CEC Cost of Generation Workshop

16 May 2011

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CEC COG study strives to achieve the most current levelized cost estimates for use in program studies at CEC and other state agencies.

- Objective analysis (avoid tilting the playing field)
- Correctly model relationships among alternatives

COG model is a valuable public source of California cost data

- Assumptions and results are used in a wide variety of analyses, including many at E3.
- Importance of accuracy of each cost component.

Eye to focusing additional complexity on areas with greatest impact
Proposition: the goal of the analysis should drive the calculation methodology and assumptions used. For example:

- IOU revenue requirement or IPP cash analysis
- IPP contracted or IPP merchant or IOU rate-based asset
- LCOE calculation or full system impacts analysis
- Single-year snapshot or year-over-year analysis

Will touch on this idea throughout today’s presentation.
Topics discussed today

+ Capital costs
+ Cost of capital
+ Project finance issues
+ Taxes
+ Treatment of dispatchable resources
+ System cost analysis
Granularity of Capital costs

+ Certain additional capital cost granularity would be very helpful
  - Technology type and configuration sub-categories
  - Land
  - Labor agreement
  - Development, permitting, legal
  - Emission reduction credits (ERCs)
  - Sales tax, property tax
  - Incentives
  - Treatment of transmission upgrade costs
  - Interest during construction (IDC)
  - Mobilization, Commissioning, Spares
  - Contingency
  - Reserve accounts

+ Goal of each analysis will dictate inclusion/exclusion of certain cost categories.
Appropriate Cost of Capital

+ IOU – capital structure, debt interest rate & equity return defined in cost of capital regulatory proceeding
  - Utility assumed to exactly achieve its target cost of capital

+ IPP – cost of capital is not public, however basic principles can be applied to help determine appropriate return levels
  - Market returns will be achieved
    - Developers will want to achieve highest possible returns
    - Competitive bidding will force returns down
  - Returns will be appropriate for the RISK of the underlying asset
    - As an asset’s risk increases, its return should increase also to compensate investors for increased risk
    - Otherwise, for the same return, investors will choose to invest in a less risky asset
## Examples of IPP Risks

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Location</td>
<td>California: weather, earthquakes, legal framework, power crisis history &amp; power markets.</td>
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<td>Technology</td>
<td>New or established. Presence of manufacturer, O&amp;M guarantees.</td>
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<td>Revenue Expectation</td>
<td>Merchant or contracted. Contract terms impacting revenue (i.e., availability). Credit quality of off-taker.</td>
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<tr>
<td>Cost Expectation</td>
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<td>Regulatory Uncertainty</td>
<td>Curtailment, cap &amp; trade, once-through cooling.</td>
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<td>Finance Market</td>
<td>Inflation, tenor.</td>
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COST OF CAPITAL CANNOT BE PRICED IN ABSENCE OF CONTRACT TERMS AND ASSET RISK SPECIFICS
What risks do we assume when we price IPP cost of capital for LCOE?

- California generation asset
- 20-yr contract with California utility
- Contract terms per publicly available RFP
- Current low inflation environment
- Legislative mandate not a factor – contract assumed to be in place

What sources do we have to price these risks?

- Not many – IPP returns are confidential
- One publicly available source is State Board of Equalization (BOE) capitalization (cap) rate study
## 2011 Capitalization Rate Study
### Electric Generation Facilities
#### Beta Analysis

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**Merchant Generators Relevered Beta based on 45% Debt Capital Structure**

**Diversified Electric Utilities Relevered Beta based on 40% Debt Capital Structure**

**Merrill Lynch Adjusted Beta Independent Power Producers**

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Sources: Columns a, b, c and g were extracted from the Value Line Investment Survey Reports. Column d was extracted from Zacks.com. Column e was extracted from Standard and Poor’s Stock Reports.

1. Average Debt to Equity Ratio over the last five years.
2. Unlevered Beta = Corrected Beta/[1+(1-tp)(D/E)]; where D/E is the debt to equity ratio, tc is the company’s 2010 tax rate.
3. Relevered Beta = [Unlevered Beta][1+(1-tp)(D/E)]; where D/E is the debt to equity ratio, tp is a prospective purchaser’s tax rate (assumed to be 40%)
Comparables Not Appropriate for Valuing Calif Contracted Assets

NRG Energy, Inc.
- 24,000 MW of generation (nuclear, wind, solar, natural gas and coal) in California, Nevada, Arizona, Texas, northeast, Australia, Germany.
- NRG Energy Services provides engine maintenance and parts.
- NRG Thermal is one of the largest third-party steam providers in the US.
- Reliant Energy provides electricity and energy related products to more than 1.6 million customers.
- eVgo electric vehicle ecosystem of home charging stations and fast charging stations at retailers and work places.

