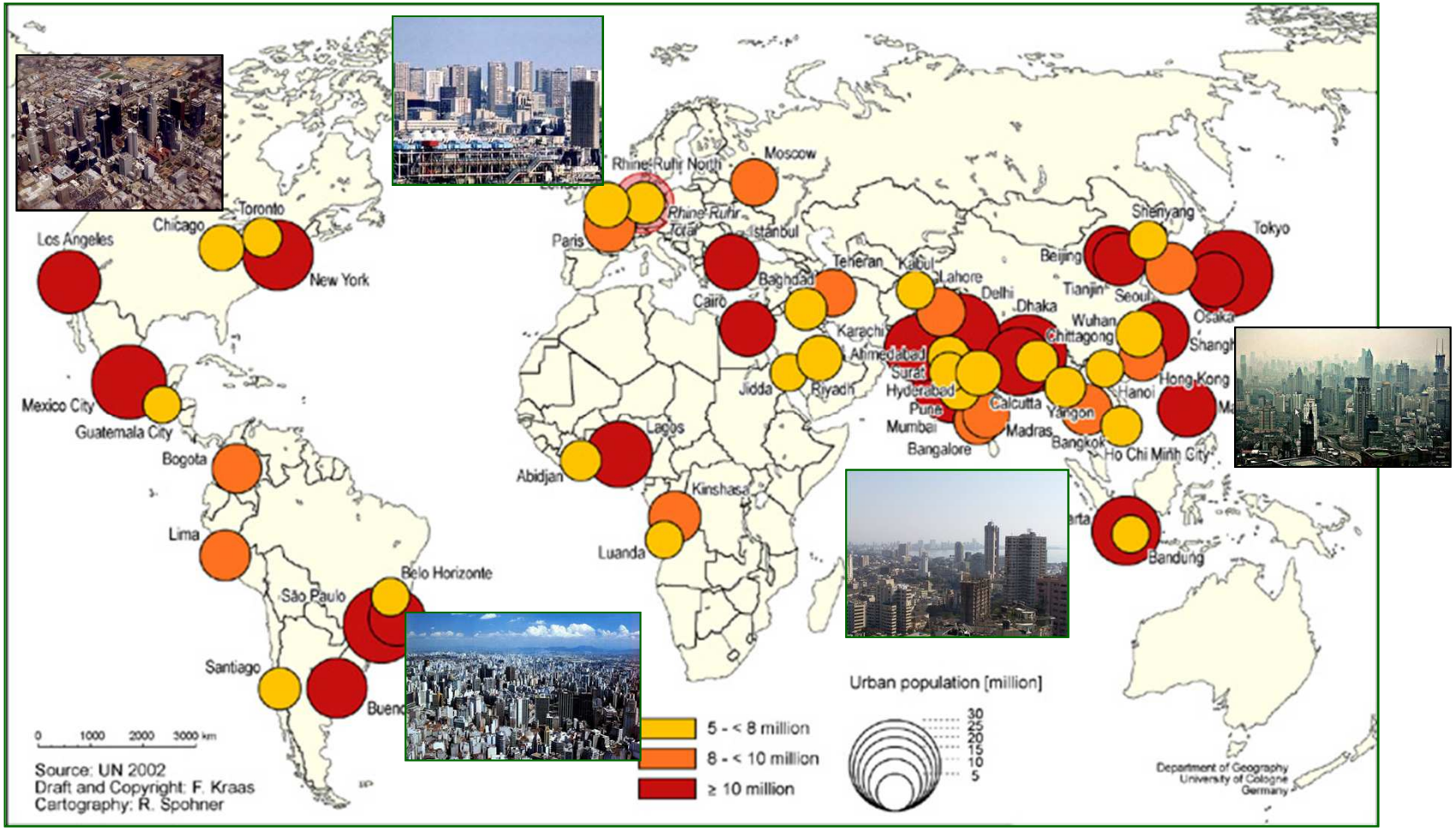
Community Energy Planning

Creating Globally Competitive Communities

Peter Garforth
Principal – Garforth International llc

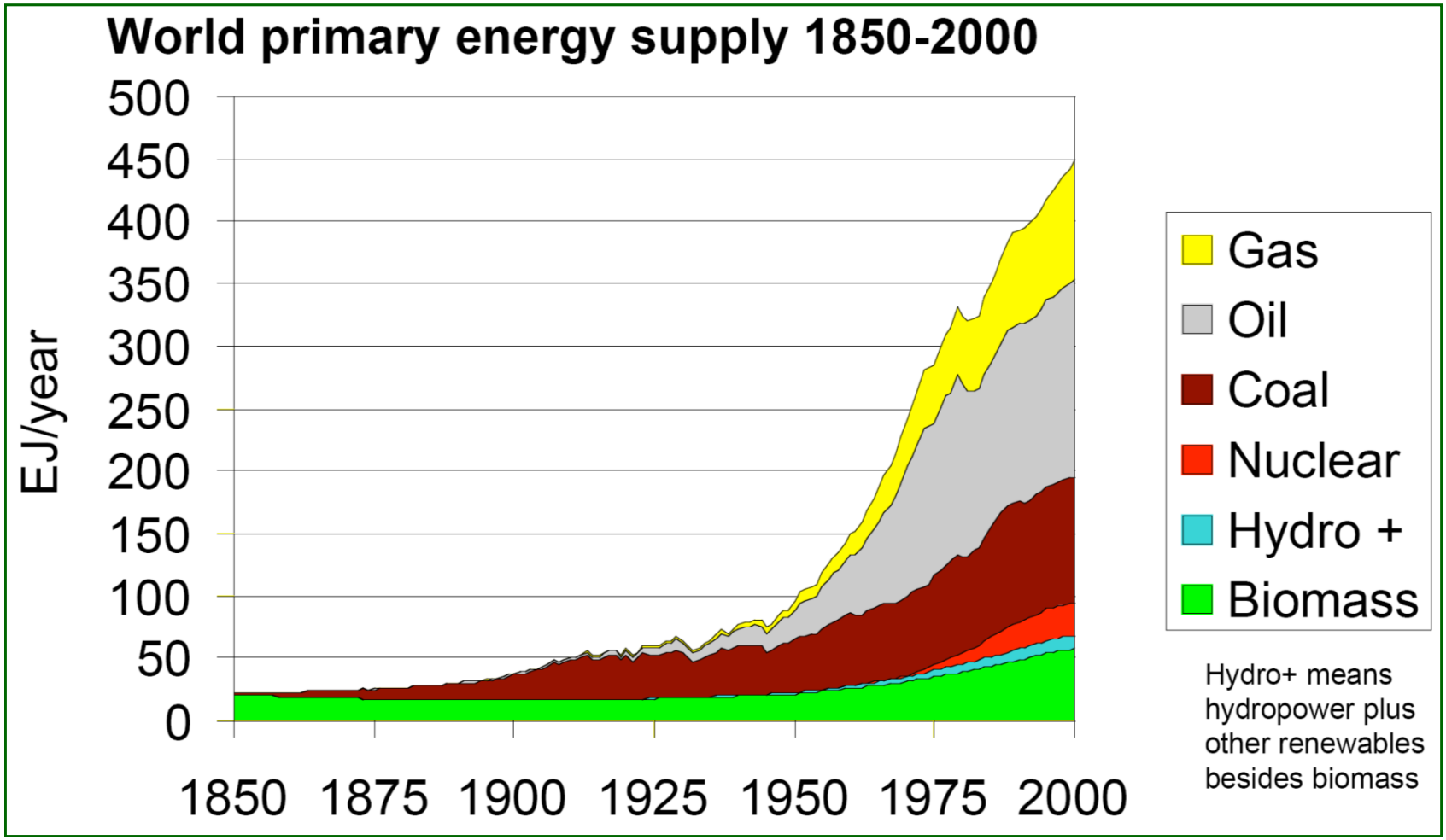
COG Climate, Energy and Environment Policy Committee
November 17th, 2010 Washington DC

