Creating Energy Security for Communities

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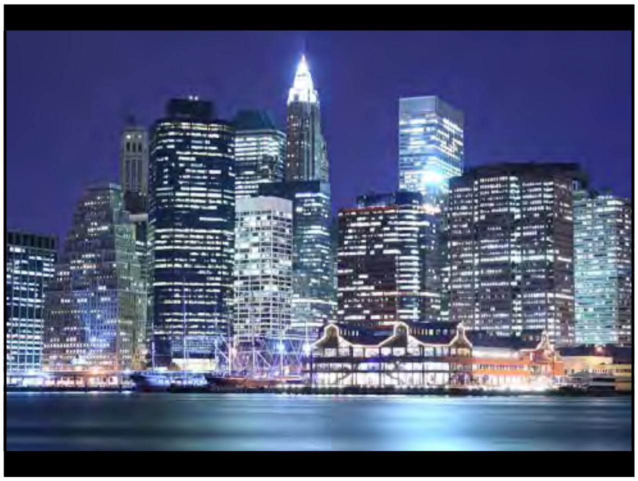
1. Energy Future
2. Energy Security
3. Unique Opportunities
4. Community Concepts
5. Challenges
6. Urban Planning Considerations
7. Energy Planning Considerations
8. Energy Independence Planning
9. Q & A / Workshop



Energy Drivers

10

1. Change

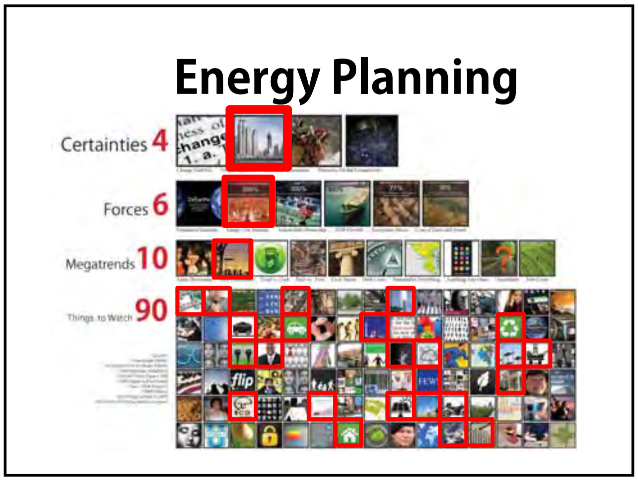
The amount of new technical information is doubling every 2 years XXX

11 months!

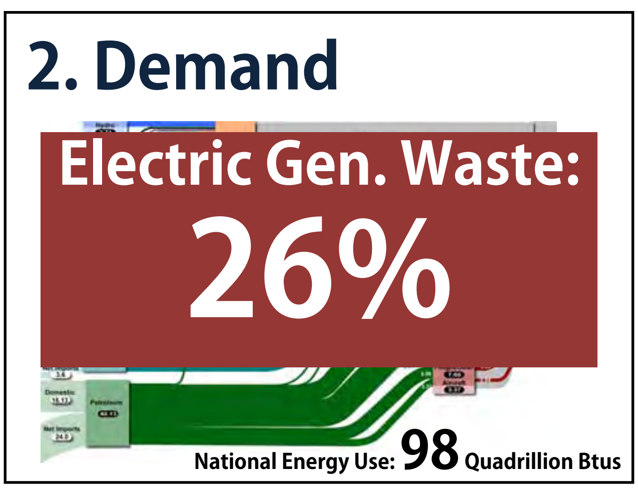
2x

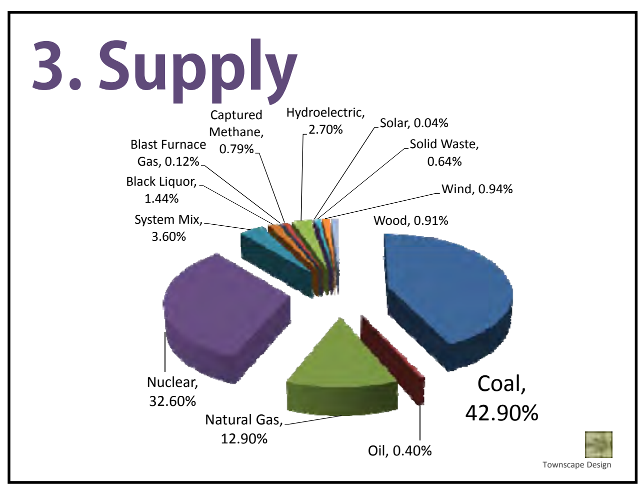
In 1950 it took 10 years…
In 1750 it took 250 years…

Opportunities / Externalities


Energy Planning
Certainties 4
Forces 6
Megatrends 10
Things to Watch 90
flip


Integrated Clean Energy
10 Things to Watch in 2012 and beyond...
1. Goodbye Coal; Hello What?
2. Gen Go, Loose Cubes, etc.
3. Building Integrated
4. Fuel from Waste
5. Access Anywhere
6. Smart Grids
7. Urban Industrial
8. Neighborhood Power
9. Rethinking the Roof
10. Next Gen EVs


2. Demand
Electric Gen. Waste:
26%
National Energy Use: 98 Quadrillion Btus


3. Supply
Captured Methane, 0.79%
Hydroelectric, 2.70%
Solar, 0.04%
Solid Waste, 0.64%
Blast Furnace Gas, 0.12%
Black Liquor, 1.44%
Wind, 0.94%
System Mix, 3.60%
Wood, 0.91%
Nuclear, 32.60%
Coal, 42.90%
Natural Gas, 12.90%
Oil, 0.40%
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PJM Interconnection

