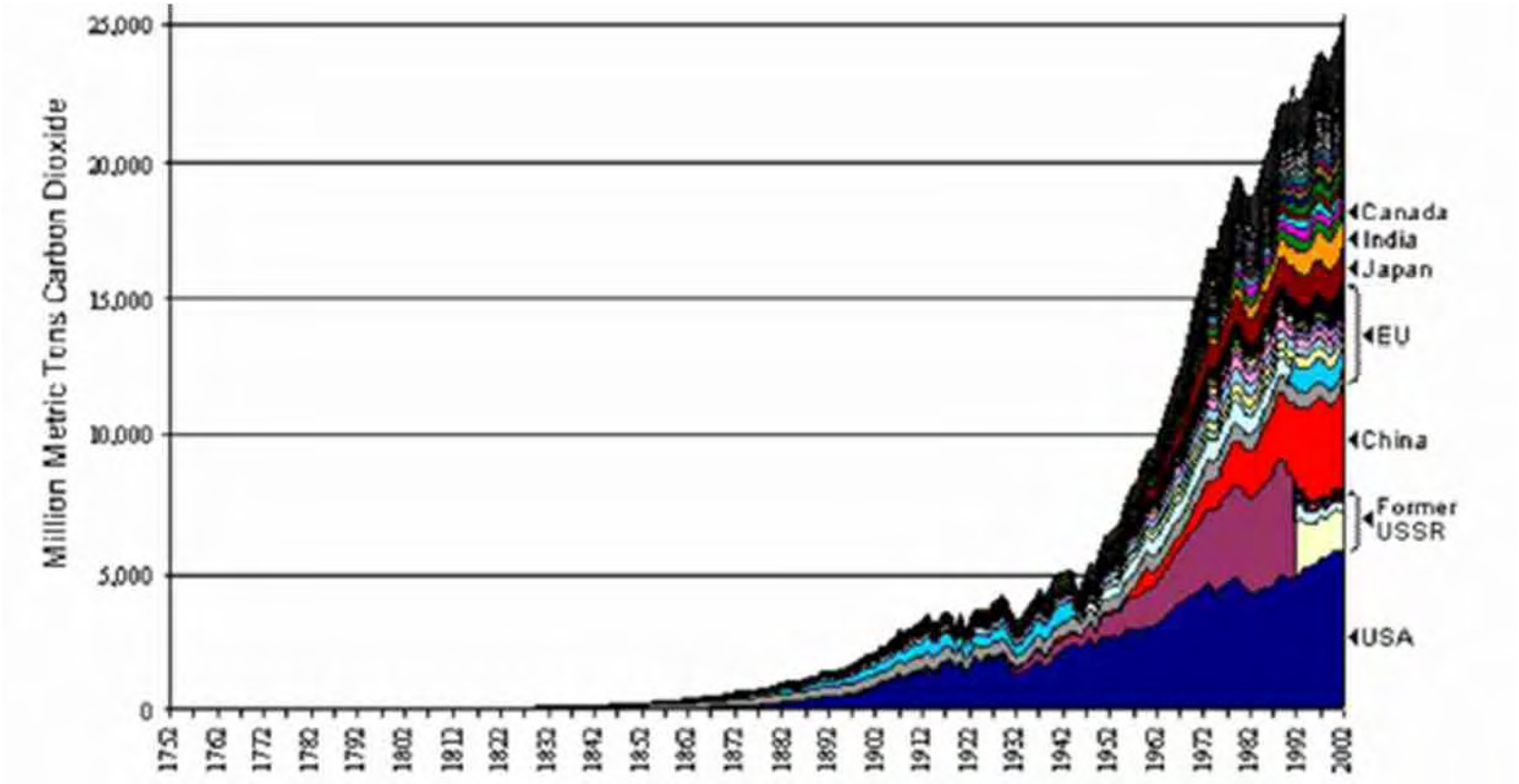
* Design value = 3-year average of 4th highest daily maximum 8-hour average ozone concentrations. 2012 data is draft and may change.

Ozone Exceedance & 90^{0}F Days



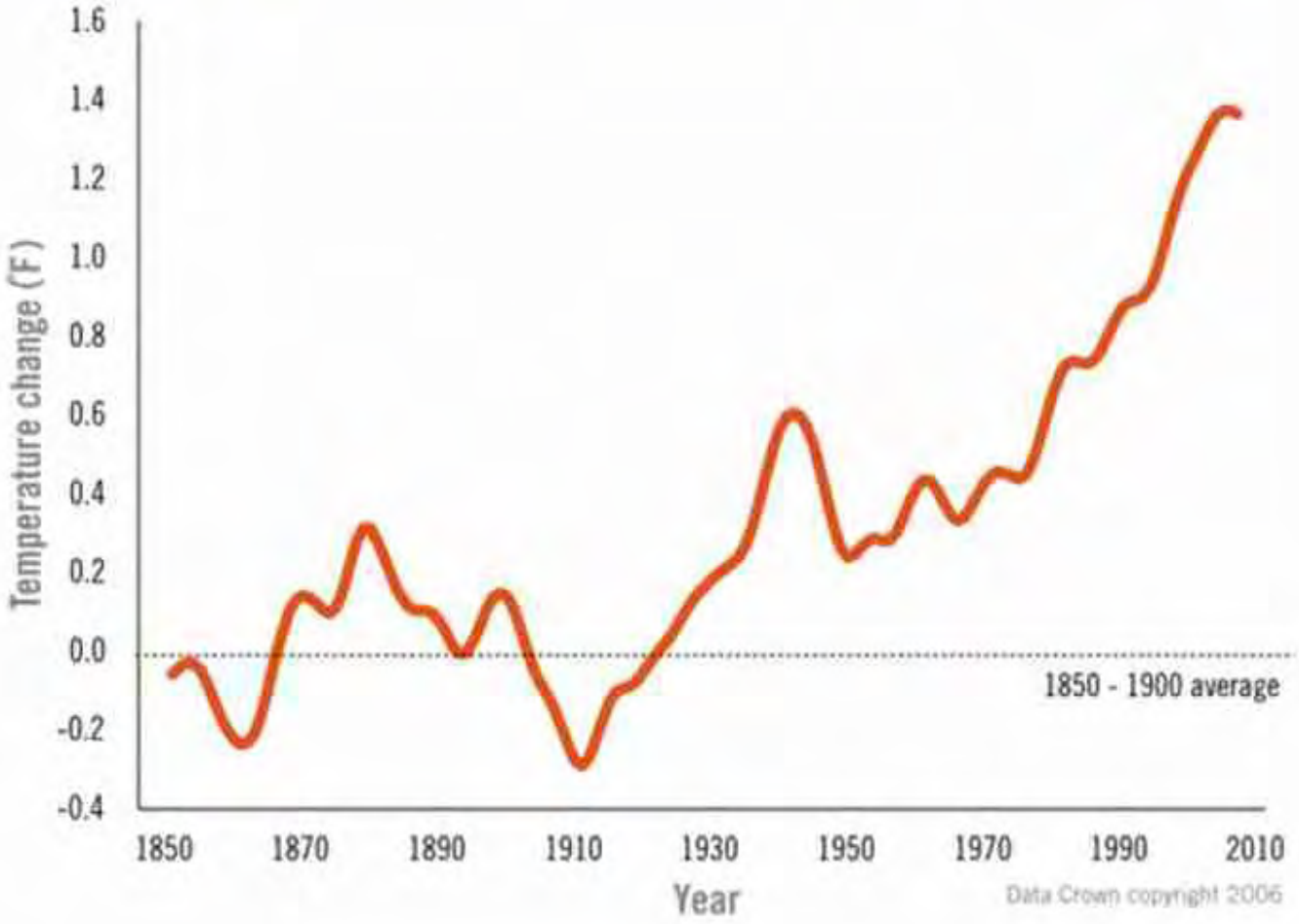
*** 2012 analysis is based on draft data as of September 9, 2012 and is subject to change.**

Global CO_2 Emissions Since 1752



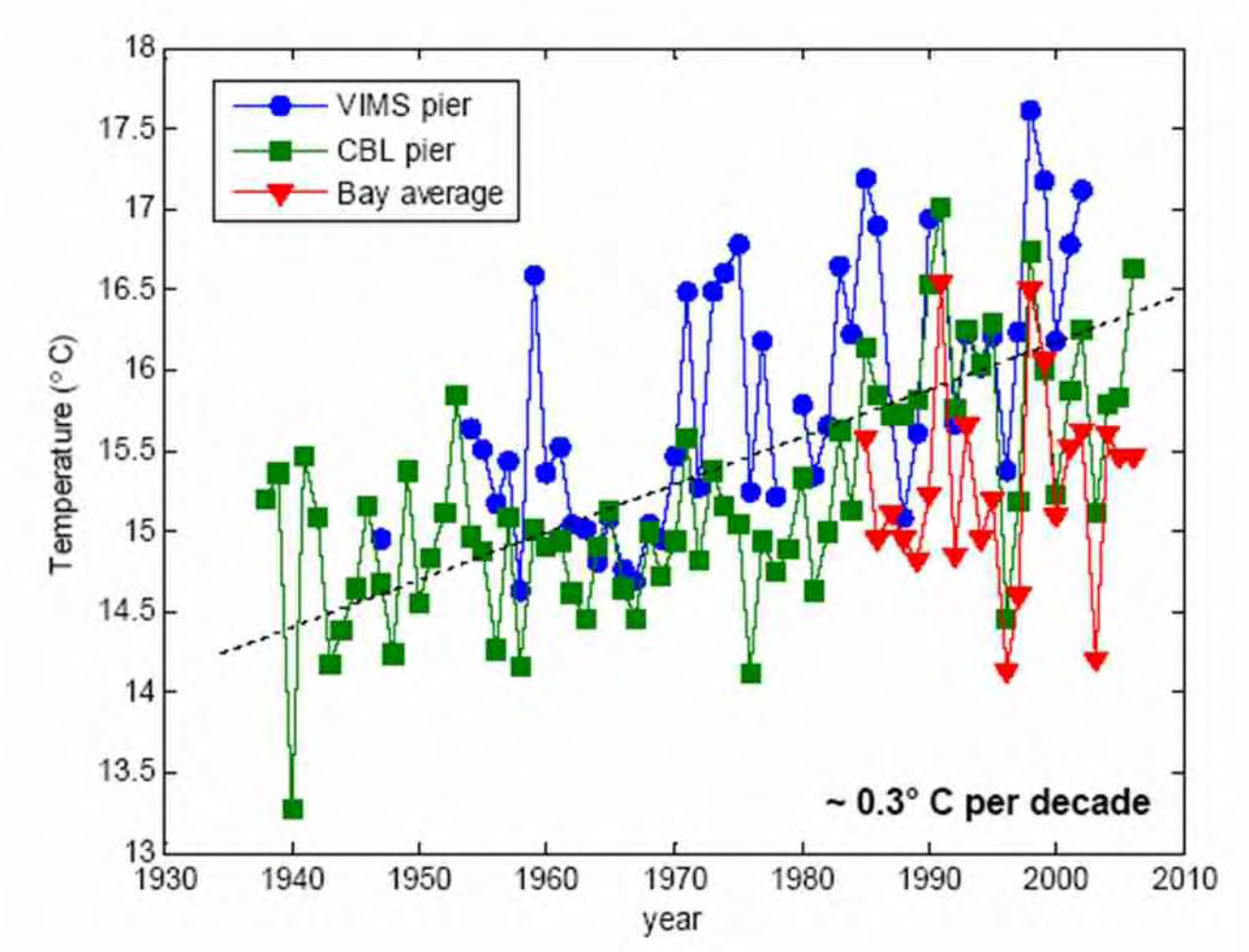
Source: Carbon Dioxide Information Analysis Center, U.S. Dept. of Energy

Increasing Global Surface Temperature



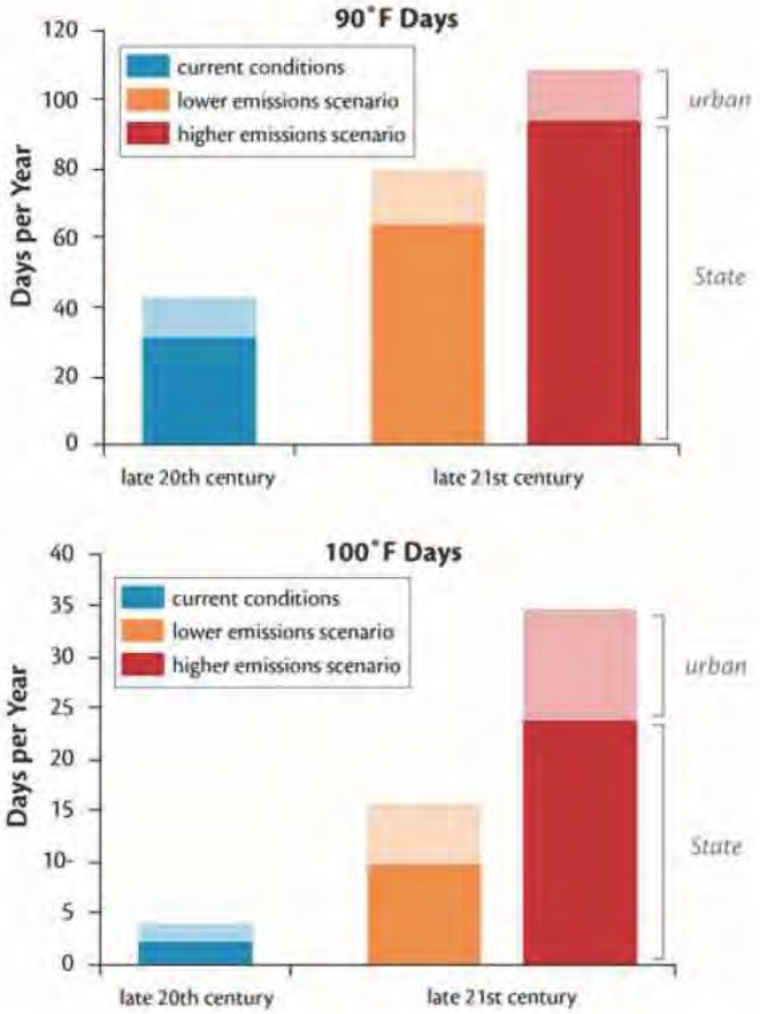
Source: Pew Center on Global Climate Change

Measured Temperature Changes in Chesapeake Bay Surface Waters



Source: Virginia Institute of Marine Science

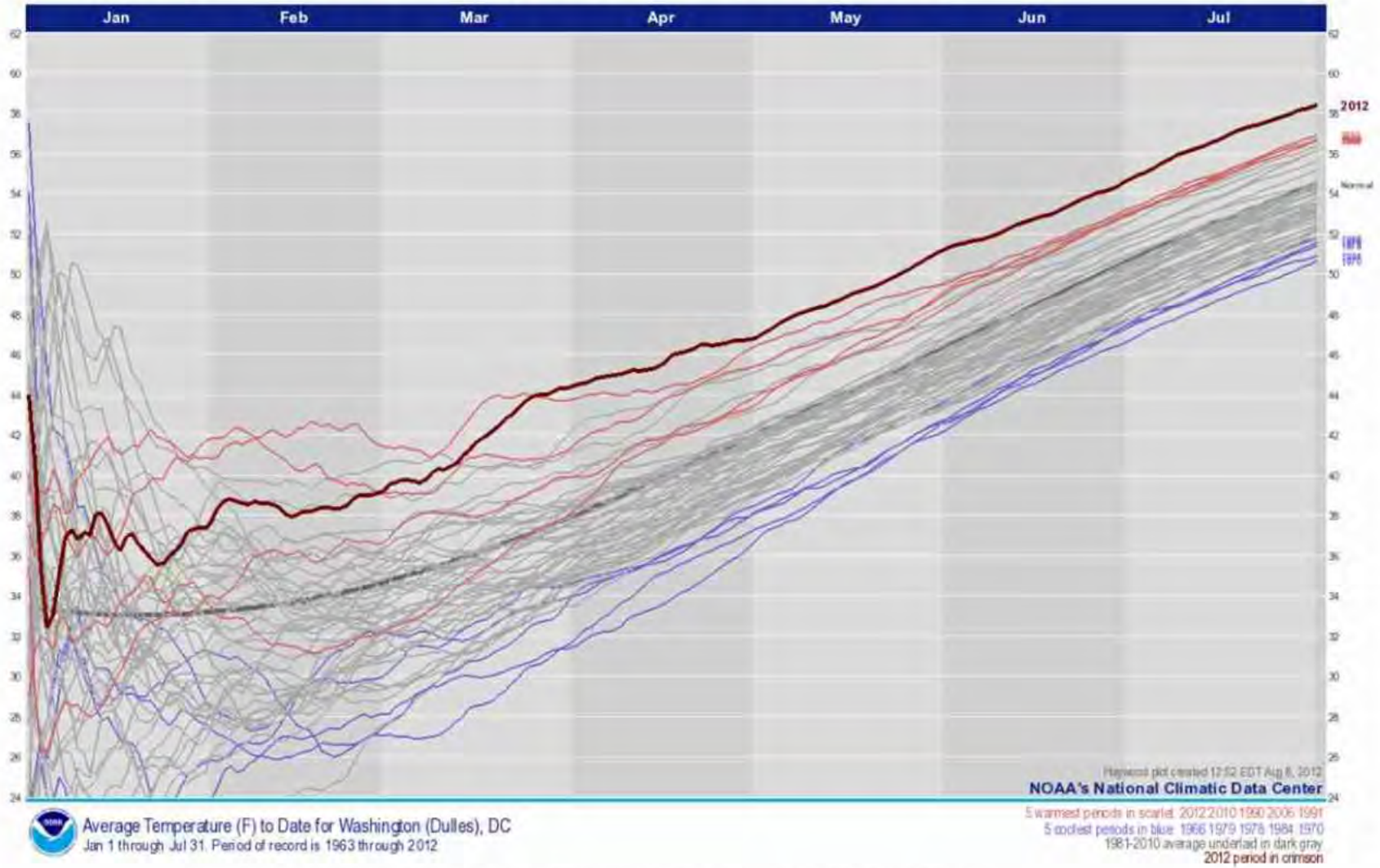
Milder Winters, Much Hotter Summers



Source: Dr. Donald Boesch, University of Maryland

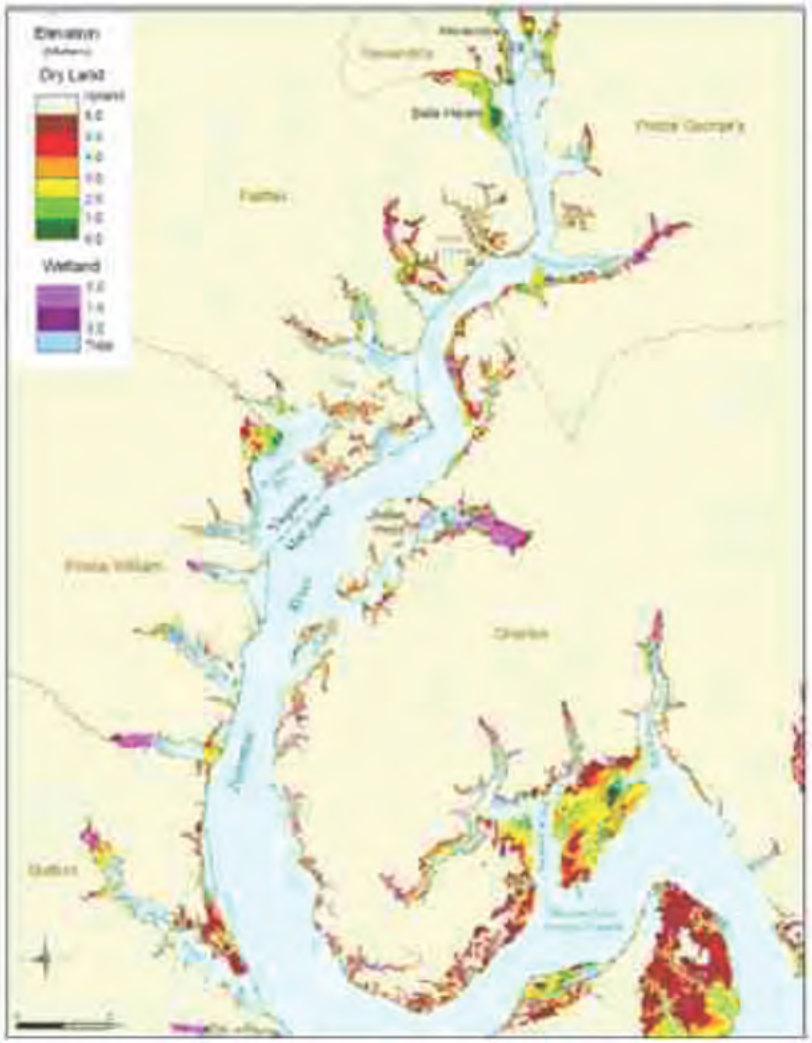
Long-Term Temperature Trend - Dulles

- July 2012 – Warmest July on record (1963-2012)



