RICHMOND, VIRGINIA COMMUNITY SOLAR IMPACT ANALYSIS: IMPLICATIONS FOR FUTURE STATE-LEVEL POLICY PROPOSALS

Gilbert Michaud
Voinovich School of Leadership and Public Affairs, Ohio University

Prepared for the 47th Annual Mid-Continent Regional Science Association (MCRSA) Conference

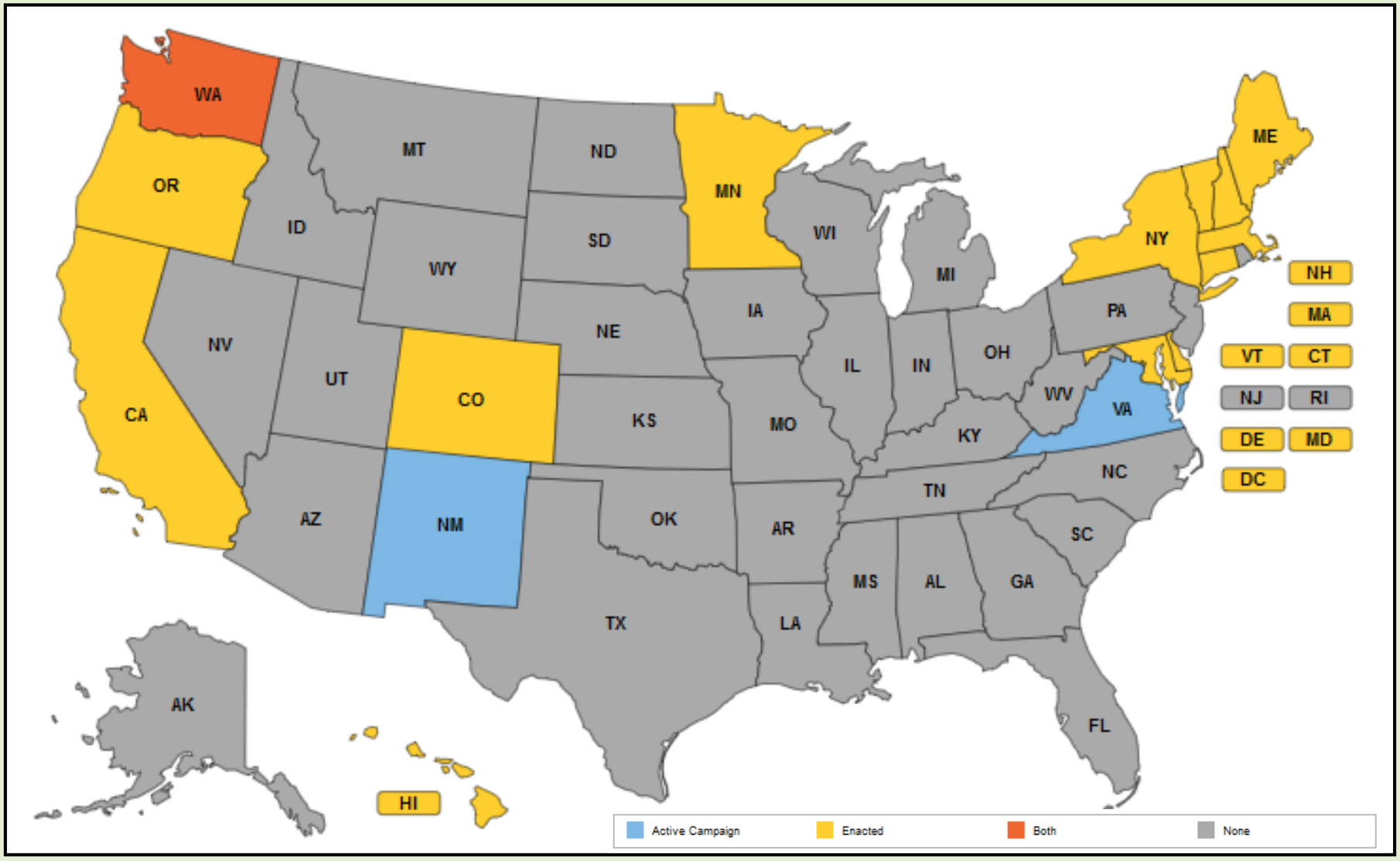
Introduction

- Solar photovoltaic (PV) systems
  - Decreasing costs
  - Increasing deployment
- Diverse public policy approaches to encourage solar PV (e.g., NEM, RPS, tax credits, tax exemptions, loans)
- Community Shared Solar
  - Lack of feasibility of certain customers to own solar PV systems (e.g., lack of homeownership, roof orientation, shading, size)
    - Roughly 25% of U.S. households & businesses have the structural ability to install panels on their roofs (Denholm & Margolis, 2008)

