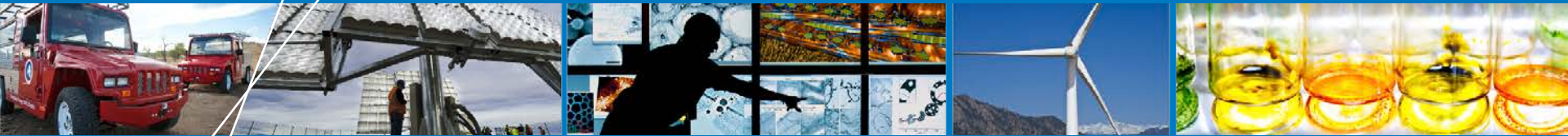


NREL Activities to Open Capital Market Investment and Bank Lending for Solar Deployment



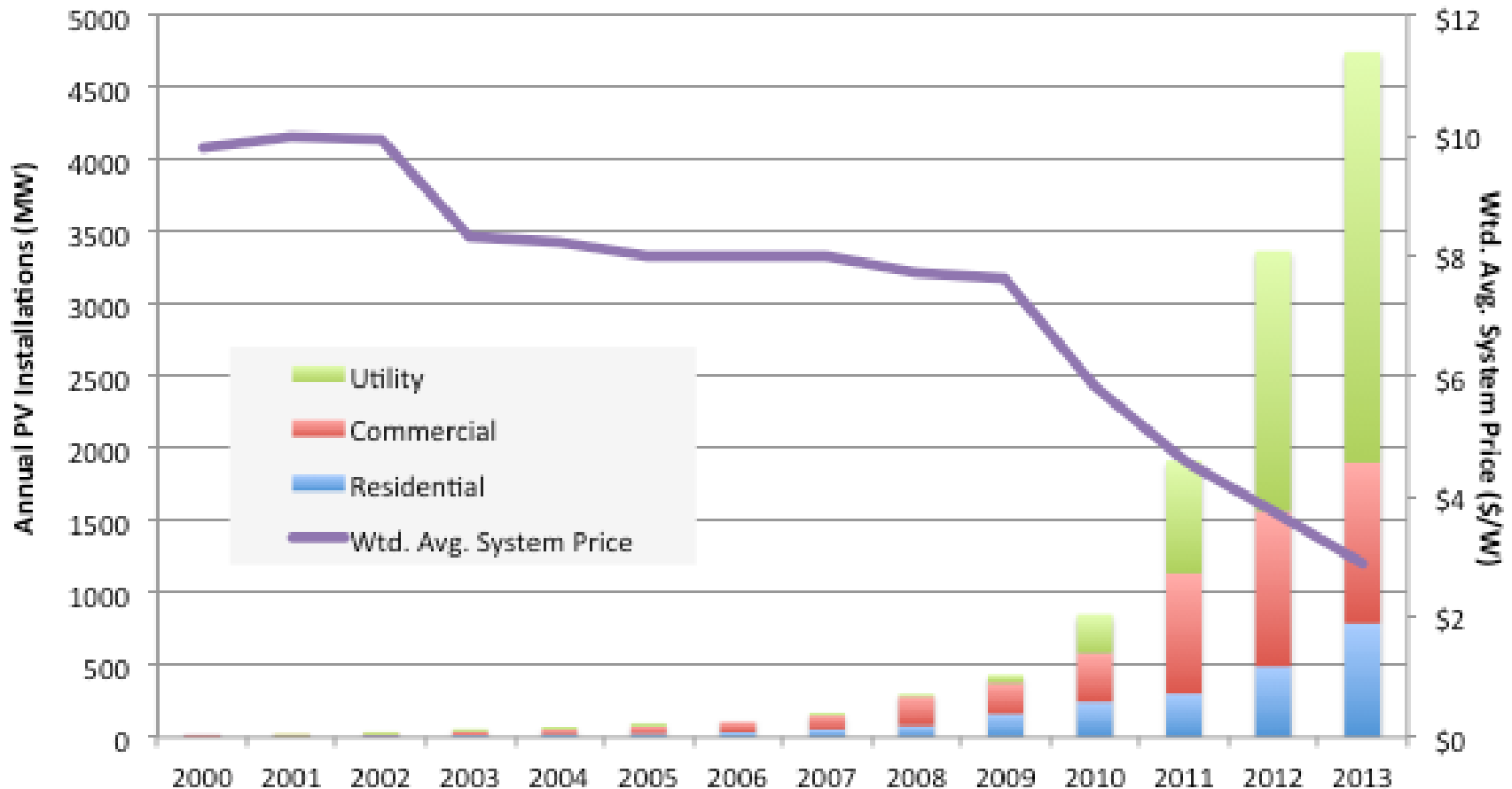
**Presentation to Senate & White House Staff
September 15 & 16, 2014**