http://www.ncdc.noaa.gov/img/haywood/jul/janjul.USW00093738.png

Sea-level Rise Vulnerability in DC Area



Source: Dr. Donald Boesch, University of Maryland

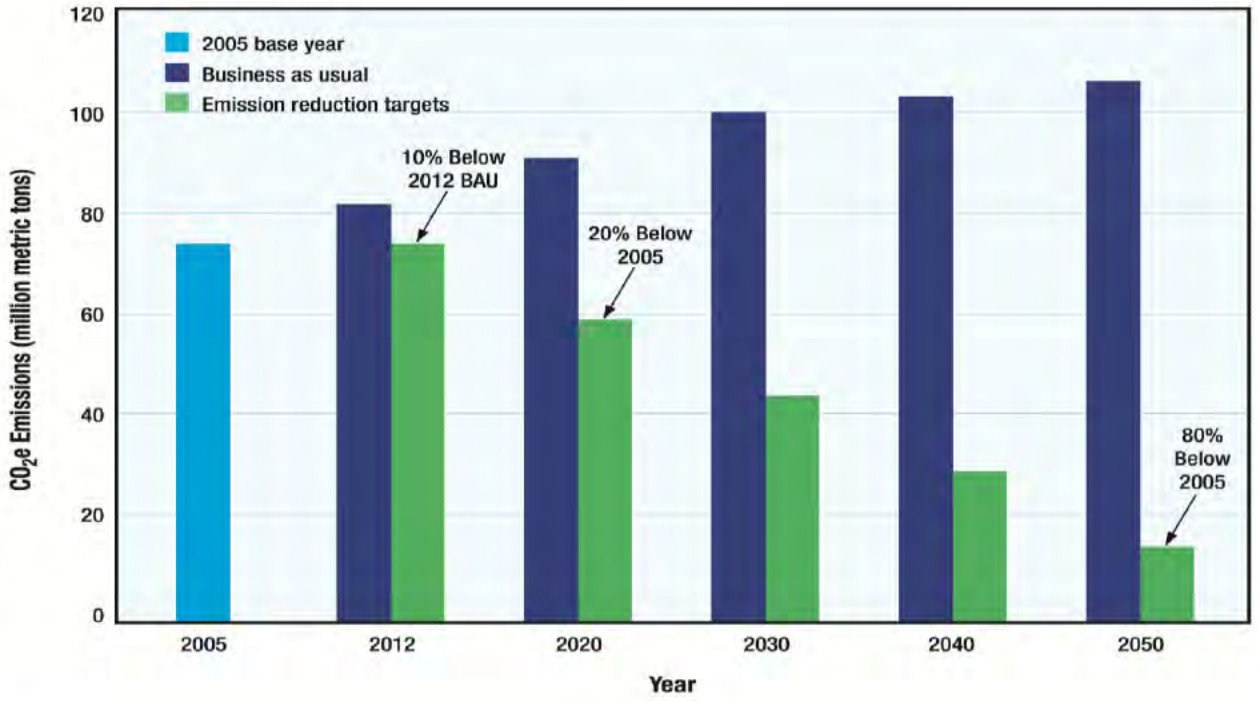
Adopted Regional Reduction Goals

2012: Return to 2005 Levels

2020: 20% Below 2005

2050: 80% Below 2005

Recommended Regional Greenhouse Gas Emission Reduction Targets Compared to Regional Greenhouse Gas Emissions Under BAU: 2005–2050

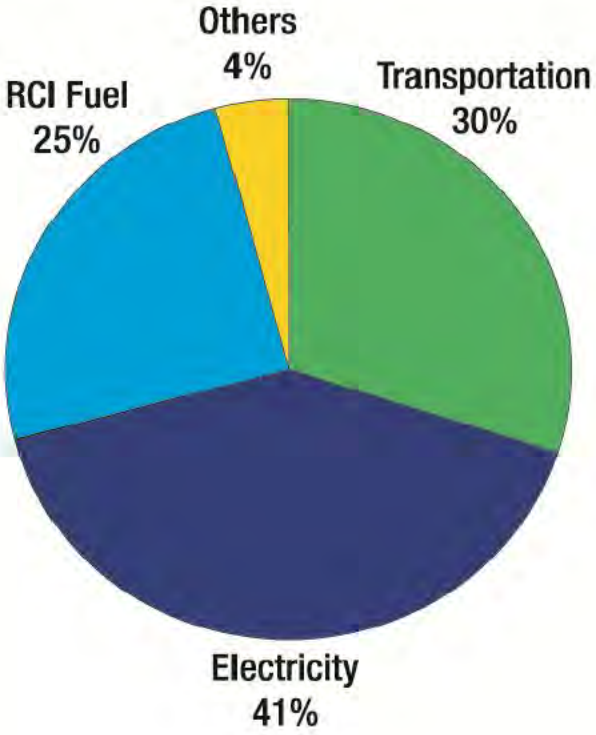


COG Targets

- 2012: 10% below BAU
- 2020: 20% below 2005 levels
- 2050: 80% below 2005 levels

Greenhouse Gas Emissions Inventory

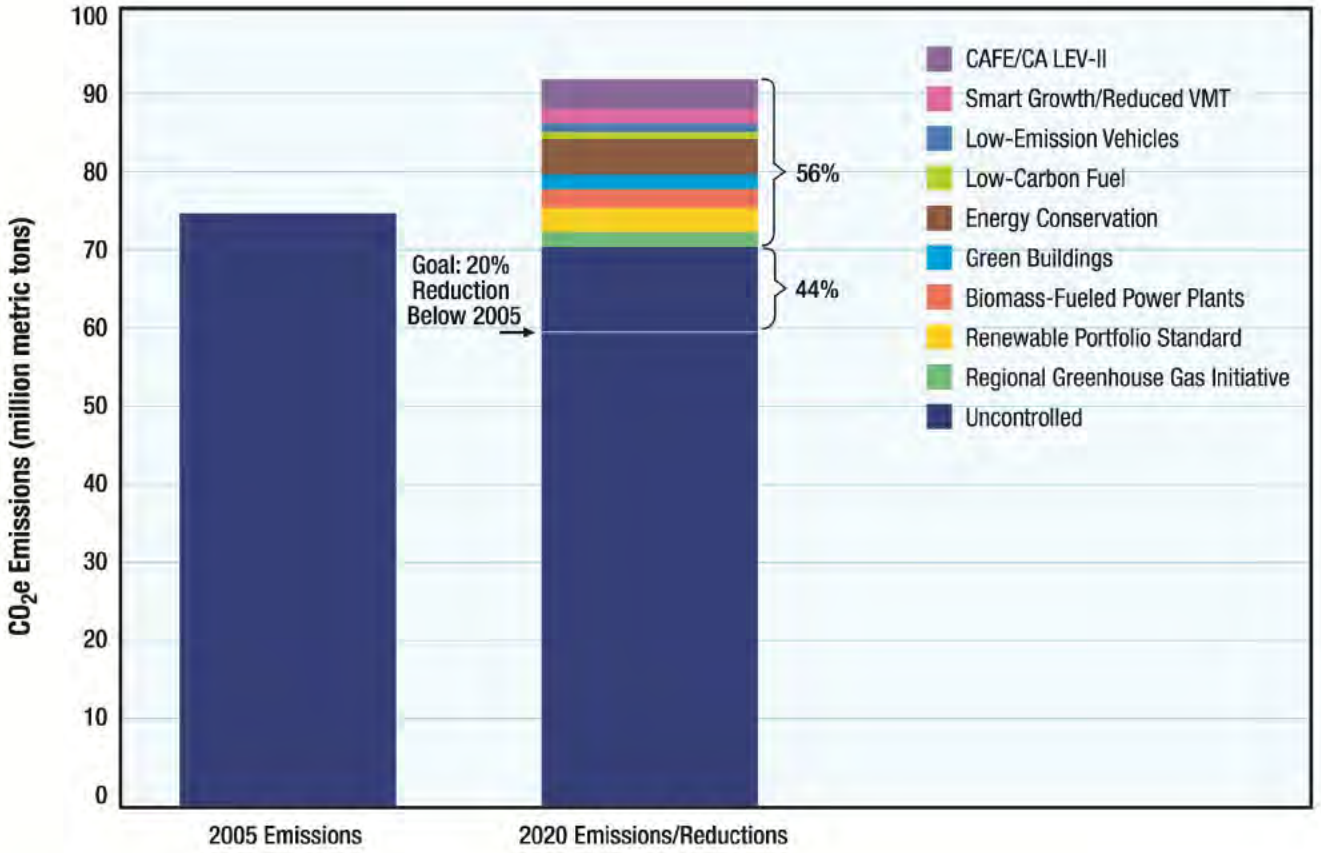
Metropolitan Washington Greenhouse Gas Emissions: 2005



Notes:
RCI fuel includes residential, commercial, and industrial natural gas, home heating oil, nonroad diesel, and aviation fuel.
Other sources include methane from wastewater treatment and landfills, as well as high global-warming-potential gases used as refrigerants and solvents.

Total – 74 million metric tonnes in 2005
Source: MWCOG 2008.

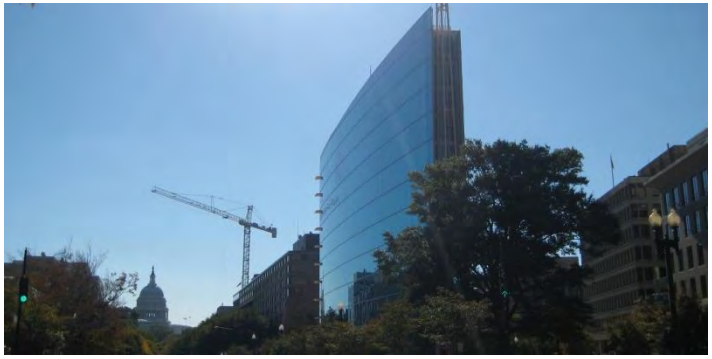
Opportunities to reduce regional GHG emissions



Source: COG staff estimates.

2010-2012 Climate/Energy Action Plan
Local Government Actions

By 2012, COG-Member Local Governments:



Green Building Policy

Efficient Street Light Deployment

Use 10% Renewable Energy

Use 10% less energy

COG 2012 Climate & Energy Action Plan Adopted Local Government Actions

- **By 2012, <u>All</u> COG-Member Local Governments:**
  - Prepare plan to reduce greenhouse gas emissions from government operations; adopt target.
  - Adopt COG green building policy
  - Reduce government energy use by 10% below forecast 2012 levels
  - Purchase or consume 10% renewable energy
  - Regional target of 5000 solar roofs

COG Resource Guide Example

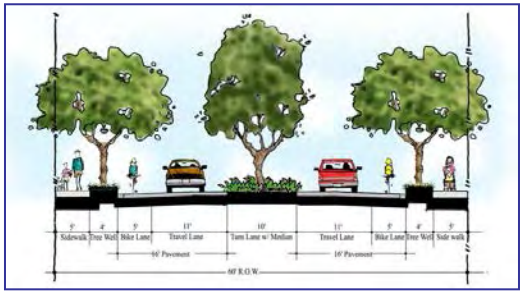
Description: Green streets are a vegetated area in the transportation public right-of-way that manage stormwater, increase tree canopy, reduce urban heating….

Examples:

- Prince George's County, MD Complete and Green Streets Policy was adopted to create more livable communities and places; manage stormwater in an environmentally friendly way, and increase tree canopy.

Resources:

- National Complete Streets Coalition Green Streets Information and Resources
- US EPA Conceptual Guide to Green Streets, Municipal Handbook to Green Streets, Green Streets Initiatives Around the US



National Capital Planning Commission

SW Ecodistrict

A VISION PLAN FOR A MORE SUSTAINABLE FUTURE

September 26, 2013

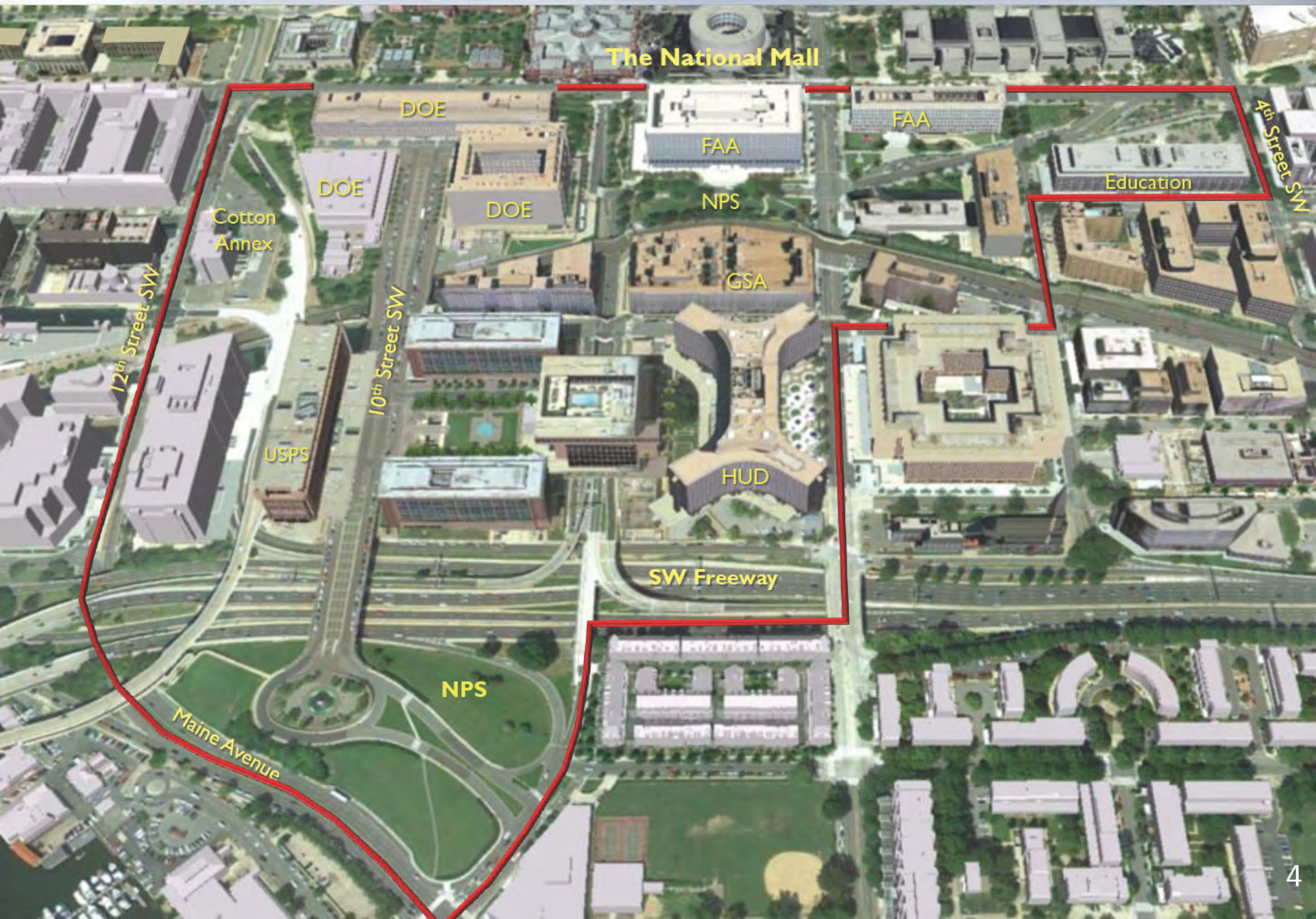
DCRA Green Building Symposium

Bringing Ecodistricts and Cogeneration to the District

SW Ecodistrict

National Capital Planning Commission

Study Area

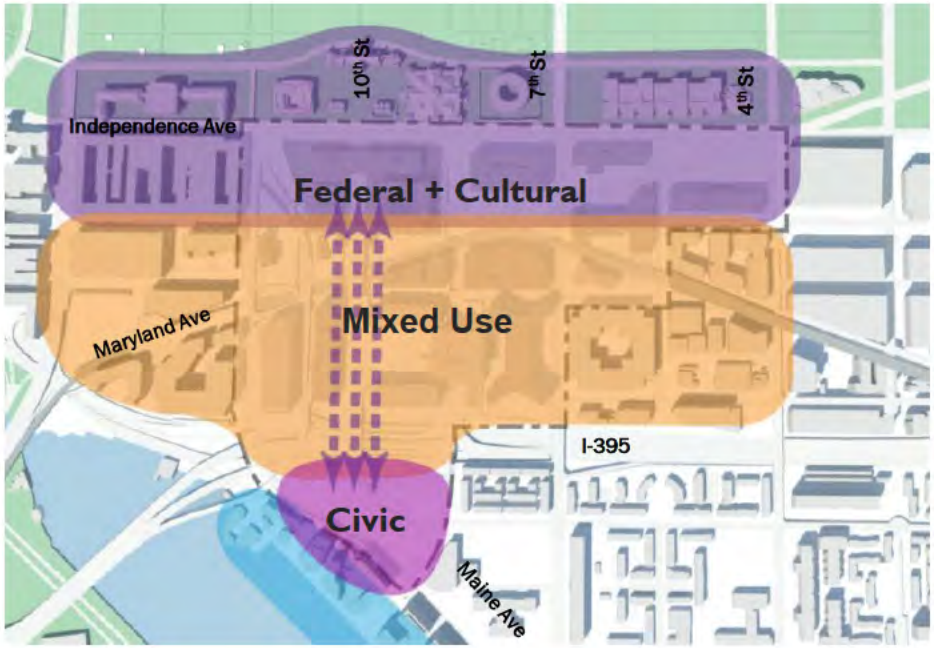


What is an Ecodistrict?

