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Financing Solar Energy Systems

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Solar Energy Challenges

- Significant financial investment
- Unfamiliar technology
- Execution complexity
- End-market misperceptions

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Important Terms

- Net metering
- Grid-Tied
- kW vs. kWh
- AC vs. DC
- Efficiency vs. Productivity
- Thin-film
- ITC – investment tax credit
- MACRs – modified accelerated cost recovery system

Solar Energy Economics

- Return Components
  - Energy production
    - Avoided costs : grid power
    - Production-based incentives
  - Goodwill : corporate goals, green marketing
- Cost Components
  - Investment
  - Maintenance
- Incentives
  - Sources : Federal/State/Utility/City
  - Types : Rebate/Production/Feed-In Tariff
- Energy price stability/visibility

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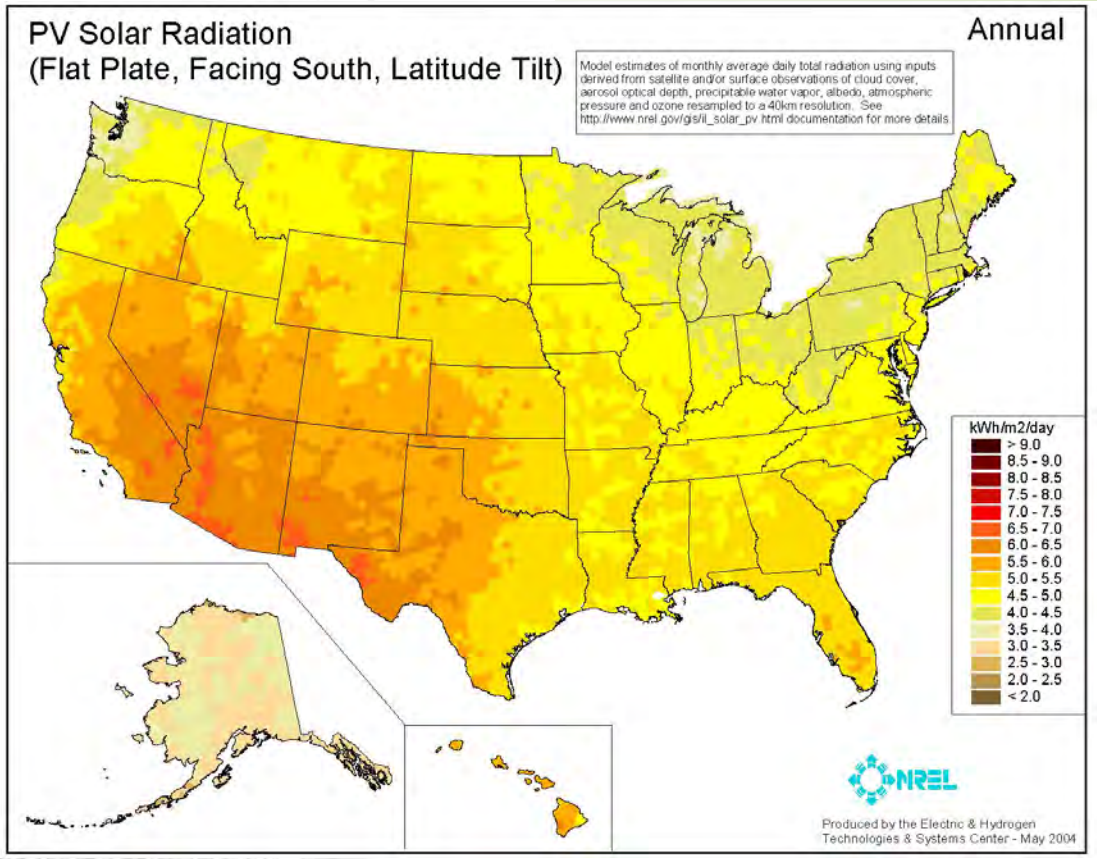
Solar Resource Drives Economics



Phoenix, AZ
32 tilt
crystalline
1,617 kwh/watt

Worcester, MA
38 tilt
crystalline
1,224 kwh/watt

32%
Productivity
Difference!

Energy production depends on your location, as do incentives..