**Michael Mendelsohn, NREL
John Joshi, Capital Fusion Partners**

NREL/PR-6A20-62717

Solar Industry Maturing Rapidly

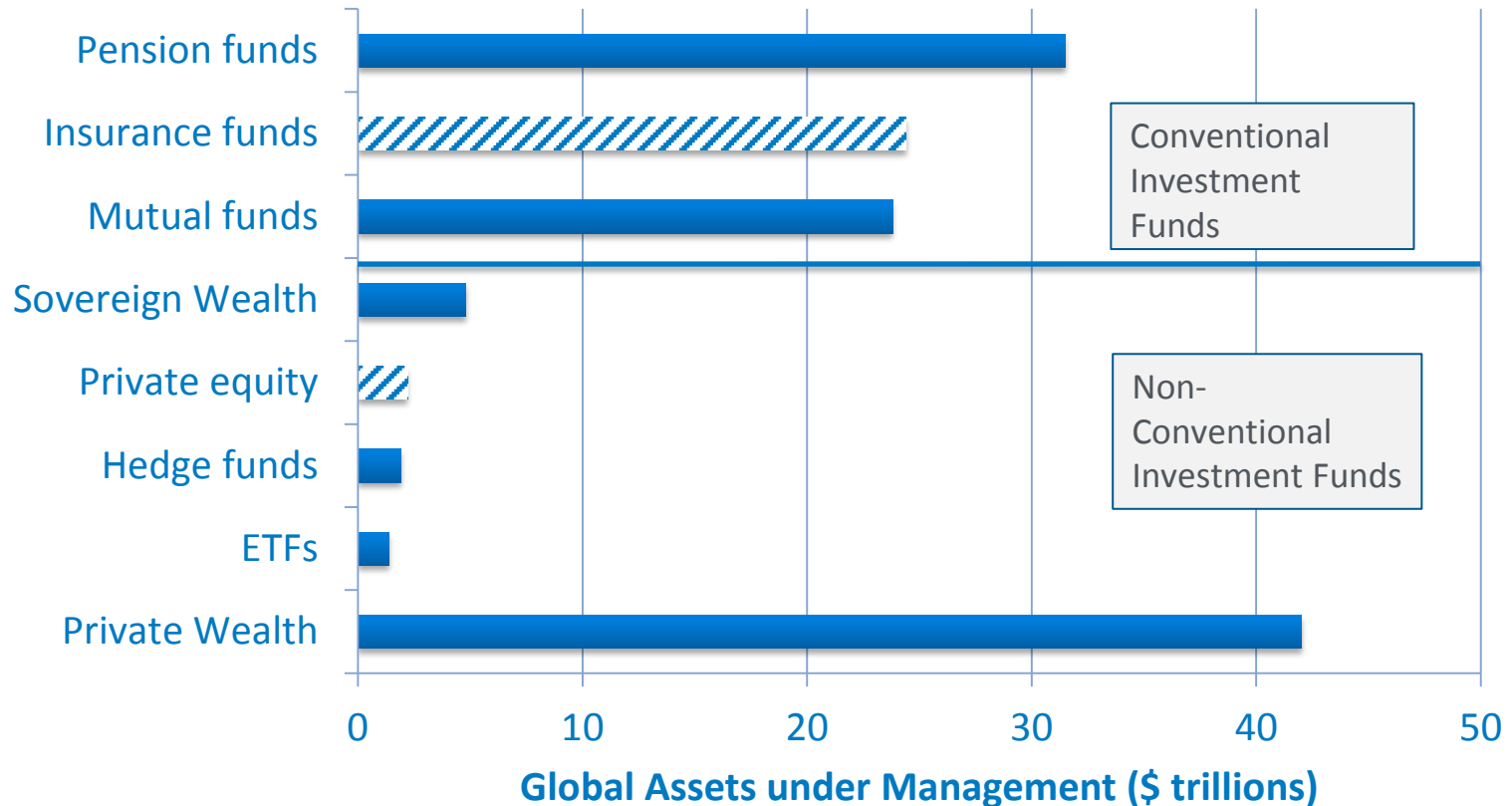
*4.75 GW installed in 2013 requiring \$13.7 billion in deployment investment;
36% growth forecasted for 2014*



Source: GTM/SEIA 2014

Value: Expand the Availability of Capital

Traditionally, most managed funds did not invest in renewable energy (RE), although new financial innovations are opening investment opportunities. To further tap this capital, investors need liquid, tradable, market-priced products.