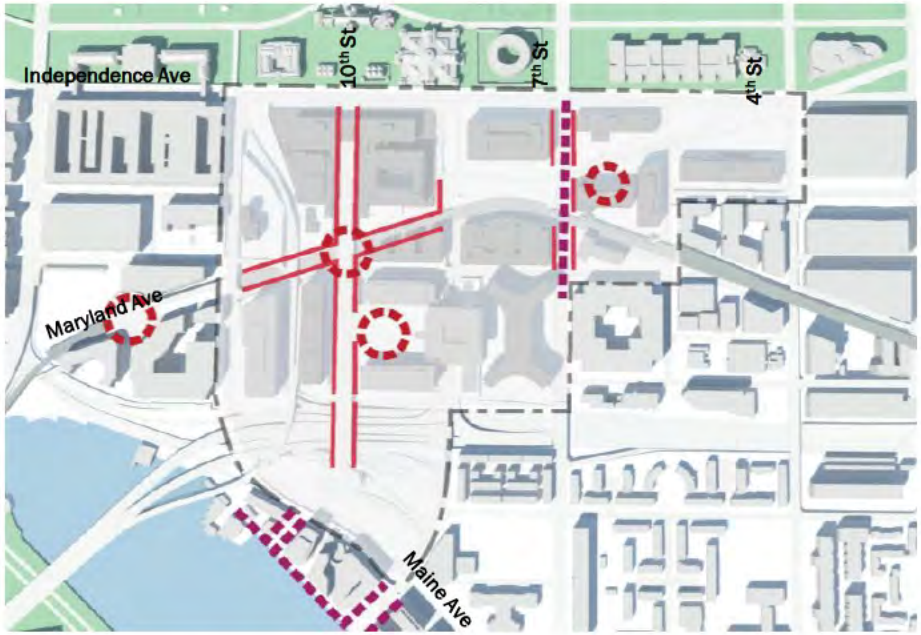
- It captures, manages, and reuses energy, water, and waste beyond a single building to a group of buildings within a precinct
- It includes transportation choices and a mix of uses within a neighborhood
- It creates a neighborhood of connected parks, plazas and open spaces for a vibrant, green, and walkable community

Planning Approach

Land Use Mix



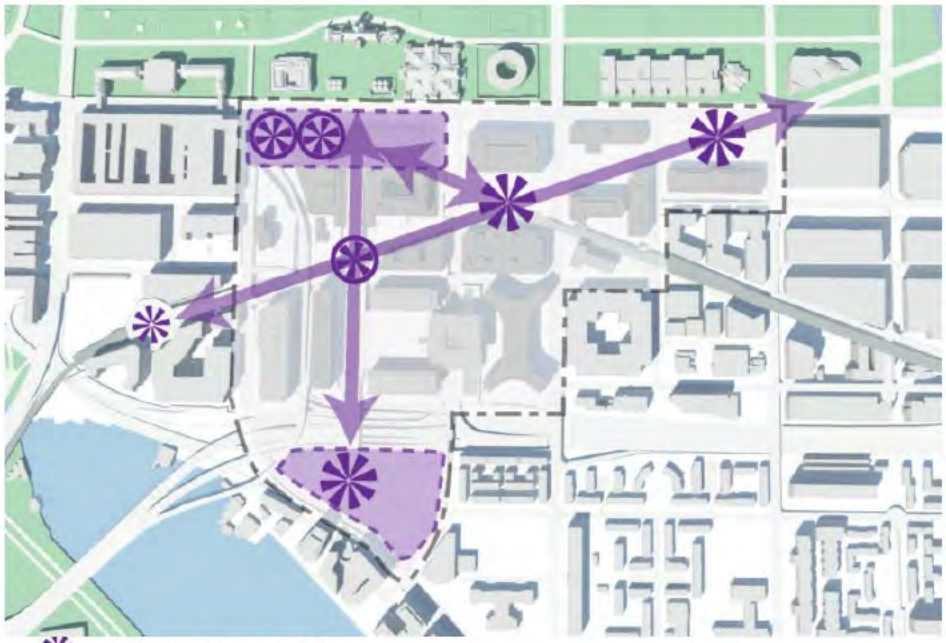
Active Street Frontage



Open Space

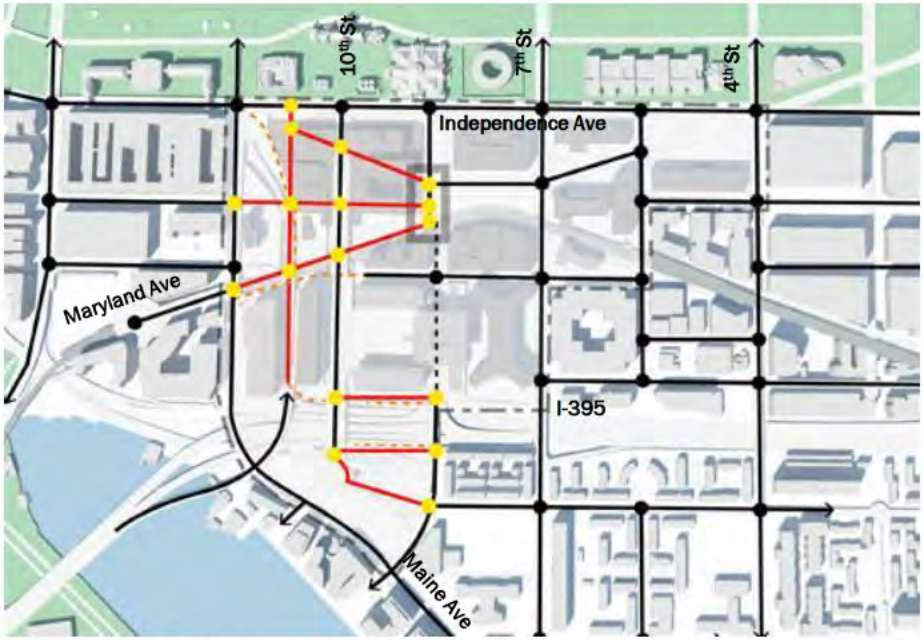
Public space – Exist. & Planned
View Corridor
Enhanced Green Spine
Civic Anchor

Cultural Facilities



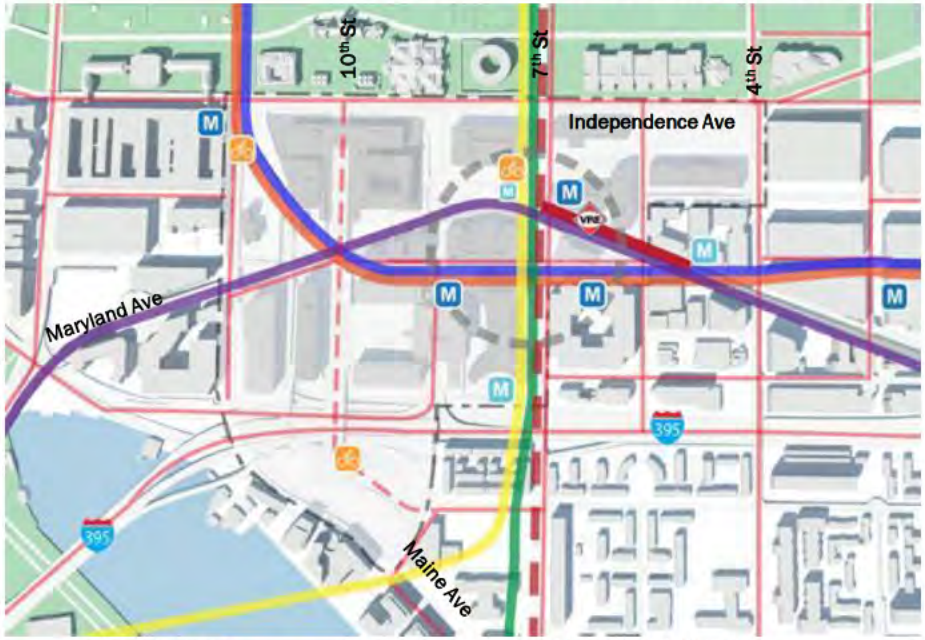
Museum/Memorial Sites
Zone for Future Facility
Enhanced Links

Street Grid

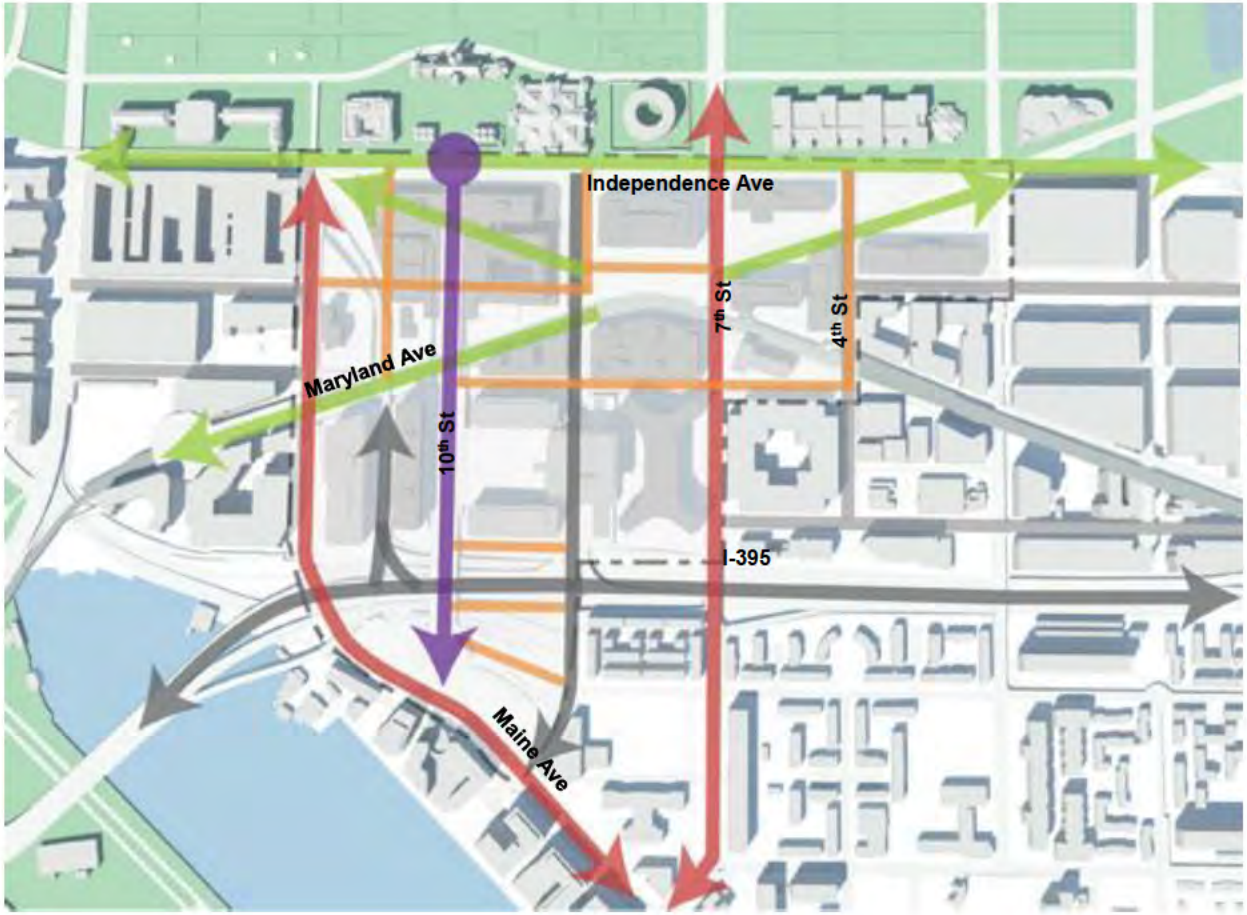


- Existing Streets
- Existing Streets (below grade)
- Proposed Streets
- Proposed Ramp
- Existing Intersection
- Proposed Intersection

Transit and Transportation



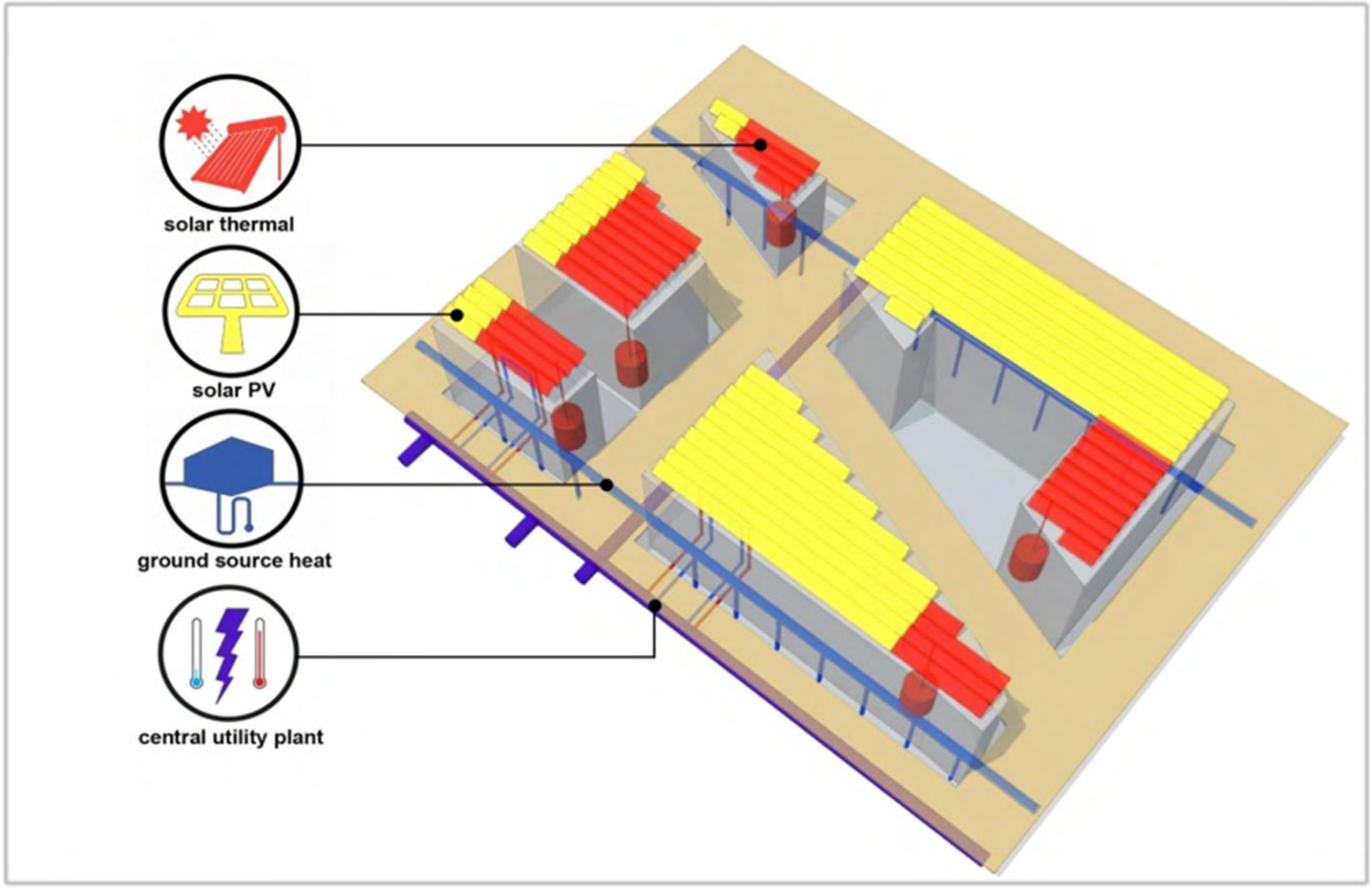
- Metro Orange
- Metro Blue
- Metro Yellow
- Metro Green
- Future Streetcar
- VRE
- Bus
- Bike
- Transit Node
- Metro (Exist Elevator)
- Metro (Potential Access)
- Metro (Existing Entrance)
- Capital Bikeshare



