Pepco's Plans for Grid Modernization

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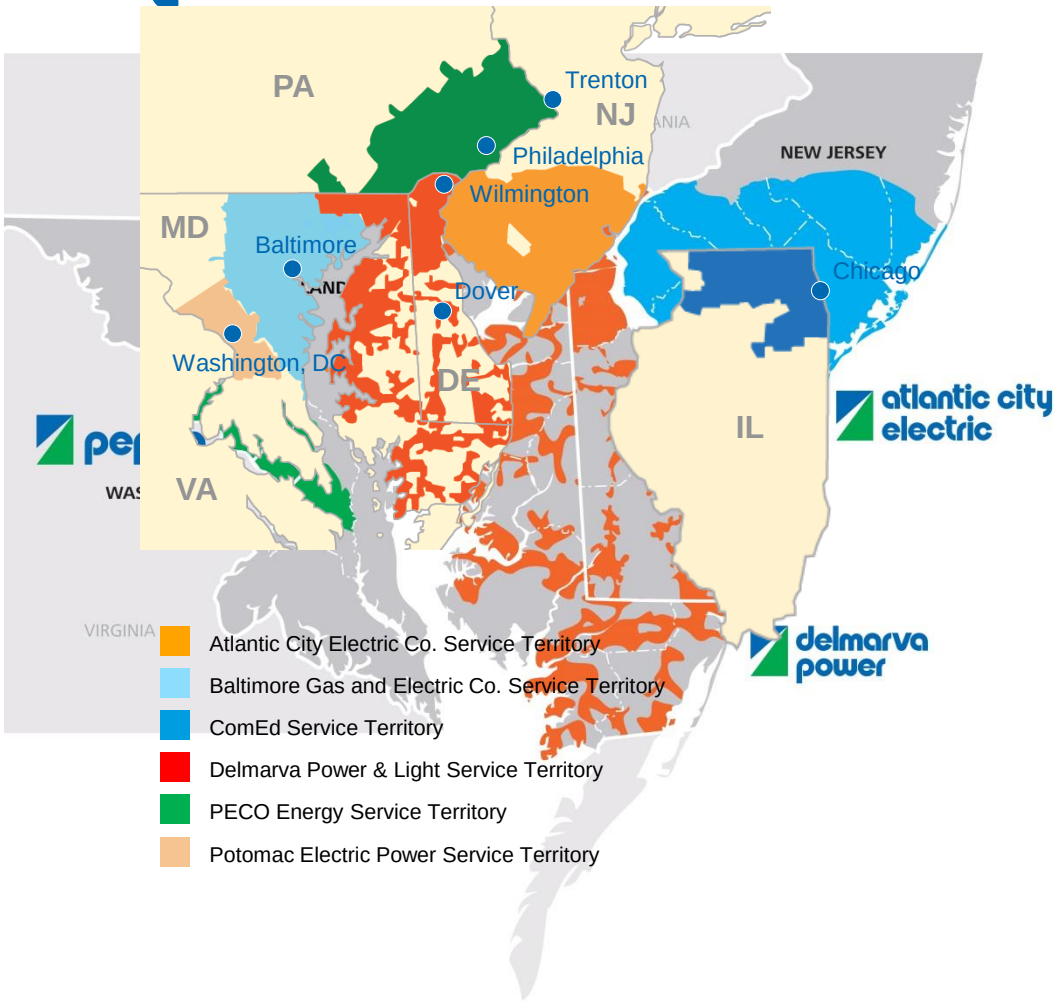
MPCA Annual Meeting

Presented by: Robert Stewart

January 12, 2017

Pepco Holdings, Inc. Quick Facts

- Incorporated in 2002
- Service territory:
  8,340 square miles
- Customers served
  - Atlantic City Electric:
    - 545,000 – electric
  - Delmarva Power:
    - 506,000 – electric
    - 126,000 – natural gas
  - Pepco:
    - 801,000 – electric
- Total population served
  5.6 million



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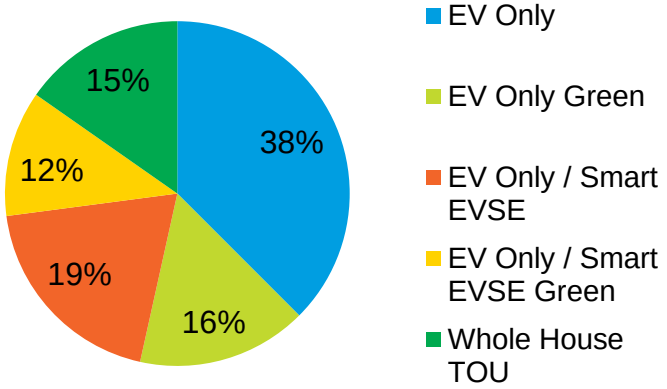
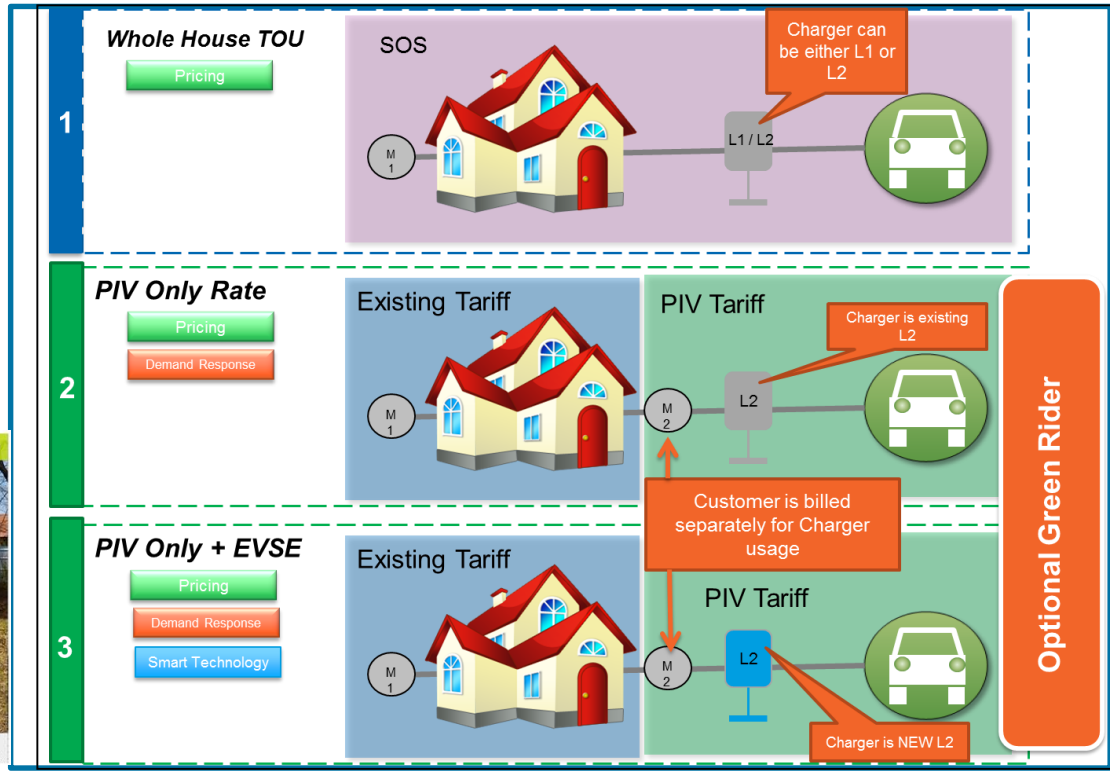
MD EV Pilot Program

