

Community Energy Planning *Creating Globally Competitive Communities...*



...in a Globally Competitive Region

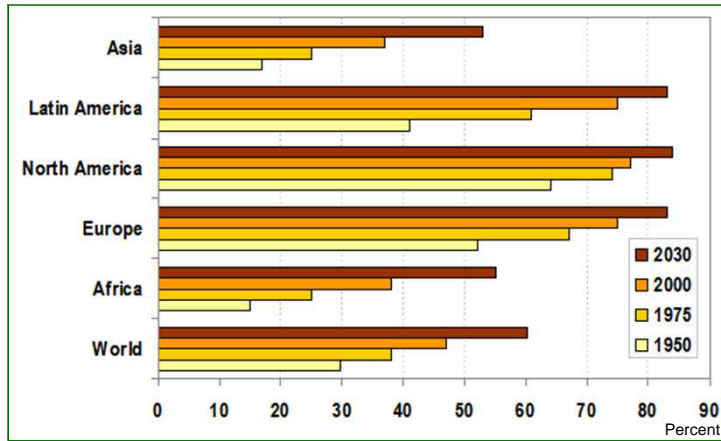
Metropolitan Washington Council of Governments
2011 Leadership Planning & Work Session
July 22-23, 2011 Cambridge, Maryland

Why Should We Care ? *New Energy Realities...*

- Unpredictable energy prices
- Dependence on imports and supply security
- Impacts of climate change legislation
- Under-invested energy infrastructure
- China and India major new energy customers
- Blackouts, weather events, water shortages..
- Nuclear moratorium? –Energy price impacts?
- Energy innovation? – Competitive advantage?

Fundamentally Different From Past

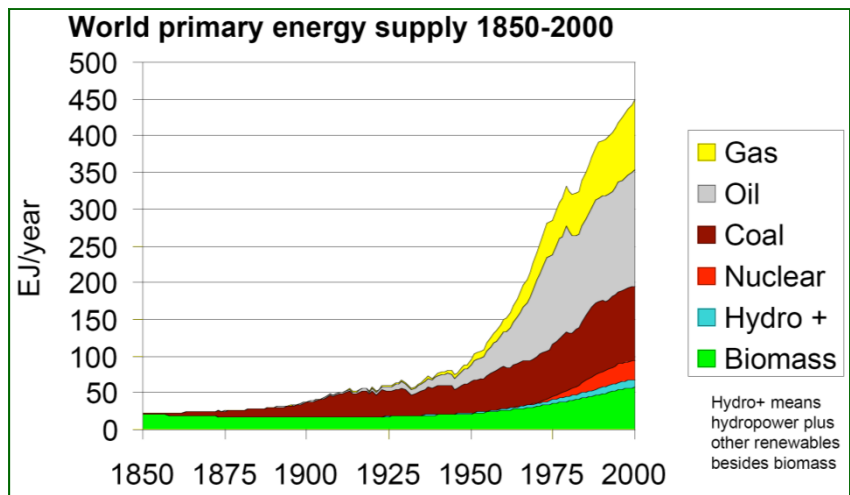
Most of us live in Urban Setting
Over 80% in USA



Urban Population passed 50% in 2008

**UN Sources*

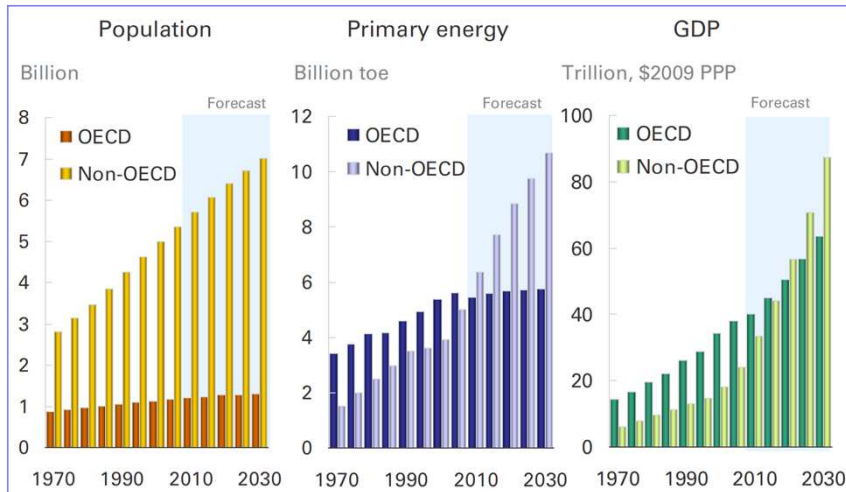
Insatiable Global Appetite for Energy
About 70% in Urban Areas



