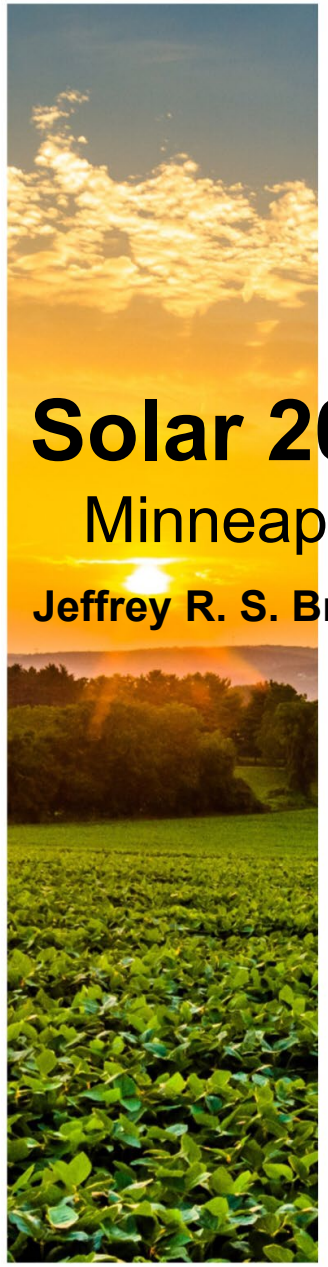


Solar 2019

Minneapolis, MN

Jeffrey R. S. Brownson, PhD

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Energy Programs Office

Finding Pennsylvania's Solar Future

A 30 Month Scenario Planning and Stakeholder Engagement Project to Identify Tomorrow's Solar Development and Investment Strategies in Pennsylvania

This project is funded by a $550,000 award from the U.S Department of Energy Solar Energy Technology Office.

Email: RA-EPPASOLARFUTURE@pa.gov **Website:** www.dep.pa.gov/PAsolarfuture

Finding Pennsylvania's SOLAR FUTURE

PennFuture

Vermont Energy Investment Corporation

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION

Project Leadership Team:

David Althoff, *Principal Investigator*, Pennsylvania Department of Environmental Protection
Robert Altenburg, *Project Coordinator*, Citizens for Pennsylvania's Future
Kerry Campbell, Pennsylvania Department of Environmental Protection
Allen Landis, Pennsylvania Department of Environmental Protection

Facilitation Team:

Dr. Jeffrey Brownson, Pennsylvania State University
Ron Celentano, Celentano Energy Services
Maureen Mulligan, Sustainable Futures Communications, LLC.
Sharon Pillar, Hot Earth Collaborative, LLC.

Modeling Team:

David Hill, Vermont Energy Investment Corporation
Damon Lane, Vermont Energy Investment Corporation
Kate Desrochers, Vermont Energy Investment Corporation