Completed 12/31/15

- Established through MD Legislation for Demand Response
- Demonstrated Passive and Active control for EV Charging
- Over 90% of the customers charged off-peak
- Included installation of 50 smart chargers
- Performed active EVSE control in concert with Demand Response events
- EPRI compiled and published results*





*Pepco Demand Management Pilot for Plug-In Vehicle Charging in Maryland, 3002007478, Technical Update 2016

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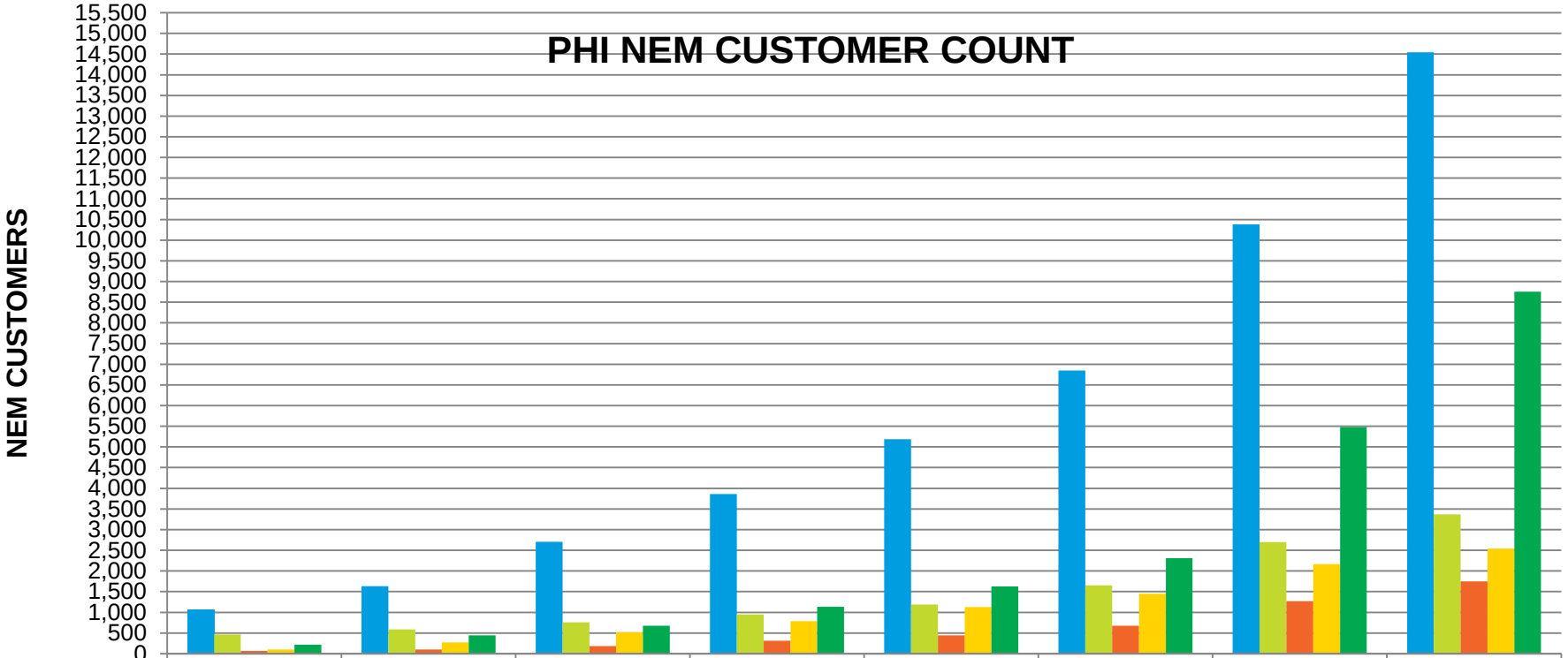
Current Status of NEM Customers
30,956 Customers & 401 MW's