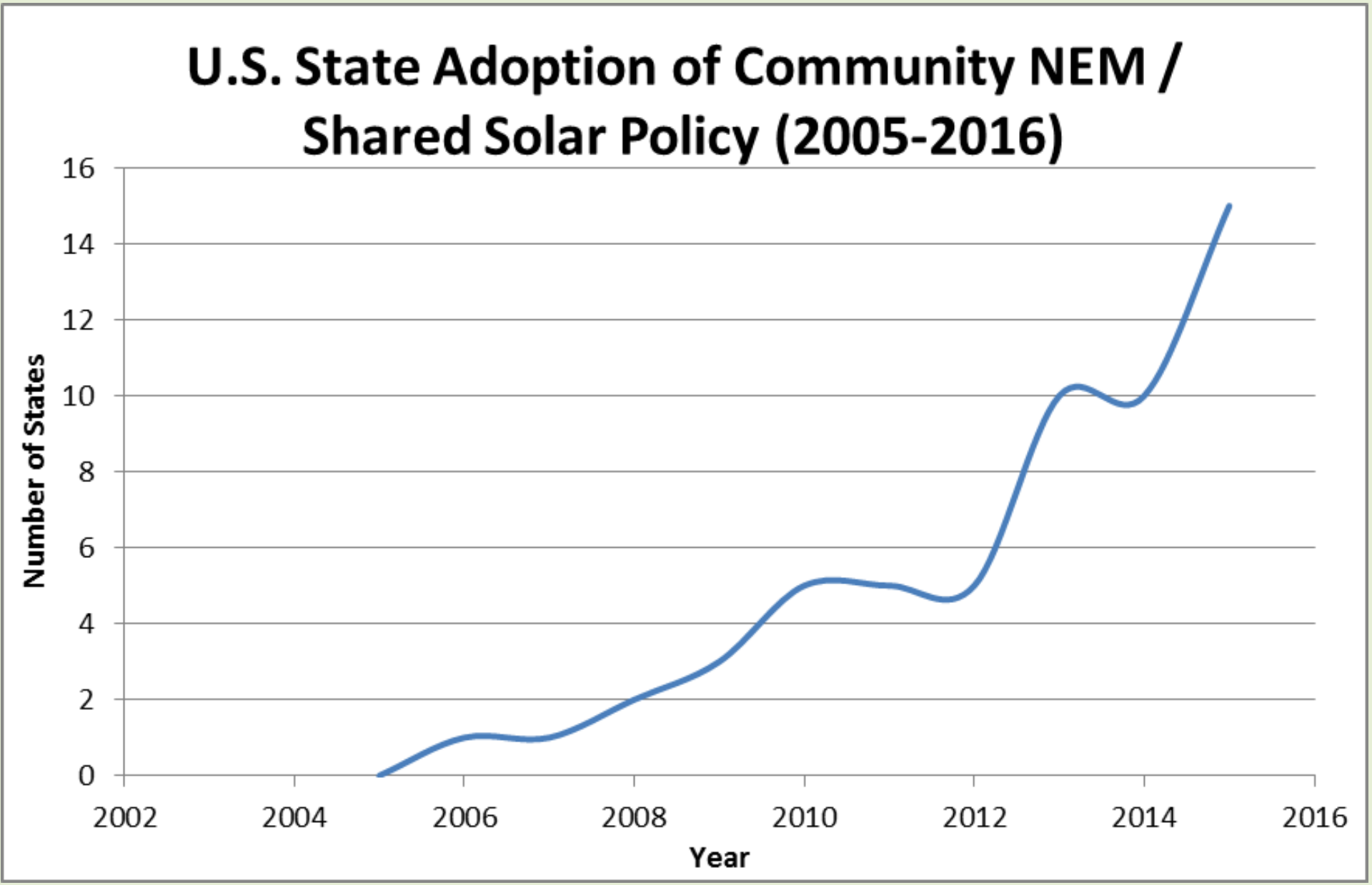
Community Shared Solar

- Economies of scale and ideal project locations
- Financial benefits and mitigate concerns about climate change and rising energy costs (Bomberg & McEwan, 2012); local control (Weinrub, 2010); community cohesion (Bollinger & Gillingham, 2012; Irvine, Sawyer, & Grove, 2012)
- Three common models
  - Utility Owned
  - Special Purpose Entity Owned
  - Nonprofit Owned
- In Virginia, no rules that require utilities to permit community shared solar

U.S. Community Shared Solar Policy



Note. Figure from Shared Renewables HQ (2015) website. http://www.sharedrenewables.org/community-energy-projects/



Note. Compiled by author from National Conference of State Legislatures (2015) and Shared Renewables HQ (2016).

Research Questions

- What is the feasibility for community shared solar installations in the Richmond, VA region?
- What impact could such installations have?
- What is the path forward to initiate community shared solar projects in the Richmond, VA region?