Source: PVWatts

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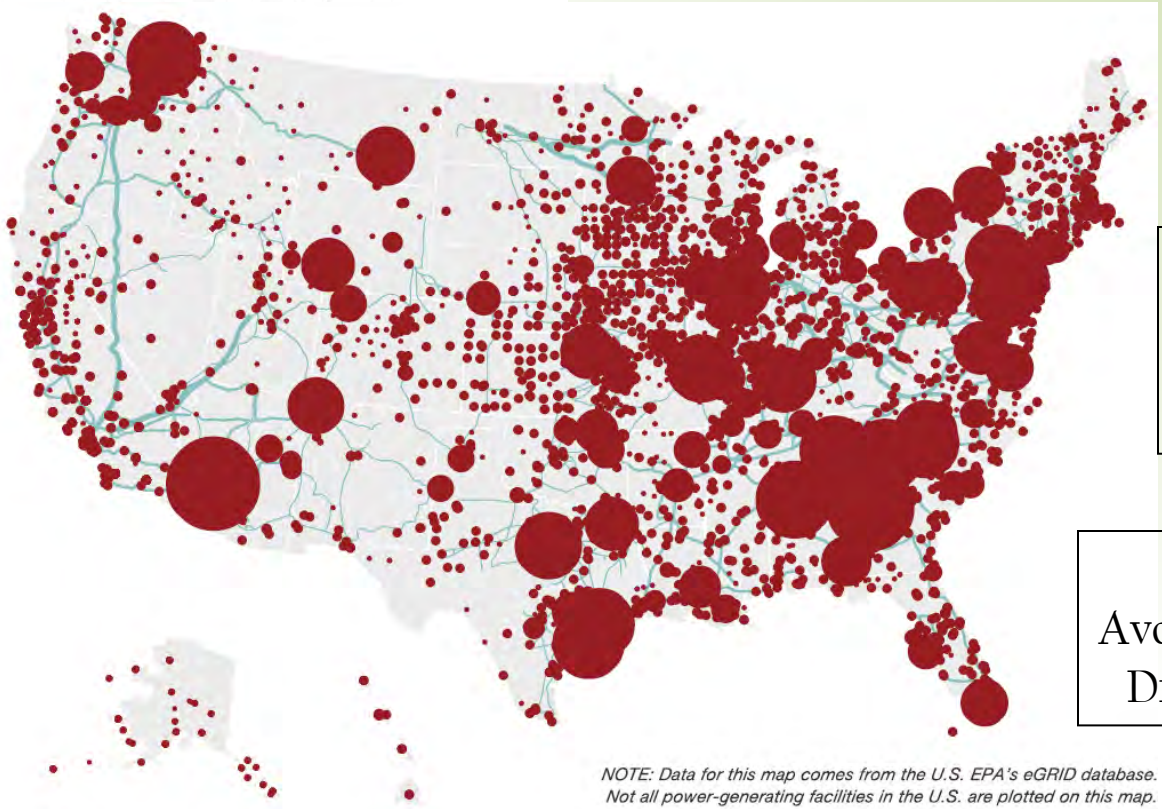
Grid Power Prices Drive Economics

Idaho
$0.051 kwh

1,000kwh=$50



NOTE: Data for this map comes from the U.S. EPA's eGRID database.
Not all power-generating facilities in the U.S. are plotted on this map.

Connecticut
$0.165 kwh

1,000kwh=$165

224%
Avoided Cost
Difference!

Comparative grid-power prices impact
payback of investment in renewable energy

Source: EPA, EIA, DOE: 2007 Prices

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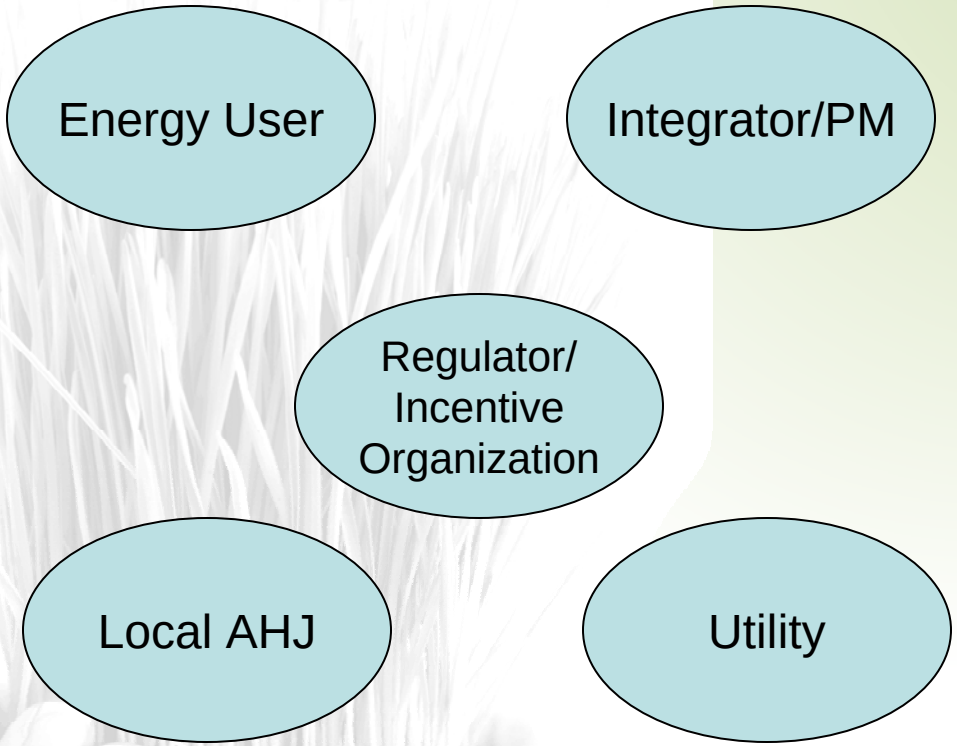
Project Examples

