



## Financing for solar deployment on university campuses

Shivani Mathur, Eric O'Shaughnessy, Nicole Harman, and Eric Rehm

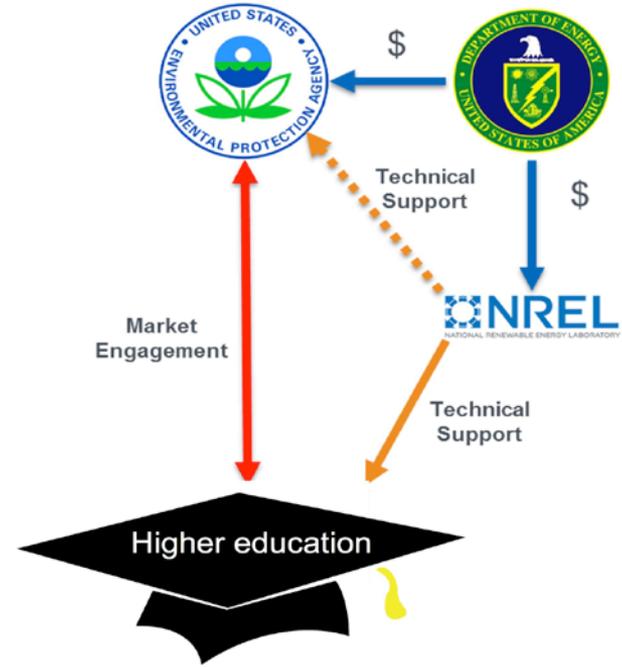
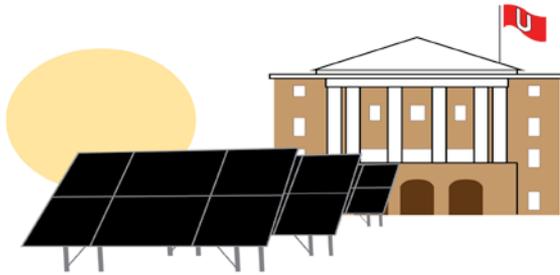
April 27, 2017

# Housekeeping

- Participants are joined in listen-only mode.
- Use the Q&A panel to ask questions during the webinar.  
We will hold all questions until after all speakers have presented.
- Slides from today's webinar will be shared later this week with all registered attendees.
- If you have technical difficulties with the webinar, contact the GoToWebinars Help Desk at 888.259.3826 for assistance.

# NREL is Assisting Universities to Deploy PV

With funding from the Department of Energy's SunShot Initiative, NREL is providing technical support to higher education institutions to deploy solar.



# Webinar Plan

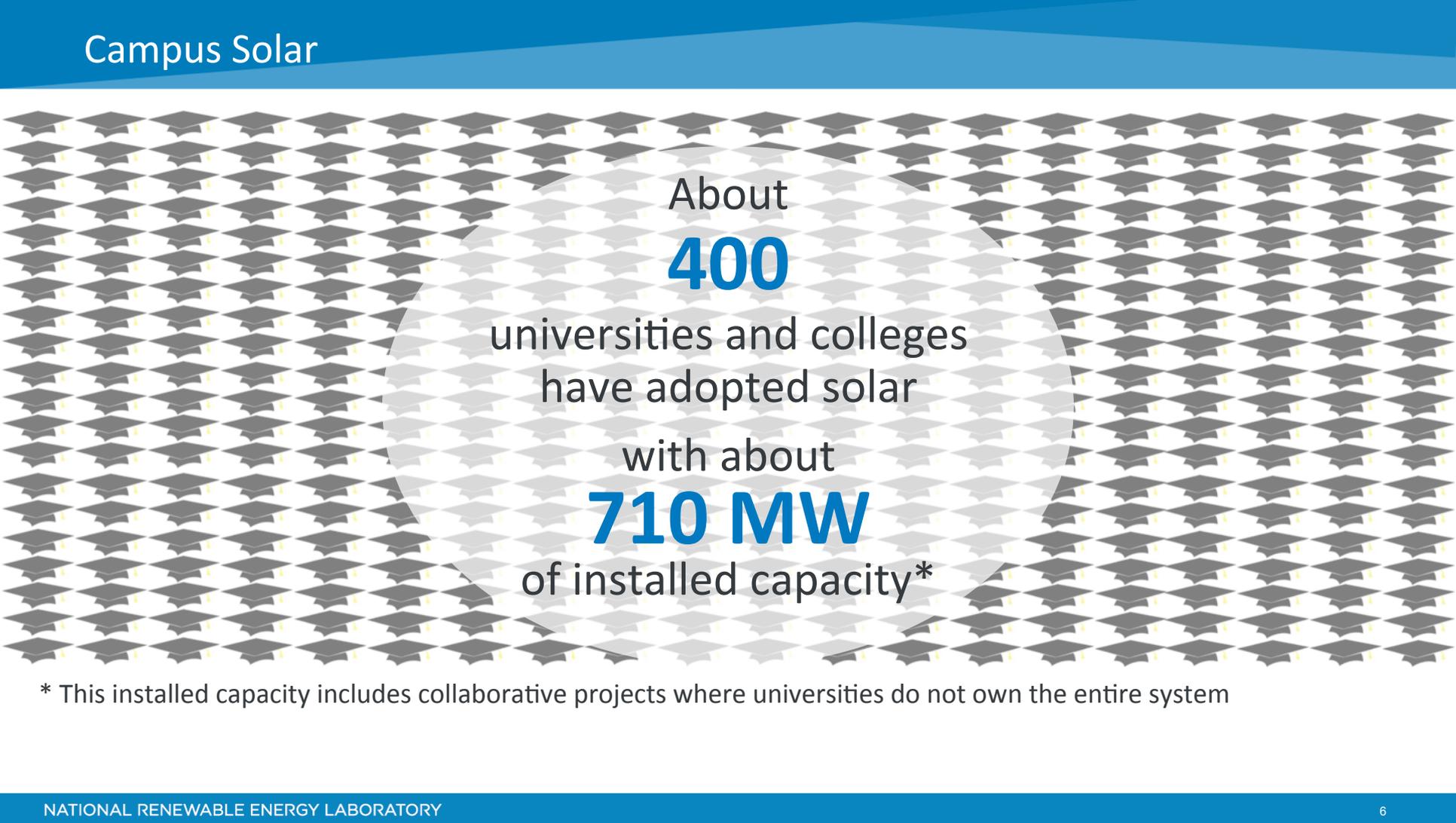
- **Solar Deployment in Universities: Update 2017**  
Eric O'Shaughnessy, National Renewable Energy Laboratory
- **Investing in Clean Energy: Campuses and Endowments**
  - Nicole Harman, Intentional Endowments Network
- **Higher Education Solar Investment:  
Building A Financial Model for Success**
  - Eric Rehm, Midwest Renewable Energy Association



