



coalition for green capital

Montgomery County Green Bank – Market Assessment

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Montgomery County DEP

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Market Assessment Deliverables

Landscape

Landscape Analysis
& Green Bank Roles



Market Gaps

Market Sizing &
Interview Synthesis



Recommendations

Green Bank Recommendations

Montgomery County needs to deploy more clean energy to meet state and county goals

- The state and county have ambitious policies and goals
- Electricity fuel mix in Montgomery County is dominated by coal
- Huge opportunity to save money & reduce consumption with EE
- Majority of RECs used in RPS are sourced from out of state

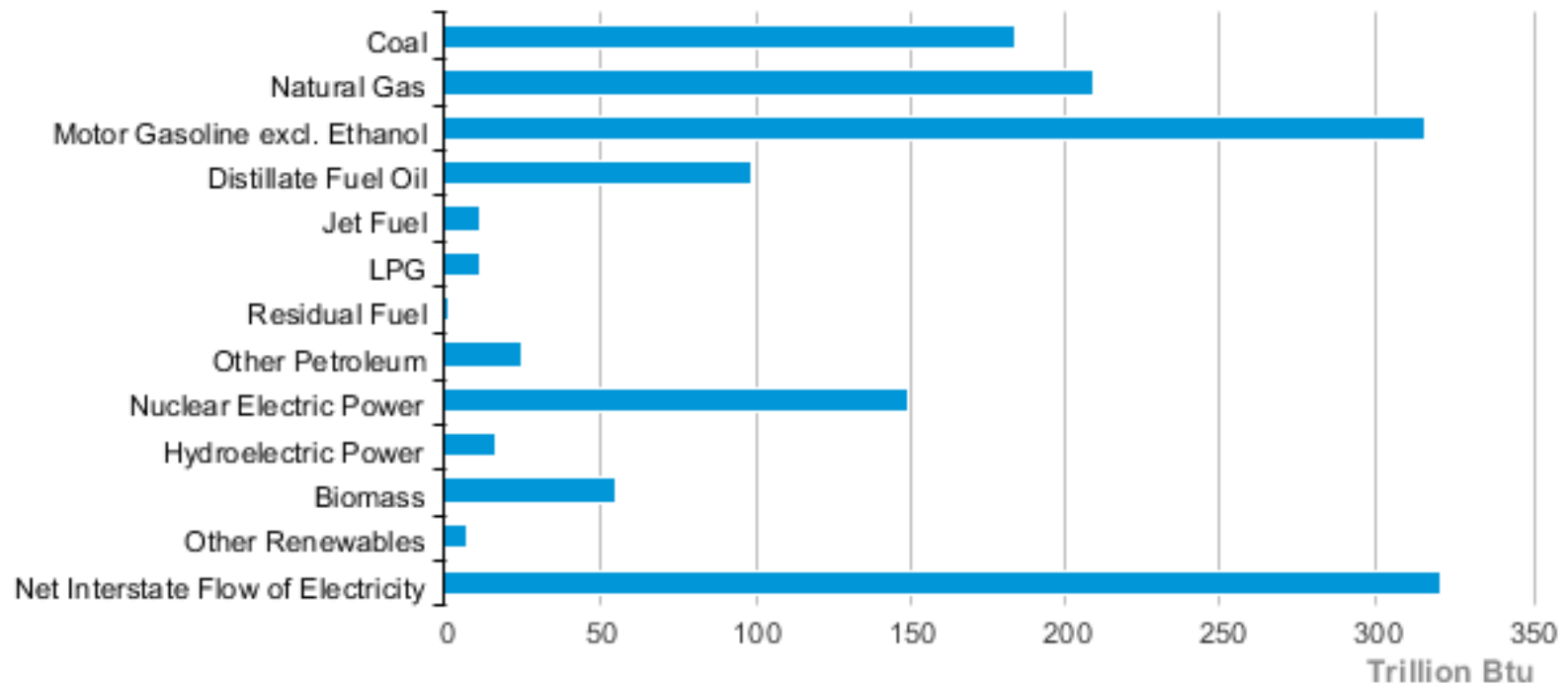
By scaling up clean energy deployment, MC can decarbonize its energy consumption and meet its goals

Agenda

- Energy Facts
 - Thermal – Electric – Transportation
- Energy Programs & Policies
 - Grants – Finance – Policies – Goals
- Green Bank Role

Maryland's total energy mix almost entirely fossil fuels for electricity, transportation, and heating

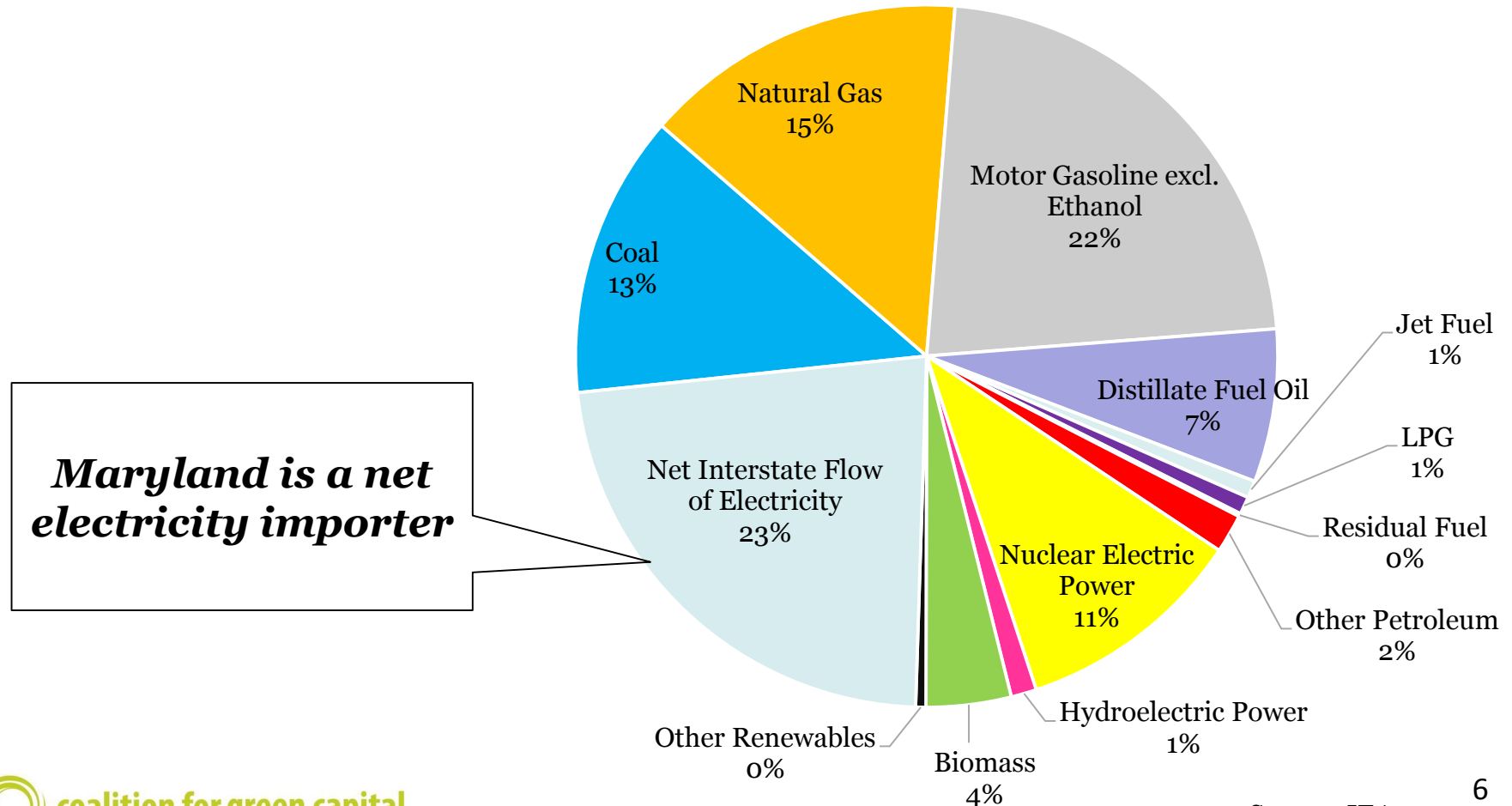
Maryland Energy Consumption Estimates, 2013



Source: Energy Information Administration, State Energy Data System

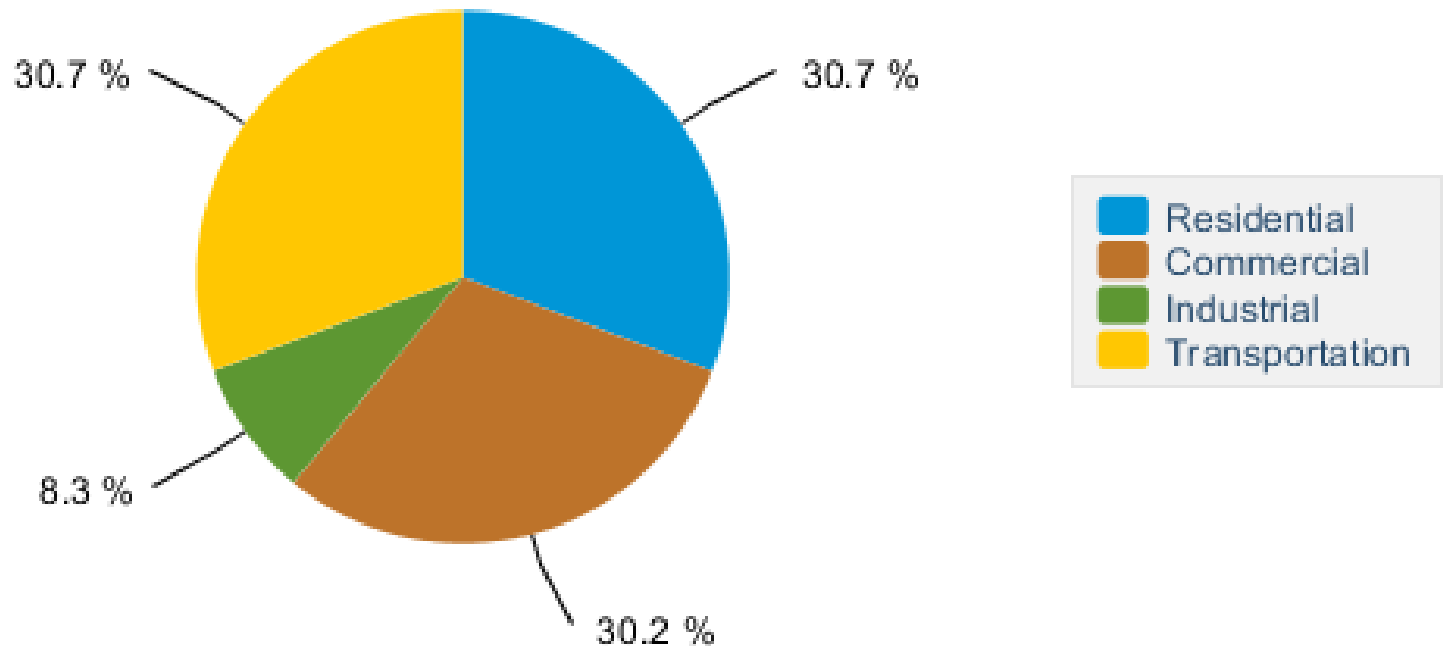
Maryland's total energy mix almost entirely fossil fuels for electricity, transportation, and heating

MD Energy Consumption by Source
(Trillion Btu)



Maryland residential, commercial, and transportation sectors consume roughly same amount of energy

Maryland Energy Consumption by End-Use Sector, 2013



Source: Energy Information Administration, State Energy Data System

Montgomery County is densely populated but in a state with relatively low energy consumption

Montgomery County Market Facts

- *Population* – 1,017,000 people
 - 17% of state's population
- *Area* – 507 sq. mi.
 - 4% of state's land area
- *Building Stock* – 235,500 buildings
 - 10% of state's building stock
- *Energy Consumption per Capita (State)* – 236 MMBtu
 - 40th in U.S., 3rd in Del-Mar-Va
- *Energy Spend per Capita (State)* - \$3,868
 - 38th in U.S., 3rd in Del-Mar-Va

Commercial buildings on average are small, old, and lack funds for upgrades

- About 4,288 commercial buildings in Montgomery County as of 2013
 - Majority of commercial buildings are less than 10,000 square feet
 - Wide variety of energy systems, operations, ownership, and financing across commercial buildings in the County
 - 150 million sq. ft. of conditioned space
- Electricity & natural gas are major energy sources
- In a survey of 52 building owners/managers in Montgomery County, 85% of building owners say lack of capital is barrier to upgrades
- Lack of information is another key barrier

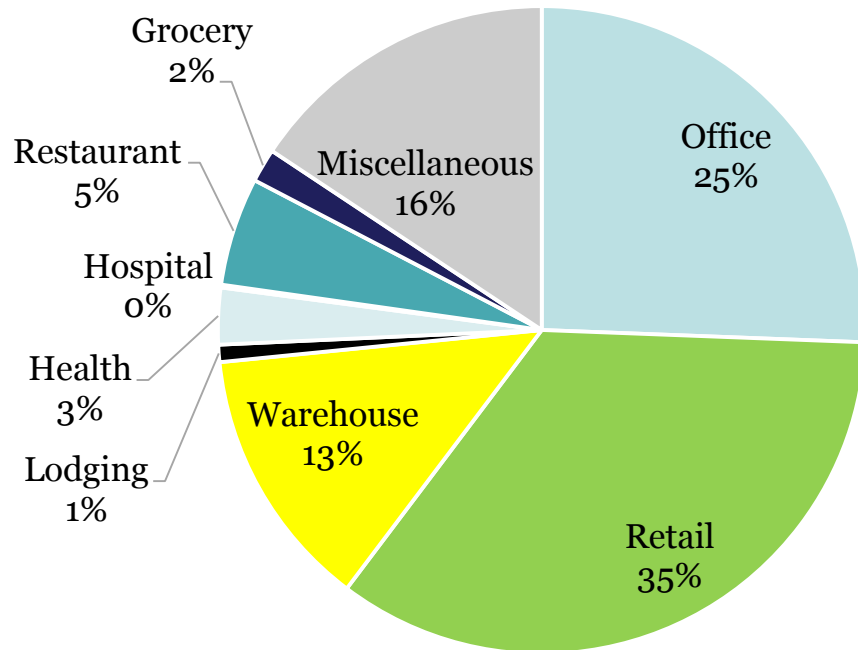
Office and Retail are largest segments of commercial building market

County Level Subsectoral Building Sharedown and Energy Consumption

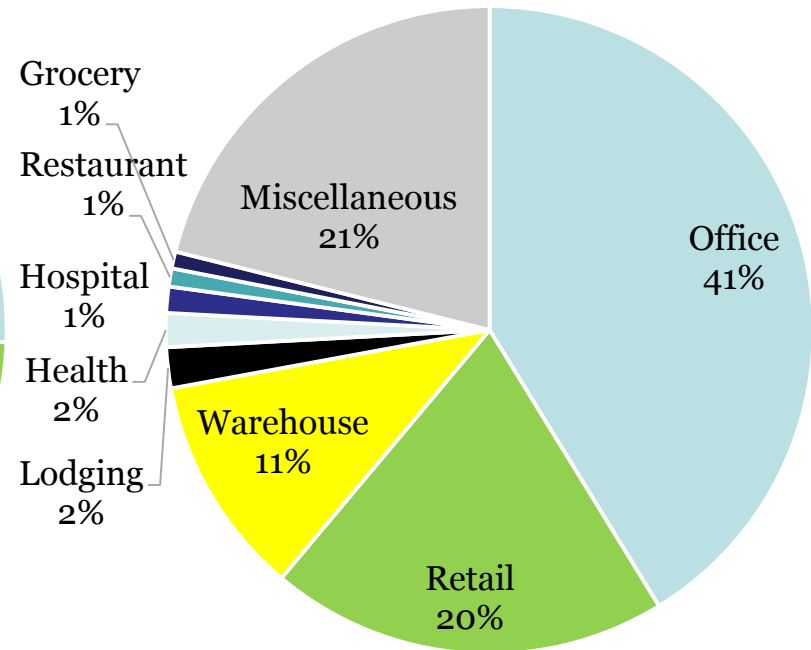
Building Type	Number of Properties	Area ft2	Electricity kWh/ft2	Nat Gas Therms/ft2	EUI MMBtu/ft2	Energy MMBtu
Office	1,098	63,061,439	15.48	0.24	0.076	4,816,690
Retail	1,487	30,382,958	10.72	0.17	0.054	1,629,206
Warehouse	563	16,820,482	13.50	0.59	0.105	1,765,534
Lodging	37	3,110,514	17.19	0.52	0.111	343,906
Health	121	2,590,881	16.51	1.39	0.196	506,897
Hospital	6	1,997,836	31.03	1.29	0.235	469,864
Restaurant	232	1,384,969	39.76	1.19	0.255	352,764
Grocery	72	1,283,412	55.59	0.58	0.248	317,965
Miscellaneous	672	32,274,218	12.28	0.50	0.092	2,965,723
Commercial Subtotal	4,288	152,906,709	14.46	0.37	0.086	13,168,550
Multifamily	1,002	98,095,161	8.61	0.10	0.039	3,846,705
County Level Total	5,290	251,001,870	12.17	0.26	0.068	17,015,256

Office and retail buildings are most numerous and represent most building space

Properties by Type

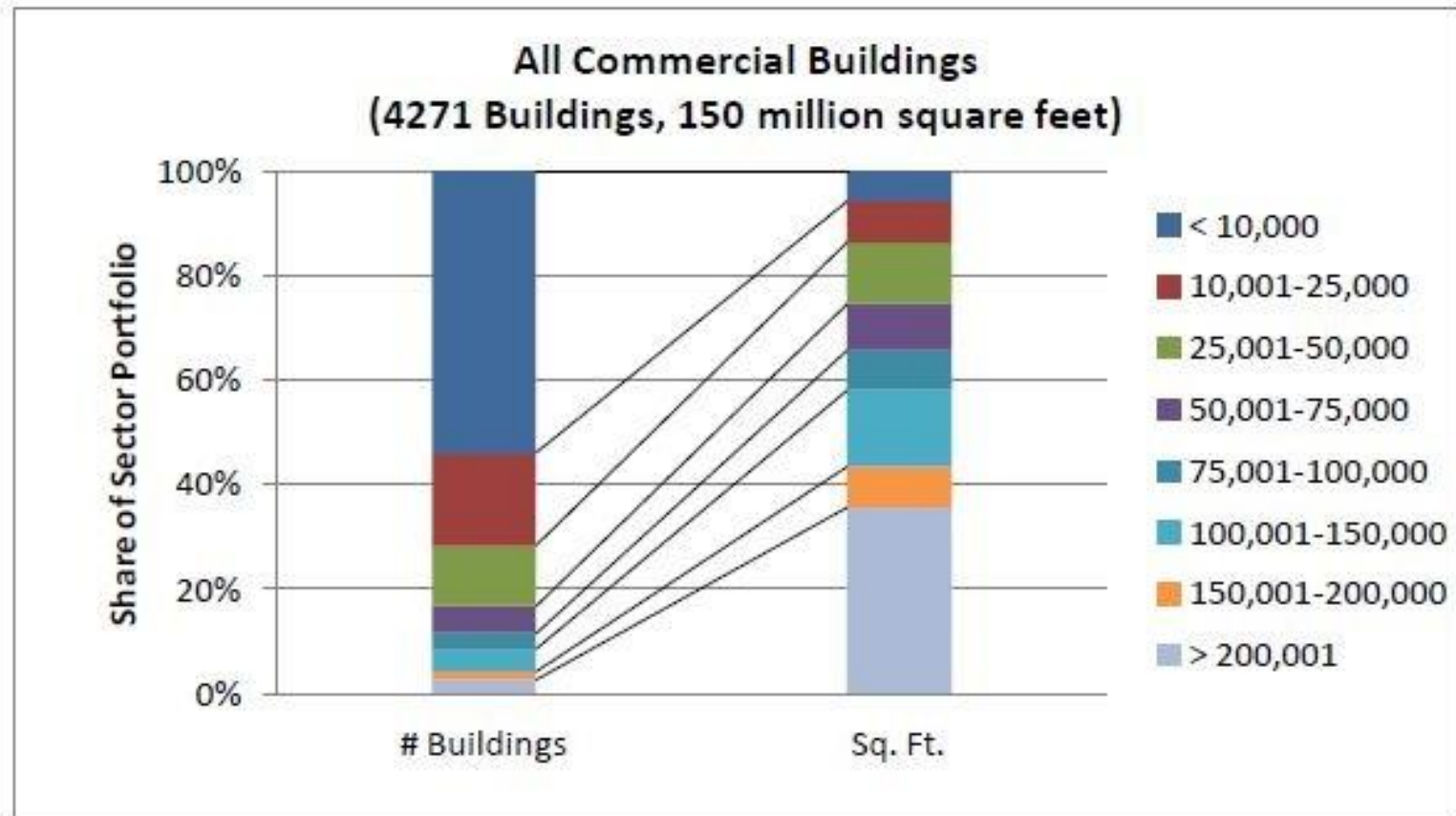


Square Footage by Type



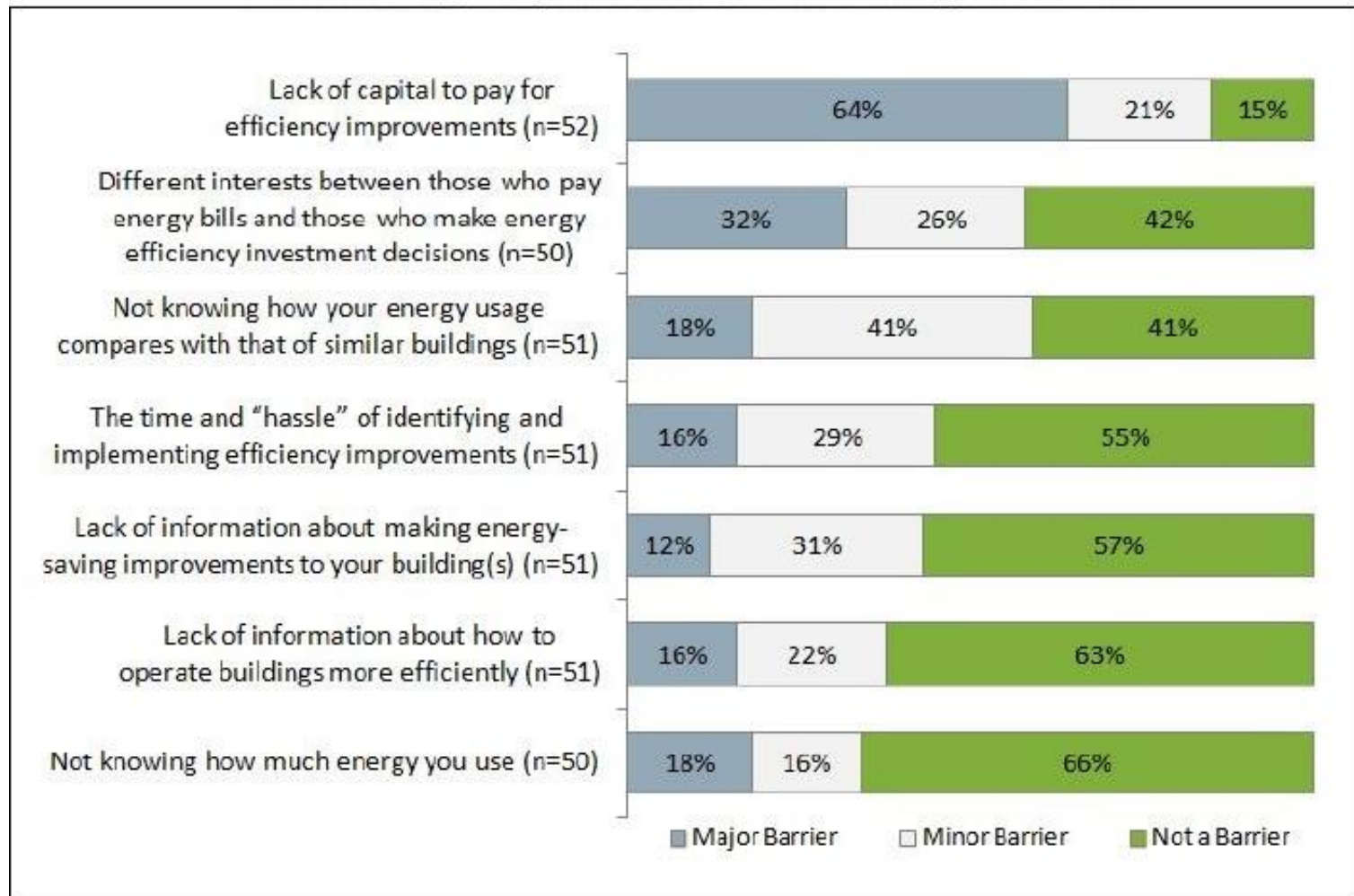
Only 30% of buildings make up 90% of building space, but small buildings are most numerous

Distribution of Commercial Floor Space by Building Size



Lack of capital is perceived as largest barrier to installing efficiency upgrades in commercial buildings

Owner/Manager Respondents' Market Barrier Perceptions



MC housing is dominated by single-unit owner-occupied, but significant large multi-family buildings

- *Housing Stock* - 359,631 housing units (33% rented)
 - 232,211 single-family (20% rented)
 - 127,420 multifamily (57% rented)
- 65% are single units, 35% are buildings with 3 or more units
 - 61% of rental units are in buildings with 3 or more units
- Average home is more than 35 years old!