A World of Cities
3 Billion Urban Citizens



**UN Sources*

Insatiable Appetite for Energy
About *70% of it in Cities*



Forecast to double by 2030

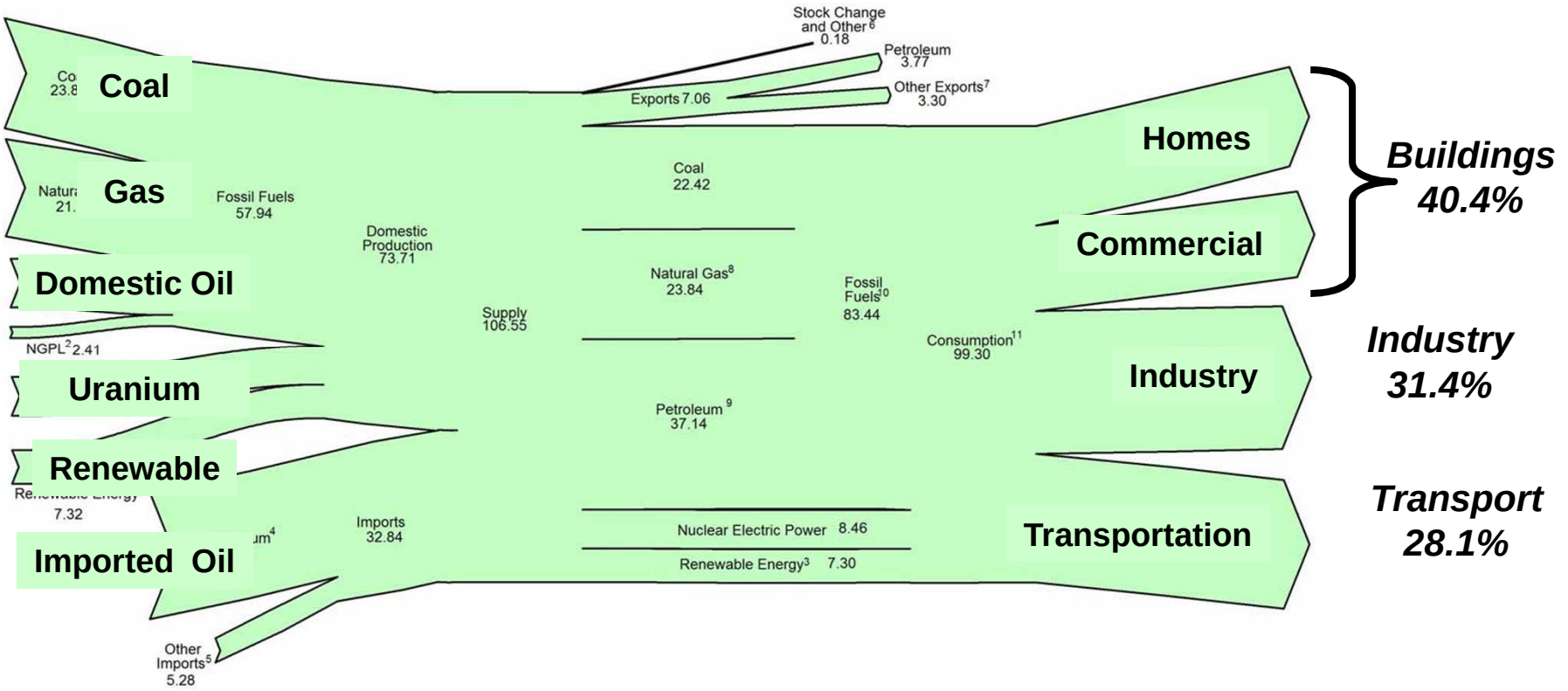
Source: IIASA / BP / EIA / Eurostat

New Global Energy Realities
Risks and Opportunities

- Unpredictable energy prices
- Dependence on imports and supply security
- Uncertain impacts of climate change legislation
- Underinvested energy infrastructure
- China and India major new energy customers
- Trigger events – blackouts, hurricanes, tornados ….
- Energy innovation, investments, jobs

Fundamentally different from past

Total US Energy Use
Most in Urban Environment



Largest User is Buildings

Source: US DoE EIA - 2008

Energy Productivity Differences
How well do we spend our $1.5 Trillion?

Region	Population	GDP	Energy	Energy /Capita	Energy /GDP
USA	4.6%	18.9%	19.5%	*100*	*100*
EU	7.5%	25.1%	14.8%	*47*	*57*
Japan	1.9%	8.8%	4.3%	*52*	*47*
China	20.0%	4.5%	16.3%	*19*	*355*
India	17.0%	1.5%	4.9%	*7*	*317*
World	100%	100%	100%	23	97

Major Competitiveness Challenge

**IEA and World Bank – 2007 sources*

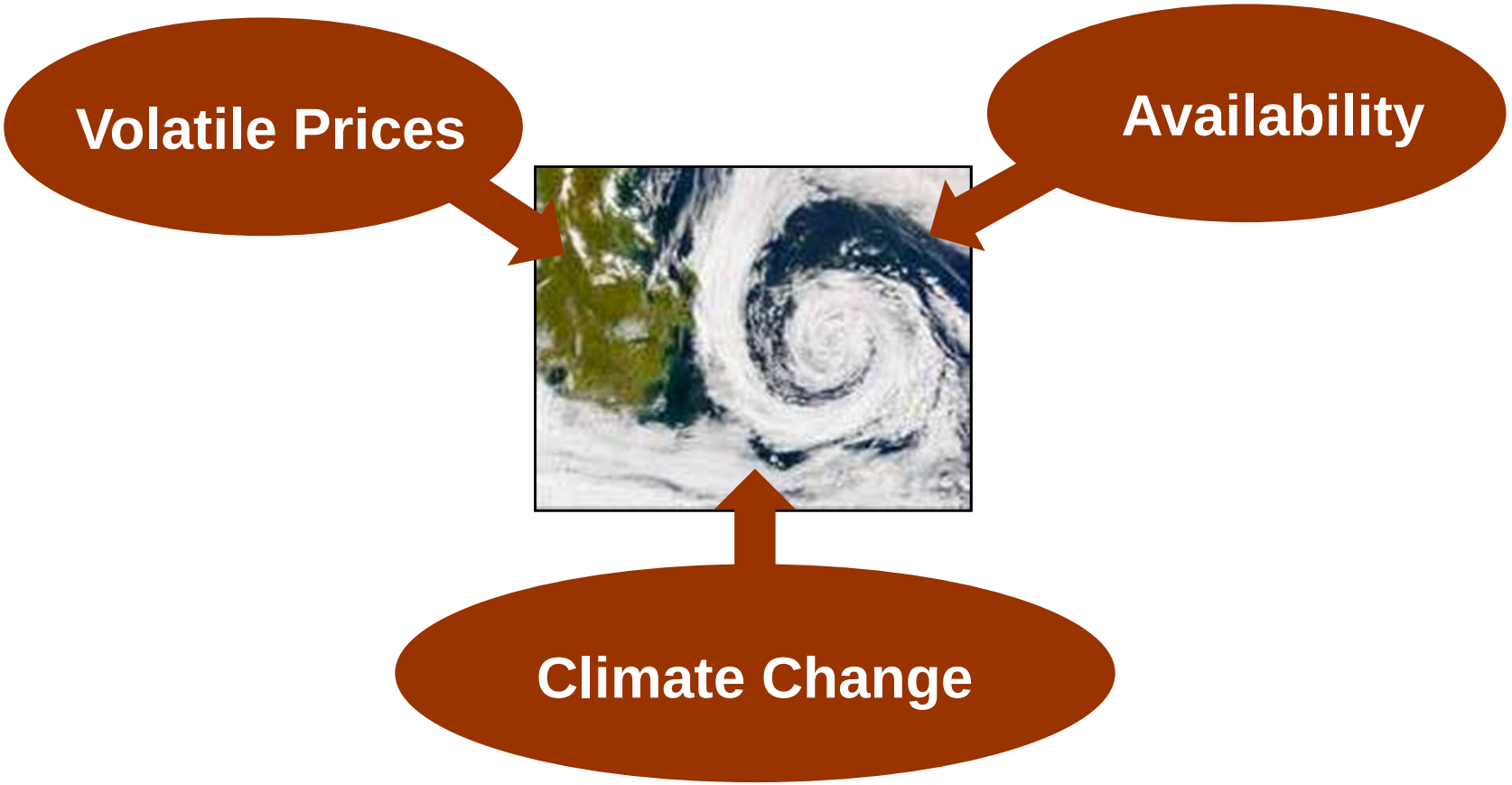
Energy Use by Sector
How does the USA Compare?

Sector	Share	Index USA/EU
Industry	32%	***1.2 : 1***
Buildings*	40%	***2.5 : 1***
Transportation*	29%	***1.4 : 1***

Potential for productivity gains!

