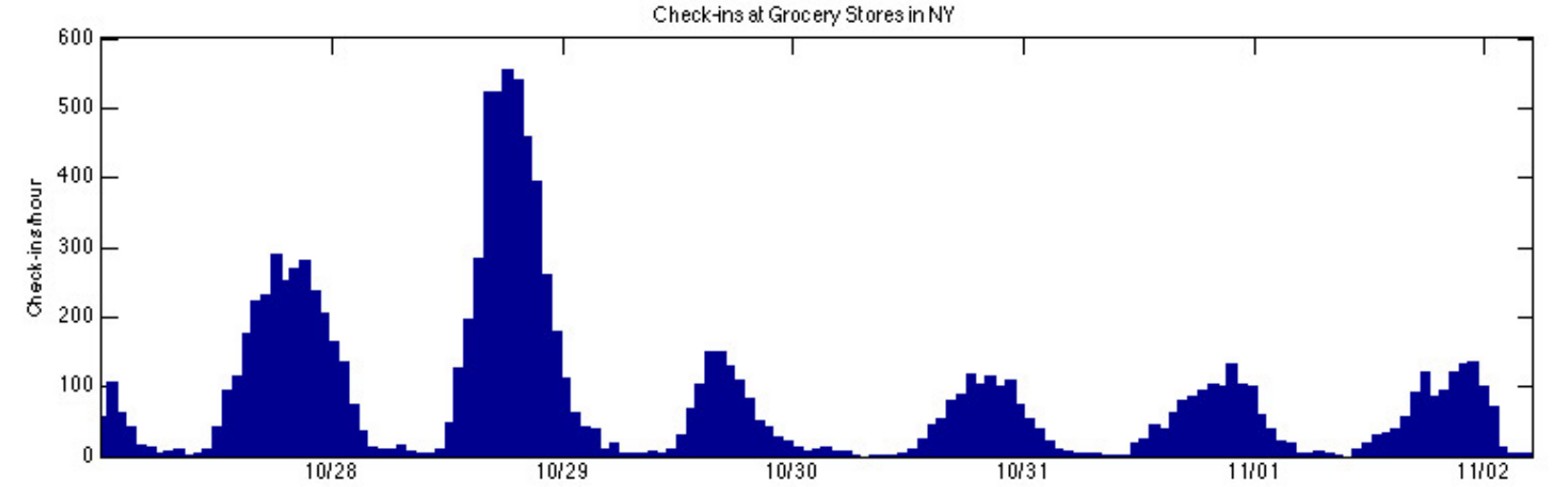
Planning for Micro-grids and Disaster Relief

Integrating Microgrids and Community Planning

What do you do when...



Planning for Micro-grids and Disaster Resilience

2013 MPCA MEETING, ABERDEEN, MARYLAND

Planning for Micro-grids and Disaster Resilience

2013 MPCA MEETING, ABERDEEN, MARYLAND

Princeton, NJ

June 30, 2012

de·re·cho

dāˈrāˌCHō/
noun

1. a line of intense, widespread, and fast-moving windstorms and sometimes thunderstorms that moves across a great distance and is characterized by damaging winds.

AP photo by,Salisbury Daily Times, Kristin Roberts

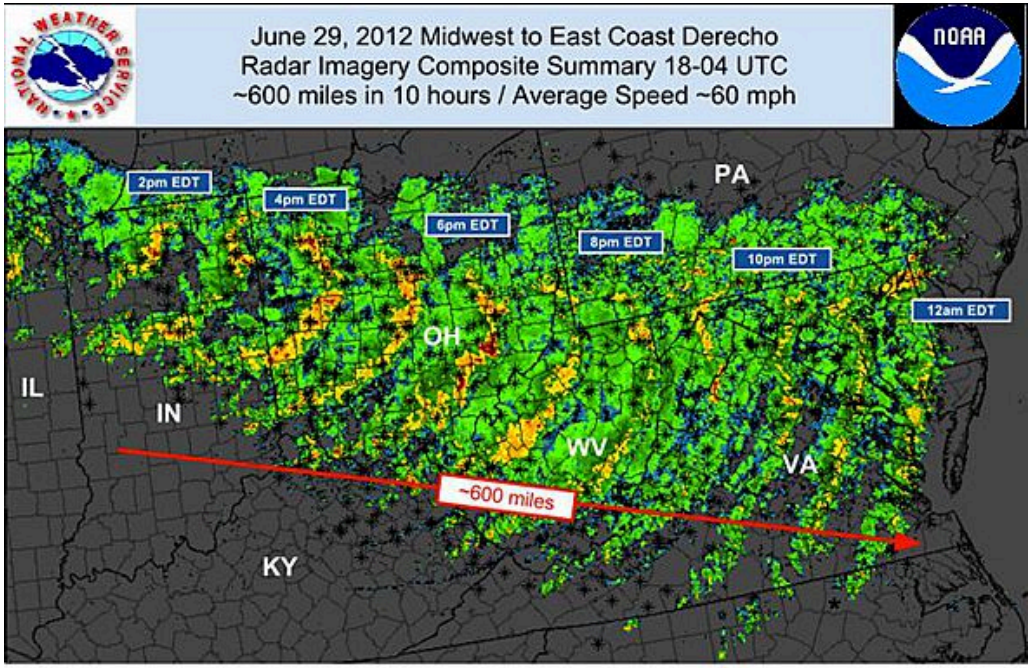
June 29, 2012

The East Coast Derecho Strikes

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.



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

Summary Map by G. Carbin NWS/Storm Prediction Center

Maryland / DC (685,000)

343,569 – PEPCO
316,634 – BGE
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+)

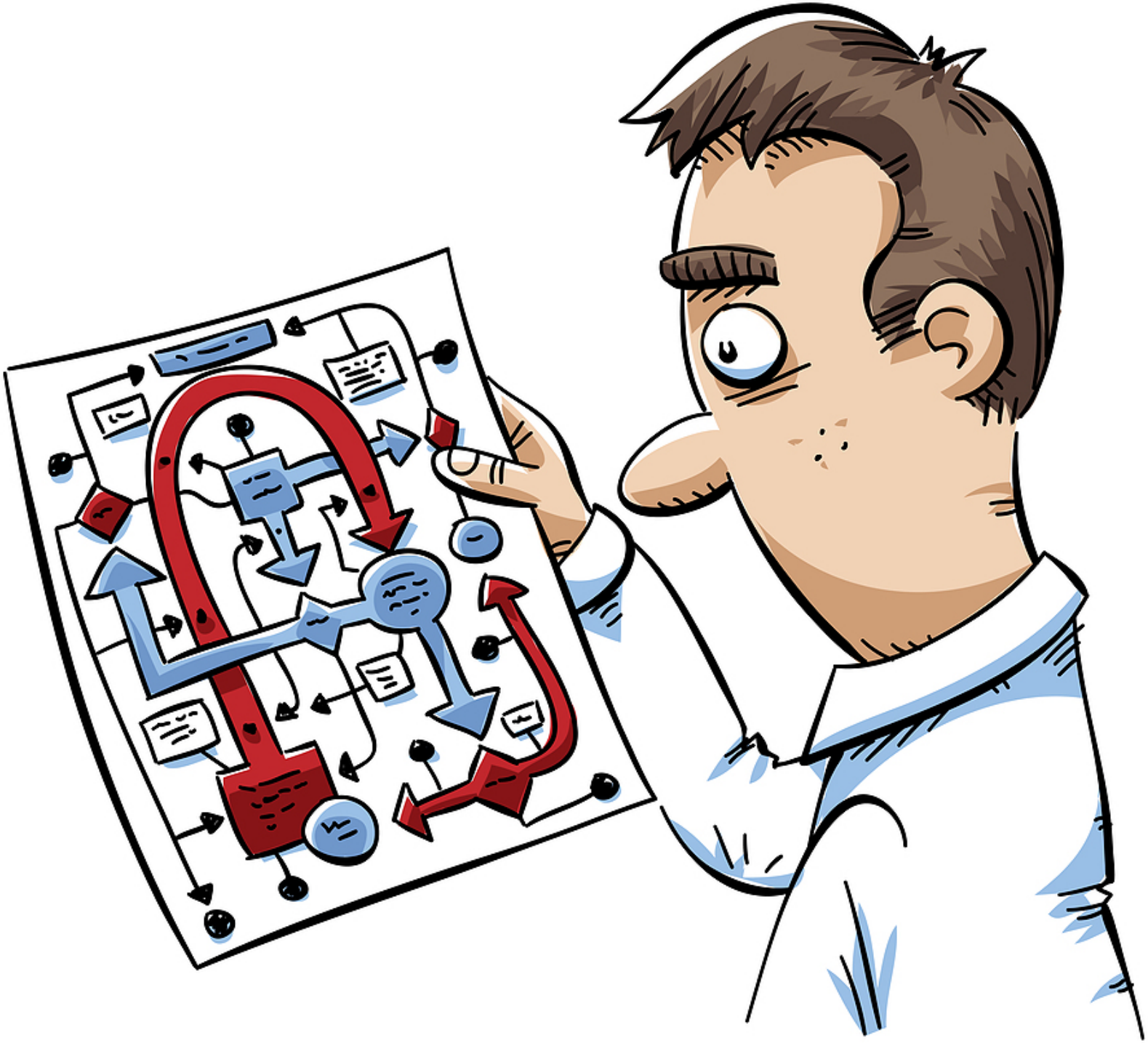
296,904 – Appalachian Power
220,005 – Potomac Edison
11,478 – AEP Ohio

Indiana (75,000+)