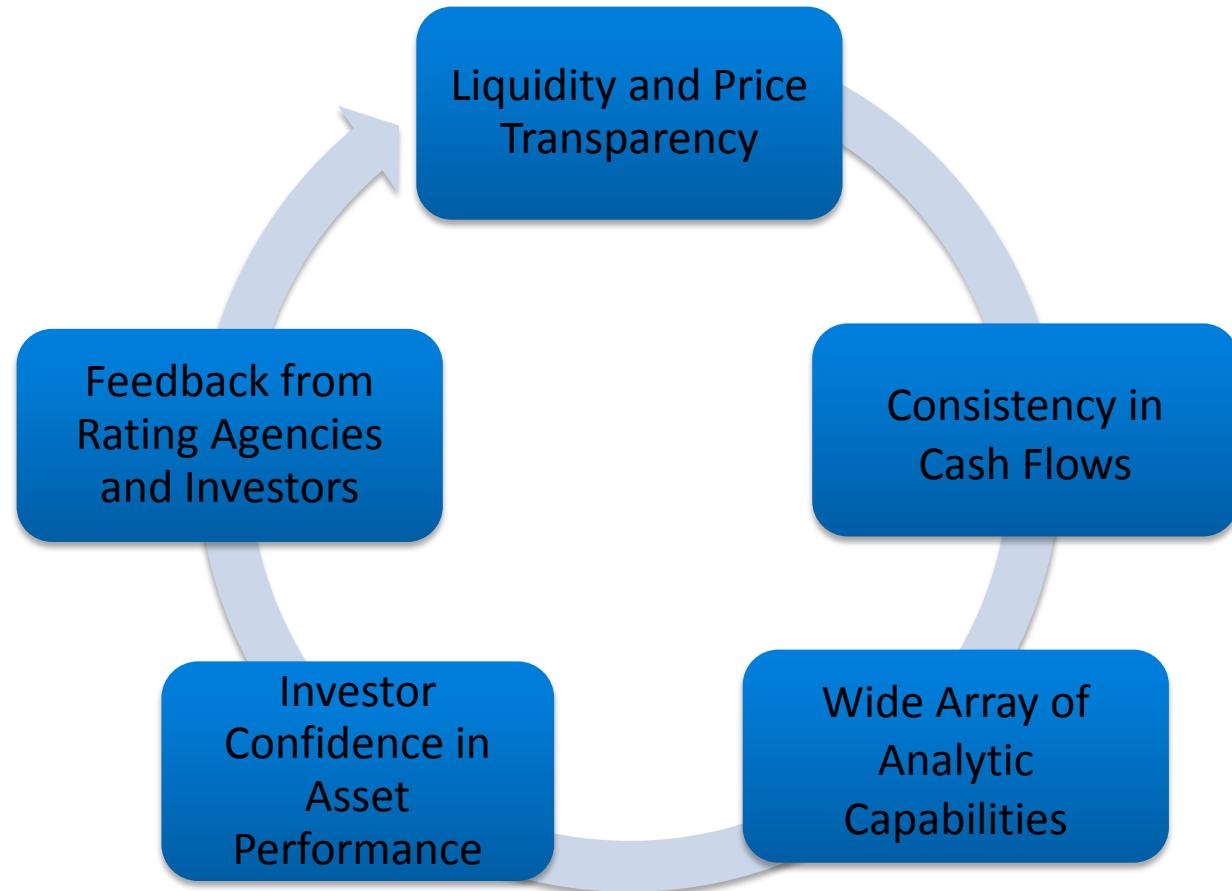
Hatched sources of capital historically invested in RE, but not necessarily from all investment buckets

Source: The CityUK

Capital Market Participation Requires...

- i. **Asset and contractual consistency**, which allows project cash flows to be pooled into tradable and highly liquid securities, and
- ii. **Availability of data to conduct due diligence** necessary to build market confidence in the asset class.