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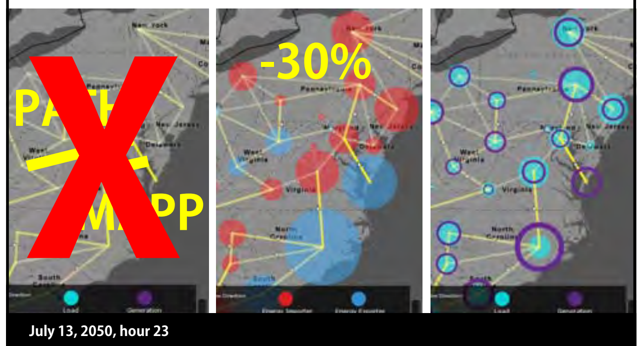
4. Dependency



Source: NREL

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5. Price Instability

6. Regulation

PJM Cap: 164,561.2 MW

EPA/MATS: -14,500 MW (9%)

Add: +6,076 MW

Efficiency:	922 MW
Wind:	796 MW
Solar:	56 MW
Purchase:	4,302 MW

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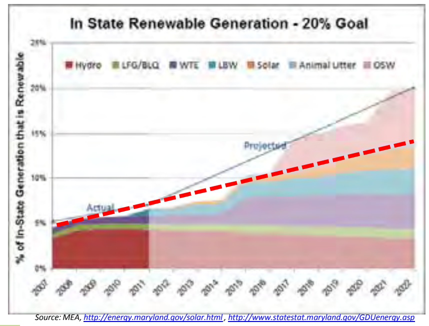
44.6%

2011 to 2012: One year, coal production has dropped from 44.6% to 36% of the total portfolio

36.1%

RPS Renewable Portfolio Standard



Solar Yr	MW	RPS%
2011	47	0.05%
2012	75	0.10%
2013	124	0.25%
2014	175	0.35%
2015	251	0.50%
2016	356	0.70%
2017	489	0.95%
2018	730	1.40%
2019	923	1.75%
2020	1,069	2.00%
2021	1,081	2.00%
2022	1,094	2.00%

Source: MEA, http://energy.maryland.gov/solar.html, http://www.statestat.maryland.gov/GDUenergy.asp

7. System Age

- D- from ASCE
- Demand up 25%, T+D Const. down 30% since 1990
- $1.5 to $2 Trillion by 2030
- 50%+ is more than 30 years old, 70%+ for T+D
- Bottlenecks = Blackouts
- Our region is one of the most congested in U.S.

8. Vulnerability

July 2, 2012

More than 2.5 million customers still in the dark.

Numbers are down slightly from the more than 4 million customers out overnight, but will likely continue for several days.

June 29, 2012

The East Coast Derecho Strikes

Over 500 preliminary thunderstorm wind reports indicated by •
Peak wind gusts 80-100mph. Millions w/o power.

Maryland / DC (685,000)
- 343,569 – PEPCO
- 316,634 – Baltimore Gas & Electric
- 24,984 – Potomac Edison

Ohio (560,000+)
- 476,001 – AEP Ohio
- 39.296 – Dayton Power & Light
- 23,194 – Duke Energy
- 22,327 – South Central Power

Virginia (725,000+)
- 465,183 – Dominion Virginia Power
- 198,809 – Appalachian Power
- 28,848 – Rappahannock Electric COOP
- 19,006 - Shenandoah Valley Electric COOP
- 12,865 – Southside Electric COOP

West Virginia (525,000+)
- 296,904 – Appalachian Power
- 220,005 – Potomac Edison
- 11,478 – AEP Ohio

Indiana (75,000+)
- 74,750 – Indiana & Michigan Power


AP Photo/Jeff Gentner

9. Gaps

TABLE 3 ★ **Regional Breakdown of Electric Distribution Investment Gap, 2020 and 2040** *(billions of 2010 dollars)*

REGION	CUMULATIVE GAP ESTIMATE BY REGION 2011–2020	2011–2040
Texas	14.6	56.0
Florida	4.2	18.2
Midwest	4.4	45.3
Northeast	8.0	51.2
Mid-Atlantic	18.2	130.3
Southeast	29.7	225.6
Southwest	2.4	9.2
West	25.5	196.0
U.S. Total	**107.0**	**731.8**

NOTE Regional descriptions are approximations of NERC Regions.

SOURCE EIA Annual Energy Outlook 2011 (years 2008-2035) and *NERC 2011 Long-term Reliability Report.*

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10. Security

Homeland Security
18 Critical Sectors

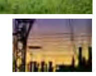
Water

410 Billion Gallons a Day

205 Billion Gallons a Day

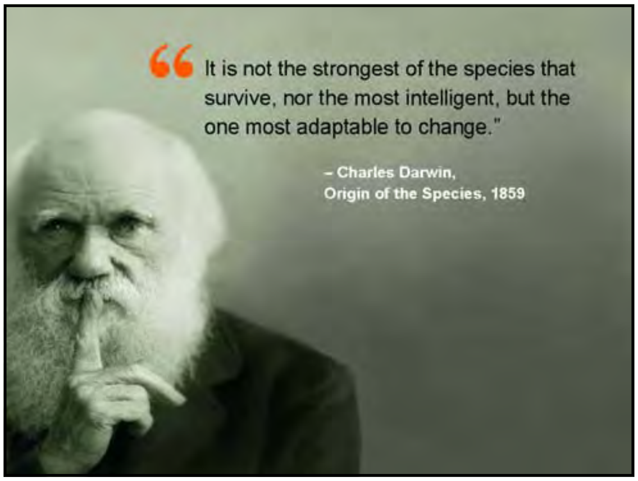
100 Billion Consumed

84 Billion Gallons a Day



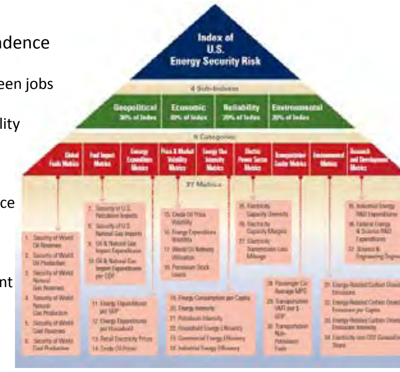
8 Billion Gallons a Day

8 Billion



Energy Security / Energy Independence

- National energy independence
  - →National security
  - →Economic development (green jobs /manufacturing)
  - →Climate change and air quality
- Local energy independence
  - →Insulation from national price shocks
  - →Resilience during natural disasters
  - →Local economic development
  - →Local air quality



What Is "Local" Energy Independence?