Forecast to nearly double by 2030

Source: IIASA / BP / EIA / Eurostat

Population GDP / Energy Growth *Redefining our World!*



Non-OECD Countries driving energy demand

Source BP 2011 Statistical Review of World Energy

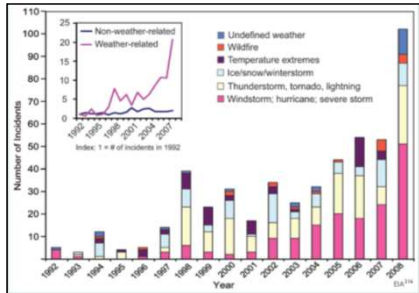
Extreme Weather Events

- More frequent
 - Asian Floods
 - Russian heat storm
 - US floods, tornados, droughts
 - Heat storms / floods
- Impacts of rising temperatures
 - Sea rise 8" to 12" in last 50 years
 - Changing crop yields
 - Arctic opening up for exploration
 - Higher intensity hurricanes
- Energy use a suspected contributor
- Will this impact energy costs?



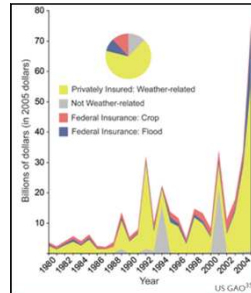
Climate Change Making Headlines again in USA

Energy Cost and Reliability Risks Increasing



US Transmission Grid Disturbances

- Weather events increasing
- Average 180,000 people /event affected
- Unforced events also at historic highs



Insurance Claims

- 2011 may be costliest on record
- 2008..09..10 costliest three years
- \$30 Bn Private claims in these years

Importance of Local Strategies

Sources: UD DOE-EIA, US GAO

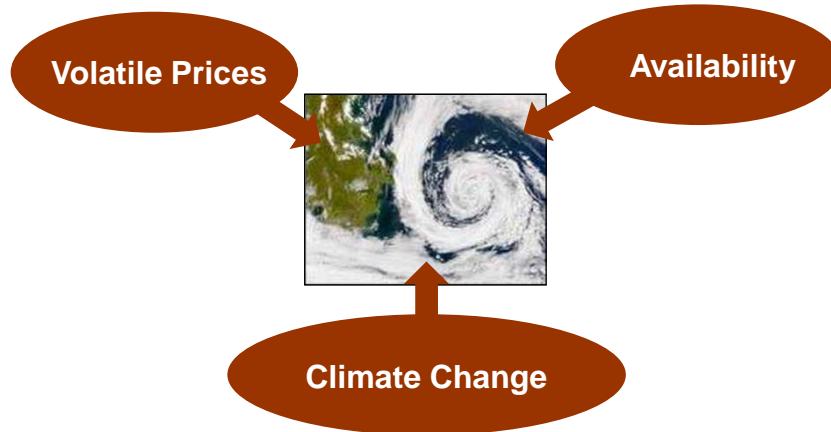
Energy Productivity Differences How well do we spend our \$1.5 Trillion?

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

Key to Competitiveness

*IEA and World Bank - 2007 sources

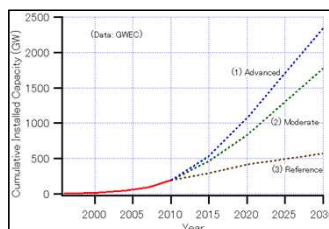
Perfect Energy Storm *Uncertainties combine...*



Growing Risks – Growing Opportunities

Markets are responding... *Example: Wind Power*

- Global total 194GW growing at 20%
- EU 84 GW
 - 2010 adds 9 GW
 - 2020 target 256GW
- China 42 GW
 - 2010 adds 17 GW
- USA 40 GW
 - 2010 adds 5 GW
- India 13 GW
 - 2010 adds 2 GW
- Prices falling
 - Installed costs \$2/watt in 2010
 - Estimated generating costs ~ 4 c to 8 c / kWh



Growing need for Smarter Grids

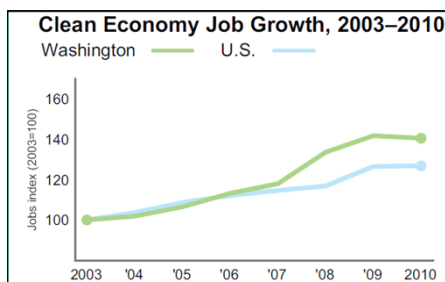
Markets are responding... *Example: Solar Power*