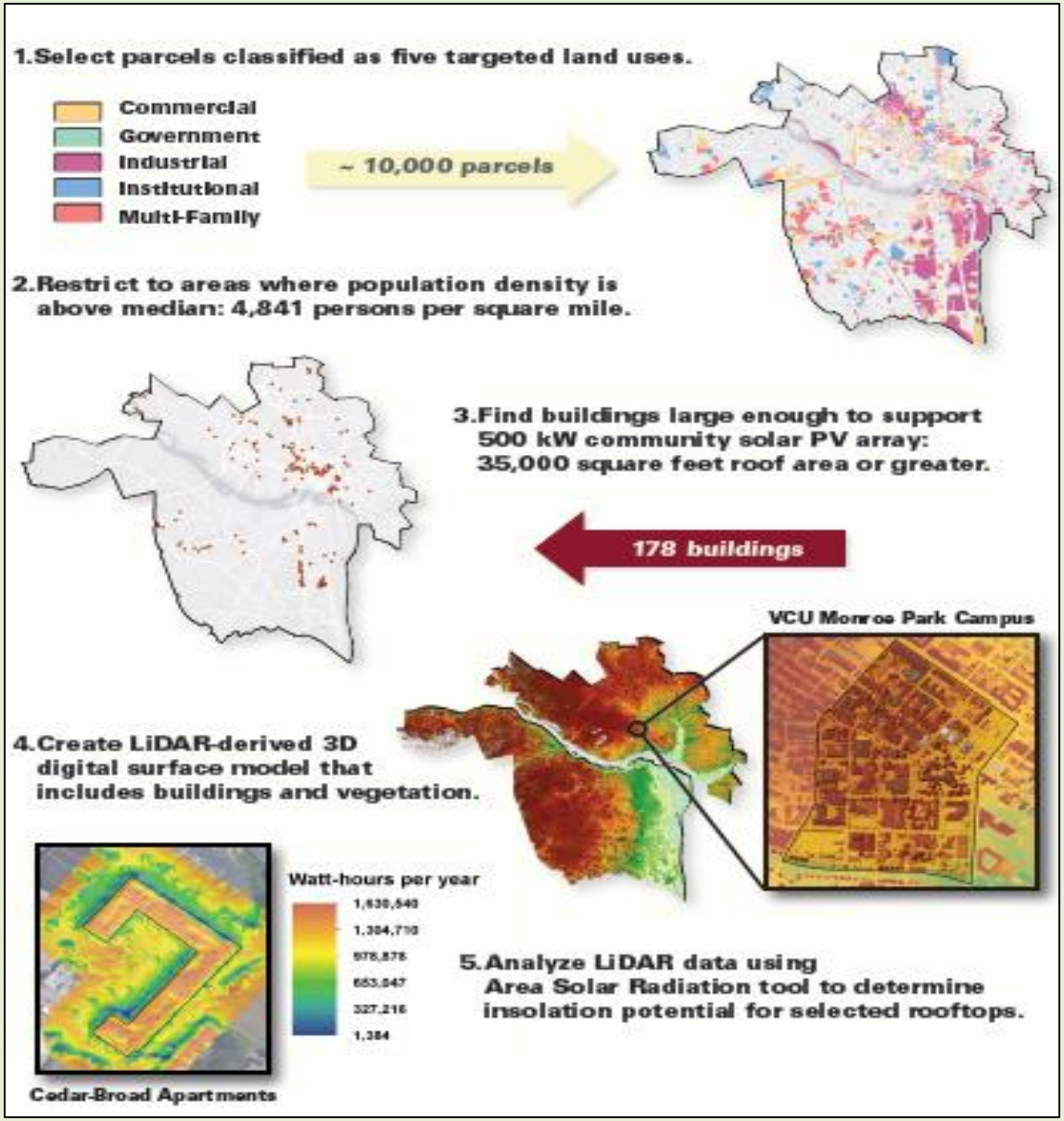
Methodology

- GIS to find properties in Richmond with strong potential for community shared solar array
  - Parcels, Land Use, Structures (City of Richmond)
  - Population Density (U.S. Census Bureau)
  - LiDAR Point Cloud (USGS)

"Light detection and ranging." Pulsed laser scanning to create accurate 3D model of surfaces.

