

QUALITY PV

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

Perceived Certainty

\ 'sər-tə'n\ - 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

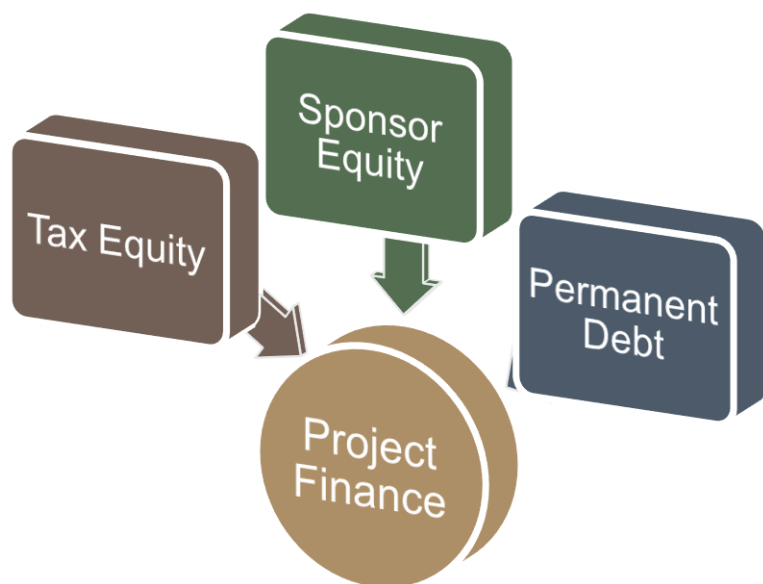
Project Finance

Tax Equity
Permanent Debt
Sponsor Equity

6+ Year

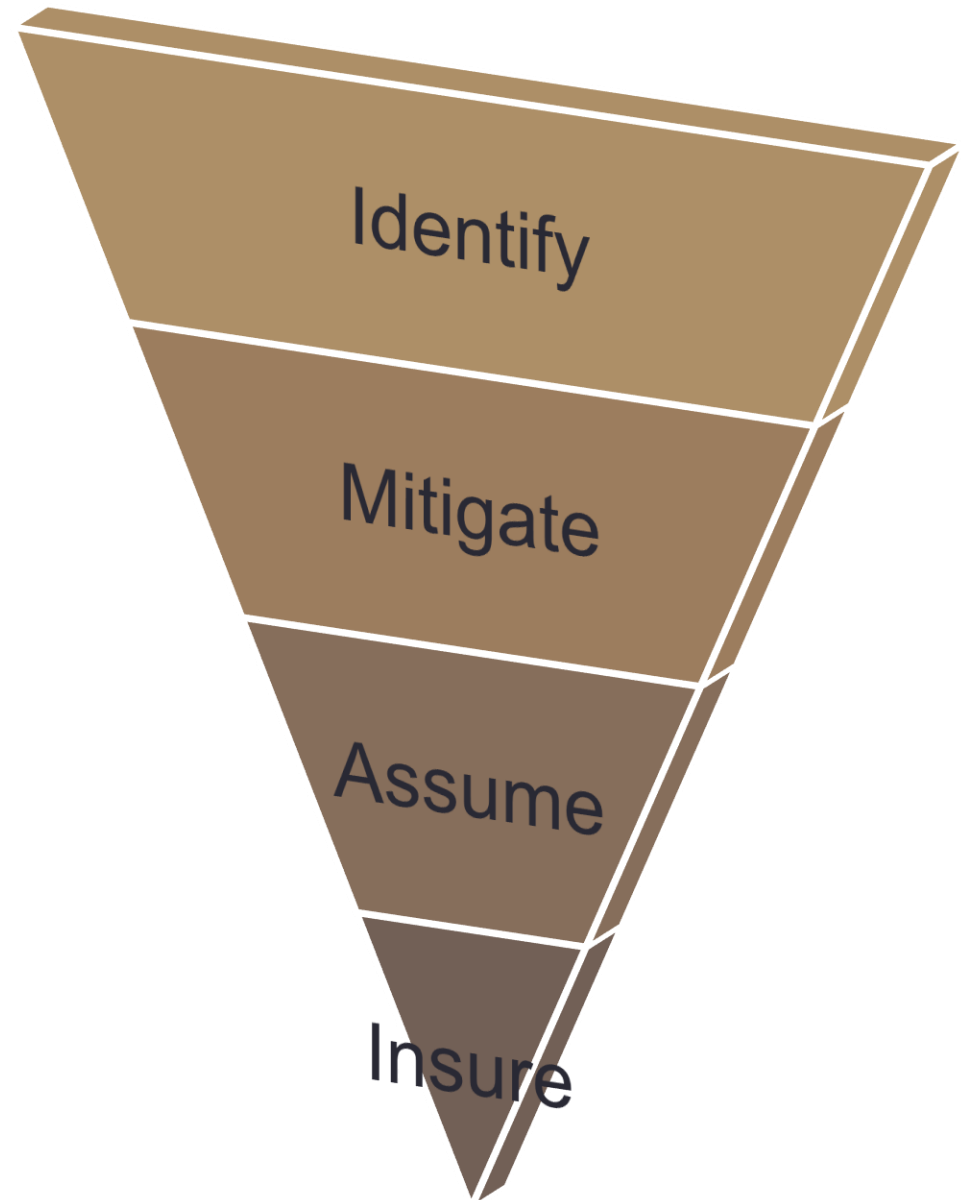
Equity
Refinanced Debt

benjamin's



- 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



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

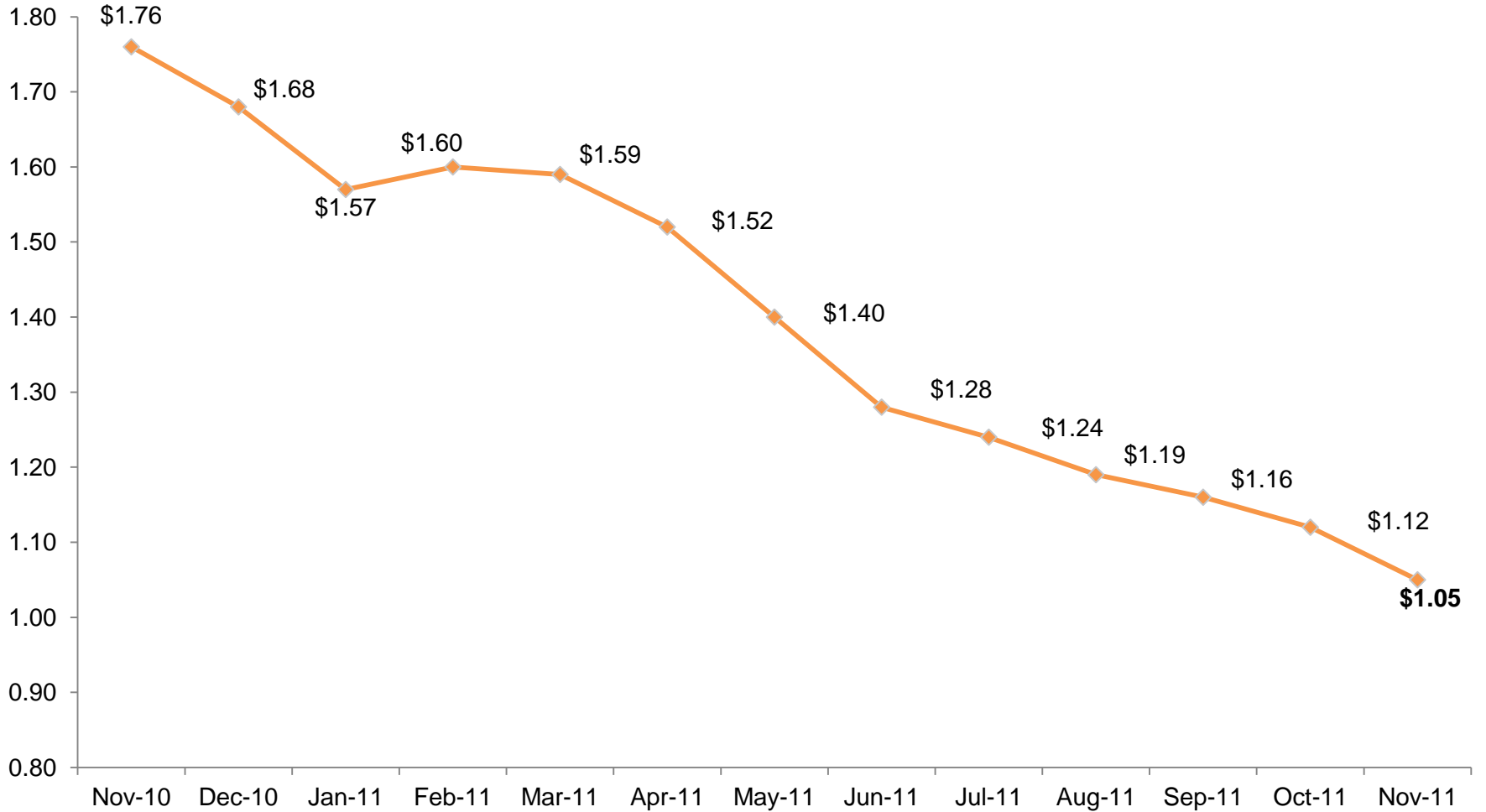
2017 -2020

- NO Investment Tax Credit
- Low to no subsidies
