

SETO CSP Program Summit 2019



Introduction

March 18, 2019

Charlie Gay, Director, Solar Energy Technologies Office

Solar Energy Technologies Office Staff



DOE Golden Field Office



SETO Leadership Team

Dr. Becca Jones-Albertus
Deputy Director



Concentrating Solar Power
Dr. Avi Shultz,
Program Manager



Photovoltaics
Dr. Lenny Tinker,
Program Manager



Systems Integration
Dr. Guohui Yuan,
Program Manager



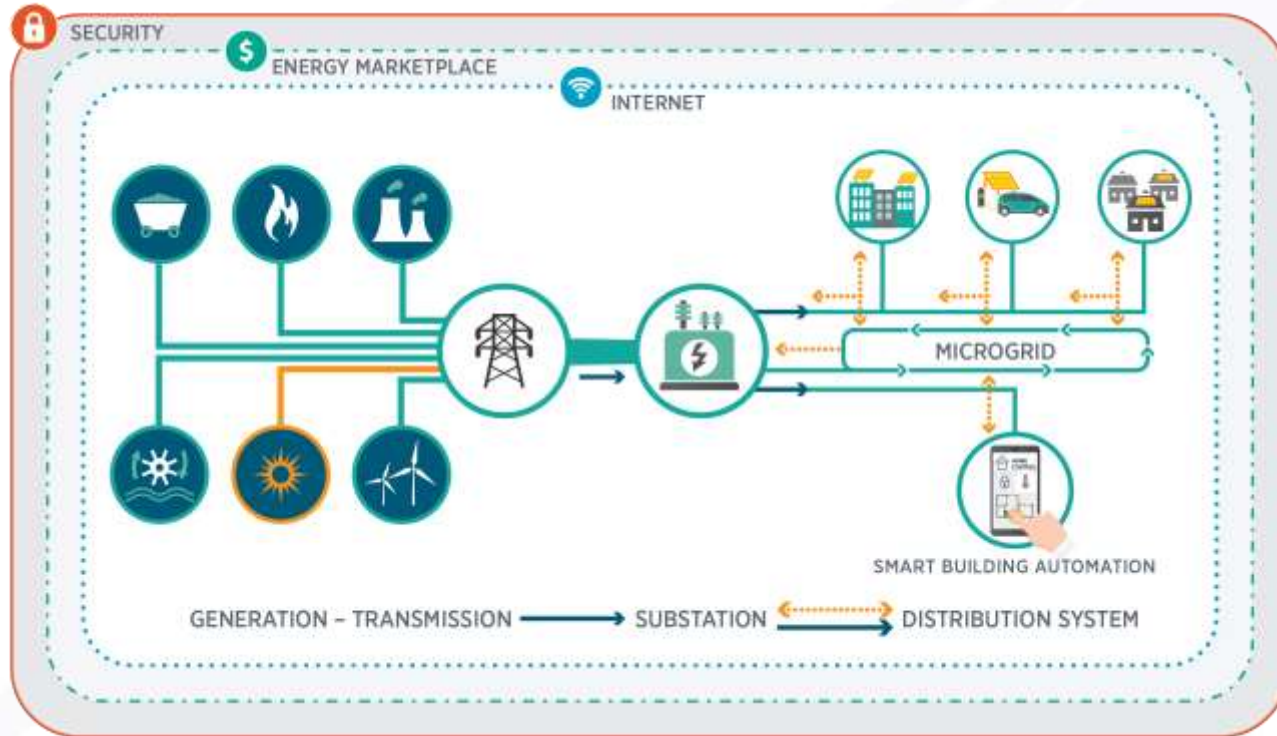
Technology to Market
Garrett Nilsen, Program Manager



Solar Energy Technology Office Funding

SETO Subprogram	2017	2018	2019
Concentrating Solar Power	\$55,000,000	\$55,000,000	\$55,000,000
Photovoltaic R&D	\$64,000,000	\$70,000,000	\$72,000,000
Systems Integration	\$57,000,000	\$71,200,000	\$54,500,000
Balance of Systems	\$15,000,000	\$11,000,000	\$35,000,000
Innovations in Manufacturing	\$16,600,000	\$34,400,000	\$30,000,000
TOTAL	\$207,600,000	\$241,600,000	\$246,500,000

Modern Electric Grid: Two Way Energy and Data Flow



Goal: Centralized and distributed generation optimized with finely tuned, 2-way load balancing