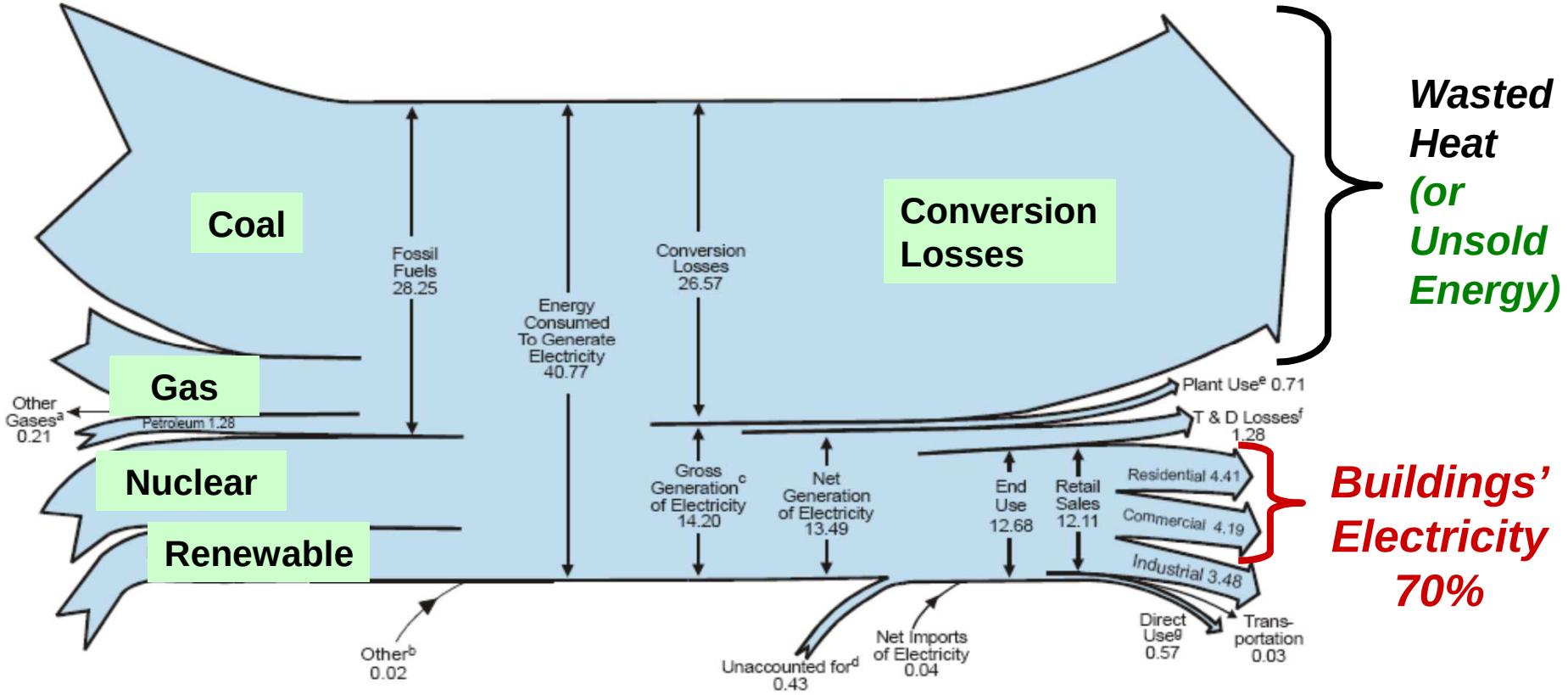
**Indicative ratio of US average to EU Average*

Perfect Energy Storm
When fears collide…



Growing awareness – Growing Opportunity

Electricity in USA
Most used in Homes and Buildings



Largest Cause of Greenhouse Gas

Source: US DoE EIA 2007

Dysfunctional Energy Supply Chain
From fuel to service

Uses 70% of all energy

25%

5%

- High greenhouse gas
- High-cost low returns
- High risk

Pay 100 for fuel - Get less than 10 in services

Greenhouse Gas Indicators

- GHG good surrogate for overall energy productivity
- National GHG per capita per year (metric tons CO_2)
  - *Canada* *22.6*
  - ***USA*** ***21.7***
  - *Denmark* *14.1*
  - *Germany* *11.7*
  - *European Union* *10.5*
- Municipal GHG per capita per year (metric tons CO_2)
  - ***Arlington County VA*** ***14.6 with 4.5 goal***
  - ***Loudoun County VA*** ***14.2 with 6.0 goal***
  - *Guelph - Ontario* *12.2 with 5.0 goal*
  - *Mannheim - Germany* *6.0 with 4.5 goal*
  - *Copenhagen - Denmark* *3.0 with zero goal*

Communities Embracing Breakthrough Targets

**Rough indicators - multiple sources*

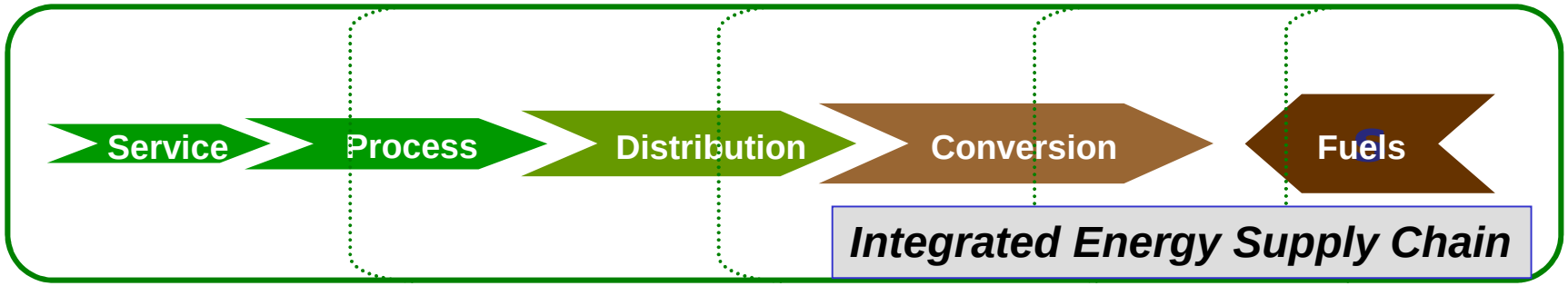
Copenhagen - Integrated Energy Solution
"Environmental Capital of Europe"

- Triggered by 70's energy crisis
- 3.0 tons / capita GHG
- Efficiency
  - *World leading building efficiency*
  - *Energy Performance Validation*
- District heating / cooling
  - *Systematic expansion*
- Fuel flexibility
  - *Multi-fuel cogeneration*
  - *Coal, oil, gas, biomass, waste-to-energy*
  - *Wind and solar generation*
- Transport
  - *Urban design for bike/walking*
  - *Efficient trams/trains*
  - *City-wide EV plans*
- High Value Employment

2009 – Voted "Second Most Livable City"

Framework for Community Energy Plans
Seamless analysis from use to fuel

100% of total energy



- Key questions
  - *"How much energy is really needed?"*
  - *"How to minimize greenhouse gas emissions?"*

- Community Energy Master Plan
  - *Optimize investments between efficiency, distribution, conversion, fuel*
  - *Minimum 25 year horizon*
  - *Integral to Community Policy*

Pay for 100 get 30 to 50 !