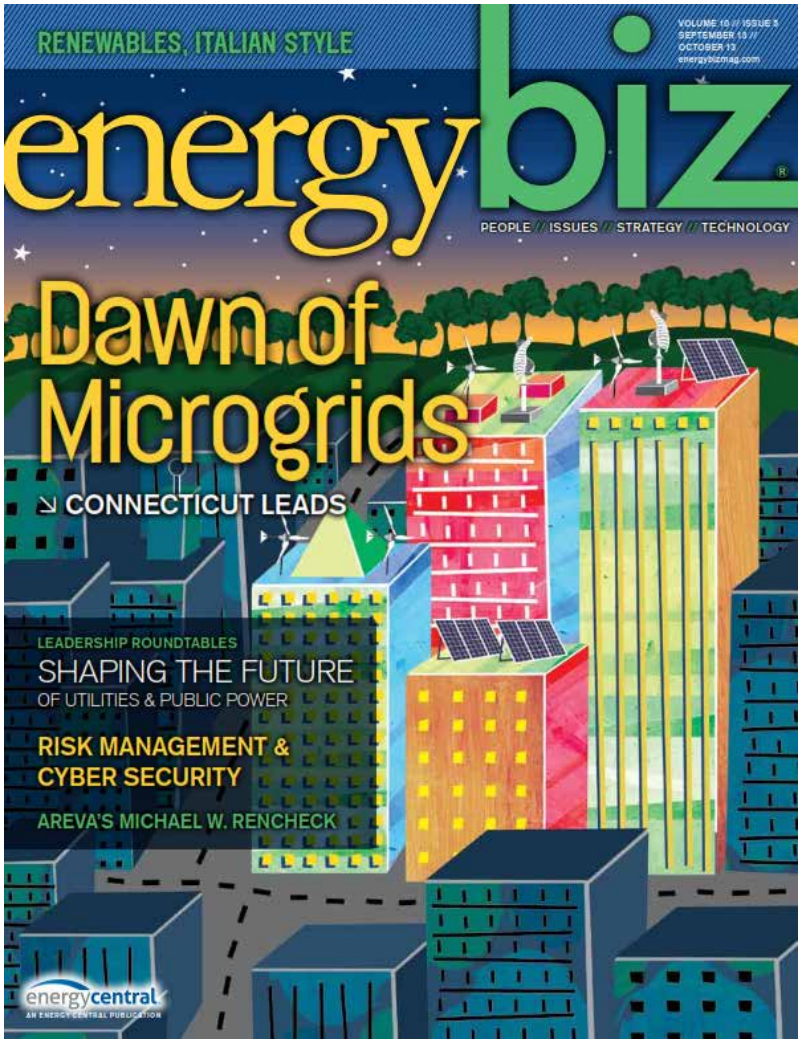
74,750 – Indiana & Michigan Power

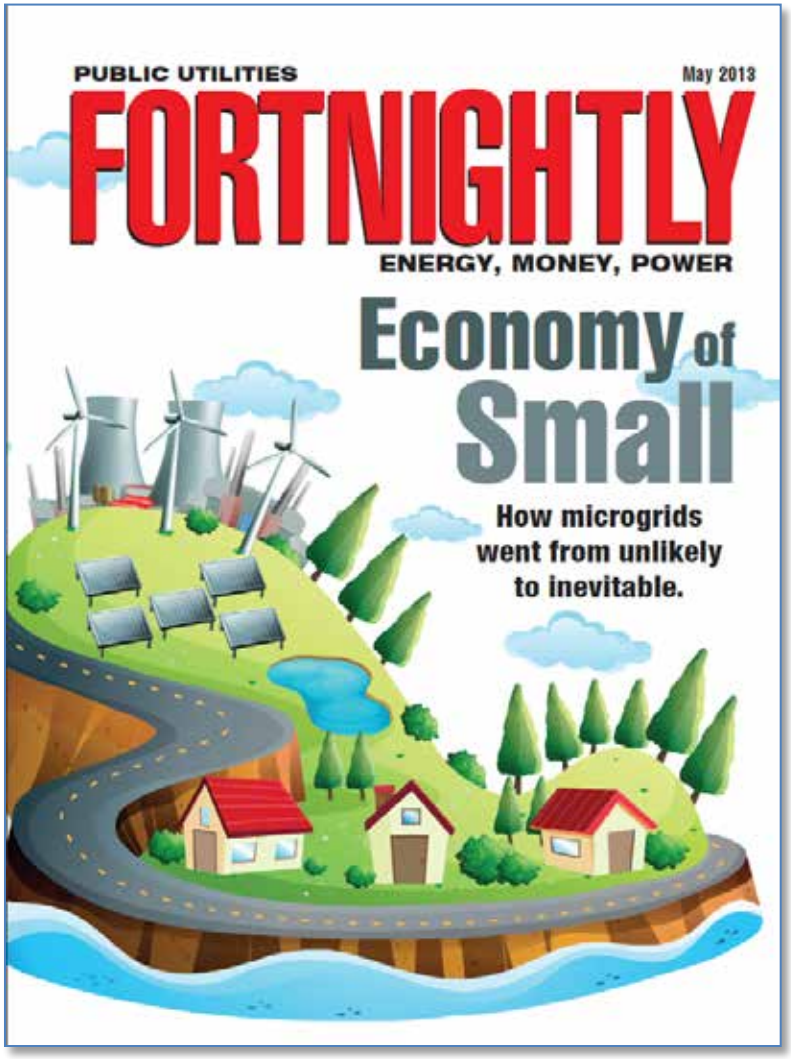
AP Photo/Jeff Gentner

AP Photo/Karen Mahabir



In the news...


RENEWABLES, ITALIAN STYLE
energybiz
PEOPLE // ISSUES // STRATEGY // TECHNOLOGY
Dawn of Microgrids
CONNECTICUT LEADS
LEADERSHIP ROUNDTABLES
SHAPING THE FUTURE
OF UTILITIES & PUBLIC POWER
RISK MANAGEMENT & CYBER SECURITY
AREVA'S MICHAEL W. RENCHECK
energycentral


PUBLIC UTILITIES
May 2013
FORTNIGHTLY
ENERGY, MONEY, POWER
Economy of Small
How microgrids went from unlikely to inevitable.

Drivers:

Source: GE

Successful Community Energy Planning

Three Groups of Balanced Benefits

Competitiveness

1. Energy cost
2. Employment
3. Investment

Security

4. Supply security
5. Supply quality
6. Flexibility

Environment

7. Greenhouse Gas Reduction

Something for the Entire Community

Courtesy: Peter Galforth

Financing Sources and Solutions

Project Class	Financing Sources: Strategic Equity	Tax Equity	Term Debt	Constr Debt	Bridge Debt	Credit Support	Grants	State Incentives	PACE	Other
Solar										
Wind										
Bio Fuels										
CHP										
DR										

Source: SEM/Pace Global

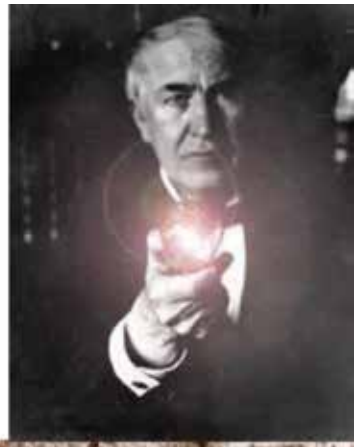
Key

- Excellent capital availability for well-structured projects
- Good capital availability for well-structured projects
- Average capital availability with emerging challenges
- Significant challenges to capital availability
- Not available, or only in special cases

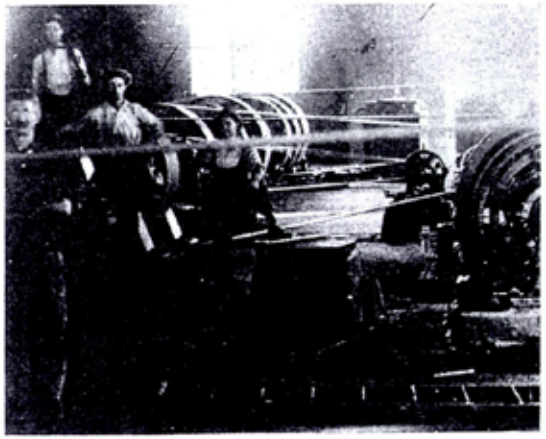
Not a new idea...

Pearl Street Microgrid (1882)

- Ten 27 ton 100Kw steam Gensets
- DC Power Microgrid
- Served 59 Customers
- Islanded operation
- HMI enabled



GE imagination at work



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

SERVING THIS GROWING COMMUNITY SINCE 1896

WITH CHEAP and AMPLE ELECTRIC POWER

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

Value Proposition

So Why Do This?

•Reduced Cost
•Reliability
•Security
•Green Power
•Service and Source Differentiation: Choice

When should we start?

Now

Why:

It takes decades to implement, and

IT TAKES COMPREHENSIVE PLANNING

Connecticut Department of Energy and Environmental Protection

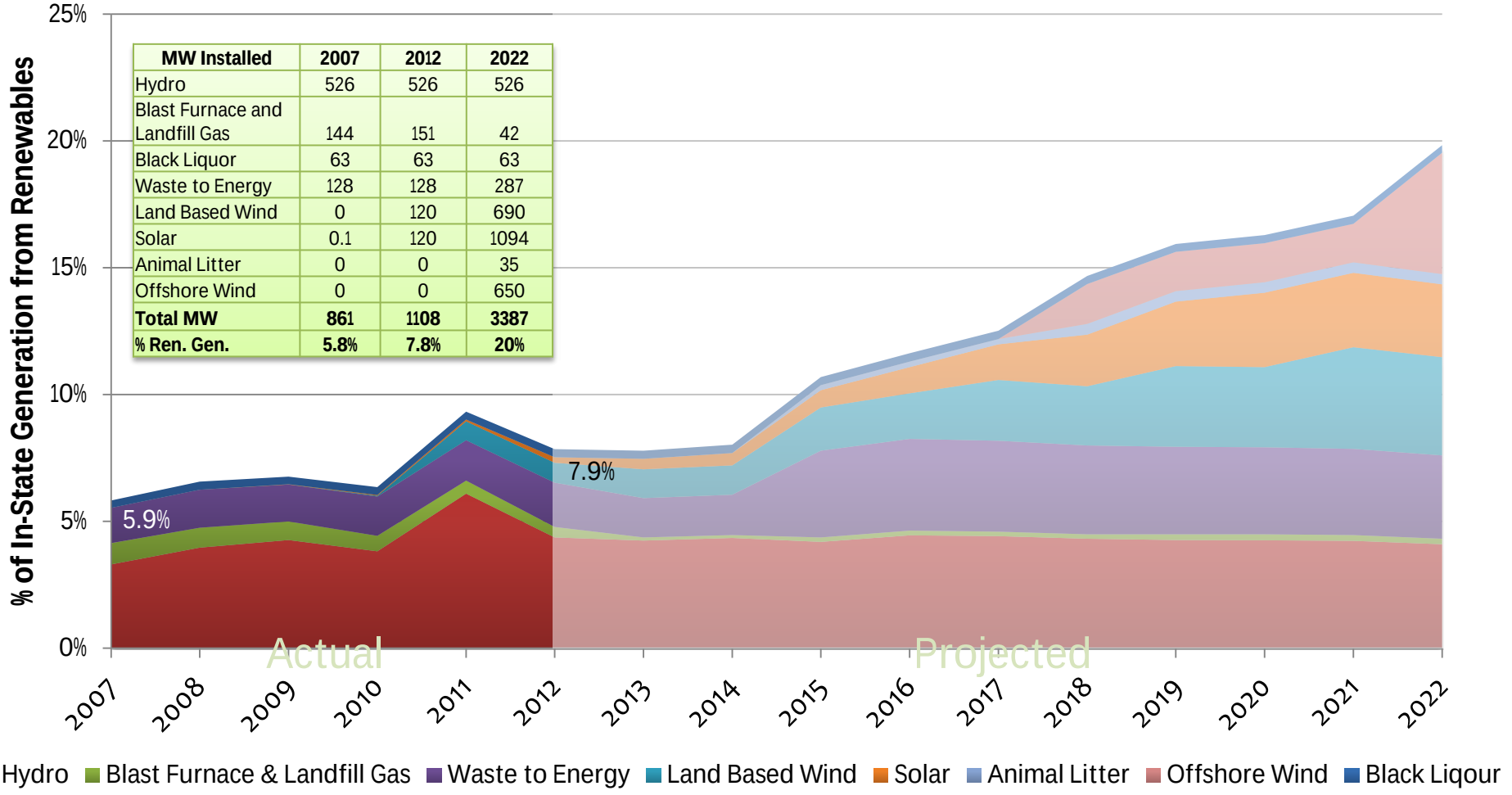
Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

A fresh approach in Connecticut

- Governor Dannel Malloy wanted to do something different
- Worked with Connecticut legislature to design a “microgrid” program
- Program provides enhanced levels of safety and quality of life for Connecticut residents in large-scale outage situations

Maryland's Strategic Goal
20% In-State By 2022

MW Installed	2007	2012	2022
Hydro	526	526	526
Blast Furnace and Landfill Gas	144	151	42
Black Liquor	63	63	63
Waste to Energy	128	128	287
Land Based Wind	0	120	690
Solar	0.1	120	1094
Animal Litter	0	0	35
Offshore Wind	0	0	650
Total MW	**861**	**1108**	**3387**
% Ren. Gen.	**5.8%**	**7.8%**	**20%**



Source: MEA

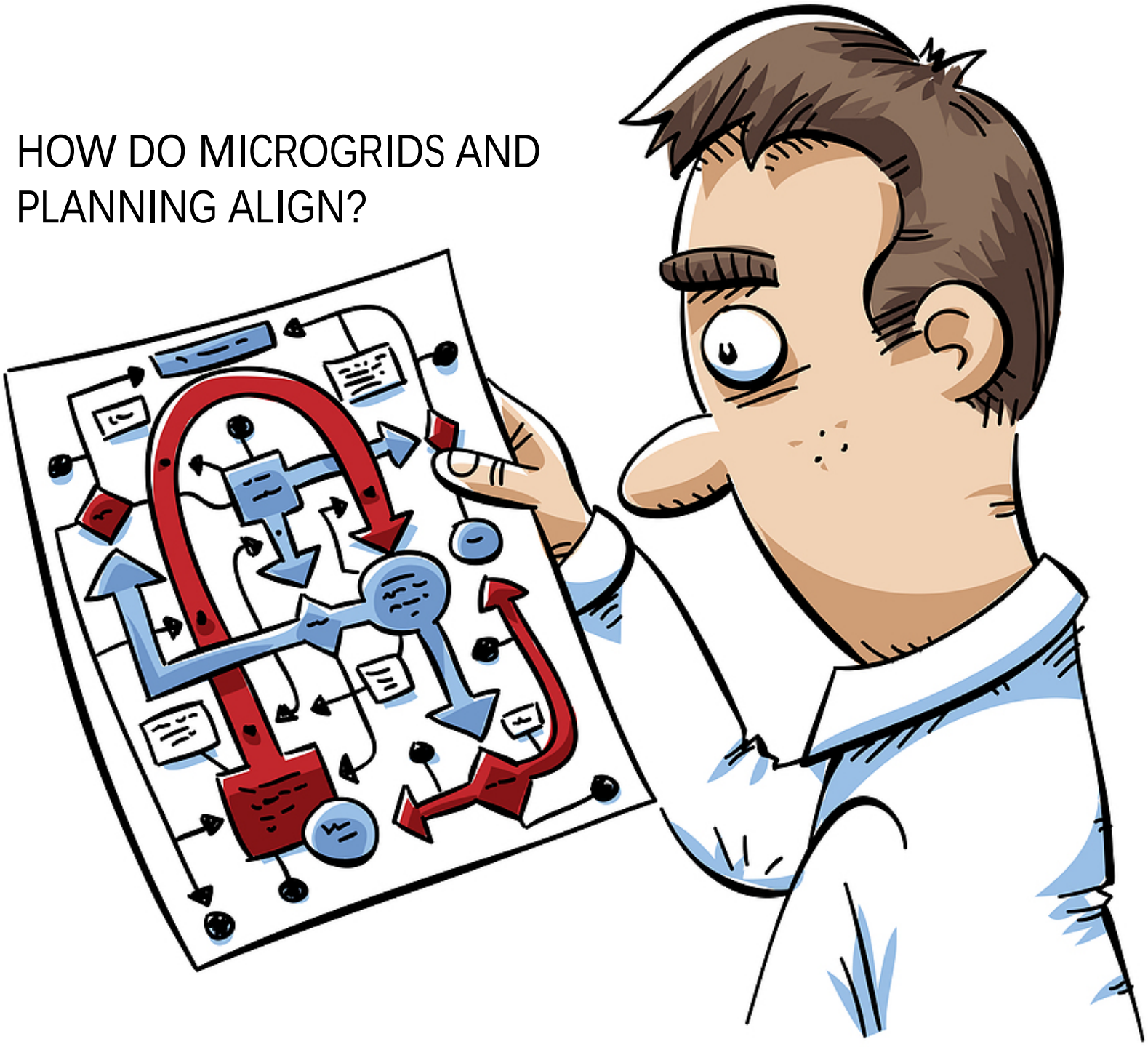
2013 MARYLAND CLEAN ENERGY SUMMIT

SOLVING the DISTRIBUTED ENERGY PUZZLE:
Microgrids & Other Smart Solutions

October 15th & 16th, 2013 • Marriott Inn & Conference Center, UMUC • Hyattsville, MD
www.mcecsummit.org • (443)-949-8505

http://www.mcecsummit.org/agenda/

HOW DO MICROGRIDS AND PLANNING ALIGN?