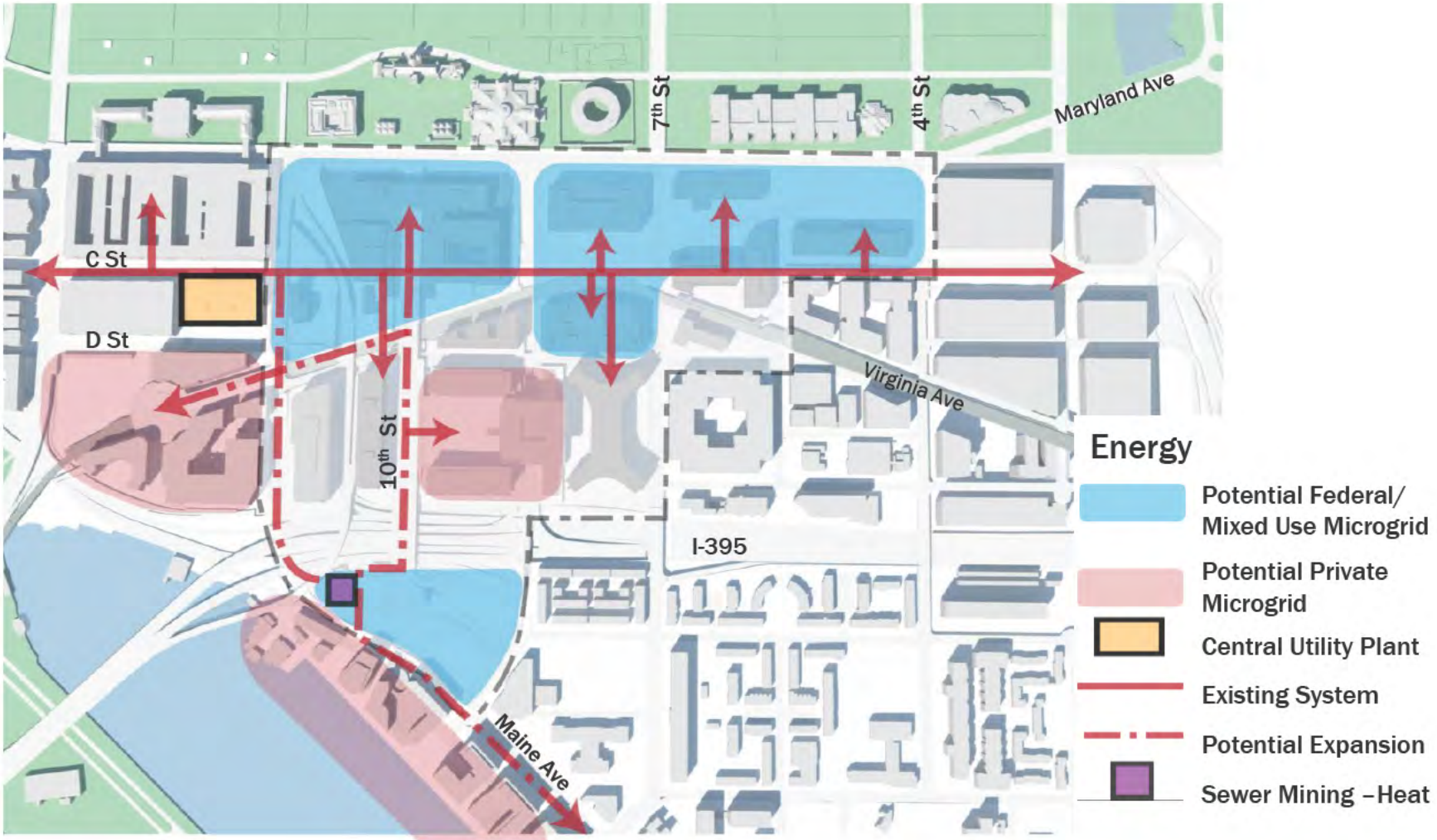
Street Function and Character

- Civic Street
- Monumental Street
- Local City Street
- Local Neighborhood Street
- Regional Freeway

Block Scale Energy Systems

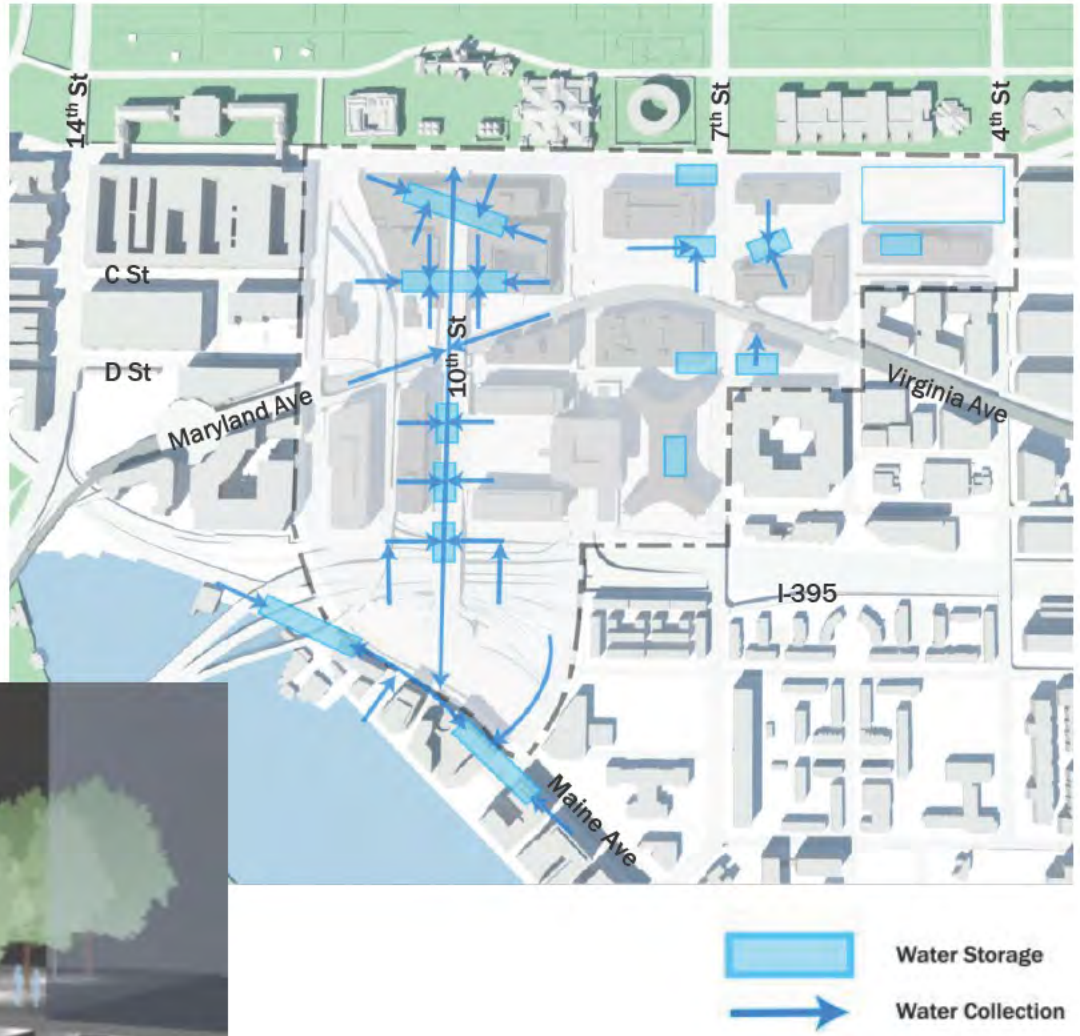


District Scale Energy Systems



District Scale Water Systems

Large tanks (under 10th Street) could hold enough stormwater to provide 71 percent of the total water used in the ecodistrict.



10th Street cross section with below ground tanks

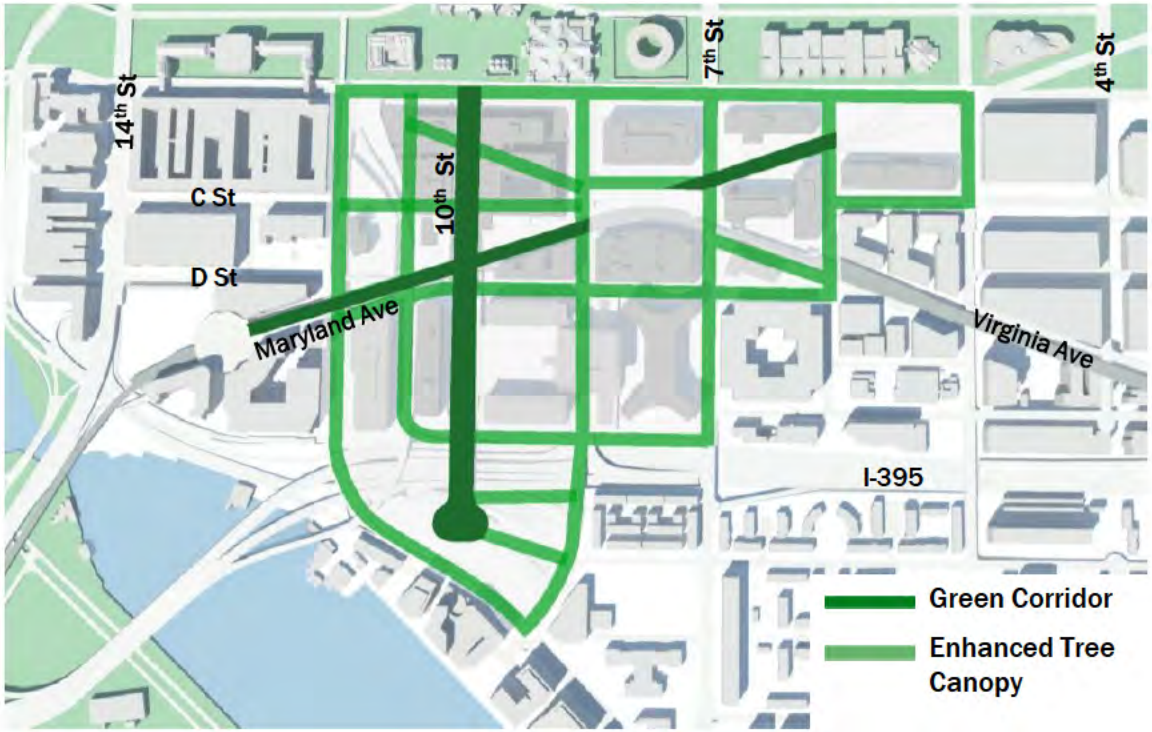
Green Street Infrastructure

Building Scale Strategies

- Green roofs
- Edible rooftops
- Green walls
- Rain gardens

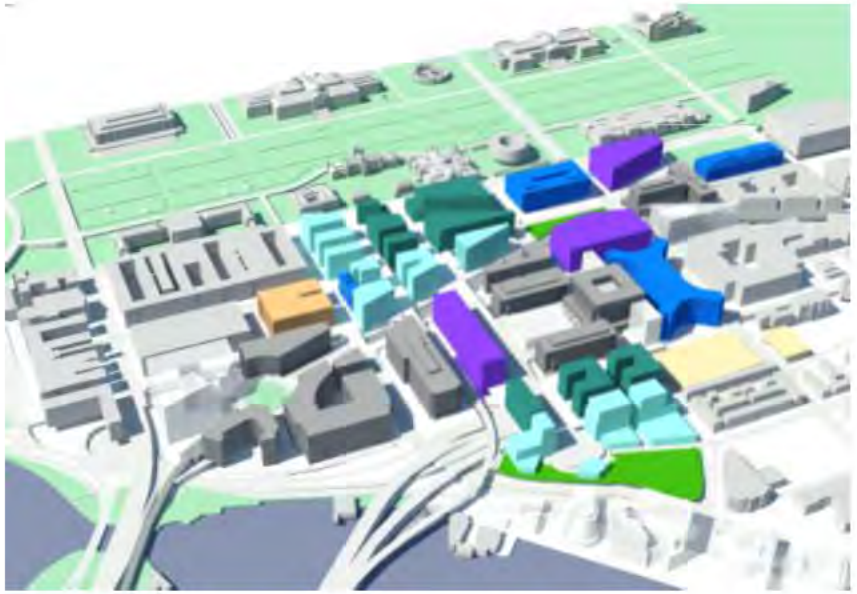
Block /District Strategies

- Native vegetation
- Healthy soils
- Shade trees
- Pervious areas



	Building Strategy				
	Light Rehab	Full Rehab	Repurpose	Infill	Redevelop
Energy					
Tenant Improvement					
Lighting System Upgrade	X	X	X	X	X
Plug Load Reduction	X	X	X	X	X
Sustainable and Certified Materials	X	X	X	X	X
Radiant Heating and Cooling		X	X	X	X
Low Volume Air Distribution		X	X	X	X
Core and Shell					
Upgrades to building systems during natural cycle of obsolescence.	X				
New Mechanical and Electrical System - Hydronic thermal energy distribution.		X	X	X	X
High performance building envelope		X	X	X	X
Maximize the use of renewable energy resources (PV) and shared energy technology		X	X	X	X
Maximize building energy use efficiency		X	X	X	X
Capitalize on Ground Source Heat Below Building Site				X	X
Capitalize on Ground Source Heat Below Open Space and Streets					X
Water					
Replace plumbing existing fixtures with high efficiency fixtures	X	X	X		
Install high efficiency fixtures		X	X	X	X
Collect rainwater		X	X	X	X
Install non-potable water system		X	X	X	X
Waste					
Provide waste sorting stations at point of use locations.	X	X	X	X	X
Reclaim, recycle, and compost the majority of waste (solid and organic) generated within the area.		X	X	X	X
Minimize construction waste.		X	X	X	X

Energy, water, and waste at the building scale



Path to Sustainability - Today

Path to Sustainability - Rehab

- Light rehab
- Full rehab
- Central utility plant
- Park space

Path to Sustainability -

Repurpose

Central utility plant

Park space

Path to Sustainability - Infill

Infill

Central utility plant

Park space

Path to Sustainability - Redevelop

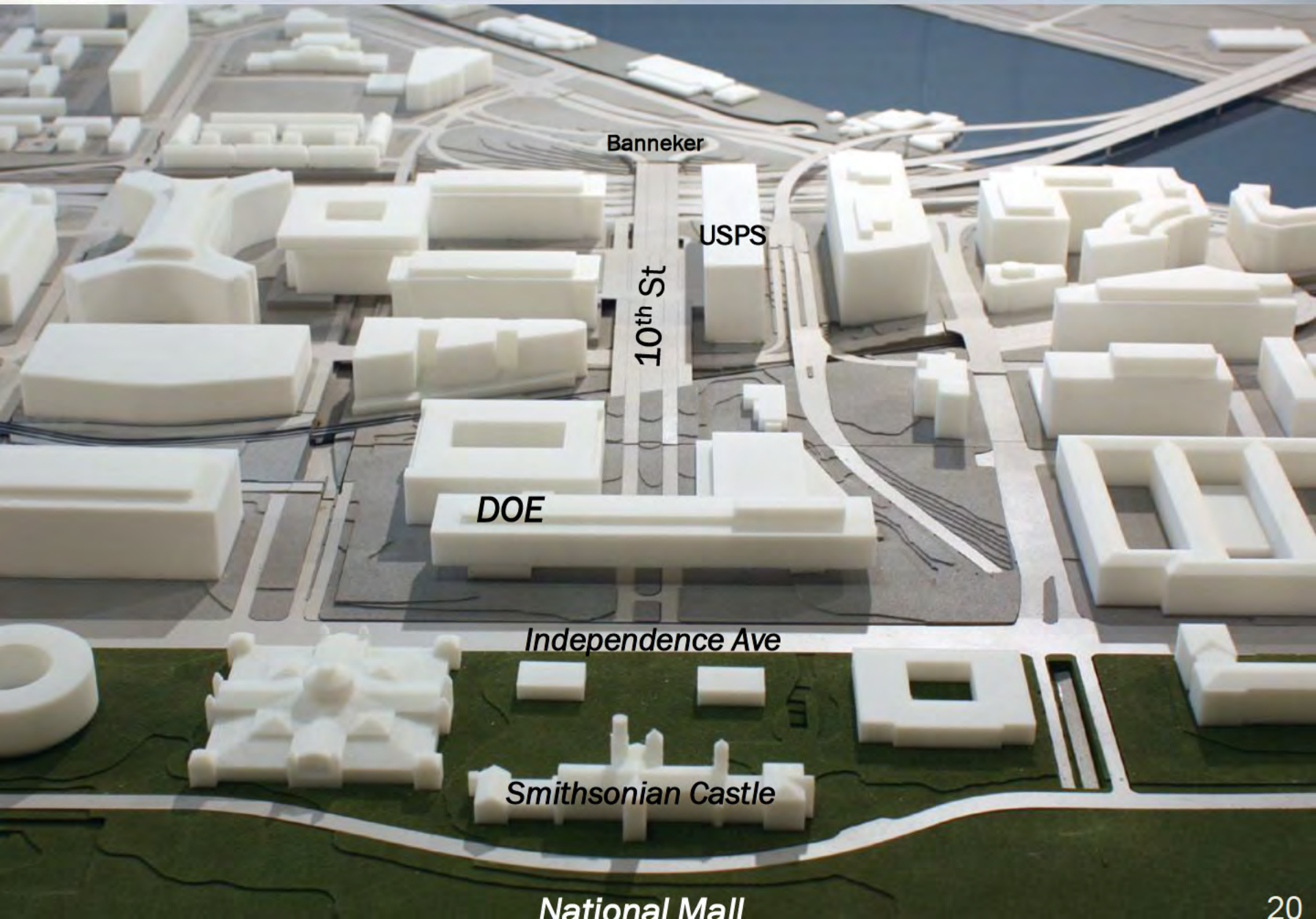
- Redevelopment
- Solar canopy
- Central utility plant
- Park space

Path to Sustainability - Composite

- Light rehab
- Full rehab
- Repurpose
- Infill
- Redevelopment
- Solar canopy
- Central utility plant
- Park space

National Capital Planning Commission

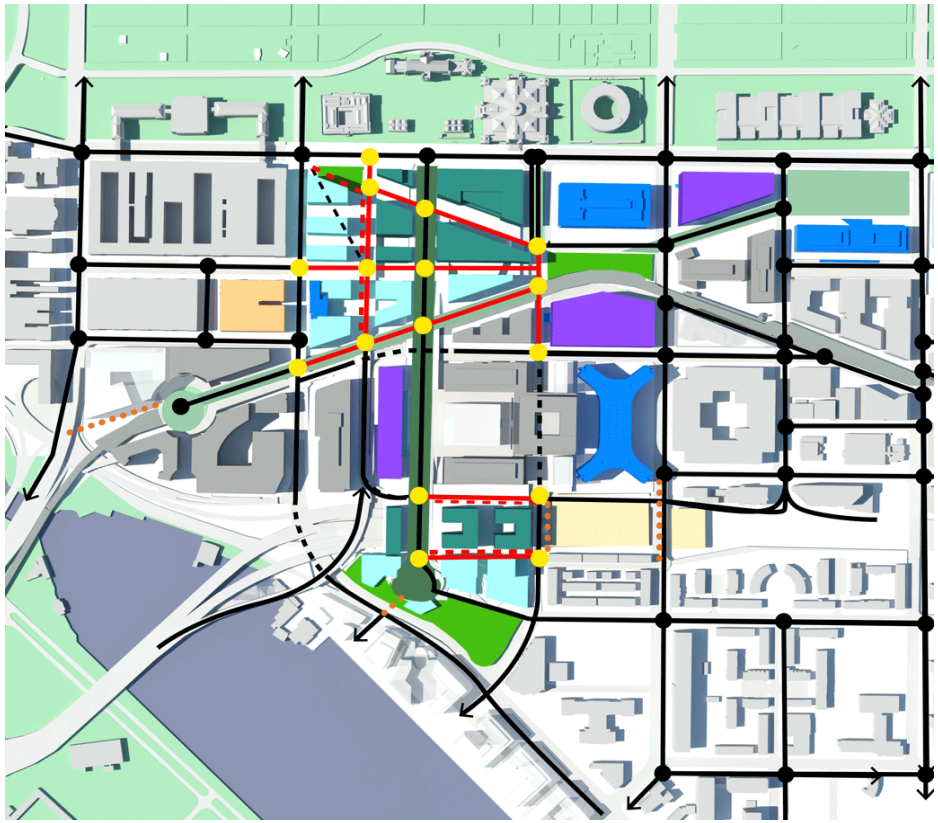
Focus Area: 10th Street + Banneker Park



National Capital Planning Commission

Focus Area: 10th Street + Banneker Park

Neighborhood Results



- Retains/improves **7.9M** sf of federal office space; accommodates up to **19,000** additional workers;
- Creates **1.0M** sf of offices for **5,000 -6,000** private/federal) workers;
- Provides for **100,000** sf of new commercial services;
- Provides **1.8M** sf residential/ hotel for **1,500** residents, and **240,000** visitors per year;
- Establishes **1.2M** sf of museum space for **4-5** new cultural sites;
- Creates **14.3** acres of new/improved parks and plazas, **5** memorial sites;
- Reconnects street grid and creates **17** new intersections for easy accessibility;
- **EXPANDS** rail corridor and L'Enfant Station to **INCREASE** regional commuter transit capacity.