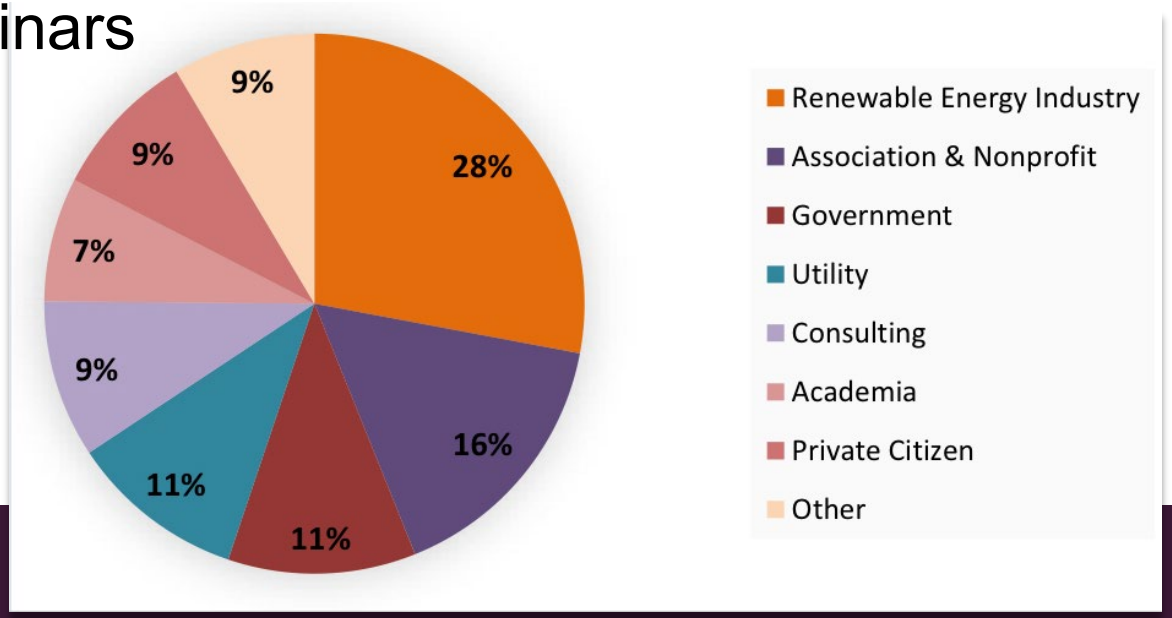
Finding Pennsylvania's Solar Future

Project Team

- Pennsylvania Department of Environmental Protection
  - Energy Programs Office
- Citizens for Pennsylvania's Future
- Vermont Energy Investment Corporation
- Pennsylvania Solar Energy Industries Association (PASEIA)
- Penn State University, Solar Ecology Program, EMS Energy Institute
- Solar Unified Network of Western PA (SUNWPA)
- Sustainable Futures Communications, LLC

Facilitated Workshops & Webinars

Stakeholder Representation: (500+ participants!)



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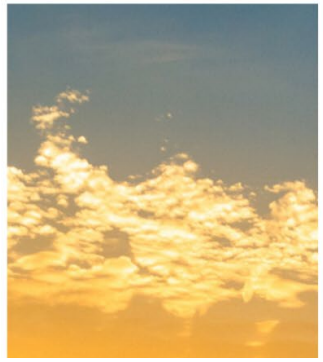


Strategies Co-Developed Among Stakeholder Groups Over 30 Months

Target:
Identify specific strategies to increase in-state solar-powered electricity generation by 10 percent by 2030.

Top Line Finding: Accelerate Grid-Scale Solar

Solar energy comes from two types of systems:

- Smaller, distributed systems--the panels you see on some homes, barns, businesses, and organization buildings;
- Larger, grid-scale systems connected directly to the transmission system.

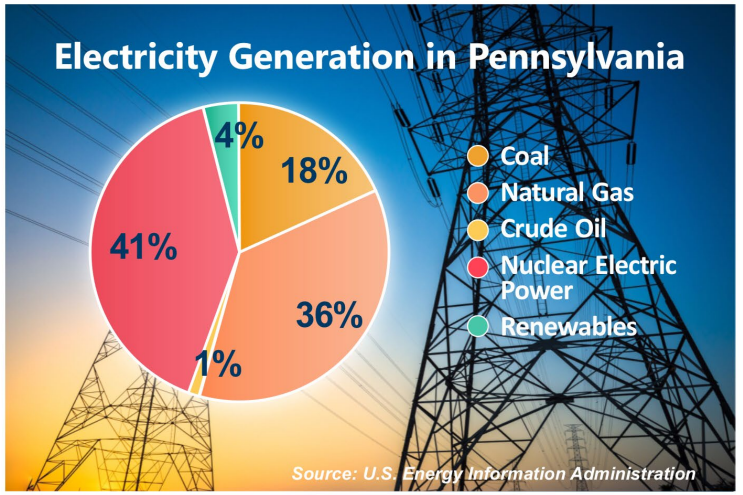
Distributed system: Farm in Germansville, Lehigh County

Target: 10 Percent Electricity from In-State Solar by 2030

Just 4 percent of net electricity generation in Pennsylvania currently comes from renewable energy sources, and only a fraction of that is from solar.

If no changes are made to increase new solar energy development, Pennsylvania is on track to get .5 percent of its electricity from solar energy by 2021. This is the amount required by Act 213 of 2004. In the absence of any changes to increase solar, Pennsylvania may stay at .5 percent.

Compare this with other Northeast states: Massachusetts: 8.5 percent, New Jersey: 3.8 percent, New York: 1 percent



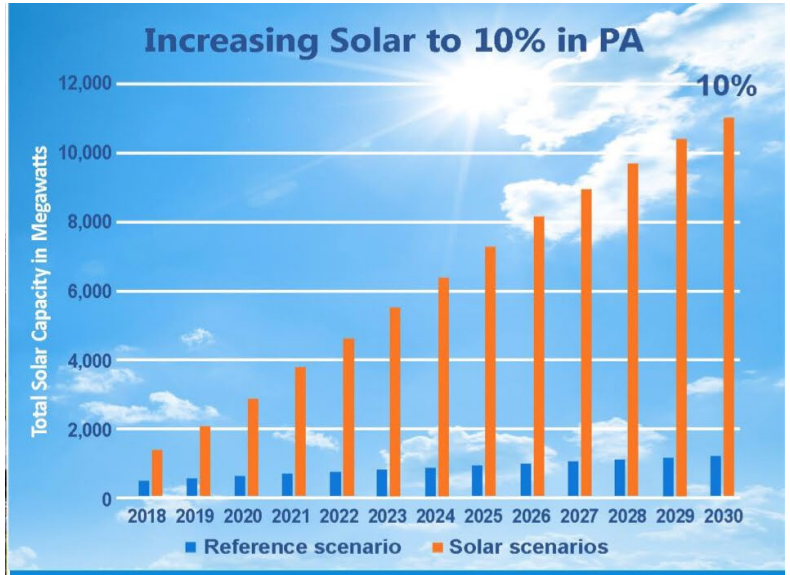
Scenarios Modeled to Sharpen Our Questions