Homeland Security 18 Critical Sectors


Food and Agriculture


Banking and Finance


Chemical


Commercial Facilities


Communications


Critical Manufacturing


Dams


Defense and Industry Base


Emergency Services


Energy


Government Facilities


Public Health


Information Technology


National Monuments

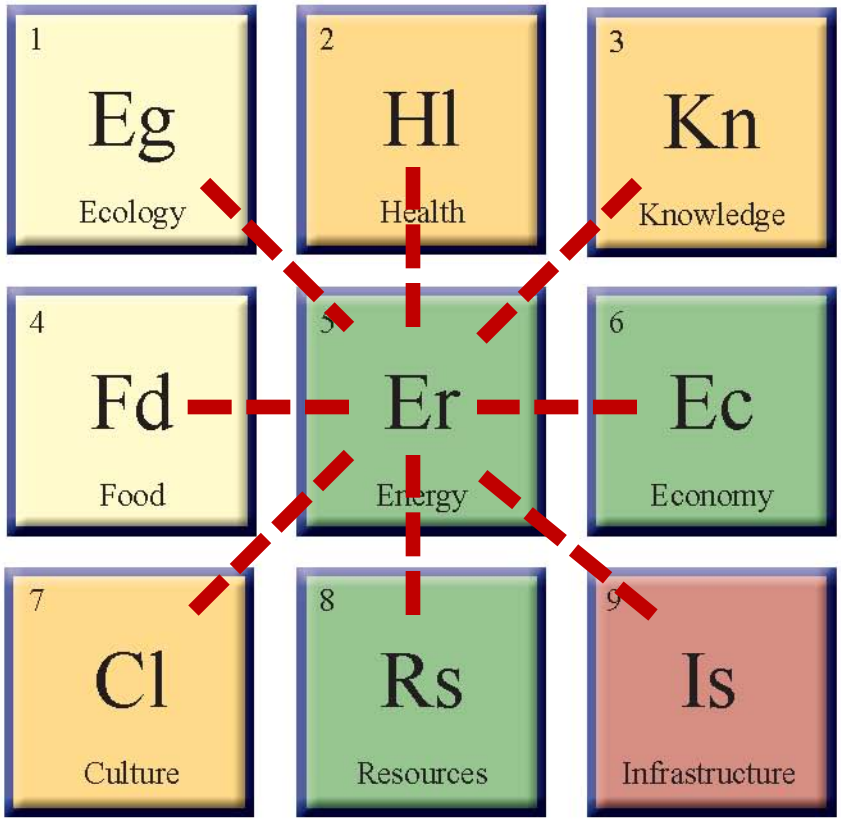

Nuclear Reactors, Materials & Waste


Postal and Shipping


Transportation Systems

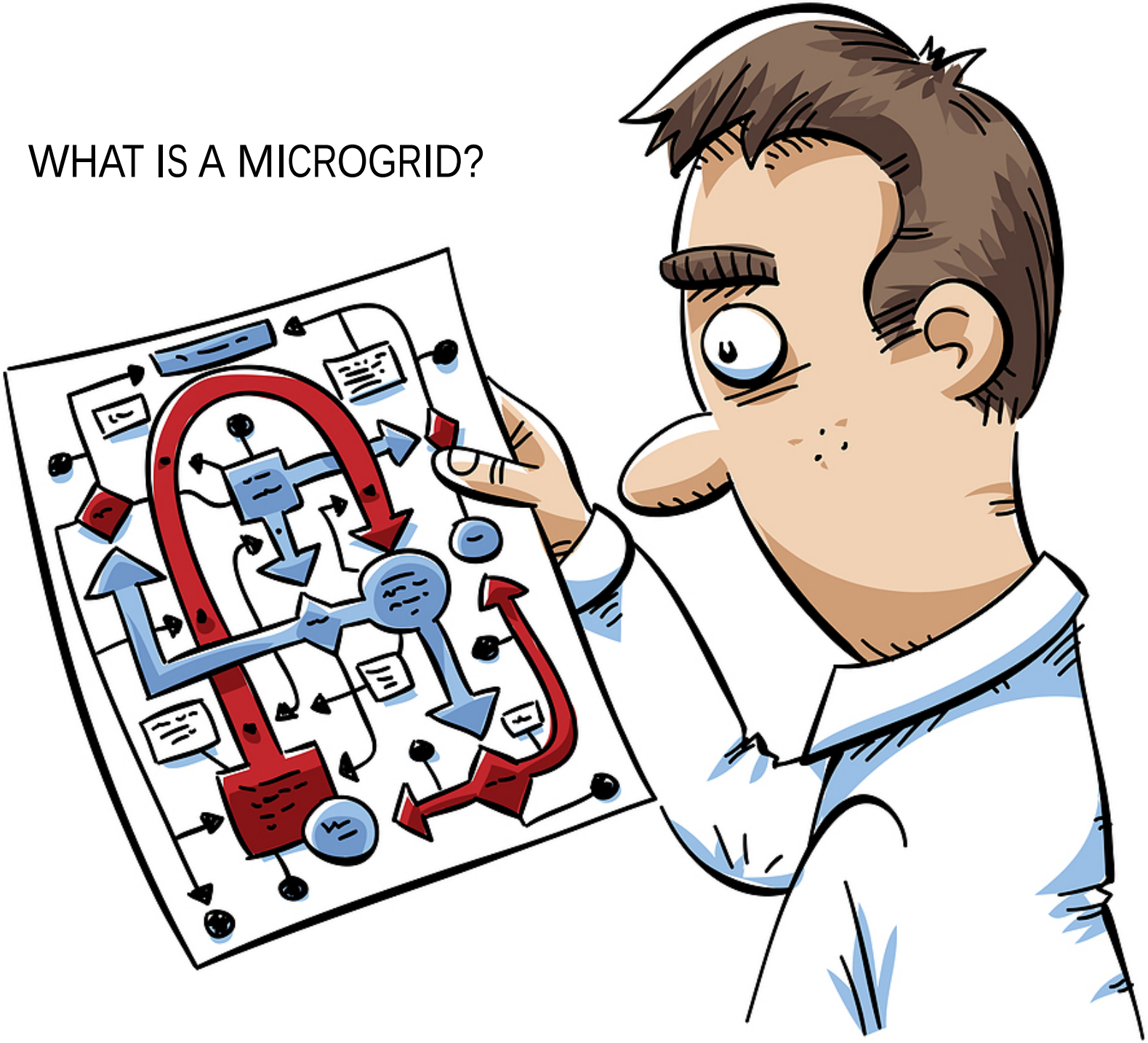

Water

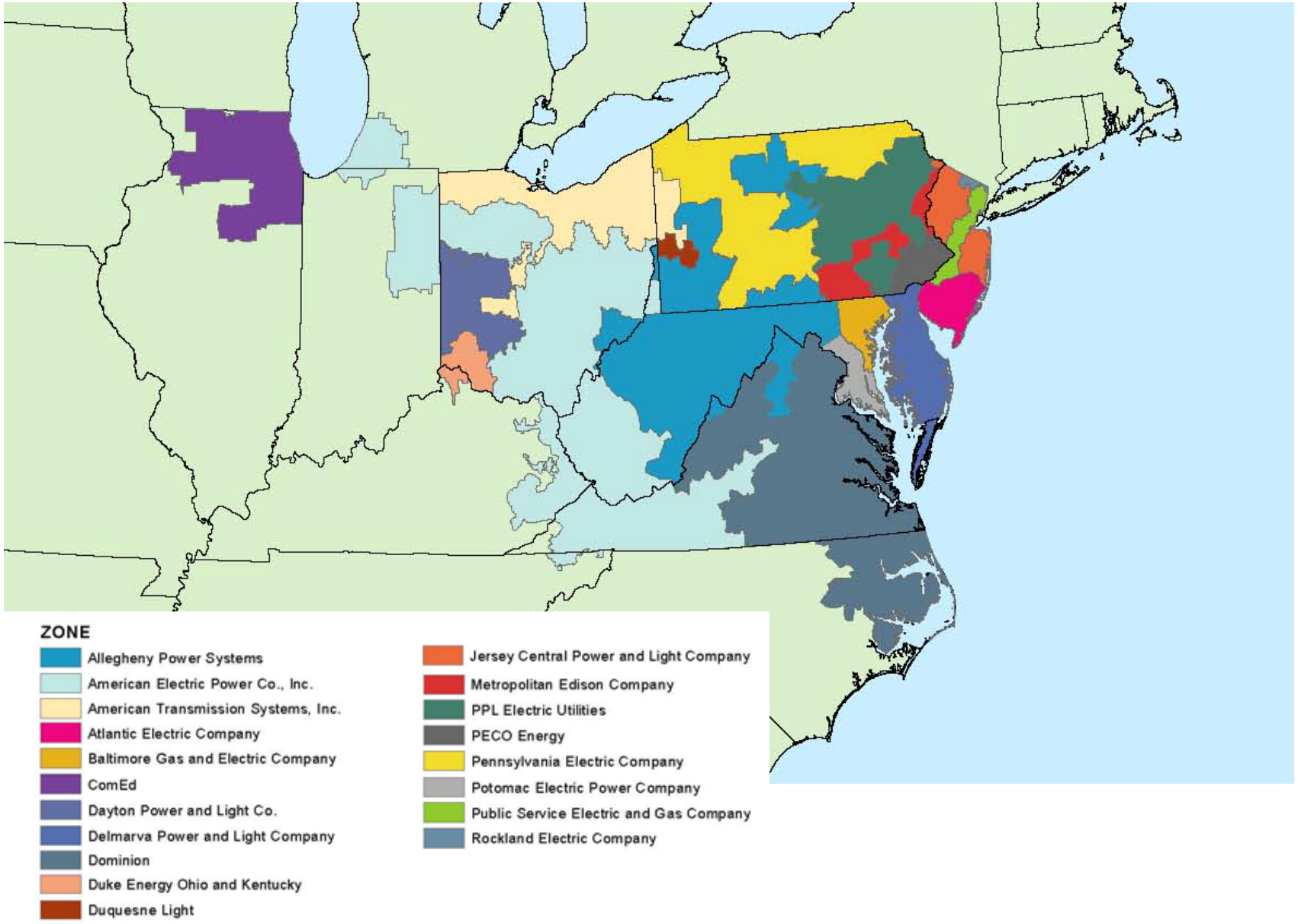
9 Community Elements (HOK)



- **Place**
  Smart Location and Linkages
- **Pattern**
  Neighborhood Pattern and Design
- **Power**
  Sustainable generation and efficient use