## Solar Deployment in Universities: Update 2017

Eric O'Shaughnessy, National Renewable Energy Laboratory

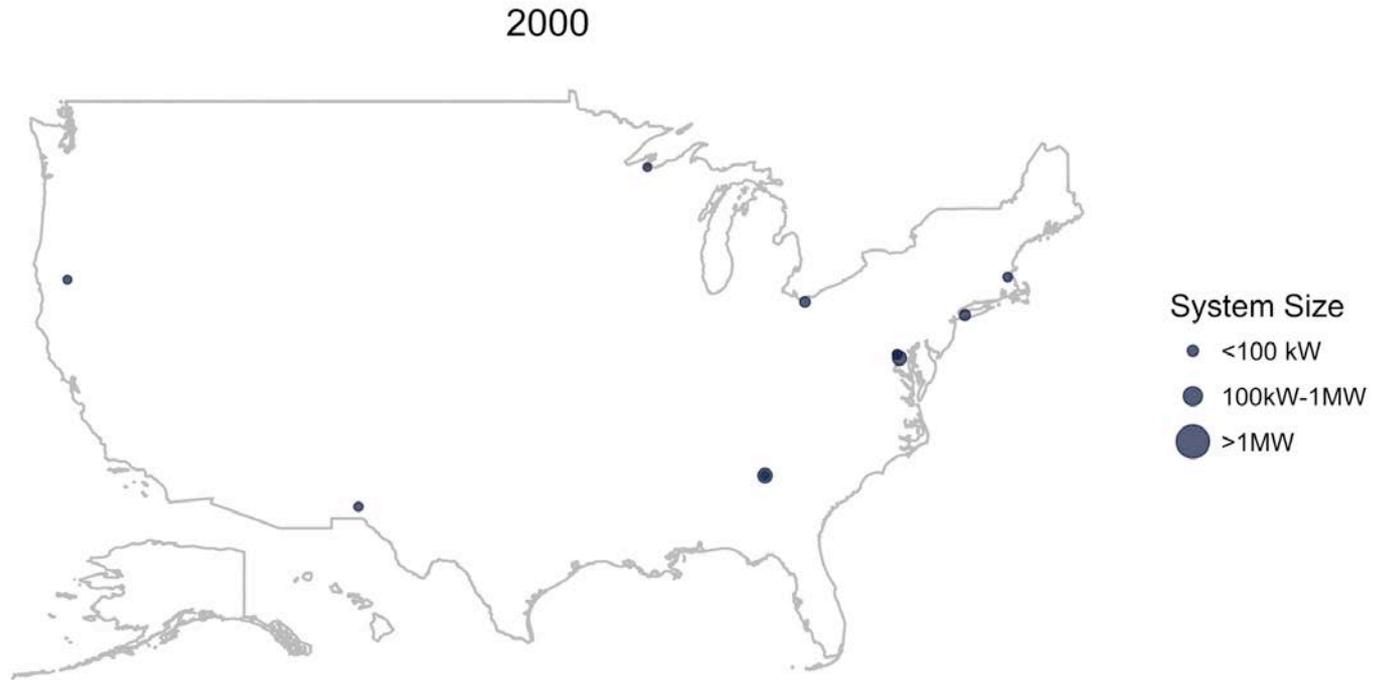
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About  
**400**  
universities and colleges  
have adopted solar  
with about  
**710 MW**  
of installed capacity\*

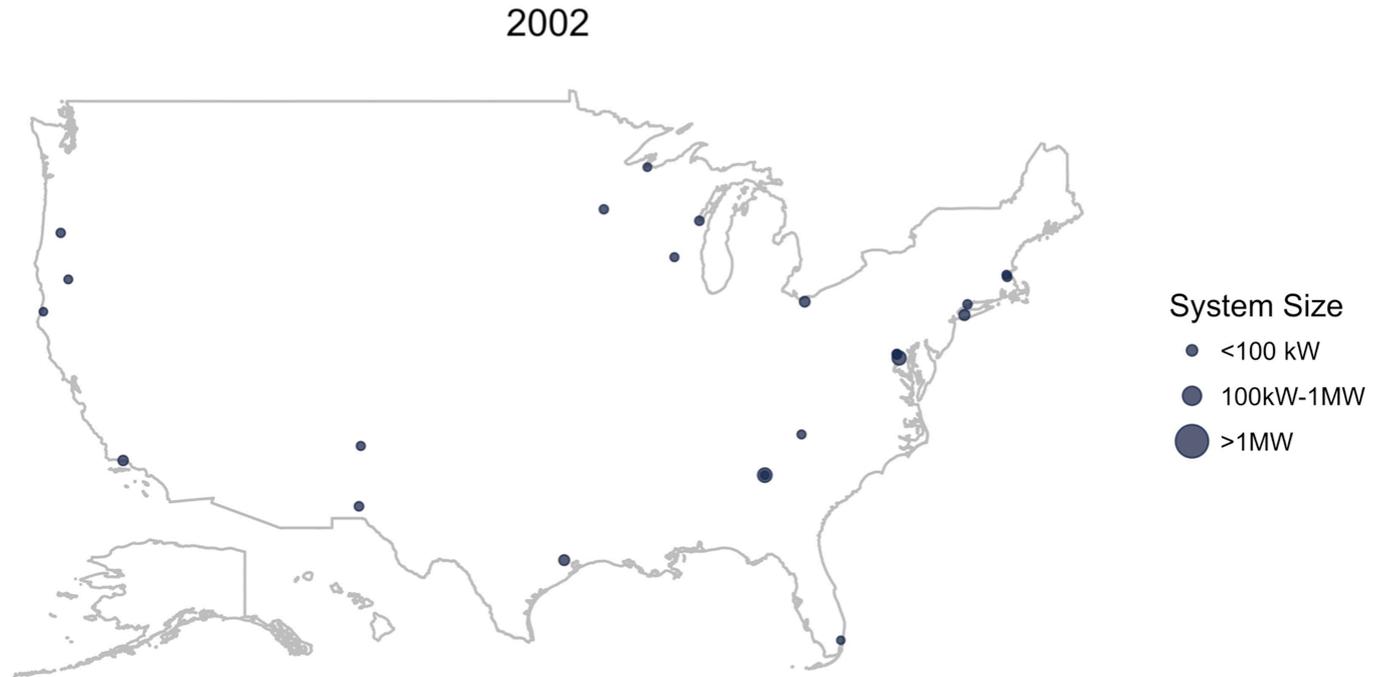
\* This installed capacity includes collaborative projects where universities do not own the entire system