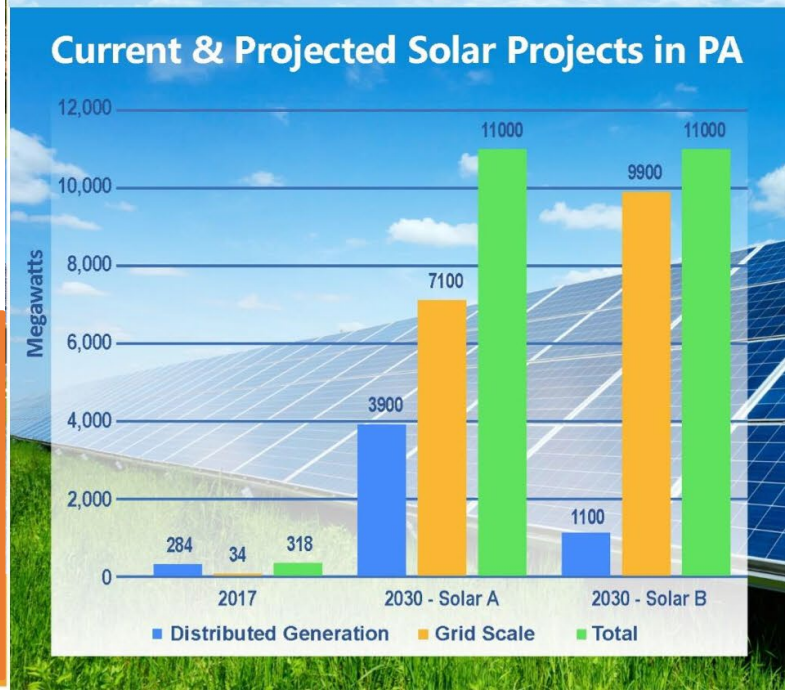
	Reference	Solar A	Solar B
Target for in-state solar	0.5% by 2020	10% by 2030	10% by 2030
Total solar capacity in 2030	1.2 GW	11 GW	11 GW
Distributed capacity in 2030	0.6 GW	3.9 GW (35% of total) 50% residential 50% commercial	1.1 GW (10% of total) 50% residential 50% commercial
Grid scale capacity (>3MW) in 2030	0.6 GW	7.1 GW (65% of total)	9.9 GW (90% of total)

Table 1. Comparison of the basic assumptions of the three primary scenarios

Economic cost: The modeling found that over 15 years, the Solar A and Solar B scenarios have average net annual economic costs ranging from $513 million to $613 million. These estimates represent the lifetime costs and savings associated with the solar capacity in each scenario compared to the reference scenario.

For context, over the 15-year study period the investments required for the Solar A and Solar B Scenarios are 1.2 to 1.4 percent above current energy spending.





Solar Powered Electricity = Significant Benefits to Pennsylvania

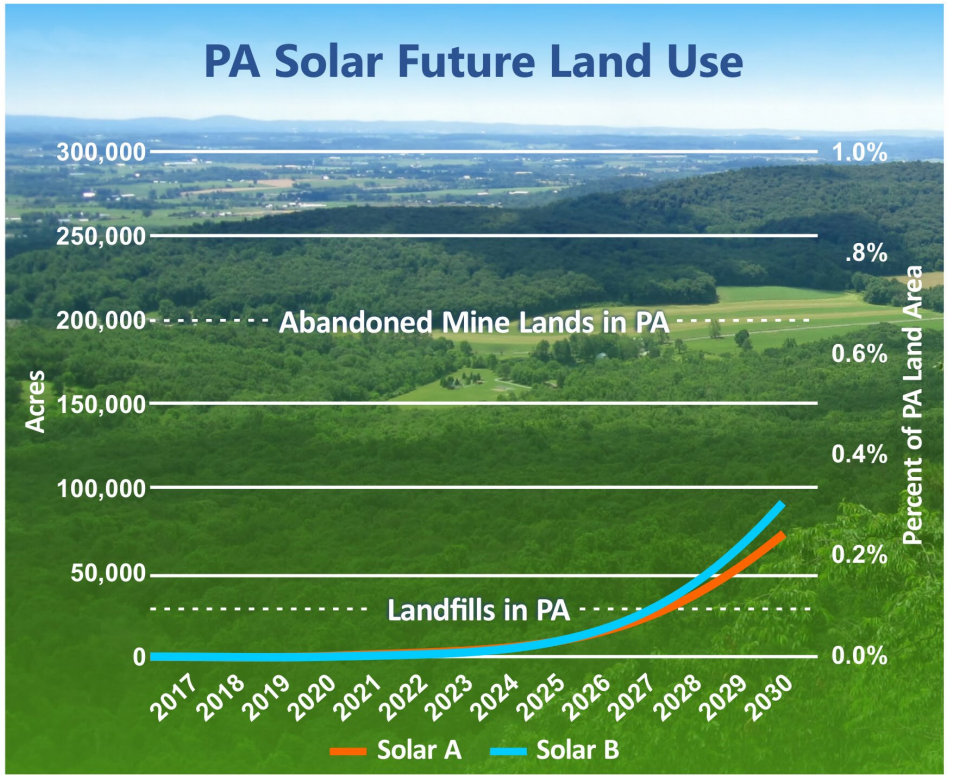
More jobs: 60,000 to 100,000+ jobs, depending on the ratio of smaller systems to larger systems. From installers to system designers, these solar jobs have median wages of $20–$38 per hour, and will be available in rural, urban, and suburban areas.