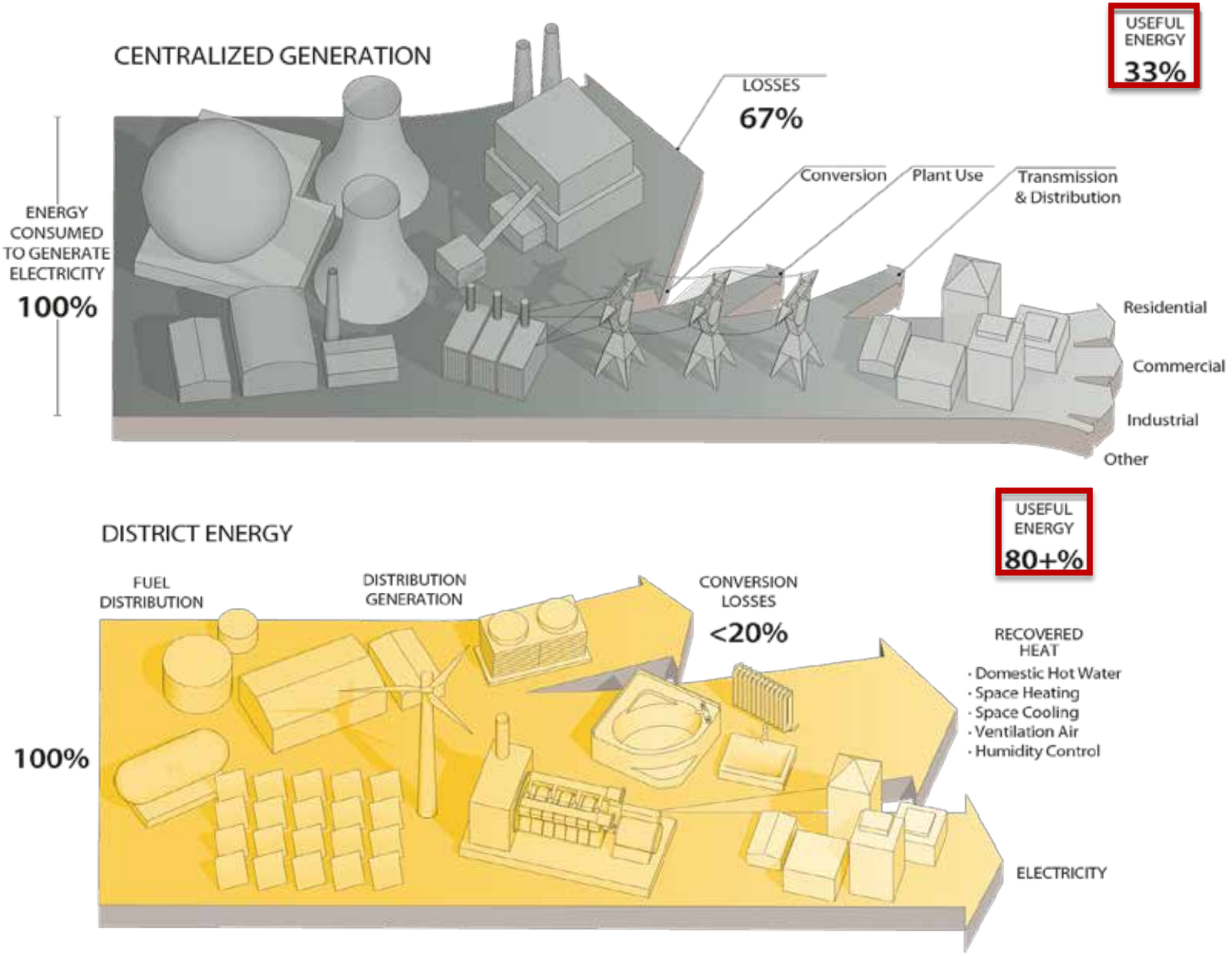
WHAT IS A MICROGRID?