Source: Montgomery County Planning Department, Census

Montgomery County has aging residential building stock, in need of efficiency upgrades

EXISTING HOUSING BY DECADE BUILT

	countywide
pre-1950	12.8%
1950s	17%
1960s	14.2%
1970s	13.3%
1980s	23.7%
1990s	10.8%
2000s	8.1%
2010	0.2%
pre-1980	57.2%
after-1990	19.1%

***Almost 60% of
residential building
stock is ≥ 35 years
old!***

Source: Montgomery County Planning Department, 2010

Affordable housing “Moderately Priced Development Units” comprises 3.6% of the housing in Mont. Co.

MPDUs Produced in Montgomery County
1976 - 2011

Unit Type	Number	Percent of Total
For-sale	9,290	70.1%
Rental	3,956	29.9%
Total	13,246	
MPDUs percent of all units produced: 8.65%		

Source: DHCA

Low and moderate income county residents make up a significant chunk of the market

- Median Household Income is approximately \$89,000
- 27% of County households make less than \$50,000
 - These households can't afford average rent (assuming 30% of income goes to rent)
- An estimated 7.5% of the county's population lives in poverty

Source: Montgomery County Housing Policy 2012

Montgomery County's low-income households increased over the previous decade

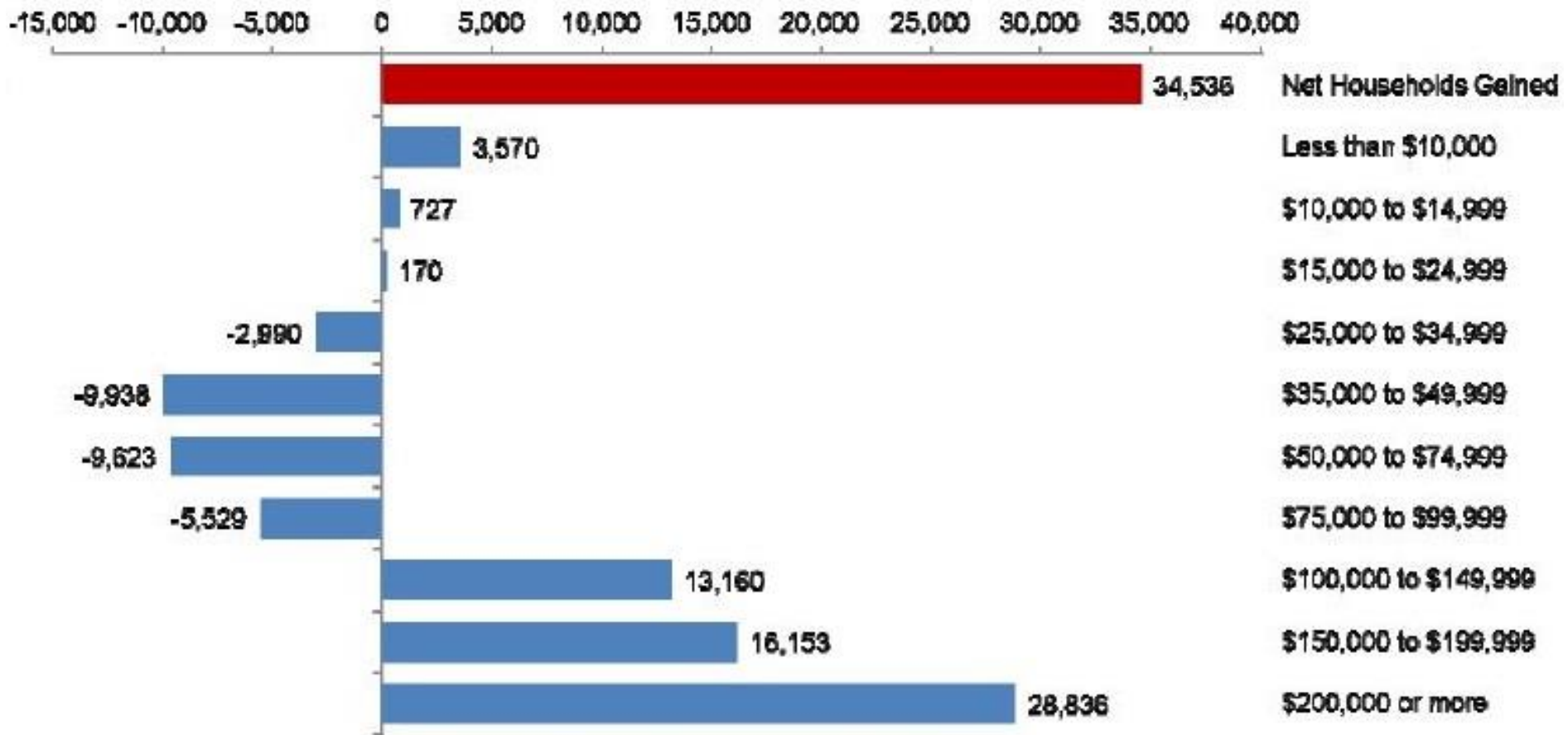
Income & Benefits (2013 dollars)	Households	Share of Total
Less than \$10,000	12,035	3.3%
\$10,000 to \$14,999	6,994	1.9%
\$15,000 to \$24,999	16,312	4.5%
\$25,000 to \$34,999	16,914	4.7%
\$35,000 to \$49,999	31,524	8.7%
\$50,000 to \$74,999	53,659	14.9%
\$75,000 to \$99,999	45,517	12.6%
\$100,000 to \$149,999	71,257	19.8%
\$150,000 to \$199,999	43,919	12.2%
\$200,000 or more	62,432	17.3%

Source: Census, American Community Survey

Montgomery County's low-income households increased over the previous decade

CHANGE IN NUMBER OF HOUSEHOLDS BY INCOME BRACKETS FROM 1999 TO 2010

(Unadjusted dollars)



Sources: U.S. Census Bureau's Decennial Census 2000 and American Community Survey (ACS) 2010 1-Year and Montgomery County Planning Department.

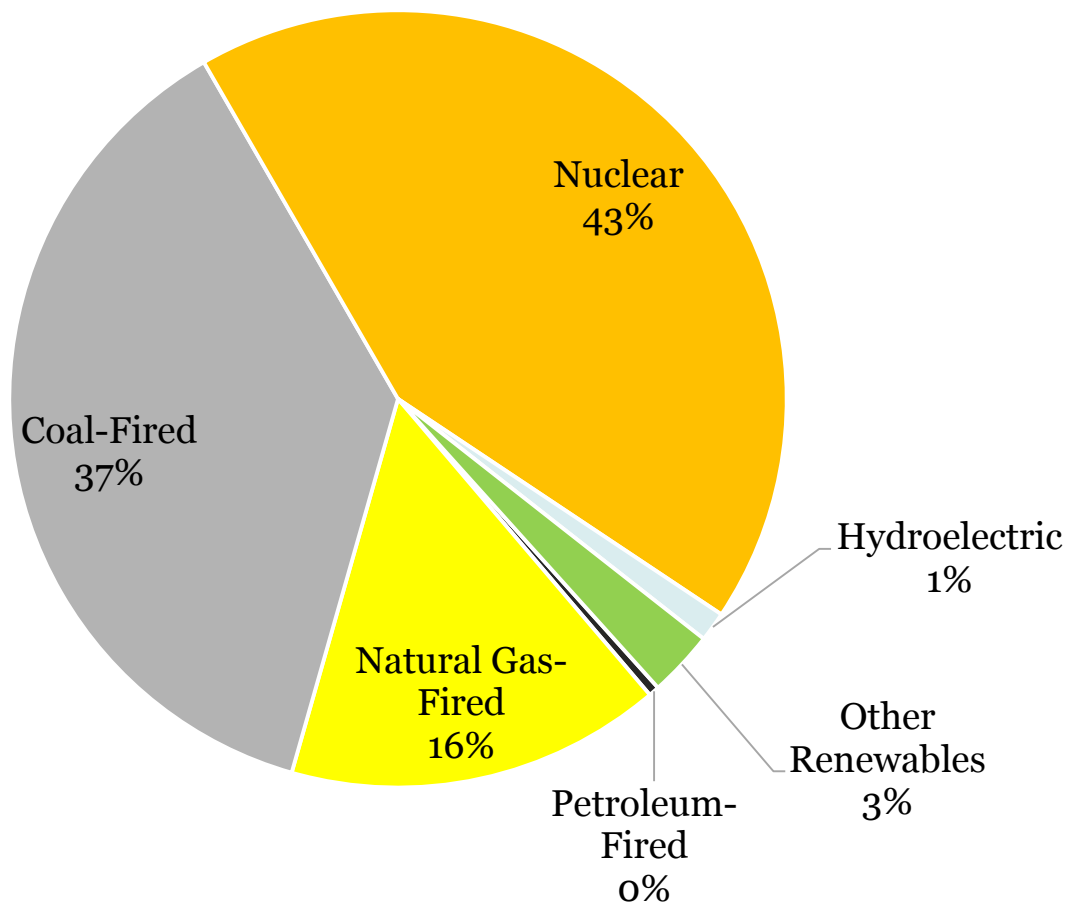
Natural gas primary residential heating source in Maryland, but still large reliance on electricity

Energy Source for Home Heating	Maryland	Delaware	Virginia
Natural Gas	44.2%	41.0%	33.4%
Electricity	40.1%	32.5%	53.2%
Fuel Oil	9.9%	14.2%	5.5%
Liquefied Petrol Gases	3.1%	9.7%	4.5%
Other/None	2.7%	2.6%	3.4%

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Among Maryland-based generation, 50% is fossil fuel, negligible in-state renewable generation

Maryland Net Generation, September 2015
(GWh)



But most of MC power is imported and delivered by Pepco, with even more reliance on fossil fuels

ENERGY SOURCE (FUEL MIX) JULY 1, 2013 - JUNE 30, 2014	
Coal	43.2%
Gas	15.7%
Nuclear	32.7%
Oil	0.3%
Hydroelectric (> 30MW)	0.3%
Renewable Energy	
Captured Methane Gas	3.6%
Geothermal	0.0%
Hydroelectric (< 30MW)	0.7%
Solar	0.2%
Solid Waste	1.4%
Wind	1.7%
Wood or other Biomass	0.2%
Unspecified Renewable	0.0%
Total	100%
Renewable energy resource subtotal:	7.8%

***Coal is nearly
half of what
Pepco delivers to
customers!***

E MD electricity prices are above national average, and other states in region

*Residential Electricity
Price – May 2015*

State	¢/kwh
NJ	15.66
DE	14.45
PA	14.03
MD	13.63
DC	13.12
VA	11.63
U.S.	12.95

*Commercial Electricity
Price – May 2015*

State	¢/kwh
NJ	12.73
DC	11.59
DE	10.98
MD	10.83
PA	9.58
VA	8.15
U.S.	10.44

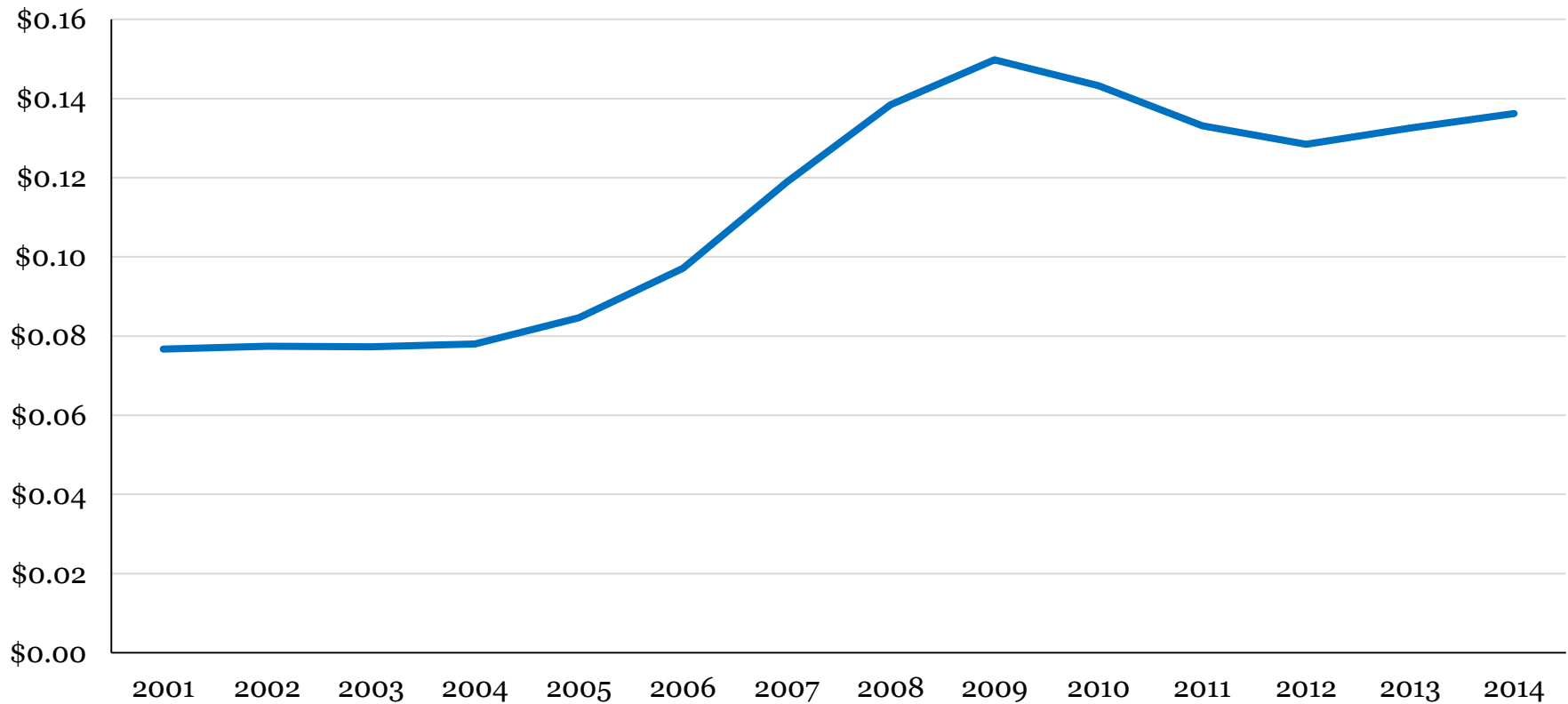
*Industrial Electricity
Price – May 2015*

State	¢/kwh
NJ	10.57
DC	8.57
MD	8.16
DE	7.88
PA	6.95
VA	6.84
U.S.	6.65

Source: EIA.

MD electricity prices almost doubled in last decade

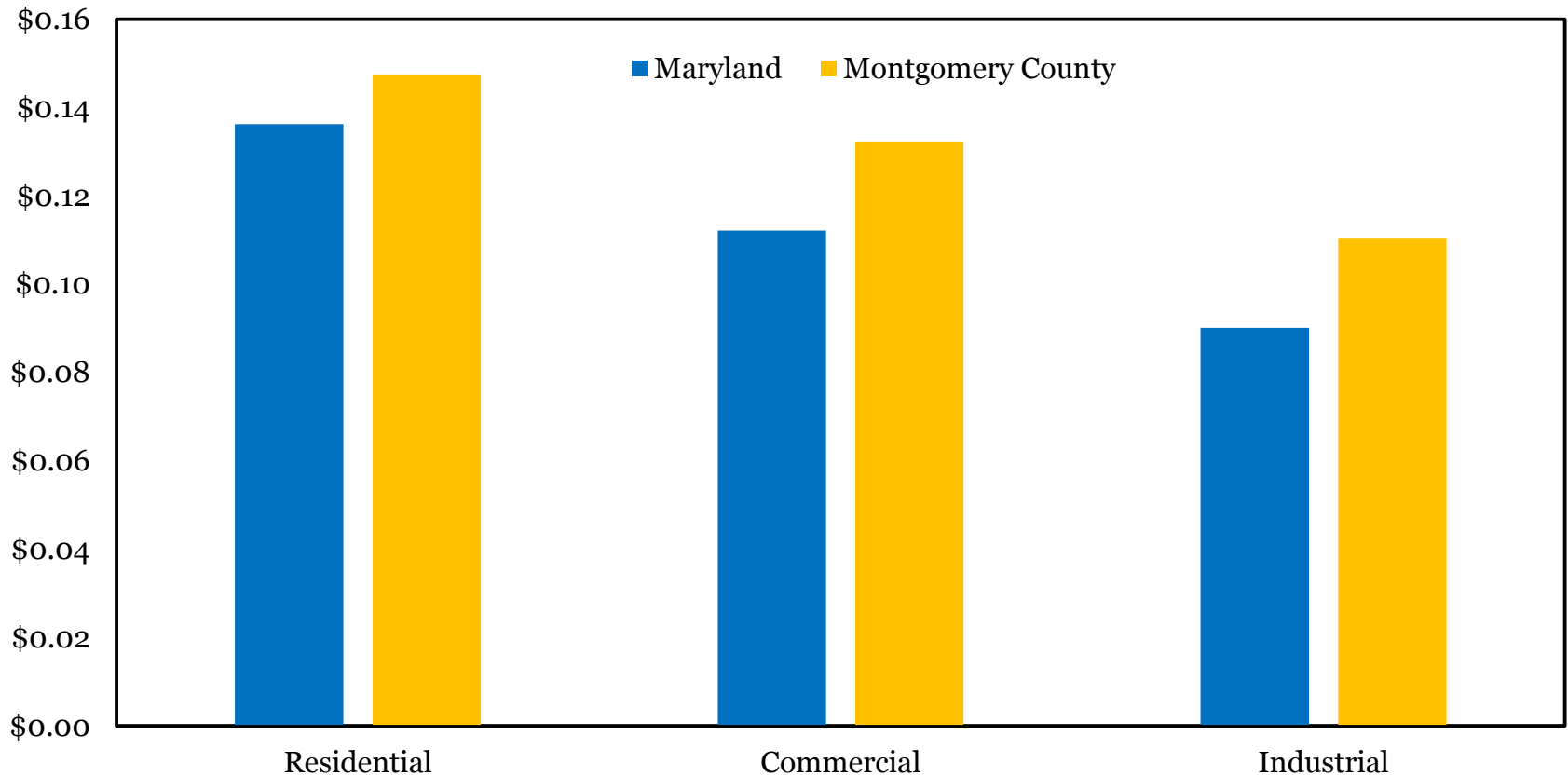
MD Residential Electricity Prices (\$/kW)



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Montgomery County electricity prices are ¢1-2 higher due to county's energy tax

2014 Montgomery County Electricity Prices (\$/kWh)



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Most residents drive to work, high transportation costs in the County

WORK LOCATION OF COUNTY RESIDENTS

	2000	2010
inside Montgomery County	58.67%	58.69%
elsewhere in Maryland	10.04%	11.29%
work outside of Maryland	31.30%	30.02%

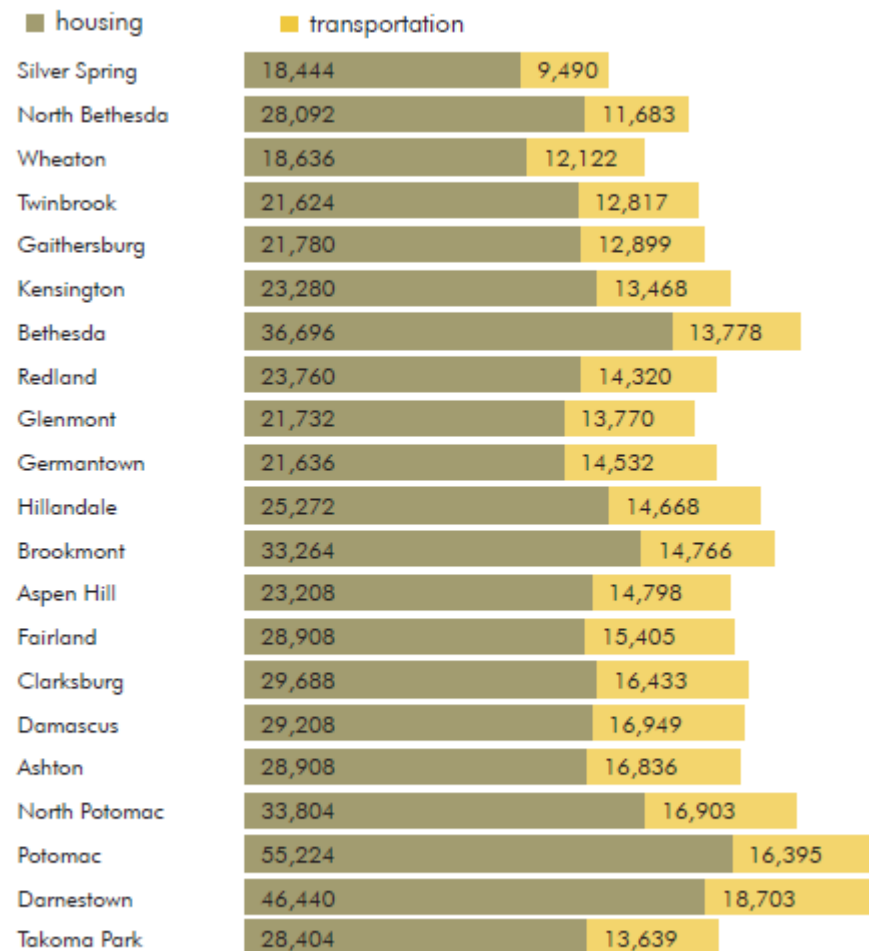
Source: U.S. Census Bureau, 2000 U.S. Census; 2010 American Community Survey

COMMUTE MODE OF COUNTY RESIDENTS

	2000	2010
drive alone	68.9%	64.8%
public transit/rail	12.6%	15.1%
carpool	10.9%	11.1%
work at home	4.8%	5.9%
walk/bike/other	2.7%	3%
average commutes (in minutes)	33	34

Source: U.S. Census Bureau, 2000 U.S. Census; 2010 American Community Survey

ANNUAL TRANSPORTATION AND HOUSING COSTS




Source: Urban Land Institute, Terwilliger Center Housing + Transportation Calculator



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Key Takeaways

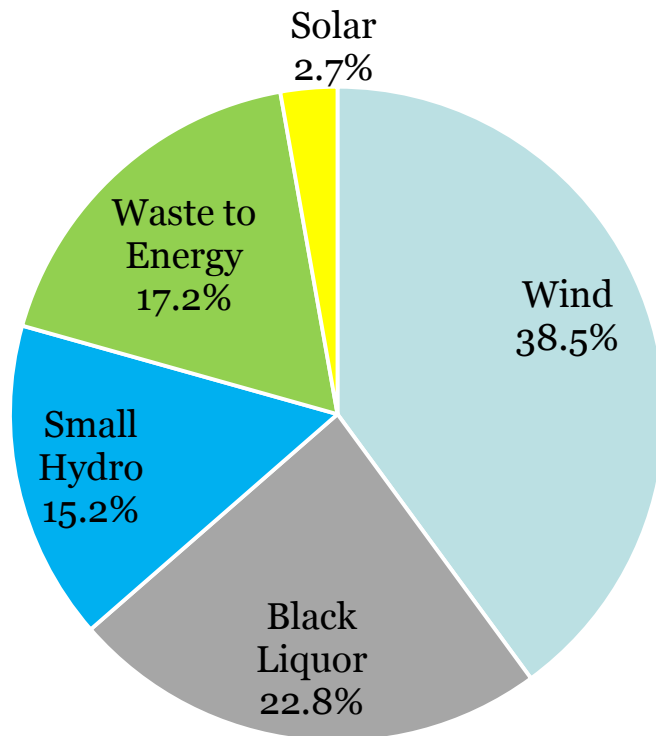
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- Lots of old housing, roughly 2/3 single family (mostly owned) and 1/3 multifamily (mostly rented)
 - Commercial buildings, mostly retail and offices, face lack of financing as key barrier to efficiency upgrades
 - Grid electricity heavily reliant on coal and nuclear
 - Grid electricity prices are above national average

Agenda

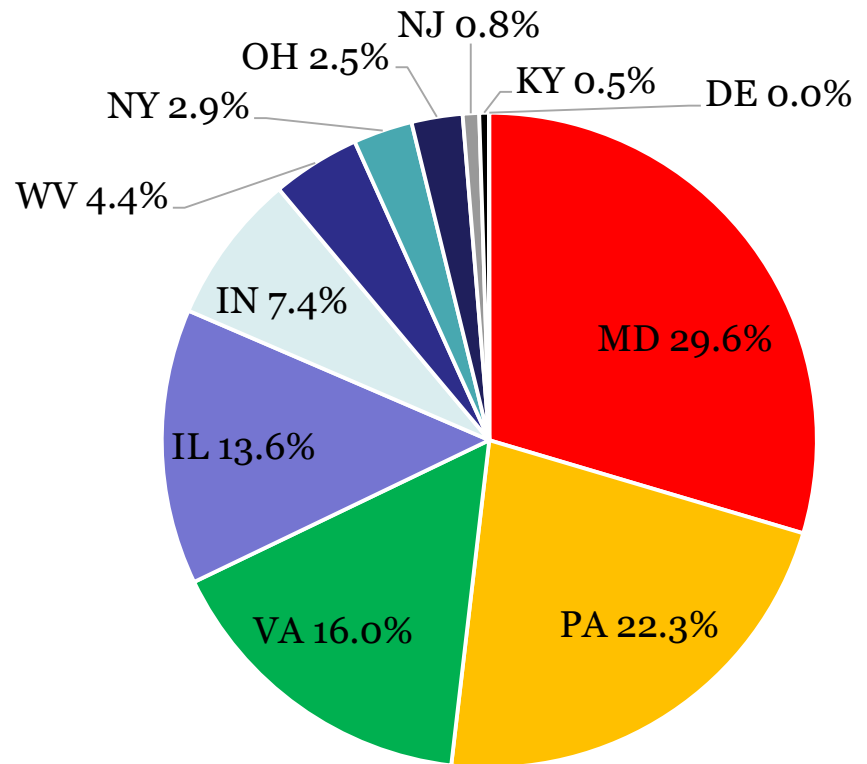
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Majority of MD's RPS satisfied by wind, black liquor, and out-of-state resources