- Reduced demand from outside sources for power
- Strategy to reduce the impact of external energy forces on your community
- For the foreseeable future – a mixture of:
  - →Urban planning to reduce energy intensity of the community
  - →Energy efficiency to reduce total demand
  - →Load shifting to reduce peak demand
  - →Local fossil fuel combustion to provide baseload power (level of independence also depends on sourcing of fuels)
  - →Combined heat and power to reduce combustion waste
  - →Renewable energy to generate clean, local energy

Continuum of Energy Independence

- Energy independence is a continuum
- Different levels are possible for different entities
- The maximum possible independence is not necessarily practical or desirable.

High Energy Exposure → Low Energy Exposure

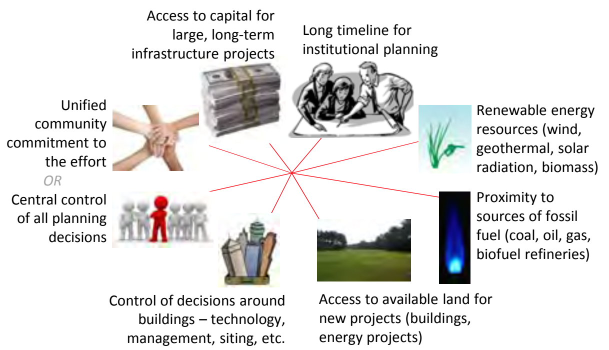
- All energy secured from outside the community
- High energy intensity of infrastructure

- Mixture of energy sources from inside and outside the community
- Energy performance improvements have begun

- All energy generated inside the community (with external fuel support)
- Energy efficient conventional buildings – plans to incorporate low energy concepts into future facilities

- All energy secured from inside the community
- Low energy intensity of infrastructure using passive solar design

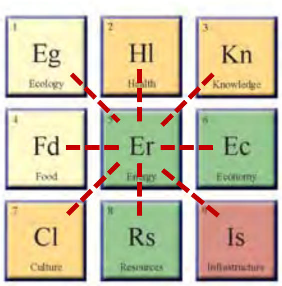
Driving Factors for Energy Independence



Unique Opportunities For Communities

- Being smaller than a state or the entire nation
  - Typically less large, energy-intensive energy users like industrial manufacturing parks
  - A greater ability to forecast where energy use will be increasing or decreasing over the next 20 years
  - Fewer stakeholder groups that need to be coordinated
- Being larger than a campus or base environment
  - A wider variety space types and usage providing more flexible opportunities for saving energy and creating generation
  - More and more varied land on which to install new generation
  - Ability to connect economic development to the value proposition
  - More leverage to get local utilities to engage in this effort
- Being government rather than a private entity
  - Able to engage multiple types of businesses and residents to address opportunities and leverage skills/resources
  - Can leverage planning and zoning to effect changes in efficiency
  - More leverage to get local utilities to engage in this effort

HOK's 9 Elements of Community



Berkeley County Comprehensive Planning

Berkeley County

Systems Integration Menu

Source: L. Krier

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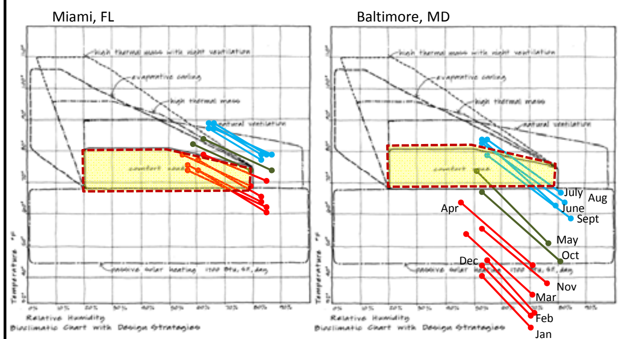
Energy Mapping



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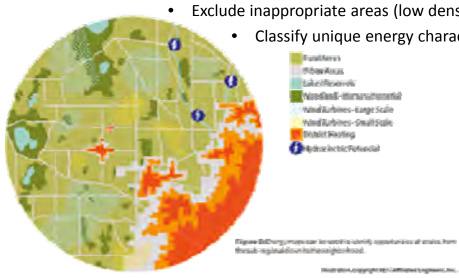
Energy Mapping

- Identify local energy opportunities in development areas
  - Inform growth options and help prioritize investment
    - Exclude inappropriate areas (low density; rural)
      - Classify unique energy character areas



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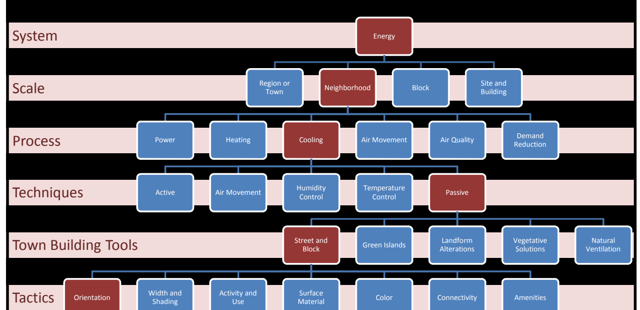
Complete Town Planning