# University PV Adoption



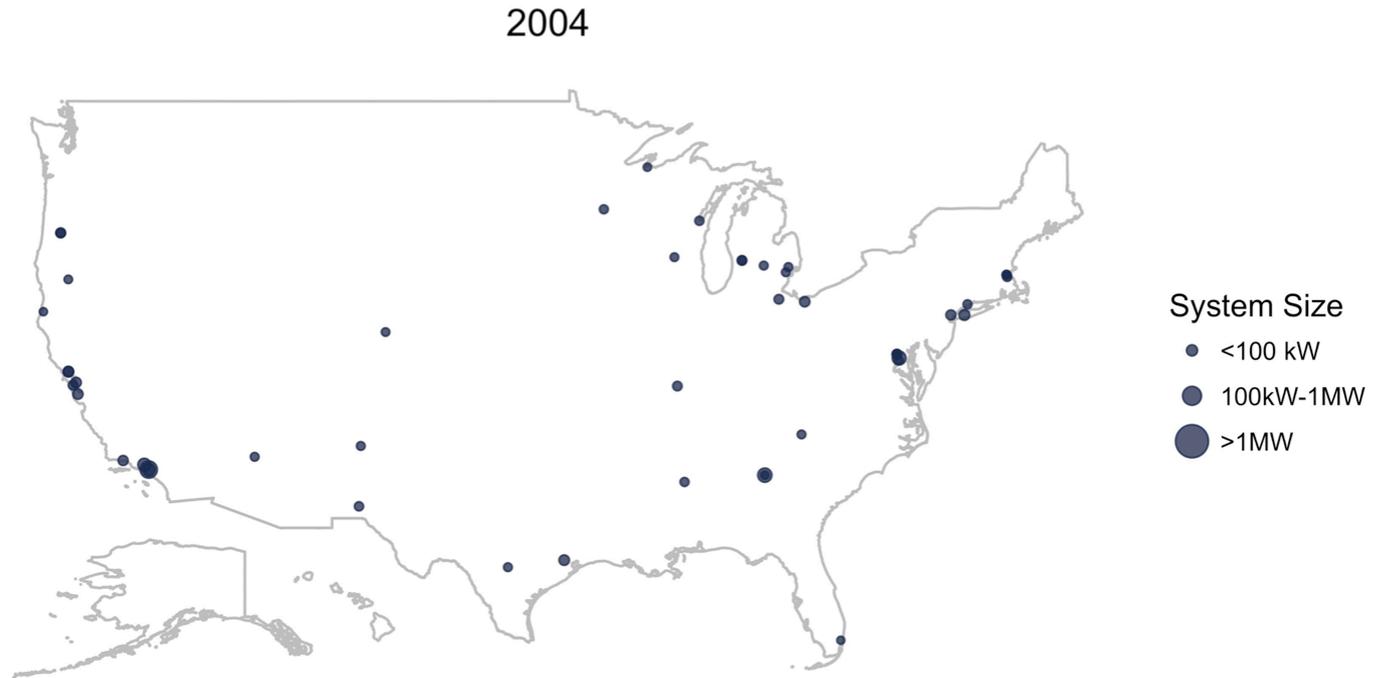
Based on data from: AASHE, BNEF, SN

# University PV Adoption



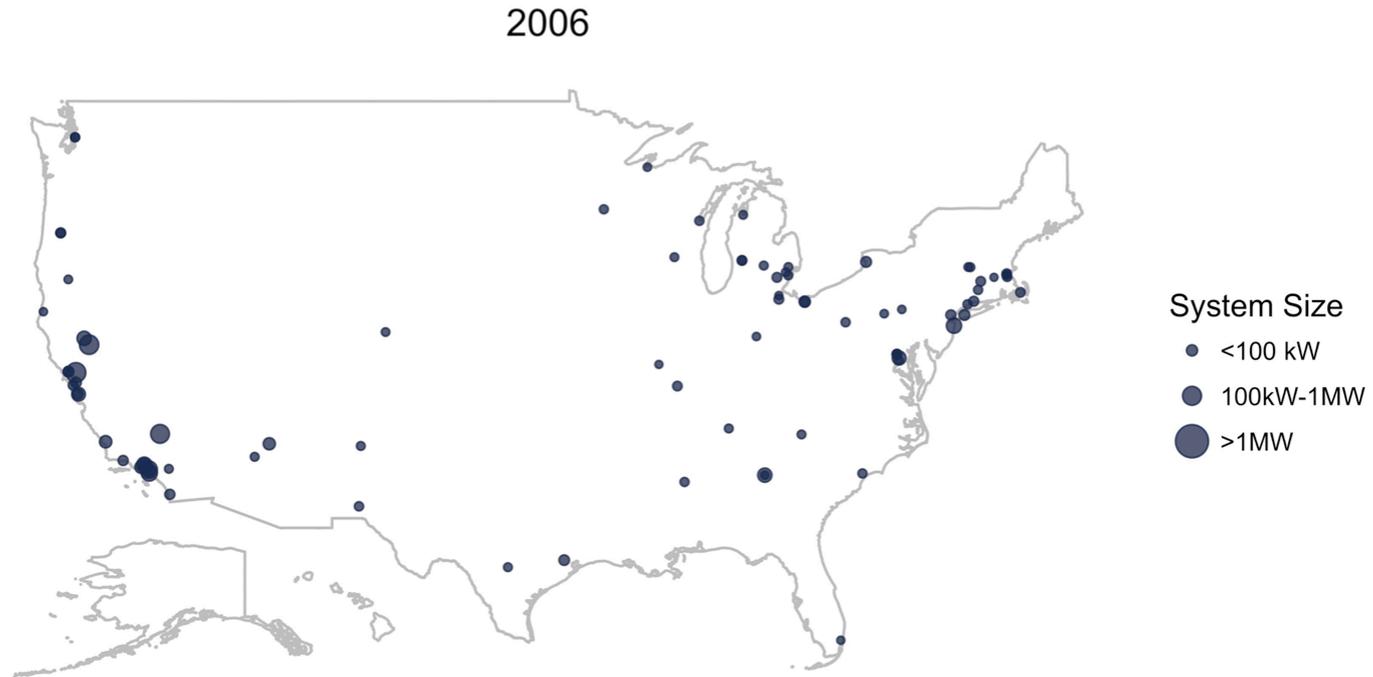
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# University PV Adoption



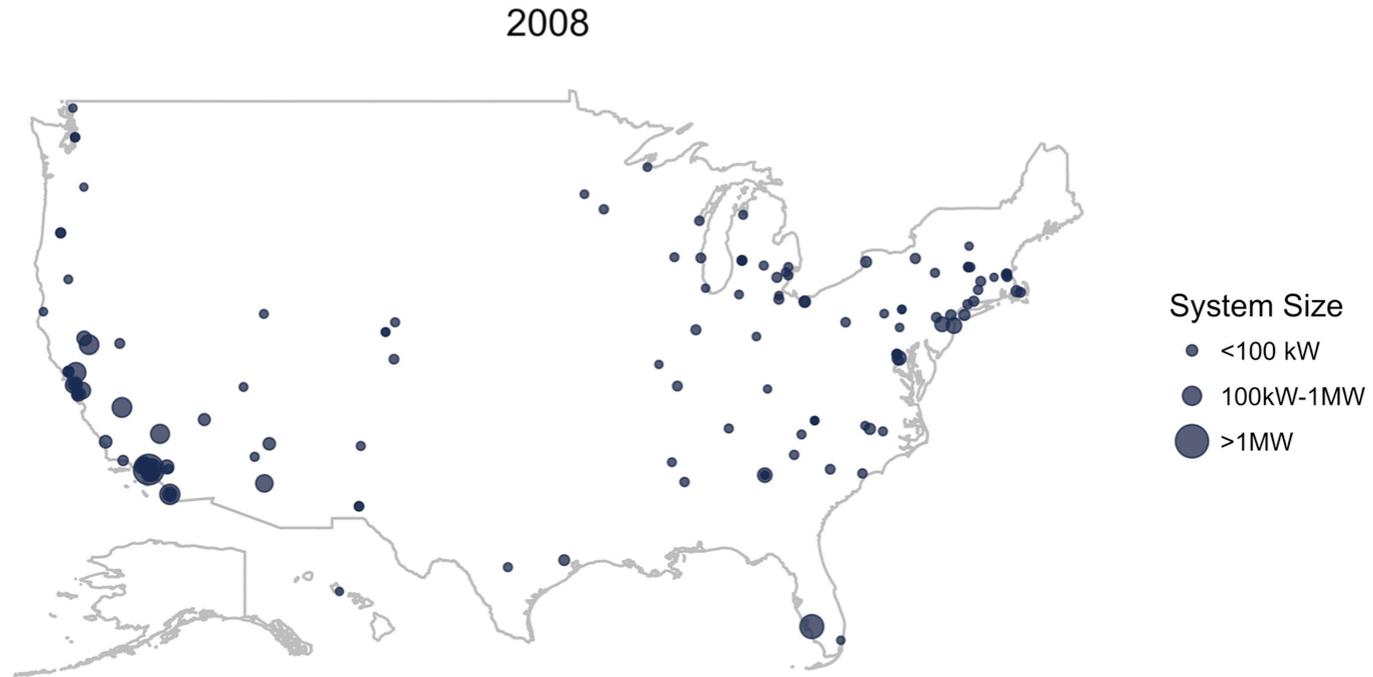
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# University PV Adoption