Community Energy Plan Goals
Arlington and Loudoun County Examples

Competitiveness

- Energy cost
- Employment
- Investment

Security

- Supply security
- Supply quality
- Flexibility

Environment

- Greenhouse Gas Reduction

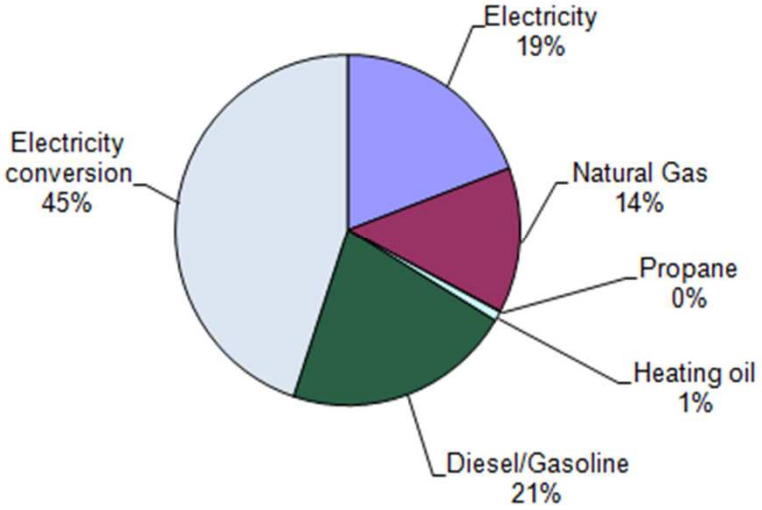
Three Groups of Benefits

**Courtesy of Arlington County VA*

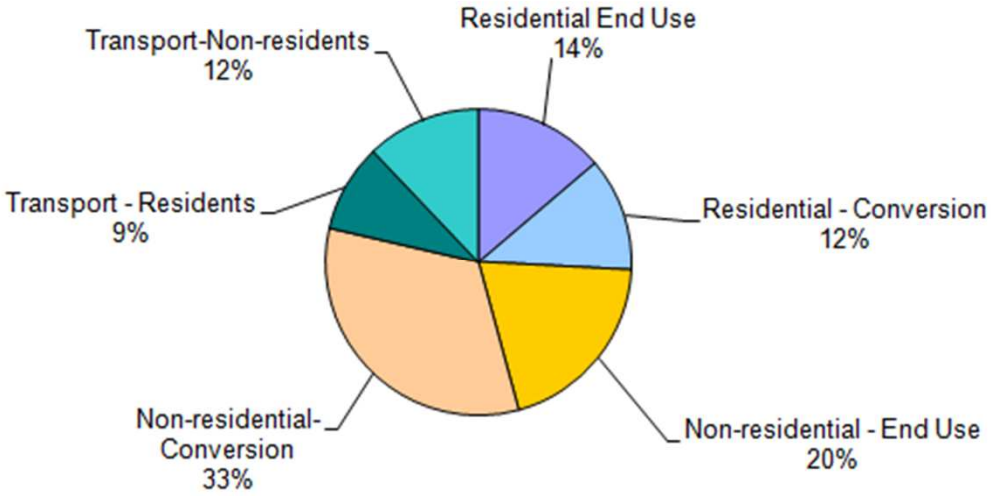
Arlington County - Energy Use

2007 Fuel Use

48,252,000 $MMBtu_e$ / 14,141,000 MWh_e



by type



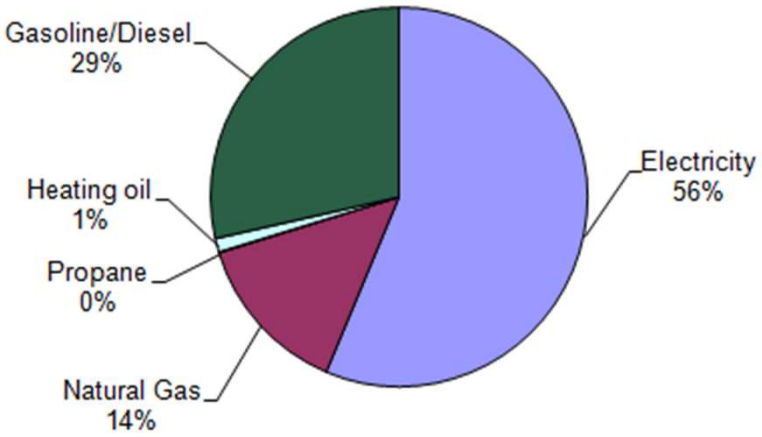
by sector

236 MMBtue / 69 MWhe for each Resident

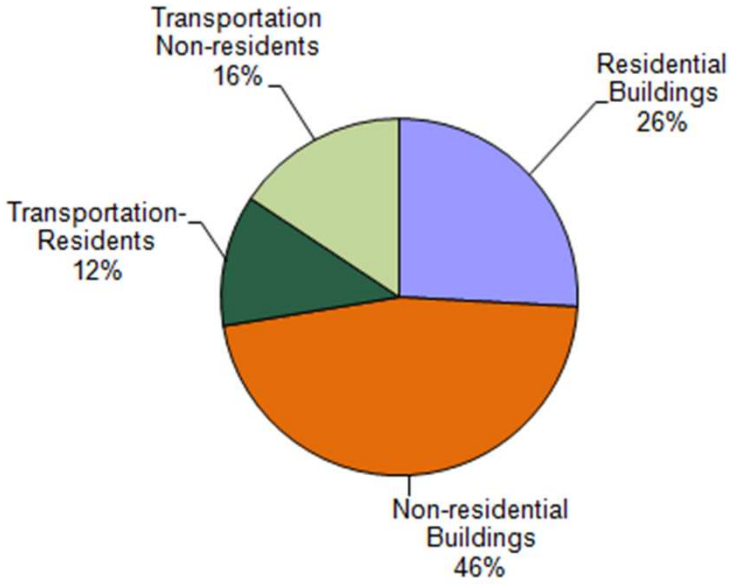
Arlington County - Carbon Footprint

2007 Greenhouse Gas Emissions

2,730,000 metric tons / 6,020,000,000 lbs CO_{2e}



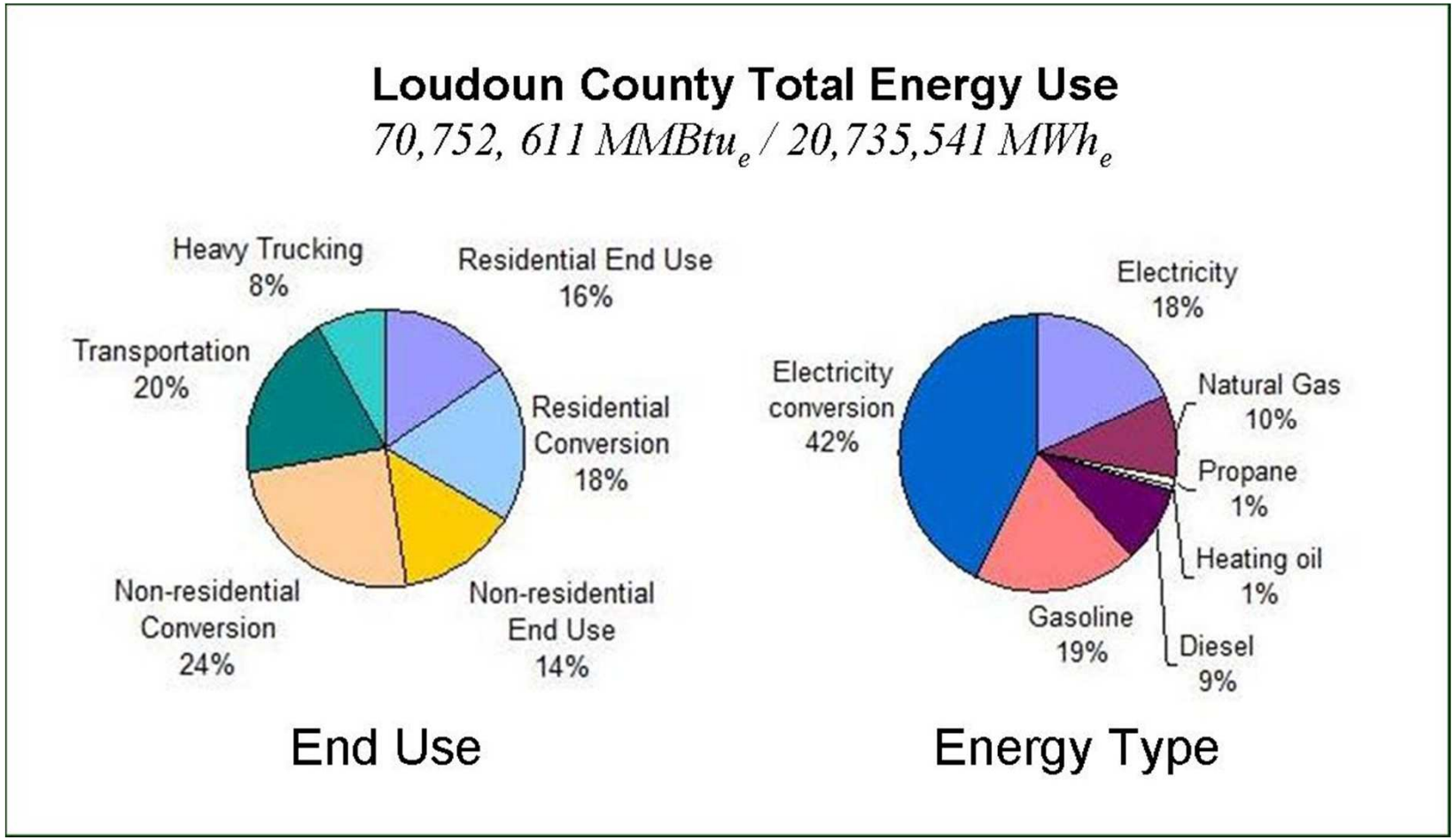
by type



by sector

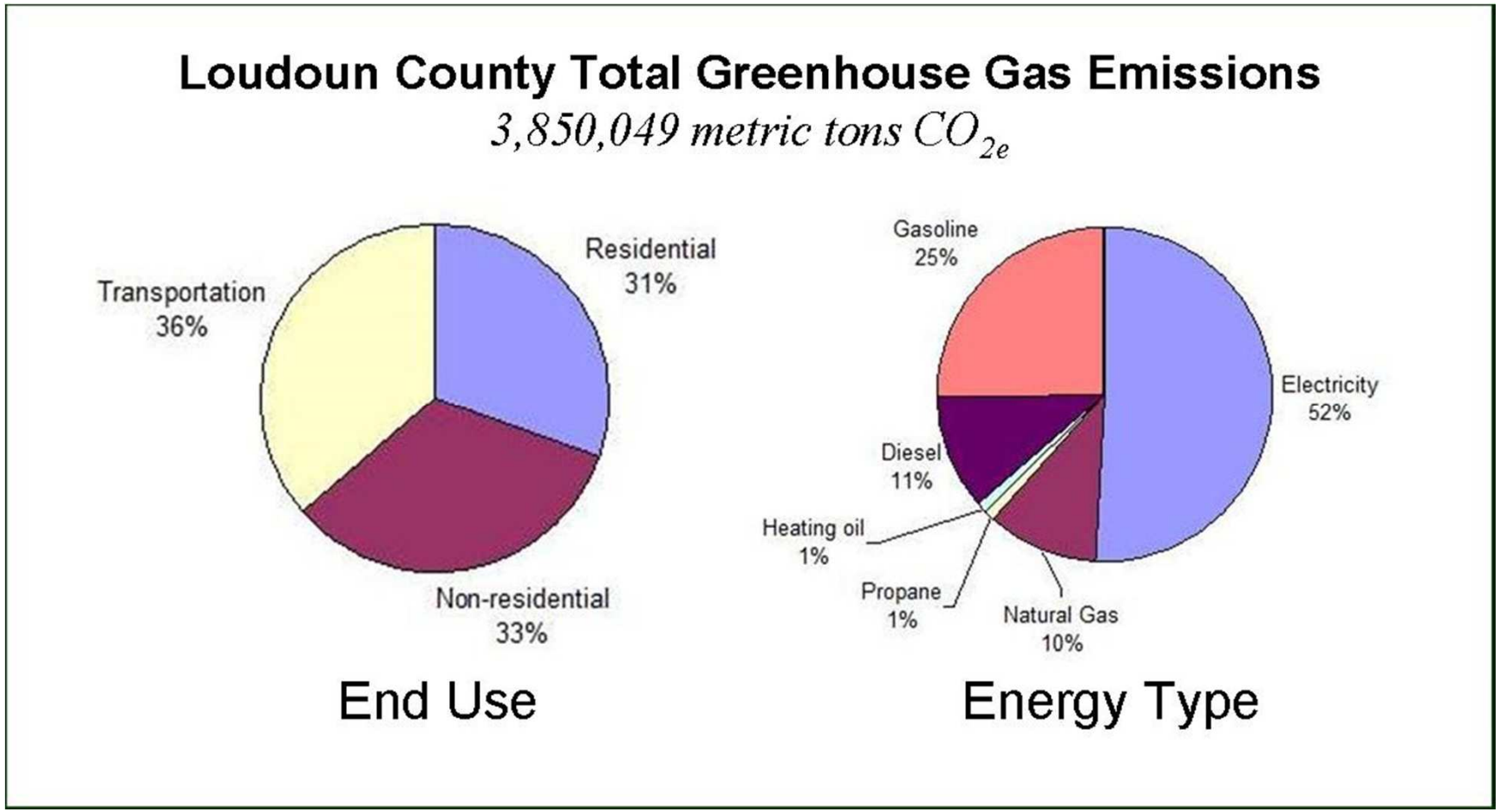
13.4 metric tons for each Resident

Loudoun County - Energy Use



261 Million Btu / 77 MWh for each resident

Loudoun County - Carbon Footprint



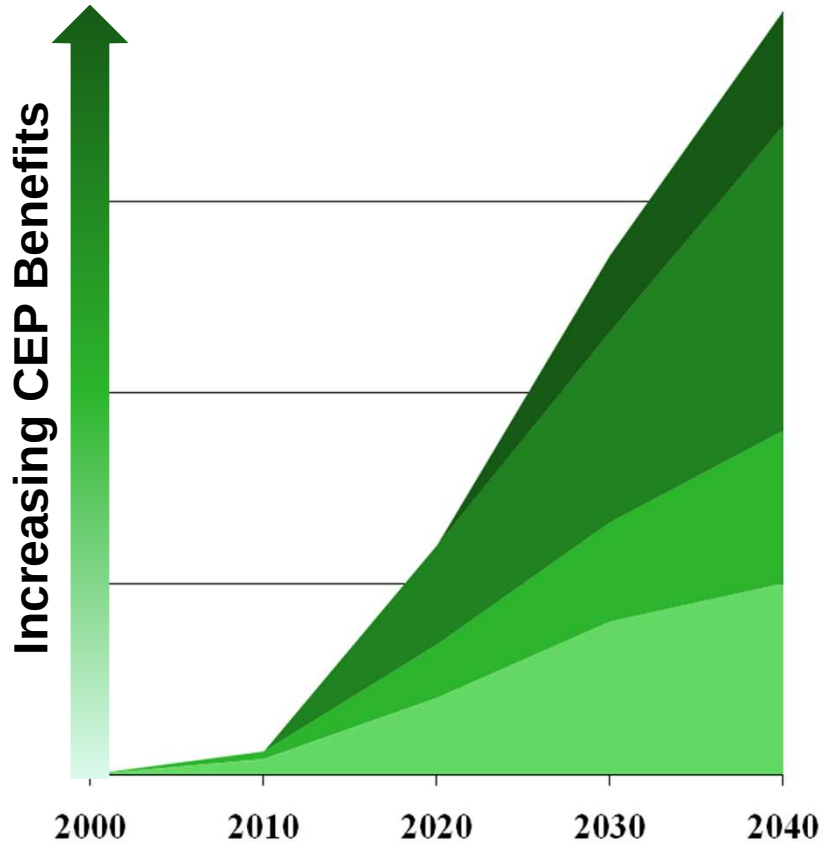
14.2 metric tons for each Resident

CEP Framework
Loading Order / Trias Energetica

- Energy efficiency – ***If you don't need it don't use it***
  - *Efficient buildings, vehicles*
  - *Urban design for transport efficiency*
  - *Local employment for commuting efficiency*
- Heat Recovery – ***It it's already there – use it***
  - *Distributed combined heat and power*
  - *Use existing "waste" heat*
  - *Structure commercial/industrial sites to maximize "waste" heat use*
- Renewable energy – ***If it makes sense, go carbon free***
  - *Renewable electricity – Photovoltaic, Wind, Run-of-river Hydro*
  - *Renewable heat - Solar thermal, Biomass, geothermal*
  - *Renewable heat and power – waste-to-energy, biomass*
- Energy distribution – ***Invest where it makes sense***
  - *Flexible distribution – electricity, gas, district heating, cooling…*
  - *Accepts multiple fuels and energy conversion technologies*
  - *Optimize local / regional investment choices*

Integrated Solution – Tailored for Community

Evolution of Benefits
Four Distinct Types of Activity



Integrated policy
Regional wide norms
•New "business-as-usual"

Scale Projects
•Neighborhood size
•Local changes in "policy"