Tool Kit Menu



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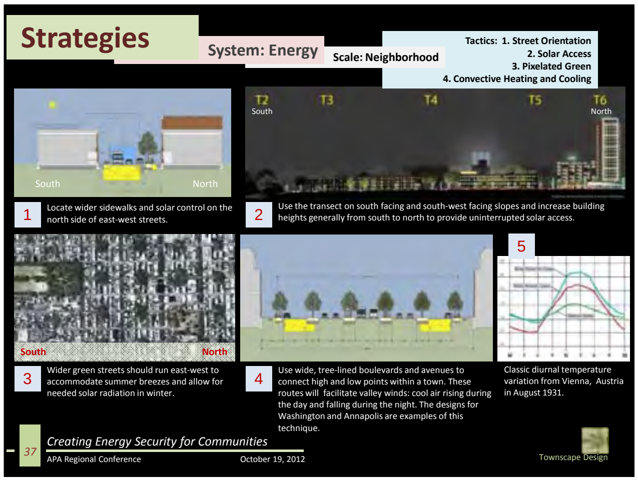
Strategies
System: Energy
Scale: Neighborhood
Tactics: 1. Street Orientation
2. Solar Access
3. Pixelated Green
4. Convective Heating and Cooling
South
North
T2
South
T3
T4
T5
T6
North
1
Locate wider sidewalks and solar control on the north side of east-west streets.
2
Use the transect on south facing and south-west facing slopes and increase building heights generally from south to north to provide uninterrupted solar access.
5
South
North
3
Wider green streets should run east-west to accommodate summer breezes and allow for needed solar radiation in winter.
4
Use wide, tree-lined boulevards and avenues to connect high and low points within a town. These routes will facilitate valley winds: cool air rising during the day and falling during the night. The designs for Washington and Annapolis are examples of this technique.
Classic diurnal temperature variation from Vienna, Austria in August 1931.
37
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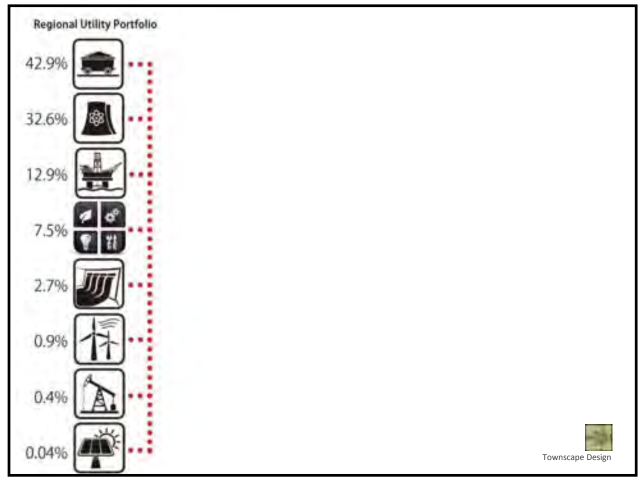
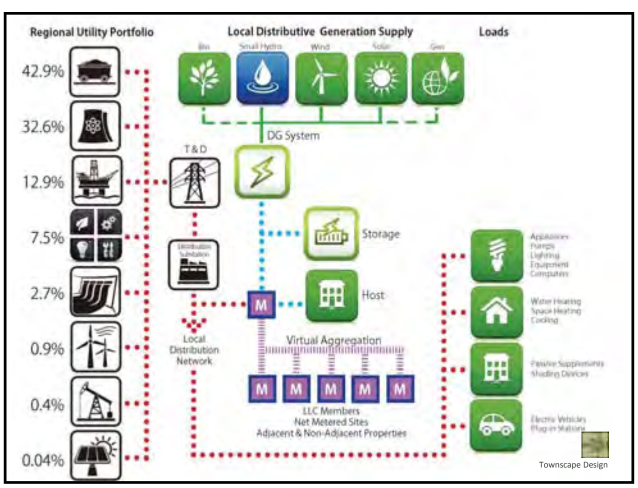
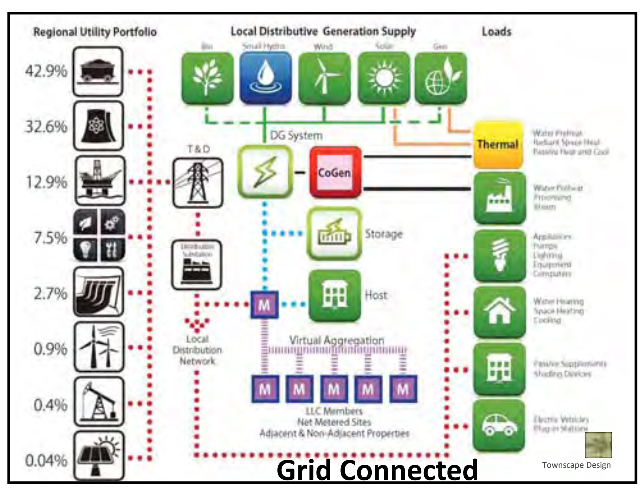
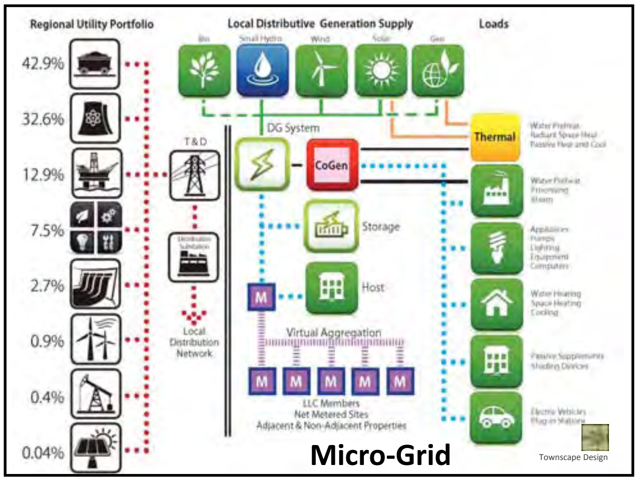

Regional Utility Portfolio
42.9%
32.6%
12.9%
7.5%
2.7%
0.9%
0.4%
0.04%
Townscape Design


Regional Utility Portfolio
Local Distributive Generation Supply
Loads
42.9%
32.6%
12.9%
7.5%
2.7%
0.9%
0.4%
0.04%
DG System
T & D
Storage
Host
M
Local Distribution Network
Virtual Aggregation
LLC Members
Net Metered Sites
Adjacent & Non-Adjacent Properties
Townscape Design