- Global Capacity triple to 131 GigaWatt by 2015
- EU total ~ 29 GW
 - 2010 adds 13 GW
- Japan total 4GW
 - 2010 adds 990MW
- China total 1GW
 - 2010 adds 0.9 GW
 - 2015 target 18 GW
- USA total 0.9 GW
 - 2010 adds 0.4 GW
- Prices falling
 - US \$5/watt - down 20% in 2010
 - Germany \$4 / watt – down 50% since 2006
 - China \$3/watt – falling fast



Challenge to Plan and Use Effectively

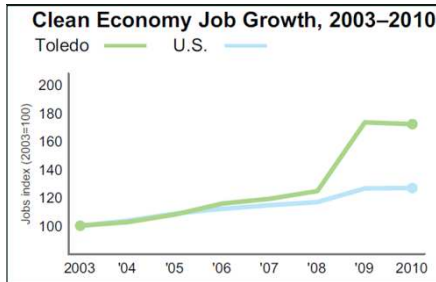
Creating High Quality Employment *Clean Economy-Metro Washington Area*



- Clean Jobs
 - 70,828
 - 4th in USA
- Growth since 2010
 - 20,403 jobs / 5% per year
 - 3rd / 38th in USA
- Share of Total Jobs
 - 2.3%
 - 27th in USA
- Median Wage
 - \$51,651
 - 6% less than average

Substantial Upside Potential

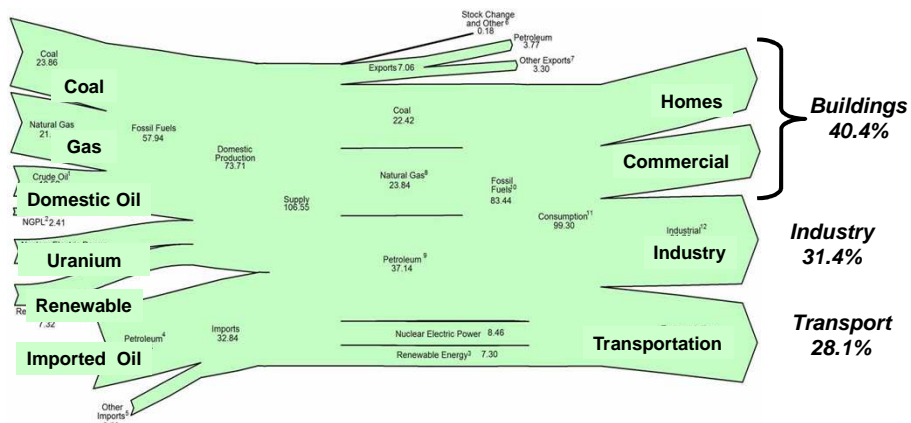
Competition Heating Up Clean Economy-Example of Toledo Area



- Clean Jobs
 - 11,831
 - 45th in USA
- Growth since 2010
 - 4,958 jobs / 8% per year
 - 26th / 9th in USA
- Share of Total Jobs
 - 3.9%
 - 5th in USA
- Median Wage
 - \$40,276
 - 16% higher than average

Potential to Transform Communities

Total US Energy Use ~ \$1.5 Trillion Most in Urban Environment



Largest User is Buildings

Source: US DoE EIA - 2008

Benchmark Efficiencies by Sector USA / EU Energy Example

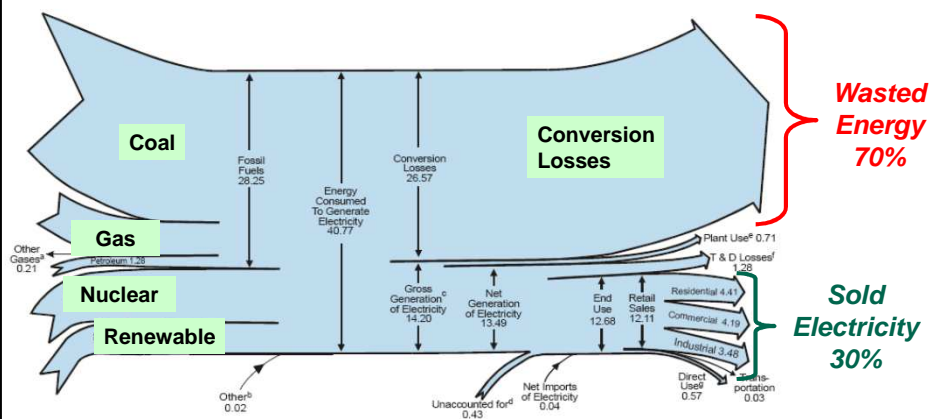
Sector	Share	Index USA/EU
Industry	32%	1.2 : 1
Homes & Buildings	40%	2.5 : 1
Transportation	29%	1.4 : 1

- Most energy lost in range of inefficiencies
- Building efficiency potential often underestimated
- Industrial efficiency potential often overestimated

High potential for productivity gains!