Reduction in greenhouse gas emissions: Emissions from the electricity generation sector will likely decrease up to 9.3 percent, which will help reduce health problems and negative environmental impacts of these pollutants.

Economic development opportunities: There are opportunities to site solar development in ways that complement the working landscape and rural economy, such as using solar on buffer zones, disturbed lands, and in conjunction with grazing or pollinator friendly perennials.

Net benefit of free fuel and cost savings: The combination of fuel savings (free sunlight) and anticipated cost savings (avoided public health and environmental damages) could result in *a net benefit of over $1.6 billion annually* from 2018 to 2030.

Grid-scale system: Community Energy, Radnor, Lancaster County



15 Strategies to Get to 10 Percent of Electricity from Solar

The "Finding Pennsylvania's Solar Future" project group identified 15 strategies that, if implemented, will enable Pennsylvania to get 10 percent of its electricity from in-state solar energy.

- Seven strategies incorporate development of both grid-scale and distributed systems.
- Eight strategies are specific to either distributed or grid-scale solar development.

The list isn't meant to be exhaustive, and strategies can be combined to create many pathways to 10 percent.

PennState

Finding Pennsylvania's Solar Future

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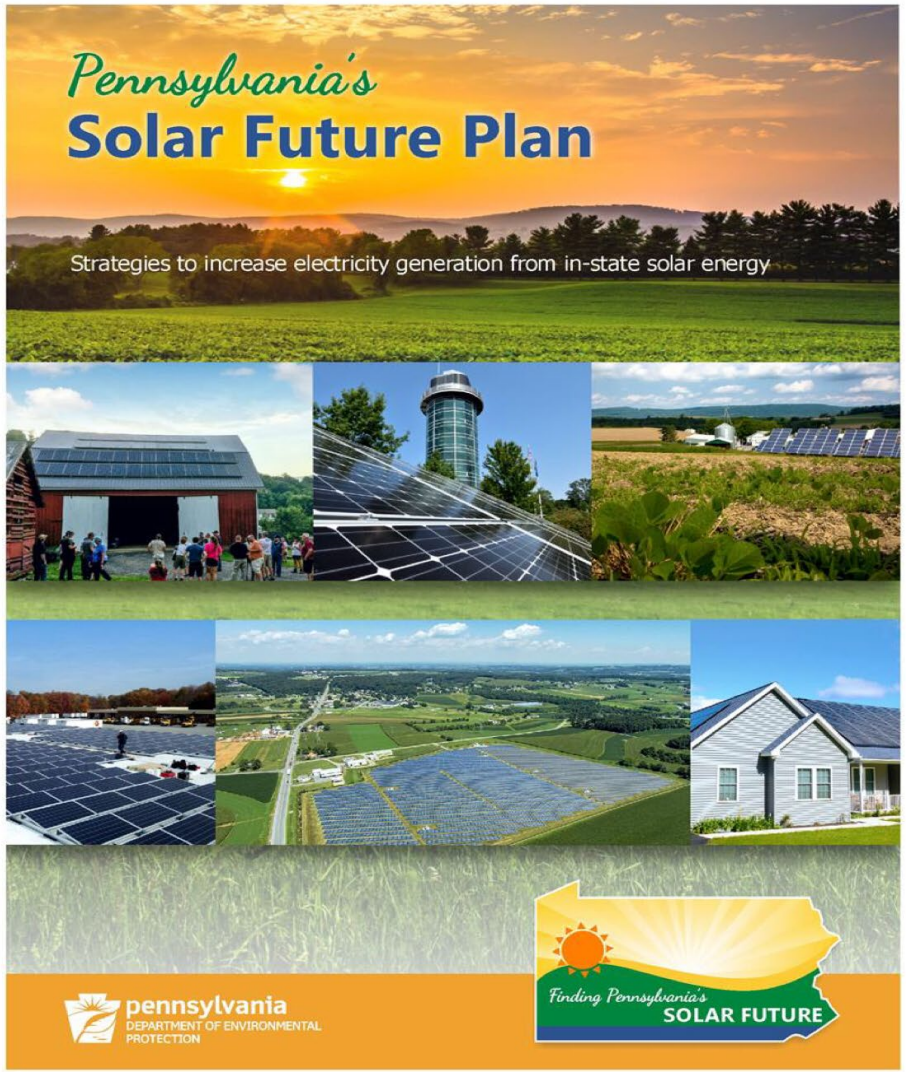