Regional Utility Portfolio
Local Distributive Generation Supply
Loads
42.9%
32.6%
12.9%
7.5%
2.7%
0.9%
0.4%
0.04%
DG System
T & D
CoGen
Thermal
Storage
Host
M
Local Distribution Network
Virtual Aggregation
LLC Members
Net Metered Sites
Adjacent & Non-Adjacent Properties
Grid Connected
Townscape Design



Interconnection

is

Decentralization

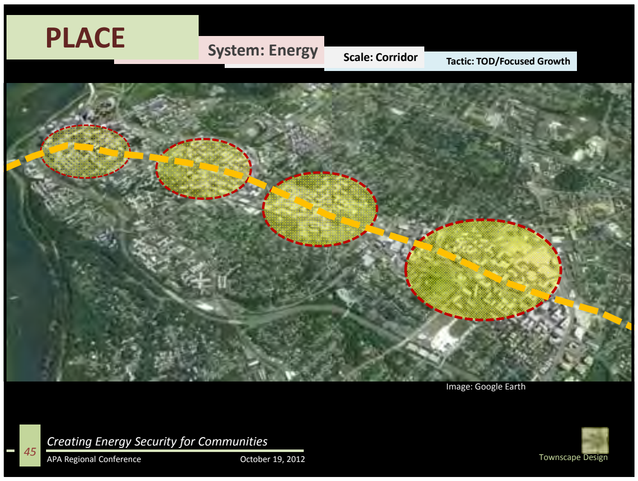
is

Smart Growth

integrated with a new

Smart Grid

(Smart Substations and Integrated Local Power Production)


PLACE
System: Energy
Scale: Corridor
Tactic: TOD/Focused Growth
Image: Google Earth
45
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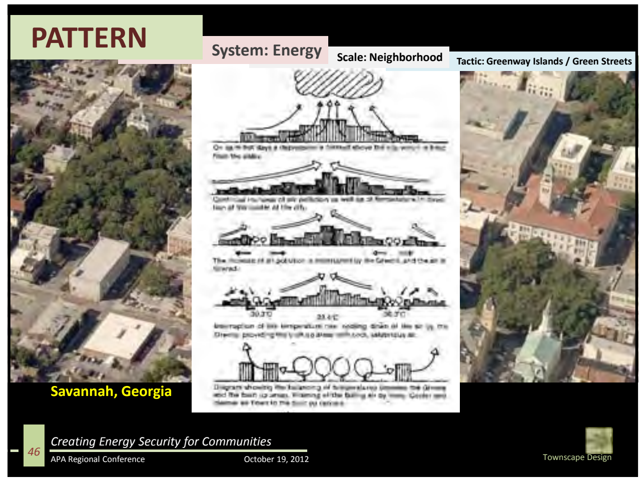
PATTERN
System: Energy
Scale: Neighborhood
Tactic: Greenway Islands / Green Streets
Savannah, Georgia
46
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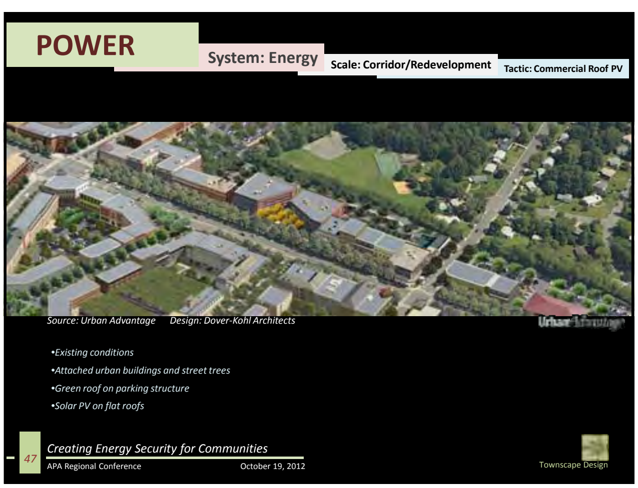
POWER
System: Energy
Scale: Corridor/Redevelopment
Tactic: Commercial Roof PV
Source: Urban Advantage
Design: Dover-Kohl Architects
•Existing conditions
•Attached urban buildings and street trees
•Green roof on parking structure
•Solar PV on flat roofs
47
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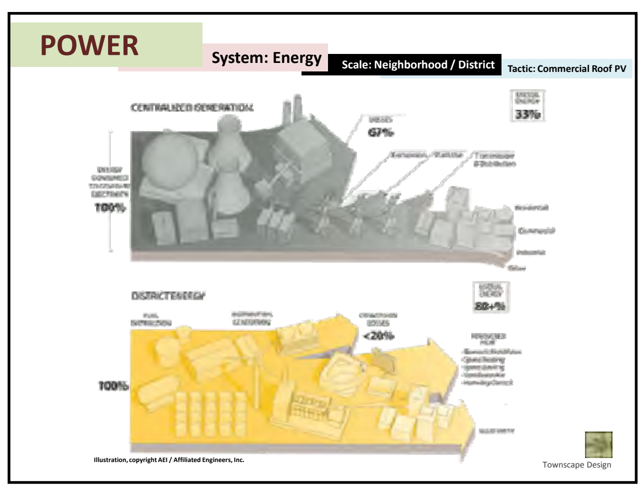
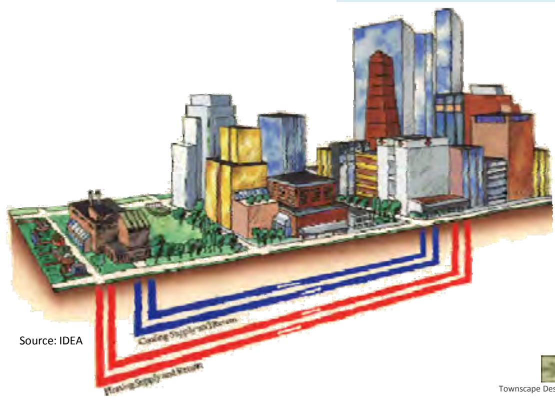