Planning for Micro-grids and Disaster Resilience

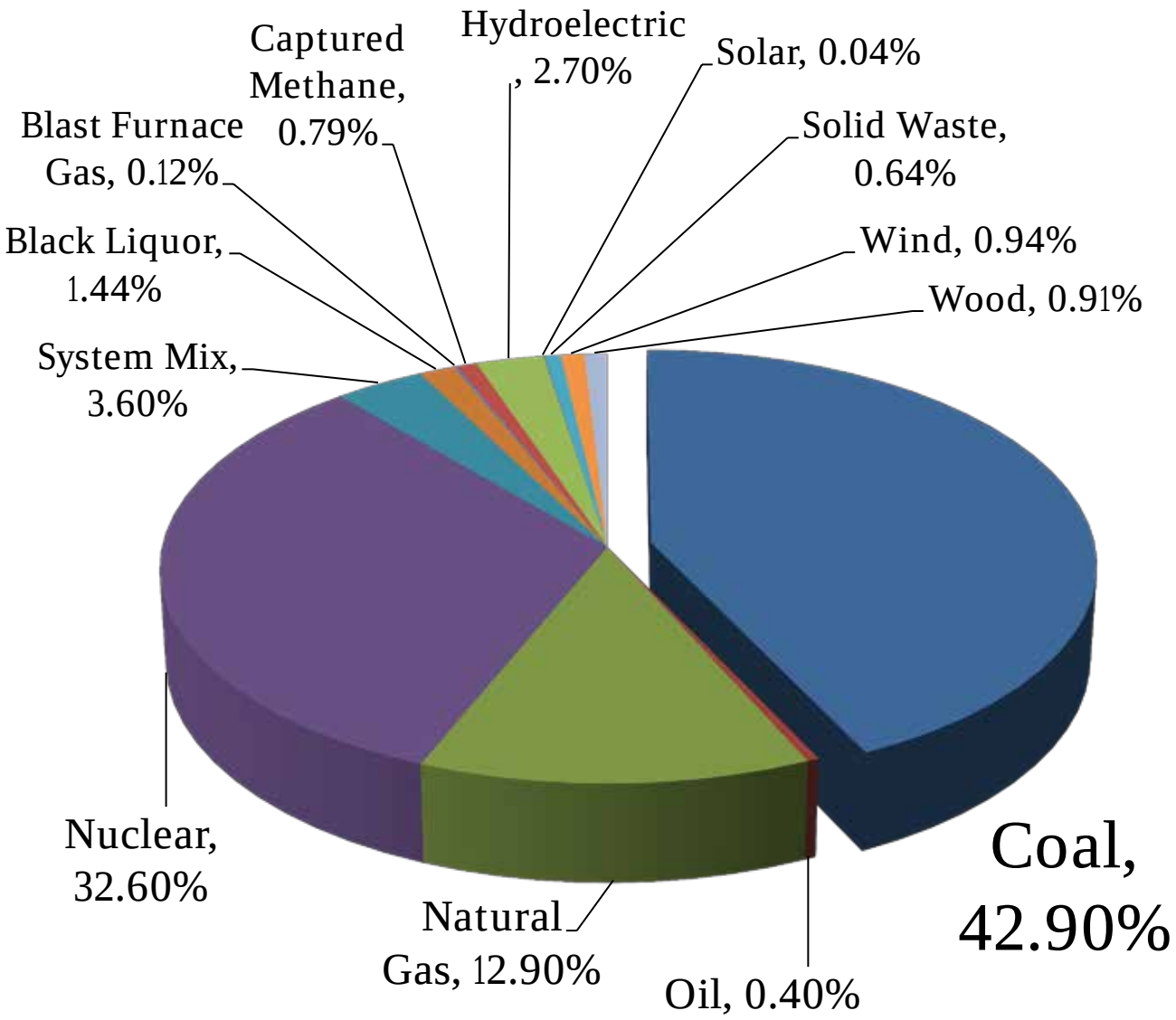
2013 MPCA MEETING, ABERDEEN, MARYLAND

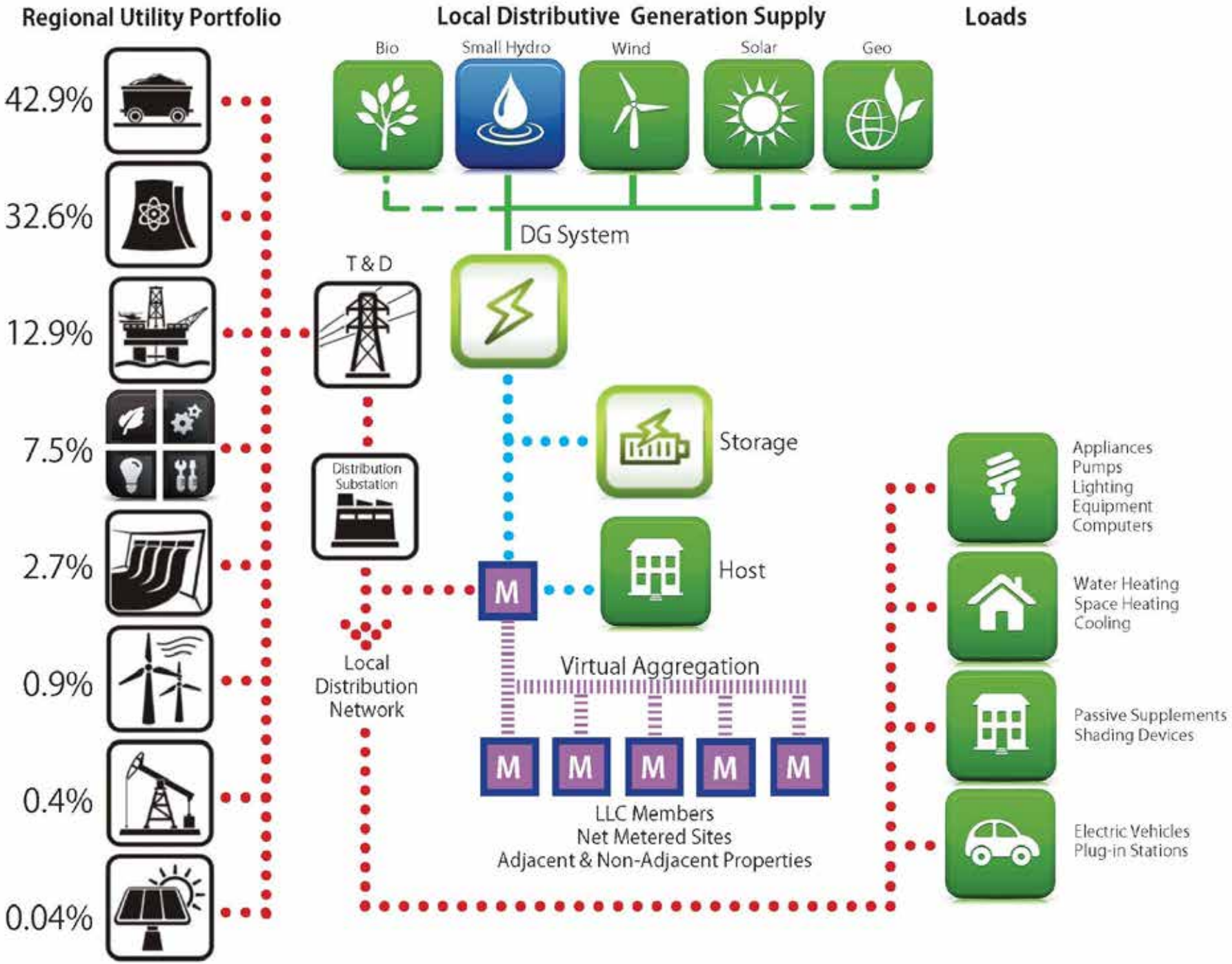


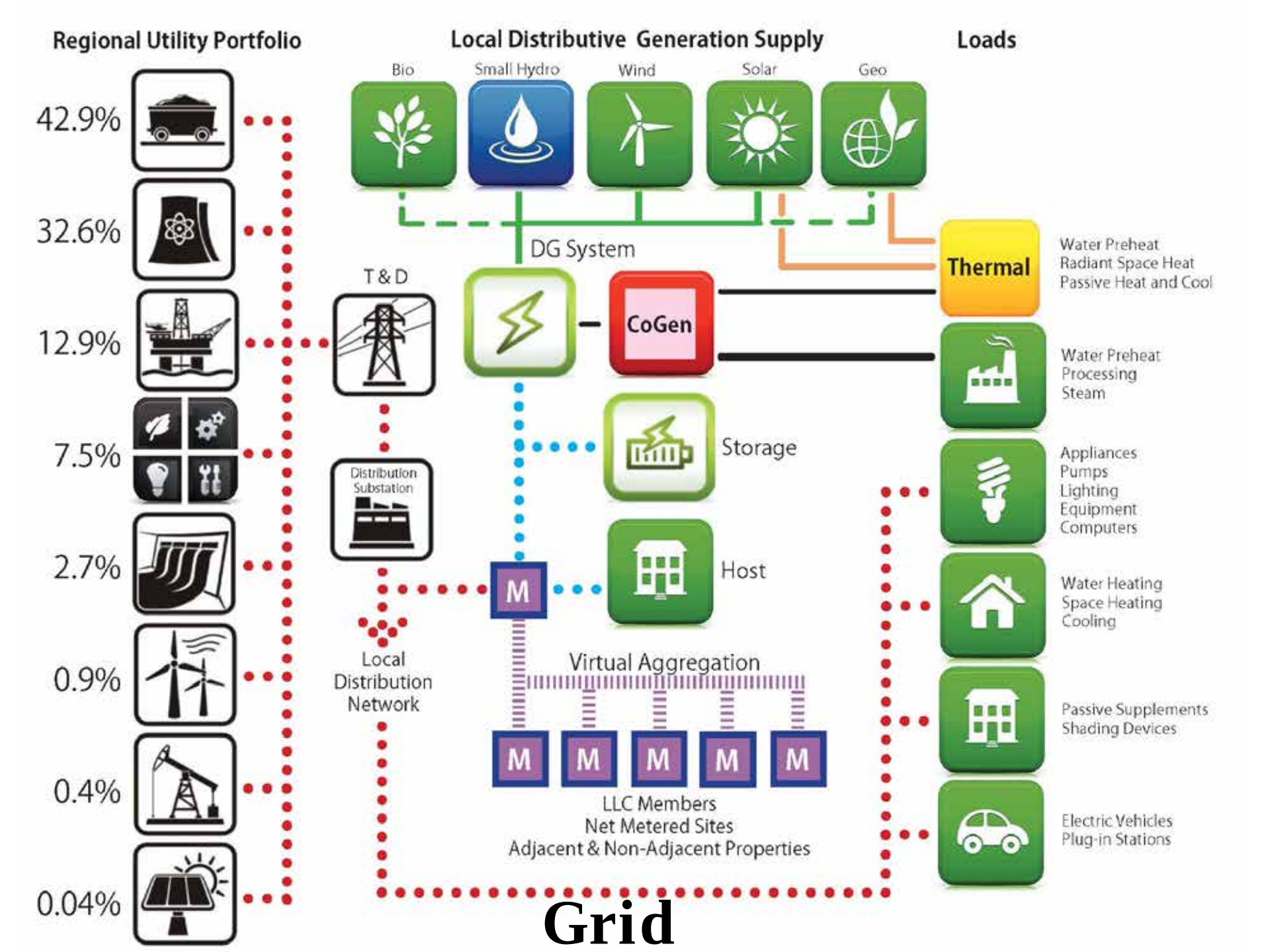
Planning for Micro-grids and Disaster Resilience

2013 MPCA MEETING, ABERDEEN, MARYLAND

Regional Utility Portfolio




Regional Utility Portfolio
Local Distributive Generation Supply
Loads
Bio
Small Hydro
Wind
Solar
Geo
42.9%
32.6%
12.9%
7.5%
2.7%
0.9%
0.4%
0.04%
DG System
T&D
Distribution Substation
Storage
Host
M
Local Distribution Network
Virtual Aggregation
LLC Members
Net Metered Sites
Adjacent & Non-Adjacent Properties
Appliances
Pumps
Lighting
Equipment
Computers
Water Heating
Space Heating
Cooling
Passive Supplements
Shading Devices
Electric Vehicles
Plug-in Stations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Radiant Space Heat
Passive Heat and Cool
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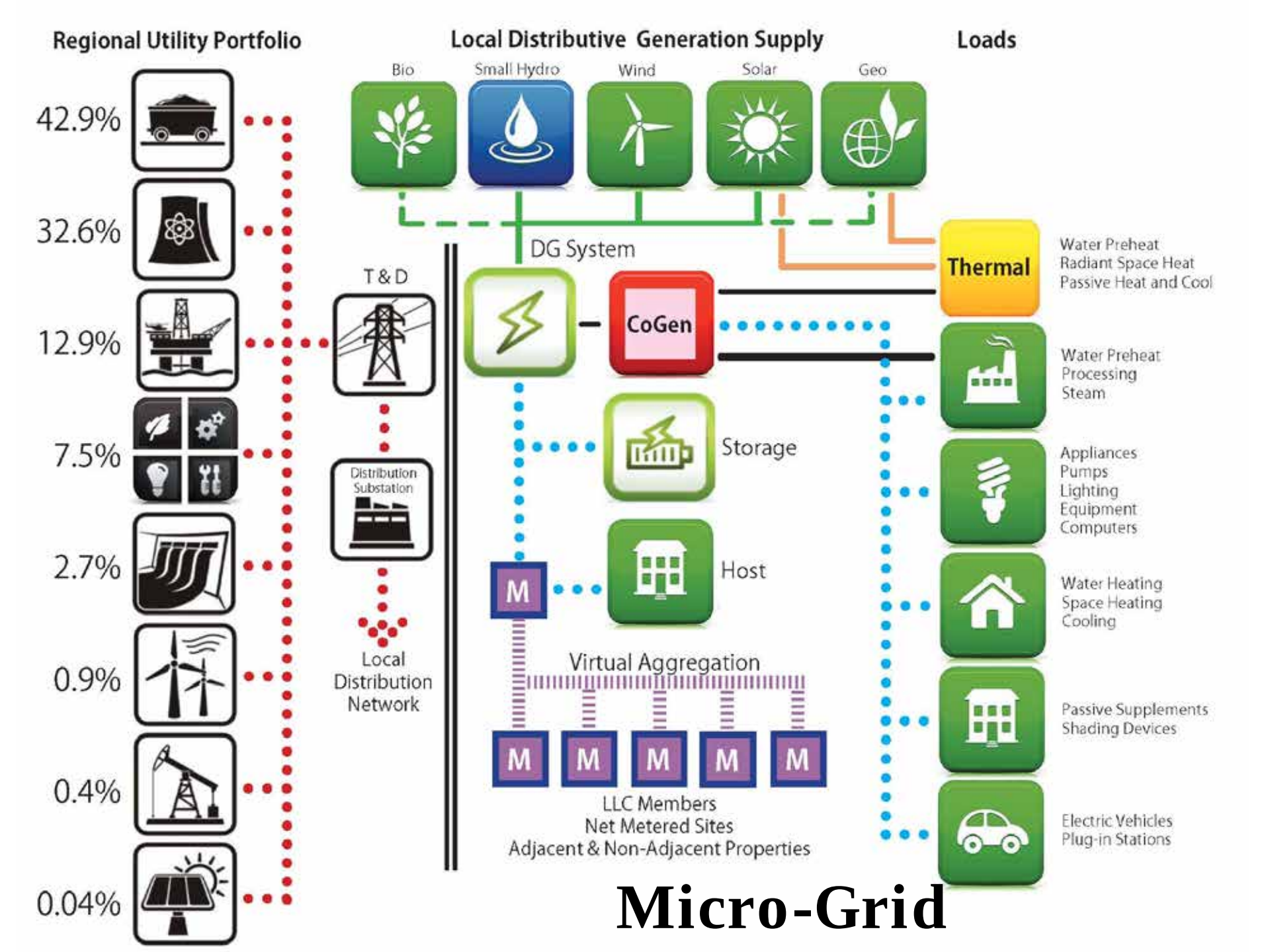
Grid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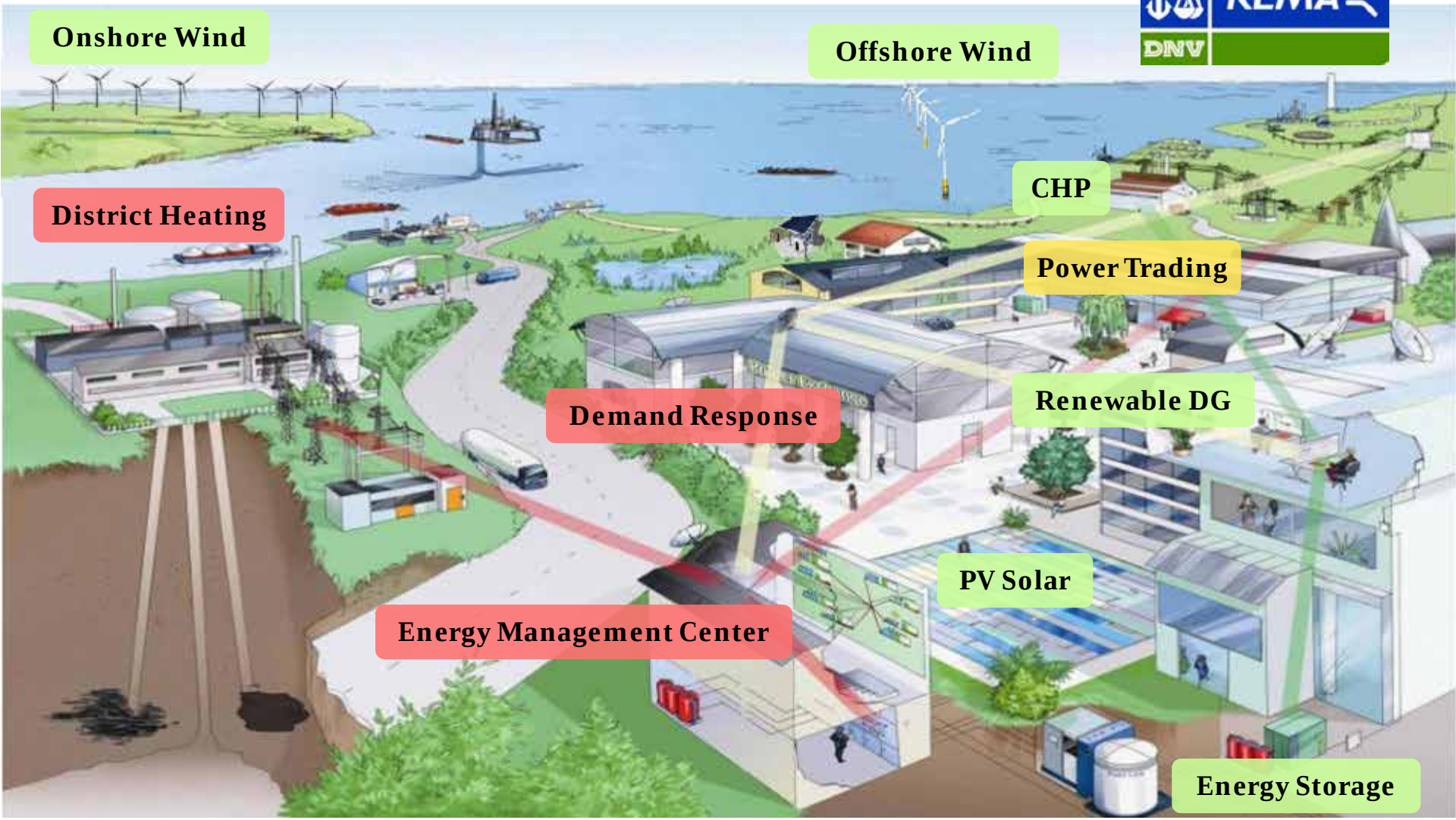
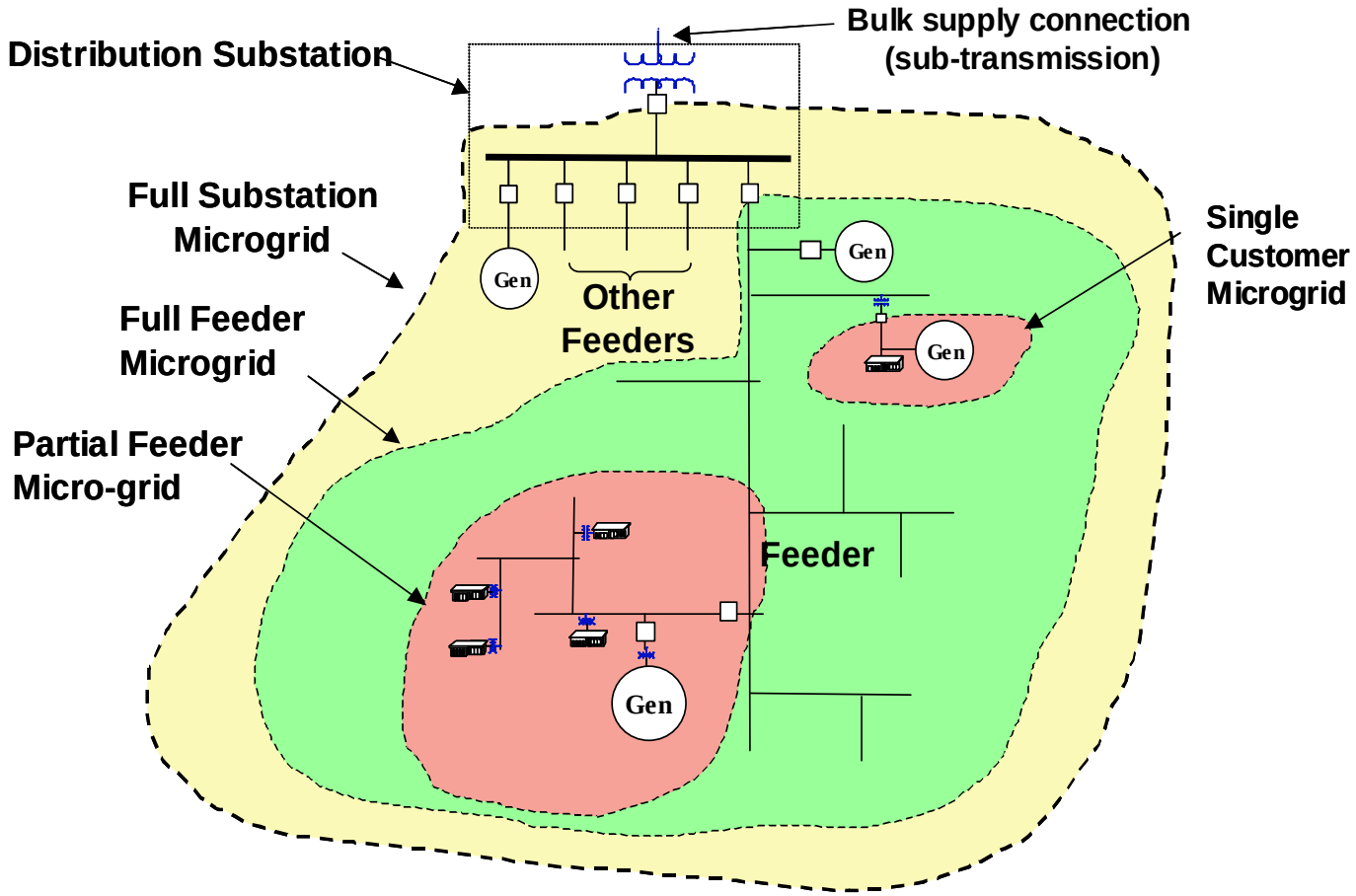
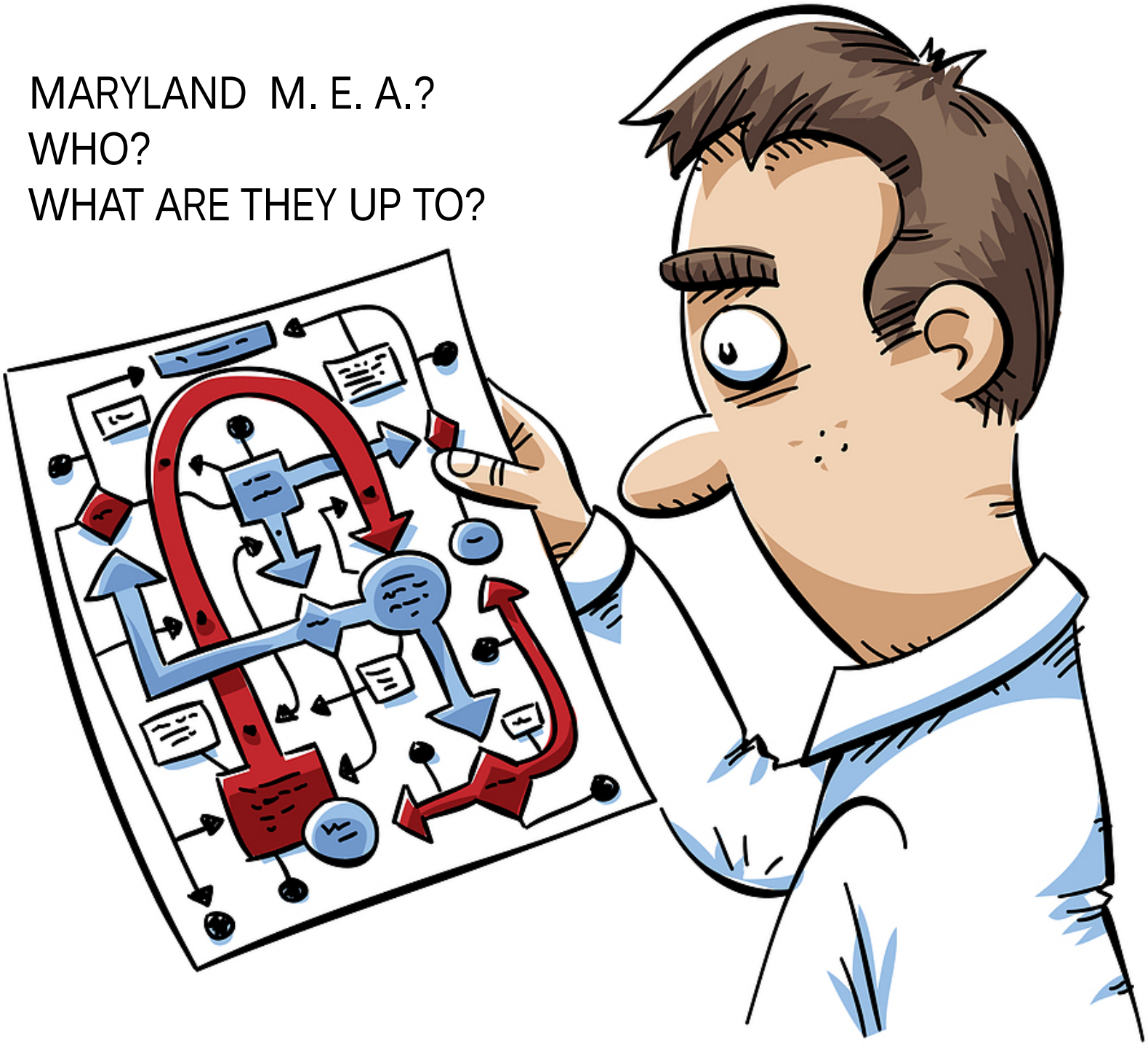
Electric Vehicles
Plug-in Stations
Micro-Grid