	2009	2010	2011	2012	2013	2014	2015	2016
ACE	1,063	1,636	2,708	3,860	5,189	6,850	10,381	14,546
DPL DE	465	585	758	949	1,191	1,653	2,698	3,367
DPL MD	67	104	181	313	445	679	1,270	1,751
PEPCO DC	103	271	517	784	1,124	1,450	2,165	2,540
PEPCO MD	215	441	676	1,134	1,626	2,310	5,484	8,752

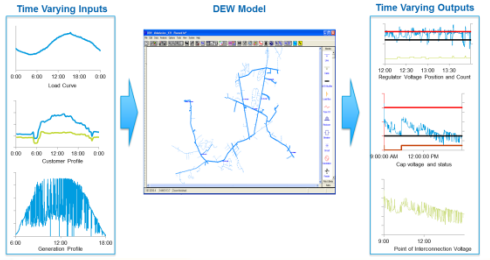
Activities Underway to Help Accommodate Increased DER

Engaging Regulators and Public Officials: Engaging FERC, State public officials, DOE and other industry groups to better understand the issues and work collaboratively on solutions

Modelling & Analytics: Advanced load flow being implemented, Distributed Energy Resources Planning and Analytics department formed, technical and financial analysis of Micro grids

Collaborative R & D: Inverter technology, advanced voltage regulation control, penetration studies with a variety of different partners.

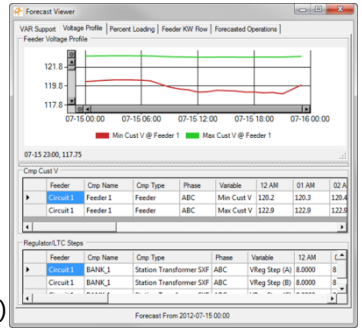
- Hosting Tests based on modeling Advanced Volt/VAR Control, smart inverters and
- AMI to monitor and provide control for small size inverters
- Implementing Cellular telemetry for systems over 2 MWs
- Integrating PV output data into Distribution Automation schemes
- Reviewing feasibility of online application and approval process



DOE Sunrise Project

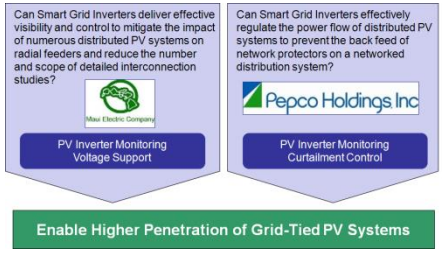
- Model-Based Analysis to simulate the impact solar has on the grid.
- This project is testing advanced voltage regulation strategies to find the most cost effective way to use existing and new equipment as penetration rates of DERs increases.
- It will model both autonomous and central controlled approaches.
- PHI is partnering with:
  - Electrical Distribution Design (DEW software development/technical)
  - Clean Power Research (solar Irradiance data)
  - Rutgers University (economic analysis)

Control can be run against simulator or real system through connection to SCADA



Office of Naval Research Smart Grid Inverter (SGI) Project

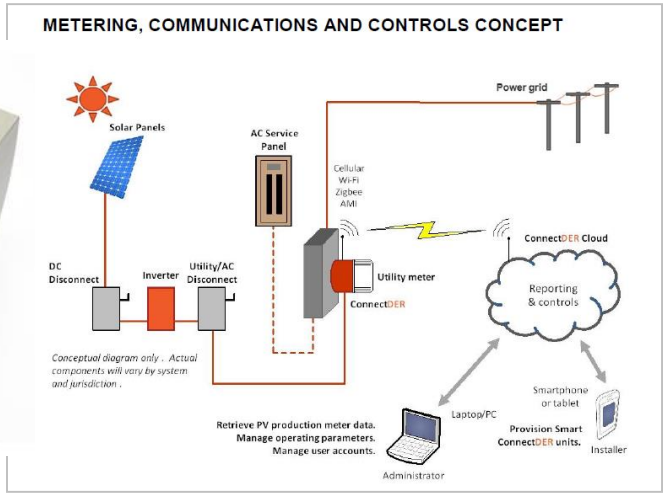
- Pilot using AMI data and an algorithm from Silver Spring to dynamically set the power factor and overall watts for inverters.