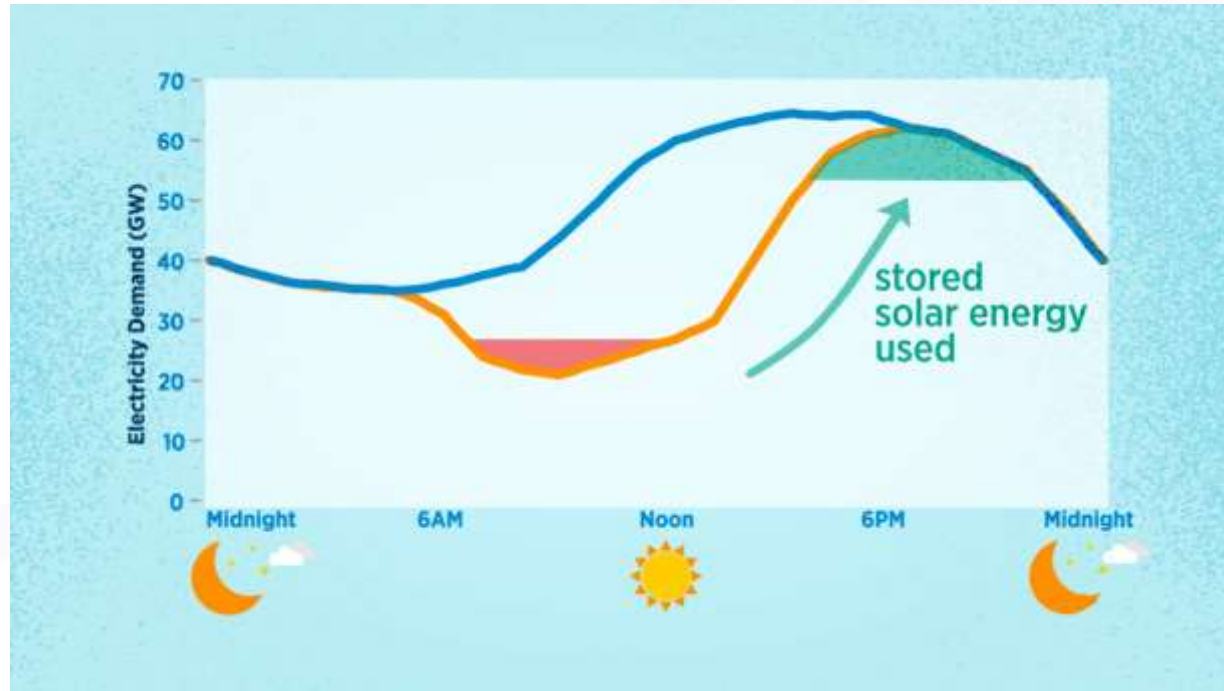
Grid Operational Challenges

Distributed Energy Resources
Net Energy Metering
Renewable Portfolio Standards
Variable and Uncertain Generation
Fast Ramping Requirements
Distributed Storage
Community Solar
Community Choice Aggregators
Need for Flexibility
Autonomous Microgrids
Grid Defection
Self-Generation

Stagnant or Declining Demand
Aging Infrastructure
Negative ISO Clearing Prices
Physical and Cyber Threats
Transmission Right-of-Way Access
Confused Regulators
Confused Investors
Electric Vehicle Loads
Carbon
Retail Choice
Virtual Power Plants
Reduced Grid Inertia

SETO's Expanding Focus: Solar-on-demand

Making solar available when energy is needed is the next critical challenge and represents an opportunity for solar to support the nation's energy resilience.



Flexible & Dispatchable Solar ... Key to Market Expansion & Value Retention

Solar 1.0: Traditional

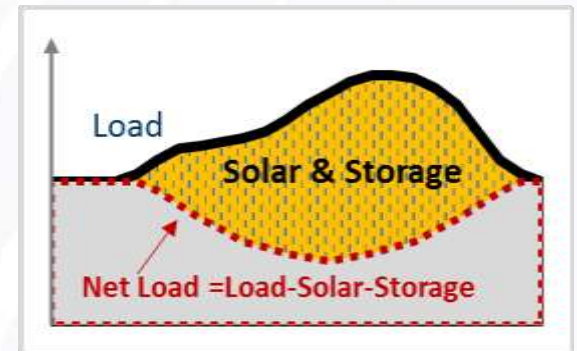
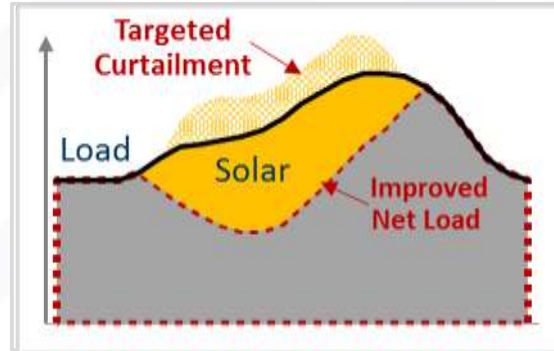
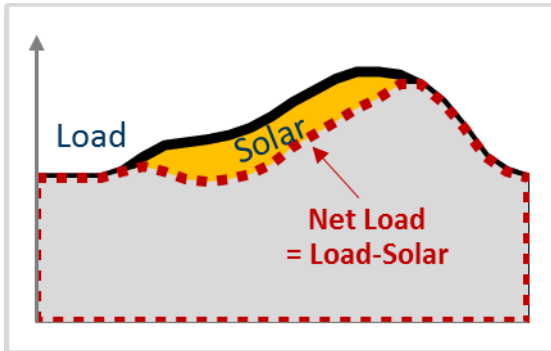
- Solar is part of mid-day load offsets peak or near-peak demand
- **Energy-Only Value**