		NY		NJ
System Size (kW)		80		80
Production (kWh/kW)		1,200		1,200
Grid Electricity Price ($/kWh)	$	0.20	$	0.15
Annual Savings ($000)	$	19.2	$	14.4
System Install Price ($000)	$	560.0	$	560.0
Federal ITC (30%)	$	168.0	$	168.0
State Incentive Type		Rebate		Production
Upfront Incentive ($/watt)	$	2.00	$	-
Upfront Incentive ($000)	$	160.0	$	-
Net Investment ($000)	$	232.0	$	392.0
Production Incentive ($/kwh)	$	-	$	0.65
25 yr Production Incentive ($000)	$	-	$	408.6
Federal MACRs	$	166.6	$	166.6
25 yr Electricity Savings ($000)	$	865.3	$	648.9
Post-Install Incentives & Savings	$	1,031.9	$	1,224.1
Nominal Profit over 25 yrs	$	799.9	$	832.1
Internal Rate of Return (25 yrs)		22.1%		17.9%
Net Present Value @ 8% (25 yrs)	$	211.6	$	220.7

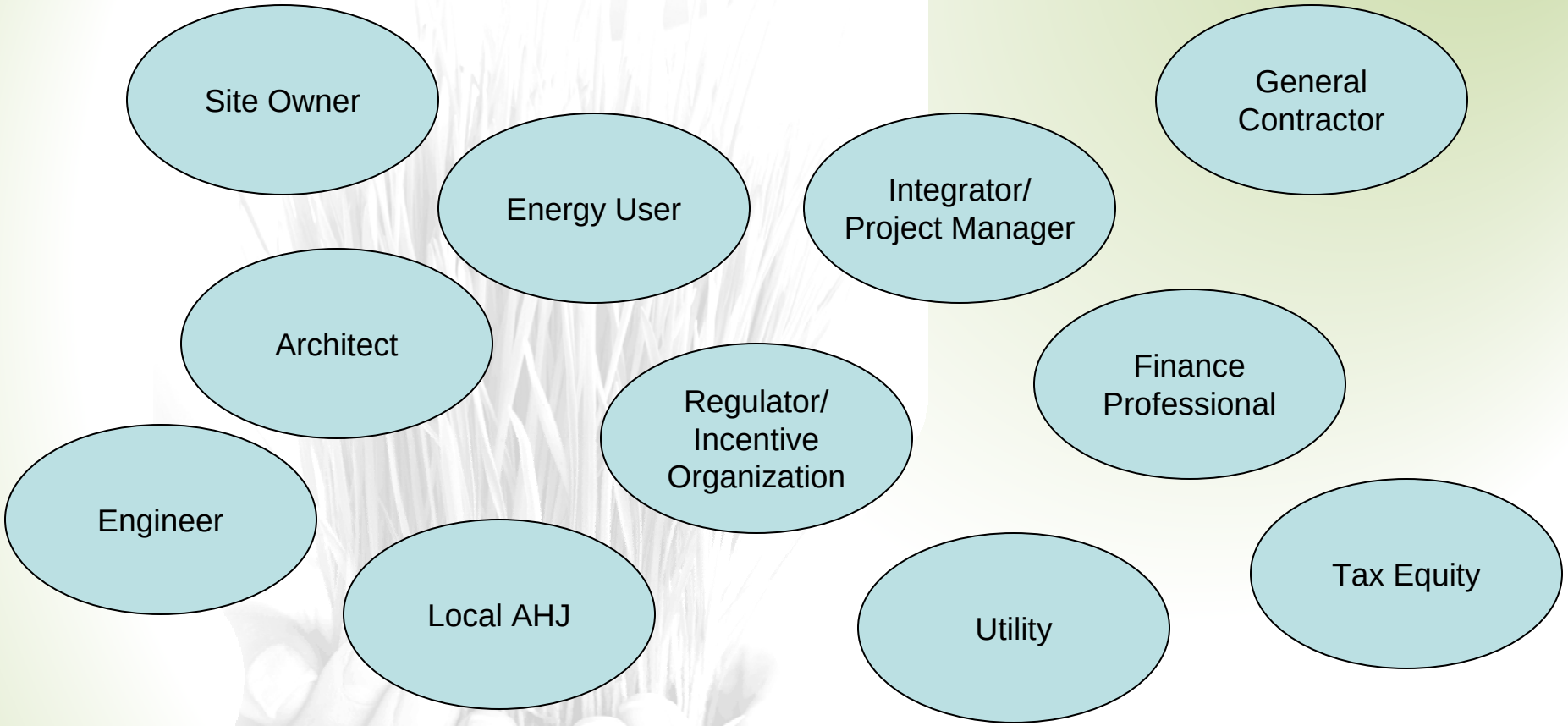
Financing Alternatives

- Purchase Equipment
  - Initial capital investment
  - Operating costs
- Purchase Energy
  - 3rd Party Ownership
    - Power Purchase Agreement -PPA
    - Lease

Parties to a Typical Solar Project



Parties to a Commercial Solar Project