Penn State Solar

Solar 2019

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https://hub.aashe.org/browse/video/22031/A-Solar-PPA-Designed-for-Positive-Externalities

PennState sustainability INSTITUTE

Sustainability Institute

- Consultants and coaches to guide and bolster sustainability efforts at Penn State in:
  - Student and staff engagement
  - Curriculum development
  - Operations
  - Outreach and community-student projects
  - Research

green teams

COUNCIL OF sustainable leaders

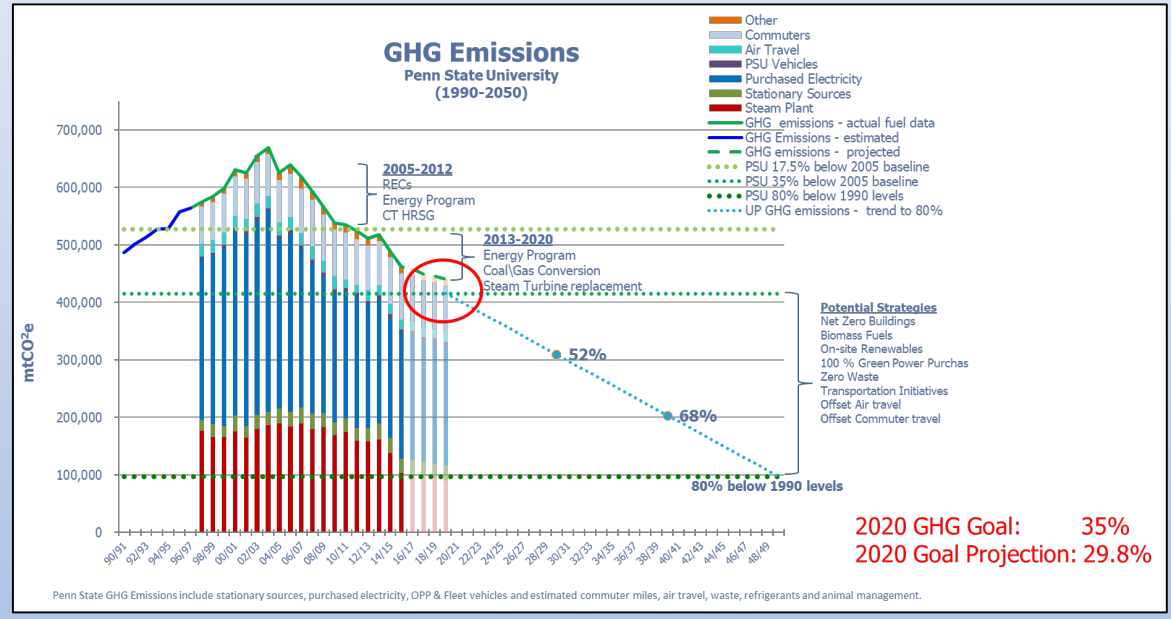
PennState

sustainability INSTITUTE

Request for Proposals for Penn State Solar

- Penn State has GHG Emissions Reduction Goals
- Renewable Energy project was determined to be feasible
- RFP = Request For Proposals
  - Solar developers were asked to submit proposals to Penn State, considering Penn State priorities:
    - **Community Benefits**
    - Cost
    - Counterparty
    - Development Schedule
    - **Ecosystem Benefits**
    - **Location**
    - **Penn State Benefits**
    - Size

➢ Creates a market push!



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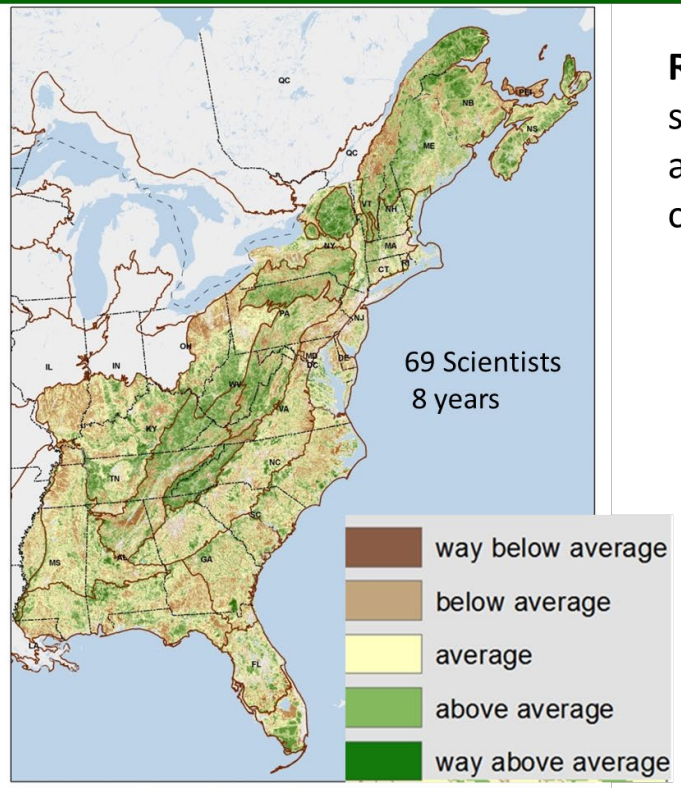
The Nature Conservancy Partnership