**Indicative ratio of US average to EU Average*

US Electricity Supply Chain



Largest Cause of Greenhouse Gas

Source: US DoE EIA 2007

Dysfunctional Energy Supply Chain

From fuel to service

Uses 70% of all energy



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

Pay 100 for fuel - Get less than 10 in services

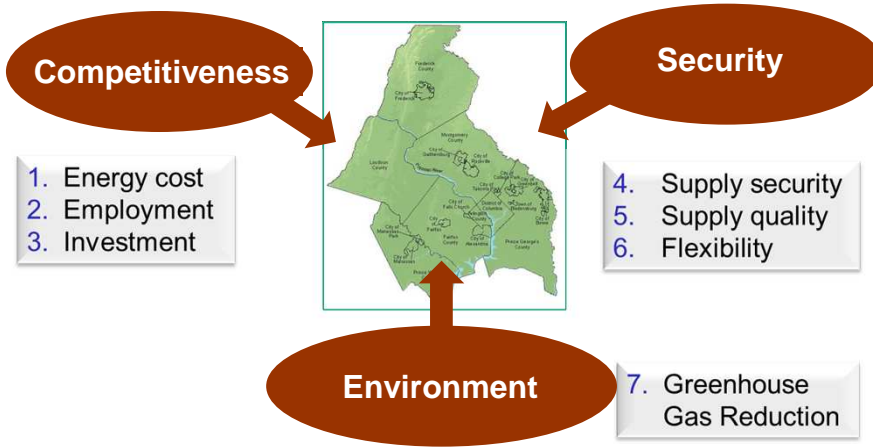
Meeting the Challenge

Wide Range of Community Responses

- Community Commitments
 - *Cool Climate Initiatives*
 - *US Mayors Climate Protection Agreement*
 - *EU Covenant of Mayors*
- Directional Plans
 - *Climate Action Plans.....*
- Clean and Efficient Initiatives
 - *Education and outreach*
 - *Municipally owned assets as role models*
 - *Voluntary private sector engagement*
 - *Demonstration projects*
 - *Selected policy changes or guidelines*
 - *Local tax and incentives density incentives...*

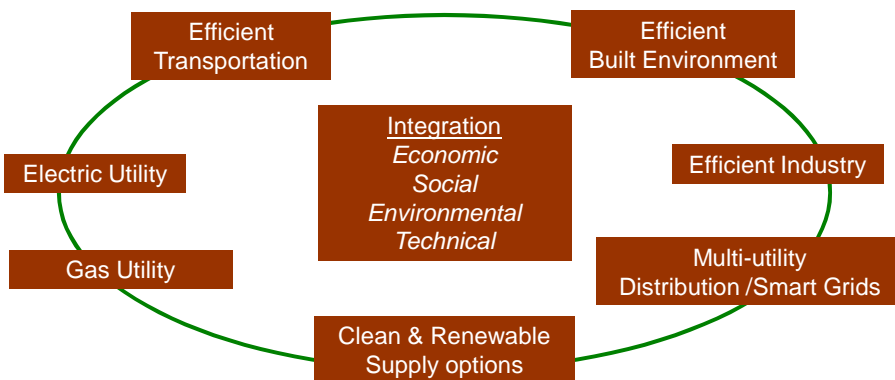
CEP is Bridge to Sustained Implementation