Which creates virtuous cycle of...



NREL Securitization Activities: Project History

NREL / DOE Goal

Expand availability
of capital

Lower cost
of capital

Reduce
transaction cost,
time to
access capital

3 Yr. DOE Award

Under SunShot Initiative (FY '13 – '15)

Organize the industry around:

- Standard documents
- Best practices
- Robust datasets

Comprehend
opportunities and barriers

Promote adoption by developers,
financiers, law firms, etc.

Solar Access to Public Capital (SAPC): 330 Participant Entities *(as of August 2014)*

Developers	Legal	Investment	Advisory	Manuf. / Other
Affordable Solar	Akin Gump	B of A Merrill Lynch	Black & Veatch	Enphase
Altus Power	Bingham McCutchen	Barclays	Citi Trust Services	Hanwha Q-Cells
Amicus Solar	Chadbourne & Parke	CalCef	CohnReznick	KACO
Borrego Solar	Chapman & Cutler	Citi	Corelogic	SMA
CleanPath	Cooley	Clean Power Finance	First Associates	Solectria
Distributed Sun	Coronal Mgt	Credit Agricole	DNVGL	Energi
Enfinity	Covington	Credit Suisse	Katten Muchin	CleanPath
Duke Energy	Dechert	Deutsche Bank	Kroll Bond Ratings	Skystream Markets
HelioPower	DLA Piper	Energy One Finance	KPMG LLP	PV Evolution Labs
Main Street Power	Hunton & Williams	Foresight Group	Lease Dimensions	Solar Electric Power Ass.
NextEra	K&L Gates	Global Capital Finance	Locus Energy	Global Cool Cities
OneRoof	Kramer Levin	Hannon Armstrong	Mercatus	Demeter Power
PsomasFMG	Milbank	KeyBanc	Moody's	Ballard Spahr
Recurrent	McCauley Lyman	kW Financial	Novogradac	Standard Solar
Rosendin	Nixon, Peabody	Macquarie	Power Factors	Amp Solar
SolarCity	Orrick, Herrington	MorganStanley	PwC	Department of Energy
SPG Solar	Patton Boggs	Nord LB	Rocky Mtn. Institute	SunSpec
Sungevity	Perkins Coie	PNC	SAIC	Birch Tree Capital
SunPower	Sidley Austin	Rabobank	Sol Systems	C2ES
Sunrun	Skadden Arps	Seminole Financial	Standard and Poor's	Underwriters Laboratory
Vivint Solar	Stoel Rives	Union Bank	Trepp	Assurant
Wiser Capital	Troutman Sanders	US Renewables Group	TUV Rheinland	Mayer Brown

SAPC Activities

- **Standard Contracts – first set available and in use:**

- Residential Lease (aggregated, disaggregated)
- Commercial Power Purchase Agreement (PPA)
- Residential PPA

Consistency in
Cash Flows

- **Develop Best Practices**

- Installation, Operation & Maintenance (O&M)
- *First public releases due Q4 2014*

Investor
Confidence in
Asset
Performance

- **Build Robust Datasets**

- System performance: oSPARC (Open Solar Performance and Reliability Clearinghouse) available here
- Credit performance

Wide Array of
Analytic
Capabilities

- **Develop Mock Filing to Rating Agencies**

- Residential mock presented to 5 rating agencies
- Commercial mock in development w/ innovative structure

Feedback from
Rating Agencies
and Investors

Standard Contracts

Benefits of Adoption:

- Facilitate cash flows to be pooled into securities to access capital market investment
- Lower transaction costs
- Speed deployment
- Improve customer protection
- Enable market liquidity of projects

Adopters:

• Developers

- SolarCity
- Clean Power Finance
- Sunrun
- One Roof Energy
- OnSwitch
- Altus Power

• Law Firms

- K&L Gates
- Nixon Peabody

• Financing / Risk Platforms

- Mercatus
- truSolar
- ModSolar

Performance Data Set

oSPARC: Aims to be first national public database of system performance - [available here](#)

First release in July 2014

- 3,100 systems - California Solar Initiative crossed with weather data
- Other public & private data acquisition in process

Will be critical resource for DOE, NREL, PUCs, other labs, non-profits, etc.

oSPARC Plus was launched with GTM in April 2014 to provide value-added services.