Tier 1 RECs By Technology



Tier 1 & 2 RECs By Geography

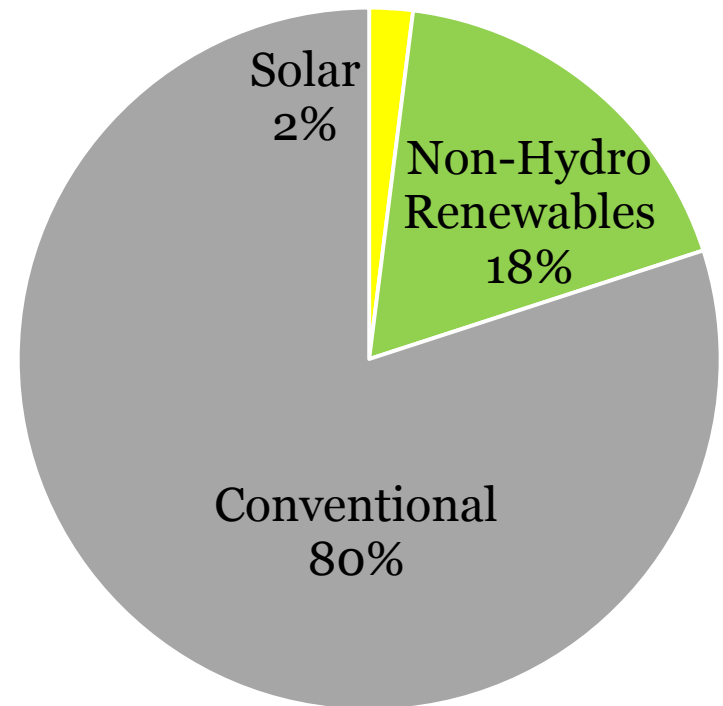


State law requires large and rapid adoption of renewable energy into state electricity mix

Status of MD Goals

- Mandate that 20% of electricity is renewable by 2022
- 2% must come from solar by 2020, remainder coming from non-hydro renewables
- Through 2013, RPS compliance primarily from wind in Midwest and black liquor in VA
- Most renewables from out of state – only 2.7% of in-state generation from non-hydro renewables

MD Renewable Legal Goals

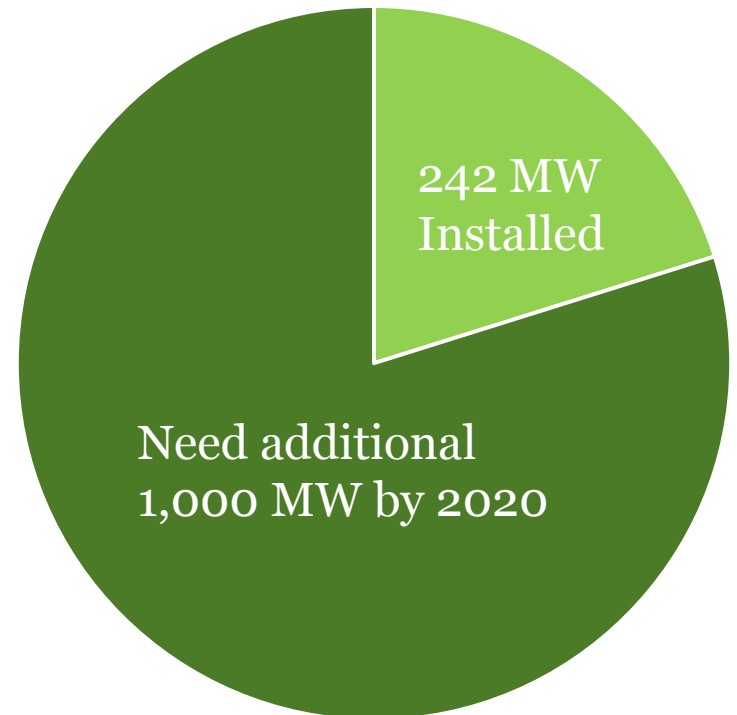


Maryland solar requirement specifically calls for billions of investment in short order

Need for Investment in Solar

- >1200 MW of solar needed by 2020 to satisfy MD's 2% solar requirement
- Only 242 MW of solar installed to date through 2014
- Approximately of 1,000 MW of solar needs to be built in 5 years
- Equivalent to 140,000 residential PV systems
- Montgomery County's "share" is roughly 200 MW of solar
- \$600M investment in 5 years

MD Solar Requirement



Montgomery County itself has passed efficiency goals, which come with their own investment needs


County Climate Protection Plan

- Goals calls for 50% of county homeowners to reduce annual energy usage by at least 25% by 2020
 - Estimated to require between \$800M and \$1.2B in investment
- Goal also calls for county commercial and multi-family buildings to reduce energy consumption by 25% by 2020
 - This would require between \$1B and \$3B in investment
- Approximately \$225 million invested to date through utility programs

Montgomery Efficiency Goals



Taken together, goals sum to billions of total clean energy investment in the County

- 
- \$600 million → 200 MW of solar for MC's share of the RPS 2% target
 - ~\$1B → reduce 50% of homeowners' energy use by 25%
 - ~\$2B → 25% reduction in commercial building energy use

\$3.6 billion in clean investment may be necessary to meet all goals by 2020

MD has a handful of residential sector grant programs

Residential Programs	
Bio-heating oil purchases	Tax credits for purchasing biofuels
Clean Burning Wood Stove Grant Program	Grants for clean wood burning stoves
EmPOWER Maryland	Links to utility rebates for energy efficient products and equipment
EmPOWER Clean Energy Communities Grants	Grants for MD counties to finance energy efficiency project that benefit LMI
Maryland Statewide Farm Energy Audit Program	Farm energy audits and cash rebates for energy-saving projects
Residential Clean Energy Grant Program	Financial assistance for the installation of PVs, solar water heaters, geothermal heat pumps, and wind turbines

MD has many commercial sector grant programs for a variety of market segments

Commercial Programs	
Bioheat Tax Credit Program	Tax credits for producing biofuels
Clean Energy Production Tax Credit	Tax credits for producing electricity
Commercial Clean Energy Grant Program	Financial assistance for the installation of PVs, solar water heaters, geothermal heat pumps, and wind turbines.
EmPOWER Maryland	Links to utility rebates for energy efficient products and equipment
Energy Resiliency Grant Program	Financial assistance for the installation of wiring and back-up power generation at retail service stations and volunteer firehouses
Game Changer Program: Energy Innovation Competitive Grants	Grants for innovative clean energy projects that are in the early stages of commercialization
Maryland Save Energy Now (SEN)	Low cost energy assessments and implementation support for industrial facilities
Kathy A. P. Mathias Agriculture Energy Efficiency Program	Grants from \$25k to \$200k to assist with the costs of installing eligible energy efficiency technologies
Maryland Statewide Farm Energy Audit Program	Farm energy audits and cash rebates for energy saving projects

MD also has many grant programs for state and local government

State & Local Government Programs	
Commercial Clean Energy Grant Program	Financial assistance for the installation of PVs, solar water heaters, geothermal heat pumps, and wind turbines
EmPOWER Clean Energy Communities Grants	Grants for MD counties to finance energy efficiency project sthat benefit LMI
Energy Resiliency Grant Program	Financial assistance for the installation of wiring and back-up power generation at retail service stations and volunteer firehouses
Game Changer Program: Energy Innovation Competitive Grants	Grants for innovative clean eneryg projects that are in the early stages of commercialization
Public Schools Energy Efficiency Initiative Engineering Design Program	Recovery of some engineering costs for schools implementing eligible energy efficiency projects
Mont. Co. Renewable Energy & Energy and Environmental Design Tax Credits	Property tax credits for the installation of energy efficiency devices in homes and for LEED certified green buildings (credits for solar panels are suspended)

MD has small set of public financing programs, almost all for efficiency

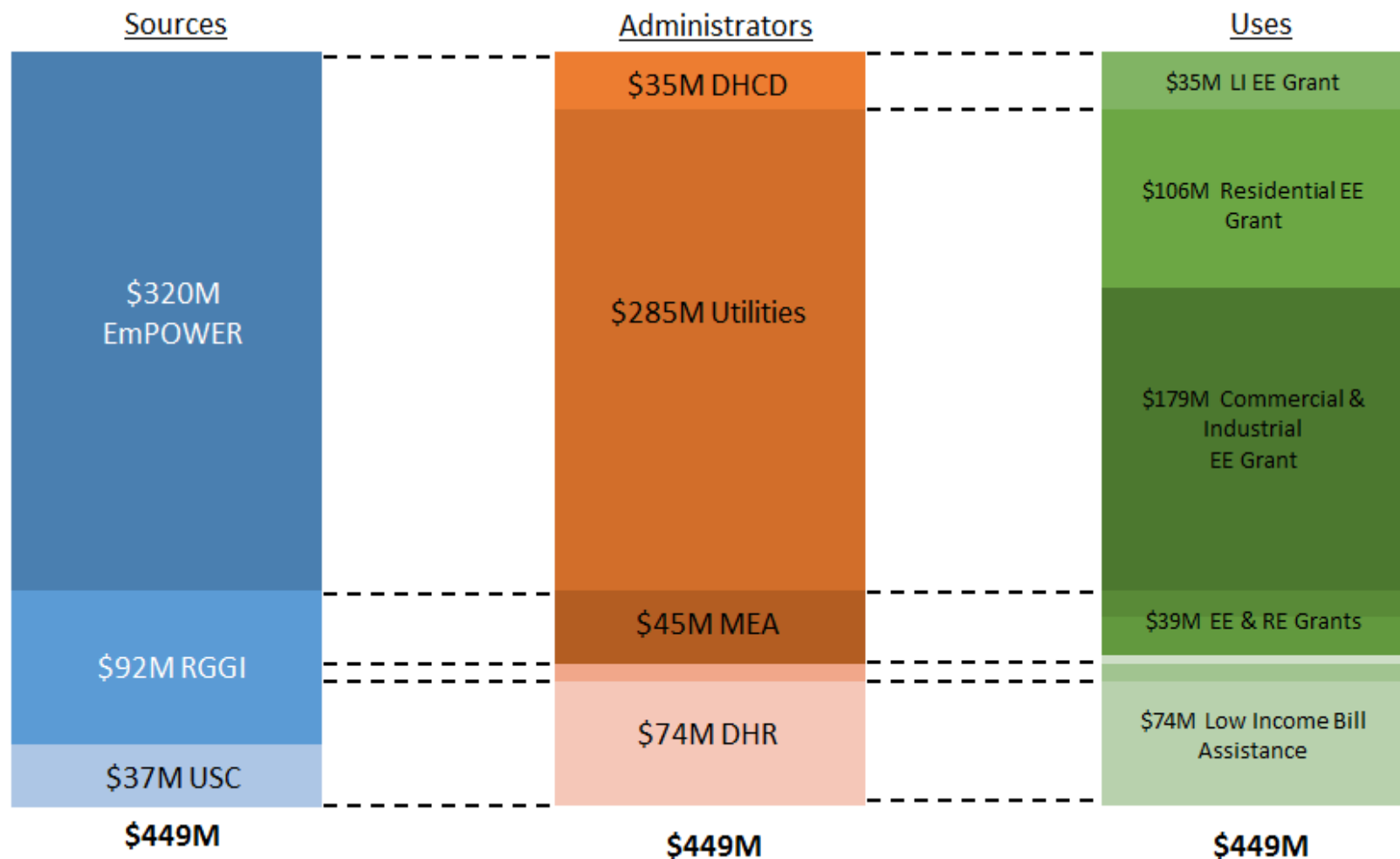
Name	Admin Org	Eligible Participants	Target Technologies	Financing Product	Loan Volume	Status
BeSMART Home	DHCD	Residential	Energy Efficiency	Loans	\$1.3 million in loans	Active
BeSMART Multifamily	DHCD	Multifamily	Energy Efficiency; Renewables	Loans, Loan loss reserve	\$12.1 million in financing	Active
BeSMART Business	DHCD	Commercial	Energy Efficiency	Loans	\$737,000 in loans	Closed
Jane E. Lawton Conservation Loan	MEA	Non-profits, local governments, businesses, others	Energy Efficiency	Revolving loan fund	\$5.2 million	Active
Maryland Clean Energy Capital (MCAP)	MCEC	Non-profits, government, MUSH	Energy Efficiency	Tax-exempt bonds	\$15 million	Active
Maryland Home Energy Loan Program (MHELP)	MCEC	Residential	Energy Efficiency	Loans, via loan loss reserve	\$20.4 million	Active
State Agency Loan Program (SALP)	MEA	State buildings	Energy Efficiency	No-interest loan	\$24 million	Active

Montgomery County has several tax credits that promote clean energy improvements

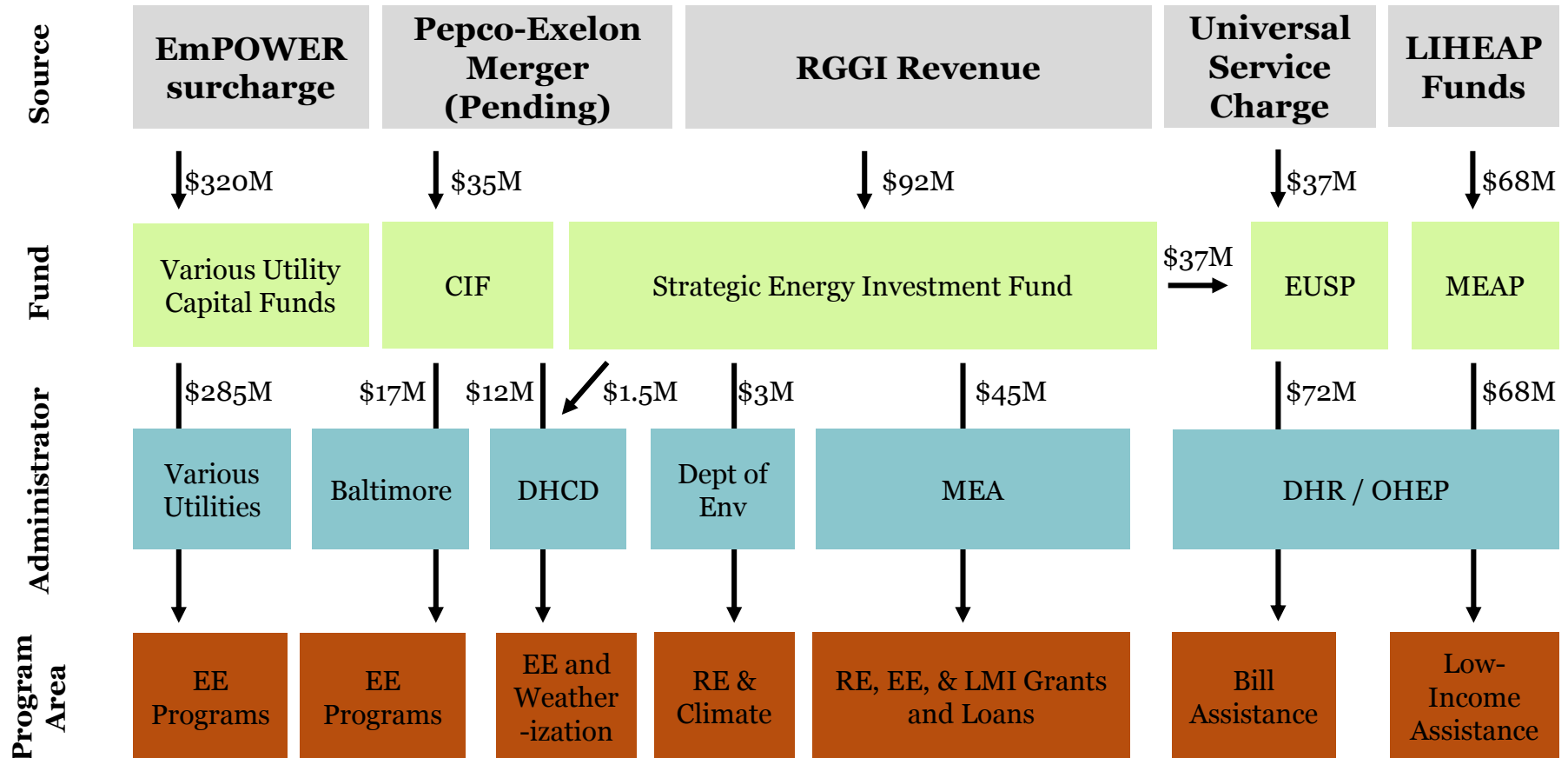
Montgomery County Property Tax Credits

- **Energy and Environmental Design**
 - Between 25-75% tax credit on the property tax owed on the building for 3-5 years, depending on which level of certification is achieved
 - Total credits disbursed can't exceed \$5M in a year
- **Renewable Energy Devices**
 - Suspended since 2011
 - Tax credit for the lesser of 50% of the system costs, \$5000 for a device that generated electricity or heats/cools a structure
- **Energy Conservation Devices**
 - Up to \$250 in tax credits for each property for energy efficiency and conservation devices
 - Total credits disbursed can't exceed \$100,000 in a year

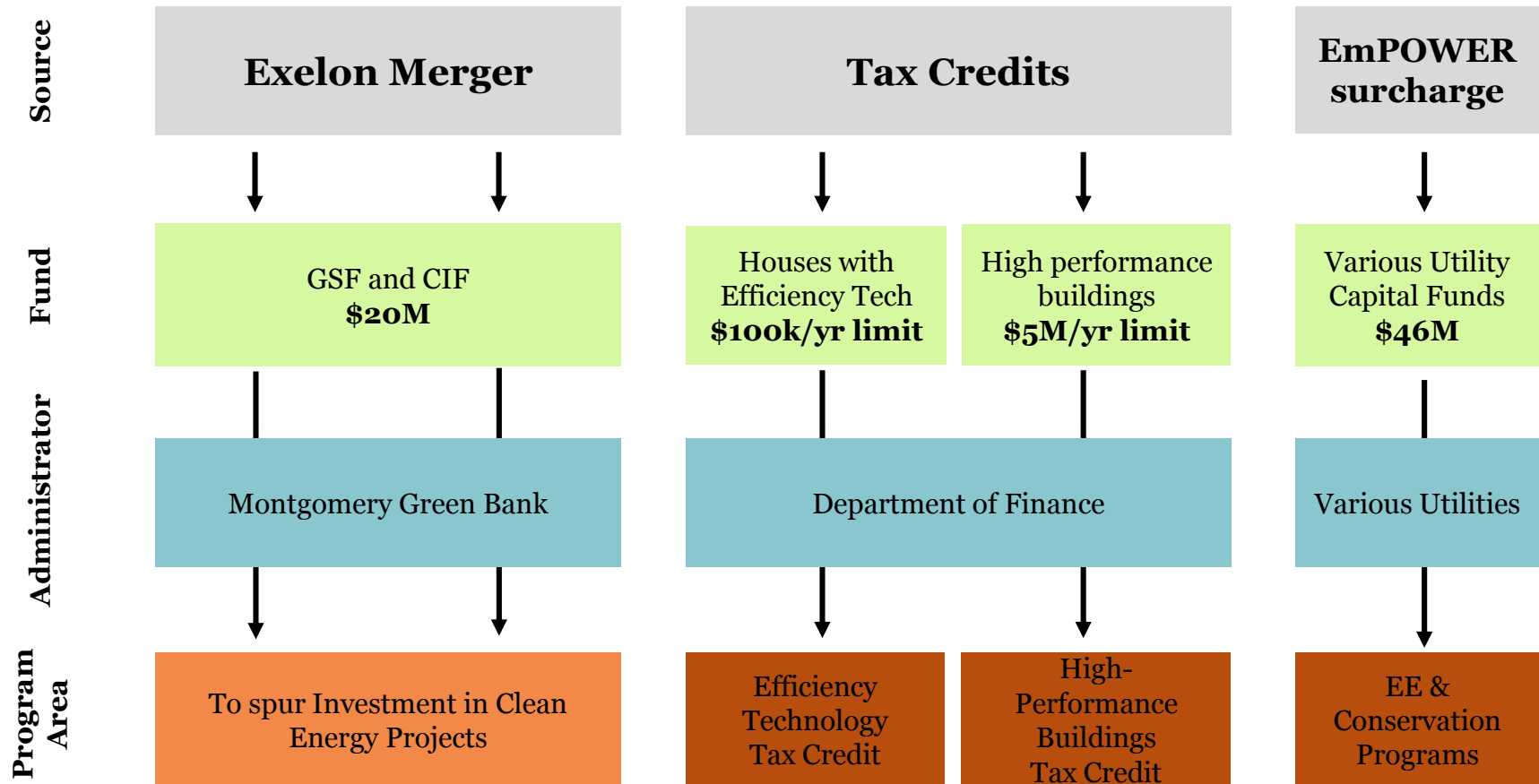
In 2014 ratepayers paid for \$449M in energy grants, \$324M going to non-commercial & non-LI residential



MD spends >400 million dollars on clean energy through a variety of agencies/organizations



County-level clean energy programs and spending is primarily toward incentives and grants



EmPOWER achievements are noteworthy, if expensive

- Equivalent of \$4 billion in lifetime energy bill savings
- Lifecycle cost of only 2.6¢/kwh
- \$1.81 of benefits per every dollar of utility or participant cost
- \$1.4 billion in total expense of the program to date
- **PSC itself points to need for more market development tools**
 - *“Based solely on currently approved EmPOWER programs, the Utilities may be challenged to fully realize the 10% per-capita reduction in energy usage and the 15% per-capita reduction in peak demand by the end of 2015.”*



In 2014 EmPOWER spent \$285M of public capital on grants, leveraging \$90M of private capital

Business as Usual Grant Programs

\$0.32

*Private Investment
per Public Dollar*

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Typical Green Bank Financing

\$5.00

*Private Investment
per Public Dollar*

*Green Bank can increase private leverage by **15x** over
current Maryland program structure.*

Key Takeaways

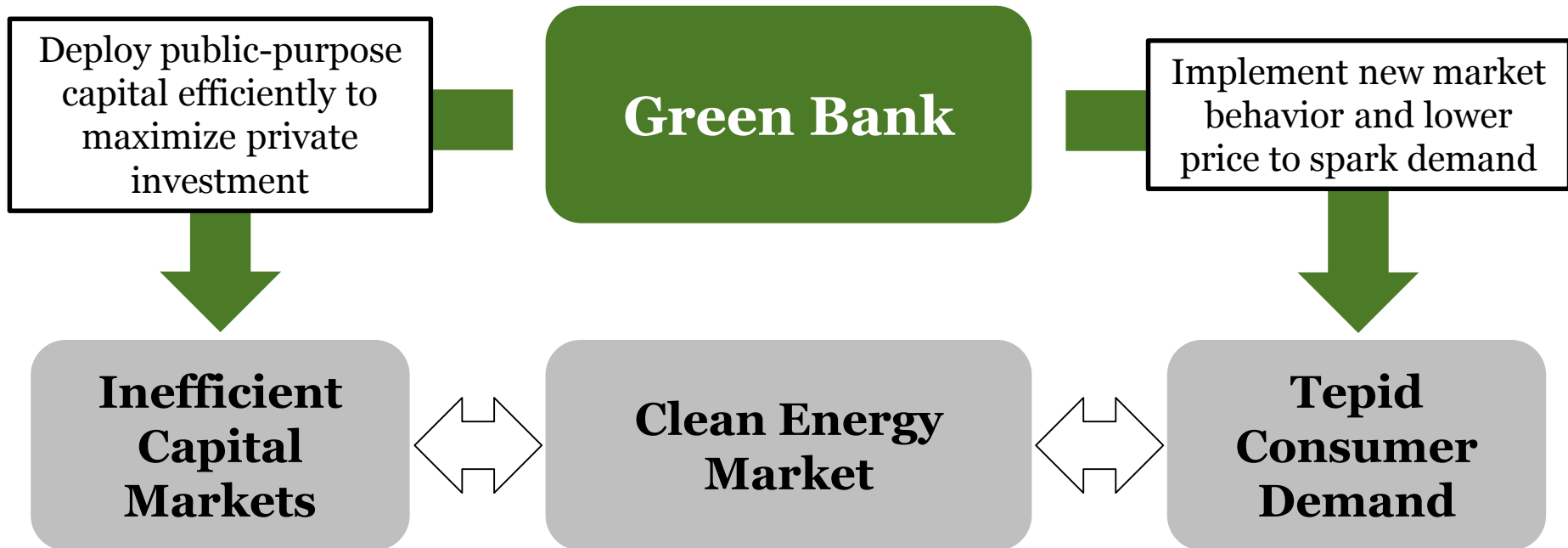
- 
- Ambitious RPS and county goals, will need large scale deployment of clean energy to meet targets
 - Existing financing programs cover small section of market
 - Most clean energy programs in the state are in the form of grants and subsidies
 - Large opportunity for finance to scale up and speed up clean energy deployment
 - Relatively small county-level program/policy support to meet ambitious efficiency goals