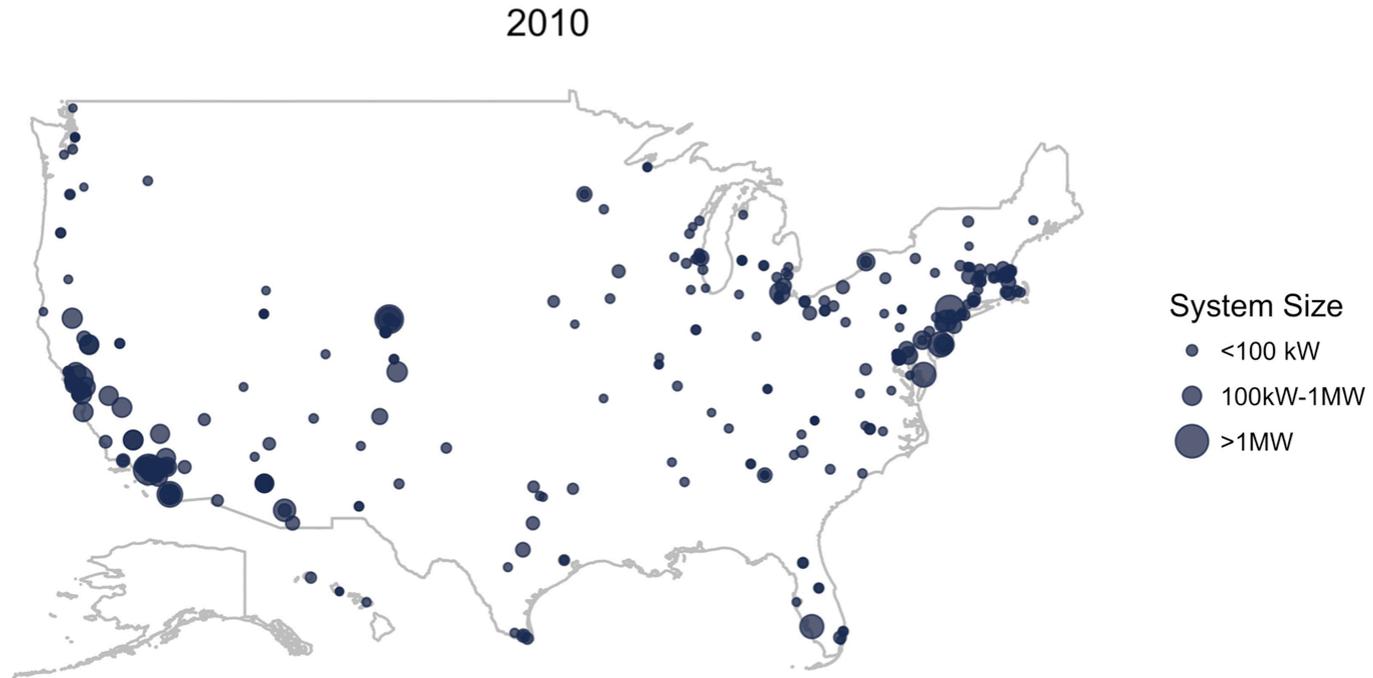
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# University PV Adoption



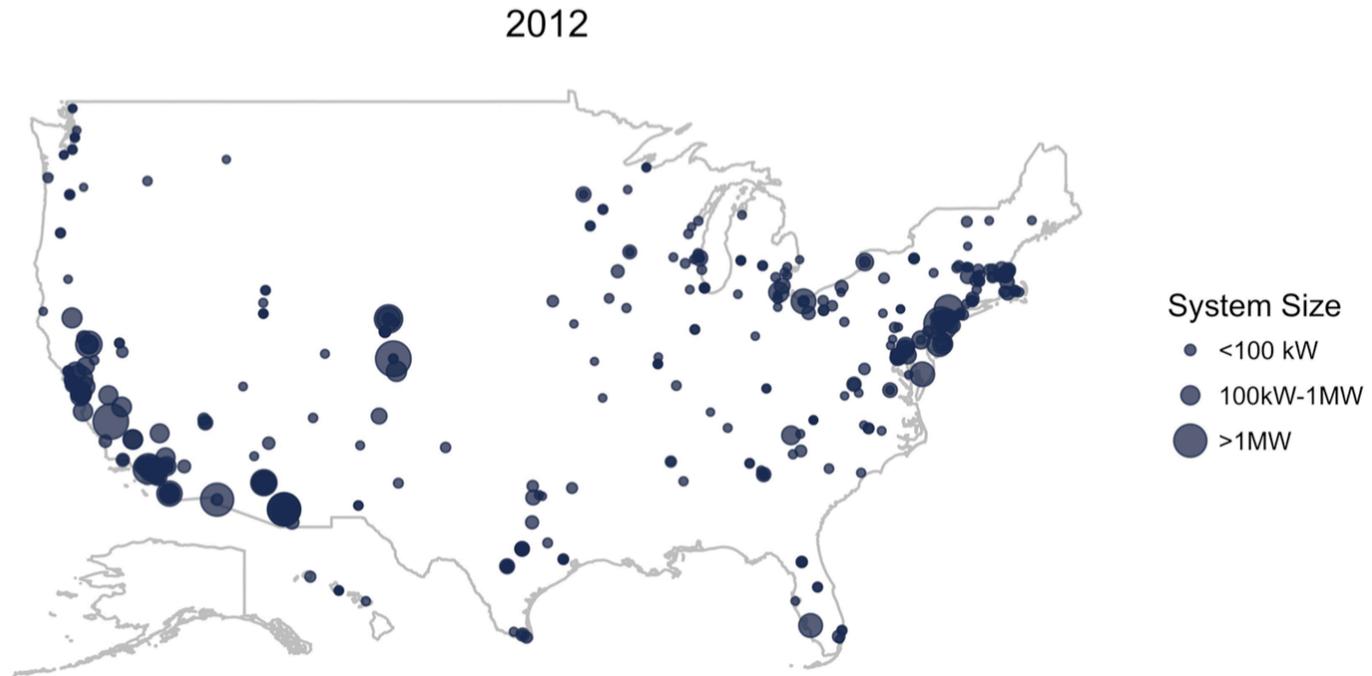
Based on data from: AASHE, BNEF, SN

# University PV Adoption



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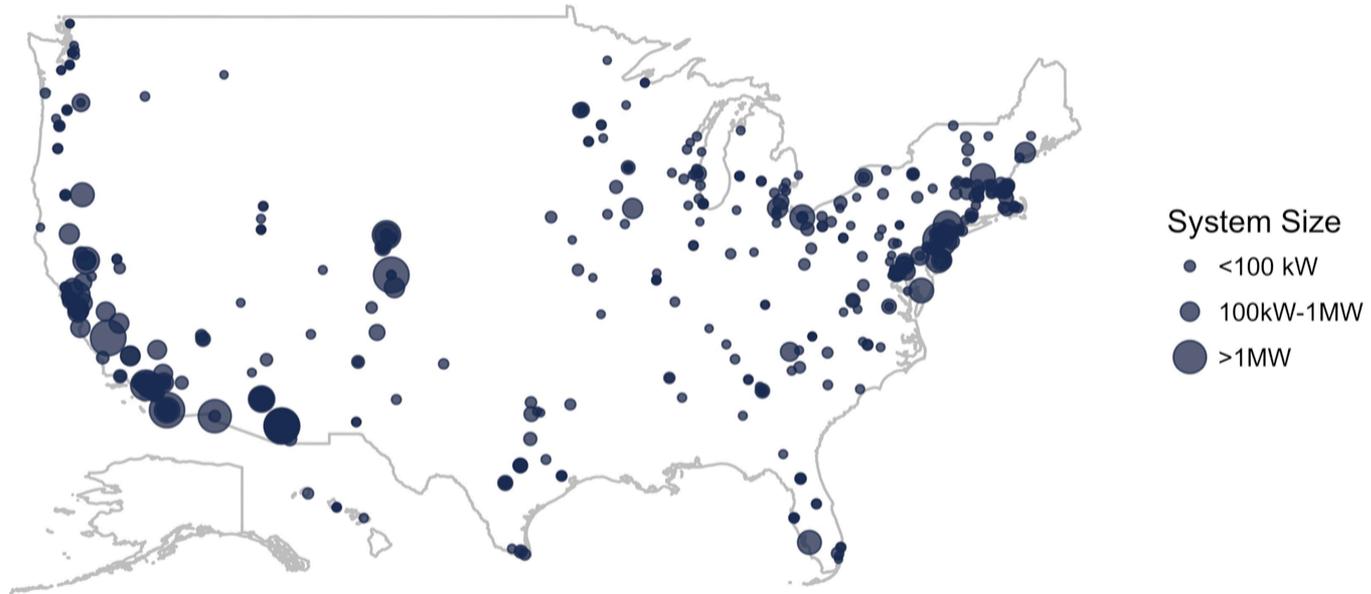
# University PV Adoption