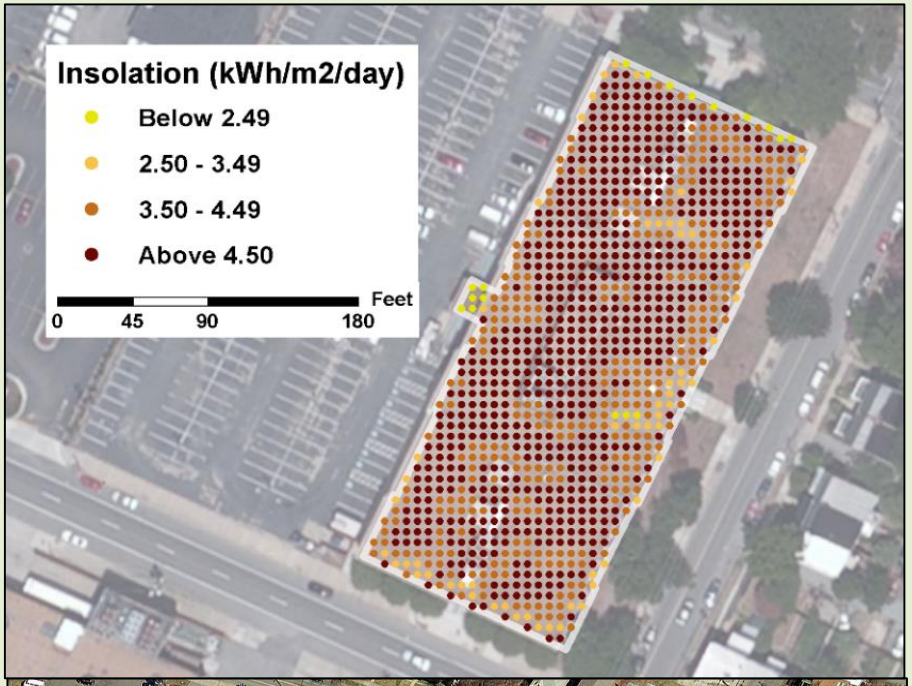
- Environmental Impact
  - Energy produced
  - CO_2 reduced
  - Equivalent homes powered & cars taken off the road
- Jobs and Economic Development Impact (NREL's JEDI)
  - Project costs
  - Local spending
  - Labor impacts (direct, supply chain, and induced)
  - Earnings impacts