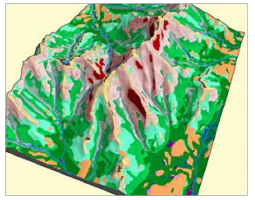
- To ensure sites were selected appropriately, we partnered with The Nature Conservancy
- Science of adaptation to climate
- What are the areas that should NOT be developed?

Climate Resilience

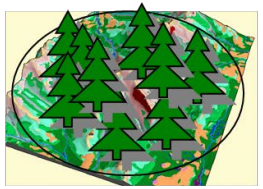


Resilient sites = sites that continue to support biological diversity, productivity and ecological function even as they change in response to climate change.

Many Microclimates
Create climate options



Locally Connected
Allows species to move



Courtesy of The Nature Conservancy

PennState

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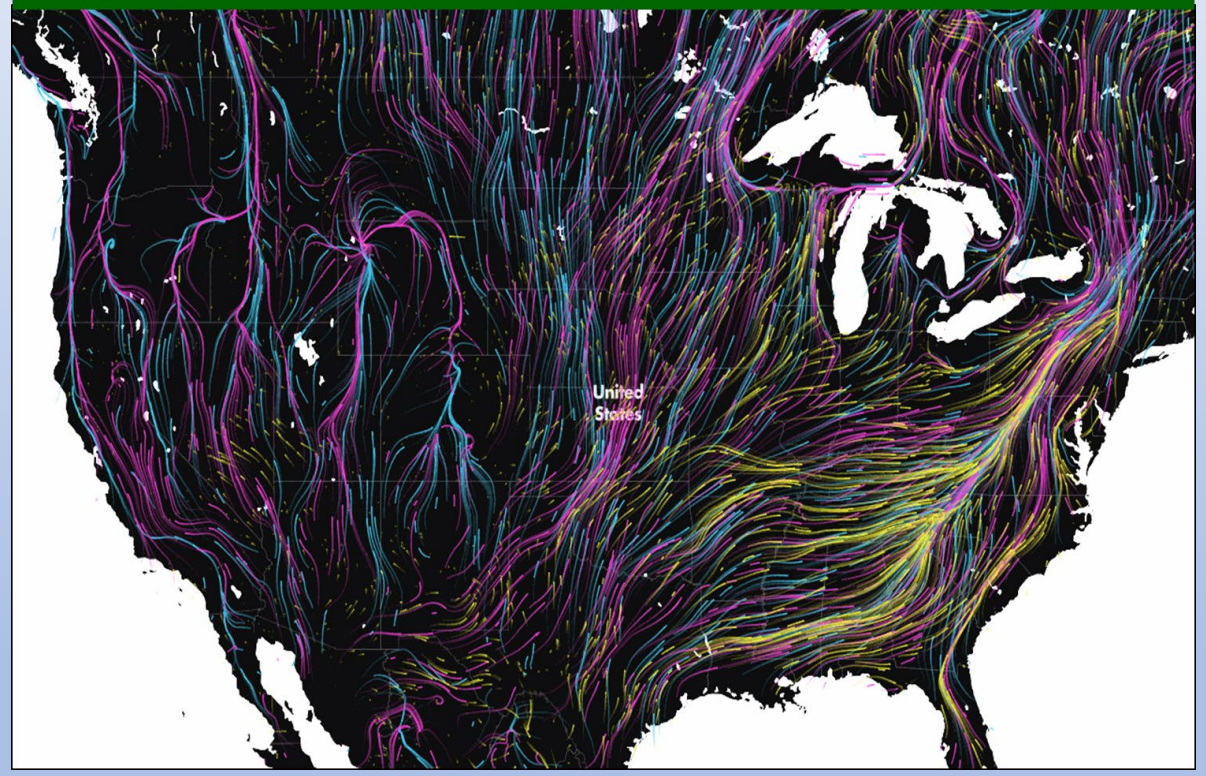
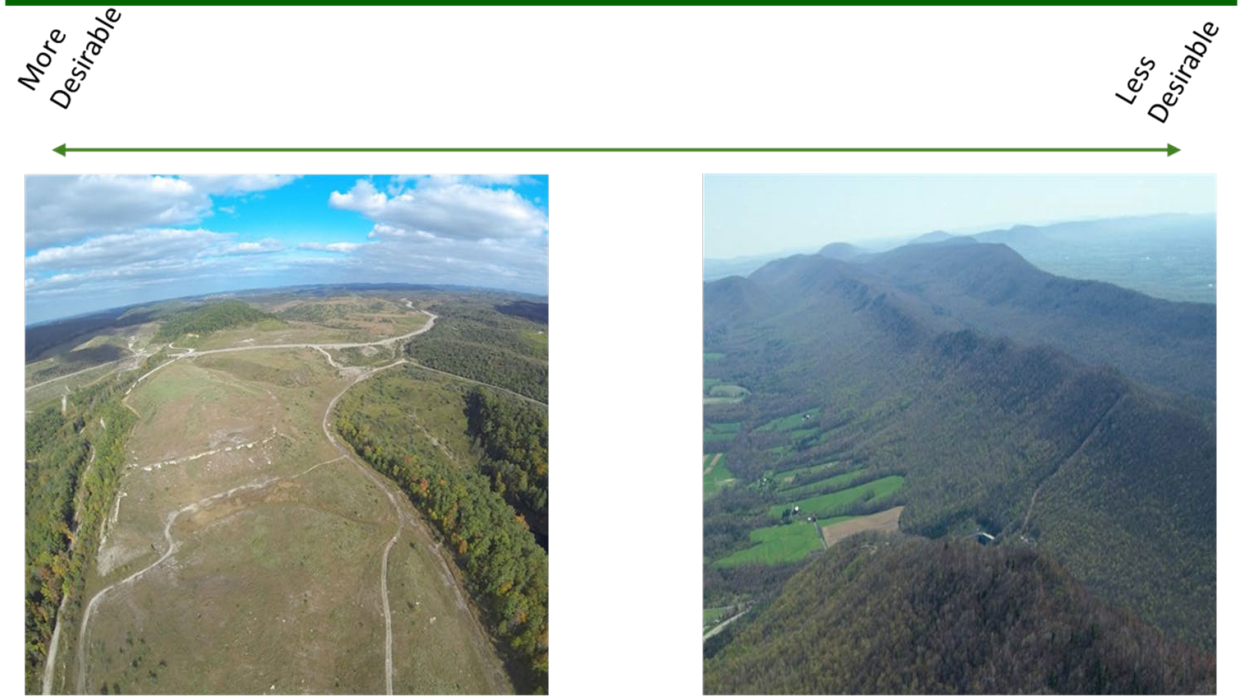
The Nature Conservancy Partnership