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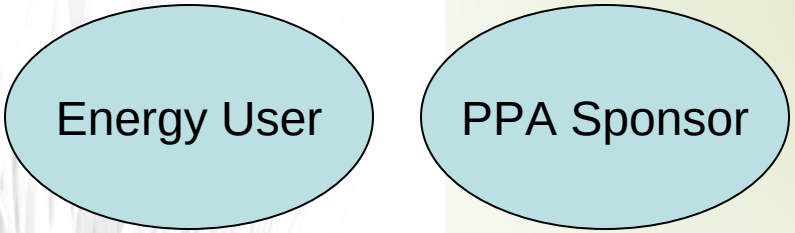
Power Purchase Agreements



- Simplified project execution
  - PPA Sponsor provides turnkey system
- Price visibility
  - Contractually determined annual price escalation
- No operating responsibility/risk
- No large capital outlay
- Creates long-term obligations

Recent Financial Innovation

2004	• SunEdison - Commercial PPA
2006	• Solar City- Residential lease
2007	• Sun Run - Residential PPA
2010?	• "Community" Solar – group ownership

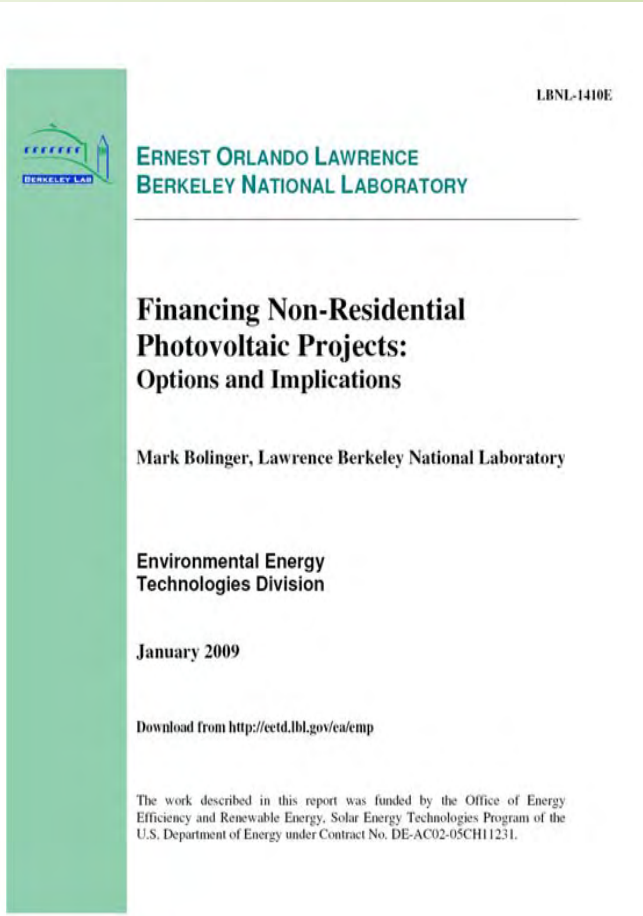
Useful Information

- Lawrence Berkeley Labs

  January 2009

  https://eetd.lbl.gov/ea/emp

- dsireusa.org
- www.eia.doe.gov



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Financing Non-Residential Photovoltaic Projects:
Options and Implications

Mark Bolinger, Lawrence Berkeley National Laboratory

Environmental Energy
Technologies Division

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Download from http://eetd.lbl.gov/ea/emp

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