Based on data from: AASHE, BNEF, SN

# University PV Adoption

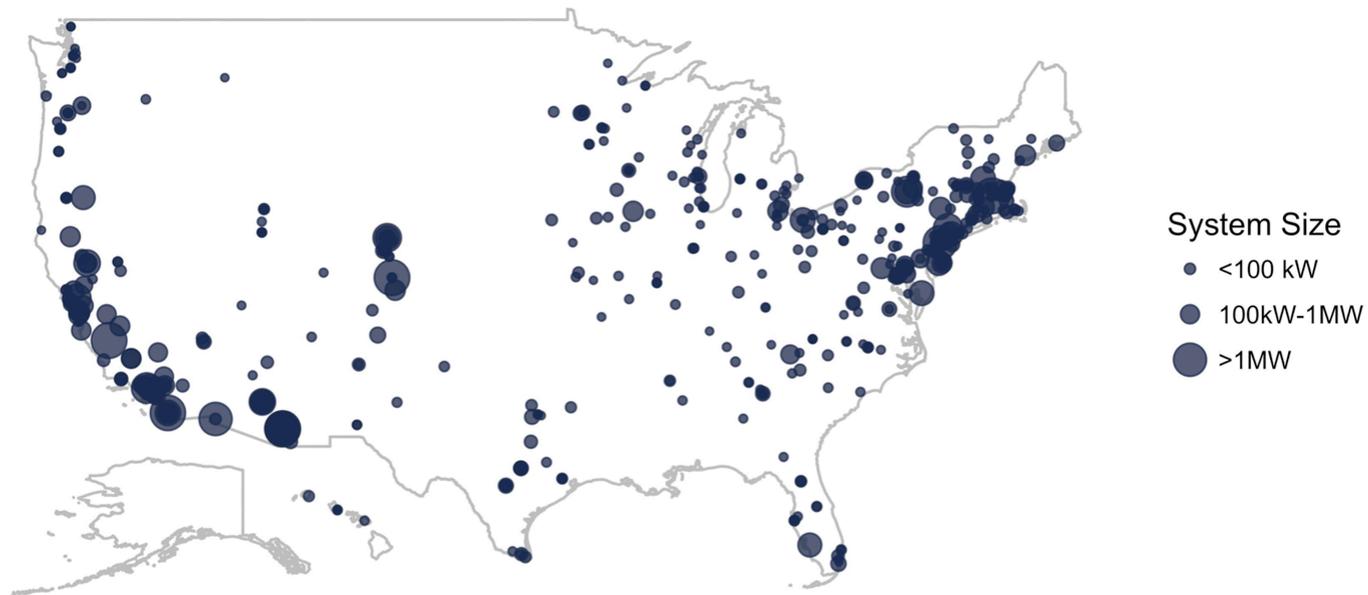
2014



Based on data from: AASHE, BNEF, SN

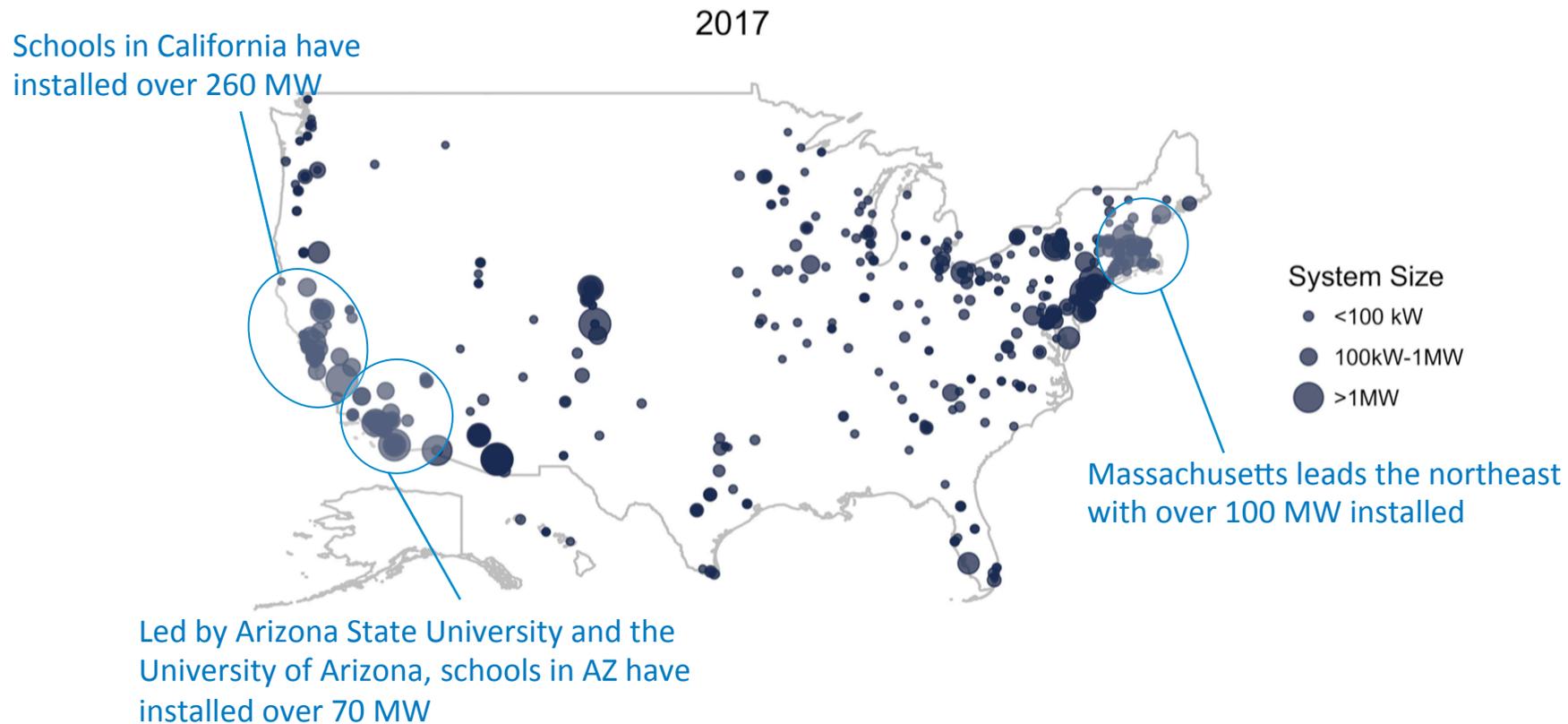
# University PV Adoption

2016



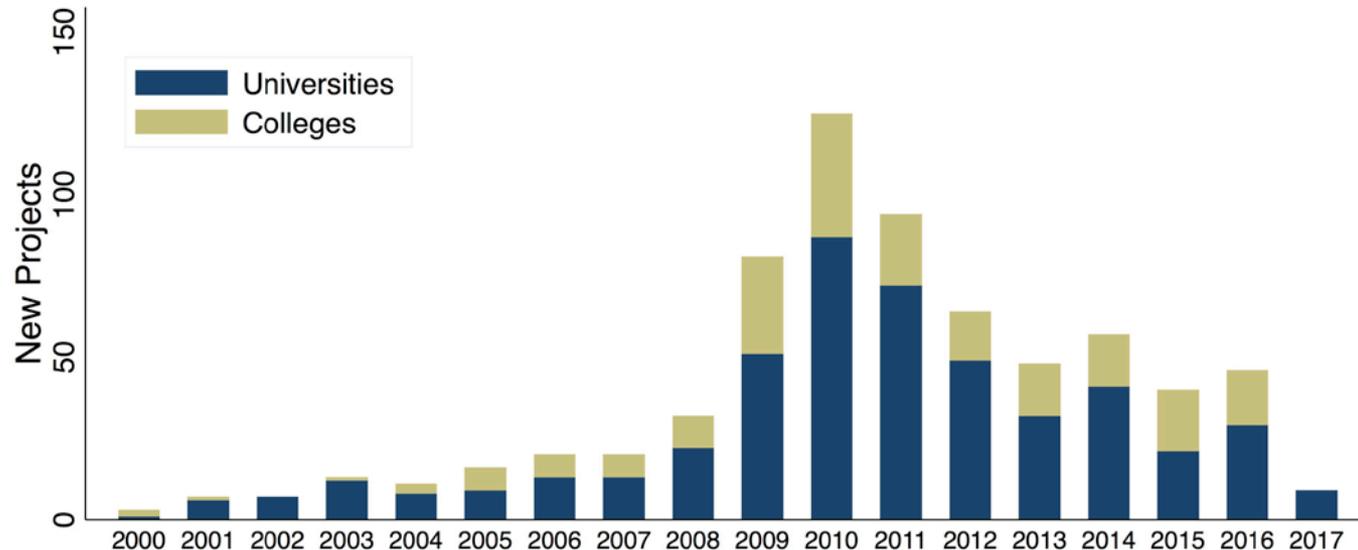
Based on data from: AASHE, BNEF, SN

# University PV Adoption



# Universities and Colleges

- About 55% of adopters are universities, and 45% are colleges
- Universities account for about 81% of installed capacity
- Universities tend to deploy larger systems:
  - Median university system = 66 kW, median college system = 36 kW

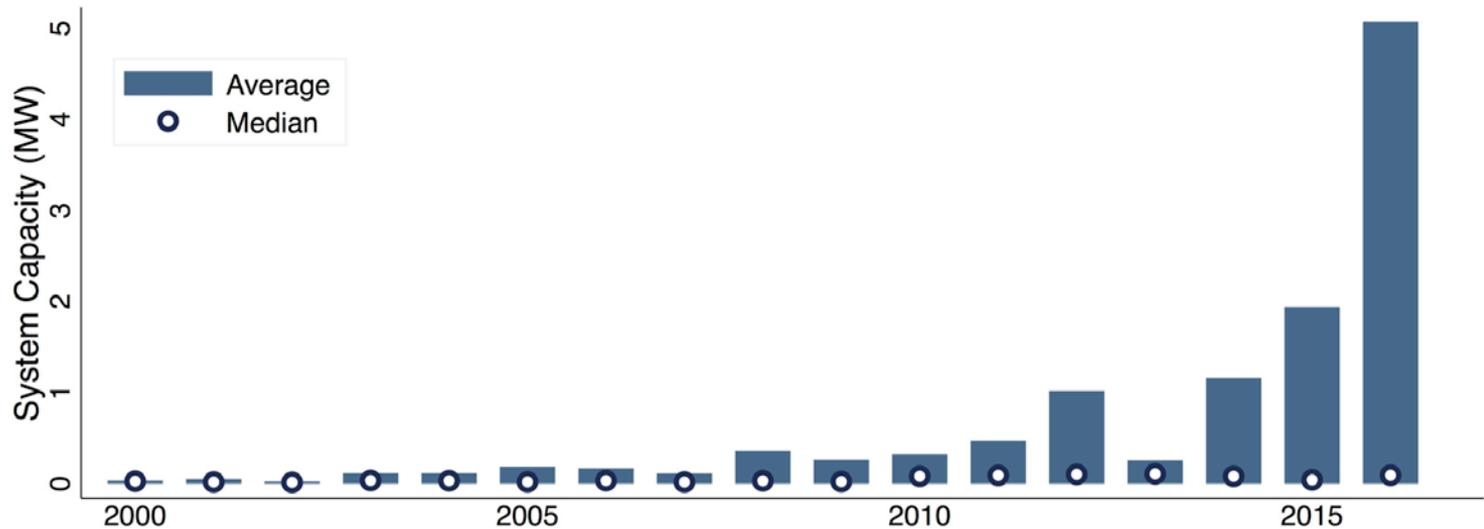


New Projects by Universities and Colleges (2000-2017)

# System Sizes

- The average system is around 1 MW, or around 70 kW at the median