Environmental Results

- Reduces the area's greenhouse gas emissions by **51%**;
- Allows for the capture and reuse of **ALL** the rainwater in the Ecodistrict throughout the year;
- Reduces the potable water use by **70%**;
- Increases the amount of waste diverted from the land from **35%** to **80%**;
- Transforms the federally-owned central utility plant into a **HIGHLY EFFICIENT** and **FINANCIALLY SUCCESSFUL** energy model.

Precedent Project

Capitol Crossing
Property Group Partners

- Cogeneration Plant will serve 8-10M sf

What are the challenges moving forward?

- The funding and phasing of infrastructure.
- The need for a governance entity for implementation and ongoing operations.
- The coordination and legislative actions needed to improve efficiency of the central utility plant.
- Prioritizing multiple agency missions and objectives.
- The need for private sector participation and ability to interface with the private sector.

DEPARTMENT OF CONSUMER & REGULATORY AFFAIRS
2nd Annual Green Building Symposium and Expo

CHP and Building Systems Energy Efficiency

September 24th, 2013
Washington, D.C.

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U.S. Department of Energy
Clean Energy Application Center
MID-ATLANTIC
Promoting CHP, District Energy, and Waste Energy Recovery

DEPARTMENT OF CONSUMER & REGULATORY AFFAIRS

2nd Annual Green Building Symposium and Expo

Combined Heat & Power Systems – Efficient if Applied Correctly

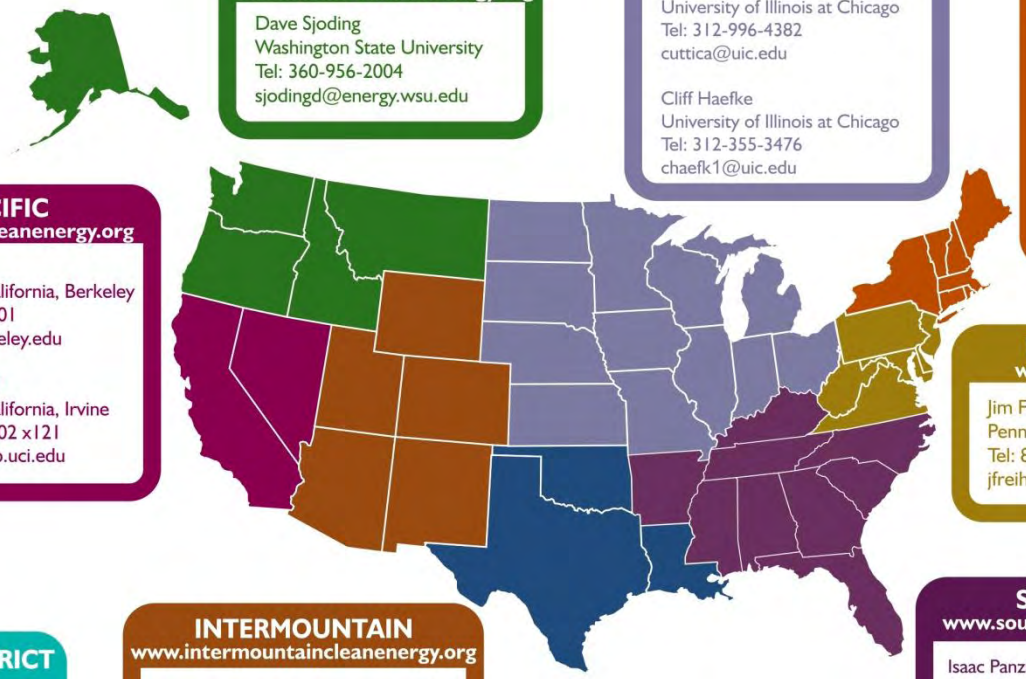
Snowstorms and Hurricanes Influences – CHP is Resilient

Shale Gas Development Influences – CHP is Cost effective

U.S. Department of Energy
Clean Energy Application Center
MID-ATLANTIC

Promoting CHP, District Energy, and Waste Energy Recovery

DOE Clean Energy Application Centers: Locations, Contacts, and Web Sites



NORTHWEST
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U.S. Department of Energy
Clean Energy Application Centers

Combined Heat and Power (CHP) solutions represent a proven and effective near-term energy option to help the United States enhance energy efficiency, ensure environmental quality, promote economic growth, and foster a robust energy infrastructure. The U.S. DOE National CHP Roadmap, a culmination of state, regional, national, and international efforts, states that increased regional CHP outreach and assistance could help increase the deployment of CHP opportunities in the United States. In response to the National CHP Roadmap, DOE established a network of Regional **Clean Energy Application Centers (CEACs)**, formerly called the CHP Regional Application Centers (RACs).

DOE's Regional Clean Energy Application Centers promote and assist in transforming the market for combined heat and power, waste heat recovery, and district energy technologies and concepts throughout the United States. Key services of the CEACs include:

- **Market Assessments** – Supporting analyses of CHP market potential in diverse sectors, such as health care, industrial sites, hotels, and new commercial and institutional buildings.
- **Education and Outreach** – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations and others.
- **Technical Assistance** – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

For more information on the DOE Clean Energy Application Centers, visit:
http://www.eere.energy.gov/manufacturing/distributedenergy/ceacs.html

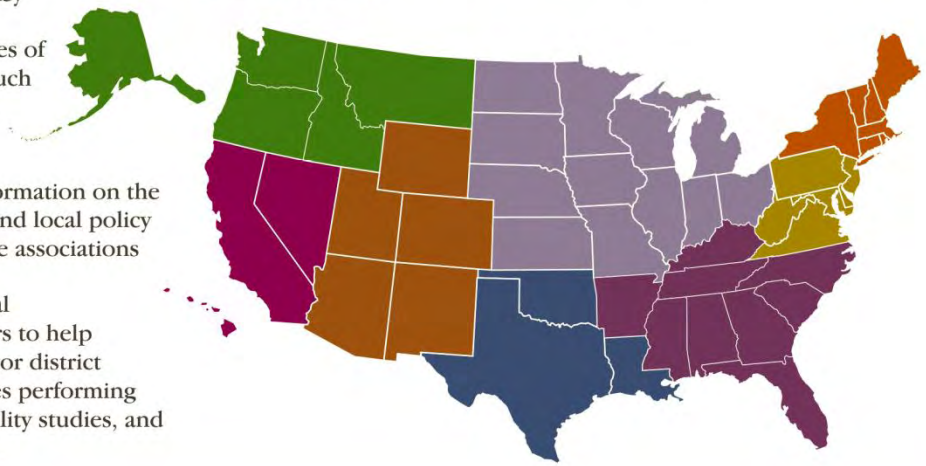
or visit the individual DOE CEAC web sites directly for details on the services provided and upcoming events.

Related Links

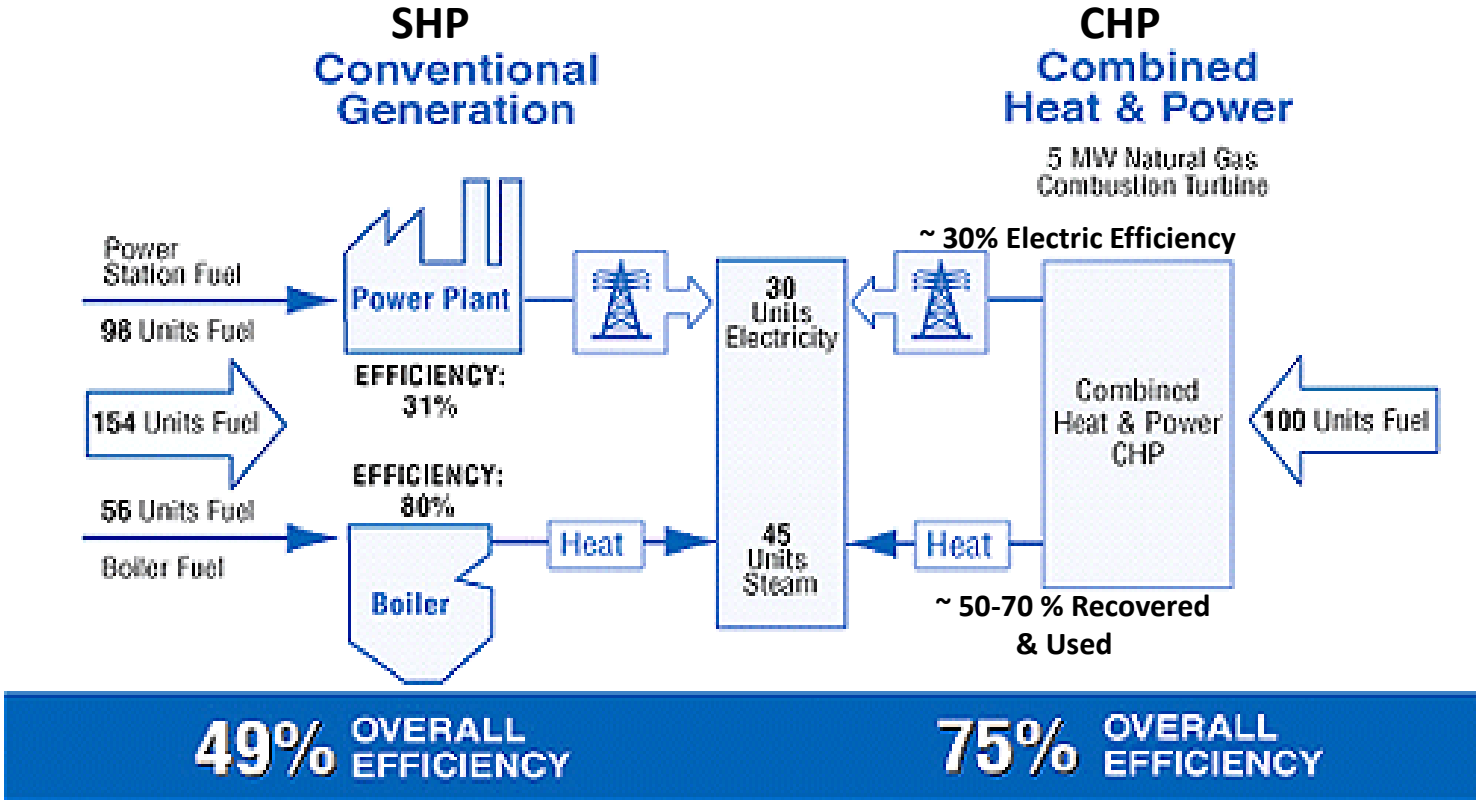
International District Energy Association
www.districtenergy.org

U.S. Environmental Protection Agency
Combined Heat and Power Partnership
www.epa.gov/chp

United States Clean Heat and Power Association
www.uschpa.org



Separate Heat & Power vs Combined Heat & Power



Key Design Parameter → $\lambda_U = \frac{Heat}{Power} = 1.5$

Lower emissions
Higher reliability (resiliency)
Lower Life Cycle costs?

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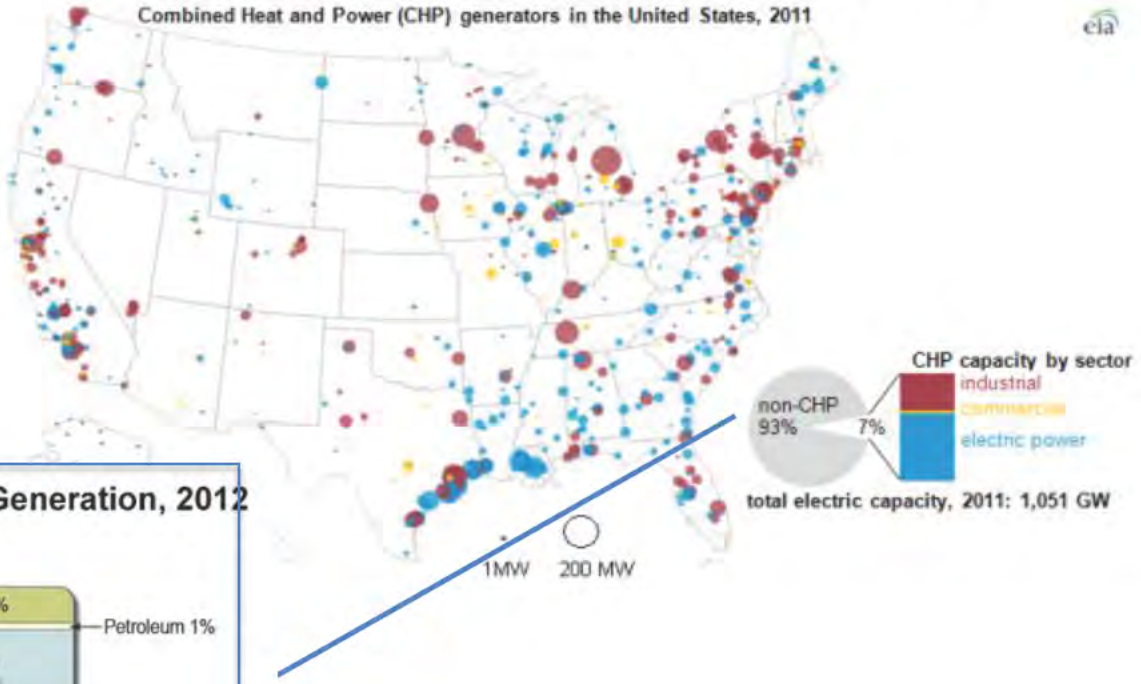
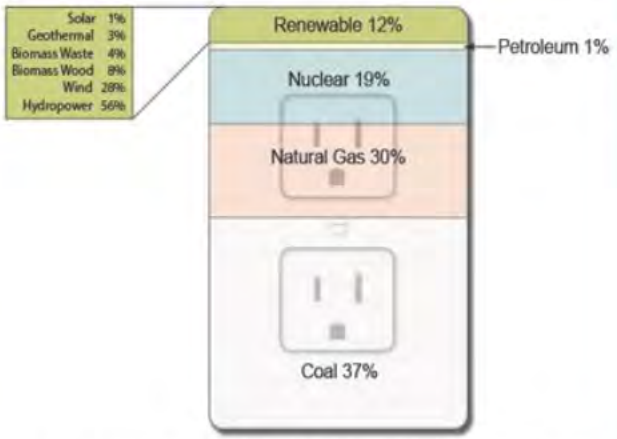
DOE Seeks to Expand CHP e- Generation by 40 GW by 2020



Sources of U.S. Electricity Generation, 2012



Source: U.S. Energy Information Administration, *Electric Power Monthly* (March 2013). Percentages based on Table 1.1 and 1.1a; preliminary data for 2012.

U.S. power plants used renewable energy sources — water (hydroelectric), wood, wind, organic waste, geothermal, and sun — to generate about 12% of our electricity in 2012.