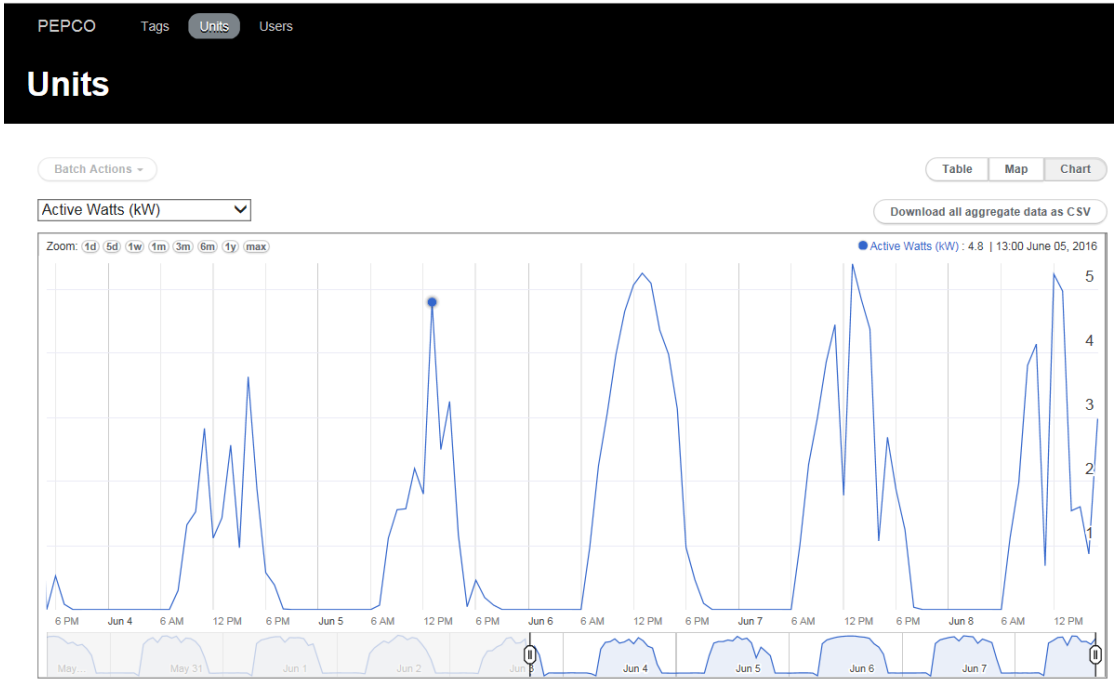


HNEI	Project Lead
Maui Electric Company	Co-Utility Lead
Pepco Holdings Inc	Co-Utility Lead
Hawaiian Electric Company	Co-Utility Lead
Silver Spring Networks	Technology Lead
OG&E	Inverter Testing Lead
Standard Solar	Co-Services Lead
RisingSun Solar+Electric	Co-Services Lead
Fronius	Inverter Technology Lead
Hitachi	Inverter Technology Provider

Smart ConnectDER

- UL Listed
- Integrated circuit breaker provides PV equipment protection & safe field connection to terminal block
- Onboard revenue grade telemetry and communications track system production
- Supports solar PV installations up to 15kW AC
- Track mixed model inverter fleet operations through headend application
- Provides “Missing Data Link” – Inverter Output
- ***Can be used to meter EVSE as well***





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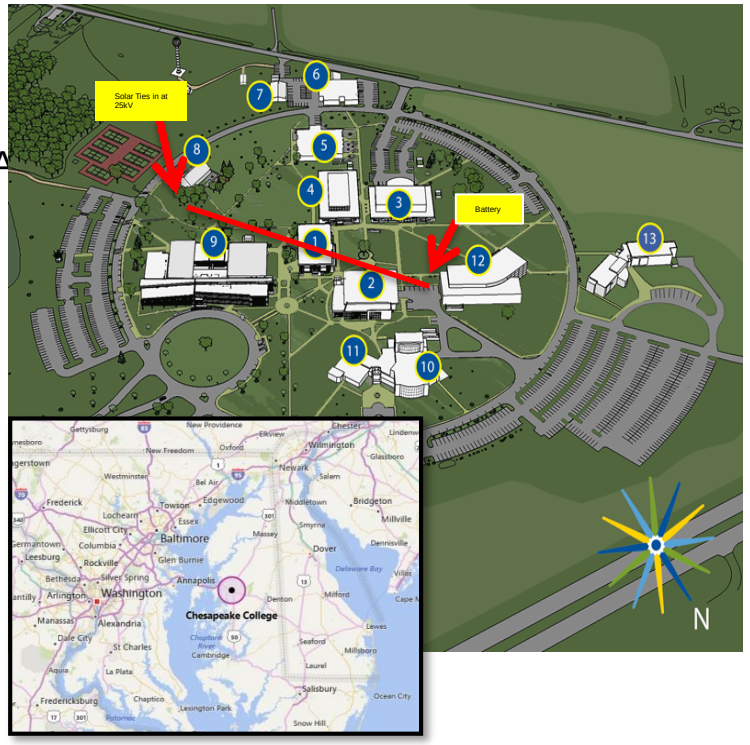
PHI Current Microgrid Projects: Chesapeake College

- Started as a solar DER system on a high penetrations feeder
- Pepco applied for, and received, $250K grant from MEA or installing batteries to help mitigate the effects on the Distribution System
- College is identifying critical loads to create microgrid



Building Loads to Back Up:

2 – Caroline Center

12 – Learning Resource Center

The College has a 25kV system for the campus with switchgear connecting to DPL in Bldg 12

Distance from Solar Tie in at 25kV to where Battery System will be located (shown as red line) is about 2,000'

PV System

Size: 2.18 MW DC, 1.76 MW AC

Installer/Owner: Solar City

Inverters: Solectria (with smart inverter functions)

Output from inverter will be 480V then tied to 480/25kV transformer to step up to 25kV

System is split into a 1,464 kW ground mount array and 300 kW carport with EV charging capability

In-service date: May 2016

Battery System

Proposed size is 500kW, 250kWh (half hour battery)

Installer/Owner: AF Mensah

Battery and PV system will have separate inverters for independent operation

Electrical interconnection design to be proposed by AF Mensah

Next Steps

Work with Solar City, AF Mensah, and Chesapeake College to develop final design and present to appropriate stakeholders

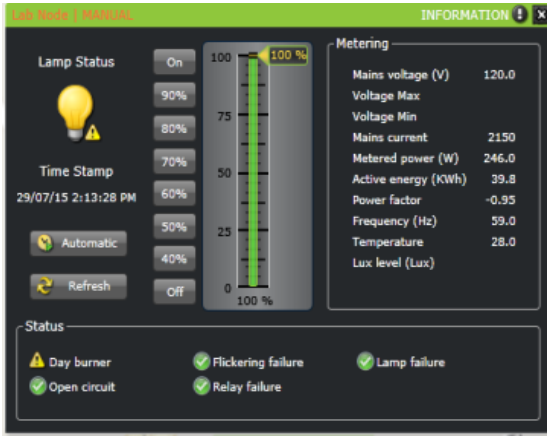
Develop project charter and project plan

