Financing Solar Energy Systems
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Solar Energy Challenges

- Significant financial investment
- Unfamiliar technology
- Execution complexity
- End-market misperceptions
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
Solar Resource Drives Economics

Energy production depends on your location, as do incentives.

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

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

32% Productivity Difference!

Source: PVWatts
Grid Power Prices Drive Economics

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

Source: EPA, EIA, DOE: 2007 Prices
# Project Examples

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

- Energy User
- Integrator/PM
- Regulator/Incentive Organization
- Local AHJ
- Utility
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