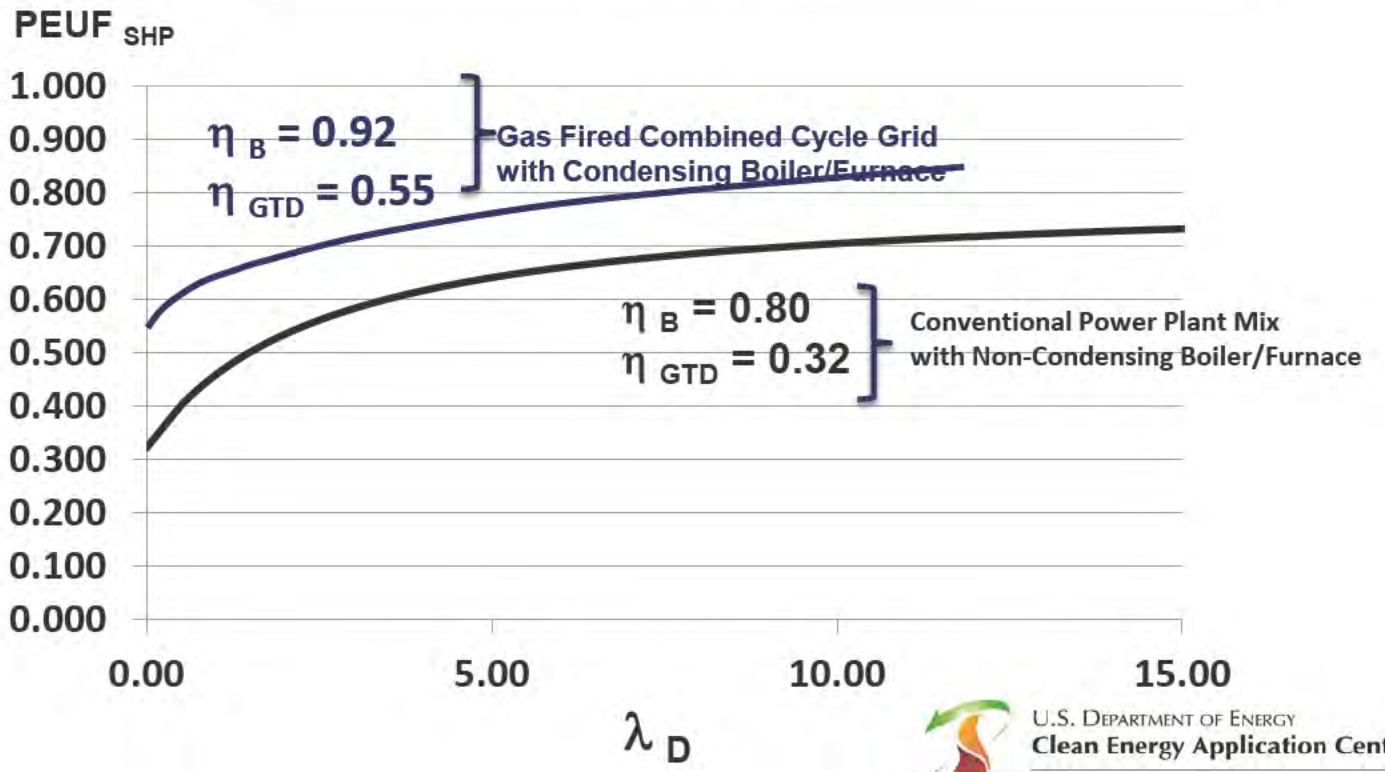
SHP Primary Energy Utilization Index

$PFF_{site} = Q_u/\eta_B$

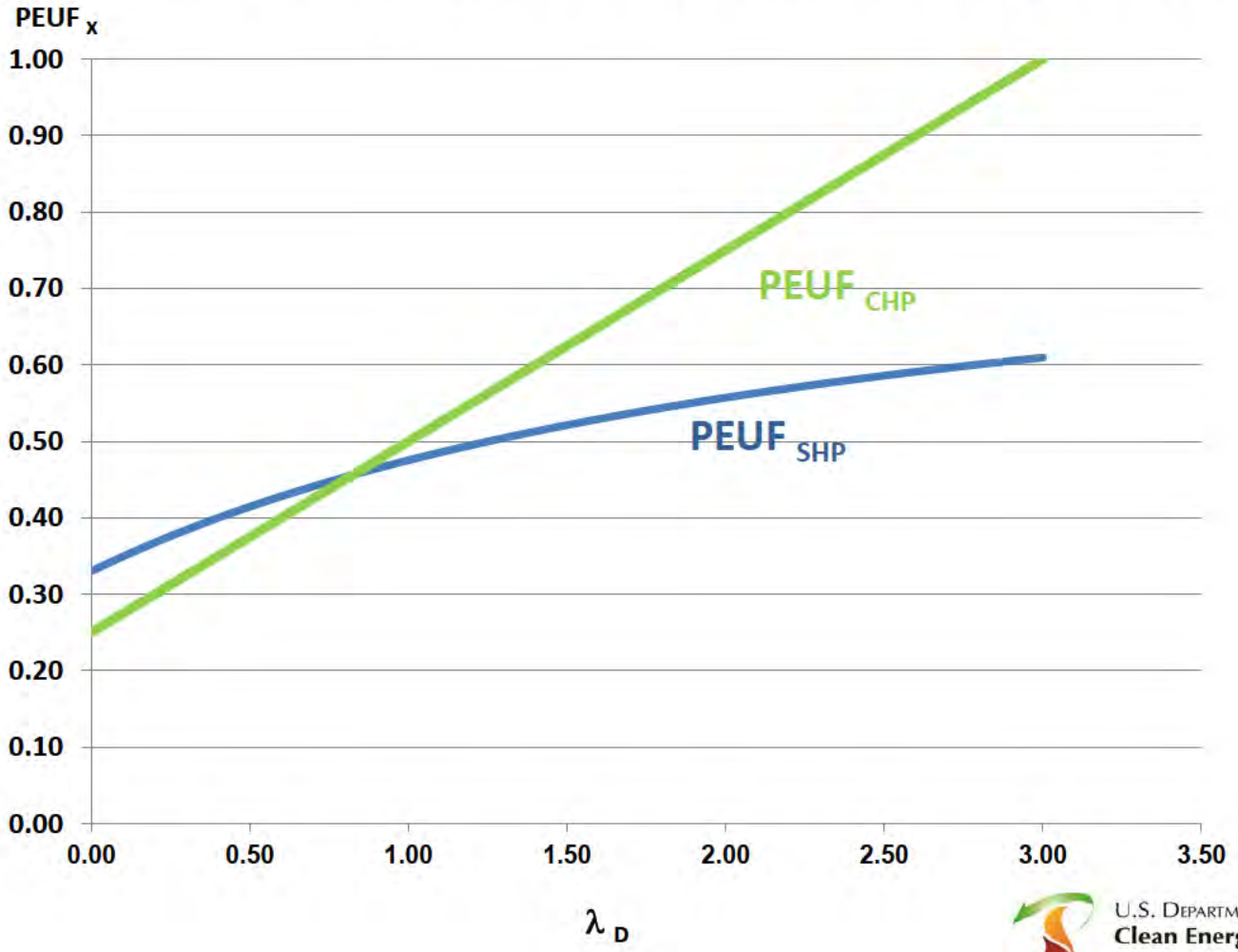
$PFW^e_{site} = W^e_{site}/\eta_{GTD}$

$$(PEUF)_{SHP} = \frac{(1+\lambda_U)}{F_{SHP}}, \text{ where } F_{SHP} = 1/(\eta_{GTD}+\lambda_U/\eta_B)$$

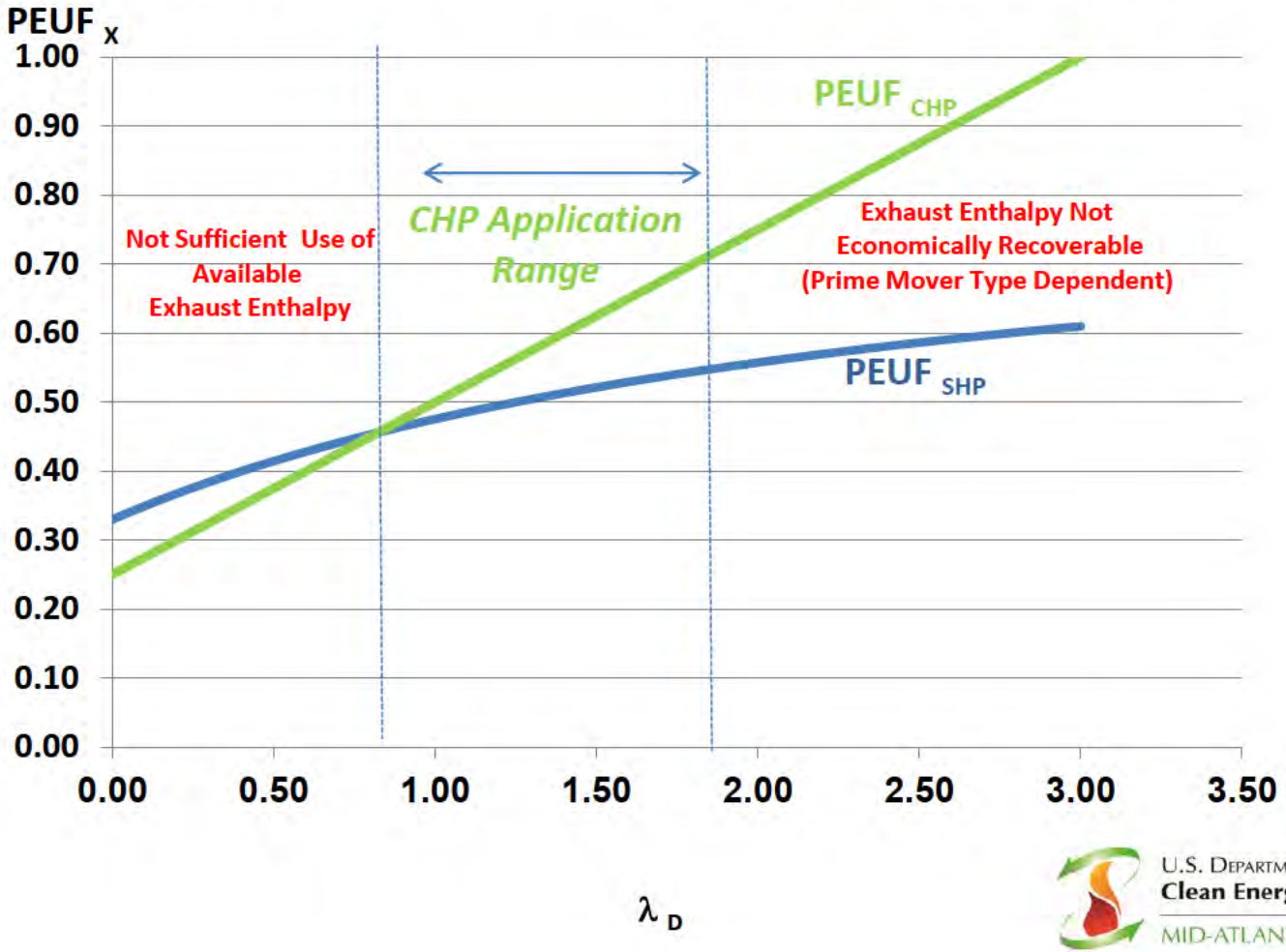
$$(PEUF)_{SHP} = \frac{(1+\lambda_U)\eta_{GTD}\eta_B}{\eta_B + \eta_{GTD}\lambda_U}$$



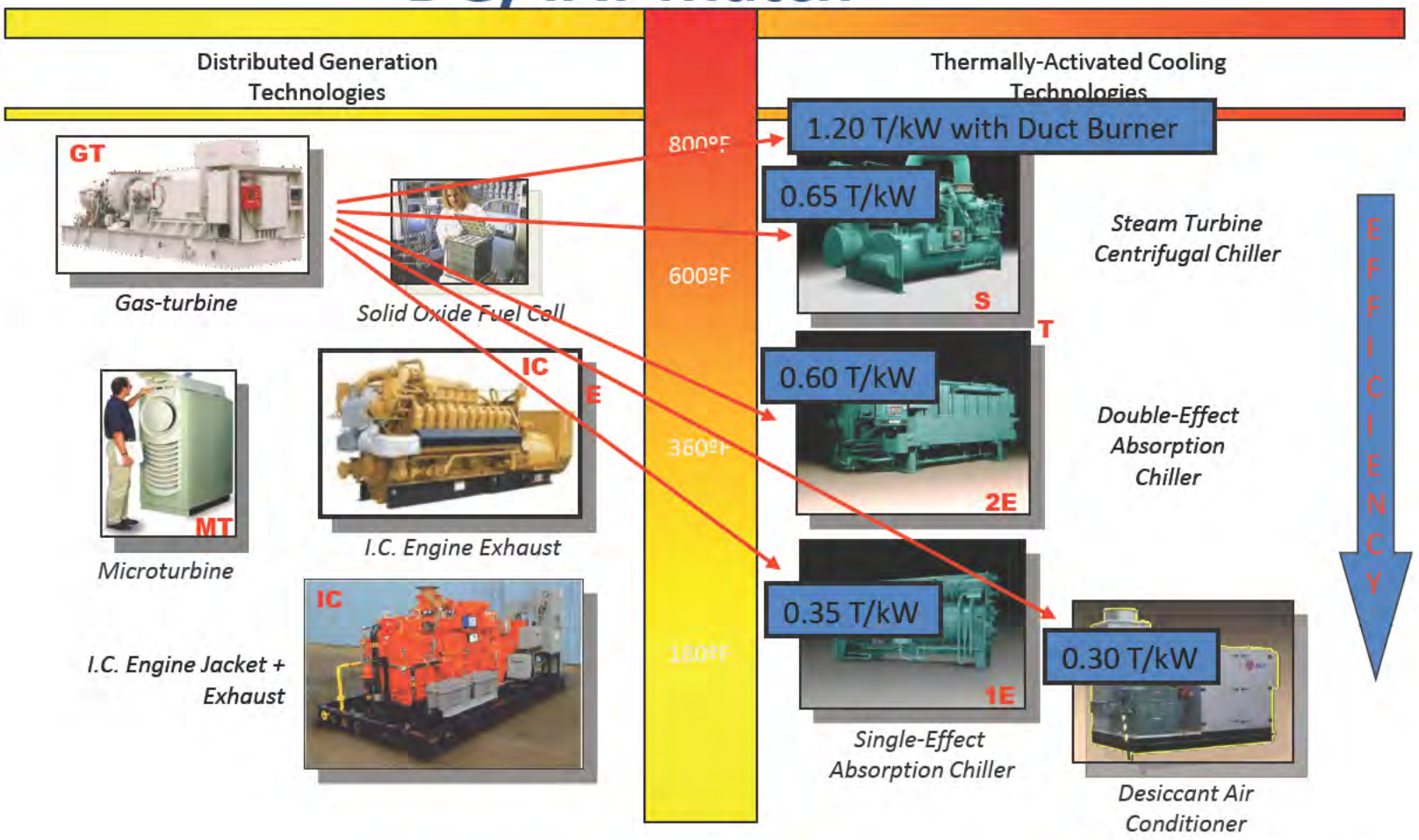
SHP vs/ CHP and Primary Energy Use Comparison
The Importance of the Heat-to-Electric Power (λ_u) Ratio (1)



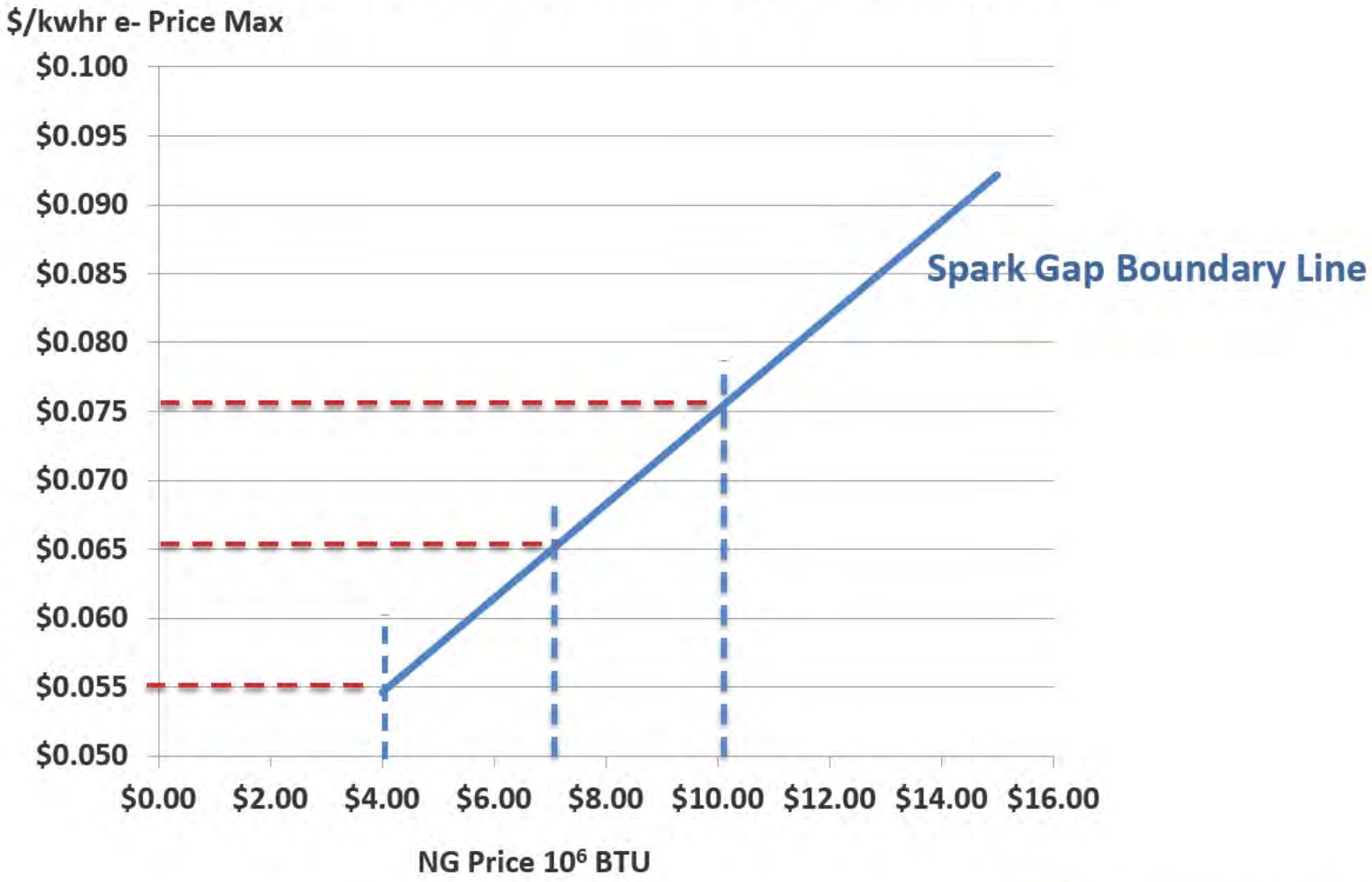
SHP vs/ CHP and Primary Energy Use Comparison
The Importance of the Heat-to-Electric Power (λ_u) Ratio (2)



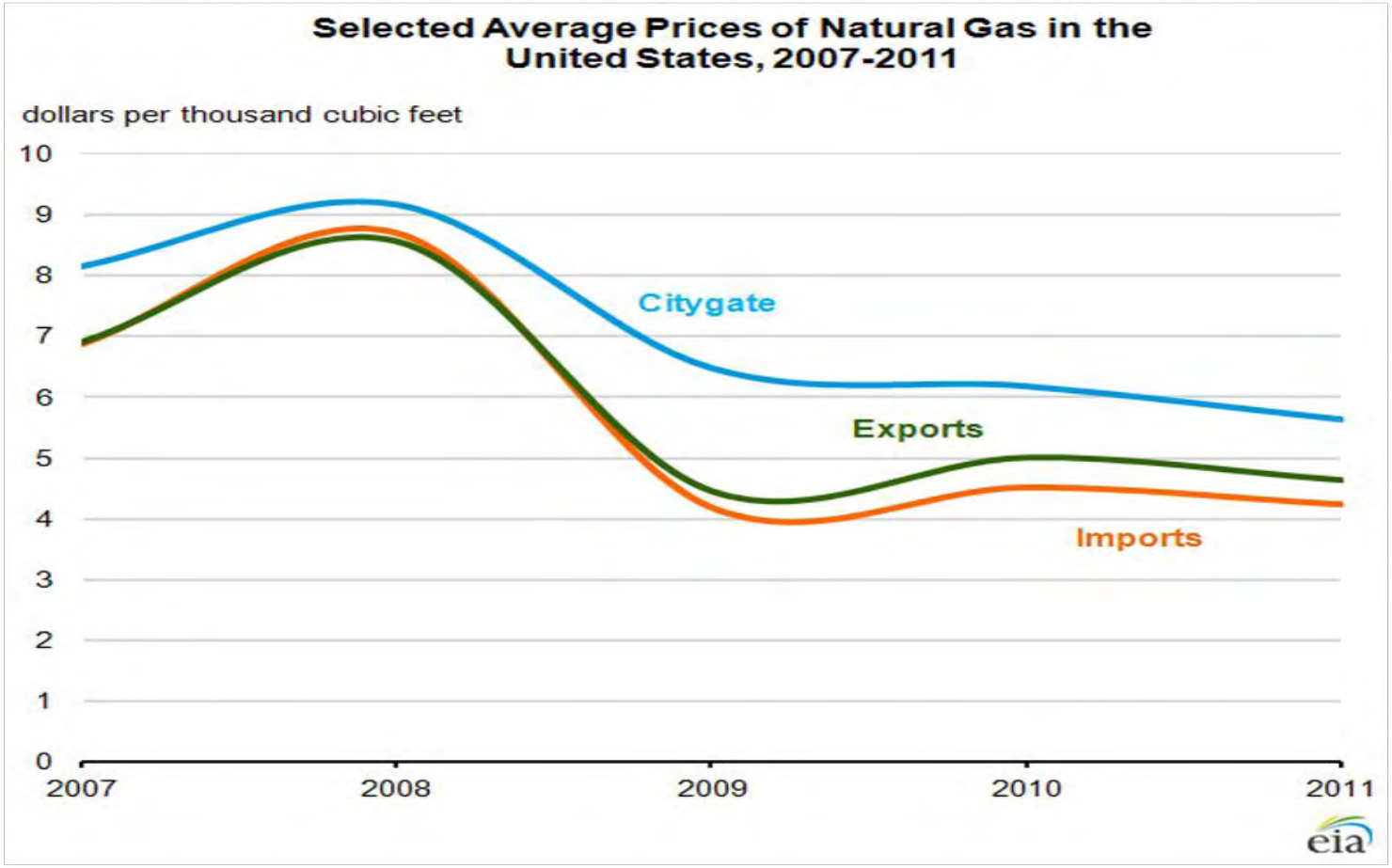
DG/TAT Match


Distributed Generation Technologies
Thermally-Activated Cooling Technologies
800ºF
600ºF
360ºF
180ºF
GT
Gas-turbine
Solid Oxide Fuel Cell
1.20 T/kW with Duct Burner
0.65 T/kW
S
Steam Turbine Centrifugal Chiller
IC
E
I.C. Engine Exhaust
0.60 T/kW
T
2E
Double-Effect Absorption Chiller
MT
Microturbine
IC
I.C. Engine Jacket + Exhaust
0.35 T/kW
1E
Single-Effect Absorption Chiller
0.30 T/kW
Desiccant Air Conditioner
EFFICIENCY