Stand alone projects
•Fewer larger initiatives
•Minor changes in policy

Community Activity
•Many initiatives
•No changes in policy

Transformative

Incremental

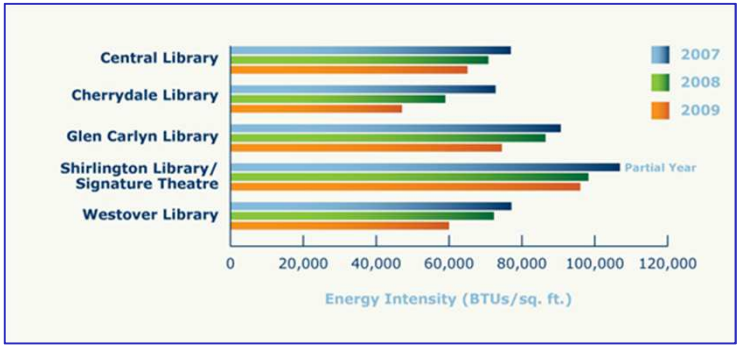
Commit to World Class Performance

Sustainable Built Environment
Multiple initiatives –Arlington Examples

AIRE
ARLINGTON INITIATIVE TO REDUCE EMISSIONS

EPA GREEN POWER PARTNERSHIP

ENERGY STAR ASK ABOUT ENERGY STAR




Westover Library

green restaurant ASSOCIATION dinegreen.com

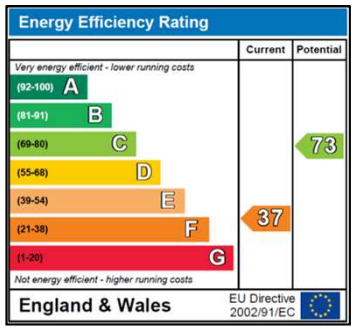
Go Green Virginia

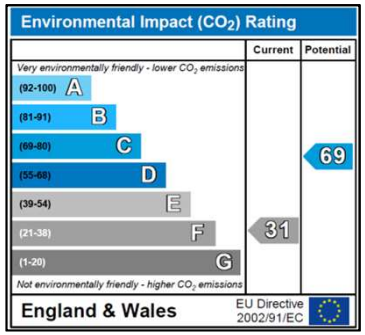
U.S. GREEN BUILDING COUNCIL MEMBER

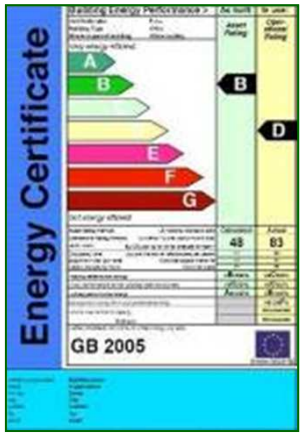

Langston-Brown Community Center

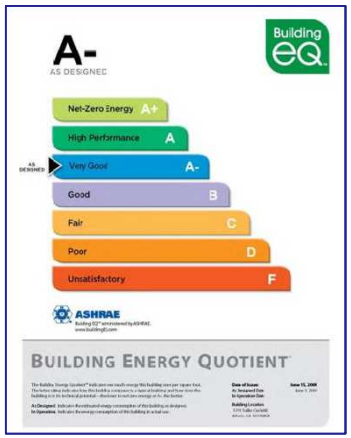

Walter Reed Community Center

Performance Validation
Energy Performance Labeling





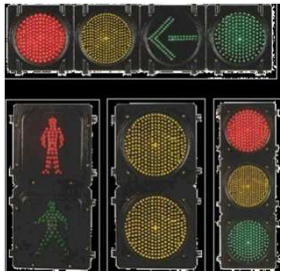


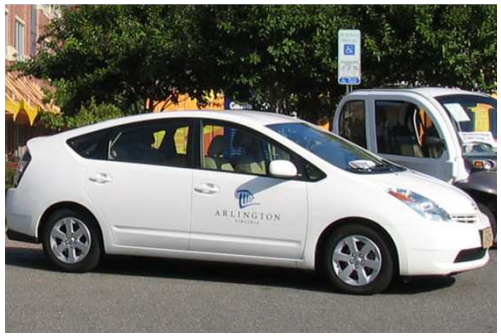


- Low-cost performance validation tool
- Available when sold or rented
- Display in public buildings
- Independent certification
- Access to discount financing
- Voluntary or mandatory approaches possible

Basis for Market Driven Improvement

Sustainable Transportation
Multiple Initiatives –Arlington Examples





Successful CEP Implementation
Common Features

- Leadership and community engagement
- Transparency and outreach
- Necessary planning policy changes in place
- World-class energy efficiency
- Integrated utility approach
- ***Early implementation of "Scale Projects"***
- Magnet for business and academic excellence
- Continuous improvement – raising the bar!

Consistent Execution Over Decades

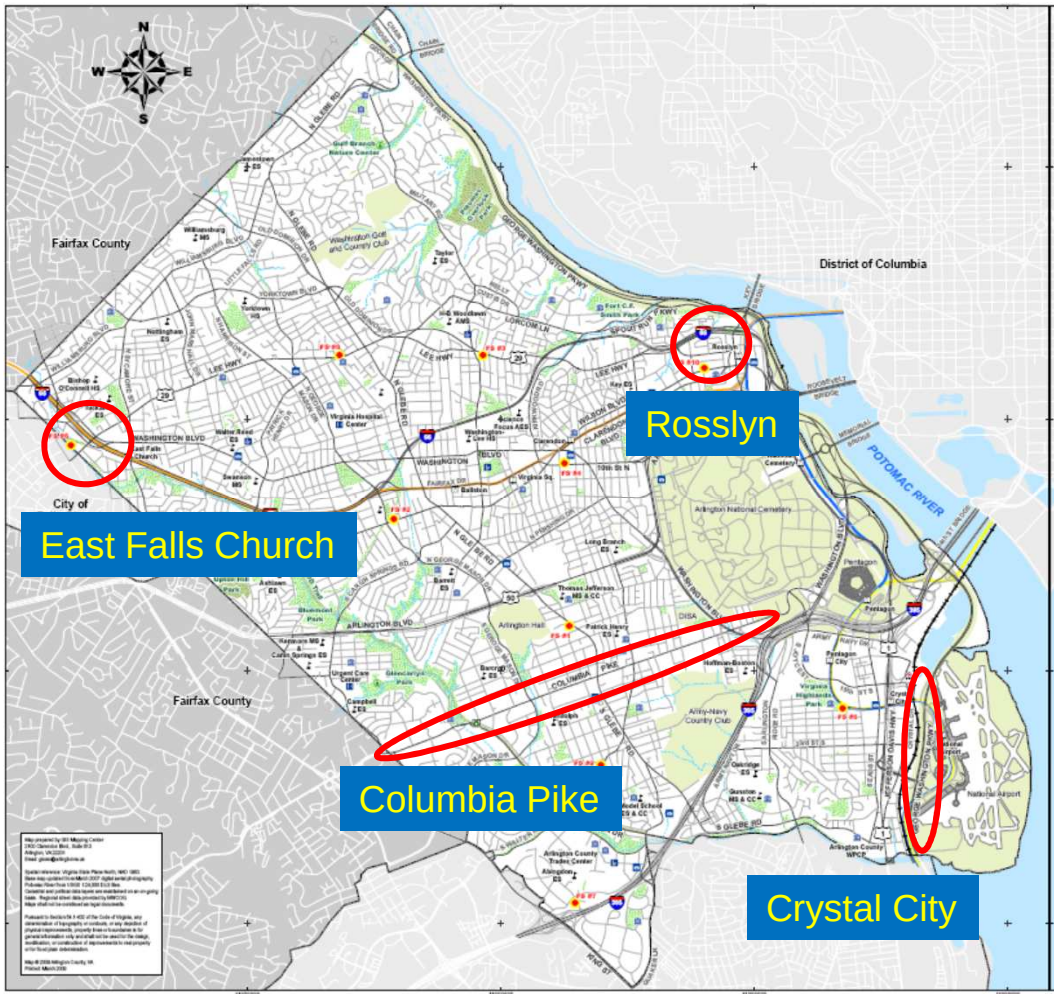
CEP Candidate "Scale Projects"
Selection Criteria

- High probability of being implemented
- Manageable number of participants
- Large enough to implement integrated energy solutions within its boundaries
- Possibility to apply different energy supply and efficiency than surrounding norms
- Potentially economically, environmentally and operationally attractive
- Future possibility to link to other community projects

Typical Scale Projects

- High Density Urban Villages
- Core renewal neighborhoods
- Commercial or Research Parks
- Major retail clusters
- Greenfield Smart Growth
- Sports and Recreation Centers
- Transit hubs/neighbourhoods
- Academic Campuses
- Military Bases
- *(Industrial Parks)*