- Universities began deploying larger systems around 2010: average system size for systems installed after 2010 is 1.7 MW

Average and  
Median System  
Sizes (2000-2016)





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The logo consists of a dark green square tilted slightly to the right. Inside the square, the words "Intentional Endowments Network" are written in white, stacked vertically in a sans-serif font.

Intentional  
Endowments  
Network

*An initiative of  
CraneSustainability.org*

# Investing in Clean Energy: Campuses and Endowments

Nicole Harman, Program Associate  
Intentional Endowments Network

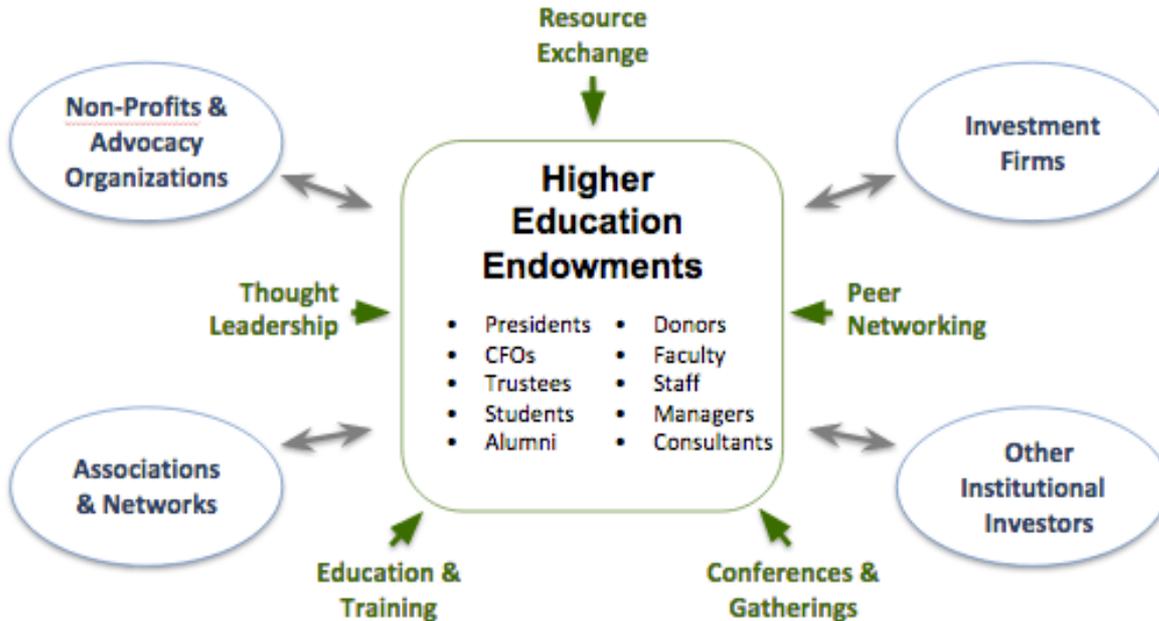
[nicole@intentionalendowments.org](mailto:nicole@intentionalendowments.org)

A smaller version of the dark green square logo with the text "Intentional Endowments Network" inside, located in the bottom right corner of the slide.