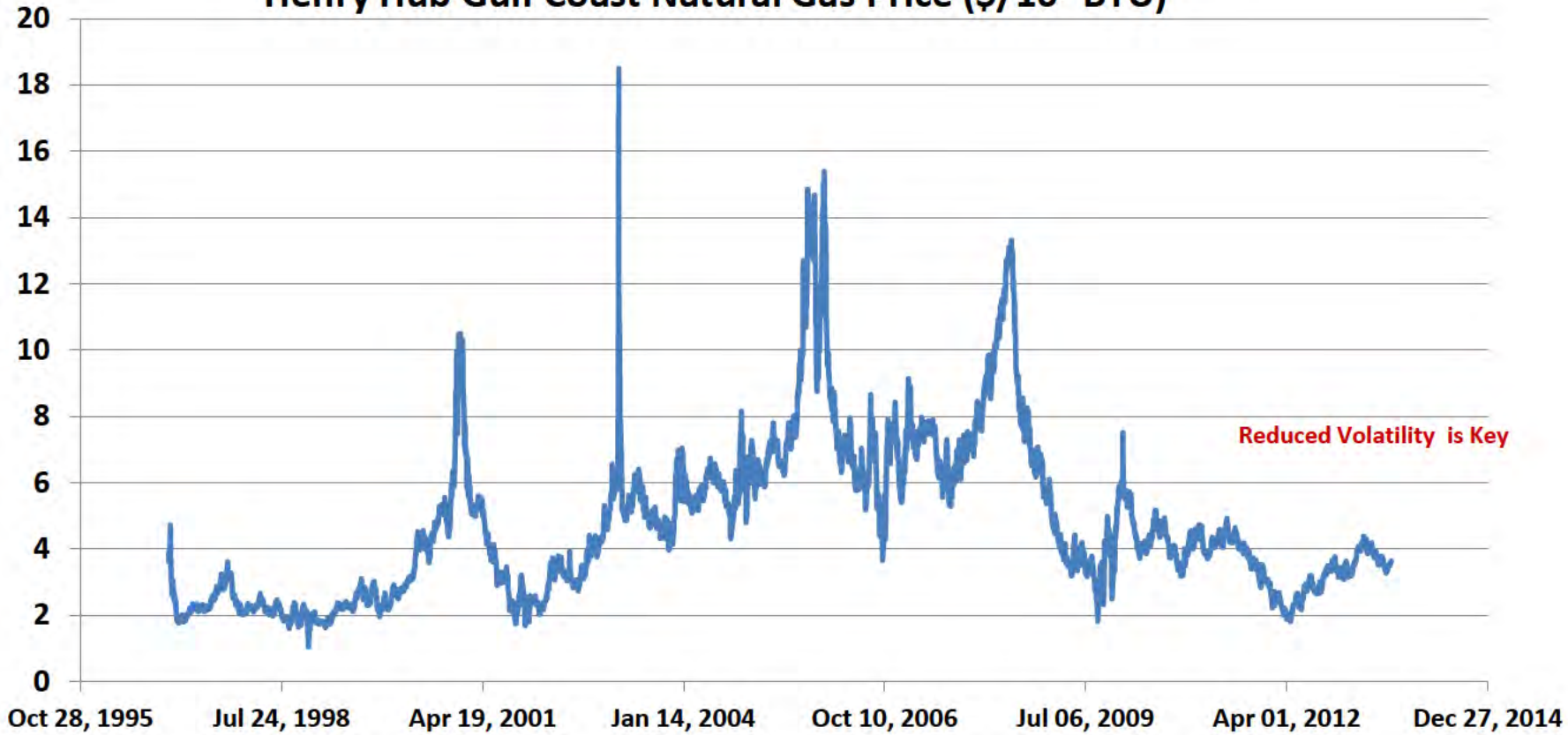
e- Prices to Maintain $12 Sparkgap @ Given NG Price



Recent Natural Gas Prices

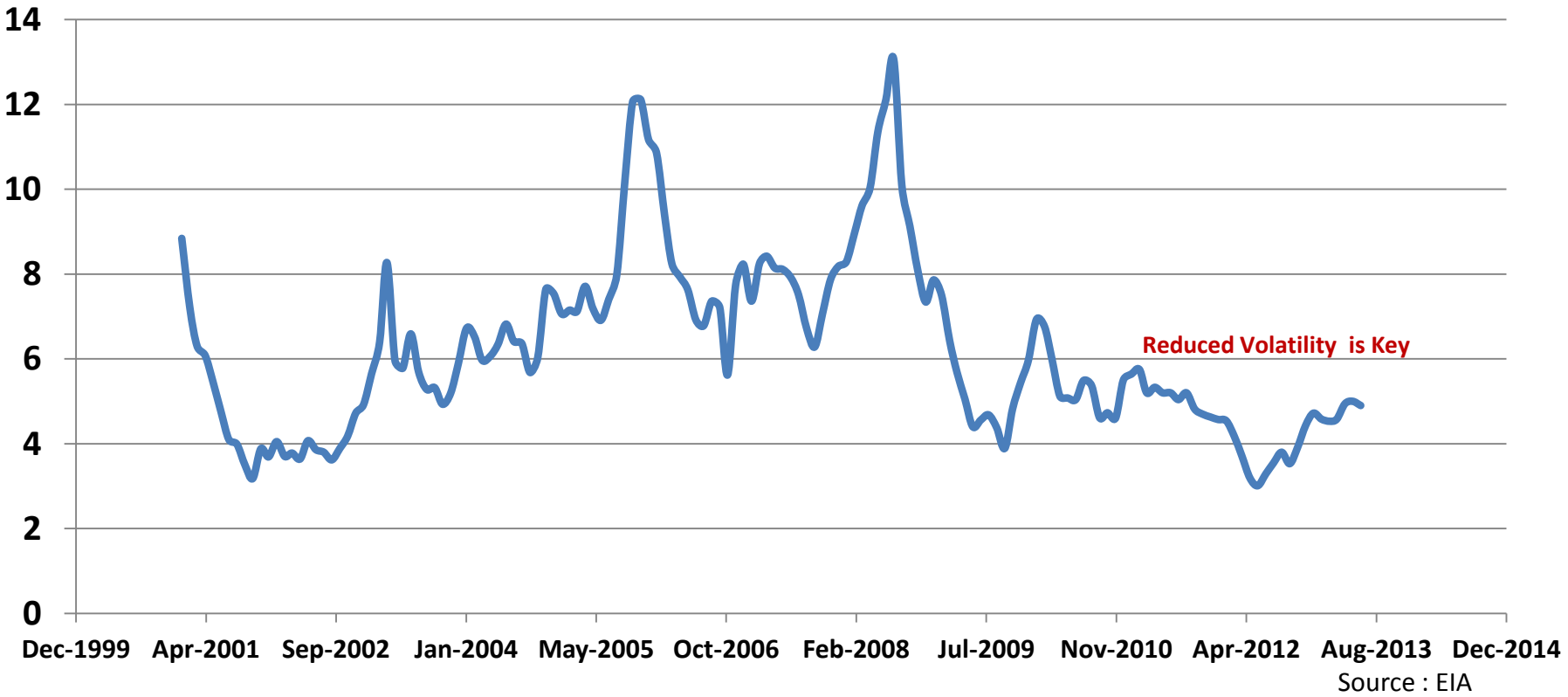


Henry Hub Gulf Coast Natural Gas Price ($/10^6 BTU)



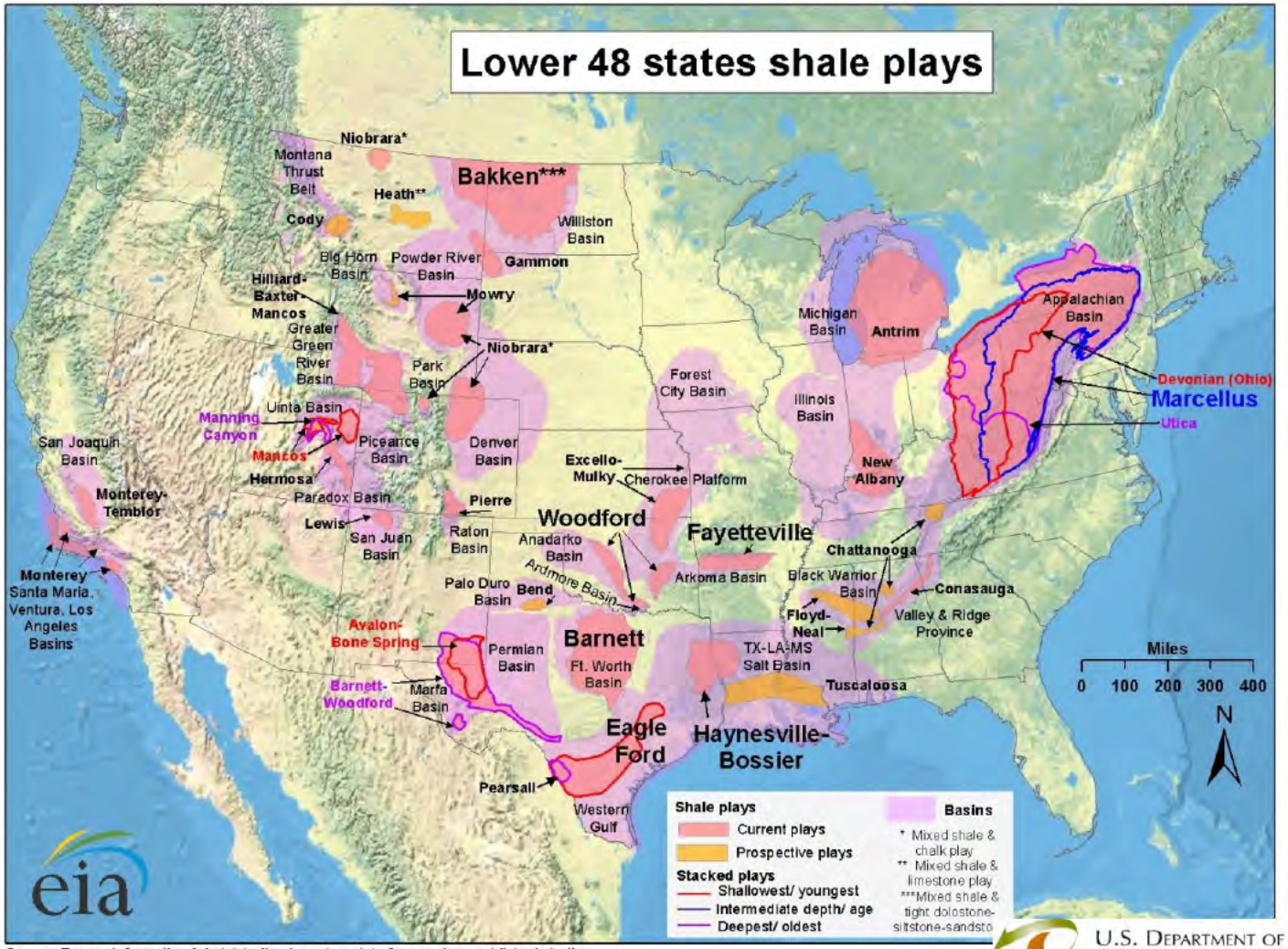
Source : EIA

Industrial Use Natural Gas Price ($/10^6 BTU)



Source : EIA

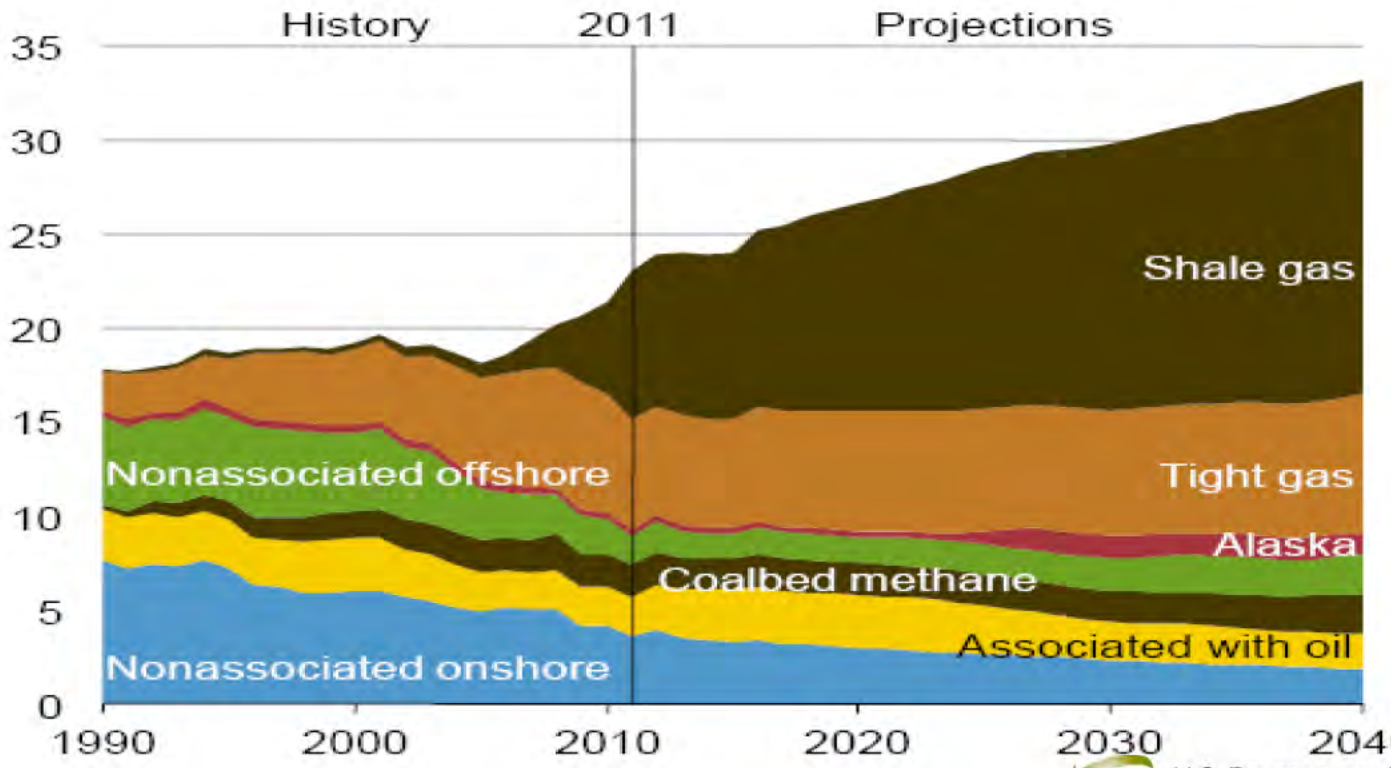
Amount and location of shale gas reserves



Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

EIA: Gas Production Projections by Source

Figure 3. U.S. dry natural gas production by source, 1990-2040 (trillion cubic feet)



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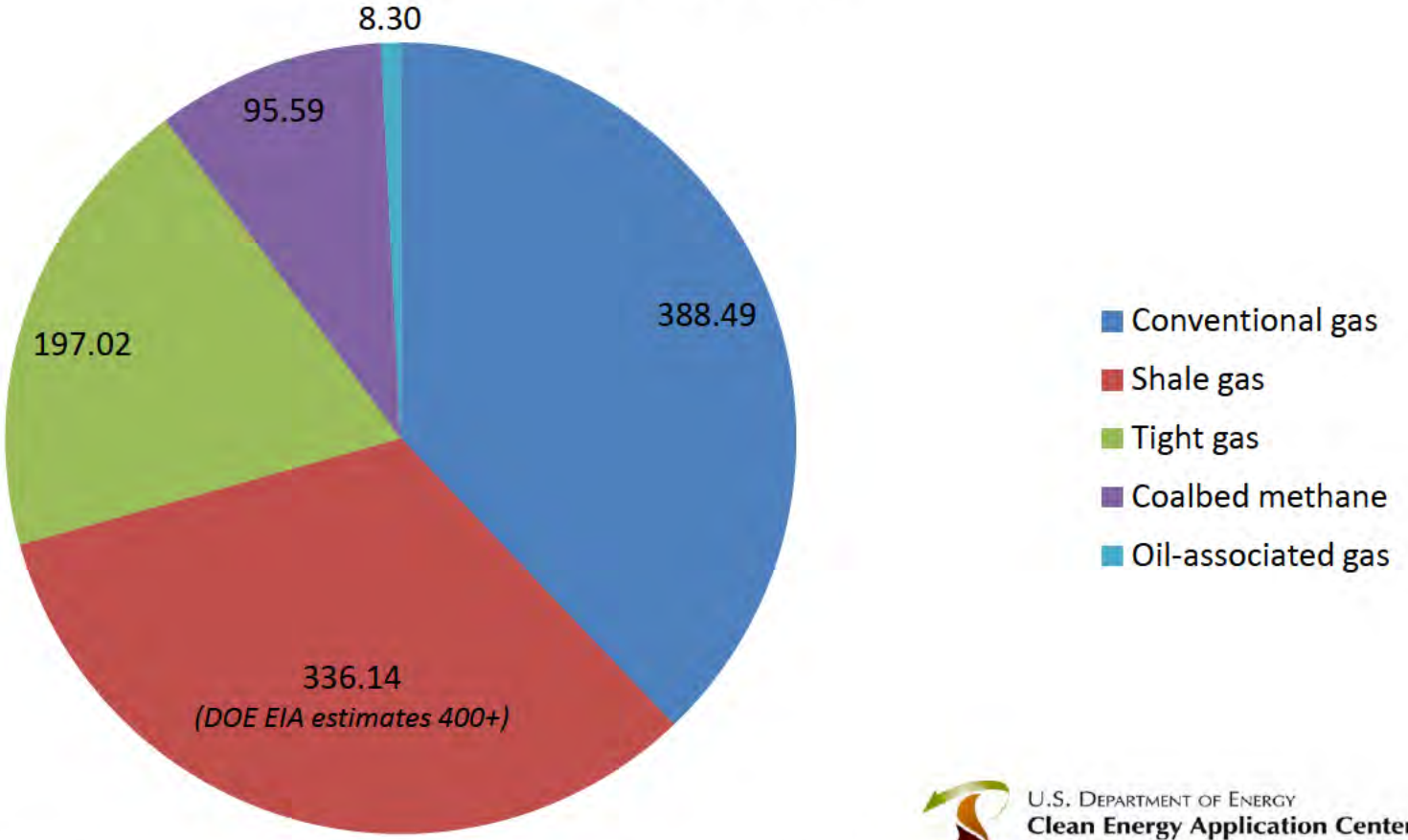
Amount and location of shale gas reserves

Undiscovered technically recoverable natural gas in the US
Units: [trillions of cubic feet]



Source: Total Oil and Gas Resources Data Table, National Assessment of Oil and Gas Project, US Geological Survey, 2011

Why CHP: Best End-Use of Marcellus Gas
Or its Better to be Lucky than Good ?