Typical CEP Measures of Success *Three Groups of Benefits*



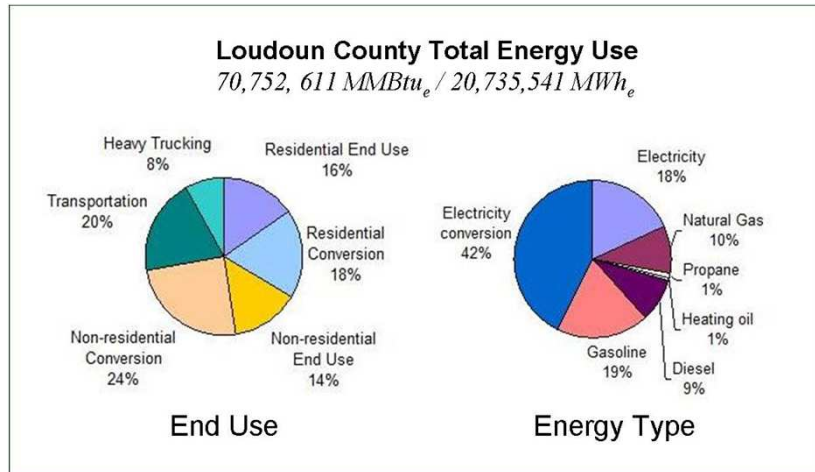
Framing goals need to be set early

Build CEP Team *Global & Local Expertise*



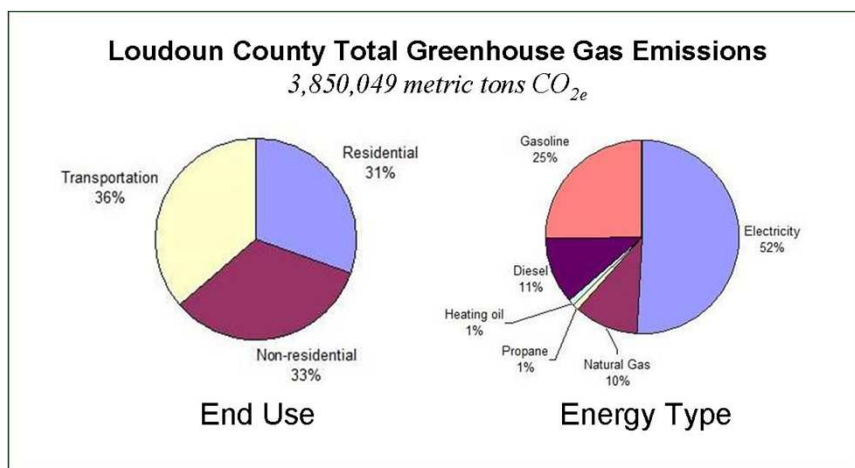
Guided by Community Leadership

Develop Energy Baseline Example Loudoun County 2007



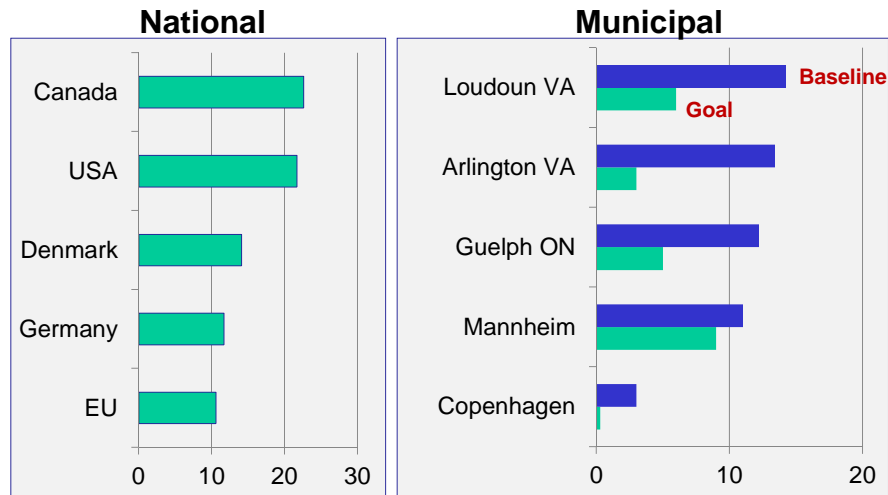
261 Million Btu / 77 MWh for each resident

Develop Carbon Baseline Example Loudoun County 2007



14.2 metric tons for each Resident

Benchmark Globally Example Greenhouse Gas / Capita



Establish Long term Framing Goals?

Evaluate Global and Local Benchmarks Example of Copenhagen



- Triggered by 70's energy crisis
- 3.0 tons / capita GHG
- Efficiency
 - World leading building efficiency
 - Energy Performance Validation
- District Energy
 - Widespread across city
- 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”

Develop Long-Term CEP Goals

Example – Arlington County

- Affordable, reliable energy supplies
- Flexible to meet changing technologies, legislation and market conditions
- Meet investor, employer and resident needs
- Meet Arlington’s “Cool County” commitment

Headline Measurement

Reduce Arlington’s annual GHG emissions to 3.0 mt CO₂e per capita by 2050. If an effective regional energy plan is put in place, achieve 2.2 mt CO₂e per capita per year.