AES
- In 28 countries on five continents
- 132 generation plants, including 15 facilities at integrated utilities
- 14 utilities
- A global workforce of 29,000
## 2011 Capitalization Rate Study
### Electric Generation Facilities
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Median: 1.20
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### Merchant Generators Relevered Beta based on 45% Debt Capital Structure

1.11

### Diversified Electric Utilities Relevered Beta based on 40% Debt Capital Structure

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### Merrill Lynch Adjusted Beta Independent Power Producers

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Calculation of Asset Return

Calculation of Asset Return:

- Unlevered beta = 0.75 (see red circle)
- Asset return = Rf + βa * (Market risk premium)
  
  = 4.37% + 0.75 * 6.7% = 9.4%
- Asset return prices the risk of the “comparables”.
  - If you invest in an asset of equivalent risks to comparable companies, then a return of 9.4% is appropriate for that risk.
- It is the return achieved on total capital cost (= debt + equity investment).
- If 100% equity financed, equity return = asset return = 9.4%
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<td></td>
<td>0.53</td>
<td>0.46</td>
</tr>
<tr>
<td>Median</td>
<td>0.75</td>
<td>0.53</td>
<td>0.52</td>
<td>0.60</td>
<td>0.34</td>
<td></td>
<td>0.46</td>
<td>0.46</td>
</tr>
<tr>
<td>Weighted</td>
<td>0.60</td>
<td>0.34</td>
<td>0.52</td>
<td>0.60</td>
<td>0.34</td>
<td></td>
<td>0.47</td>
<td></td>
</tr>
</tbody>
</table>

### Sources:
Column a, b, c and g were extracted from the Value Line Investment Survey Reports.
Column d was extracted from Zacks.com.
Column e was extracted from Standard and Poor’s Stock Reports.

1. **Average Debt to Equity Ratio over the last five years.**
2. **Ulevered Beta = Corrected Beta/[1+(1-tc)(D/E)];** where D/E is the debt to equity ratio, tc is the company’s 2010 tax rate.
3. **Relevered Beta = [Ulevered Beta][1+(1-tp)(D/E)];** where D/E is the debt to equity ratio, tp is a prospective purchaser’s tax rate (assumed to be 40%).
Calculation of Equity Return

+ **Calculation of Equity Return:**

  - Re-levering beta means addition of debt in capital structure to produce **levered equity return** (see formula in red circle)
  - BOE study re-levers with 45% debt
  - $\beta_e = [0.75] \times [1+((1-0.4) \times (0.45 / 0.55))] = 1.118$

  + **Equity return = Rf + \beta_e \times (Market risk premium)**

    - Equity return = $0.0437 + 1.118 \times 0.067 = 11.86%$
    - Assumes 55% equity
SBE Makes Further Adjustments to Equity Return

- Data shows $\beta_e = 1.118$, resulting in 11.86% equity return (see prev slide)
- Staff recommends $\beta_e = 1.2$
  - So equity return = $0.0437 + 1.2 \times 0.067 = 12.41\%$
- Staff recommends equity return = 13.87%

<table>
<thead>
<tr>
<th>Modern Technology</th>
<th>Facility Type</th>
<th>Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Recommended Rate</td>
<td>Modern Electric Generation Technology</td>
<td>13.25%</td>
</tr>
<tr>
<td>14.00%</td>
<td>Recommended Rate</td>
<td>Flotation Cost in %</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.19%</td>
<td>13.25%</td>
<td>4.50%</td>
</tr>
<tr>
<td>12.41%</td>
<td>13.87%</td>
<td></td>
</tr>
<tr>
<td>14.53%</td>
<td></td>
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</tr>
</tbody>
</table>

2011 Recommended Rate

13.25%
Several factors make 11.16% cap rate inappropriate

- Prices risk of “comparable” companies
- Uses staff-adjusted 13.87% equity return
- Mixes pre-tax debt and post-tax equity
  - Need to make (1-t) adjustment to debt rate
  - Should be 0.55 * 13.87% + 0.45 * 7.83% *(1-.4) = 9.74%, not 11.16%
- If equal to risk of “comparables”, should be 9.4%
What Price is Appropriate for Pricing California Asset LCOE?

<table>
<thead>
<tr>
<th>Source</th>
<th>Asset Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 MPR</td>
<td>8.25%</td>
</tr>
<tr>
<td>E3 33% RPS model</td>
<td>8.70%</td>
</tr>
<tr>
<td>COG – IPP Alternatives</td>
<td>8.45%</td>
</tr>
<tr>
<td>COG – IPP Fossil</td>
<td>10.46%</td>
</tr>
</tbody>
</table>

- The asset return used to price LCOE should be appropriate for the risks inherent in the asset.
- Table above shows examples that have been recently used.
  - What risks could support a higher return for a fossil asset?
How does asset return impact ROE?