Site Selection



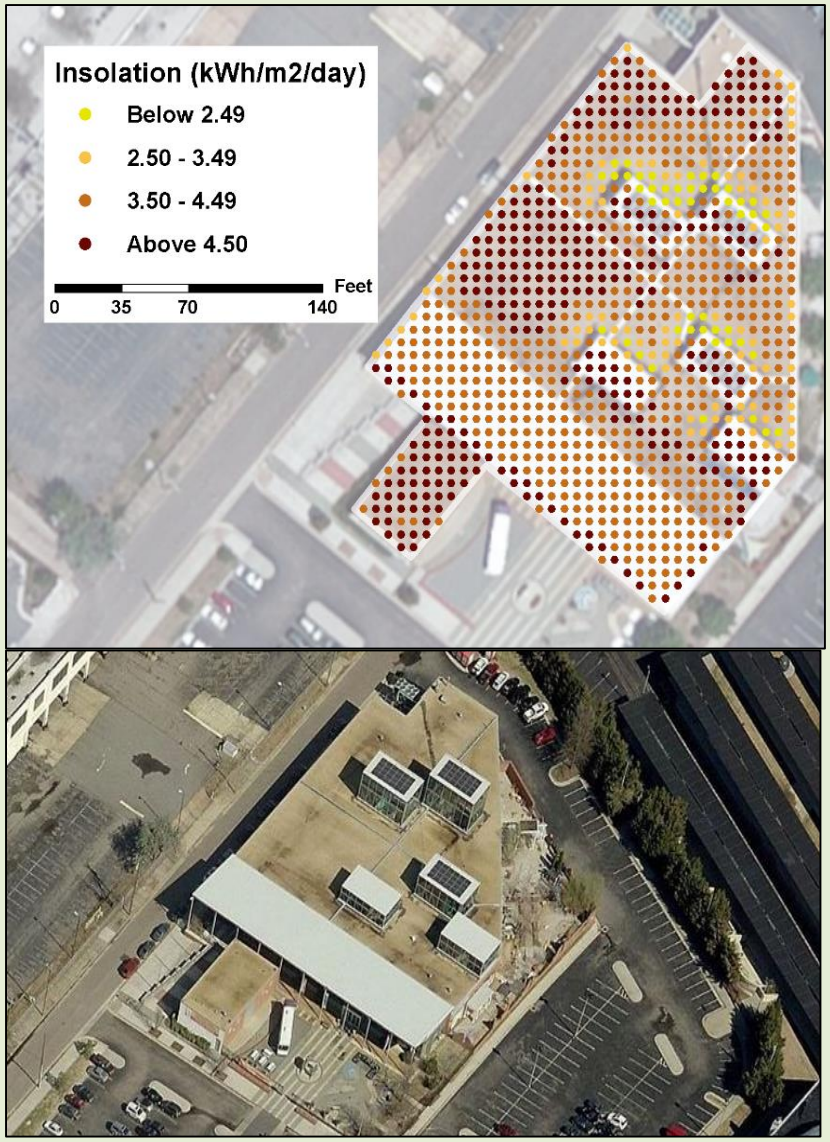
Site 1: Carytown Place (Commercial)

- 10 North Nansemond St.
- Average Insolation: 4.38 kWh/m^2/day
- Potential system size: 511 kW
- Annual energy production: 612,840 kWh
- Retail and residential market
- Simple roof geometry