Agenda

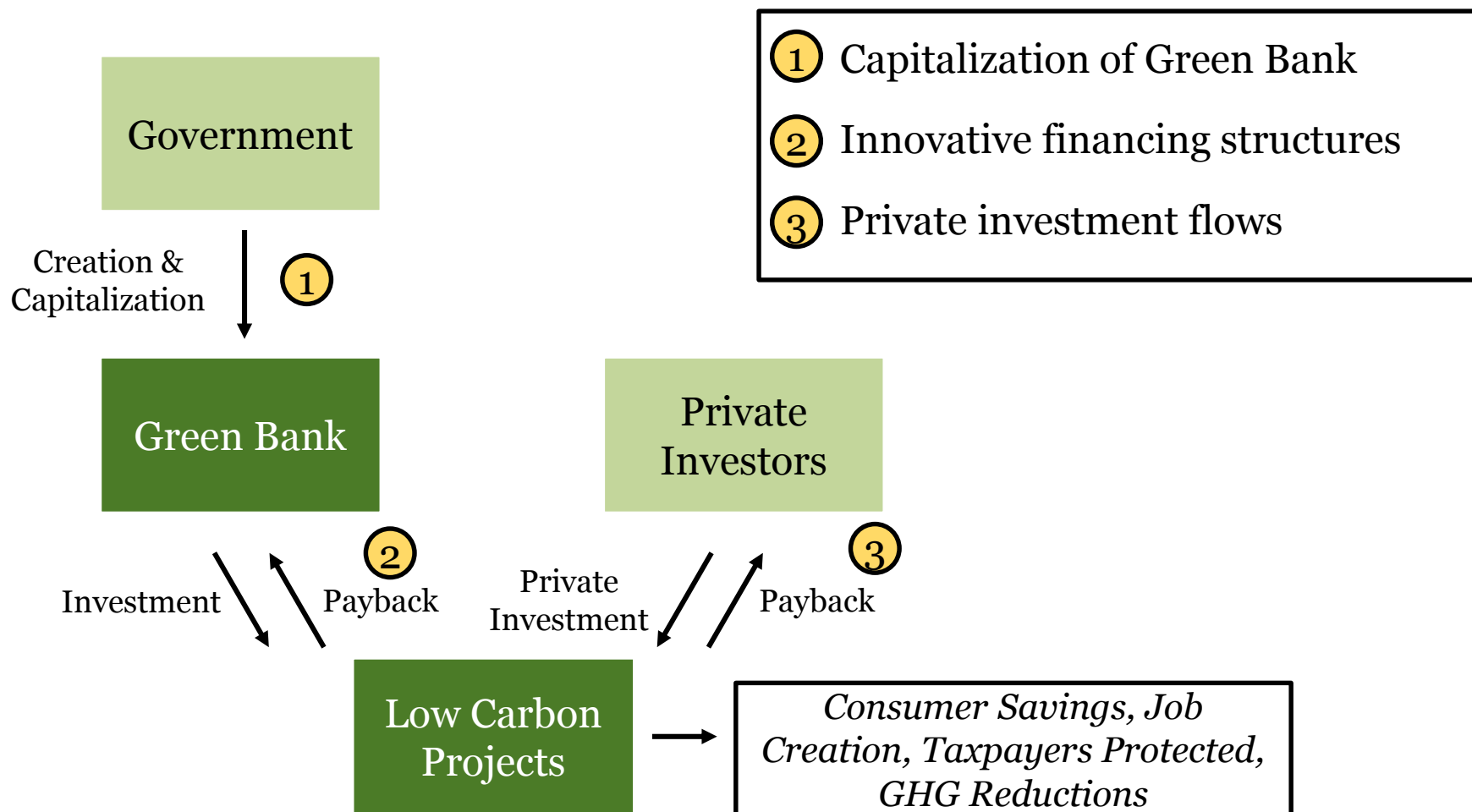
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Green banks fill the financing gap and draw in the capital needed to make clean energy markets grow

A green bank is a public financing authority that leverages private capital with limited public-purpose dollars to accelerate the growth of clean energy markets



Green Bank is a public institution that channels public and private investment



Green bank plays dual role of increasing the flow of capital and building market to increase demand

Financing Projects

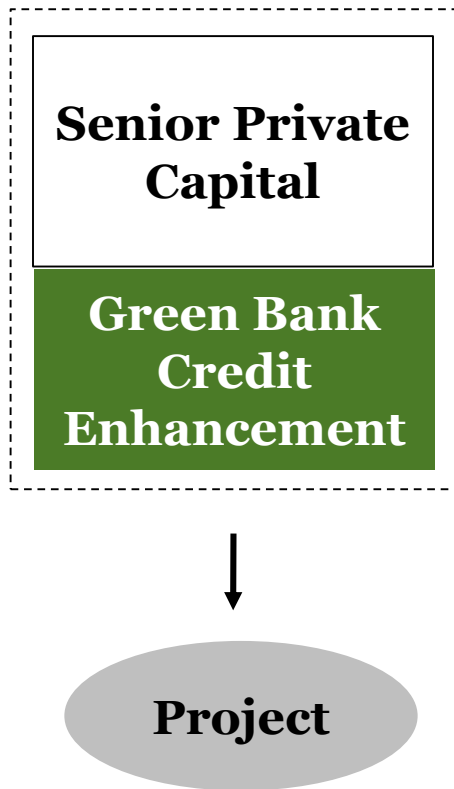
- Leverage public-purpose dollars
- Stimulate private investment
- Fill market gaps

Generating Demand

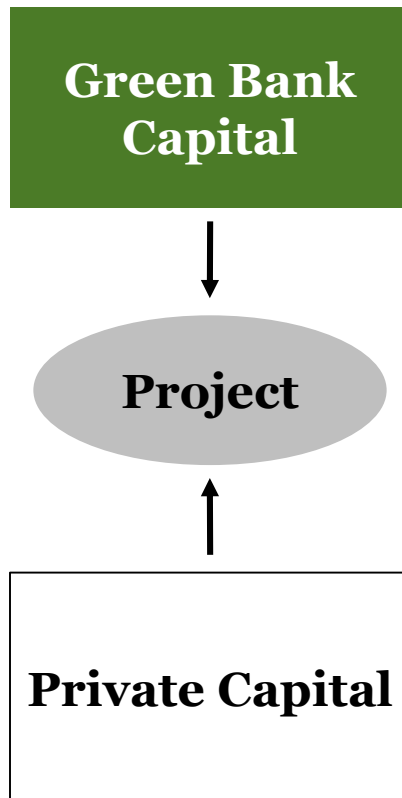
- Turn-key solutions
- Minimize customer confusion
- Cross-agency coordination

Green Banks are flexible institutions that can employ various financing methods to suit the need

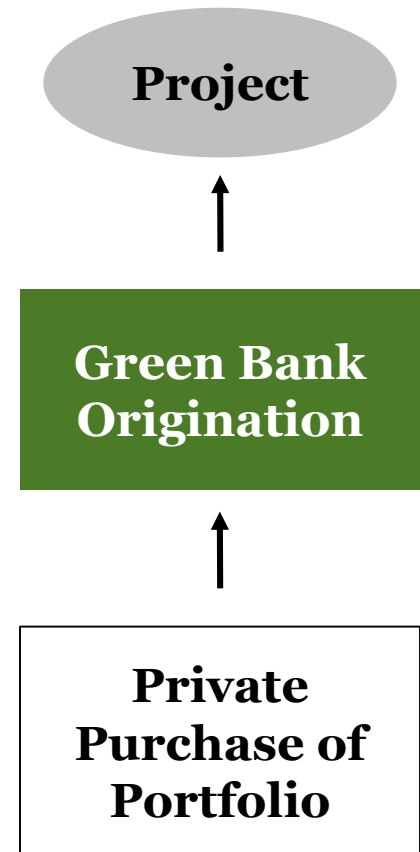
Credit Support



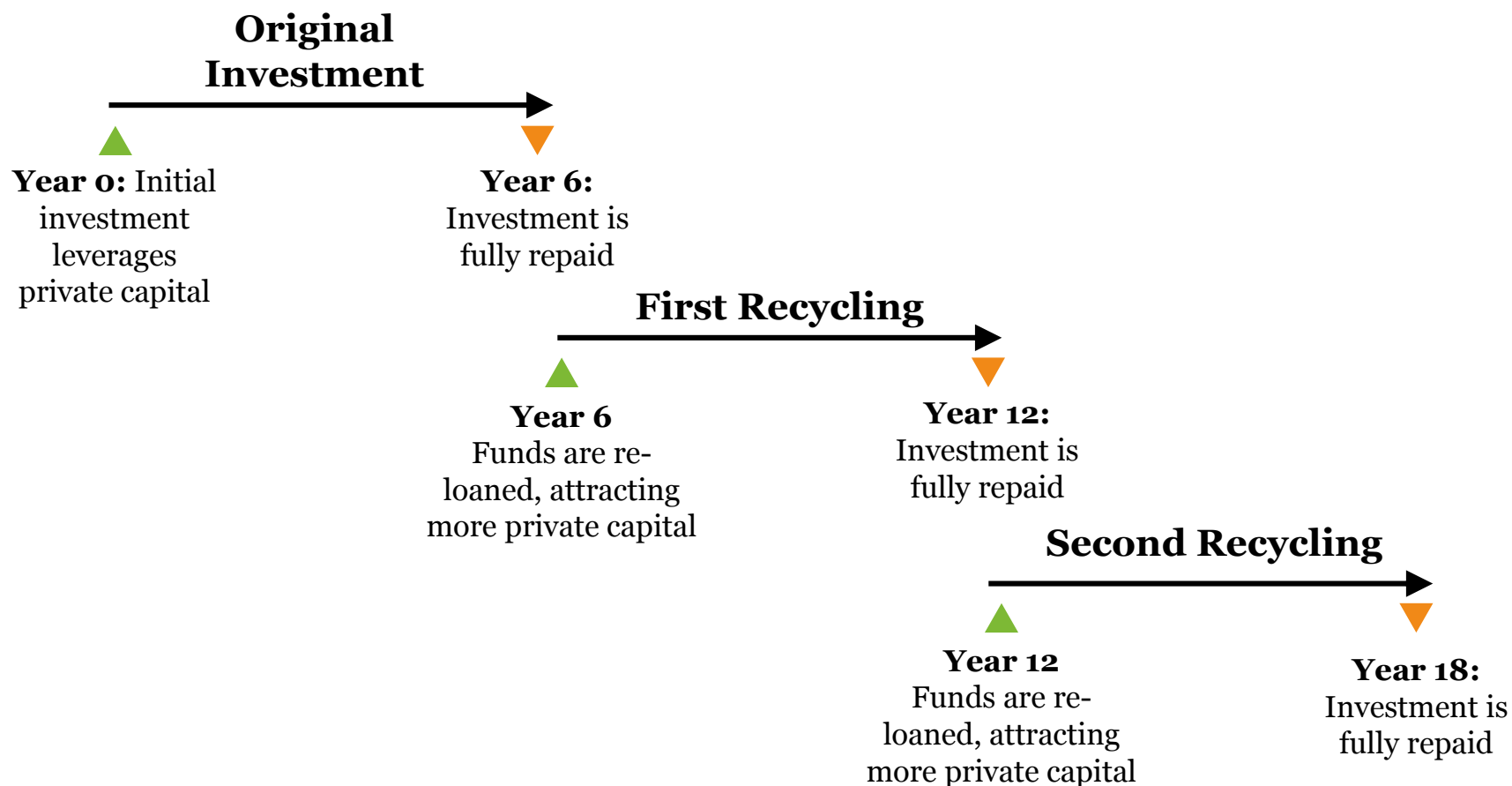
Co-Investment



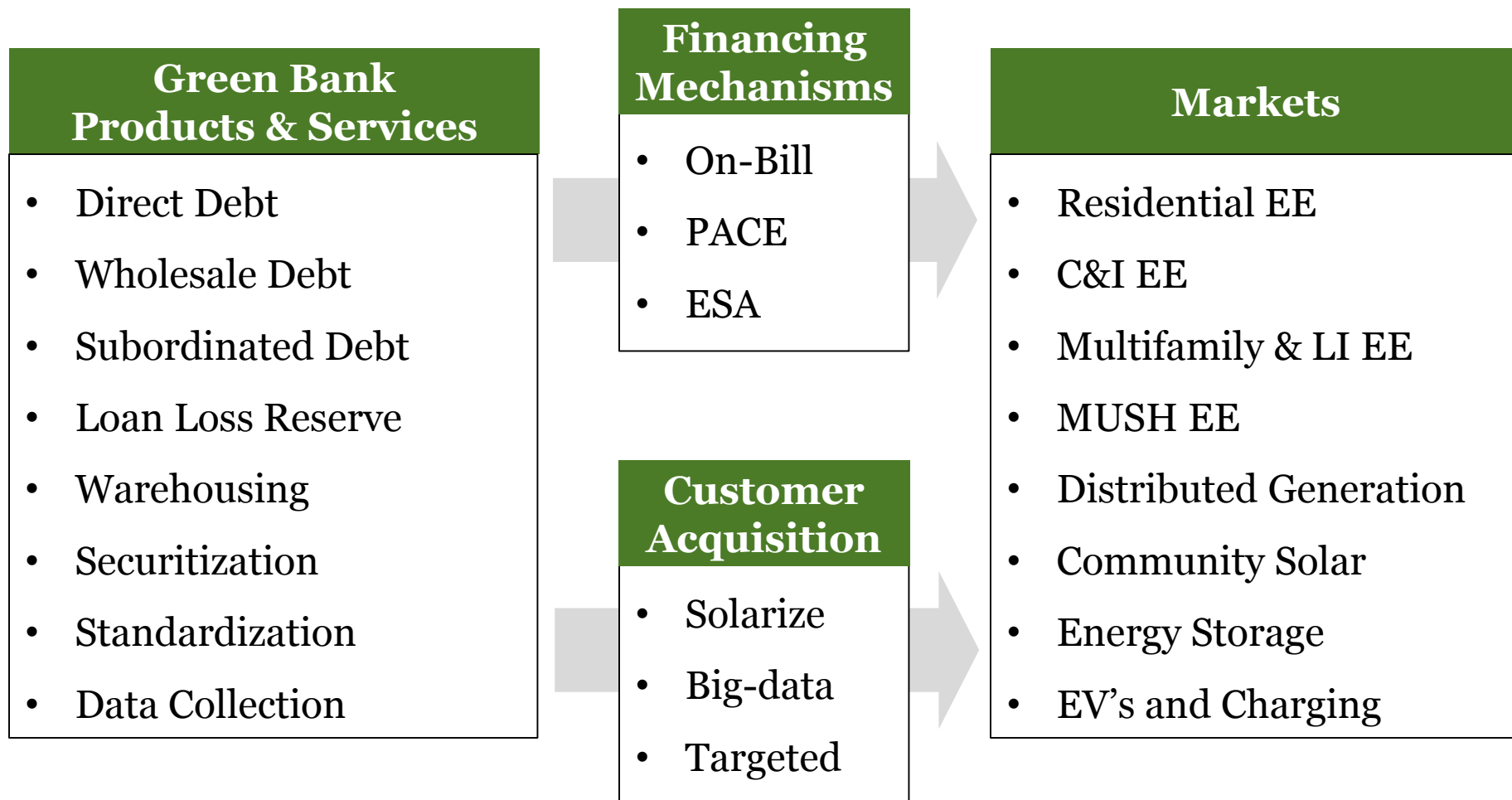
Warehousing



Green Banks recycle capital, re-leveraging private investment multiple times



Range of financial tools, applied to prioritized markets, through innovative structures



Green Bank doesn't just create financing products with private sector – it delivers products to customers

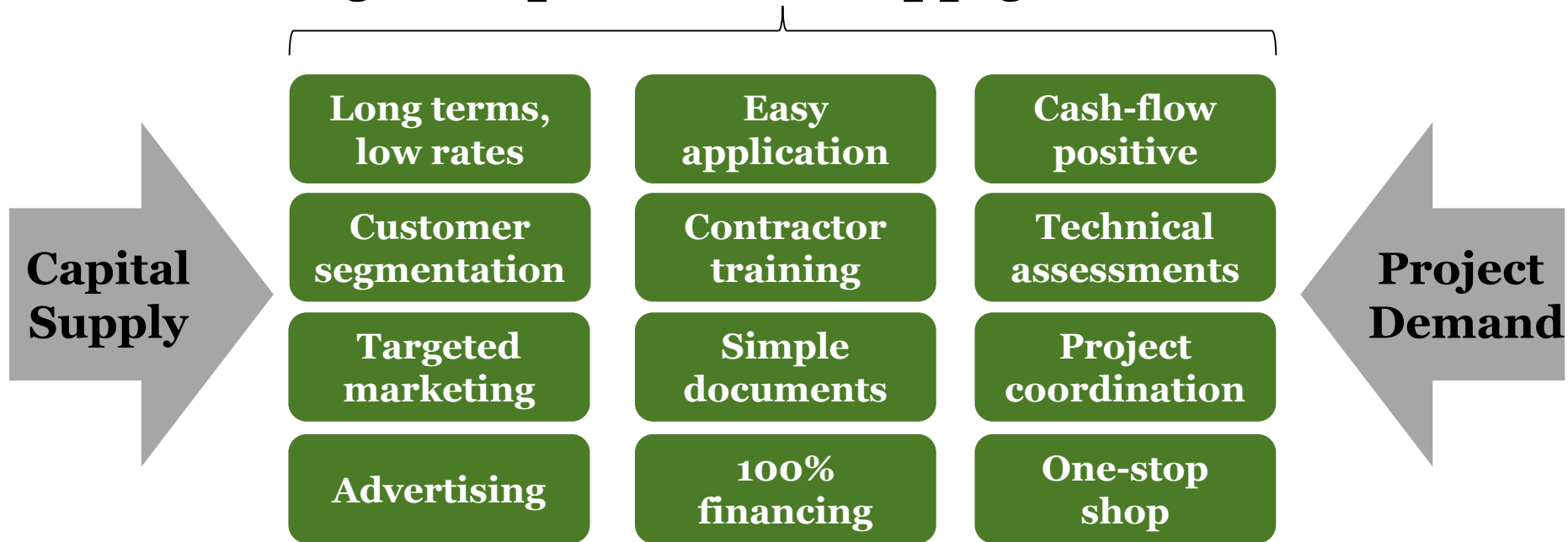
Financing Products *NOT* Useful to Customers

- Residential EE loan at 10% interest rate and 4 year term
- Commercial building upgrade loan with max loan size of \$10,000
- Residential solar financing product with no outreach to contractors for channel marketing
- Multifamily EE financing with 1 year underwriting process
- LMI loan product that requires 680 FICO SCORE
- Whole-home upgrade with PV & EE with no savings calculation

Simply making capital available is not effective – it must be packaged attractively, marketed, and sold to create demand.

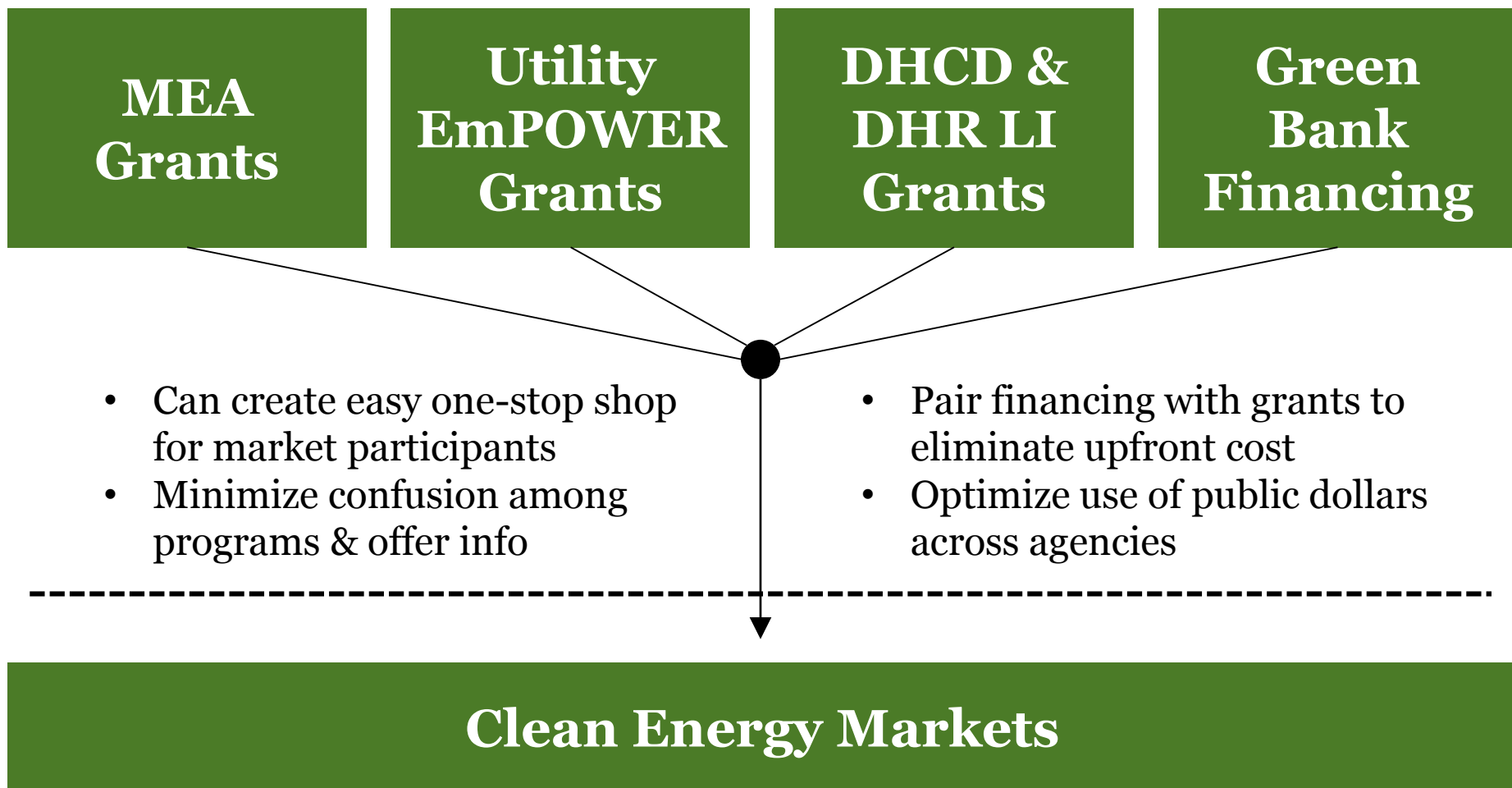
Green Banks help bridge the long gap between capital supply and demand for clean energy

Green Bank Market Development Activity Bridges Gap Between Supply & Demand



All of this activity must occur to reduce barriers to demand – some can be done by green bank, some done by private partners

Green Bank is complementary to existing programs, works in coordination for maximum market efficiency



Montgomery Green Bank can stimulate investment, finance clean energy for greater market growth

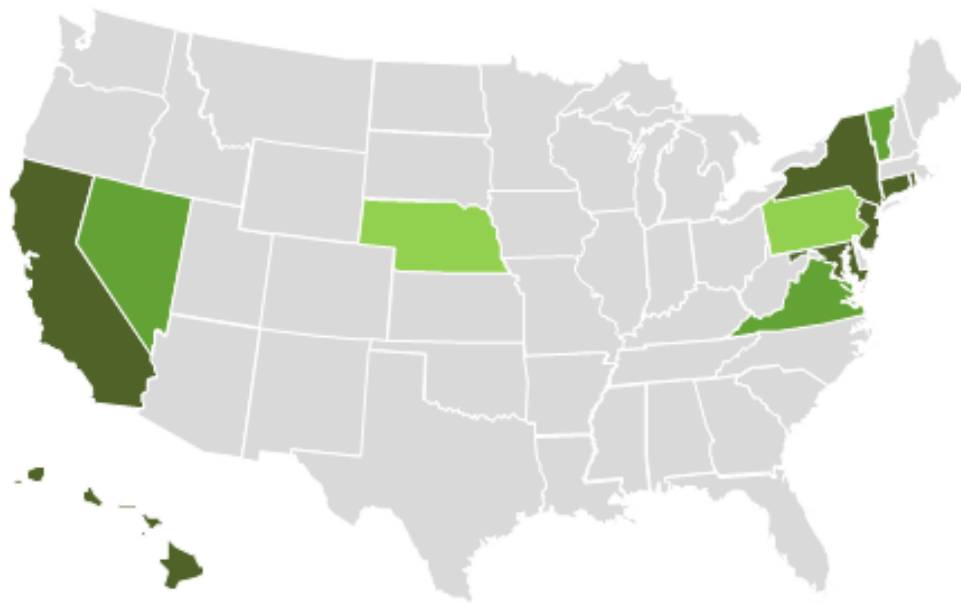
- The upfront cost of clean energy technology is the greatest barrier to adoption
- 100% financing eliminates the upfront cost associated with clean energy
- Financing eliminates the need to meet short payback period requirements
- Financing enables customers to be net cash flow positive immediately