Intentional  
Endowments  
Network

# The Intentional Endowments Network (IEN)

Non-Profit Peer Learning Network with Facilitated Cross-Sector Collaboration



# IEN Working Groups

- ▶ *Meet regularly to advance key strategies in support of the Network's goals*
- ▶ Shareholder Engagement
- ▶ Fiduciary Duty & Policy
- ▶ Trustee Peer-Networking
- ▶ Student-Managed Investment Funds
- ▶ Investing in Clean Energy

[http://www.intentionalendowments.org/working\\_groups](http://www.intentionalendowments.org/working_groups)

# Investing in Clean Energy Working Group

- ▶ *Identifying and sharing strategies for colleges and universities to invest in energy efficiency and renewable energy through campus operations and their endowments*
- ▶ Chair: Chris O'Brien, Director of Higher Education Programs, Altenex; Lecturer and former Director of Sustainability, American University
- ▶ John Chaimanis, Managing Director, Kendall Sustainable Infrastructure
- ▶ Daniel Dixon, Director, Office of Sustainability, University of Maine
- ▶ Kevin Brennan, Principal, Equilibrium Capital
- ▶ Alex Bernhardt, Head of Responsible Investment, US Mercer
- ▶ Jenny Heeter, Senior Energy Analyst, NREL
- ▶ Bracken Hendricks, CEO, Urban Ingenuity
- ▶ Nick Hylla, Executive Director, Midwest Renewable Energy Association
- ▶ Ken Locklin, Director, Impax Asset Management
- ▶ Michele Madia, Director of Education and Partnerships, Second Nature
- ▶ Erik Melang, Senior Managing Director, Clean Energy Advisors
- ▶ Mark Orłowski, Executive Director, Sustainable Endowments Institute
- ▶ Liesel Schwarz, Sustainability Director, Villanova University
- ▶ Dave Wallace, Managing Director, Investments, Pomona College

# Investing in Clean Energy: Campuses and Endowments White Paper

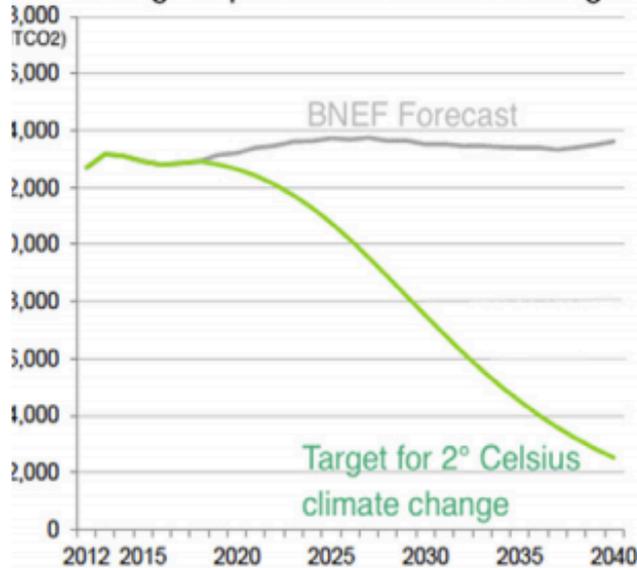


- ▶ Designed to encourage conversation about the financial and societal benefits of clean energy investments higher education can make
- ▶ **Both** as a customer through campus operations and an institutional investor through their endowments.
- ▶ Explores the current opportunities and barriers to such investments.

[http://www.intentionalendowments.org/  
clean\\_energy\\_white\\_paper](http://www.intentionalendowments.org/clean_energy_white_paper)

# The Climate Is Still In Trouble

Global power emissions will remain far too high to prevent excessive warming...

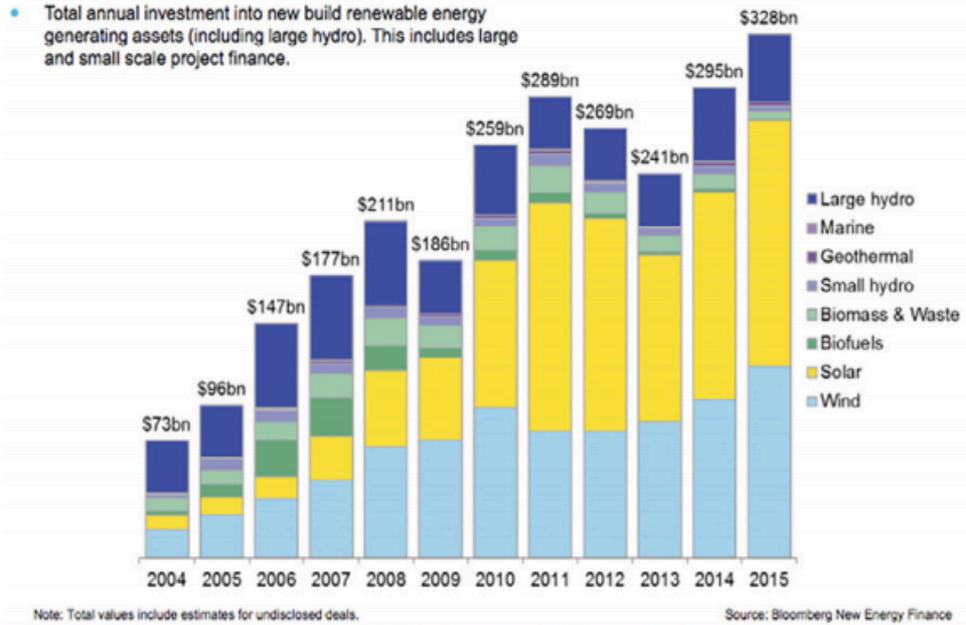


...and clean-energy investment will fall short by \$5.3 trillion



Source: Bloomberg, 2016<sup>18</sup>

# Clean Energy Investment Opportunities and Capital Needs



Source: Bloomberg, 2015

## THE CLEAN ENERGY INVESTMENT GAP

### Annual Investments in Clean Energy to Reach 2°C Goal:



Source: Ceres, 2014

# Investing in Clean Energy: What are the Options?

- ▶ **Direct Ownership / Asset Acquisition**
- ▶ **Asset Leasing**
- ▶ **Power Purchase Agreement (PPA)**
- ▶ **Green Revolving Funds (GRFs)**
- ▶ **Purchasing “Unbundled” Renewable Energy Certificates (RECs)**
- ▶ **Public Market Investments**
- ▶ **Private Market Venture Investments**

# Direct Ownership / Asset Acquisition

# Asset Leasing

# Power Purchase Agreement (PPA)

# Green Revolving Funds (GRFs)

# Barriers & Solutions

- ▶ **Concerns about the financial performance of such investments**
- ▶ **Lack of peer examples to follow**
- ▶ **Challenges in organizational communication among decision-makers within institutions**
- ▶ **Market regulations**
- ▶ **Lack of suitably structured investment opportunities for endowments**
- ▶ **Tax law**
- ▶ **Lack of familiarity with these strategies**

# Financial Performance: Direct Ownership

- ▶ A university may consider direct ownership in order to offset procuring power from their utility or retail electric provider.
- ▶ Such a strategy could average 5% - 15% or higher savings off of electric bills. The ownership structure of such an asset is important when considering owning, as there are tax benefits of ownership which may be complicated for a non-profit institution. The amount of dollars that can be invested through this strategy may be constrained by the energy needs or the physical space available for such an installation.

# Financial Performance: Green Revolving Funds (GRFs)

- ▶ Established Green Revolving Funds (GRFs) report a median annual return on investment (ROI) of 28%
- ▶ North Central College: Committed \$1.8 million of endowment funds to their GRF. First project was a 539 kW solar array with a 250 kW energy storage system (2014)
- ▶ Caltech: GRF manages \$8 million within the endowment, with an average ROI of 33% (2009)
- ▶ These examples suggests that GRFs can significantly outperform average endowment investment returns while maintaining strong returns over longer periods of time.

# Peer Examples

# Peer Example: Luther College



*Luther College Wind Turbine*



# Peer Example: American University & George Washington University



*A partnership involving GW, American University, the George Washington University Hospital and Duke Energy Renewables will enable GW to derive more than half its electricity from solar energy.*

# Peer Example: University of Vermont, Boston University, & Weber State University



Intentional  
Endowments  
Network

*An initiative of  
CraneSustainability.org*

THANK YOU!