53 MW Combustion Turbine CHP Systems installed in 1985

Marcellus shale gas will become a competitive advantage for this site and will help existing or new industries develop that are energy intensive in PA.

The lowest cost plant from an energy per unit basis based on the CHP system they are using.

CHP Value Proposition

Resiliency Value Models Being Established

Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	25%	34%	87%
Annual Electricity	74,446 MWh	21,900 MWh	29,784 MWh	76,212 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None
Footprint Required	6,000 sq ft	1,740,000 sq ft	76,000 sq ft	N/A
Capital Cost	$20 million	$60.5 million	$24.4 million	$10 million
Cost of Power	7.6 ¢/kWh	23.5 ¢/kWh	7.5 ¢/kWh	5.8 ¢/kWh
Annual Energy Savings	316,218 MMBtu	225,640 MMBtu	306,871 MMBtu	203,486 MMBtu
Annual CO_2 Savings	**42,506 Tons**	**20,254 Tons**	**27,546 Tons**	**35,090 Tons**
Annual NOx Savings	**87.8 Tons**	**26.8 Tons**	**36.4 Tons**	**76.9 Tons**

Based on: 10 MW Gas Turbine CHP - 28% electric efficiency, 68% total efficiency, 15 PPM NOx

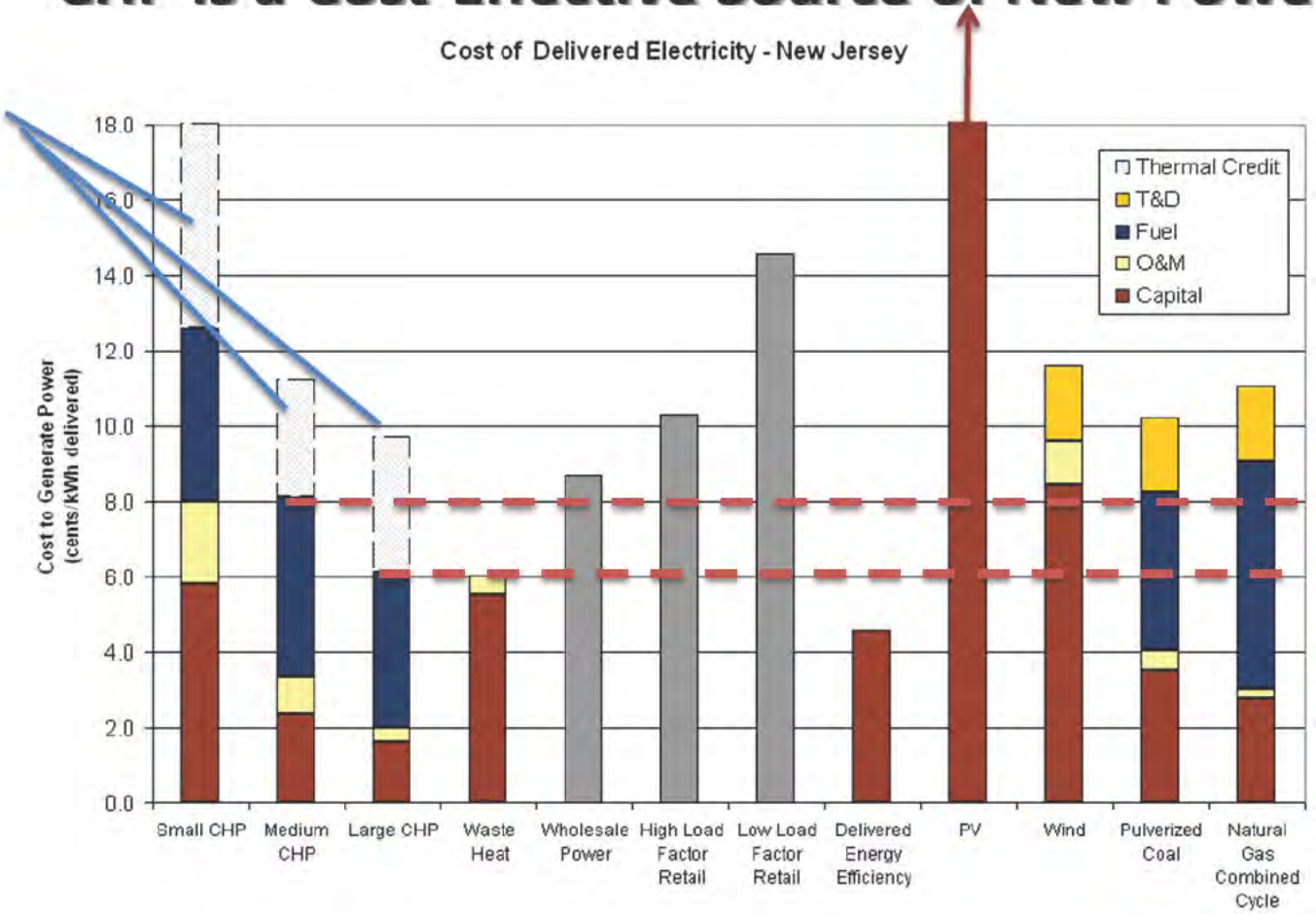
Electricity displaces National All Fossil Average Generation (eGRID 2010) -

9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses

Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

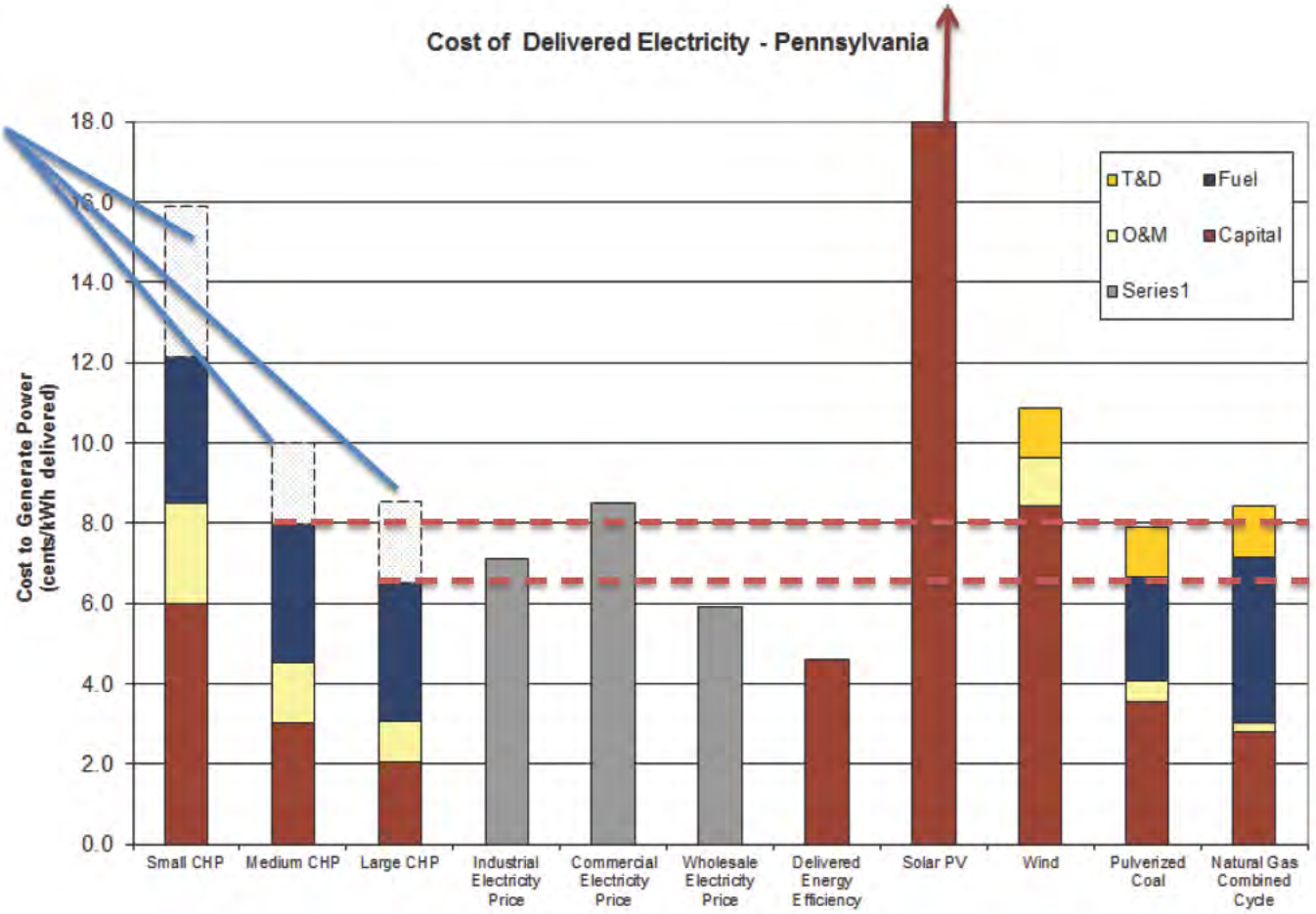
CHP Is a Cost-Effective Source of New Power

Thermal Recovery Utilization



PA Economics

Thermal Recovery Utilization



October 29, 2011 Northeast Snowstorm

The nor'easter storm became the 14th multibillion-dollar weather-related disaster of 2011, breaking the three-year-old record of nine.

State/Province	Deaths	Power outages	Maximum Snowfall
Connecticut	10[28]	830,000	18.6 inches (47 cm)
Maine	0	160,000	20.0 inches (51 cm)
Maryland	0	43,000	11.6 inches (29 cm)
Massachusetts	6[29]	420,000	**32.0 inches (81 cm)**
New Brunswick	3	3,500	N/A
New Hampshire	0	315,000	31.4 inches (80 cm)
New Jersey	8[30]	700,000	19.0 inches (48 cm)
New York	3	300,000	21.6 inches (55 cm)
Nova Scotia	0	40,000	1.2 inches (3.0 cm)
Pennsylvania	8	500,000	16.0 inches (41 cm)
Prince Edward Island	1	3,000	1.4 inches (3.6 cm)
Rhode Island	0	20,000	6.6 inches (17 cm)
Vermont	0	7,500	16.0 inches (41 cm)
Virginia	0	>4,000	9.0 inches (23 cm)
West Virginia	0	43,000	14.0 inches (36 cm)
Total	39	>3,389,000	

Sandy: Total Estimate of Economic Losses Now Up to $50 Billion

Losses from the storm could total $30 billion to $50 billion, according to Eqecat, which tracks hurricanes and analyzes the damage they cause. On Monday, before the storm hit the East Coast, the firm estimated $10 billion to $20 billion in total economic damages. The flooding of New York's subways and roadway tunnels and the extensive loss of business as a result of utility failures across the region were behind the sharp increase in the estimate, the firm said. "The geographic scope of the storm was unprecedented, and the impacts on individuals and on commerce are far larger," said Tom Larsen, Eqecat's senior vice president and product architect. "Lost power is going to contribute to higher insurance losses."

Eqecat predicted that New York would bear 34 percent of the total economic losses, with New Jersey suffering 30 percent, Pennsylvania 20 percent and other states 16 percent.

CHP is Resilient

Co-Op City

Bronx, NY

- One of the largest cooperative housing units in the world
  - 35 residential buildings
  - over 55,000 residents
- 38 MW CHP
- Utility savings estimated at $15,000,000 per year
- The CHP facility provided full power to Co-Op City before, during, and after Superstorm Sandy

Many other examples!

DEPARTMENT OF CONSUMER & REGULATORY AFFAIRS

2nd Annual Green Building Symposium and Expo

Chemical And Gas Suppliers Battle Over LNG Exports

The U.S. oil and gas industry sees big dollars in liquefied natural gas exports; chemical companies see trouble

Chemical & Engineering News
ISSN 0009-2347
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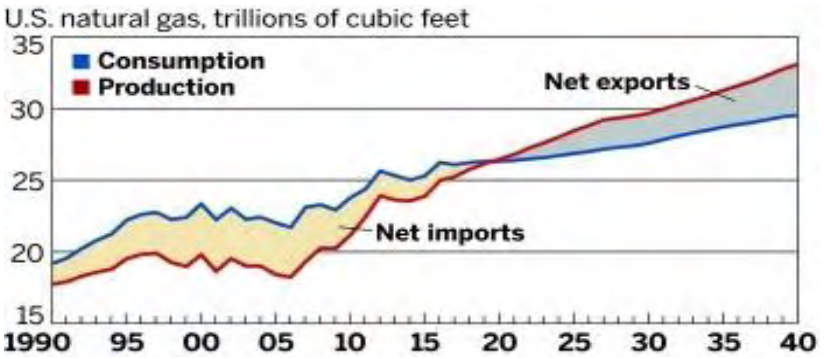
By Jeff Johnson, Alexander H. Tullo

FLOW REVERSAL
ExxonMobil and Qatar Petroleum plan to add export capability to their Golden Pass import terminal in Sabine Pass, Texas.

Gas prices are about $3.50 per thousand cu ft and oil prices hover near $95 per bbl, for a much more favorable ratio of 27 to one. As a result, Ames notes, “we are investing here.” Indeed, many large chemical firms are investing in the U.S. ChevronPhillips Chemical, Dow, ExxonMobil Chemical, Formosa Plastics, Occidental Chemical, Sasol, and Shell Chemicals are each spending billions of dollars on new ethylene crackers and derivatives complexes that are generally scheduled to open around 2017.



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PennState

Combined Heat and Power: A Resource Guide for State Energy Officials

National Association of State Energy Officials

Julia Friedman, Program Manager
Garth Otto, Project Manager

2013

NRDC ISSUE PAPER

APRIL 2013

Combined Heat and Power Systems:

Improving the Energy Efficiency of Our Manufacturing Plants, Buildings, and Other Facilities

AUTHORS
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Hannah Druckenmiller

U.S. Department of Energy
Clean Energy Application Center
MID-ATLANTIC

Promoting CHP, District Energy, and Waste Energy Recovery

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The Guide provides state policy makers with actionable information regarding:

- Design of standby rates
- Interconnection standards for CHP with no electricity export
- Excess power sales
- Clean energy portfolio standards
- Emerging market opportunities: CHP in critical infrastructure and utility participation in CHP markets

In development: State workshops w/ PUCs on the Guide & how to refine policy implementation to achieve greater CHP.

SEE Action
STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

PennState

Guide to the Successful Implementation of State Combined Heat and Power Policies

Industrial Energy Efficiency and Combined Heat and Power Working Group

Driving Ratepayer-Funded Efficiency through Regulatory Policies Working Group

March 2013

The State and Local Energy Efficiency Action Network is a state and local effort facilitated by the federal government that helps states, utilities, and

U.S. Department of Energy
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Promoting CHP, District Energy, and Waste Energy Recovery

SEE Action
STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

Guide to the Successful Implementation of State Combined Heat and Power Policies

The *Guide to Successful Implementation of State Combined Heat and Power Policies* provides state utility regulators and other state policymakers with actionable information to assist them in implementing key state policies that impact combined heat and power (CHP).

Combined heat and power can be an efficient and clean method of generating electricity and useful thermal energy from a single fuel source at the point of use. Instead of purchasing electricity and utilizing an on-site boiler or furnace for thermal needs, CHP can provide both energy services in one energy-efficient step. As a result, CHP can provide energy efficiency and environmental advantages over separate heat and power. Cost-effective, clean CHP can provide a suite of benefits to the user (e.g., reduced energy costs), the electric system (e.g., low-cost approach to new electricity generation capacity) and to the nation (e.g., improved manufacturing competitiveness and using clean domestic energy sources).

The *Guide* discusses five policy categories and highlights successful state CHP implementation approaches within each category:

- **Design of standby rates.** Design standby rates that closely preserve the nexus between charges and cost of service—encourage CHP users to use electric service most efficiently and minimize costs they impose on the electric system.
- **Interconnection standards for CHP with no electricity export.** Streamlined application timelines and procedures, simplified contracts, and appropriate cost-based application fees are necessary to ensure CHP projects are implemented without jeopardizing grid safety.
- **Excess power sales.** Excess power sales may provide a revenue stream for a CHP project and may help a state achieve energy goals. There are opportunities to facilitate this aspect of CHP if such markets for excess power sales exist.
- **Clean energy portfolio standards (CEPS).** If CHP is included in a state portfolio standard, utility regulators should consider the CHP eligibility definition and minimum efficiency requirements or performance-based metrics.
- **Emerging market opportunities.** CHP offers an opportunity to improve critical infrastructure resiliency; improved coordination of government emergency planners and the electricity sector must occur. Allowing incumbent utilities to participate in CHP markets by owning CHP facilities directly or providing services to customers who own CHP facilities is a significant policy option to increasing CHP.

Download the Guide!

Download the *Guide to Successful Implementation of State Combined Heat and Power Policies* at www.seeaction.energy.gov/chp_policies_guide.html.

Additional Information

This *Guide* was developed by SEE Action's Industrial Energy Efficiency and CHP Working Group and the Driving Ratepayer-Funded Efficiency through Regulatory Policies Working Group. Learn more at www.seeaction.energy.gov.

Key Points

- Combined heat and power (CHP) can provide significant energy efficiency and environmental advantages over separate heat and power for industrial, institutional, and commercial users.
- State utility regulators and other policymakers can learn successful implementation approaches to state CHP policies from their peers.
- Achieving greater use of CHP is consistent with President Obama's Executive Order 13624 that calls for 40 gigawatts of new, cost-effective CHP by 2020.

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About SEE Action

The State and Local Energy Efficiency Action Network (SEE Action) is a state and local effort facilitated by the federal government that helps states, utilities, and other local stakeholders take energy efficiency to scale and achieve all cost-effective energy efficiency by 2020.