Affordable and accessible financing enables more demand for clean energy

Interest in Green Banks is growing across the country

Established Institutions

- 1 Connecticut Green Bank
- 2 Hawaii Green Infrastructure Authority
- 3 New York Green Bank
- 4 New Jersey Resilience Bank
- 5 California CLEEN Center
- 6 Rhode Island Infrastructure Bank
- 7 Montgomery County (MD) Green Bank



States with Active Initiatives to Develop Institutions

- | | |
|---------------------------------------|---|
| 8 Maryland – Legislation for GB Study | 10 Vermont – Govt Steering Committee |
| 9 Nevada – Legislation for GB Study | 11 Virginia – Gov’s Climate Change Commission |

States with Similar Programs

- | |
|-------------------------------------|
| 12 NE Dollar and Energy Saving Loan |
| 13 Pennsylvania Help |
| 14 WHEEL |

Varying capitalization sources and org structures, common principles and objectives

	Institution	Eligible Technology	Key Products	Source of Funds and Initial Capital	Oversight/Structure	Staff
1	Connecticut Green Bank	<ul style="list-style-type: none"> Solar, fuel-cell, geothermal, biomass Energy efficiency 	<ul style="list-style-type: none"> C-PACE Smart-E loan Solar Lease II Solar Loan 	<ul style="list-style-type: none"> RGGI funds, utility bill surcharge ~\$35M per year 	<ul style="list-style-type: none"> Quasi-public Independent board of directors 	<ul style="list-style-type: none"> 33
2	Hawaii Green Infrastructure Authority	<ul style="list-style-type: none"> Solar (primary focus) Energy efficiency 	<ul style="list-style-type: none"> Solar leases for LMI and non-profit sector, paired with on-bill recovery 	<ul style="list-style-type: none"> \$150 million bond issuance backed by ratepayer fee 	<ul style="list-style-type: none"> PUC oversight Econ Development Agency administration 	<ul style="list-style-type: none"> 5
3	New York Green Bank	<ul style="list-style-type: none"> Renewable energy Energy efficiency Clean transportation 	<ul style="list-style-type: none"> Issued RFP for private sector financial intermediaries 	<ul style="list-style-type: none"> \$218.5 M initial capital from repurposed utility bill surcharge, RGGI funds 	<ul style="list-style-type: none"> PSC oversight Division of state energy office 	<ul style="list-style-type: none"> 12
4	New Jersey Energy Resilience Bank	<ul style="list-style-type: none"> Combined heat and power Fuel cells Off-grid solar backup 	<ul style="list-style-type: none"> Water treatment, wastewater plants Hospitals, healthcare facilities Transportation and transit infrastructure 	<ul style="list-style-type: none"> \$200M of disaster relief funds from US HUD 	<ul style="list-style-type: none"> Jointly administered by PUC and NJ Economic Development Authority 	<ul style="list-style-type: none"> 5

Varying capitalization sources and org structures, common principles and objectives

	Institution	Eligible Technology	Key Products	Source of Funds and Initial Capital	Oversight/Structure	Staff
5	California CLEEN Center	<ul style="list-style-type: none"> • Efficiency (first priority) • Renewable generation 	<ul style="list-style-type: none"> • SWEEP (MUSH market efficiency) • CEEP (commercial market efficiency) 	<ul style="list-style-type: none"> • Pre-existing bonding authority of the state IBank 	<ul style="list-style-type: none"> • Division of state Infrastructure Bank • Governor appoints the board 	<ul style="list-style-type: none"> • TBD
6	Rhode Island Infrastructure Bank	<ul style="list-style-type: none"> • Renewables • Efficiency • Grid and demand-side upgrades 	<ul style="list-style-type: none"> • Commercial & Residential PACE Program • Efficient Buildings Fund for municipal buildings 	<ul style="list-style-type: none"> • \$3M from RGGI • \$2M from ARRA • \$2M from ratepayers • QECCBs • General bonding authority 	<ul style="list-style-type: none"> • Body politic of the state • Governor appoints board 	<ul style="list-style-type: none"> • 12
7	Montgomery County Green Bank	<ul style="list-style-type: none"> • Renewable energy • Energy efficiency • Grid and demand-side upgrades 	<ul style="list-style-type: none"> • TBD 	<ul style="list-style-type: none"> • \$20M from utility merger settlement 	<ul style="list-style-type: none"> • Independent non-profit • Has official designation, bylaws and board as defined by county 	<ul style="list-style-type: none"> • TBD

1

Connecticut Green Bank offers a diverse suite of products, focus on solar and energy efficiency

Overview	Product	Description	Results
<ul style="list-style-type: none"> Established 2011 through Public Act 11-80 \$48M initial funding from repurposed system benefit charges Green Bank was created by repurposing existing agency 	Smart-E loan	<ul style="list-style-type: none"> Loan loss reserve for local banks allows for loan terms, can target lower FICO scores 	<ul style="list-style-type: none"> \$2.5M of public funds enables \$30M of private investment in clean energy through credit enhancement
	C-PACE	<ul style="list-style-type: none"> Commercial energy efficiency and clean energy loans Repayment through tax assessment Secured by lien on property 	<ul style="list-style-type: none"> Closed 31 deals with nearly \$25M in financing Private investor purchased \$27M of C-PACE transactions Total pipeline near \$100M
	Solar Lease II	<ul style="list-style-type: none"> Green Bank acts as a solar developer, pooling many leases to utilize depreciation and ITC, attracts private funds, open to FICO scores ≥ 640 	<ul style="list-style-type: none"> \$60M total funding (5:1 ratio private to public dollars) Will fund rooftop solar PV systems on about 1,500 homes and 40 businesses
	Solarize	<ul style="list-style-type: none"> Outreach through community networks, tiered pricing, and temporary monopoly for installer 	<ul style="list-style-type: none"> Lowered installation cost 30% 1/5 interested customers signed contracts Doubled amount of solar in communities
Milestones Achieved ¹	Solar Loan	<ul style="list-style-type: none"> 15-year solar loan to finance installation of solar PV systems Green Bank acts as warehouse 	<ul style="list-style-type: none"> \$4.9M approved (\$3.25M closed, \$1.35M funded) Assisted 230 homeowners
<ul style="list-style-type: none"> Catalyzed \$715M of investment Achieved private: public leverage ratio of 10:1 Created over 1,200 jobs Projects will prevent release of more 250,000+ tons of GHG emissions 			

Sources: 2013 Annual Report. "Connecticut's Green Bank: Energizing Clean Energy Finance."

1

CT transition from grants to loans brings leverage, spike in total clean energy investment

Connecticut Grant-Making Authority versus Connecticut Green Bank

	FY 2000 – FY 2011 (CCEF)	FY 2012 – FY 2014 (CGB)	FY 2015 (CGB)
Model	Subsidy	Financing	Financing
Years	11	3	1
Energy (MW)	43.1	65.3	62.6
Investment (\$MM)	\$350	\$350	\$365
Leverage Ratio	1:1	5:1	5:1-10:1
Investment % Loans	9%	57%	77%

1

Connecticut's Solar Lease 2 (SL2) program provides local installers with financing offering

Program Overview

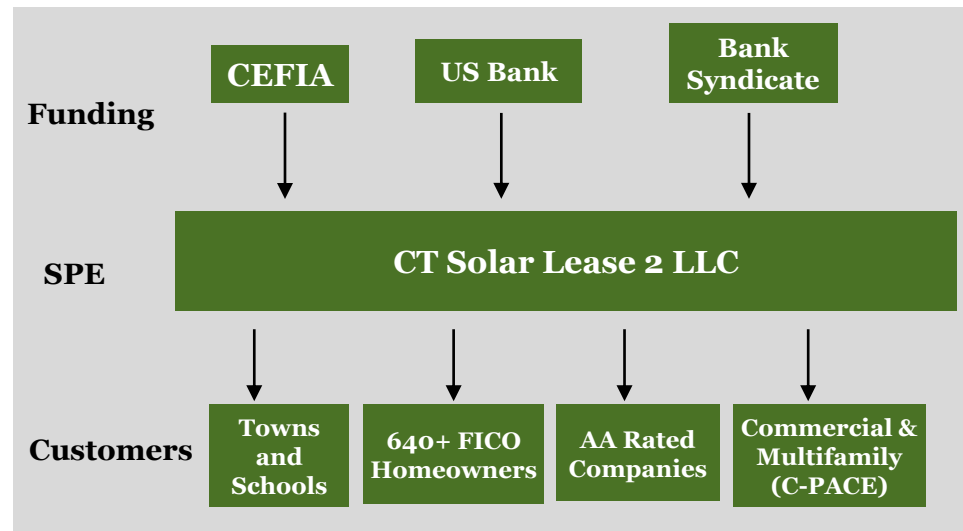
- In SL2, Green Bank acts as solar developer:
 - Establishes special purpose entity (SPE)
 - Uses federal and state incentives
 - Acquires tax equity from US Bank in order to utilize investor tax credits
 - Pools many smaller leases
- Allows property owners to lease Solar PV and solar hot water systems
- Property owners make lease payments over 20 years, opportunity to purchase system at 5 years

Milestones Achieved

- Funded projects will generate 14,000 kW annually and create more than 1,000 jobs
- Green Bank provided \$9.5M public funding to attract \$50M of private capital
- Assurant provides comprehensive insurance and warranty management
- Works with syndicate of local banks and financiers including: US Bank, First Niagara, Webster, Liberty, and Peoples United

Financial Structure

- Expect sponsor equity IRR of 9% from 2014 to 2034
- 20-year term for subordinated debt at a 2% yield with level payments of principal and interest starting in 2015
- Repurposed ARRA-SEP funds of up to \$3.5M with a coverage ratio of 200%
- Performance-based incentive of \$15.2M over 9 years from 2029 through 2034
- Overall IRR ~2%



Connecticut's unique state-wide PACE created significant investment, pipeline, national praise

Program Overview

- Legislation established Green Bank as single statewide administrator of PACE
- Requires consent of existing mortgage lender
- Funds C&I, MF for EE, RE, and micro-grid
- Green Bank provides 100% of upfront financing
- As single administrator, Green Bank standardizes underwriting

Milestones & Lessons Learned

- Closed 31 deals, worth 22.82M in financing
- Sold \$24M of PACE loans to Clean Fund
- Deployed over 6.8 MW clean energy
- Green Bank worked hard to onboard towns, municipalities across the state
- GB worked with mortgage lenders to acquire consent of senior lien position
- Need adequate staff to acquire customers

Step 1:
CGB
lends to
customers



Step 2:
CGB
bundles
loans



Step 3:
CGB sells
loans, gets
cash



Step 4:
CGB makes
new loans

Hawaii GEMS program targets underserved markets for low-cost residential solar financing

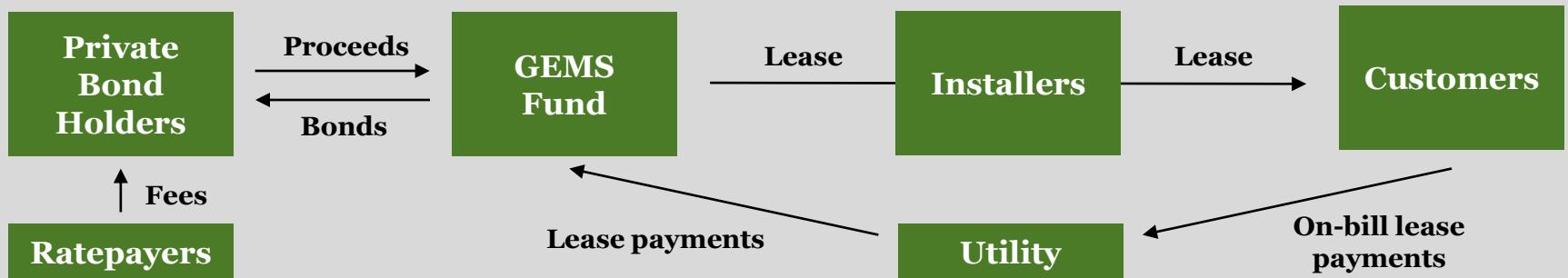
Overview

- Established June 2013 through Act 211
- \$150M initial funding through rate-reduction bonds
- Provides lease financing for local installers
- Will be overseen by Green Infrastructure Authority Staff within Department of Business, Economic Development, and Tourism (DBEDT)
- Seeks to fill market gaps by targeting low-moderate income segments, renters, non-profits

Financial Structure¹

- \$150M from rate-reduction bonds, secured by Green Infrastructure Fee
- Fee will be added to utility ratepayer bills, other fees will be reduced to offset the cost of the new fee
- Bonds not tied to state's credit rating
- Proceeds paired with private tax-equity investment
- Distributed solar leases provided through installers
- Repaid directly or through on-bill repayment
- Lease repayments do not repay bond holders

Green Energy Market Securitization Program Structure



New York Green Bank focused on catalyzing private wholesale financial markets for clean energy

Program Overview

- Established in January 2014
- \$218.5M initial funding from system benefits charge and RGGI, will increase to \$1B
- Part of New York State Energy Research & Development Authority
- Focus on financing projects that have difficulty accessing financing
- Recently announced first investments \$200M public with \$600M private

Financing Approach

- Issued an open market solicitation to private sector lenders, investors, and other industry participants
- Solicitation is very broad, open to both investors and clean energy project developers
- Constantly receives submissions, including resubmissions by previous applicants

Financial Structure

Guiding Principles	Eligible Technology	Eligible Financial Products
<ul style="list-style-type: none"> • Enhance private sector participation • Partner with existing market participants • Operate exclusively in wholesale markets • Does not provide grants or subsidies • Recycles public capital 	<ul style="list-style-type: none"> • Renewables (e.g., solar, wind, hydro, thermal, bioenergy, tidal) • Energy efficiency • Combined heat power • Electric vehicle infrastructure • Fuel cells • Anaerobic Digestion • Offshore wind 	<ul style="list-style-type: none"> • Credit enhancements (e.g., reserve account, junior interest) • Loans (e.g., mezzanine, subordinated, or senior) • Warehousing with the likelihood of being taken out by private third parties

New Jersey Energy Resilience Bank applies similar principles to resiliency in response to Sandy

Program Overview

- Proposed by Governor Christie in 2013
- Capitalized by \$200M from Community Development Block Grant-Disaster Recovery Funds allocated to New Jersey by U.S. Department of Housing and Urban Development
- Goal to finance resilient power projects to protect against power outages during weather events
- Has authority to make loans, give grants, and provide credit enhancements for bond issuances and private financing

Target Markets

- Water treatment plants; wastewater treatment plants
- Hospitals and long term care facilities
- Colleges and universities; state and county correctional Institutions
- Multifamily housing; primary and secondary schools that serve as community shelters during disasters
- Other facilities that serve as community shelters during disasters
- Transportation and transit infrastructure

Early Program Guidelines

- Initial focus will be on waste water treatment facilities
- Energy Resilience Bank (ERB) will offer up to 90% of funding; remaining from private sector
- 80% of ERB funds will be loans; 20% will be grants; a quarter of loan can be forgiven
- Eligible technologies include CHP, Fuel Cells and Batteries & Inverters for solar systems (not actual panels)

Recently created state and county institutions are now ramping up

	State	Current Status
5	California CLEEN Center	<ul style="list-style-type: none"> • Created by executive action within Governor's Infrastructure Bank • Will operate like a green bank, filling financing gaps and investing in partnership with private sector • Will use existing bonding authority, entirely self-sufficient • First programs will be SWEEP and CEEP, to provide long-term, low-cost financing for energy upgrades for MUSH market and commercial market buildings • CLEEN Center business plan outlines future objectives of financing renewables and other sectors
6	Rhode Island Infrastructure Bank	<ul style="list-style-type: none"> • Created through bi-partisan budget legislation • Built from existing Clean Water Finance Agency – given expanded responsibility to address clean energy, named Infrastructure Bank • First two roles are centralized state-wide PACE administration, and creation of municipal building upgrade financing program • Capitalized with small pieces of money from multiple sources, including bond issuances.
7	Montgomery County Green Bank	<ul style="list-style-type: none"> • Legislation passed unanimously by County Council • Working Group will determine GB activities and markets • Will be a designated 501(c)(3) non-profit • Capitalized \$20M from Exelon as part of Pepco merger settlement

Recently created state and county institutions are now ramping up

	State	Current Approach & Status
8	Maryland	<ul style="list-style-type: none"> State quasi-public Clean Energy Center (MCEC) completed legislatively directed Green Bank Study in December 2015. MCEC is now advancing legislation to officially designate it as the state green bank and capitalize this effort with \$40 million in investment capital.
9	Nevada	<ul style="list-style-type: none"> State assembly passed legislation directing the Maryland Clean Energy Center to conduct a study of the need and potential role of a state Clean Energy Finance Initiative
10	Vermont	<ul style="list-style-type: none"> Dept. of Employment and Economic Development, Dept. of Commerce, Dept. of Agriculture have launched assessment of need and role of a state Clean Energy Finance Initiative
11	Virginia	<ul style="list-style-type: none"> State's Energy Efficiency Resource Management Council is conducting a formal study for role of increased clean energy financing in place of grants, and potential creation of a Clean Energy Finance Initiatives

12 States with similar finance programs demonstrate

13 success in offering low-cost loans

	Nebraska's Dollar & Energy Saving Loan: Limited Product Menu, But Great Outreach	Pennsylvania's Keystone Home Energy Loan Program (HELP): Standardization
Overview	<ul style="list-style-type: none"> Established 1990 Funds have revolved from \$24M to \$74M 28,000 projects to date Maintained default rate of 0.08% 	<ul style="list-style-type: none"> Established 2008 \$20M initial funding from Pennsylvania State Treasury By 2011, Keystone had financed \$52.4M (7,966 loans)
Program	<ul style="list-style-type: none"> Interested borrowers approach local financial institution, which approves projects and coordinates with the Nebraska State Energy Office (NSEO) NSEO provides 65%–75% of funding at 0% interest, private lending institution provides remainder at 2.5%–3.5% NSEO works with 286 local Nebraska lending institutions in all 93 counties 	<ul style="list-style-type: none"> Underwriting standards follow Fannie Mae Leverages AFC First's network of 1,800 approved contractors Tiered rate structure offers borrowers more attractive financing for deeper energy retrofits Keystone HELP sold \$29M to a syndicate of private banks¹ WHEEL² aggregates loans, attracts institutional investors, creates secondary market
Lessons Learned	<ul style="list-style-type: none"> Market through local lending institutions Allow private banks to keep returns Lending institutions take the risks State energy office helps customer calculate energy savings 	<ul style="list-style-type: none"> Partner with private sector administrator Leverage contractor networks Align with contractor incentives so contractors are encouraged to advertise program Standardize underwriting standards

WHEEL works across states to aggregate energy efficiency financial products

	Warehouse for Energy Efficiency Loans (WHEEL)
Overview	<ul style="list-style-type: none"> • Came out of Pennsylvania's Keystone HELP Loan program • Provides lower-cost financing for residential energy efficiency • Uses public capital as credit enhancement to secure private debt • Open financing platform that any state may enrol in as a sponsor by contributing subordinate or credit-enhancing capital to the pool
Program	<ul style="list-style-type: none"> • A collaboration between Renewable Funding, State of Pennsylvania Treasury, Citigroup Global Markets, and the Energy Programs Consortium that utilizes the RenewFund financing platform to deploy institutional capital for state and utility programs • Warehouse facility funded by Citigroup and Pennsylvania Treasury • Low/no cost subordinate capital provided by state sponsor using by ARRA, utility, and other funds • Warehouse repaid via issuance of an investment grade security • Unsecured loans; 640+ FICO; Up to 10 year terms • Return provided to sponsors who participate in WHEEL, based on actual defaults and repayment levels.

...and around the world

National Initiatives



UK Green Investment Bank

- Established 2012
- \$4.7B initial capital



Clean Energy Finance Corporation

- 2013 launch
- \$10B initial capital



Malaysia Green Technology Financing Scheme

- Established 2010
- \$1B loan to be used until 2015



Japan Green Fund

- Created 2013
- \$14M annually from cap and trade revenues

Conclusions Drawn from the OECD International Conference on Green Investment Banks (GIBs)

Role of GIBs

- Investment activities to mobilize private capital
- Encourage co-investment in clean energy projects from institutional investors

How GIBs Work

- Leverage public expenditures to encourage private capital markets to make loans and investments in clean energy markets

Target Sectors

- Clean Energy, energy efficiency
- Ecosystem adaption
- Electric vehicles and air quality

CGC led the Green Investment Bank discussion at OECD's Green Investment Finance Forum in Paris in 2014 & 2015. At the event former U.S. Vice President Al Gore called on all OECD members to establish CEFIs.

Green Banks are quickly spreading across U.S.

Green Banks Operating Or Under Development/Consideration



Green Bank operating principles designed to meet market needs through flexibility and filling gaps

Green Bank Operating Principles

- **Leverage through Finance**
 - Green bank will seek to maximize private investment per public dollar
 - Work with finance community to understand lender needs
- **Fill Market Gaps**
 - Respond to market participant needs and step in to fill finance gaps
 - Encourage private investment, defer to private sector when working
- **Flexible Program Design**
 - Build finance programs that are user friendly, adaptable to different needs
 - Products designed to support multiple technologies, fit market needs
- **Increase Demand & Market Strength**
 - Facilitate information sharing and ease of use for finance & other programs
 - Build industry capacity by seeking out partnerships with private sector

Green Bank delivers value to MC and its citizens beyond growing clean energy markets

Green Bank Benefits

- **Private Sector Leverage**
 - Financial tools designed to maximize the amount of private sector investment per public dollar used
- **Efficient Government**
 - Provide loans to preserve public capital & do deeper efficiency projects
 - Work in coordination with other agencies to maximize program value
- **Create Jobs & Economic Growth**
 - Clean energy financing enables demand for projects from contractors
 - Public private partnerships create investment opportunities for lenders
- **Put Money Back in Citizens' Pockets**
 - Less funding needed to support public financing than public grants
 - Reduced energy bills with efficiency, renewables create monthly savings

Green banks create jobs and economic development with local investment


More Jobs for Contractors

- **Increased Demand**
 - Greatest barrier to adoption of clean energy technology is the upfront cost
 - Public-private financing eliminates that barrier, enables demand for clean energy services
- **More Local Jobs**
 - Trained professionals with good wages needed to install equipment
 - Must be done locally, jobs cannot be outsourced
 - More demand and an expanding market meets new businesses

New Investments for Lenders

- **New Profitable Opportunities**
 - Green banks stimulate market growth, create demand for financing products
 - Lenders become active in growing, low-risk market
 - Lenders can expand business
- **Early Safety Net**
 - Green Bank partnership provides initial assurance about risk
 - Credit enhancements encourage market entry
 - Lenders can learn about market structure with govt security

Key Takeaways

- 
- Green Banks offer financing and market development resources that can animate the market
 - Green Banks have demonstrated success in a variety of capacities, confer various cobenefits
 - Efficient, high-impact use of limited capital for clean energy
 - Flexible, market-oriented institution that can adapt to market needs



coalition for green capital

Thank You

Jeffrey Schub, Executive Director

Nick Kline, Program Director

Coalition for Green Capital

Twitter: @CGreenCapital



Montgomery County Green Bank – Market Sizing & Market Interview Synthesis

Nick Kline, Program Director, CGC

Montgomery County DEP
February 2016

Market Assessment Deliverables

Landscape

Landscape Analysis
& Green Bank Roles



Market Gaps

Market Sizing &
Interview Synthesis



Recommendations

Green Bank Recommendations

Agenda

- Market Sizing
- Stakeholder Interview Summary
- Interview Synthesis

Current market size presented in terms of energy and dollars invested

		Objectives	Limitations
Current size of individual clean energy markets	Total Investment	<ul style="list-style-type: none"> Determine total amount of public and private investment for each market segment Present single dollar figure representing current market size Use most current values available 	<ul style="list-style-type: none"> Limited access to private sector financial information Availability of data varied across years, necessary to extrapolate when current data was unavailable Most data exists at state level
	Total Installed Capacity ¹	<ul style="list-style-type: none"> Determine total amount of installed capacity or net energy savings for each market segment Present single measurement of total installed capacity or net energy savings Use most current values available 	<ul style="list-style-type: none"> Units of measurement vary across technologies Availability of data varied across years, necessary to extrapolate when current data was unavailable Most data exists at state level

Serviceable Addressable Market (SAM) describes the market segment that should be targeted

SAM = Economically viable market

- SAM – Serviceable Addressable Market
 - Total possible investment that is technically, economically, and politically viable for a given technology
 - Total possible installed capacity based on available resources (e.g., units, households, people in the market, natural resources) and constraints
- SAM calculated based on variety of reports, studies and assumptions to account for county-level market

Market sizing focuses on five current clean energy markets

	Technology	Definition
1	Wind	<ul style="list-style-type: none">• Wind power technology including turbines, blades, and towers, and services installed in residential, commercial, and utility-scale markets• Small-scale wind was the focus, utility- scale not included because of scale, ease of acquiring capital and lack of resources
2	Solar	<ul style="list-style-type: none">• Solar photovoltaic (PV) installed in the residential, commercial, and industrial markets• No solar thermal, solar hot water• Utility-scale solar not included because of ease of acquiring capital, scale
3	Energy Efficiency	<ul style="list-style-type: none">• Technologies, methods, or strategies that result in using less energy to produce the same service or level of comfort• Technologies may include a conservation or efficiency strategy that helps users save energy in the built environment or a technology that is more efficient than traditional types• Includes electric and thermal efficiency
4	Bioenergy Electric Generation	<ul style="list-style-type: none">• Technology that uses biomass or methane emissions to generate electricity
5	Combined Heat and Power	<ul style="list-style-type: none">• Technology that generates electricity and useful thermal energy in a single process, also known as cogeneration