Solar 2.0: Dispatchable

- Solar mitigates value erosion through plant controls
- Adds **Grid Reliability Services & Flexibility Value**

Solar 3.0: Fully Dispatchable

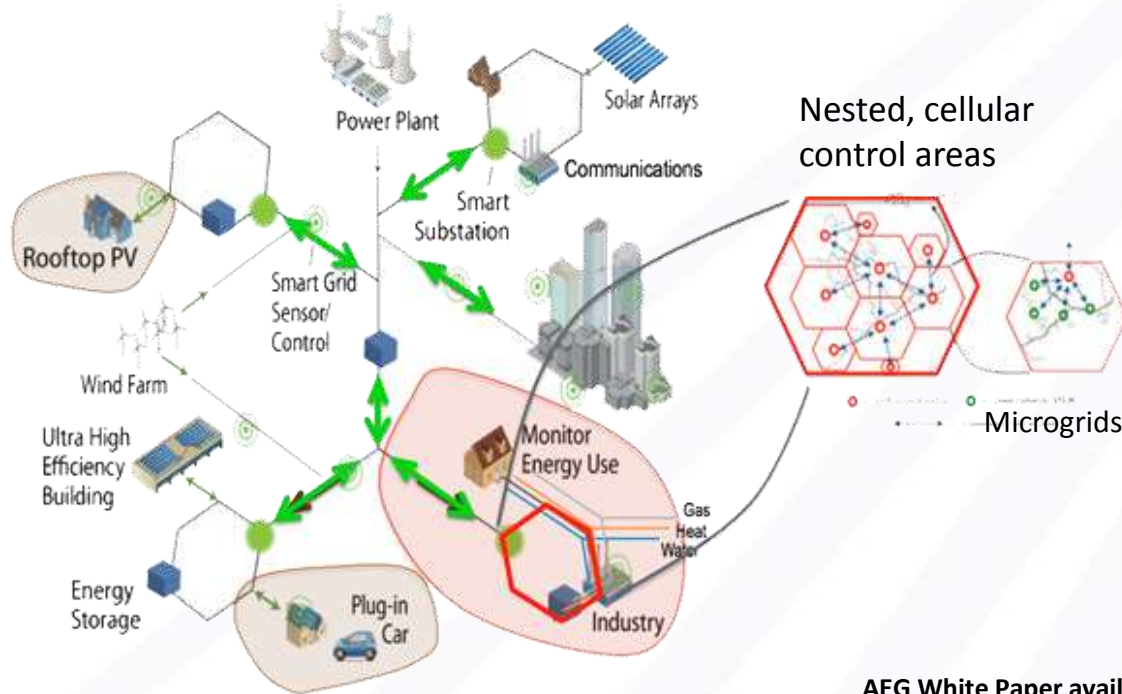
- Storage (hours, not days) time-shifts solar - dispatchable
- Adds **Firm Generation Capacity Value**



Autonomous Energy Grids (AEGs)

Optimized for secure, resilient and economic operations

Central-station based Grid



Key Features of AEGs

- **Autonomous** – Makes decisions without operators
- **Resilient** – Self-reconfiguring, cellular building blocks, able to operate with and without communications
- **Secure** – Incorporates cyber and physical security against threats
- **Reliable and Affordable** - Self optimizes for both economics and reliability
- **Flexible** – Able to accommodate energy in all forms including variable renewables

AEG White Paper available at:

<https://www.nrel.gov/docs/fy18osti/68712.pdf>

Renewable Energy Challenges

- Continue Cost Reduction
- Increase Overall Energy Use Efficiency
- Demand Management – just-in-time control
 - Vehicle to Grid, Thermal Storage, Smart Homes, Smart Communities
- Develop Firm Renewables
 - CSP with sCO₂; Biomass
- Develop Flexible Base-load
- Enhance Long Distance Transmission
- Increase Grid and Generator Flexibility
- Peak Shift (4-8 hour) Storage
- Seasonal Storage (2 to 4 months)
 - Power to gas, liquids

SETO's role

Early-Stage Research Investments

- PV, CSP, and grid integration R&D with a history of commercial impact
- Pre-competitive R&D, typically 10-20 years from the market, is beyond the private-sector horizon

Mid-Stage Development Investments

- Topics include reliability and open-access performance data not addressed by the private sector
- Public-private partnerships to support the next generation of innovative solar products

Energy System Planning

- In-depth technical studies and modeling solar's impact on the national grid
- Unique facilities for RD&D at the national laboratories (e.g.the Energy Systems Integration Facility)

Regional/National Scope Technical Analysis

- National labs provide tools and trusted, impartial information
- Leadership in data standardization and best practices

Expanding Consumer Choice

- Efforts to streamline solar deployment taking root with co-ops and utilities
- Programmatic efforts to expand household solar access to all Americans

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& RENEWABLE ENERGY

SOLAR ENERGY TECHNOLOGIES OFFICE

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