Initial Scale Projects
High Priority Candidates



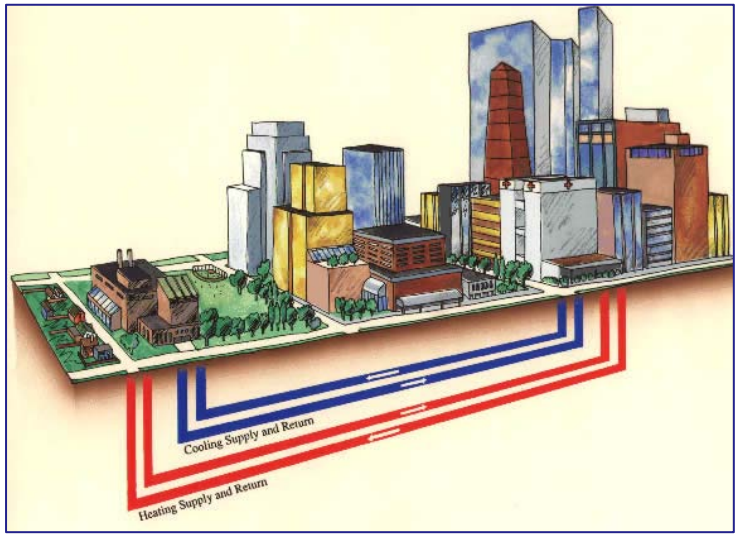
Integrated Energy Plans Needed

CEP Scale Project

Moorefield Station Community Scale Project:

It is a 400-acre mixed-use development clustered around the proposed "Dulles Silver Line". Two critical components of the development are its density and its focus on transit. It includes 550,000 square feet of office space and 1,500 units of residential space in Phase One. When fully built-out, the development will include approximately 6,000 homes and 9.75 million square feet of commercial and retail development. Funded by about $400,000 from both the Claude Moore Foundation and the DOE grant, and with the support from Digital Realty Trust, a fully integrated energy master plan (IEMP) will be prepared by 2011

What is District Energy?



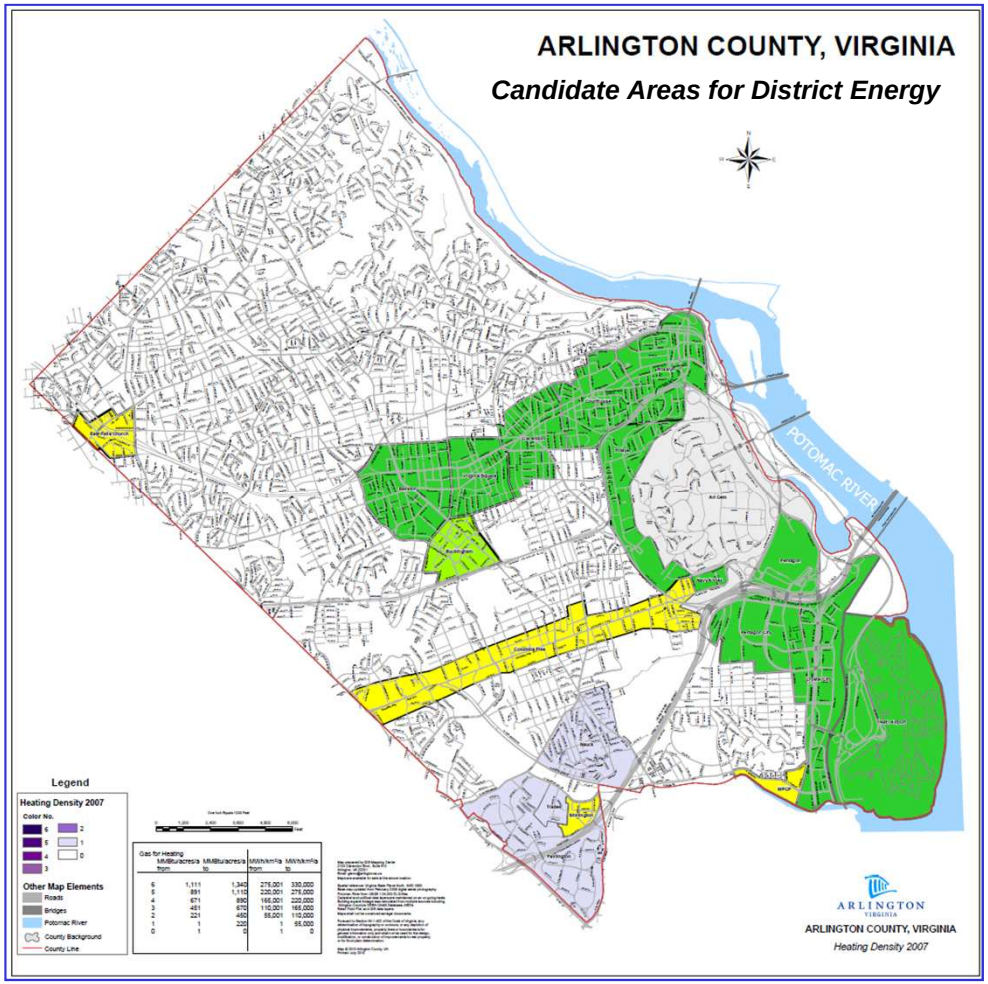
Centralized supply and delivery

- *Heating*
- *Cooling*
- *Domestic hot water*

- Distribution to many homes and buildings
- Closed network of highly insulated pipes
- Optimized energy supply from multiples sources
  - *Combined Heat & Power*
  - *Boilers/Furnaces*
  - *Absorption Chillers*
  - *Electric Chillers*
  - *Solar and Biomass*
  - *Waste heat recovery*
- Typically operated by dedicated DE-Utility