Greenhouse gas emissions used as a good surrogate for energy and fuel use efficiencies

CEP Framework

Loading Order Priorities

1. Energy efficiency – *If you don’t need it don’t use it*
2. Heat Recovery – *It it’s already there – use it*
3. Renewable energy – *If it makes sense, go carbon free*
4. Energy distribution – *Invest where it makes sense*

Integrated Approach – Tailored for Community

Develop Integrated Strategies *Loading Order Prioritization*

1. Energy efficiency

- *Efficient homes, buildings and internal equipment*
- *Urban design for transport efficiency*
- *Efficient vehicles*
- *Efficient Industry*
- *Local employment for commuting efficiency*

2. Heat Recovery

- *Distributed combined heat and power*
- *District Energy in higher density neighborhoods*
- *District Energy on commercial/industrial parks*
- *Use existing “waste” heat*

Integrated Approach – Tailored for Community

Develop Integrated Strategies *Loading Order Prioritization*

3. Renewable energy

- *Electricity - Solar PV, Wind, Run-of-river Hydro*
- *Heat - Solar thermal, Biomass, geothermal*
- *Heat and power – waste-to-energy, biomass*
- *Fuels – Ethanol, Biodiesel*

4. Energy distribution

- *Optimize community / regional investments*
- *Flexible community distribution approach – electricity, gas, district energy ...*
- *Flexibility to use different fuels and energy conversion technologies*
- *Smart metering and smart microgrids*

Integrated Solution – Tailored for Community

Develop Enabling Strategies

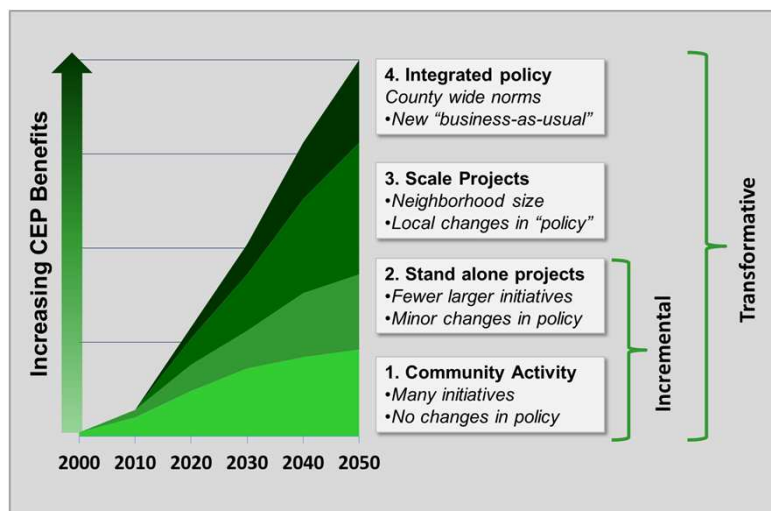
Typical examples

- Institutionalize energy planning
 - *Ongoing leadership and accountability*
 - *Include in General Plans, policies and practices*
- Energy Performance Labeling
 - *Ongoing evaluation of building performance*
- Education and Outreach
 - *Improve Community Energy Literacy*
 - *Workforce education*
- Greenhouse gas management
 - *Register and track emissions reductions*
 - *Basis for future monetization*
- Team with neighbouring jurisdictions
 - *Develop regional energy plans*
 - *Gain benefits of scale economically and politically*

From Strategy to Sustained Implementation

Identify Scale Projects

Jump Start Implementation



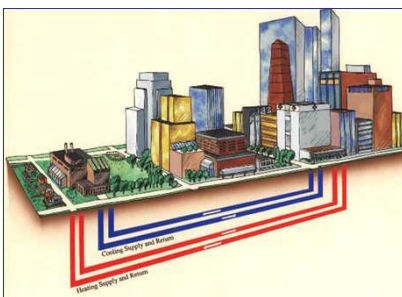
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Typical Scale Projects

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

Often Anchor Loads for District Energy

What is District Energy? *Widely Deployed Proven Technology*



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 multiple sources
 - Combined Heat & Power
 - Boilers/Furnaces
 - Absorption Chillers
 - Electric Chillers
 - Solar and Biomass
 - Waste heat recovery
- Operated by DE Company

Widely deployed proven technology

*Illustration Courtesy of IDEA

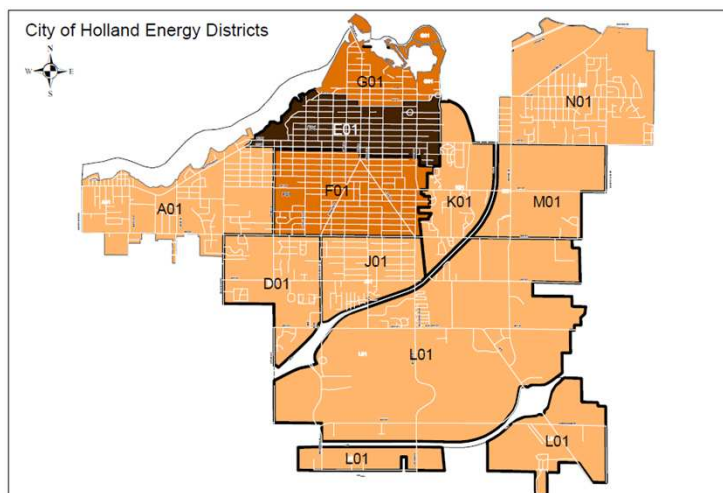
District Energy – Community Scale Heating and Cooling