Continental Connectivity



TNC PA's Renewable Energy Theory



PennState

www.conservationgateway.org

http://maps.tnc.org/resilientland/

Courtesy of The Nature Conservancy

Lightsource BP Partnership

lightsource bp

Lightsource BP is a Global Leader in Energy Development

Over 2 GW of large-scale solar developed and operated

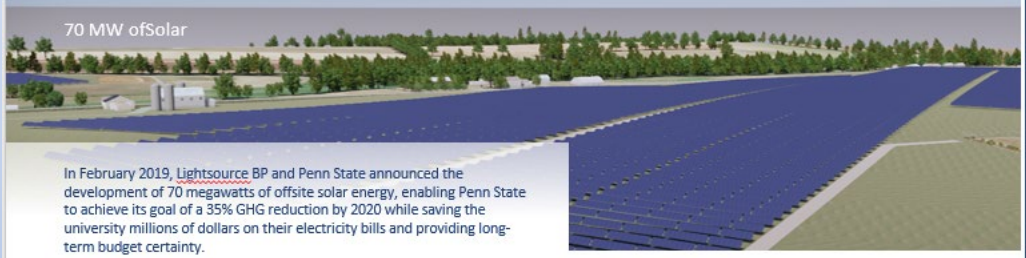
- One of the largest utility scale solar developers and operators in the world with over 200 solar farms developed and financed, a 6 GW project pipeline, and 16 offices worldwide.
- A full-service development platform, with capabilities ranging from solar project development, financing and construction to operations, maintenance and long-term asset management.
- BP, a Fortune 10 company and global energy supermajor, is a strategic partner with a 43% interest in the company.

Operational Track Record	World Class Financing	Global Platform	Full Lifecycle Capabilities	BP Strategic Partnership
2GW+	**$3.4B**	**11**	**350+**	**$200M**
operational solar portfolio	in project financing raised & deployed	countries with active operations, enabling economies of scale for supply chains & finance	staff covering full project lifecycle in-house, from development through operations	BP committed to fund new solar projects, from a strategic partnership announced Q42017

Lightsource BP, advancing solar

PennState

Case Study: Helping Penn State Meet its Sustainability Goals



In February 2019, Lightsource BP and Penn State announced the development of 70 megawatts of offsite solar energy, enabling Penn State to achieve its goal of a 35% GHG reduction by 2020 while saving the university millions of dollars on their electricity bills and providing long-term budget certainty.