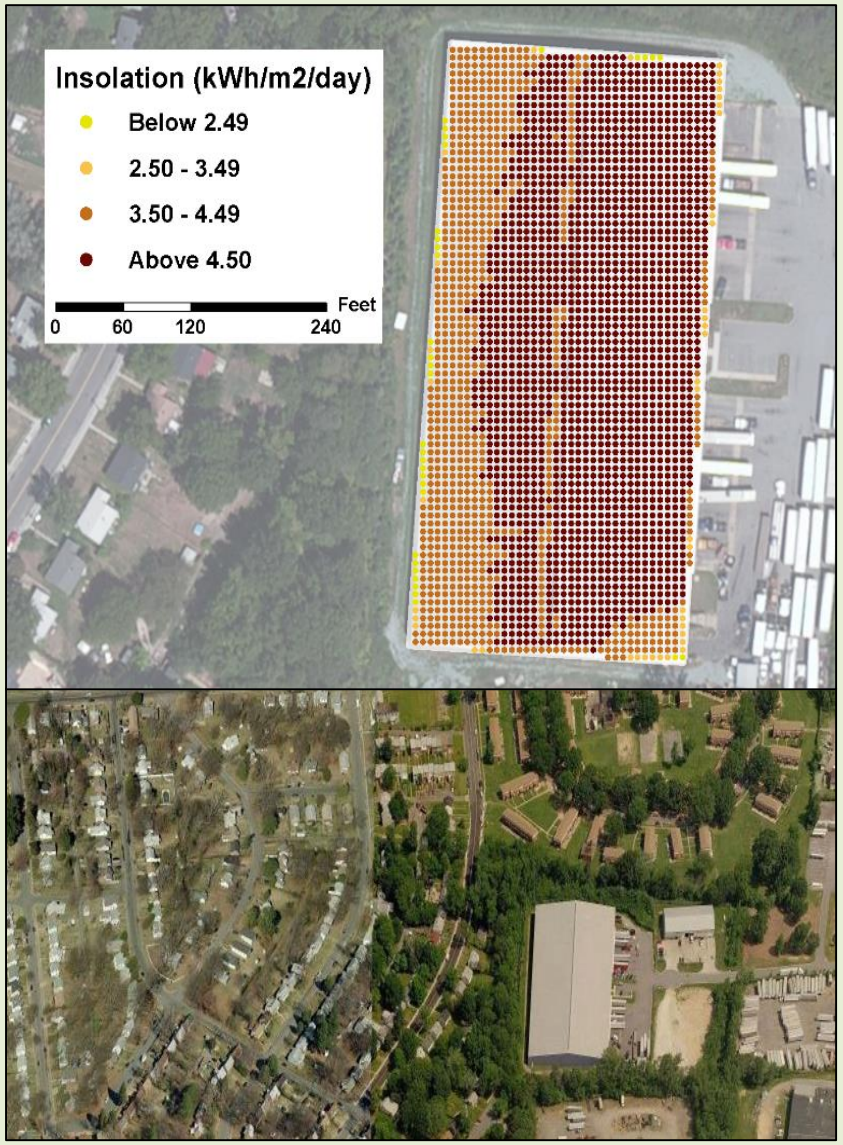
Site 2: Children's Museum (Gov't)

- 2626 West Broad St.
- Average Insolation: 4.16 kWh/m^2/day
- Potential system size: 471 kW
- Annual energy production: 536,973 kWh
- Educational opportunity
- Several roof obstacles



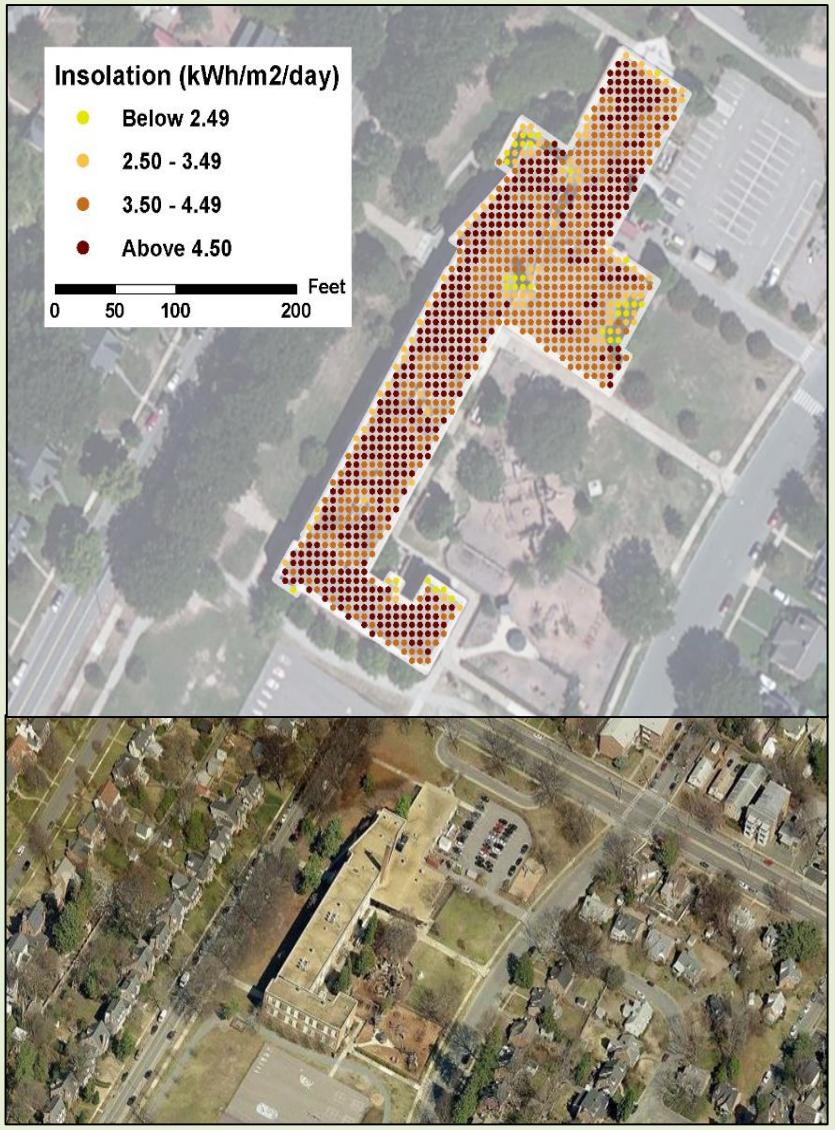
Site 3: Old Dominion Warehouse (Ind.)