Elements of a Microgrid




Distribution Substation
Bulk supply connection
(sub-transmission)
Full Substation
Microgrid
Full Feeder
Microgrid
Partial Feeder
Micro-grid
Single
Customer
Microgrid
Gen
Other
Feeders
Gen
Gen
Feeder
Gen

MARYLAND M. E. A.?
WHO?
WHAT ARE THEY UP TO?



Maryland Energy ADMINISTRATION

Powering Maryland's Future

Energy Resiliency Update & Programs

Planning Commissioner's Workshop

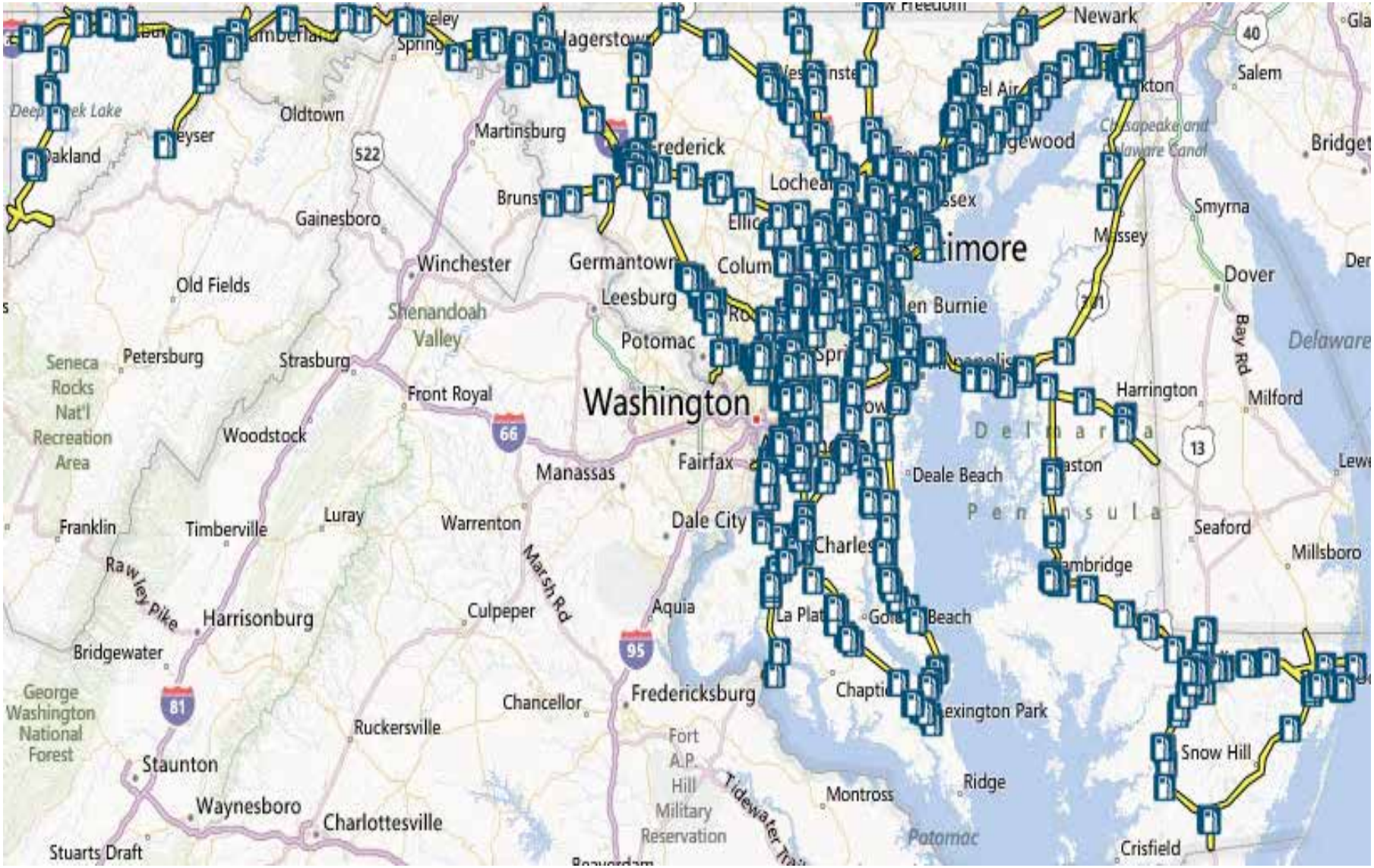
Paul Bollinger
Special Assistant Energy Resiliency
Maryland Energy Administration
October 25, 2013

Resiliency Program Overview

- Service Station Energy Resiliency Grant Program
- SB 481 Tax Holiday or Credit
- Microgrids
- State Energy Resiliency Strategy

Service Station Energy Resiliency

- A $1.7 million grant program for installation of back-up power generation at service stations:
  - *Location within ½ mile of an emergency evacuation route (State/Federal highway).*
  - *Grant award up to $15,000*
  - *Average cost $30-35k*
  - *Limit of 5 stations per owner*
- The grant program is funded by capital funds.



Planning for Micro-grids and Disaster Resilience

2013 MPCA MEETING, ABERDEEN, MARYLAND

S.B. 481 Tax Holiday or Credit for Emergency Equipment and Generators

- SB 481, requires the Task Force to study and make recommendations regarding the implementation of an income tax credit for the purchase of electric generators or a tax-free period for emergency preparedness equipment.

- The Task Force is required to present a report on or before December 31, 2013 to the Governor and the General Assembly.

- Task Force Chair Abby Hopper, Director, MEA

Smart and Secure Microgrids

- Evaluate the microgrids currently in Maryland
  - i.e. University of Maryland and Ft. Detrick
- Work with utilities to determine how they can be incorporated into the State's energy resiliency strategy.
- Develop cyber secure microgrids
- Partner with Federal and Regional Governments

State Energy Resiliency Strategy

- Work with Governor's Office of Homeland Security and MEMA to address GAP's in State critical infrastructure energy resiliency.

- Take best practices from other States and weave into a coherent strategy.
  - Draft Strategy
  - Create Pilot Programs
  - Draft Legislation that will result in larger resiliency programs
  - Integrate resiliency with energy conservation, efficiency, and renewable strategy and programs.