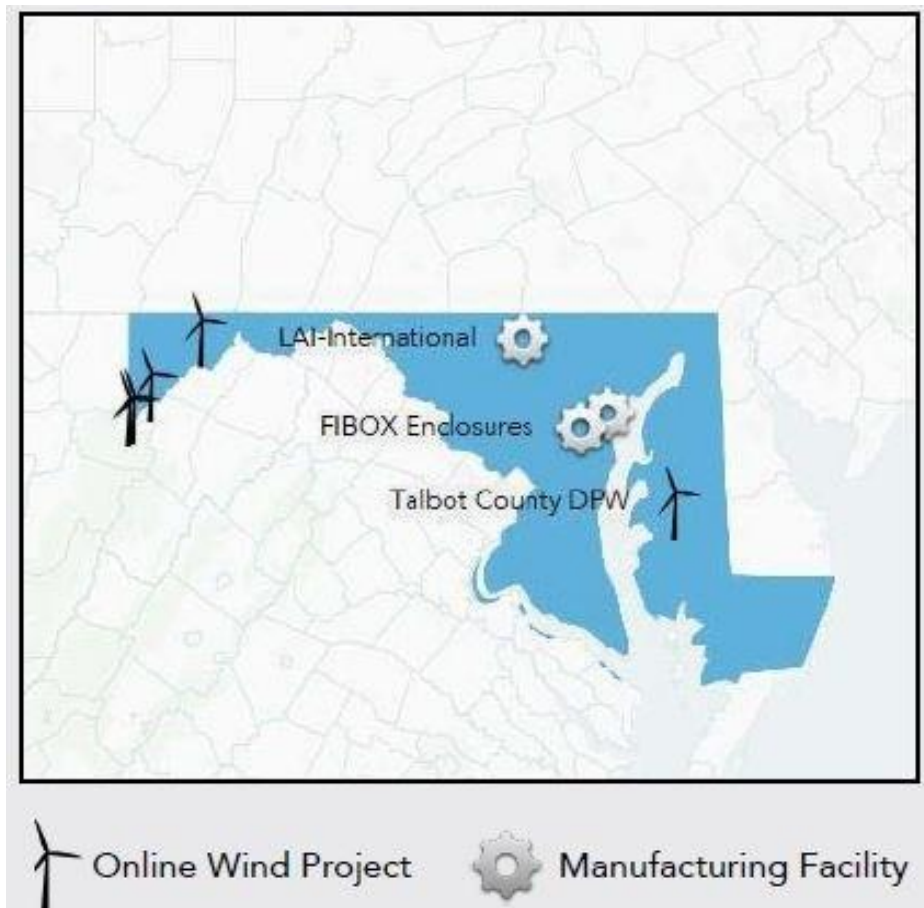
Estimated Montgomery County clean energy market potential is \$2.7B

Selected Technologies		Total Current Installed Capacity	Total Potential Market	Total Unfilled Potential Cost
Wind		0 MW	N/A	\$0
Solar PV	Residential	14.3 MW	182 MW	\$549 M
	C&I	13.7 MW	175 MW	\$308 M
Energy Efficiency	Electric	896 GWh	3,842 GWh	\$879 M
	Thermal	N/A	9,032 BBtu	\$701 M
Bioenergy Electric Generation ¹		54 MW	31 MW	\$122 M
Combined Heat & Power		67 MW	75 MW	\$90 M
TOTAL		N/A	N/A	\$2,652 M

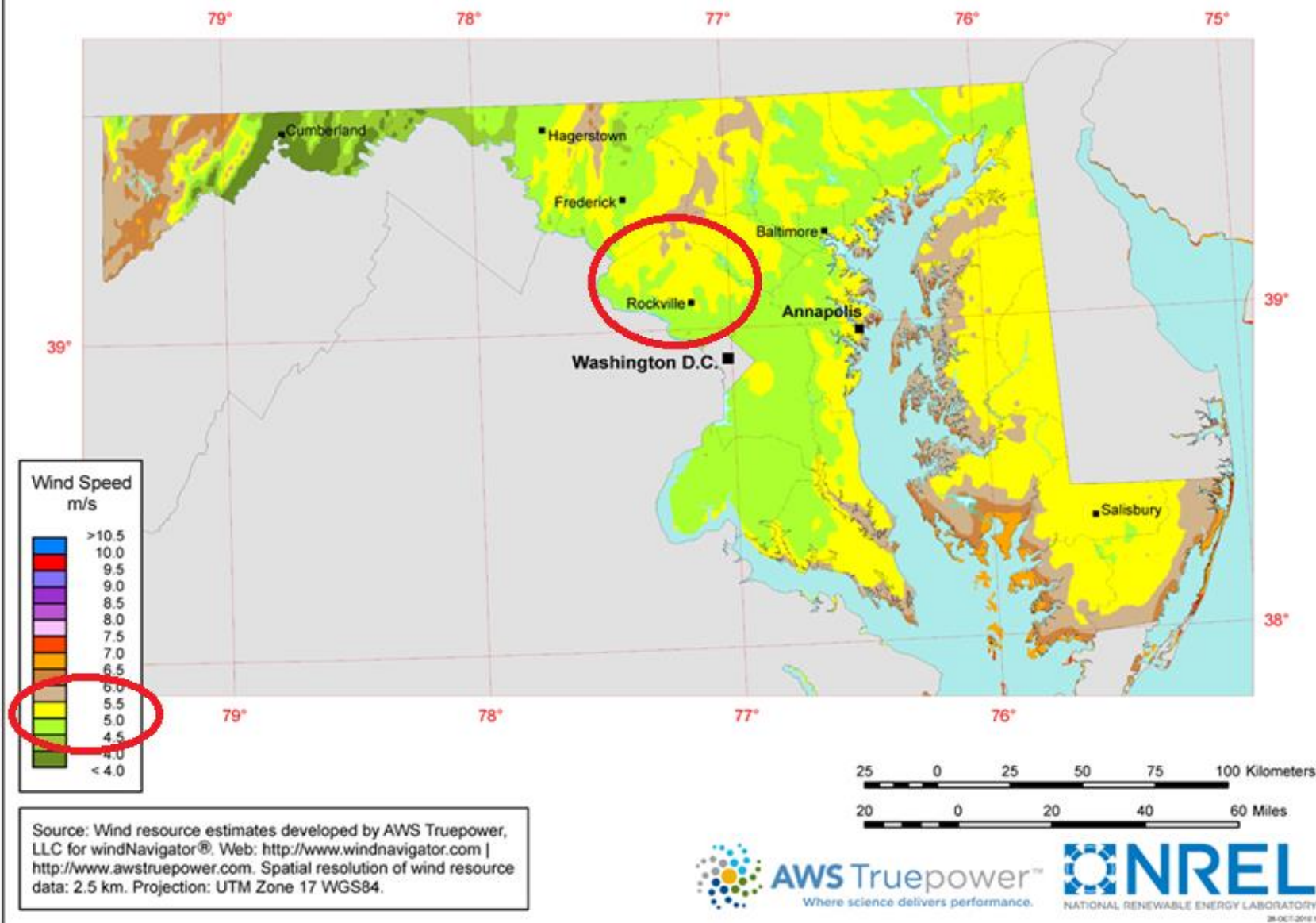
Maryland onshore wind development limited to corners of the state with exploitable wind resources

Wind Industry Statistics

- 4 operating utility-scale projects in MD, total of 160 MW of installed capacity
- 1,482 MW of onshore technical potential for wind, at 80m height
- 1,322 MW remains unbuilt, but technical potential ignores economic/practical limits
- Average wind speed key factor for wind development
- Wind is weaker in the middle of MD

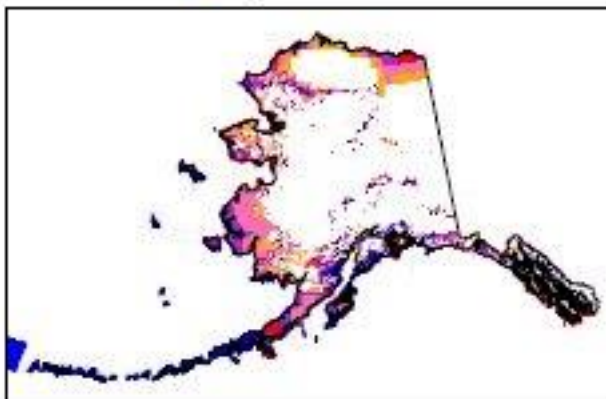
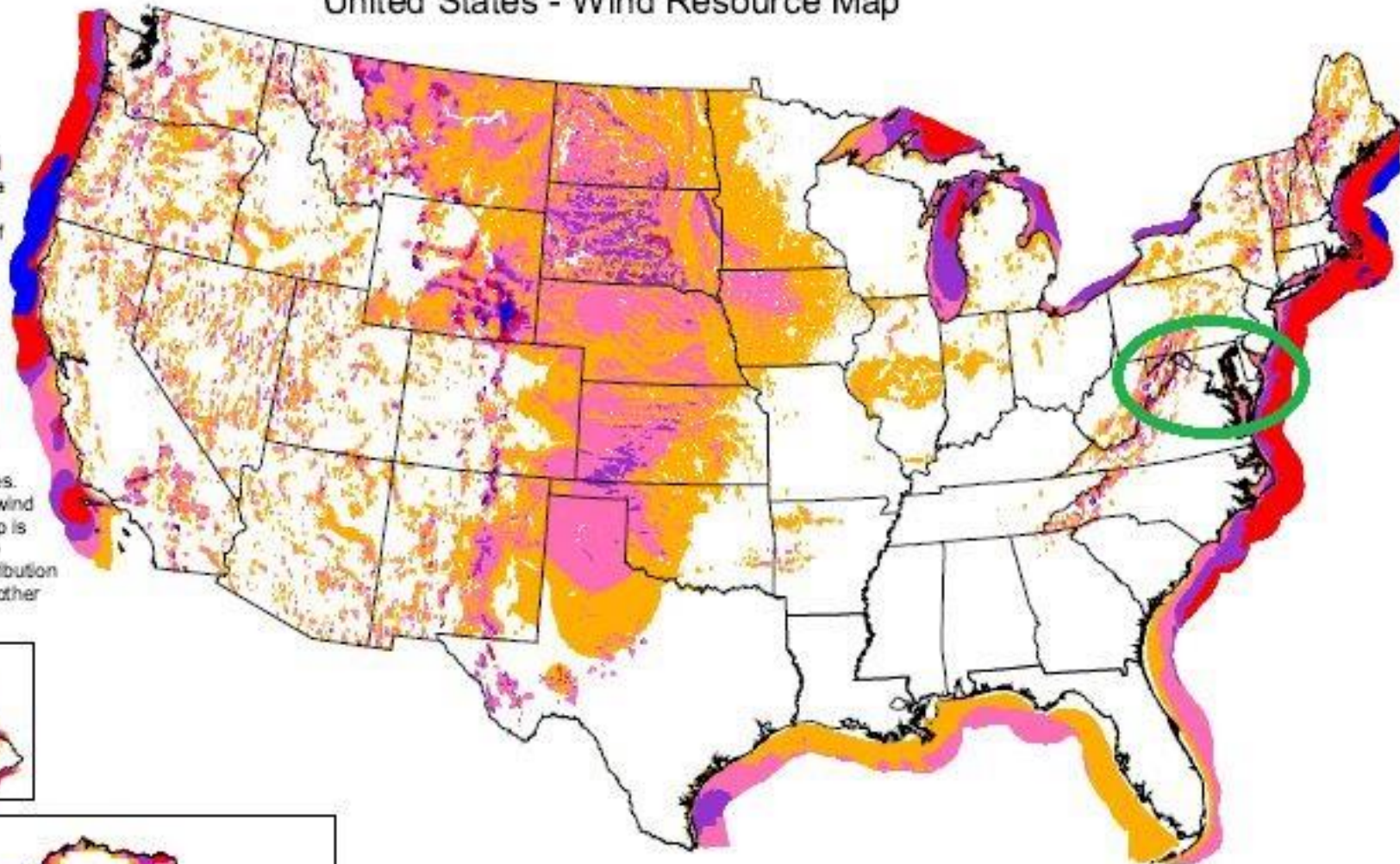


Maryland - Average Annual Wind Speed at 80 m



United States - Wind Resource Map

This map shows the annual average wind power estimates at a height of 50 meters. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed ^a at 50 m m/s	Wind Speed ^a at 50 m mph
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 - 1600	8.8 - 11.1	19.7 - 24.8

^a Wind speeds are based on a Weibull k value of 2.0



U.S. Department of Energy
National Renewable Energy Laboratory

Montgomery County's wind resources at 30m are likely to be Class 1 (unsuitable) and 2 (marginal)

Classes of Wind Power Density

	30 m (98 ft)		50 m (164 ft)	
Wind Power Class	Wind Power Density (W/m ²)	Wind Speed m/s (mph)	Wind Power Density (W/m ²)	Wind Speed m/s (mph)
1	≤160	≤5.1 (11.4)	≤200	≤5.6 (12.5)
2	≤240	≤5.9 (13.2)	≤300	≤6.4 (14.3)
3	≤320	≤6.5 (14.6)	≤400	≤7.0 (15.7)
4	≤400	≤7.0 (15.7)	≤500	≤7.5 (16.8)
5	≤480	≤7.4 (16.6)	≤600	≤8.0 (17.9)
6	≤640	≤8.2 (18.3)	≤800	≤8.8 (19.7)
7	≤1600	≤11.0 (24.7)	≤2000	≤11.9 (26.6)

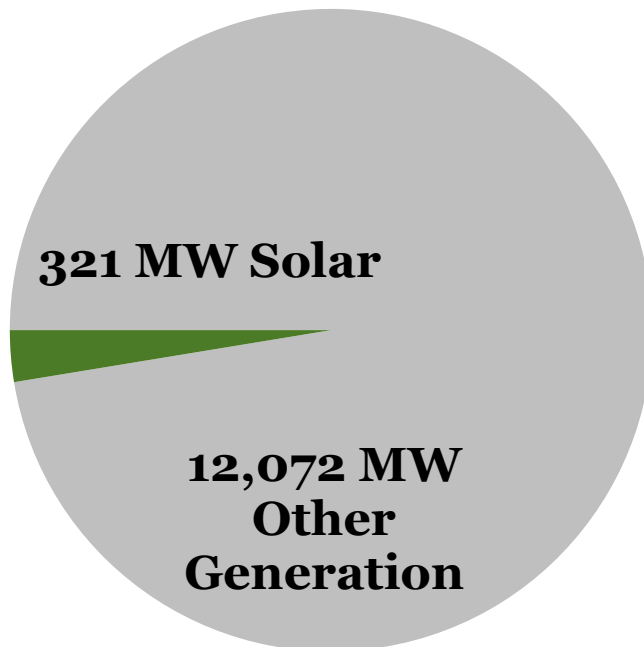
Wind resources in Montgomery County not known, likely to be insufficient for development

Height	Minimum Speed Needed	Wind Speed in Mont. Co.
80m	7.0 m/s	4.0-5.5 m/s
50m	6.4 m/s	Unknown; less than above
30m	5.9 m/s	Unknown; less than above

- “Distributed wind” = turbines at 30m and below
- Wind speed at 30m is unknown
- Speeds at 80m would not be enough for development at 30m
- Wind speed at 30m is lower than at 50m and 80m

Solar capacity in Maryland is growing, needs to continue growing quickly

Maryland Electric Generation Capacity



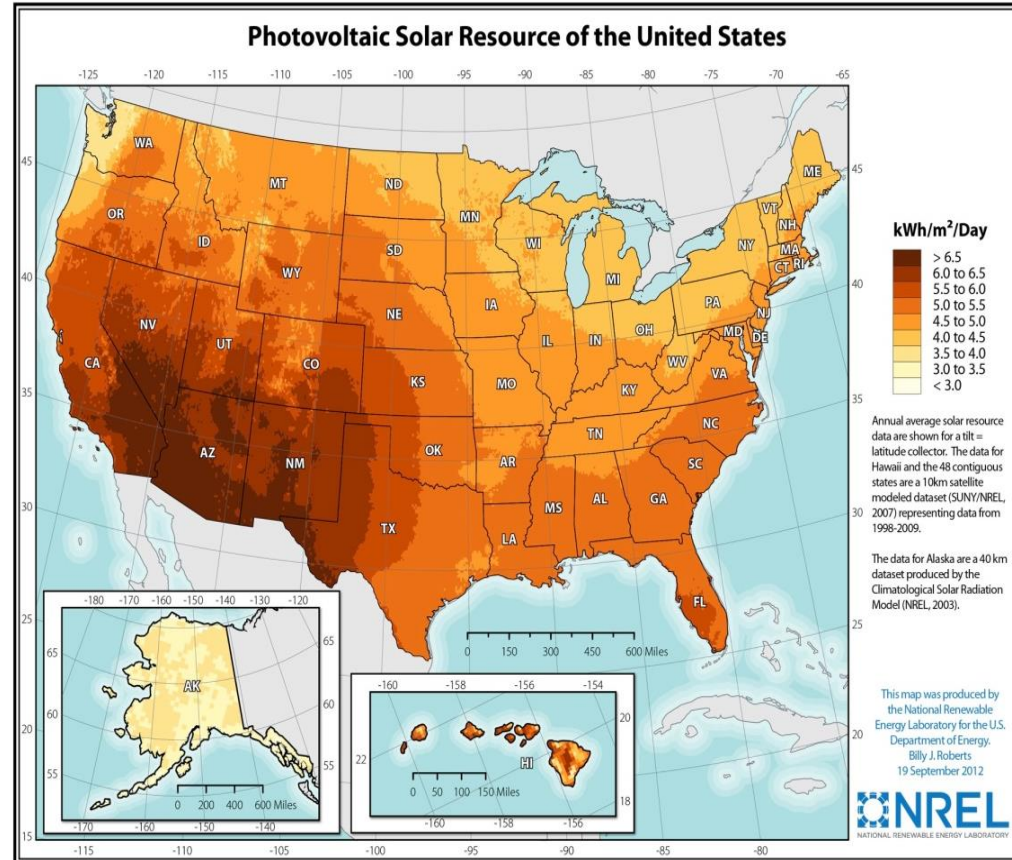
Solar Industry Statistics

- 321 MW of solar installed capacity in MD in 2015
- 73 MW installed in MD in 2014
- Nearly 25% of all MD solar installed in 2014
- Estimated 28 MW of solar in Montgomery County through 2014
- Estimated \$84 million invested so far in Montgomery County, expected to grow
- MD is 12th in nation in installed solar capacity
- MD RPS requires 1200 MW of solar by 2020

Montgomery County's large solar rooftop capacity barely tapped, market penetration is around 1%

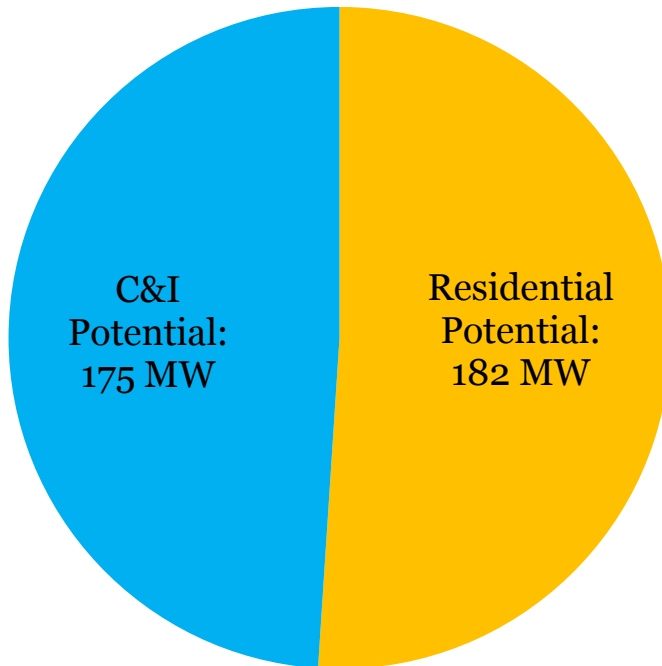
Solar Industry Statistics

- 13 GW of rooftop solar technical potential in MD
 - Does not include utility-scale
- 1.3 GW of rooftop solar technical potential in Montgomery County
 - Calculated based on share of roofs in the state
- 357 MW of rooftop solar economic potential in Montgomery County
 - Calculated based on NREL data for share of roofs for which PVs make economic sense
- Approximately 182 MW of residential rooftop and 175 MW of C&I solar



Residential and commercial solar economic potential estimated to be roughly equal

Economic Potential for Solar PV (MW)



Solar Industry Statistics

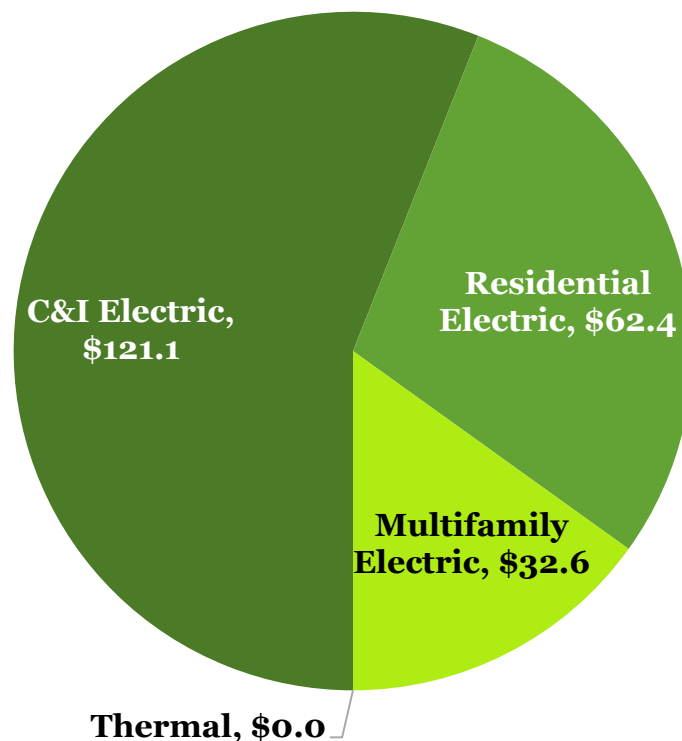
- \$549M market for residential rooftop solar
- \$308M market for C&I rooftop solar
- Potential investment sizes estimated using national average install costs for residential (\$3.48/W) and commercial solar (\$2.25/W)
- The ratio of residential to commercial solar was assumed to follow CT

Electric efficiency investments to date have been driven by utilities' use of EmPOWER funds

Energy Efficiency Statistics

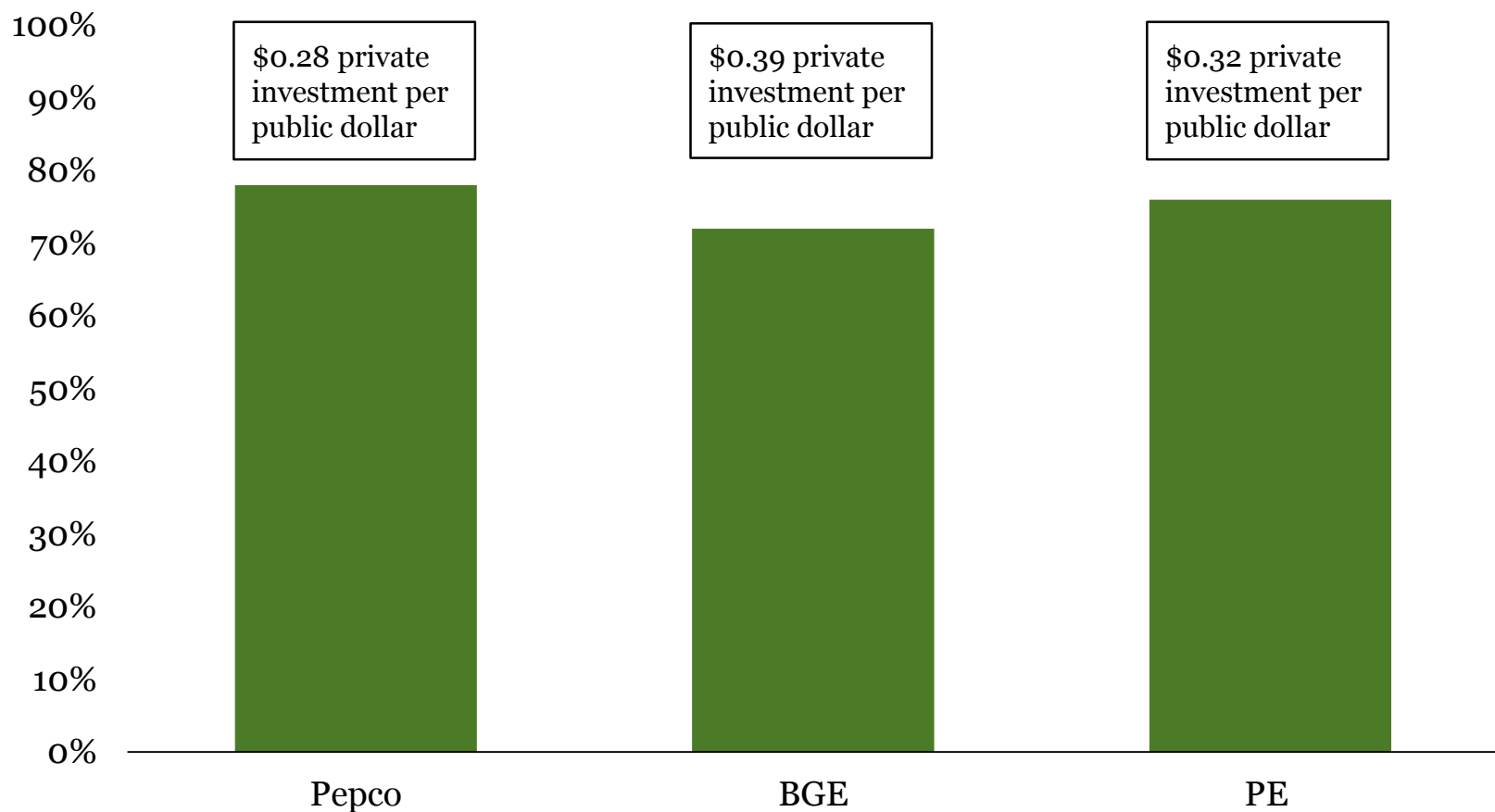
- More than \$200 M invested in efficiency from '10 to '14 through utility programs
- Almost entirely spent on electric
 - 44% of spending in residential
 - 56% of spending in C&I
- Between 2010-14 utility spending on EE grew by:
 - 1238% for Pepco
 - 89% for BGE
 - 334% for PE
- More than 774 GWh of electric savings since 2010 in residential, C&I
- Natural gas savings programs just started, thermal efficiency savings haven't been reported