Project capacity
70 megawatts (DC) / 53 megawatts (AC)

Electricity production
102,000 megawatt-hours per year, 25% of the university's state-wide annual electricity demand

Owner and operator
Lightsource BP

Power purchaser
Penn State, who will also receive in-state Solar Renewable Energy Credits (SRECs) from the project

Total project investment
$75 Million by Lightsource BP

Total size
150,000 solar panels installed across three locations, encompassing approximately 500 acres of land

Contract
25-year power purchase agreement (PPA)

Location
Franklin County, Pennsylvania, north of Penn State Mont Alto

Expected Completion
Summer 2020

Lightsource BP, advan

70MW CAPACITY

$75M LIGHTSOURCE BP FUNDED

25% PENN STATE'S ANNUAL POWER DEMAND

57,000MT ABATED GREENHOUSE GAS EMISSIONS

2020 COMPLETION DATE

250 LOCAL JOBS

PennState

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Penn State Solar Into the Future

- Continuing to develop partnership with Lightsource BP
- Intended project benefits:
  - Lowers electric generation costs
  - Provides long term budget certainty
  - Lowers GHG emissions
  - Positive Public Relations
  - Curriculum and Educational Value
  - Research Potential
  - Internship Opportunities
  - Reflects Student Attitudes

- Help others develop projects with ecosystems and communities in mind

➢ **Create demand for responsibly developed projects**

PennState sustainability INSTITUTE

PHILADELPHIA
ENERGY AUTHORITY

Solarize Philly

SOLAR 2019

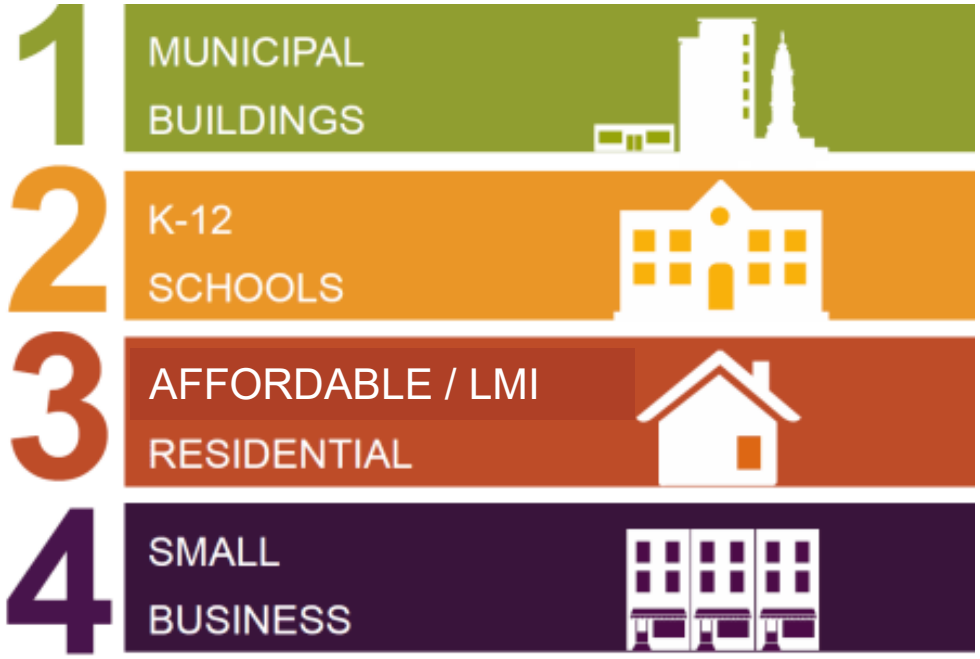
Laura Rigell, *Solar Manager*

lrigell@philaenergy.org · O: 215-686-4483

The Philadelphia Energy Campaign

- **$1 billion investment over 10 years** in energy efficiency and clean energy projects, leveraging public and private dollars
  - **10,000 jobs**
  - 25,000 households
  - 2,500 small businesses

- **First 2 years:**
  - $130+ million in active projects
  - Nearly 1000 jobs
  - $750M+ pipeline



City Off-site Solar Purchase

WHYY

POLITICS & POLICY | ENERGY | PHILADELPHIA | TECHNOLOGY

Philly signs agreement to buy solar energy

By Tom MacDonald · December 18, 2018

Philadelphia trainees working on NC solar array, 2018

A CITYWIDE PROGRAM TO HELP ALL PHILADELPHIANS

GO SOLAR AT HOME

SIGN UP **BY SEPTEMBER 30** at

solarizephilly.org

PHILADELPHIA ENERGY AUTHORITY

@solarizephilly

Bright Solar Futures

Offering intro training for high schoolers

- 70 students trained
- 20 placed into internships

Selected for $1.25 M award

- Establish nation's first Solar Energy Program of Study

The Philadelphia Inquirer

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Trump administration awards Philly $1.25M solar workforce grant

Posted: October 26, 2018 - 4:48 PM

Andrew Maykuth | @Maykuth | amaykuth@inquirer.com

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Philadelphia trainees flip switch on 150th Solarize install, 2018