POWER
System: Energy
Scale: Neighborhood / District
Tactic: Commercial Roof PV
CENTRALIZED GENERATION
67%
33%
100%
DISTRICT ENERGY
80+%
<20%
100%
Illustration, copyright AEI / Affiliated Engineers, Inc.
Townscape Design

POWER

System: Energy | Scale: Neighborhood / District | Tactic: District Heat / Cool



Source: IDEA

Townscape Design

POWER

System: Energy | Scale: Neighborhood / District | Tactic: District Heat/Cool

- Underground network of pipes "combines" heating and cooling requirements of multiple buildings
- Creates a "market" for valuable thermal energy
- Aggregated thermal loads creates scale to apply fuels, technologies not feasible on single-building basis
- Fuel flexibility improves energy security, local economy

Source: IDEA

POWER

System: Energy | Scale: Block / Lot | Tactic: Efficiency

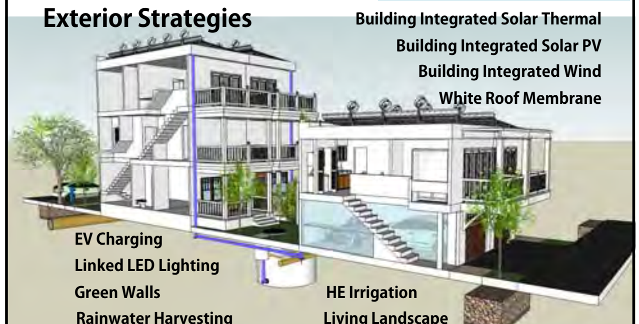
Net Zero Homes…

…designed to produce as much energy as they consume.

POWER

System: Energy | Scale: Block / Lot | Tactic: Neighborhood Power

Exterior Strategies



14 x 32 footprint 3-bed town w/ 1.5 Car Garage / Studio

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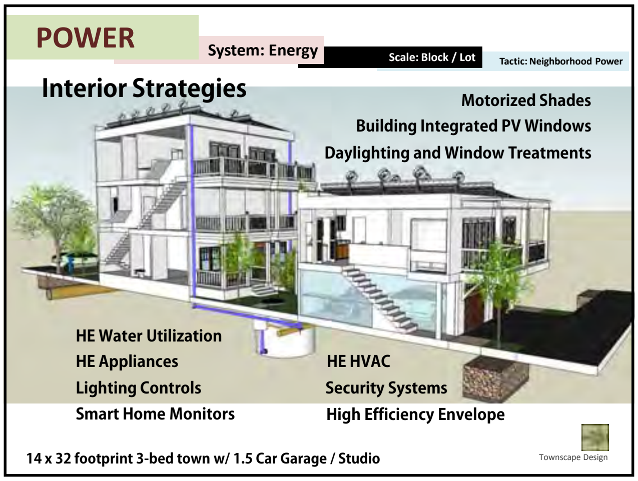
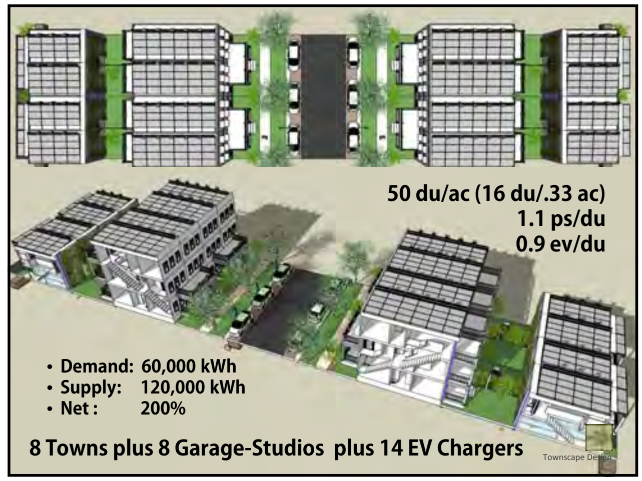
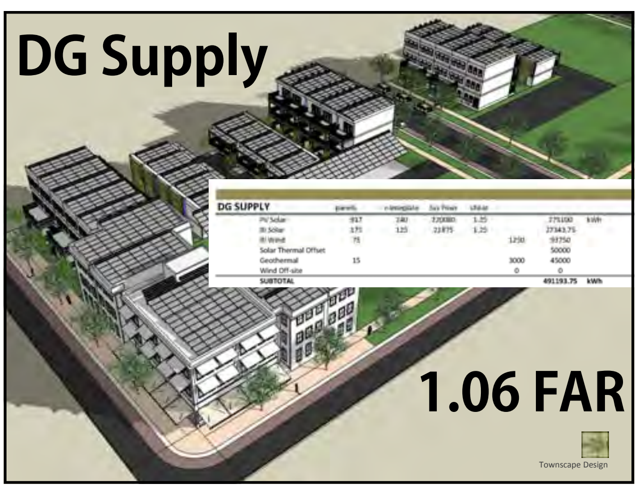
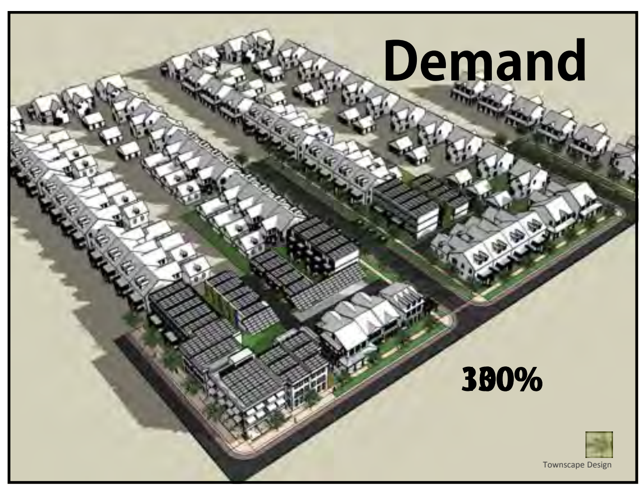






