Community Energy Planning *Creating Globally Competitive Communities*





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Insatiable Appetite for Energy About 70% of it in Cities



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Source: IIASA / BP / EIA / Eurostat

Perfect Energy Storm When fears collide...



Growing awareness – Growing Opportunity

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

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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

Greenhouse Gas Indicators

- GHG good surrogate for overall energy productivity
- National GHG per capita per year (metric tons CO₂)

Canada	22.6
USA	21.7
Denmark	14.1
Germany	11.7
European Union	10.5

Municipal GHG per capita per year (metric tons CO₂)

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

Energy Supply Chain From fuel to service

Uses 70% of all energy



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

Pay 100 for fuel - Get less than 10 in services

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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 City Policy

Pay for 100 get 30 to 50 !

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"

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Arlington Community Energy Plan Competitive Community of the Future (Work in Progress)





Arlington Community Energy Plan Process to date

- Kick-off Workshop Jan 2010
- Energy & Greenhouse Gas Baseline complete
- CEP Planning Group formed March 2010
- Task Force Meetings
 - County Departments, Dominion, Pentagon, Reagan National Airport, Washington Gas, Chamber of Commerce, Property Developers, Housing Associations...
- Task Force endorses transformative CEP goals
- Community Town Hall meeting Apr 2010
- Preliminary Recommendations Sep 2010
- Community Town Hall Meeting Oct 2010
- Completion target March 2011







Homes and buildings use 75% of all energy





13.4 metric tons for each Resident



Community Energy Plan Goals Seven Key Measures of Success



Breakthrough Performance



CEP Framework Loading Order / Trias Energetica

Energy efficiency – <u>If you don't need it don't use it</u>

- Efficient buildings, vehicles
- Urban design for transport efficiency
- Local employment for commuting efficiency
- Heat Recovery <u>It it's already there use it</u>
 - Distributed combined heat and power
 - Use existing "waste" heat
 - Structure commercial sites to maximize "waste" heat use
- Renewable energy <u>If it makes sense, go carbon free</u>
 - Renewable electricity Photovoltaic, Wind, Run-of-river Hydro
 - Renewable heat Solar thermal, Biomass, geothermal
 - Renewable heat and power waste-to-energy, biomass
- Energy distribution <u>Invest where it makes sense</u>
 - Flexible distribution electricity, gas, district heating, cooling...
 - Accepts multiple fuels and energy conversion technologies
 - Optimize local / regional investment choices

Integrated Solution – Tailored for County!



Evolution of Benefits Four Distinct Types of Activity



Arlington Commits to World Class Performance



Sustainable Energy Multiple Level 1 & 2 initiatives



















Sustainable Transportation Multiple Level 1 & 2 Initiatives



















Preliminary Recommendations Built-environment - 1

- Renovation of existing homes and buildings
 - Average renovation rate 2% to 3% per year
 - Renovate to operate 30% more efficiently from 2015
 - Continue efficiency increases after 2015
- New construction
 - Build to operate 30% more efficiently than current code by 2015
 - Continue efficiency increases of about 1% per year from 2016
 - Include energy narratives in planning request
 - Efficient Neighborhoods / Scale Projects
 - Develop neighborhood energy master plans
 Achieve speed and scale with neighborhood plans
 - Incentivize developments meeting CEP goals
- Enhance awareness and capability on efficient operation
- Widespread voluntary Energy Performance Labeling





Initial Scale Projects High Priority Candidates



Integrated Energy Plans Needed

District Energy Possible Areas for Implementation



Reliable – Flexible – Clean - Economic

Community Energy Plan

ARLINGTON



Preliminary Recommendations Built-environment - 2

- High-density neighborhoods
 - Create legal frame for DE utility
 - Designate DE targets
 - Migrate to District Energy starting with 4 Scale Projects and Aquatic Center
 - Install 146 MW CHP by 2030
 - Implement 10% renewable heat including possibly waste-to-energy
- Lower-density neighborhoods
 - Maximize individual solar, biomass, geothermal installations to supply 50% of DHW and 20% of space heating
 - Evaluate local-area energy solutions for building clusters







Preliminary Recommendations Built-environment - 3

Enhance energy supply security

- Reduced grid loads
- 146 MW Cogeneration
- Install 160MW Solar PV to reduce summer peak demand and cut emissions
- District cooling using absorption chillers for nonelectric cooling









Results 2007 to 2050 Total GHG emissions





Results 2007 to 2050 GHG emissions per capita





Benefits of Winning! Competitive-Sustainable-Flexible



Thank You

Total US Energy Use Most in Urban Environment

Largest User is Buildings

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Source: US DoE EIA - 2008

Preliminary Recommendations Transportation

- Non-resident emissions creates a 15% "headwind"
- Maintain existing comprehensive transportation strategies
 - Multi-modal nodes to increase transit usage ~ 15%
 - Urban design to reduce journeys ~ 8%
- Industry and Market factors
 - Materials, drive train, fuels evolution ~15%
 - Consumers choosing smaller vehicles ~ 15%
- Additional measures for TF

consideration - not yet recommended:

- Road pricing based on emissions rating
- Parking fees based on emissions rating
- Prioritize allocated road space

Community Energy Plan 2011 to 2050 Goals

- Affordable, reliable energy
- Flexible to meet changing technologies, legislation and market conditions
- Meet investor, employer and resident needs
- Meet "Cool County" commitment
- Use energy-related GHG as proxy for enduse, distribution and fuel efficiencies

Headline Goal

Systematically reduce Arlington per capita GHG emissions from 13.4 to 4.5 mt by 2050

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

High potential for productivity gains!

*Indicative ratio of US average to EU Average

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