- Creates a market for valuable thermal energy
- Facilitates combined heat and power
- Creates scale for fuels and technologies not feasible on single-building
- Fuel flexibility improves energy security
- Reduces price volatility
- Energy dollars re-circulate in local economy
- High quality jobs in construction & operation

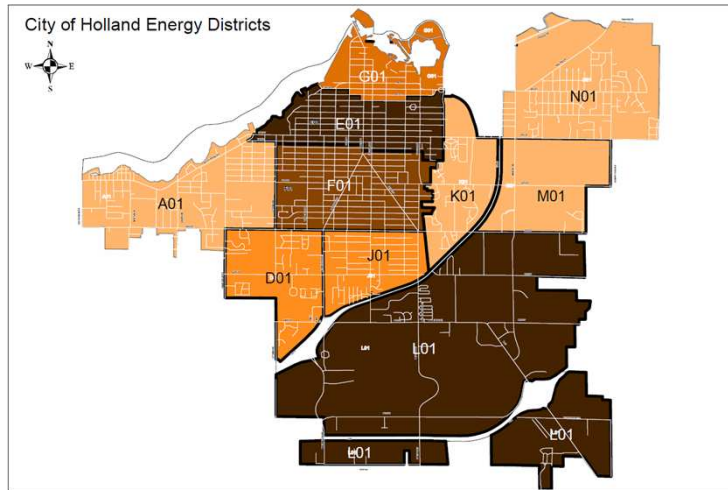
*Illustration and text courtesy of IDEA

Mapping Energy Needs by Neighborhood *Example City of Holland -2010*



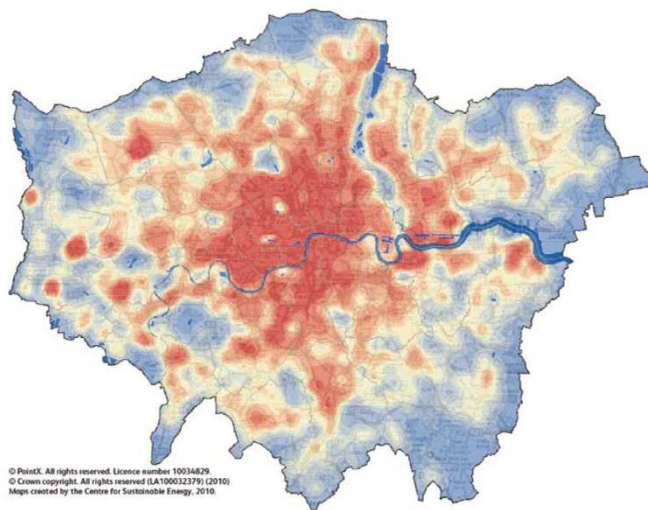
Immediate District Energy Potential

Mapping Energy Needs by Neighborhood *Example City of Holland -2050*

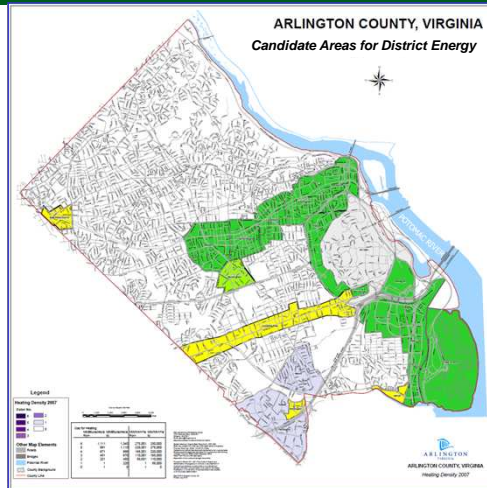


Future District Energy Potential

Mapping Energy Needs by Neighborhood *Example: Heat Map of London*



Mapping Energy Needs by Neighborhood *Example Arlington*



District Energy Potential

District Energy Company *Typical Ownership Options*

- Option 1 – Publicly owned
 - Owned and operated by Community
 - Profits flow 100% to Community
 - Community carries 100% of capital risk
 - Examples:
 - Heidelberg
 - Sacramento Municipal Utility District
 - Austin Energy
 - Lonsdale Energy – North Vancouver
- Option 2 – Public-Private ownership
 - Jointly owned & operate by Community/Private Investors
 - Profits flow partly to Community
 - Most common model in EU
 - Examples:
 - MVV Mannheim
 - District Energy St Paul (hybrid model)