- 1598 Carter Creek Rd.
- Average Insolation: 4.46 kWh/m^2/day
- Potential system size: 4,470 kW
- Annual energy production: 5,460,583 kWh
- Very high solar yield
- Simple, low-pitch roof



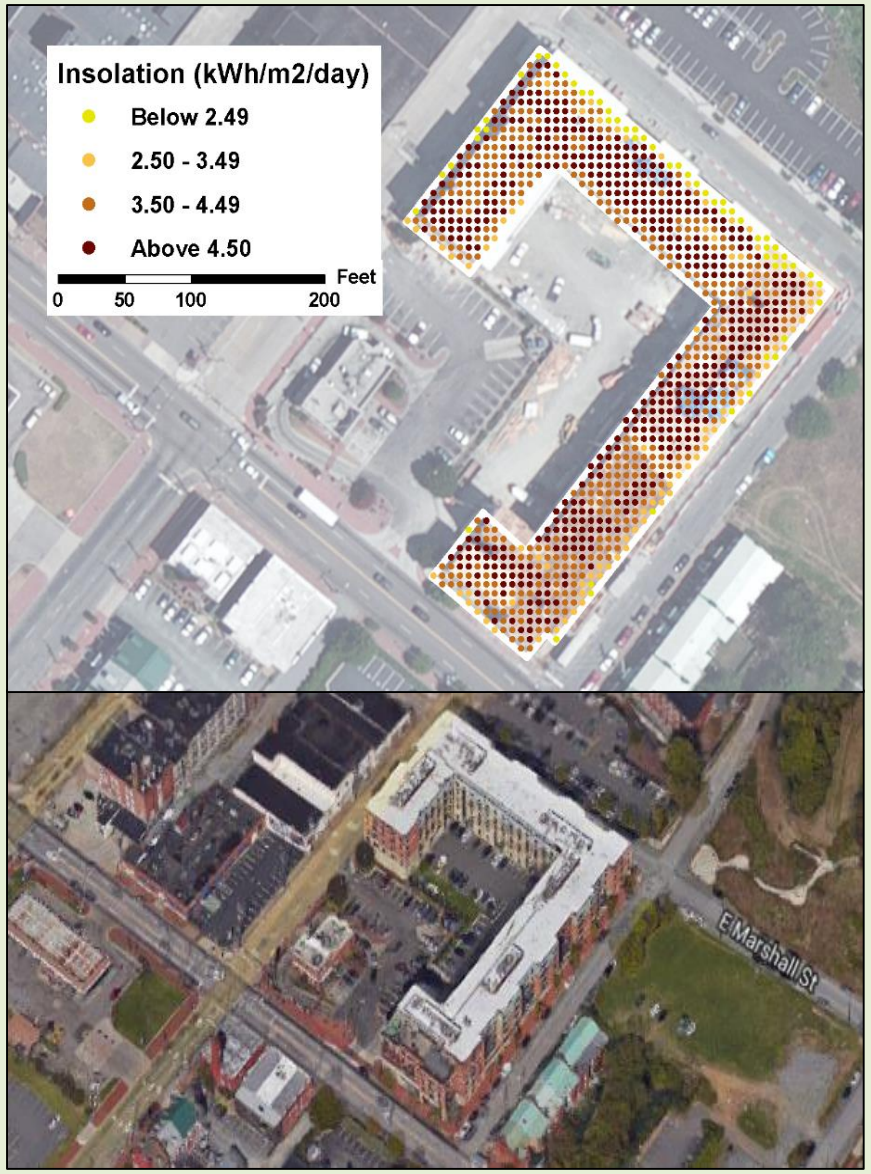
Site 4: Mary Munford School (Inst.)

