QUALITY PV

The path to *parity* is through valuing *quality*
Perceived Certainty

'sər-tən\ - perfect knowledge that has total security from error or the mental state of being without doubt
Money drives the process

Technology
Innovation &
Quality
Improvement

Construction
- Construction Equity
- Construction Debt
- Vendor Financing

Project Finance
- Tax Equity
- Permanent Debt
- Sponsor Equity

6+ Year
- Equity
- Refinanced Debt
- **Construction**
  - Debt
    - 80%; 4-10% returns
  - Equity
    - 20%; 10%-25% returns
- **Permanent**
  - Tax Equity
    - 50%; 7-15%+ returns
  - Permanent Debt
    - 30% -40%; 6-10% returns; 18 years
  - Cash Equity
    - ~10-20%; 12-15% returns; project life
Risks

- Identify
- Mitigate
- Assume
- Insure
darkest before dawn

Next 18-24 months

• Oversupply of PV “projects”
• Unrealistic installation expectations
• Insufficient tax equity
• Europe liquidity
• Fewer/lower global subsidies
• More lawsuits
• MORE equipment bankruptcy
• Less certainty of ITC
• More latent defects

2017 - 2020

• NO Investment Tax Credit
• Low to no subsidies
• Low Natural Gas prices
• Increase demand for renewable generation
• Fewer stronger equipment manufactures
• $0.80/Wp panel pricing
Module Spot Prices

$/W

- Nov-10 $1.76
- Dec-10 $1.68
- Jan-11 $1.60
- Feb-11 $1.57
- Mar-11 $1.60
- Apr-11 $1.59
- May-11 $1.52
- Jun-11 $1.40
- Jul-11 $1.28
- Aug-11 $1.24
- Sep-11 $1.19
- Oct-11 $1.16
- Nov-11 $1.12
- Dec-11 $1.05
## Impact

<table>
<thead>
<tr>
<th>Yield</th>
<th>100%</th>
<th>101%</th>
<th>102%</th>
<th>103%</th>
<th>105%</th>
<th>109%</th>
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</thead>
<tbody>
<tr>
<td>Development Fee</td>
<td>5,300</td>
<td>5,900</td>
<td>6,500</td>
<td>7,000</td>
<td>8,800</td>
<td>10,400</td>
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<tr>
<td>% Increase</td>
<td>10%</td>
<td>20%</td>
<td>31%</td>
<td>51%</td>
<td>95%</td>
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</table>

<table>
<thead>
<tr>
<th>Degradation</th>
<th>0.75</th>
<th>0.60</th>
<th>0.50</th>
<th>0.40</th>
<th>0.30</th>
<th>0.20</th>
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<tbody>
<tr>
<td>Development Fee</td>
<td>4,600</td>
<td>5,300</td>
<td>5,900</td>
<td>6,500</td>
<td>7,000</td>
<td>7,600</td>
</tr>
<tr>
<td>% Increase</td>
<td>15%</td>
<td>28%</td>
<td>41%</td>
<td>52%</td>
<td>65%</td>
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</table>

<table>
<thead>
<tr>
<th>O&amp;M ($/W)</th>
<th>28</th>
<th>24</th>
<th>20</th>
<th>16</th>
<th>12</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td>Development Fee</td>
<td>1,800</td>
<td>2,600</td>
<td>3,400</td>
<td>4,200</td>
<td>4,900</td>
<td>5,700</td>
</tr>
<tr>
<td>% Increase</td>
<td>42%</td>
<td>84%</td>
<td>126%</td>
<td>169%</td>
<td>211%</td>
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</table>

12.5 MW System  
Base Yield: 1950 kWh/kWp  
7% Unlevered Return  
0.60 Degradation  
O&M $10/MW
Subsidy Free Solar

Incremental

- Degradation
  - 0.60 - 0.25
- Yield
  - Increase 5%
- O&M
  - $10k routine, $2k non-routine
- EPC (Currently $2.75)
  - $2.00 -> 7%
  - $1.80 -> 8%
- Debt
  - 1.3 -> 1.25 DSCR
  - 5% yield 18 year
  - Enough cash to service total project
Steps

• Consistent methodology
  • Performance Simulation
  • Manufacturing quality
  • Delivered quality
  • Latent Defects
  • Actual performance

• Development Needs
  • Increase actual Performance Analytics
  • Lower degradation
  • Increase yield
  • Lower O&M costs
  • Lower BOS pricing

• PV is **NOT** a commodity
Conclusions

• 2012 & 2013 will be challenging
• 2014 and beyond will increase demand
• Financing is the key to make projects work
• Leveled cost of energy is driven by weighted average cost of capital not just equipment costs
• A tax equity constrained market will only allow for rich low risk projects

Grid Parity is close but not quite here in the US… but is abroad
Why am I here?

- Solar industry is headed for challenging times
- Technical analysis and certainty is essential
- Bridge the needs of investors, analysis of IE’s and role/budget of National organizations.
- Exciting lectures and spirited conversations
- Lunch & Drinks
- Dave Williams told me I had to
Today

Needs

• Underwriters
  • Specific needs for lower capital costs

• Independent Engineers
  • Gaps from available research & standards

• Modeling Analysis

• National Organizations
  • Specific role and communications of organizations

Communication

• Quality of Performance Prediction

• Quality of Goods Installed

• Quality of Operations and Feedback
Workshop Ground Rules

- Please speak up!
- 5 minutes limit
- Chair will take notes and prepare brief
  - List of current needs and outline impact
  - Have a sign in sheet

- NOT a one day event but an ongoing process
Now what?

- Presentations will be available online
- A short brief will be prepared
  - Outline speeches
  - Outline discussions
  - Set targeted priorities
- Identify ongoing working group members
- Identify top 5 priorities for national labs
- Keep up with national organization progress
- Quarterly updates on progress of Taskforce 6
Doubt is not a pleasant condition, but certainty is absurd.

- Voltaire
Thank YOU!

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