- Low Natural Gas prices
- Increase demand for renewable generation
- Fewer stronger equipment manufacturers
- \$0.80/Wp panel pricing

spot

Module Spot Prices

\$/W



impact

Yield	100%	101%	102%	103%	105%	109%
Development Fee	5,300	5,900	6,500	7,000	8,800	10,400
% Increase		10%	20%	31%	51%	95%
Degradation	0.75	0.60	0.50	0.40	0.30	0.20
Development Fee	4,600	5,300	5,900	6,500	7,000	7,600
% Increase		15%	28%	41%	52%	65%
O&M (\$/W)	28	24	20	16	12	8
Development Fee	1,800	2,600	3,400	4,200	4,900	5,700
% Increase		42%	84%	126%	169%	211%

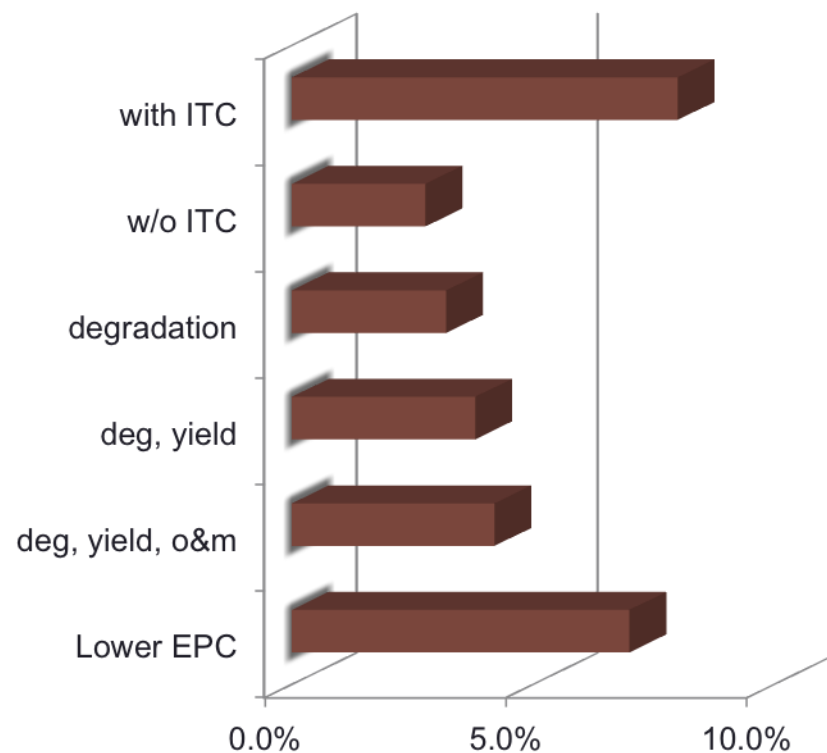
12.5 MW System
 Base Yield: 1950 kWh/kWp
 7% Unlevered Return
 0.60 Degradation
 O&M \$10/MW

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

path



Steps

- Consistent methodology
 - Performance Simulation
 - Manufacturing quality
 - Delivered quality
 - Latent Defects
 - Actual performance
- PV is **NOT** a commodity
- Development Needs
 - Increase actual Performance Analytics
 - Lower degradation
 - Increase yield
 - Lower O&M costs
 - Lower BOS pricing

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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