Nicole Harman, Program Associate

Intentional Endowments Network

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[http://www.intentionalendowments.org/  
clean\\_energy\\_white\\_paper](http://www.intentionalendowments.org/clean_energy_white_paper)

Intentional  
Endowments  
Network

# Higher Education Solar Investment

*Building A Financial Model for Success*



**Eric Rehm, Solar Finance Manager**  
Midwest Renewable Energy Association



# Midwest Renewable Energy Association

## *A Brief Review of Our History and Mission*



### **MREA History & Mission**

- Founded in 1990
- 3,000 members
- Renewable energy education demonstration

### **Office Locations**

- Custer, WI
- Milwaukee, WI
- St. Paul, MN

### **Our Work**

- Annual Energy Fair
- Accredited Certificate Training
- Midwest Grow Solar Partnership
- The Solar Endowment
- PV Technical & Financial Assistance



# Solar University Network

*Creating a Roadmap to Campus Solar PV Development*



## **Purpose**

- Collaboration in pursuit of solar PV investment strategies
- Development of project roadmaps and case studies
- Student training in solar PV design, installation, and financing.

## **Resources**

- Solarendowment.org
- MREA PV Training Courses

## **Partners**

- Second Nature
- University of Minnesota Energy Transition Lab
- Purdue University Applied Energy Lab
- Illinois State University Center for Renewable Energy
- University of Wisconsin Stevens Point

## **College Administration Initiatives**

- Purchase carbon emission offset credits
- Direct ownership using capital investment funds
- Debt financing leveraging bonding, leases or loans
- Power purchase agreements.

## **Foundation Supported Initiatives**

- Alumni and business project management expertise
- Establish taxable entities to leverage ITC & asset depreciation.

## **Student Supported Initiatives**

- Student bodies vote to self-impose nominal 'green' fees for use in renewable energy investment
- Green revolving loan funds are used to finance on-campus renewable energy
- As loans are repaid new loans are issued.

### Colby College - Climate Action Plan

- Signatory to Carbon Commitment - May 2008
- Established a goal to attain carbon neutrality by 2015
- Achieved carbon neutrality by April 2013

### Existing Capital Project

- Location: Schair-Swenson-Watson Alumni Center
- System Size: 26kW
- SRECs: Colby College retains
- Expected ROI: \$15 - \$20k over 13 - 15 years

### Power Purchase Agreement Project

- PPA selected for large-scale solar
- Summer 2015 - RFP solicitation
- NRG selected for development
- System Size: 1.865 MW
- System Production: 16% of campus load
- Land Lease: 27 - 30 years
- SRECs: Colby College retains



## **Wake Technical Community College - Climate Action Plan**

- Signatory to the Carbon Commitment - April 2010
- Established a goal to attain carbon neutrality by 2050

## **Wake Tech Foundation**

- Alumni, local business leaders, and individuals invested time and resources
- Created Wake Tech Innovations, a subsidiary of the Foundation

## **Foundation Donation & Procurement Strategy**

- **Procurement:** Leveraged management expertise and foundation donations
- **Installation:** 389kW solar PV array atop the Public Safety Education Campus
- **Incentives:** Progress Energy's SunSense Program - \$.18/kWh bill credits and other upfront rebates
- **Carbon Emissions Reductions:** Under North Carolina RPS, after 5 years RECs may be purchased and receive carbon reduction credits

### **Luther College - Climate Action Plan**

- Signatory of Carbon Commitment - June 2007
- Carbon neutrality by 2030 with a 70% target by 2020 (2003-04 baseline)

### **Internal Capacity Building to Scale Solar Investments**

- Began with small, low-risk PV projects; before pursuing large-scale systems
- Develop energy, real estate and procurement team expertise to achieve successful outcomes

### **Solar PV Development Strategies Using Donations & Third Parties**

- Sustainability House - 3.78kW (Single Anonymous Donor)
- Shirley Baker Commons - 20kW (Multiple Donors, Grants & Rebates)
- President's House - 5.3kW (Multiple Donors, & Utility Rebates)
- Baker Village Residence - 280kW (Third-Party 7 Year Lease)
- Preus Library & Regents Center - 822kW (Third-Party PPA - 10 year term)



## Appalachian State University - Climate Action Plan

- Signatory of the Carbon Commitment - April 2008
- Currently 7% of ASU energy is powered by renewable generation

## Appalachian State University Renewable Energy Initiative (ASUREI)

- Student body 83% approval
- Green fee \$10 per student per semester
- Fund accrues approximately \$170,000 annually & \$670,000 in total



## ASUREI Fund Projects

- Biofuel Facility: 2kW installed in 2007
- E3 House System: 3kW installed in 2010 w/ battery storage
- State Farm Solar Research Facility: 8kW installed in 2011
- Blackburn Vonnoy Farm House: 7kW installed in 2012

## **Purpose & Objectives**

- [SolarProjectBuilder.org](http://SolarProjectBuilder.org)
- Educate users about solar PV financing principles
- Users input solar project site assumptions
- Access exportable PDF and CSV of financial model
  - Direct Ownership
  - Debt Financing
  - Power Purchase Agreements
  - Operating Lease

## **Target Markets**

- Universities, Colleges, and Associated Endowments & Foundations
- Local Units of Government
- Hospitals Networks

## **Sponsors & Development Partners**

- US Department of Energy - *Solar Market Pathway Program Administrator*
- Midwest Renewable Energy Association - *DOE Grant Recipient*
- Sustainable Capital Advisor - *Financial Simulator Development Advisor*
- Future Web Studio - *Website Design*

# Solar Finance Simulator

## An Overview in Brief

### Step One: input project site assumptions

Form Inputs

- System
- Incentives
- Operating & Return Assumptions
- Tax Assumptions

Form Inputs

**System**

Fill in the required fields below and press calculate

\* = Required Field

\*Financing Type  
Direct Ownership

\*Tax Status  
Taxable

\*System Size (W)  
350000

\*Year 1 Generation  
500000

\*Total Installation Cost (\$)  
1000000

\*System Term (Years)  
30

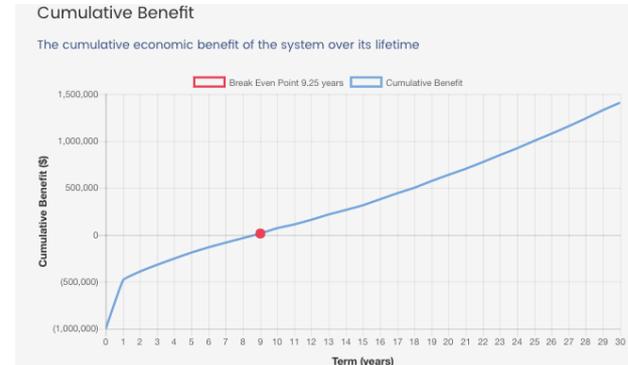
\*Electricity Rate (\$)  
0.15

\*Electricity Rate Escalator (%)  
3.0

### Step Two: review output graphs

Summary: Direct Ownership - Taxable

Inputs		Returns	
System Size (W)	350,000 W	Initial Capital Cost (\$)	\$(1,000,000)
System Term (years)	30 years	Avoided Electricity Cost (\$)	\$3,270,466
Energy Production Value (\$/kWh)	\$0.150	Operating Expenses (\$)	\$(478,465)
Energy Rate Escalator (%)	3.00 %	Federal Taxes (\$)	\$(679,700)
		ITC (\$)	\$300,000
		State Incentives (\$)	\$0
		Total Lifetime Benefit (\$)	\$1,412,301
		Lifetime IRR (%)	10.12 %
		Lifetime NPV (\$)	\$405,935
		Lifetime LCOE (\$/kWh)	\$0.134



### Step Three: Export and print PDF and CSV files

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midwest renewable energy association

**Midwest Renewable Energy  
Association**

[www.midwestrenew.org](http://www.midwestrenew.org)

# Question & Answer Period

(Presentations will be posted online in a few days.)

[www.nrel.gov](http://www.nrel.gov)



Thank you!

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