Resiliency Contact Information

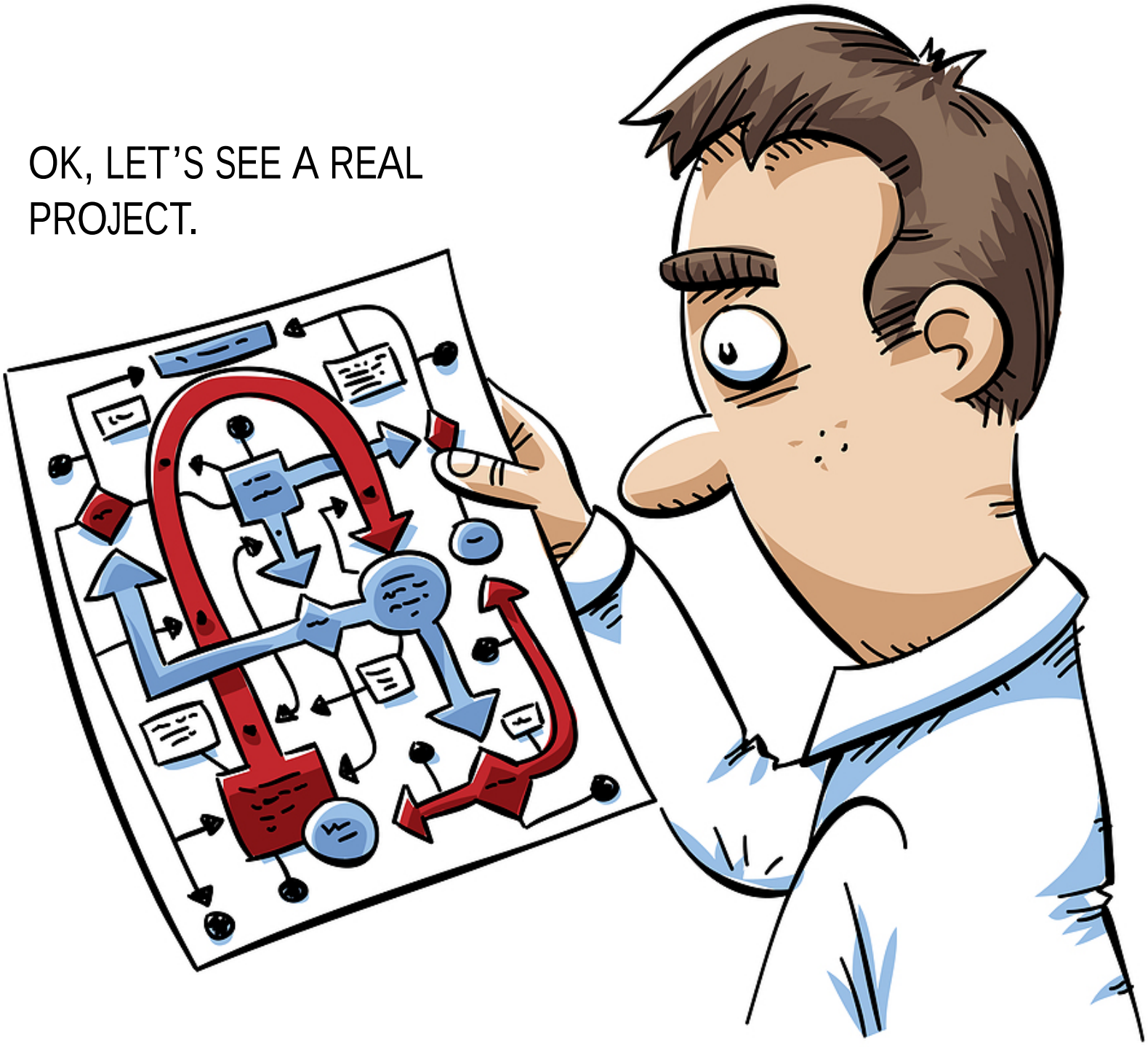
- Paul Bollinger – paul.bollinger@maryland.gov

  410-260-2608

– Service Station Energy Resiliency Grant Program Website:

http://energy.maryland.gov/Business/fuelupmd/index.html

OK, LET'S SEE A REAL PROJECT.



Planning for Micro-grids and Disaster Resilience

2013 MPCA MEETING, ABERDEEN, MARYLAND

The Legacy Grid

What Is NOT a Microgrid?

- A Single Form of Local Energy Supply, ie. solar panels on a commercial building or at the water treatment plant...or out at the prison in Washington County.
  This is distributed generation.

- 300,000 panels
- 160 acres
- 20 MW power
- Land-lease by State

Examples of MICROGRIDS
From SHIPS to Real Estate

Konterra Development -- Maryland - commercial

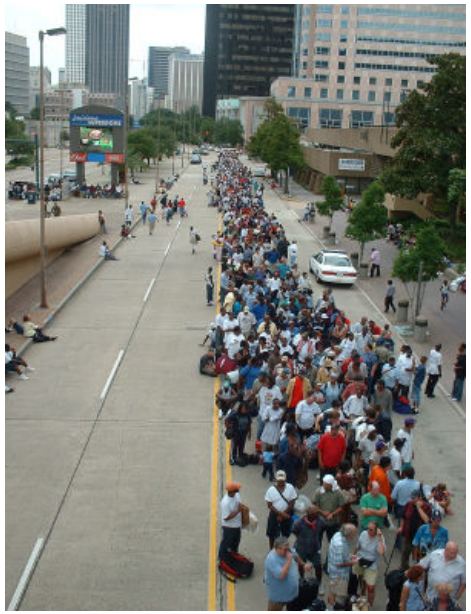
"Main Street" projects -- Hartford/Bridgeport, CT

Safe Haven for Schools -- Public/Evacuee Safety, CT

Floating cities (towns, buildings, neighborhoods) ….ships are like microgrids…

….and what happens when thousands of passengers are trapped at sea for days…

Superdome – Hurricane Katina
Night One: 9,000 residents and 550 National Guard
Additional 15,000 arrive as evacuees the next day.

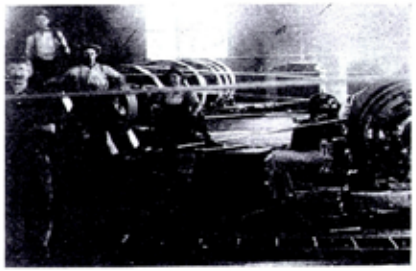


'Really primitive stuff':
Safely ashore, cruise passengers tell of hoarding, filth and fright

Luxury cruise – 4,200 passengers and crew.

PLAN WELL for EMERGENCIES: Don't Let Your Community be Remembered as a "Carnival Cruise"

History Lesson



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THE POTOMAC EDISON COMPANY

Centralized:

- Coal
- Nuclear
- Natural Gas
- Hydro
- WTE/Ag-waste
- Commercial Wind
- Commercial Solar

...To the Substation

....to YOU

Microgrid Drivers – Bank on Decentralization

Energy cost savings

Economic development

Energy Assurance -- reduce dependency

"Future-Proofing" against damage (snowstorms, hurricanes, fires, error or terror)

Greenhouse gas reductions

Three Kinds of Microgrids....

Konterra

"Main Street"

Safe Haven

Mixed Use Development:
Town center, retail, hospitality,
technology campus, educational facility,
residential and business communities,
parking lot lighting,
2 EV charging stations.

400 kW Solar AND 400 kW Battery

20% of USE in main office building

24/7

$ for the BATTERY

$ for the SOLAR

Three Kinds of Microgrids....

Konterra

"Main Street"

Safe Haven

Public Buildings and Private Buildings

Utility – Owns Electric Lines

Combination of parties own the generation/storage assets

Complicated Interconnection Systems

SERVES the Public;
Public not "sheltering"

24/7 Power Generation

Combined Heat/Power
District Heating/Cooling
Solar; Natural Gas Generators.

Three Kinds of Microgrids....

Konterra

"Main Street"

Safe Haven

Public Schools

Red Cross Refuge Center

Intake and shelter 3,000 Evacuees

Town owns the buildings, electric lines/generation/storage assets

Public is "sheltering"

24/7 Power Generation

Load Shedding:
Only the Most Critical Services get Electricity

Teach "Emergency Preparedness" through Parent/Teacher/Student groups.

MARYLAND ENERGY ADMINISTRATION

Governor's Executive Order in 2012 -- After the Derecho

30% NET IMPORTER of electricity

PEPCO has been under-performing

MEA and MEMA produced Energy Assurance Plan

MEA hires an Energy Resiliency Manager

Rollout #1 – Fuel-Up Grant for aiding EVACUEES

MARYLAND CLEAN ENERGY CENTER

30% NET IMPORTER of electricity

WE ARE VULNERABLE – -- DEPENDENT upon other areas

PLANS – Models ARE arising:

Local Energy Assurance Plans

Community Energy Plan – Comp Plan -- Arlington County, VA

Energy Savings/Assurance - City of Baltimore

State of CT – Microgrid Grants

CHEVRON and Santa Rita Prison – $11.7 multi-year year plan

Military installations

What's Next for YOUR Community? Is a MICROGRID in your future?

Most communities have an EMERGENCY plan…but is there an "**Energy Assurance**" element? Is "power continuity" mentioned? If "local power" is important, where should it be sited?

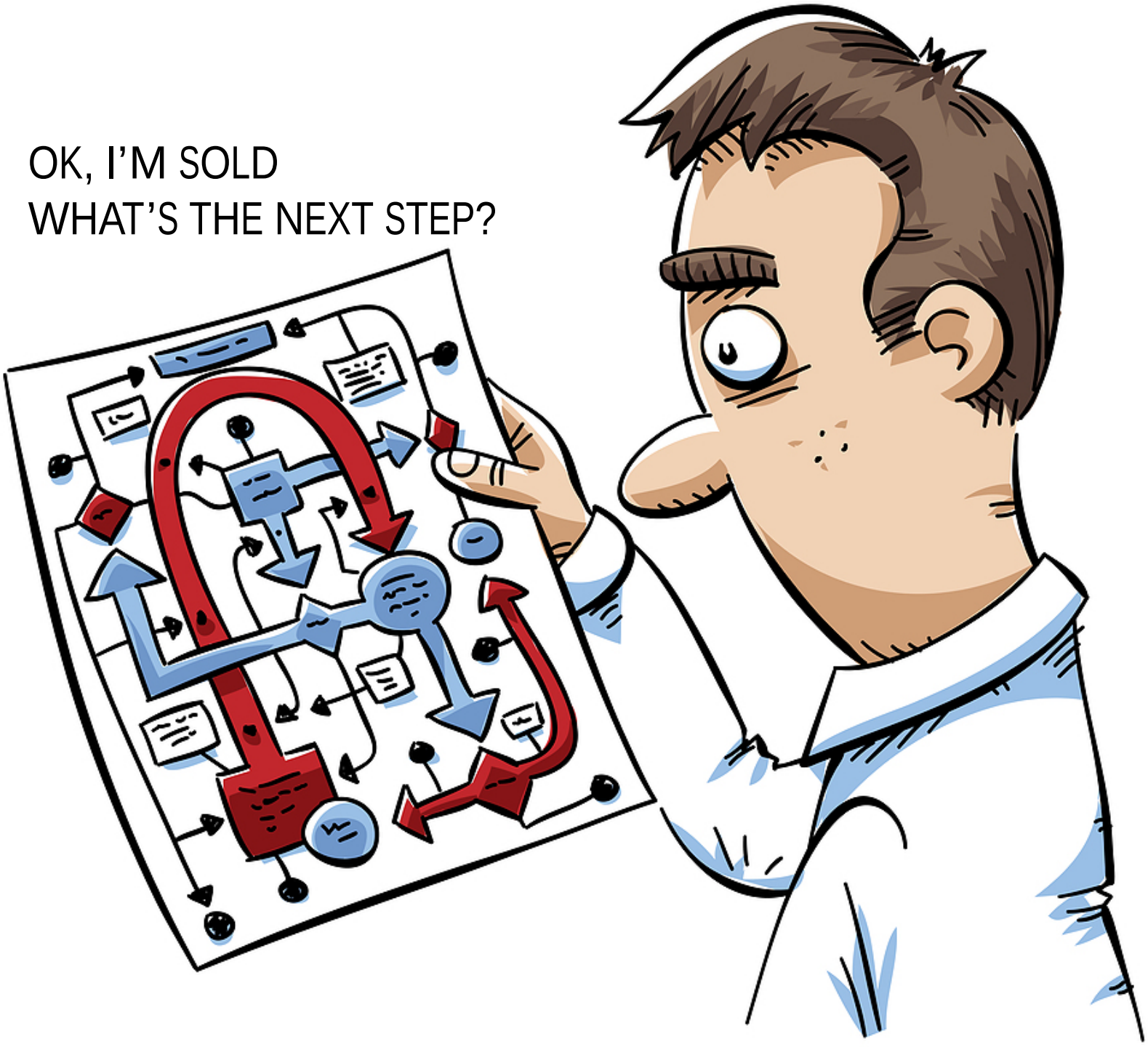
Does your plan accomplish protecting:

- Critical Infrastructure (Waste water; clean water; street lights; schools?)
- Shelter-in Place Constituents? Shelter at Work Employees?
- People traveling through to other destinations?
- Evacuees coming to be sheltered?
- Visitors? (Attractions; Hospitality) Multi-lingual?
- Farms and Food Supply Chain Members?

Thank you for your time.