EmPOWER Spending by Sector 2010-2014 - \$216M Total



Utilities in EmPOWER program offer generous rebates for electric efficiency measures

Amount of EE Measure Covered by Utilities



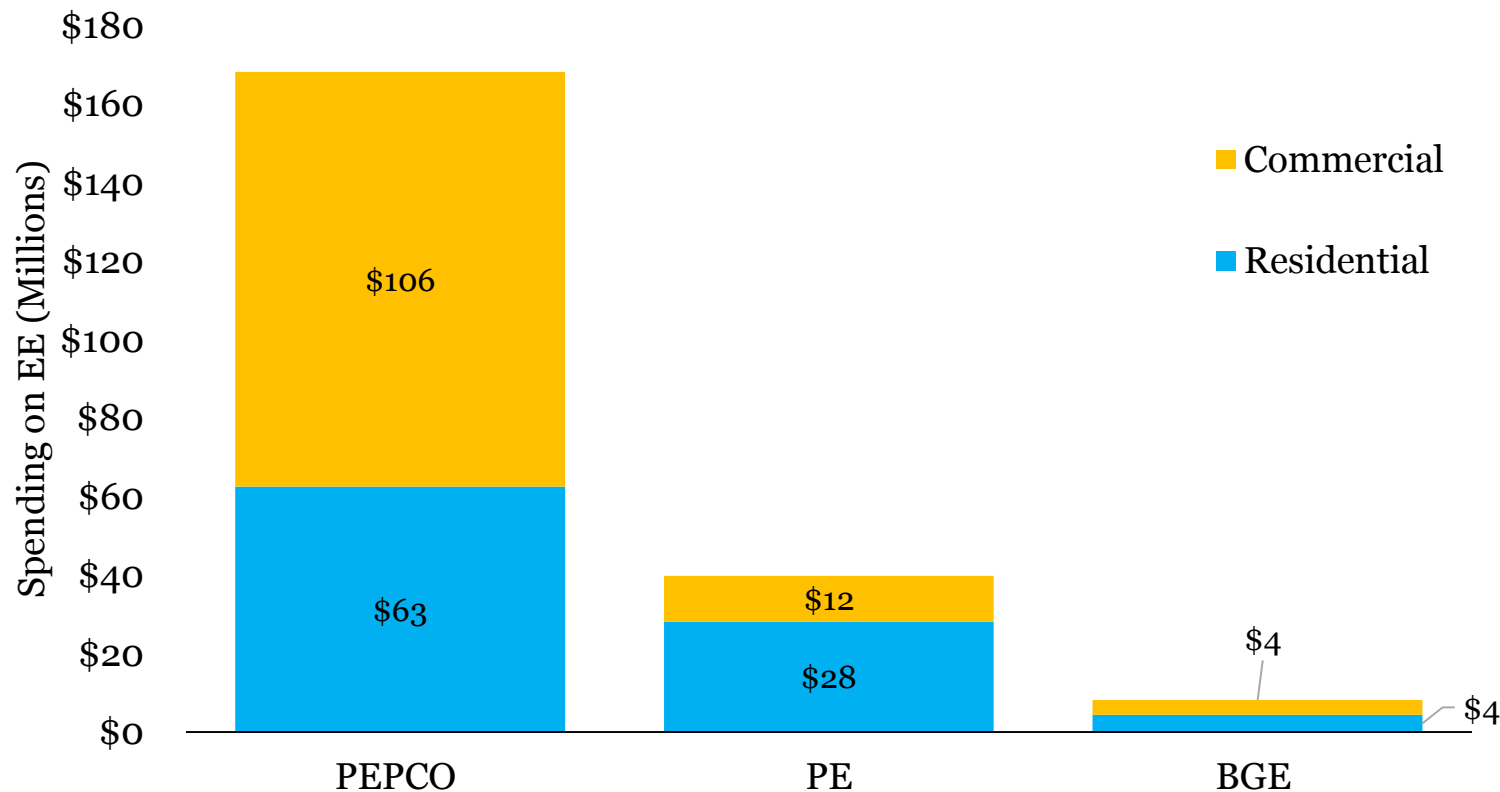
The EmPOWER program was only recently extended to the natural gas utility, savings are forthcoming

Washington Gas

- NG efficiency programs and cost recovery mechanism granted at end of 2014
- No data available on EmPOWER thermal dollars spent in Montgomery County
- Estimated 2819 BBTU savings across MD in 2015
- No real thermal savings happening outside EmPOWER

EmPOWER spending in Montgomery County from 2010 through 2014

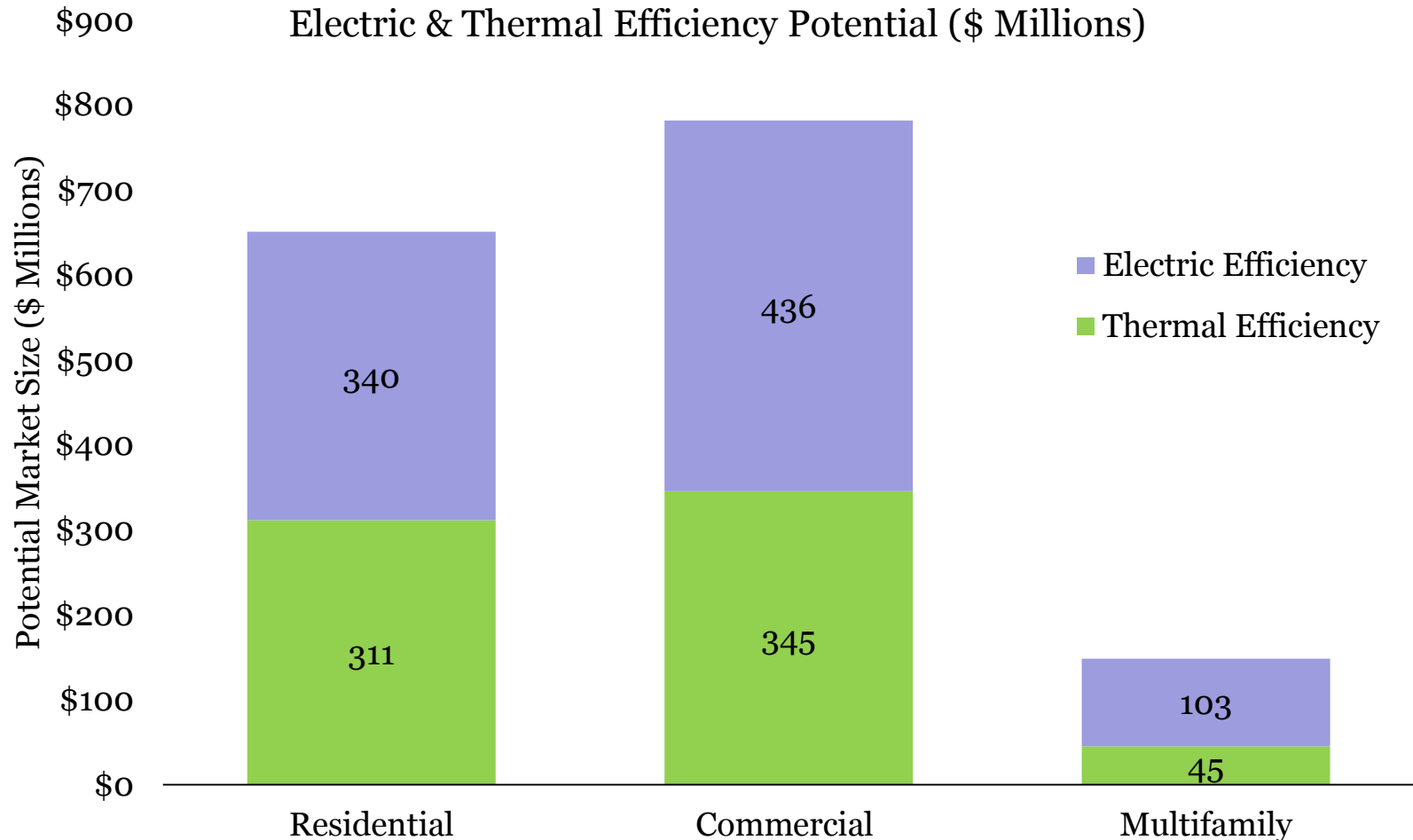
EE Spending in Montgomery County by Utility



Montgomery County efficiency SAM is \$1.5 billion

Selected Technologies		Total Savings Achieved	Total Potential Market	Total Unfilled Potential Cost
Electric Efficiency	Residential	354 GWh	1601 GWh	\$339 M
	C&I	421 GWh	2057 GWh	\$436 M
	Multifamily	122 GWh	184 GWh	\$103 M
Thermal Efficiency	Residential	N/A	3983 BBTU	\$311 M
	C&I	N/A	4420 BBTU	\$345 M
	Multifamily	N/A	629 BBTU	\$45 M
TOTAL		N/A	N/A	\$1,581 M

Approximately \$1.5 billion in economically viable electric & thermal efficiency investments



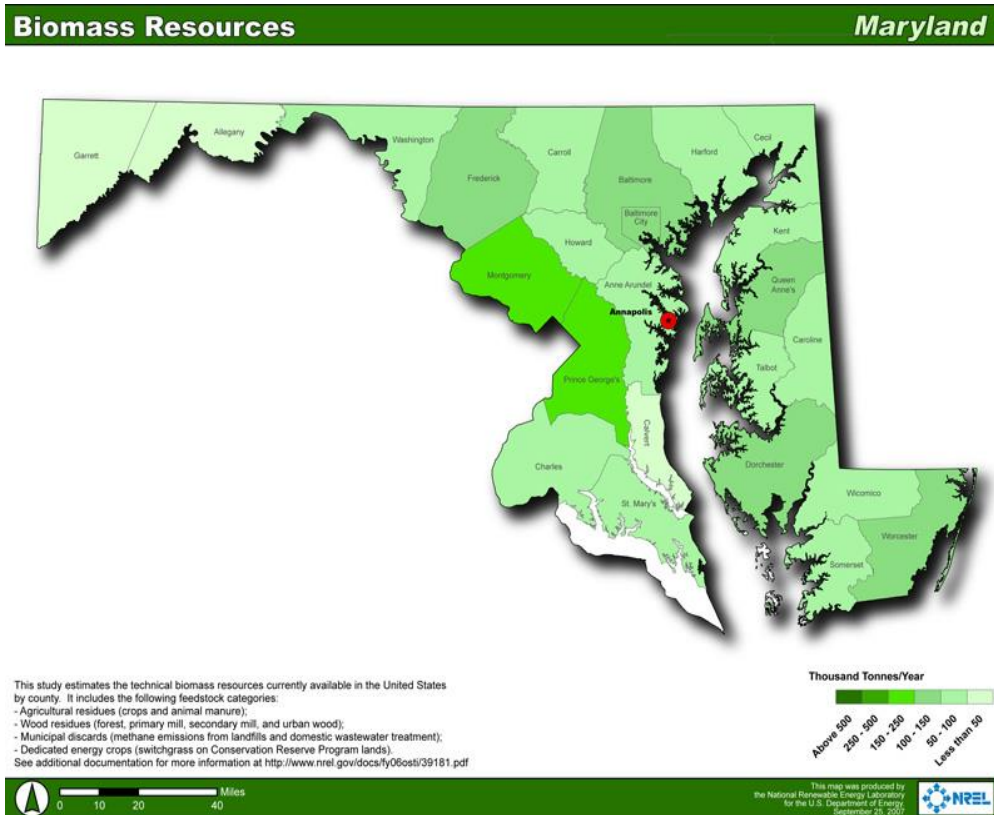
Bioenergy electricity generation is small source of renewable, in-state electricity generation

Bioenergy Statistics

- 163 MW of installed bioenergy capacity in MD
 - Makes up around 1% of state electric capacity
- There is only one large bioenergy facility in the county
- “Montgomery County Resource Recovery Biomass Facility”
- 54 MW of capacity
- Municipal solid waste facility



Economic potential of bioenergy in Montgomery County is non-trivial, needs precise calculations



Bioenergy Statistics

- 750 MW of bioenergy technical capacity in MD
- 31 MW of bioenergy technical potential in Montgomery County
 - Estimate based on share of land area
- Economic potential in Montgomery County very difficult to calculate
 - Variety of fuels & technologies with unique economics
 - Install costs range from \$2-\$6 per Watt
 - Need to examine access to local fuel sources
 - Data is scarce/old, especially at county level

Two large combined heat and power facilities in the county



Food and Drug Administration-
FDA White Oak Facility

Transportation Statistics

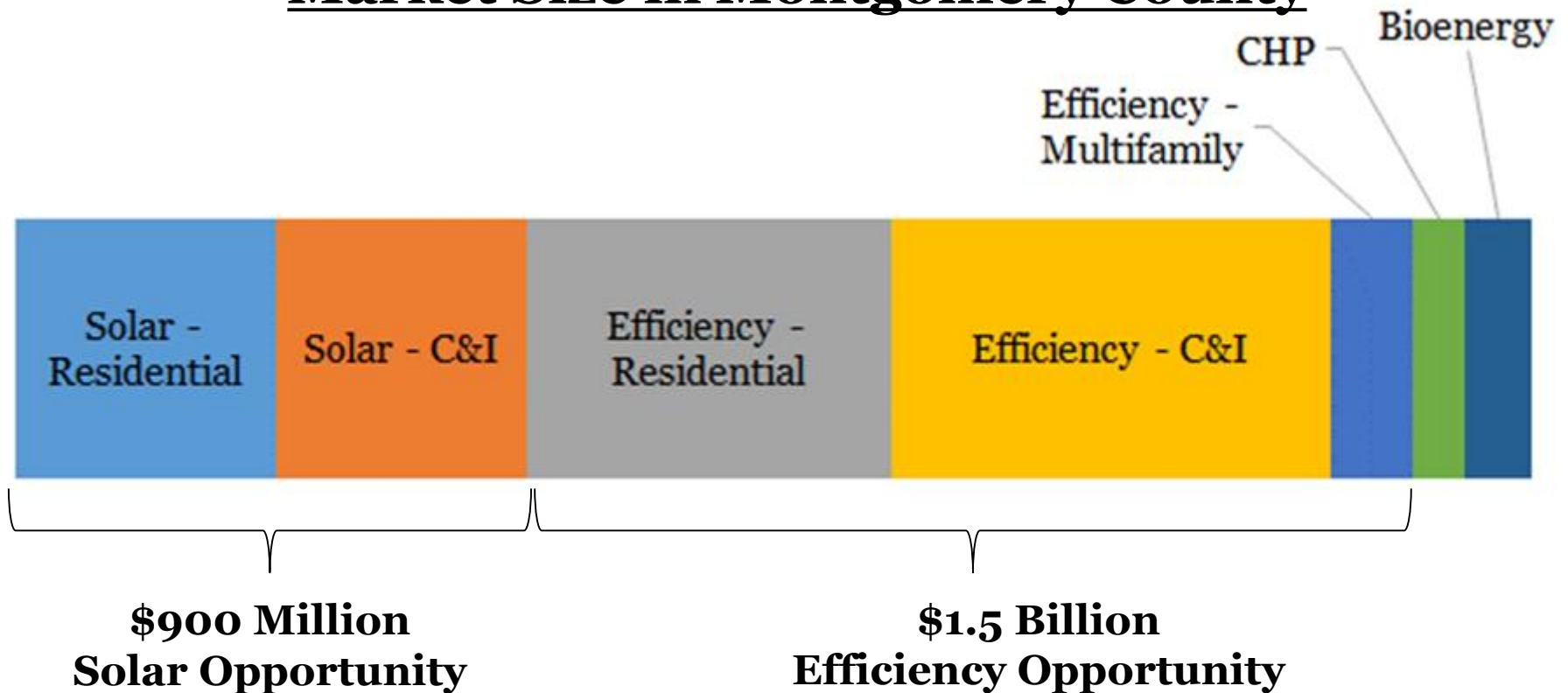
- 828 MW of CHP installed capacity in MD
- Only two large CHP facilities in Montgomery County
 - Together they have 67 MW of capacity
- “FDA White Oak Facility” 44 MW
- “National Institute of Health Central Utility Plant” 23 MW

Montgomery County CHP market size is estimated to be \$90 million in C&I sector

CHP Potential by Sector	Technical Potential	Economic Potential	Unfilled Potential Investment
Commercial	305 MW	44 MW	\$52 M
Industrial	215 MW	31 MW	\$37 M
Total	520 MW	75 MW	\$90 M

County's market potential is \$2.7 billion, efficiency and solar are largest untapped markets

\$2.7 Billion Estimated Potential Clean Energy Market Size in Montgomery County



Agenda

- Market Sizing
- Stakeholder Interview Summary
- Interview Synthesis

Contacted 52 individuals, interviewed 36 individuals

Status	Count
Completed	39
Upcoming	3
Scheduling	1
No response	7
Declined	5
Total	55

Category	Completed
Finance	10
Government	4
Nonprofit	3
Consulting	1
Utility	3
End-User	0
Property Owner/Manager	3
Contractor	6
Community Solar	4
Academic	1
Total	39

Questions focused on market size, demand, marketing techniques, barriers to growth

Financial institutions

- What kind of energy-related financing are you currently doing?
- Are demand for energy-focused capital and the supply of capital well-matched? If not, what prevents them from being matched?
- Are there any gaps in the financial products landscape (by energy segment, by project size, other)?
- What is the largest obstacle to achieving scale (financial, regulatory, technological)?

Clean energy providers

- Are you able to meet demand, or is it more / less than you can supply? Why?
- What would be helpful for increasing the amount of business you do? What would drive increased end user demand? What about investor demand?
- What types of financial instruments do you primarily use when raising capital?
- Do you use public capital, and if so, how?

Property managers

- Under what conditions do you make energy upgrades to your property?
- How do you source capital for those upgrades?
- Under what conditions would you prioritize energy upgrades?
- What are the key impediments to financing energy upgrades?

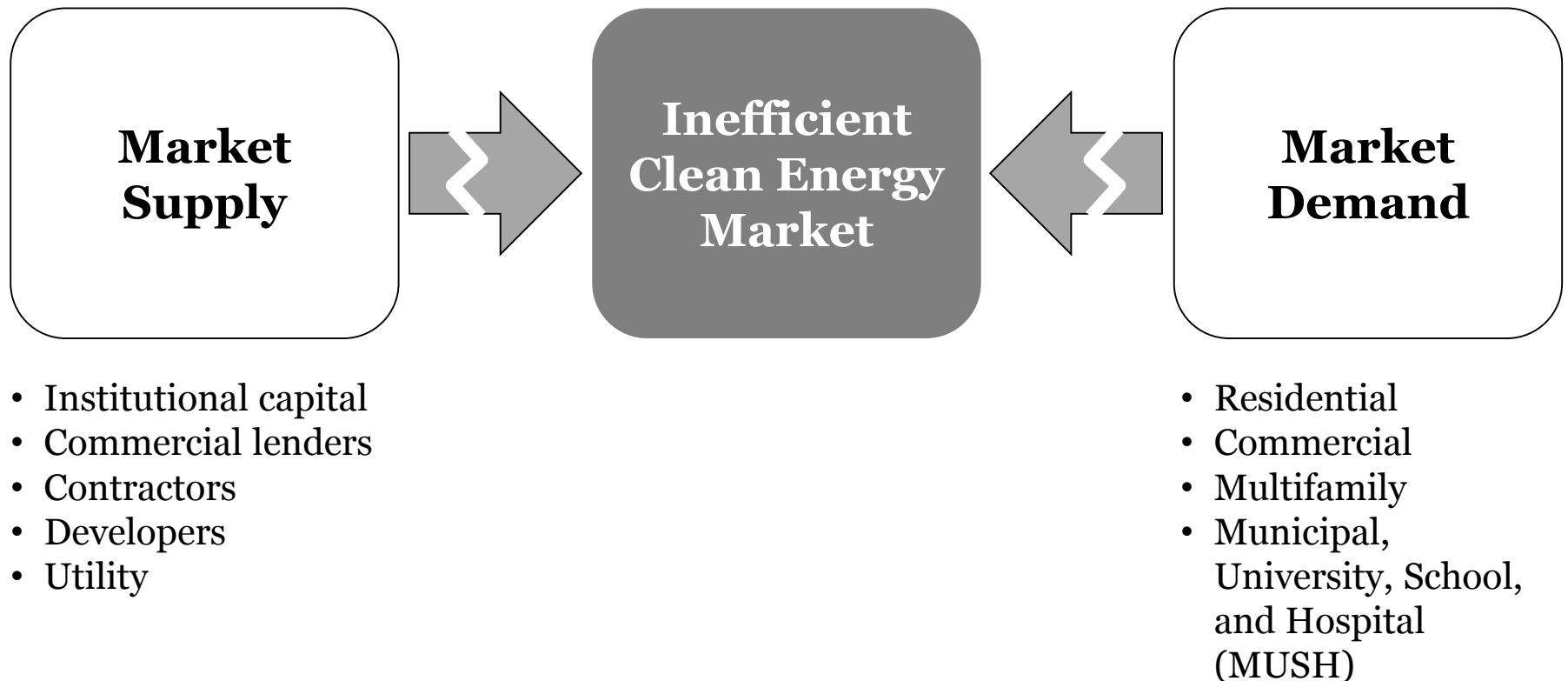
Goal: Identify which markets Green Bank should prioritize, and the kinds of solutions that could help those markets grow

Agenda

- Market Sizing
- Stakeholder Interview Summary
- Interview Synthesis

Numerous interviews uncovered obstacles to creation of efficient clean energy market

For many market segments, there is a gap between supply of capital/projects and demand for projects



Stakeholders generally support Green Bank concept

- **Broad support for Green Bank– agreement from all parties that there is a need for financing *and* market development**
- **Most appealing aspects of Green Bank concept:**
 - One Stop Shop – Convenient single repository of information & resources
 - Coordination – Minimizing confusion across existing programs such as PACE, EmPOWER, and Maryland Green Bank
 - Access to Financing – Terms, rates, structures, and partnerships that allows for more participation and volume, better cash flows
 - Working Together – Partnering with existing market actors to enable more activity, deal volume, and animate market

Priorities & Key Products Identified

- **More Technical Assistance**
 - Market actors would especially like assistance with initial project development and structuring, a road map for how the process works, technical underwriting, measurement & verification
- **Provide Consumer Education, Outreach, Marketing**
- **LMI is critical segment, not served, but hard to reach**
 - Partner with municipalities, not-for-profits, and industry to develop sound product, and facilitate consumer capacity
- **Credit enhancements and coinvesting opportunities for players already active in the space**
- **Standard offer residential solar products for community solar**

Obstacles to clean energy growth perceived across markets – Supply Side

“There is a big knowledge gap—no one knows what is available, or how things work—and there is a big learning curve—things are complicated, don’t seem worth the time.”

Perceived Obstacles

Supply-Side

- Few clean energy specific financing products available, especially for residential
- Projects too small to attract cheap capital from large investors
- Doubts around savings, no entity willing to guarantee savings
- Banks treat clean energy investments like any other loan – no favorable treatment due to savings
- Financial institutions are not clean energy experts, difficult for them to evaluate projects
- Appraisers don’t account for energy improvements

Obstacles to clean energy growth perceived across markets – Demand Side

“Financing is our biggest barrier—it’s out of reach for many in the space. Commercial clean technology is still unattainable for many.”

Perceived Obstacles

Demand-Side

- Lack of demand for clean energy projects
- Doubt about energy savings, difficult to quantify
- Consumers cannot or are hesitant to take on more debt
- High upfront costs, long pay back periods
- Debt is often not available for terms that match payback
- Competing uses for scarce capital – business equipment investments, residential home improvements, etc.