DG SUPPLY	panels	[illegible]	[illegible]	[illegible]			
PV Solar	917	240	220080	1.25		275100	kWh
BI Solar	175	125	21875	1.25		27343.75	
BI Wind	75				1250	93750	
Solar Thermal Offset						50000	
Geothermal	15				3000	45000	
Wind Off-site					0	0	
SUBTOTAL						491193.75	kWh



Net Metering 200% limit

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Zoning Incentives

Montgomery County is providing a unique incentive to developers willing to explore on-site renewable energy

Montgomery County CR Zone (Division 59 –15.8)
59-C-15.856 (b) Energy Conservation and Generation:

"Up to 15 points for constructing buildings that exceed the energy-efficiency standards for the building type by 17.5% for new buildings or 10% for existing buildings. **At least 15 points for providing renewable energy generation facilities on site or within ½ mile of the site for a minimum of 2.5% of the projected energy requirement for the development."**

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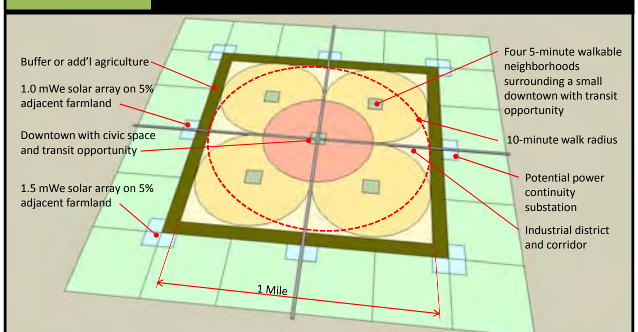
Clean Energy Town Plans



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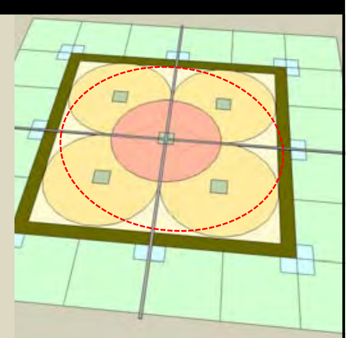
Clean Energy Town Plans

Demand:

•4,000 Residential:	44,000 mWh
•1M SF Commercial/Office :	10,000 mWh
•250,000 SF Industrial:	20,000 mWh
•Institutional	10,000 mWh
•Government & Infrastructure:	6,000 mWh
•Total Est. Annual Demand:	90,000 mWh

Supply:

•General Passive Design Eff.:	10,000 mWh
•11 mWe Solar Farms:	15,000 mWh
•5 mWe Commercial Roofs	6,900 mWh
•20 50kWe Comm. Arrays (62mWx20)	1,250 mWh
•300 15kWe Block Micro-grids:	5,550 mWh
•Off-grid exterior lighting:	4,000 mWh
•1000 net zero homes:	11,000 mWh
•1000 passive homes:	7,480 mWh
•1000 EnergyStar homes:	2,200 mWh
•100 Residential Fuel Cells	1,620 mWh
•200 4kWe Residential Arrays:	1,000 mWh
•4 Community CHP Plants	24,000 mWh
•Total Est. Annual Supply:	90,000 mWh



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The Plan is Shaped by The Drivers

Energy Security
- Focus on baseload generation and energy infrastructure
- Reduce peak loads

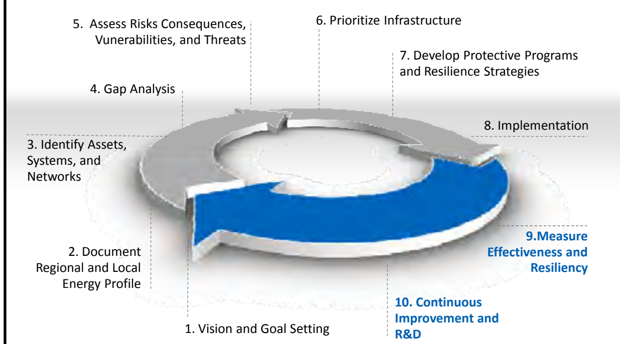
Cost Savings
- Focus on energy efficiency of existing infrastructure
- Use smart urban planning to reduce community energy intensity

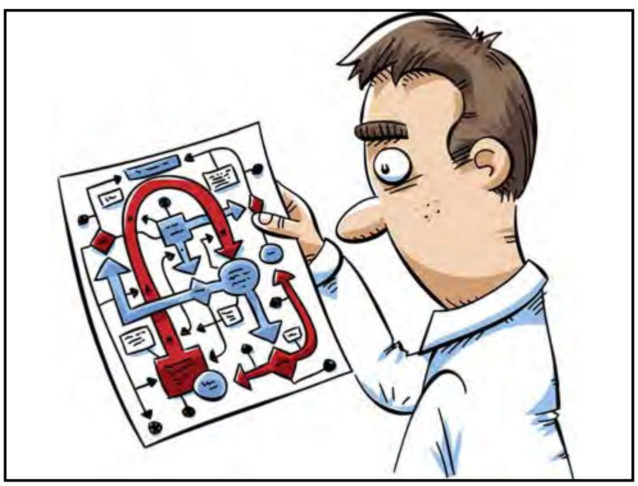
Economic Development
- Focus on new energy projects
- Focus on creating energy skills and technologies within the community

Environmental Impact
- Focus on reducing peak load and avoiding usage of high emission sources
- Focus on clean energy generation

Energy Security Planning

Protection of Critical Infrastructure and Key Resources (CIKR)





Tactics/Technologies to Get There

- Order is critical (*front-load certain efforts*)

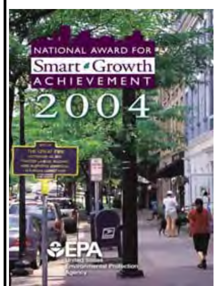
Energy Efficiency → Urban Planning → On-site Generation/ Combined Heat and Power → Renewable Energy

- Incorporate changing energy needs into your planning (growth may require more energy, efficiency efforts may reduce total or peak demand)
- Design programs so that cost savings from one effort can be used to help fund the next
- While you have temporal priorities, a long-term, master plan is critical
- Play to your community's strengths
- Look outside your community for support

Energy Planning Considerations: Energy Intensity / Efficiency

- Where is energy used in your community?
- Where are the financial and environmental impacts most acute? Is it baseload? Peak demand? Power quality?
- What are the barriers keeping residents and businesses from improving energy performance right now?
- What incentives can be leveraged to offset project costs (utility, state, Federal, etc.)
- What skills do you have in the community to address these issues?