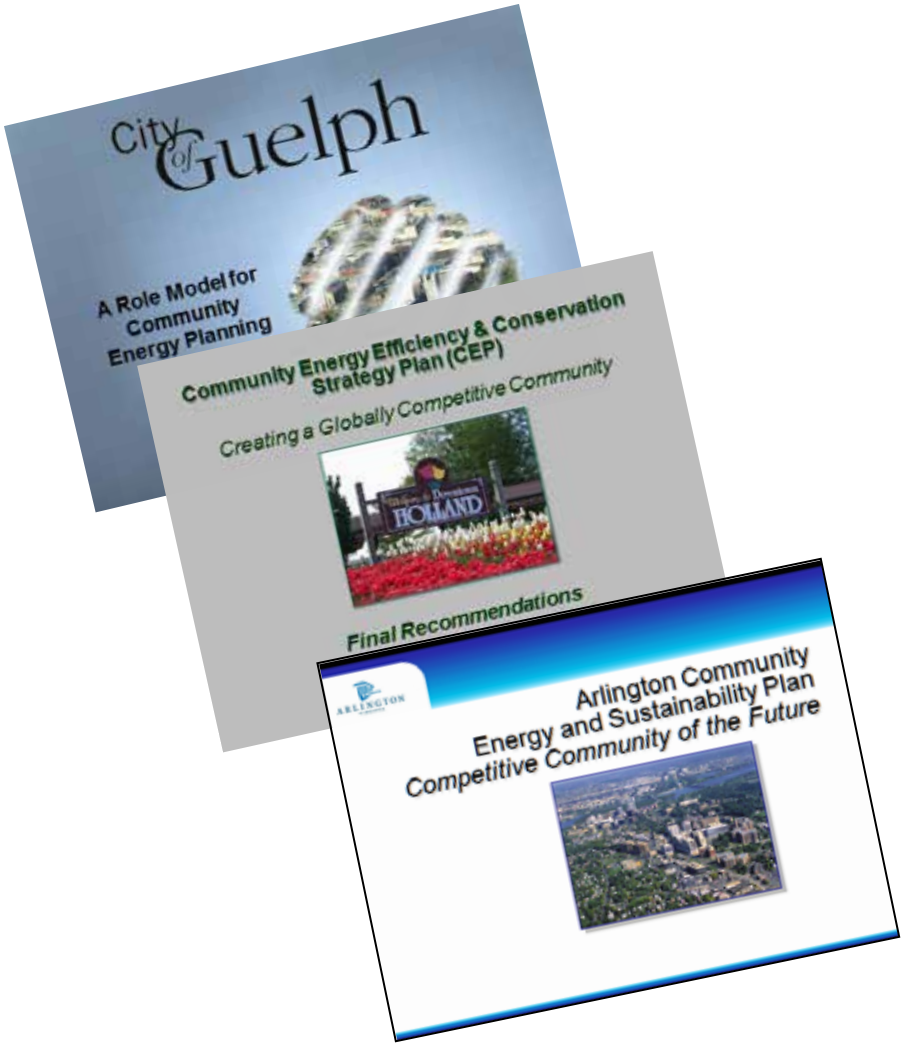
Dave Ager Rick Lank Rebecca Rush

OK, I'M SOLD
WHAT'S THE NEXT STEP?



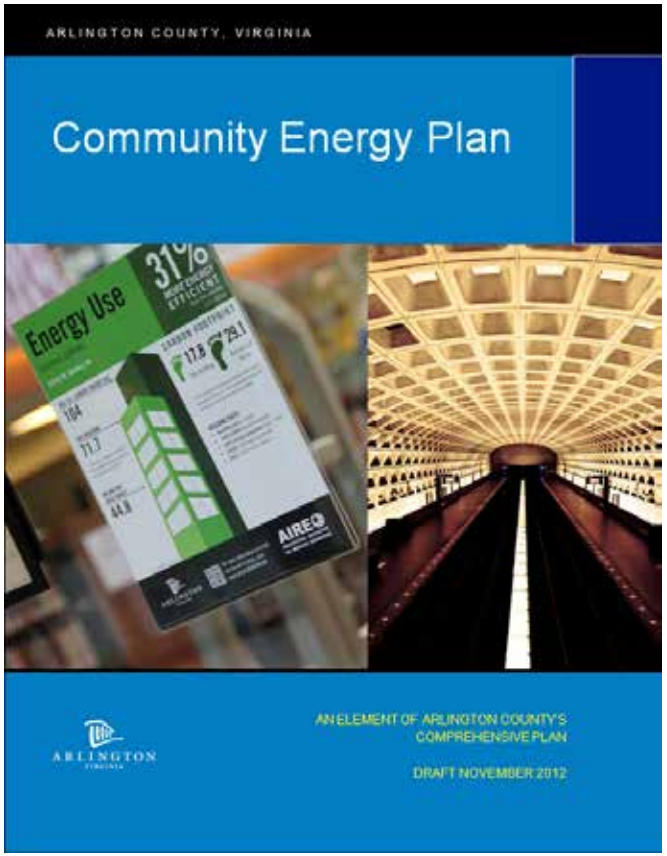
Challenging the Status Quo

US & Canadian Cities Breaking the Mold

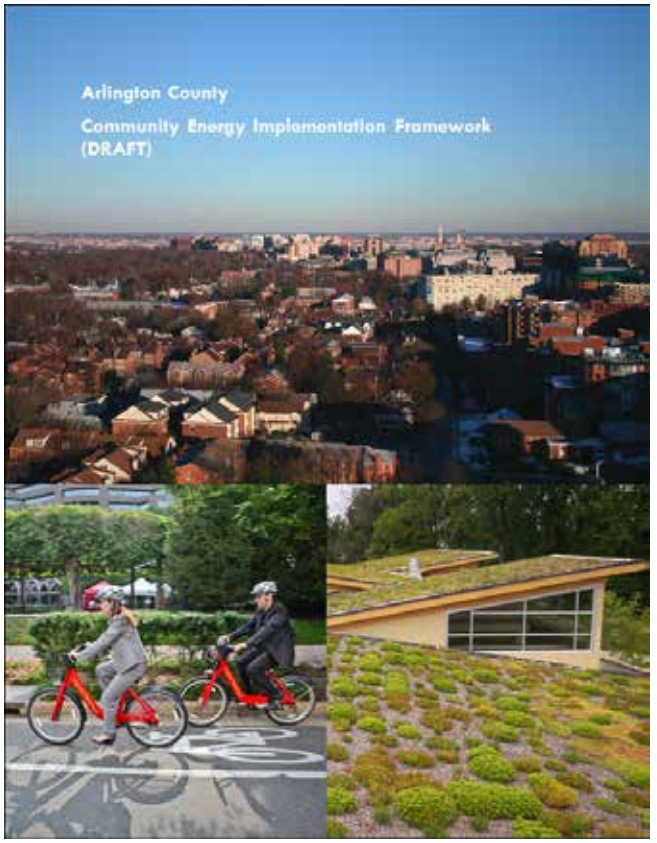


- Fully Integrated
- Breakthrough targets
- All aspects of energy
  - Economic
  - Technical
  - Environmental
  - Institutional
  - Social
- Multi-decade
- Globally benchmarked

CEP Documents



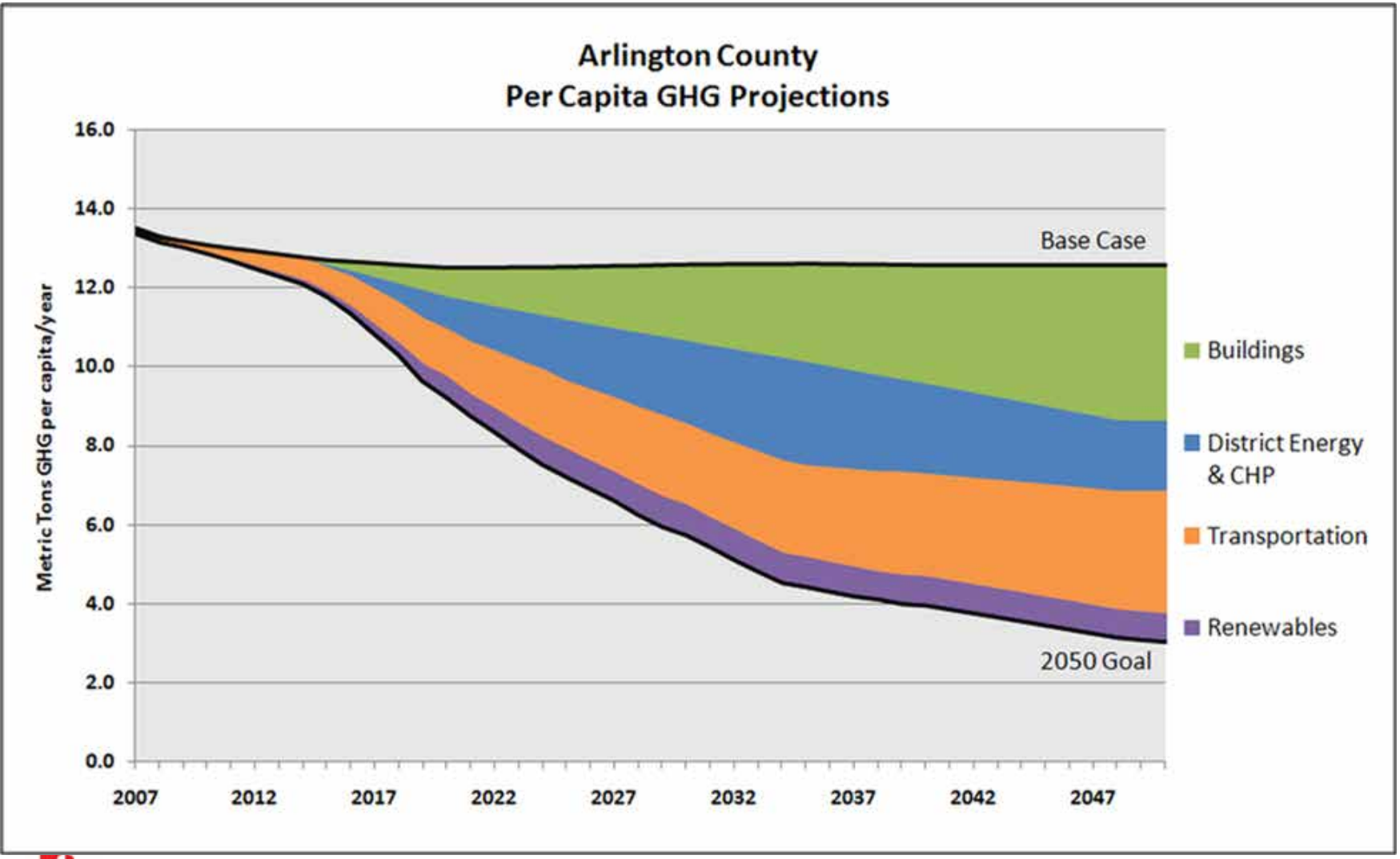
Goals and Policies



Strategies and Tools

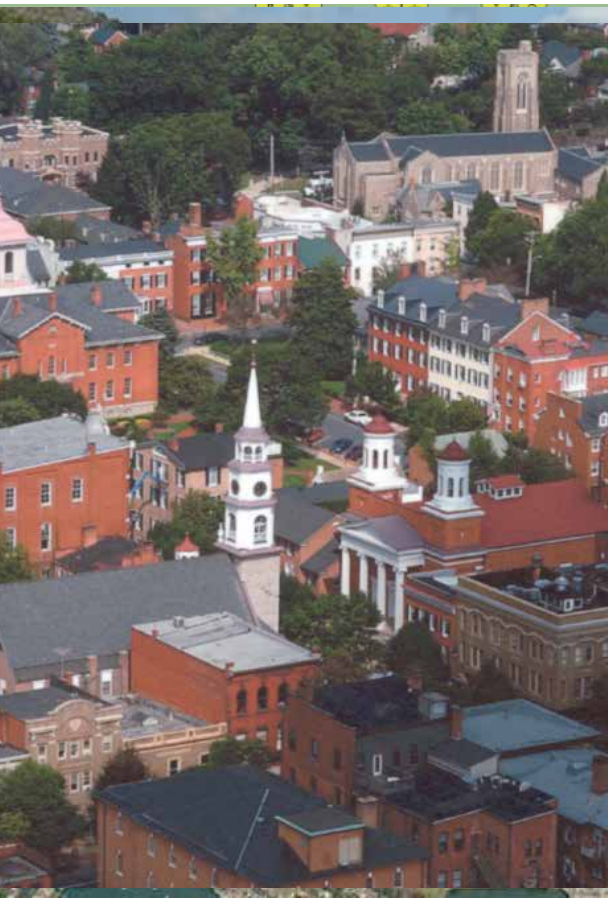
Per Capita GHG Emissions

Impacts of Key Energy Policy Recommendations



Town Planning

Systems Approach to Integrated Energy Planning



Existing Conditions

1. Understand the Site
2. Work with Nature
3. Bio-climatic Response

Efficiencies

4. Localize Distribution, Minimize Transport Los
5. Provide Efficient Systems and Networks
6. Strategically Locate and Link Centers

Minimization

7. Reduce Demand
8. Phase in Proportional Distributive Elements
9. Build with Traditional Patterns and Framewor

Optimization

10. Maximize Passive Opportunities
11. Top Off with High-Efficiency Active Systems
12. Integrate Recovery Technologies

Performance

13. Monitor and Manage

Adoption and implementation begin at the local level...you...

Thank you!

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