Obstacles to efficiency: electric, thermal, and efficiency/renewable projects – Supply Side

“Financing is the crux of the problem. It is the treasure chest that needs to be unlocked and spread around. Interest rate and terms are part of it.... Equally important are relationships, education, market-making, and winning over hearts and minds.”

Perceived Obstacles

Supply-Side

- Executing projects and applying rebates & tax credits are confusing and complex, often multiple sources of capital for a deal
- Deep, whole-building projects hard to finance
- Existing financing products are complicated and time-consuming (e.g. PACE)
- EE that is done is generally self-funded, managers don't want additional debt, desire off-balance sheet options
- Lack of trust about how much projects will cover debt service, lack of Measurement & Verification

Obstacles to efficiency: electric, thermal, and efficiency/renewable projects – Demand Side

“Small businesses want upgrades but don’t have cash and can’t take on more debt. Large businesses don’t want more debt.”

Perceived Obstacles

Demand-Side

- Big information gap around possible efficiency savings, little active demand for it, contractors need to sell it
- Unwillingness to pay a lot up front for efficiency
- Lack of information and understanding about PACE & ESAs, need for expert partners that understand them
- SMEs don’t have cash for upfront costs, no easy access to affordable financing
- Managers want to improve market value and NOI, energy projects not always best way to do it, prefer to use capital elsewhere
- Other deferred maintenance issues that take priority

Perceived obstacles to growth of Montgomery County solar market – Supply Side

“Our bank is unlikely to make loans without real estate as collateral. PACE assessment is not as secure as real estate collateral, and our terms will reflect that.”

Perceived Obstacles

Supply-Side

- MD banks don't offer non-recourse debt
- Very little solar finance happening statewide
- Small projects are not worth the resources needed to invest
- Some contractors offer financing, but there is concern about predatory rates
- Perception of uncertainty regarding returns and supportive policies
- Complexity of deals and project permitting makes banks hesitant to invest

Perceived obstacles to growth of Montgomery County solar market – Demand Side

“Upfront costs scare interested people away from solar.”

“Solar is still a rich man’s toy. Need to have lower FICO score requirements, and community outreach into communities that know nothing about it.”


Perceived Obstacles

Demand-Side


- Lots of interest in solar, particularly community solar and for LMI
- Information gaps around technology, installers, and finance
- Perception that old building stock, deferred maintenance a barrier to solar
- Few attractive solar financing options for commercial and especially residential

Key Takeaways

Supply – Side

- 
- Lots of incentives, limited financing options with variety of terms/structures, few lenders willing to include savings in the underwriting process
 - Need for expertise/clarity to navigate deal complexity, financing options, understand impact on customer cash flows and building value/NOI
 - Lenders want to see credit enhancements, savings guarantees, or co-investment strategies that de-risk investments and make the process easier for them

Demand – Side

- 
- Customers need zero upfront cost, have immediately positive cash flows, and have simple process
 - Customers need more and clearer information, and trusted, central source of information
 - Customers need a turnkey solution that requires minimal effort

Priority markets based on potential size, savings potential, current policies, practical constraints

Commercial Whole-Building Upgrades

- Combined thermal and electric efficiency opportunity is greater than \$781M
- Opportunity for clean energy substitution, significant gains in consumer savings
- Centralized approach to overcome financing and customer acquisition barriers
- Small deals can be aggregated to reach scale, attract investors

Residential Whole-Building Upgrades

- Combined thermal and electric efficiency opportunity is greater than \$651M
- Portion of commercial sector looks more like residential sector, similar challenges
- Need for solution for immediately positive cash-flow, one-stop shopping

Solar PV for Communities and down-market

- \$911M of investment needed to reach solar potential
- National and local installers already serving high-credit segments of this market
- Rest of market is underserved, huge potential
- Aggregation of small deals is critical for getting capital to flow

Multifamily Upgrades

- Efficiency investment opportunity is nearly \$150M
- Handful of market actors beginning to serve this space, but room for growth
- Unique complexity in this area, makes achieving scale difficult



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Thank You

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Montgomery County Green Bank – CGC Recommendations

Alex Kragie, Program Director

Nick Kline, Program Director

Coalition for Green Capital

April 2016

Market Assessment Deliverables

Landscape

Landscape Analysis
& Green Bank Roles



Market Gaps

Market Sizing &
Interview Synthesis



Green Bank

Potential Green Bank Activities

Agenda

- Choosing Green Bank Mission
- Potential Green Bank Activities
- Scenarios

Potential missions, or key priorities, of the Montgomery County Green Bank

- Board of Directors can choose to focus on...
 - Building market capacity of current actors
 - Creating jobs
 - Cutting-edge project design
 - Decarbonizing by sector
 - transportation, commercial (small/big), residential, multifamily
 - Easy wins
 - Improving social equity
 - Increasing climate resiliency
 - Maximizing clean energy deployment
 - Promoting economic development
 - Reducing GHG emissions
 - Or other priorities

A single priority allows the Green Bank to optimize all its activities and set metrics toward achieving that goal

- Take, for example, the Connecticut Green Bank
- Priority: max clean energy generated or energy saved
- CGB's central metric is the objective function (OF):
- The basic formula for the OF is as follows:

$$\frac{(\text{Energy Generated or Saved}) * (1 + / - \% \text{ Realized})}{\text{GB Rebates} + \text{Program and Administrative Cost} + \text{Credit Enhancements}}$$

$$+ \text{Amount of Financing} - \text{REC REvenue}$$

- The OF measures the amount of clean energy generated or energy saved per public dollar at risk in an energy project

Agenda

- Choosing Green Bank Mission
- Potential Green Bank Activities
- Scenarios

Green Bank mission, or key priority, informs which activities the GB Board can choose to pursue

- Green Bank mission is the “end”
 - Green Bank activities are the “means”
 - Large universe of activities to choose from
 - Limited resources constrain the number of GB activities
 - Single mission helps narrow choice of activities to pursue
 - Certain activities may be better suited for certain missions
-
- Following “menu” offers examples of GB activities and the missions they serve

“Menu” of potential activities for MCGB demonstrates breadth of possible directions and impact areas

- Market Development
 - Online Energy Hub
 - REC financing & aggregation
 - Market transparency: data, information, resources
 - Building Market Capacity
 - contractor training, appraiser training, investor education
 - Others
- Financing
 - Commercial EE loan for projects not suitable for PACE
 - PACE construction loans to cover gap in current PACE structure
 - Residential whole-building solar + EE loan
 - Residential solar lease and/or loan product
 - LMI-specific loan for solar + EE
 - Community solar finance & business model development
 - Forgivable pre-development loan for Multifamily EE+RE
 - Pilot projects: Microgrid financing, Virtual power plant, Electric vehicles and charging stations, Energy storage



Increase market transparency: allow all market participants and government staff access to all data

- Addresses: information gaps, barriers to entry
- Features & Benefits
 - Make all data, information, and resources public including:
 - Underwriting criteria
 - Number and size of all projects financed
 - Cost per installed Watt
 - Energy and dollars saved, GHGs avoided
 - Markets served, market penetration
 - All minutes and resolutions of Board of Directors, annual reports
 - Helps market participants understand role of Green Bank
 - Helps government understand impact/success of Green Bank
- Missions Served
 - Build market, Easy win, Economic development, GHG reduction, Workforce development

Online Energy Hub: Green Bank provides central, easily accessible location for all clean energy resources

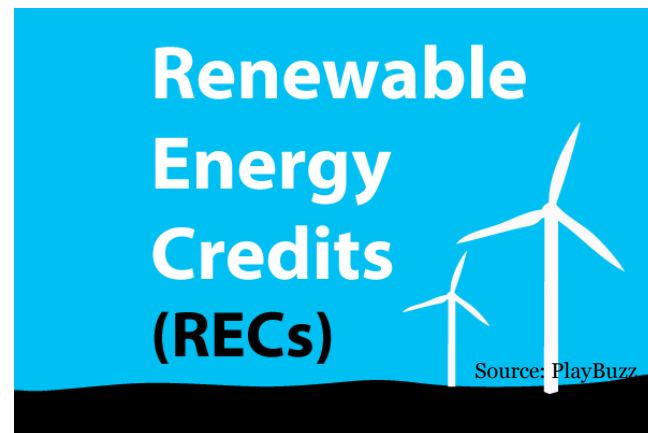
- Addresses: complexity, market/program fragmentation
- Features & Benefits
 - Single, unified website for all information, financing products, and incentives available in the County
 - Green Bank and PACE financing
 - MEA and EmPOWER for Montgomery County incentives
 - Energy data for Montgomery County and Maryland
 - Information about clean energy technologies and contractors
 - Single “brand” and logo for website, all energy programs/resources
 - Site tailored to be one-stop-shop for all contractors and customers
 - Excellent model provided in CT by EnergizeCT.com
- Missions Served
 - Build market, Clean energy deployment, Easy win, Economic development, Ratepayer bills reduction, GHG reduction, Job creation, Workforce development

Online Energy Hub example



REC Aggregation: allows homeowners to get value for stranded asset, lower upfront cost, lower RPS costs

- Addresses: market instability, monetizing value stream
- Features & Benefits
 - Green Bank buys RECs upfront from clean energy projects
 - Sells RECs through long-term contracts to utility at price below what utilities pay in the market, saving them money
 - Non-profit entity (GB) maximizes value customers get for RECs
 - Minimizes cost to utilities & ratepayers of complying with RPS
 - Green Bank sells at tiny markup to cover staff costs
 - Provides stability in the market
- Missions Served
 - Build market, Fiscal sustainability



Contractor training: help contractors understand financial products and use them as sales tool

- Addresses: familiarity with, access to financing; complexity
- Features & Benefits
 - Explain details of financial products to contractors, how to use them as sales tools
 - Certify all contractors that have completed the training
 - Provide financial products to all certified contractors
 - Allows contractors to serve more customers, do more deals
 - Contractors serve as salespeople and customers of financing products
 - Allows more customers to receive the benefits of clean energy
- Missions Served
 - Build market, Economic development, Job creation, Workforce development, Clean energy deployment

Appraiser training: help appraisers understand impact of energy upgrades on market value and NOI

- Addresses: familiarity with energy upgrades, low valuations
- Features & Benefits
 - Explain details of building energy upgrades to appraisers
 - Explain finance mechanisms (PACE, OBF) impact on energy costs
 - Demonstrate energy upgrades impact on four components of value
 - Increase revenue and occupancy
 - Decrease operative expenses and risk
 - Partner with Appraisal Institute, other industry associations
 - Certify participating appraisers, offer “continuing education” credit
 - More accurate appraisals facilitate financing (better comps, higher NOIs & LTVs)
- Missions Served
 - Build market, Economic development, Workforce development, Clean energy deployment

Partnerships with private lenders: help private capital providers enter this market, gain experience/expertise

- Addresses: familiarity/expertise, capital availability/terms
- Features & Benefits
 - Develop relationships with private capital providers interested in investing in clean energy projects
 - Several options for partnership: co-investing, warehousing, credit enhancements
 - Provide expertise, technical assistance for deal structures and terms
 - Facilitate greater participation from investor community
 - Bring more private capital in to clean energy space
- Missions Served
 - Build market, Economic development, Workforce development, Clean energy deployment

Financing for projects too small for PACE: access to finance for other segment of the commercial market

- Addresses: market gap of SMEs not served by PACE
- Features & Benefits
 - Some SME projects are too small for PACE, <\$250,000
 - Projects may be more similar to residential – “resi-mercial”
 - Combined construction & term loan for clean energy in SME
 - Allows more businesses to access financing, benefits of clean energy
- Missions Served
 - Clean energy deployment, Economic development, Fiscal sustainability



Source: lime-energy.com

PACE construction loans: allow PACE projects to move forward, overcome temporary gap in financing

- Addresses: market gap of construction financing for PACE
- Features & Benefits
 - Loan to building owner to provide capital for project construction
 - Fills big gap in the market
 - Current law requires PACE loan to be disbursed after construction
 - Private PACE lenders provide term loan for project
 - Covers construction risk for PACE lenders
 - Provides relatively quick way for Green Bank to enable more PACE lending, generate revenue
- Missions Served
 - Build market, Clean energy deployment, Fiscal sustainability



Whole-Home Upgrade: gives homeowners flexible means of reducing energy bills with single solution

- Addresses: aligning economics for deeper upgrades
- Features & Benefits
 - Set list of EE measures eligible for financing
 - Homeowner & contractor choose handful of suitable measures
 - Install EE before solar to reduce necessary system size
 - Green Bank offers variety of rates & terms to finance post-incentive project cost
 - Provides flexible means of making entire homes more efficient
 - Cash flow positive from beginning, as EE savings cover solar costs
 - Helps homeowners navigate complexity, get benefits of clean energy
 - Connecticut Green Bank has Smart E loan program, useful model
 - This product could rely on loan-loss reserve to draw in private capital
- Missions Served
 - Clean energy deployment, Economic development, Fiscal sustainability, Ratepayer bills reduction

Residential solar lease: enables local installers without own financing to offer solar without upfront cost

- Addresses: lack of standard, quality option for financing
- Features & Benefits
 - Solar project can be cash flow positive from day 1
 - Low risk means for homeowners to benefit from solar
 - No-money down financing, Third party insurance, Option to buy
 - Provides local installers with important sales tool
 - Allows local installers without in-house financing to compete with national installers
 - Can facilitates deeper penetration of solar into residential sector
 - Would pair well with a solar incentive (\$ per installed watt) that could be scaled at the Green Bank's discretion
- Missions Served
 - Clean Energy Deployment, Financial sustainability, GHG reduction, jobs/workforce, Ratepayer bill reduction,

LMI-specific financing: Use alternative underwriting to lower bills and improve social equity

- Addresses: access to benefits of clean energy
- Features & Benefits
 - Alternative underwriting instead of FICO (e.g. utility bill payment)
 - Set list of EE measures and solar eligible for financing
 - Homeowner & contractor choose measures from list
 - Green Bank finances post-incentive project cost
 - Cash flow positive from beginning
 - Helps homeowners navigate complexity, get benefits of clean energy
 - Creates more disposable income in homes that need it most
 - Excellent model provided in CT by CGB & PosiGen pilot
- Missions Served
 - Clean energy deployment, Economic development, Ratepayer bills reduction, Social equity

LMI example: PosiGen in Connecticut



The image shows a screenshot of the PosiGen website. The top navigation bar includes the PosiGen logo, the tagline "CLEAN ENERGY FOR EVERYONE", and links for "RESIDENTIAL", "COMMERCIAL", "COMPANY", and "LOCATIONS". Below the navigation bar is a large banner with a background image of solar panels being installed. The banner text reads "CONNECTICUT SOLAR FOR ALL" and "Thought You Couldn't Afford Solar? Think Again." To the right of the banner is a table titled "How Does Solar For All Work?". The table compares three payment plans: "Good" (3 Months), "Better" (6 Months), and "Best" (12 Months), all at \$20 per month. The "Good" plan is for 1-24 families, "Better" for 25-49 families, and "Best" for 50-100+ families. The table shows that all plans have a \$0 down payment, a roof assessment, and solar installation. The monthly payment after the special is \$64.99 - \$79.99 per month depending on size.

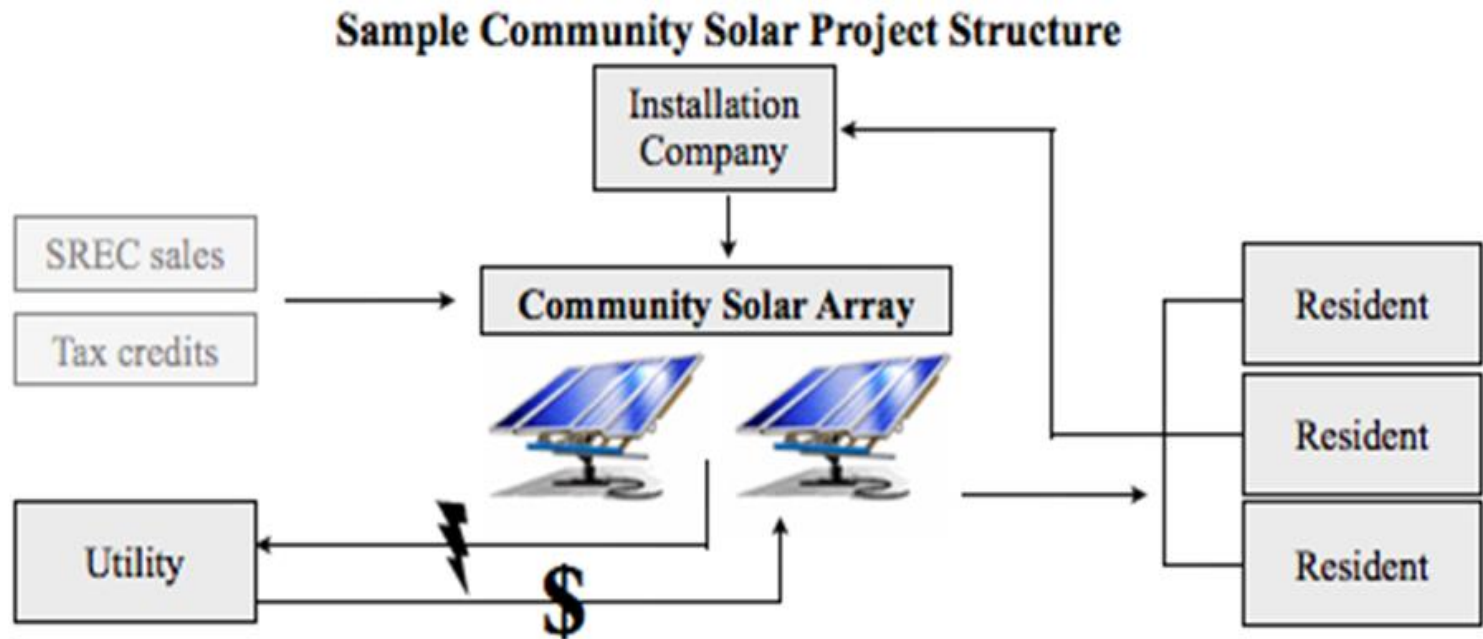
	Good 3 Months At \$20 per month	Better 6 Months At \$20 per month	Best 12 Months At \$20 per month
Saving with Solar	1-24 Families	25-49 Families	50-100+ Families
Down Payment	\$0	\$0	\$0
Roof Assessment	✓	✓	✓
Solar Installation	✓	✓	✓
Monthly Payment After Special	\$64.99 - \$79.99 per month depending on size		

- Puts solar within the reach of more residents
 - Combines residential solar system lease with energy savings agreement
 - Connecticut Green Bank invests in Posigen to provide low-cost debt capital and a tiered incentive for participating households

Community Solar: allow renters and homeowners with poor roofs to take advantage of solar

- Addresses: access to benefits of clean energy
- Features & Benefits
 - Large solar project on unused roofspace or brownfield
 - Community members “buy shares” of the solar project with financing
 - Energy produced is credited to share-owners’ energy bills
 - Monthly savings are larger than monthly cost of financing
 - Alternative underwriting options for LMI for share purchase
 - Municipal buildings on sidelines as “reserve share buyers” to take over the shares in case of default
- Missions Served
 - Build market, Social equity, Clean energy deployment, Economic development, Ratepayer bill reduction

Community Solar example



Forgivable pre-development loan for multifamily clean energy projects: use market actors experience/expertise

- Addresses: difficulty of energy projects in multifamily
- Features & Benefits
 - Pre-development loan to multifamily building owner to cover project startup costs
 - Forgivable: no payback if project does not go through
 - Other private and public financing entities finance projects
 - Enables existing market actors to overcome key barrier and do more deals
 - Helps multifamily sector enjoy benefits of clean energy
- Missions Served
 - Build market, Clean energy deployment, Cutting-edge project design, Economic development, Ratepayer bills reduction



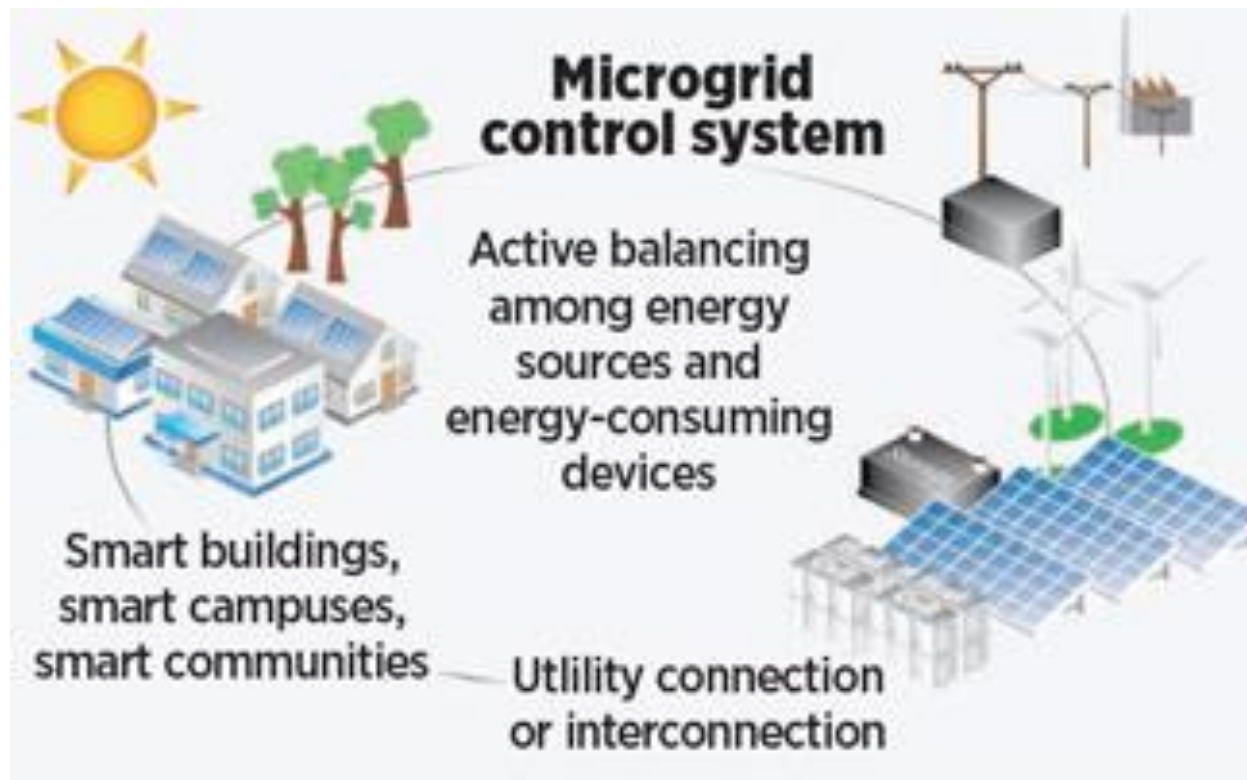
Source: Sun Light and Power

Pilot Projects: Green Bank can bring mature techs to market that have not yet been widely deployed

- Addresses: innovative financing, models for deployment
- Features & Benefits
 - Pilot new financing products and structures for common technologies
 - Support deployment of new, innovative solutions that use proven technologies but cannot get financing for broad adoption
 - For example: microgrids, EV chargers, energy storage
 - Can demonstrate to private capital providers that these technologies are bankable and low-risk
 - Gather useful data for development of industry, future projects
 - High profile projects generate publicity
- Missions Served
 - Build market, Clean energy deployment, Cutting-edge project

design

Pilot Projects example



Agenda

- Choosing Green Bank Mission
- Potential Green Bank Activities
- Scenarios

Social Equity Focus

- With Social Equity focus, Green Bank activities could include:
 - Community solar
 - LMI-specific loan
 - Online energy hub
- Potential performance metrics could include:
 - Total and average savings achieved (\$ and kWh) in LMI households, Number of LMI participants or projects, Number of participants by tax bracket or percentage of AMI, Percent reduction in reliance on other government programs

Deployment Focus

- With focus on Deployment, Green Bank activities could include:
 - Community solar
 - Online energy hub
 - Forgivable pre-development loan for multifamily projects
 - Residential whole-building loan
 - PACE construction loans
 - Residential solar lease
- Potential performance metrics could include:
 - Number of projects or participants, volume and speed of capital deployed and leveraged, amount of savings/energy generated

Building Market Capacity Focus

- With a focus on “building up the market,” Green Bank activities could include:
 - Online energy hub
 - REC aggregation
 - Commercial EE too small for PACE
 - Contractor/appraiser/lender trainings
 - PACE construction loans
 - Pilot projects
- Potential performance metrics could include:
 - Public-private leverage ratio, Reductions in average cost of capital, Number of financing arrangements the GB facilitates, Number of market entrants

Reducing GHGs Focus

- With a focus on “maximizing GHG reductions,” Green Bank activities could include:
 - Commercial EE loan for projects not suitable for PACE
 - PACE construction loans to cover gap in current PACE structure
 - Residential whole-building solar + EE loan
 - Residential solar lease and/or loan product
- Potential performance metrics could include:
 - GHGs reduced per dollar of GB capital at risk, GHGs reduced per project

Focus on Filling the Gaps

- With a focus on “filling gaps in the market,” Green Bank activities could include:
 - PACE construction loans to cover gap in current PACE structure
 - LMI-specific loan for solar + EE
 - Community solar finance & business model development
 - Forgivable pre-development loan for Multifamily EE+RE
 - Pilot projects
 - Increasing market transparency: data, information, resources
 - Contractor/appraiser/lender trainings
- Potential performance metrics could include:
 - Number of clean energy projects financed, various gap-specific metrics



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Thank You

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