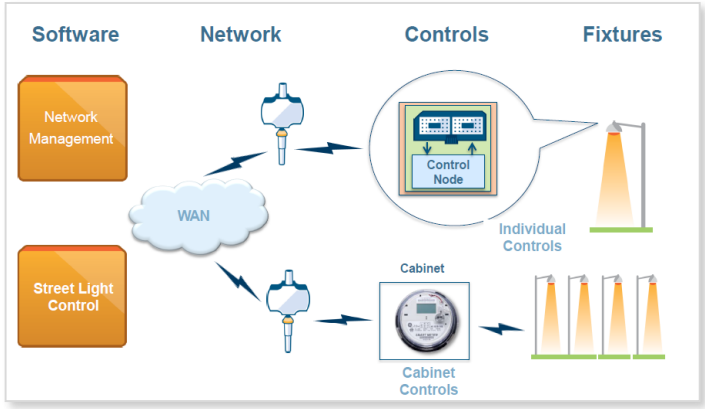
Finalize central and local control strategy after selecting Central Control vendor

Develop any needed contracts/agreements

Smart Streetlights

- SSN Streetlight Vision
  - Pilot – Rockville Service Center
  - WaterShed
- Municipal Interest
- Enhanced functionality
  - Remote Control
  - Dimmable
  - Revenue Grade Meter
  - Day Burner Notification
  - Group Management
- AMI Network Backhaul





Photocell

- ANSI compliant networked photocell, can retrofit existing lights
- Options for 5-pin receptacle, allowing for 1-10V dimming
- Ability to distribute light values in the RF mesh

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WaterShed – PHI Technology Exploration Center

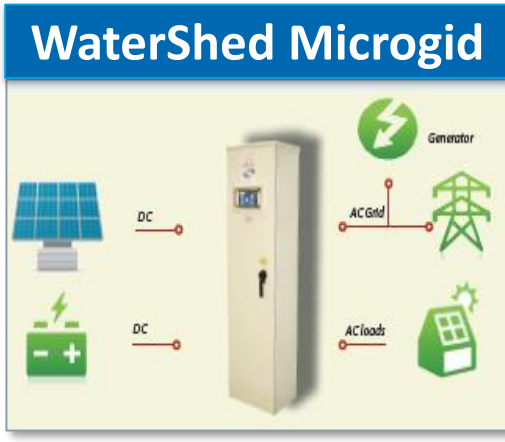
- **Pepco Purchase of UMD WaterShed, Winner of the 2011 Solar Decathlon:** Pepco is planning to relocate WaterShed to the Rockville Service Center where it will serve as an exploration center for smart grid benefits as well as a living lab to continue to educate the community on the importance of sustainability and renewable energy

- Additonal module to serve as the Exploration Center for Smart Grid Benefits demonstration.

- Smart Grid Benefits
  - AMI
  - Home Area Network Demonstration
  - Smart Appliances Testing
  - EV Charging Management
  - Solar Energy Integration and Management of Renewables
  - Battery Energy Storage / Microgrid Demonstration

- PHI is working with the University of Maryland and others to develop new and innovative curricula for middle and high school students using WaterShed as a focal point.

- It is anticipated that WaterShed will be available to students and the public for ongoing research and education for the foreseeable future.



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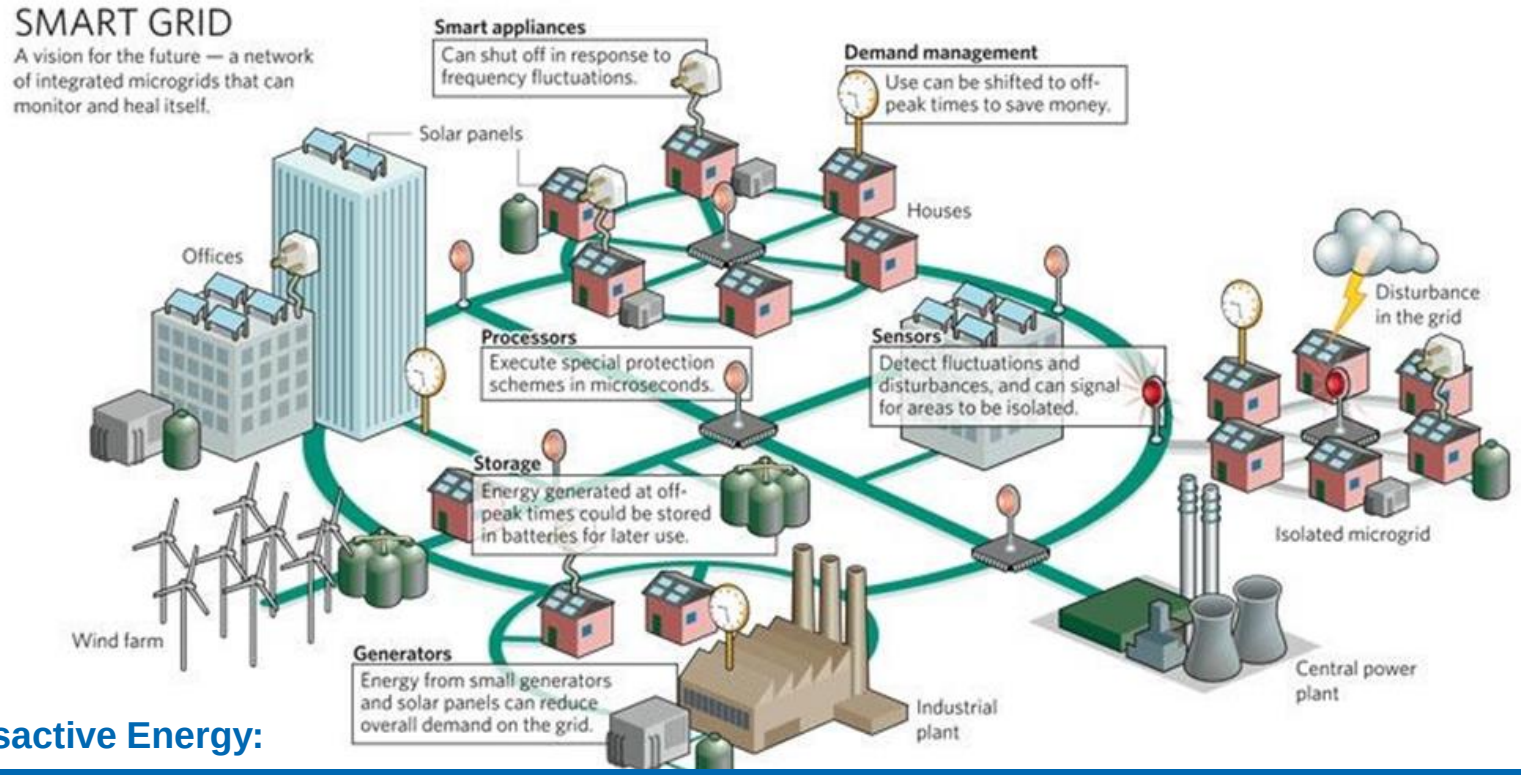
Distribution System of the Future