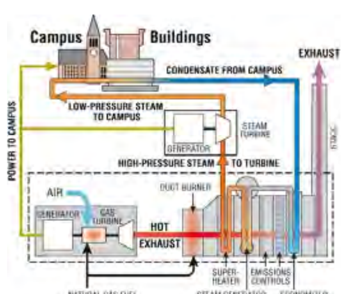
Energy Planning Considerations: Urban Planning



- What have other, similar communities done that has worked or not worked. Why and how do these lessons apply to your community?
- What legacy urban infrastructure issues impact your ability to affect energy independence?
- How can the drivers of your community master plan be aligned with energy independence efforts?

Energy Planning Considerations: Fossil Generation

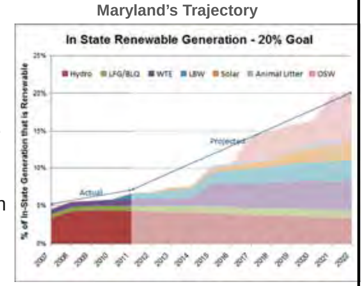
- How would additional generation (central or distributed) impact your community's energy independence?
- Are there opportunities to deploy combined heat and power applications?
- Do you have reliable access to fossil fuel sources?
- What is the transportation requirement for those sources?



Energy Planning Considerations: Renewable Energy

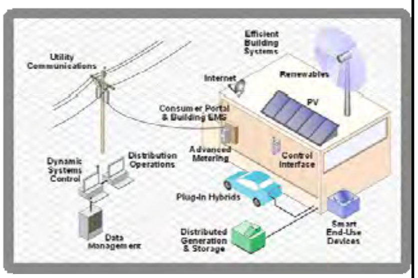
- What are the renewable energy sources available within your community?
- What additional incentives exist (utility, state, Federal) to support the financial case for renewables?
- Does your community have logical spaces for installation of renewables?
- Does your state have a net-metering law? (*YES!*)
- What is stance of the local utility on renewable integration into their grid?

Maryland's Trajectory



Energy Planning Considerations: Smart Grid

- To what extent does our community need to invest in smart grid and smart buildings in order to achieve our energy goals?
- What are the initial priorities for smart grid vis-à-vis our long-term plan?
- How can this effort be coordinated across our entire community by the government and electric utility?



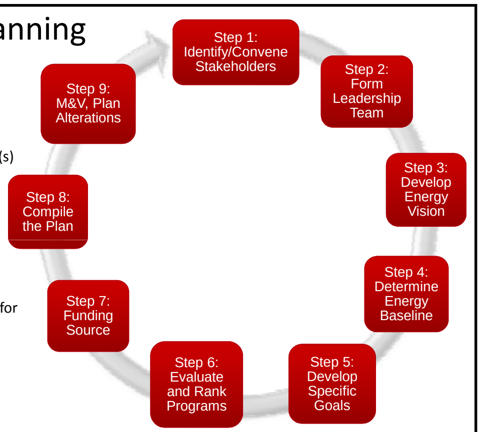
Energy Independence Planning

- This effort should be integrated with the economic development plan, sustainability plan, and urban master plan.

Energy Planning Cycle

Requirements:

- ✓ Key local champion(s)
- ✓ High-level support
- ✓ Community buy-in
- ✓ Transparency
- ✓ Excellent project management
- ✓ Communication of process and results
- ✓ Leveraging success for each next step



Who Needs To Be Involved?

Sector	Areas of Impact		
	Demand - Buildings	Demand - Transportation	Energy Supply
Public			
Residential			
Commercial			
Non-governmental			
Institutions			
Utilities – electric & fuel			

Critical First Steps

- Determine if/why your community should be moving along the continuum of energy independence
- Meet with your key stakeholders to determine if planning for energy independence can benefit your community
- Evaluate your opportunities – what resources do you have and what are your challenges?
- Create a vision for your community's energy independence
- Set priorities for near-term energy independence development
- Engage stakeholders to understand their levels and areas of commitment and determine the most productive tactics to increase energy independence.

4 Point Proposal:

"Our proposal is to simply correlate Smart Growth with the Smart Grid through the deployment of *distributed generation* of clean, renewable and small scale power production plants linked with *power continuity units* that will begin to provide risk management and grid security through decentralization, peak load shaving capacity, critical circuit continuity in the event of grid failure, legacy grid resiliency and local power production. This deployment is *scalable* to differing situations, with quick mobilization potential, but it all starts with a *comprehensive energy plan*."

----David Ager, Townscape Design
to Abigail Hopper, Energy Advisor to the Governor
September 5, 2012

SERVING THIS GROWING COMMUNITY SINCE 1896

WITH CHEAP and AMPLE ELECTRIC POWER

Equipment and personnel at the H. & F. Railway Company plant at Lee and Summit Streets in Hagerstown in the early 1900's.

The Hagerstown and Frederick Railway Co. (a predecessor of The Potomac Edison Co.) purchased Hagerstown's first light plant in 1896.

Since this small beginning, P.E.'s electric power facilities have grown until today when 21 sources of power are now available to customers in this area.

And Reddy is already planning for a big electrical future here. New generating units, new power lines, new facilities to help you Live Better . . . Electrically.

THE POTOMAC EDISON COMPANY

Energy Integration

4 Point Approach

Thank you for your time.

We would appreciate your questions.

We would be happy to engage with you after today's session

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