<table>
<thead>
<tr>
<th>Asset Return (Unlevered Return)</th>
<th>D Debt %</th>
<th>Debt Interest Rate (Rd)</th>
<th>Tax Rate (T)</th>
<th>E Equity %</th>
<th>Equity Return (Re)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5%</td>
<td>30%</td>
<td>6.0%</td>
<td>40.75%</td>
<td>70%</td>
<td>10.6%</td>
</tr>
<tr>
<td>8.5%</td>
<td>60%</td>
<td>6.0%</td>
<td>40.75%</td>
<td>40%</td>
<td>15.9%</td>
</tr>
<tr>
<td>8.5%</td>
<td>80%</td>
<td>6.0%</td>
<td>40.75%</td>
<td>20%</td>
<td>28.3%</td>
</tr>
</tbody>
</table>

+ **One asset return can support many potential equity returns**, depending on leverage assumptions:

  - Formula: Asset return = E * Re + D (1-T) * Rd

+ **In theory**, as leverage increases, equity becomes riskier, because equity gets paid after debt. More risk requires a higher equity return (otherwise, for the same return, investors will choose to invest in a less risky asset).

+ **Mathematically**, increased use of debt priced lower than the asset return produces more return for equity.

FINANCING DOES NOT IMPACT THE RISK OF THE UNDERLYING ASSET SO ASSET RETURN DOES NOT CHANGE
What drives capital structure?

Achieved capital structure (D:E ratio) is a balance:
- Developers want to achieve highest equity returns possible. This is achieved by adding leverage.
- Lenders want to make sure they are repaid. This is achieved by limiting leverage.

Debt service coverage ratio (DSCR) dictates the amount of debt a developer can obtain for its project.
- Formula: \( \text{DSCR} = \frac{\text{operating profit}}{\text{debt service}} \)

Minimum ratio depends on risks perceived by lenders
- 1.5 or so is usually adequate for a project with a good contract
- Higher coverage ratios are required for riskier projects

Projects with ITC, PTC front-load tax benefits, reducing LCOE, so support less debt in the capital structure
What is the Relationship Between “WACC” and “Asset Return”

Terminology: WACC

- WACC means weighted average cost of debt & equity capital that investors have invested in the asset

Asset return should be greater than or equal to WACC

- Otherwise, the investment produces a negative NPV
- Herein, have used “cost of capital” (note not “WACC”) to mean “asset return”

If WACC equals asset return, then target returns are achieved
Asset return is all about pricing risk.

You need to think about the risk of the underlying asset before you can price it (what is the goal of the analysis?)

How the asset is financed does not change the risk of the asset and does not change the asset return.

The equity return will change depending on how much debt is assumed.

Publicly available studies point to an asset return of around 8.5% for California generation assets holding a long-term contract with a California IOU.
Project Finance Considerations

+ Project (non-recourse) financed assets have additional fees and reserve accounts that should be considered if the goal of the analysis is to model this type of structure.

- Reserve accounts: debt service, major maintenance
  - Funded upfront – increases capex funding requirements
- Finance fees
  - Upfront, commitment fees
  - Additional legal costs
- Debt Service Coverage Ratio (DSCR) requirements
  - CFADS / DS = ~ 1.5
  - ITC, PTC scenarios are able to sustain less debt
    - Change capital structure when modeling these resources
    - More equity in capital structure reduces equity return
Utilization of tax benefits depends on project-specific structuring

- Tax benefits fully utilized in year available (keeping all else fixed, produces lowest possible LCOE)
- Tax losses carry forward 7 years (keeping all else fixed, produces highest possible LCOE)

Tax benefits vary depending on in-service year

- Cash grant, accelerated depreciation, ITC level

LCOE cost bookends could highlight these issues, illuminating range of possible outcomes

- Could segment results by tax appetite, in-service year
Focus on LCOE is driven by RPS regulations mandating MWh of energy procured

LCOE metric doesn’t appropriately measure dispatchable capacity resources

- Generators provide multiple products (energy, capacity, ancillary services)
- Dispatchability means LCOE result swings dramatically depending on capacity factor assumption
- CT, CCGT LCOE not appropriate benchmarks for as-available renewable technologies

Suggest resources be classified by type, separate capacity & energy for dispatchable resources

- $/MWh energy values varying per capacity factor
- $/kW-yr capacity values, not converted into $/MWh
System Perspective

+ **System cost analysis should include**
  - LCOE
  - Transmission costs (CREZ)
  - Distribution savings (DG)
  - Integration costs (intermittent)
  - Capacity value (NQC)
  - Energy value (peak, off-peak)

+ **LCOE should not reflect system costs/benefits**

+ **Time-of-delivery (TOD)**
  - Impacts included in system cost assumptions
  - LCOE analysis typically post-TOD, reflecting PPA payments received by developer, achieving target return
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Michele Chait – Senior Consultant
- 15+ years in energy industry
- Leads valuation, regulatory finance, project finance, contract structuring, utility cost of service, and tax.