- With the increase of distributed and community-scale generation, energy storage, and potential new capacity loads (i.e., electric vehicle), existing distribution systems will need to change in order to manage a load that is less predicable than in the past. Distribution systems of the future will not only require internal investment in controls, but also will need to integrate with smaller networks across the larger grid and be able to monitor and dispatch small scale distributed generation.



Transactive Energy:

A system of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter.

Source: Gridwise Alliance

Points to Consider…

- Planning and Operating the future Distribution Grid will become more complicated
  - Higher penetrations of DER
  - Deployment of storage
  - Microgrids
  - Electric Vehicles / Vehicle to Grid
  - Advanced Demand Response
- Distribution System Operators will need to manage the Distribution System, much in the same way PJM manages Transmission and Generation today
  - Control, Measure, Dispatch, Protect, Optimize
- Based on system conditions, some DER or Microgrids may need to be temporarily curtailed, or dispatched for system need
  - New polices will need to be developed to facilitate these future transactions

How will utilities, regulators and customers work together to create a fully integrated, efficient and affordable grid for the future?

Questions?

Your Rural Resiliency Team

COMMUNITY RENEWABLE ENERGY

Resilient Power Works!

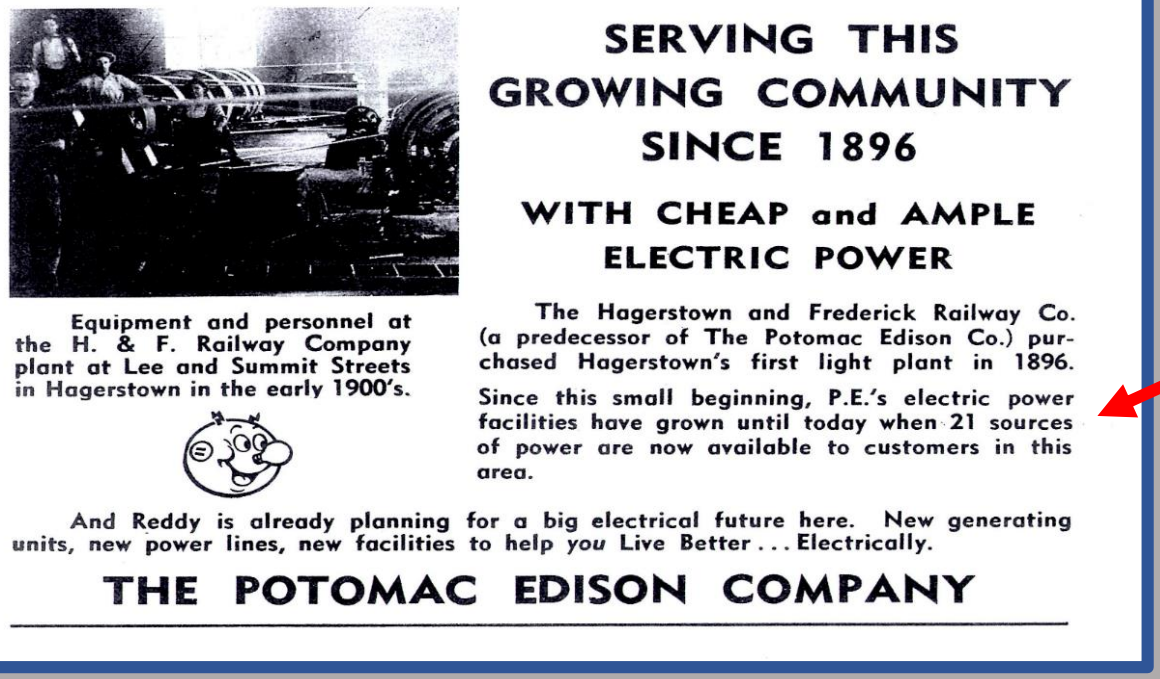
FEWS PROJECT

Integrate Best Management and Policy Practices

from the Planning and Risk Management Professions

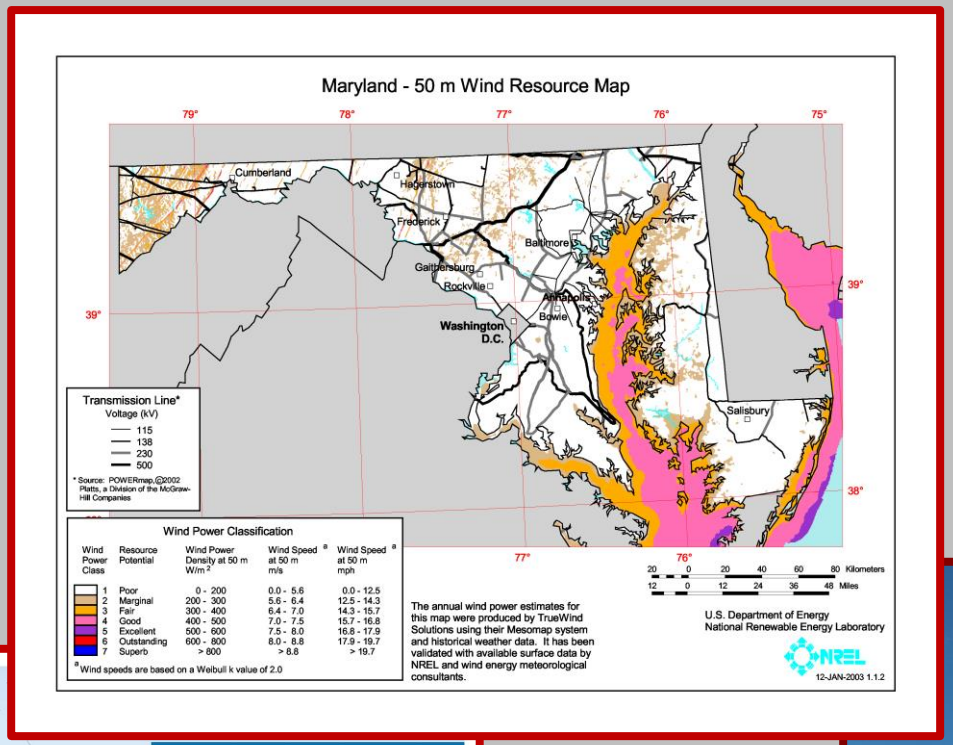
to Address New Opportunities in Integrative Energy and Community Resiliency.

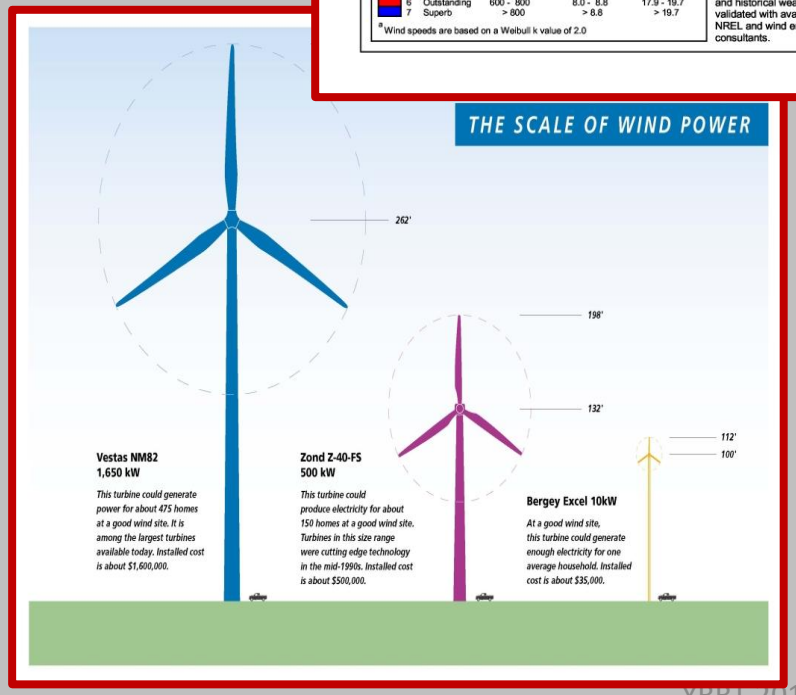
Whose Job Includes "Local Energy Planning"?



The Electric Industry FOUNDATION for Public Safety Planning

- Decentralized
- Centralized + Transmission/Distribution Infrastructure
- Future – **INTEGRATIVE ENERGY with DISTRIBUTED GENERATION**


Maryland - 50 m Wind Resource Map
79°
78°