- 211 Westmoreland St.
- Average Insolation: 4.26 kWh/m^2/day
- Potential system size: 482 kW
- Annual energy production: 561,890 kWh
- Strong existing community
- High-income area



Site 5: Cedar-Broad Apartments (M.F.)

- 1820 East Broad St.
- Average Insolation: 4.20 kWh/m^2/day
- Potential system size: 469 kW
- Annual energy production: 538,502 kWh
- On-site member base
- Transient market



Environment / Economic Development

- Community Shared Solar PV:
  - Reduces GHG emissions to mitigate future global warming and climate change impacts
  - Reduces water use (from power plants) and criteria air pollutants (e.g., SO_2, NO_x, & PM 2.5)
  - Protects ecosystems
  - Provides energy security (e.g., rising energy costs; terrorist attacks; natural disasters)
  - Enhances community cohesion (e.g., peer-effects)
  - Creates job opportunities (e.g., solar industry) and local spending

Environmental Impact

Community Solar Capacity	Energy Produced (kWh/year)	CO_2 Reduced (lbs.)	Equivalent # Homes Powered	Equivalent # Cars off Road
250 kW	307,969	332,474	23	47
500 kW	615,938	664,948	46	94
1 MW	1,231,875	1,329,895	92	189
2 MW	2,463,750	2,659,791	184	377

Note. Author calculations.

- Energy Produced (kWh/yr.) = kW × 0.75 (de-rating factor) × 4.5hr/day (insolation) × (365 day)/yr.
- CO2 Reduced (lbs.) = kw × (1079.57 lbs GHGs)/MW × MW/(1000 kw).

Installation Costs and Local Spending

- National Renewable Energy Laboratory's Jobs and Economic Development Impact (JEDI) model

Community Solar Capacity	Project Installation Cost ($)	Local Spending ($)
250 kW	1,441,618	873,618
500 kW	2,883,235	1,747,235
1 MW	5,776,470	3,494,470
2 MW	11,532,940	6,988,940

Note. Author calculation from http://www.nrel.gov/analysis/jedi/download.html

Jobs and Earnings Impact

Community Solar Capacity	Direct Jobs	Direct Earnings ($)	Supply Chain Jobs	Supply Chain Earnings ($)	Induced Impacts Jobs	Induced Impacts Earnings	Total Jobs	Total Earnings
250 kW	4.2	332,700	3.5	258,000	2.4	136,400	10.1	721,100
500 kW	8.3	665,400	7.1	516,100	4.8	272,700	20.3	1,454,100
1 MW	16.7	1,330,700	14.1	1,032,100	9.7	545,400	40.5	2,908,300
2 MW	33.4	2,661,400	28.3	2,064,200	19.3	1,090,800	81	5,816,500

Conclusions

- High theoretical potential for community shared solar in Richmond, VA
  - 178 buildings suitable for 500 kW system
- Weak solar energy incentives and utility lobbying has hindered community solar development
- Recommendations
  - Educate public through outreach programs
  - Understand potential sites and environmental / economic development impacts
  - Ease transition via group billing legislation or utility owned community shared solar program

Questions?

- For additional questions/comments concerning this research, please email me at michaudg@ohio.edu
- Thank you