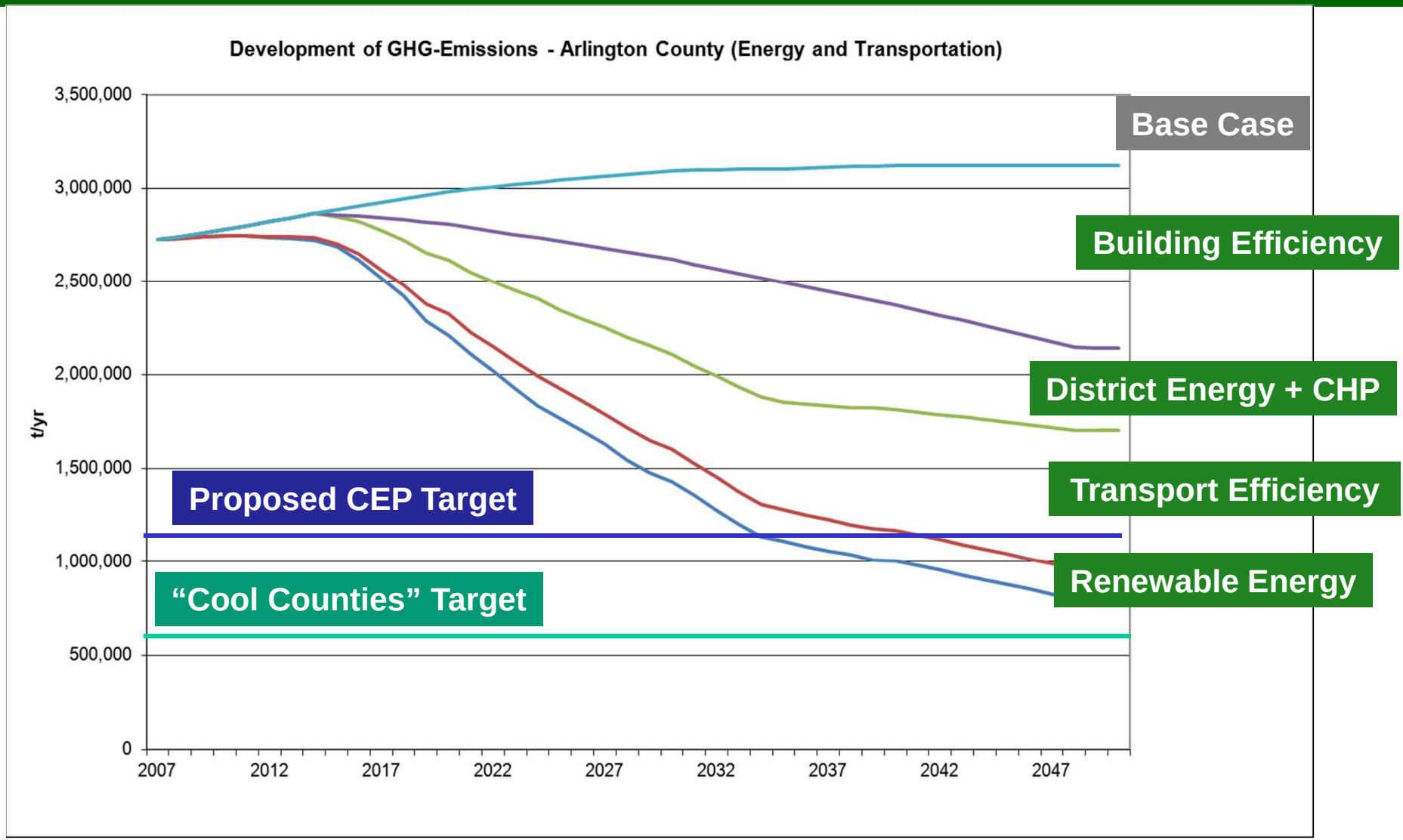
Widely deployed proven technology

District Energy
Possible Areas for Implementation

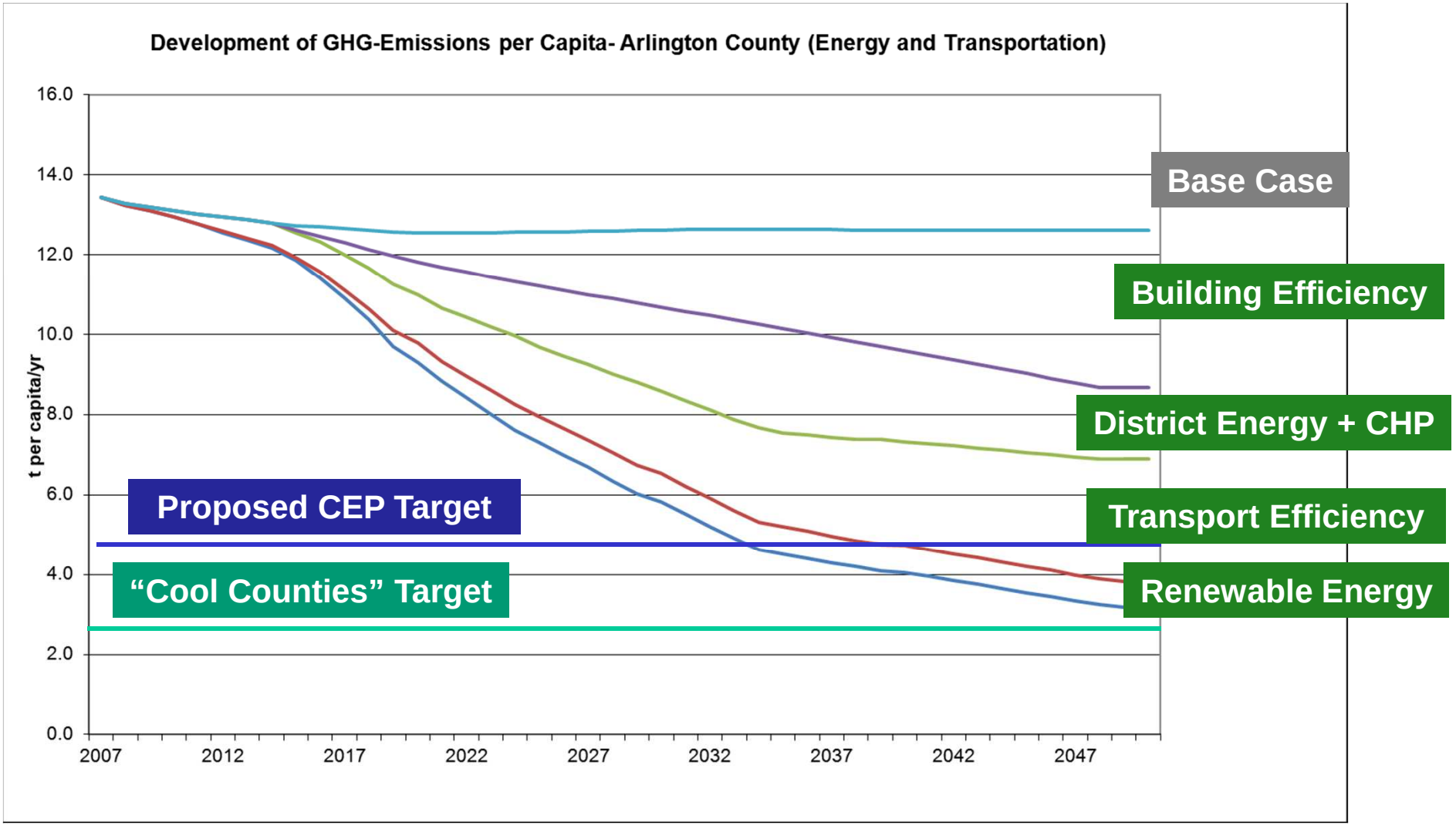


Reliable – Flexible – Clean - Economic

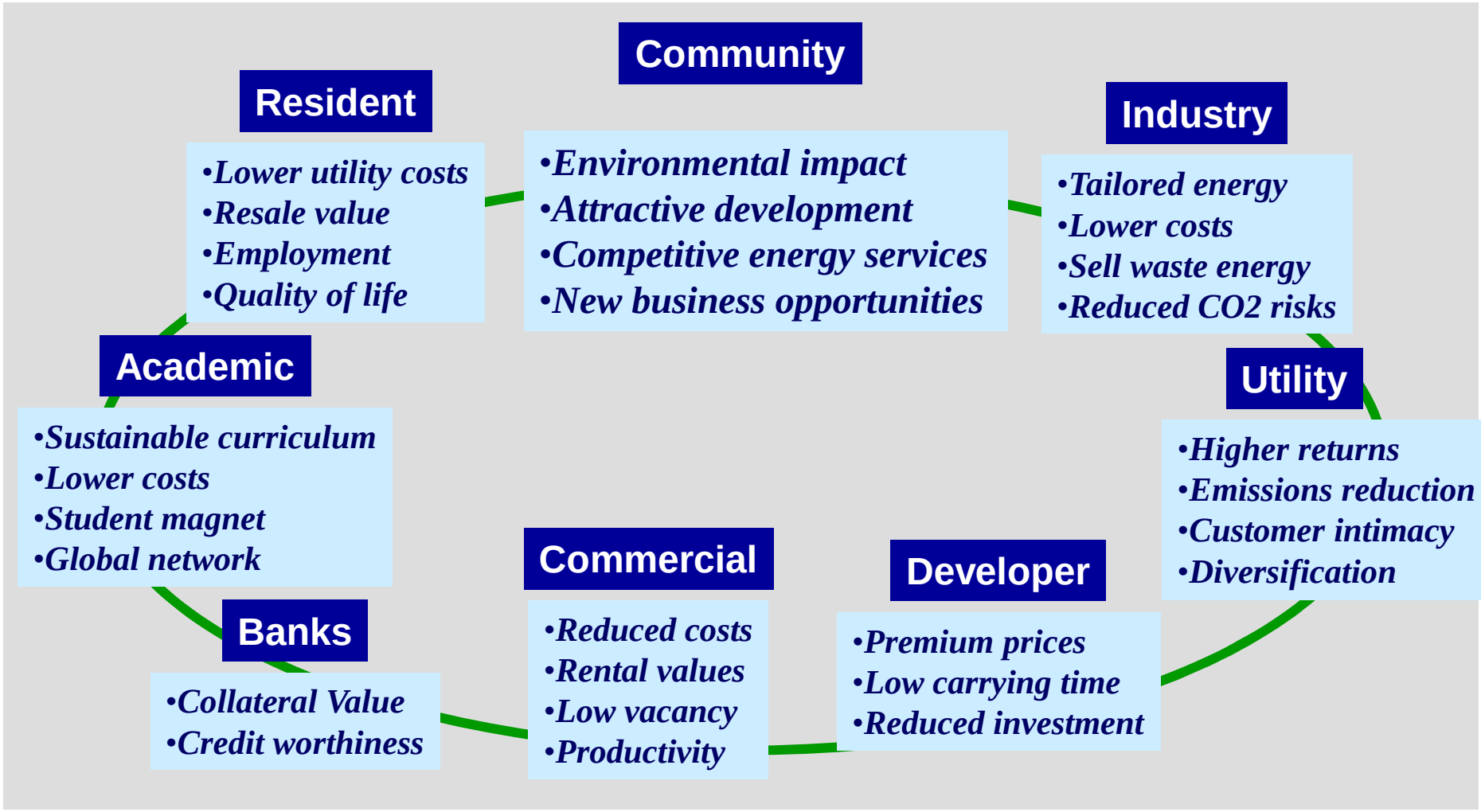
Results 2007 to 2050
Arlington Example - Total GHG emissions



Results 2007 to 2050
Arlington Example - GHG per capita



Benefits of Winning!
Competitive-Sustainable-Flexible



New Relationships – New Rules

Thank You