77°
76°
75°
39°
38°
Cumberland
Hagerstown
Frederick
Baltimore
Gaithersburg
Rockville
Annapolis
Bowie
Washington D.C.
Salisbury
Transmission Line*
Voltage (kV)
115
138
230
500
* Source: POWERmap, ©2002 Platts, a Division of the McGraw-Hill Companies
Wind Power Classification
Wind Power Class
Resource Potential
Wind Power Density at 50 m W/m²
Wind Speed at 50 m m/s
Wind Speed at 50 m mph
1 Poor 0 - 200 0.0 - 5.6 0.0 - 12.5
2 Marginal 200 - 300 5.6 - 6.4 12.5 - 14.3
3 Fair 300 - 400 6.4 - 7.0 14.3 - 15.7
4 Good 400 - 500 7.0 - 7.5 15.7 - 16.8
5 Excellent 500 - 600 7.5 - 8.0 16.8 - 17.9
6 Outstanding 600 - 800 8.0 - 8.8 17.9 - 19.7
7 Superb > 800 > 8.8 > 19.7
a Wind speeds are based on a Weibull k value of 2.0
The annual wind power estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.
20 0 20 40 60 80 Kilometers
12 0 12 24 36 48 Miles
U.S. Department of Energy
National Renewable Energy Laboratory
NREL
12-JAN-2003 1.1.2


THE SCALE OF WIND POWER
262'
198'
132'
112'
100'
Vestas NM82
1,650 kW
This turbine could generate power for about 475 homes at a good wind site. It is among the largest turbines available today. Installed cost is about $1,600,000.
Zond Z-40-FS
500 kW
This turbine could produce electricity for about 150 homes at a good wind site. Turbines in this size range were cutting edge technology in the mid-1990s. Installed cost is about $500,000.
Bergey Excel 10kW
At a good wind site, this turbine could generate enough electricity for one average household. Installed cost is about $35,000.

City of Crisfield, MD Community Wind at WWTP

Don’t Confuse Community Solar with Personal … or Commercial … Solar

(*Community Location/Community Subscribers, Community Benefit)*

Don’t Confuse Community Solar with Commercial Solar

(*Community Subscribers, Community Benefit)*

GENERIC COMMUNITY SOLAR -- TEN ACRE/2 MEGAWATT PROJECTS

Ref: 2015 HB1087; Public Service Commission RM56: Revisions to COMAR 20.62 - Community Solar Energy Generation Systems

Solar + Pollinators Photos courtesy of
Rob Davis, Fresh Energy

Adding Reliability – Where, How Much and Why?