Banking on Solar – New Task for 2014

- **Designed to facilitate direct lending for solar deployment**
 - Community banks
 - Credit unions
 - Regional / national banks
- **Working group: 130 members**
 - Develop educational materials for lenders and regulators (first piece for CEOs available)
 - Find solutions to complex legal / banking issues
 - Educate on Property Assessed Clean Energy (PACE) program benefits and opportunity
 - Promote to retail banking industry

Banking on Solar: Clarifying Legal Issues

What is the priority of liens between the mortgage holder and solar lender in the case of a homeowner default?



Banking on Solar legal committee is drafting template agreements to improve recovery opportunity for solar lenders.

SolarCity Securitizations

	November 2013	April 2014	July 2014	Improvement?
Name	2013-1	2014-1	2014-2	
Yield	4.80%	4.59%	4.32%	Yes
Bond Size (\$ mm)	\$54.4	\$70.2	\$201.5	Yes
ADSAB (PV of cashflows - \$ mm)	\$87.8	\$106.2	\$276.0	Yes
Advance Rate (% of ADSAB)	62%	66%	73%	Yes
Wtd. Avg. Seasoning	22 months	12 months	7 months	Yes
Portfolio from Residential	71%	87%	86%	Yes
Rating	BBB+	BBB+	BBB+/BB	Neutral
Tranches	Single	Single	Sr/Sub	Yes

While a substantial development, the SolarCity securitizations only represent \$325 million funding relative to total industry annual investment of approximately \$14 billion

YieldCo Activity

- **Financial conduit designed to monetize tax benefits internally, traded as equity stock**
- **Active: NRG Yield, Nextera Yieldco, Abengoa, SunEdison (TerraForm Power)**
- **SAPC benefit:**
 - Standard contracts and best practices will facilitate asset consistency and improve liquidity of projects
 - Easier to buy and sell projects to add to yieldco portfolios

SAPC Mock Securitizations: Residential and Commercial

1. Trustee and SPE Admin & Extraordinary Expense Reserve Top-off

2. Covered Expenses up to Monthly Cap

3. Master Servicer and Special Servicer Fee

4. O&M Provider Fee

5. Transaction Manager Fee

6. Class A Interest

7. Class B Interest

8. Reserve Account & Top-off

9. O&M Expense Res. Account & Top-off

10. Class A Expected Principal*

11.

Priority of Payments – to protect investors

Mock securitization benefits:

- *Legal term sheets* – lowering transaction costs for smaller entities to enter debt markets
- *Education* – of rating agencies & industry on risk perception, technology & credit performance
- *Structure* – tandem tax equity / debt structure could solve complex industry issue

As mock “SolarCo” waterfall illustrates, securitizations are highly complex

Next Steps for NREL Activities

- **Expand pool of potential investors**
 - *Structured Finance Industry Group (SFIG)*
 - *Socially responsible investors (Ceres, others)*
 - *Real estate industry (REITs, etc.)*
- **Finalize best practices, next suite of standard contracts, expand oSPARC data acquisition**
- **Finalize mock securitizations, disseminate insight**
- **Promote adoption of standard contracts, other assets**
 - *Developers*
 - *Investors*
 - *MUSH, non-profit markets*
 - *Large commercial end-users*
- **Engage banks & regulators on underwriting practices, data to comprehend asset class performance, etc.**
- **Convert to industry-led group**

Are Goals Being Met?

NREL / DOE Goal

Expand availability
of capital

Lower cost
of capital

Reduce
transaction cost, time
to
access capital



Solar industry continues to mature through operating, technical, and financial innovation



DOE / NREL efforts to standardize, facilitate asset quality, and provide analytic tools is speeding that maturity



Glossary

- **ABS – Asset-Backed Securities**
- **ADSAB – Aggregate Discounted Solar Asset Balance** (the PV of remaining cash flows of the assets in a solar ABS)
- **ETF – Exchange Traded Funds**
- **MBS – Mortgage-Backed Security**
- **MLP – Master Limited Partnership**
- **MUSH – Municipalities, Universities, Schools & Hospitals**
- **oSPARC – open Solar Performance and Reliability Clearinghouse**
- **PACE – Property Assessed Clean Energy**
- **PPA – Power Purchase Agreement**
- **REIT – Real Estate Investment Trust**
- **SFIG – Structured Finance Industry Group**
- **TE – Tax Equity**