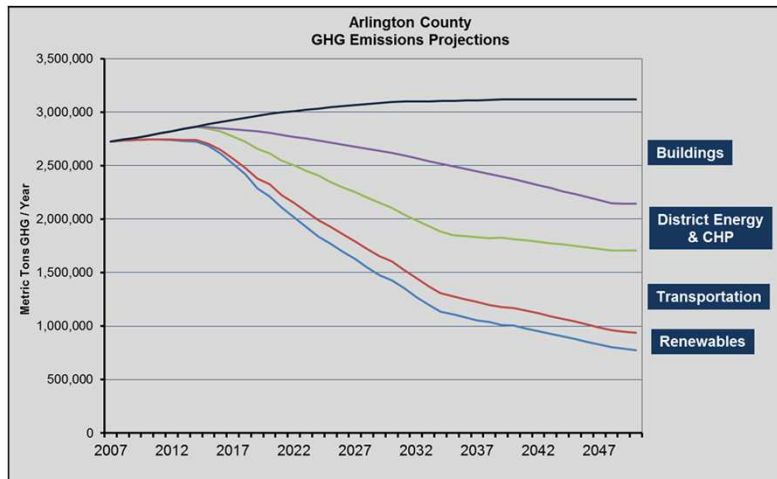
District Energy Company *Typical Ownership Options*

- Option 3 – Investor owned
 - Owned and operated by Private Investors
 - Profits flow 100% to Investors
 - Community typically charges “franchise fees”
 - Examples:
 - Berlin (Vattenfall)
 - New York (conEdison)
- Option 4 – Site Specific
 - Coop owned and operated by building owners
 - Profits flow 100% to Coop
 - Community could not charge “franchise fees”
 - Unattractive business model for many owners/developers
 - Can be bridge to municipalization
 - Examples:
 - Dockside Green Vancouver
 - Siedlungswerk Stuttgart

DECo – Business Model in COG area *All Ownership Options*

- Physical Assets owned by DECo
 - Pipe networks
 - Thermal sub-stations
 - Heating and cooling sources on the network
 - Existing chillers, boilers and furnaces
 - New chillers, boilers and furnaces
 - Distributed CHP and other heat sources
- Revenues
 - DE Services – heating, DHW and cooling
 - CHP electricity usually sold to electric utility
- Impact on building owner / developer
 - Reduced initial investments
 - Reduced maintenance
 - More internal space
 - Less volatile energy costs
 - Reduced carbon footprint

Community Energy Plans *Breakthrough Results are Possible...*



Key Challenge – Implementing the CEP!

Successful CEP Implementation *Common Features*

- Leadership and community engagement
- Transparency and outreach
- Necessary planning policy changes in place
- World-class energy efficiency
- Integrated municipal utility framework
- Early implementation of “Scale Projects”
- Magnet for investment
- Quality local employment
- Continuous improvement – raising the bar!
- Part of a wider regional initiatives

Consistent Execution Over Decades

Wider Regional Initiative *COG Integrated Community Energy Task Force*

- Expert task force formed Fall 2010
- Focus: Assist by developing technical and policy information on energy solutions
 - *District Energy*
 - *Combined Heat Power*
 - *Multi-utility Microgrids*
- Identified Priorities:
 - *Model RFPs*
 - *Inventory of Existing Sites*
 - *Technology Review/Business Case*
 - *Local Policy Assessment and Gap Analysis*



COG Task Force *Expert Consultancy Underway*

- COG hired FVB Energy to support Task Force
 - *Local Policy Analysis*
 - *Technology Overview*
 - *Business Case*
- Schedule
 - *July 2011 - Draft Report (present CEEPC July 27)*
 - *September 2011 - Final Reports*
- Preliminary Areas of Interest
 - *Establishing energy and climate goals*
 - *Mapping opportunity areas*
 - *Identify high-priority areas*
 - *Identify and facilitate pathways for investment in Community Energy Solutions*
 - *Encourage density through zoning*
 - *Incent developers to design for DE compatibility and explore community energy connection options*



Discussions

- Can we achieve world-class performance without District Energy?
- Engaging property developers and owners in District Energy strategies?
- The role of the existing utilities?
- Building powerful public/private partnerships?
- How to maintain a balance between energy goals – Security; Economic; Social and Environmental?
-

Thank You