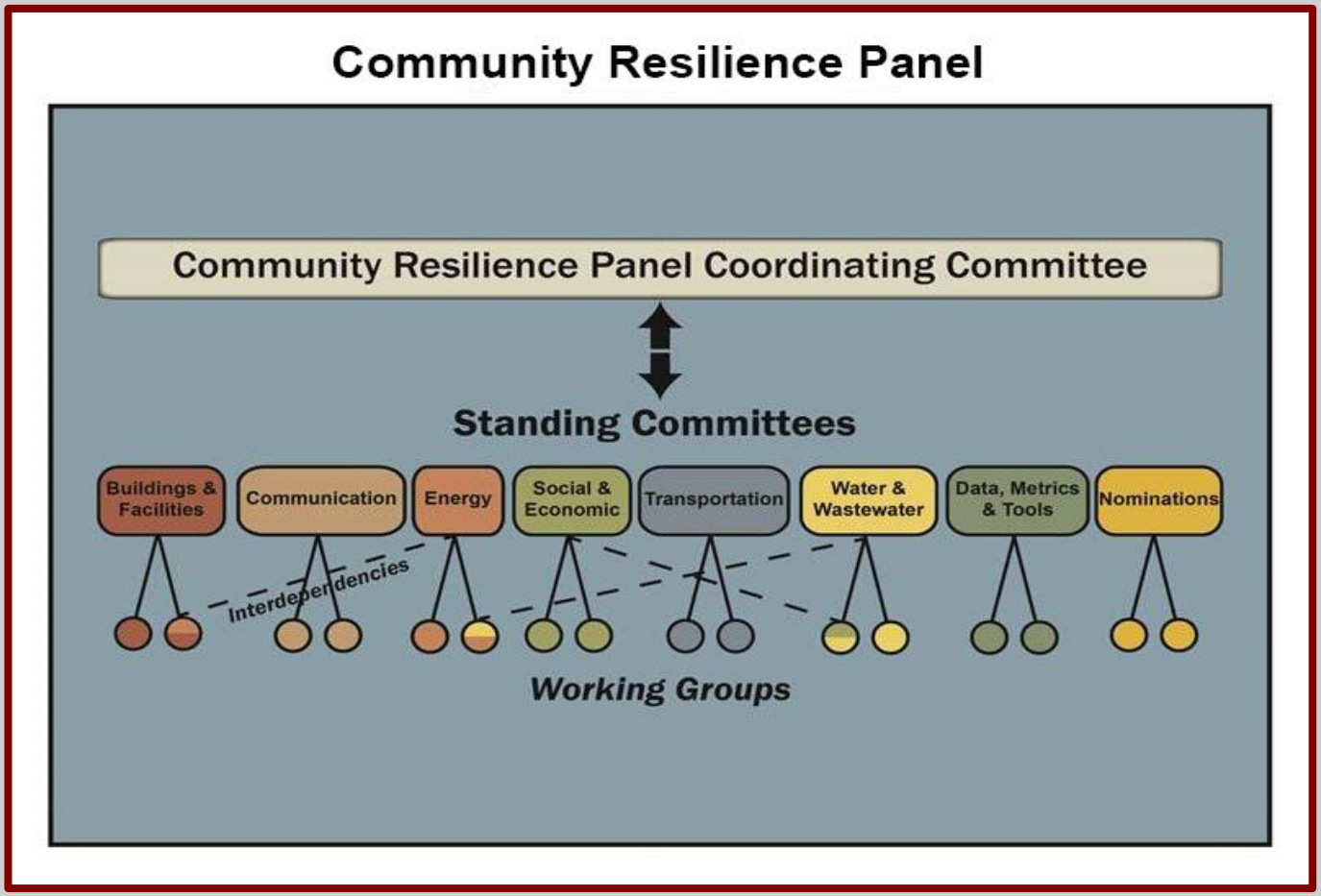
- **Vulnerability Analysis and Prioritizations (LEAP)**
- Critical Infrastructure Power Continuity (Hospitals, Fire Stations)
- Private Power Islands (Collections; Data Centers?)
- PUBLIC SAFETY and PUBLIC HEALTH: Community Approach (BGE)
- Safe Haven Microgrids™

Special Feature:
Maryland "Resiliency through Microgrids" Task Force Report – Regulatory Issues Need to Change

Energy Resiliency…when PUBLIC SAFETY is the Purpose

2012 Straight Line Storm:
Electric Customer Power Loss:
60% of WV
30% of MD

Local Energy Assurance Plans (LEAP)
Criticality Ranking
Environmental Filters



National Institutes of Standards & Technologies Model

Energy Issues are Changing Rapidly

……and Impact EVERYTHING!

- 2014 "**Resiliency through Microgrids**" Task Force and Report
  http://energy.maryland.gov/documents/marylandresiliencythroughmicrogridstaskforcereport_000.pdf

- 2014 -- Maryland Energy Administration – Community Wind -- Windswept Grants
  http://energy.maryland.gov/Pages/Info/renewable/windprograms.aspx

- 2015 Community Solar Energy Generating Stations Pilot Project (HB 1087)
  http://www.psc.state.md.us/wp-content/uploads/Maryland-PSC-Adopts-Community-Solar-Regulations_06152016.pdf

- 2016 Public Service Commission -- PC 44 to Define the "**Grid of the Future**"
  http://www.psc.state.md.us/wp-content/uploads/PC-44-Notice-Transforming-Marylands-Electric-Distribution-System.pdf

THANK YOU!

FEWSS PROJECT (501C3)

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Resilient Power Works!

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