Energy+Environmental Economics

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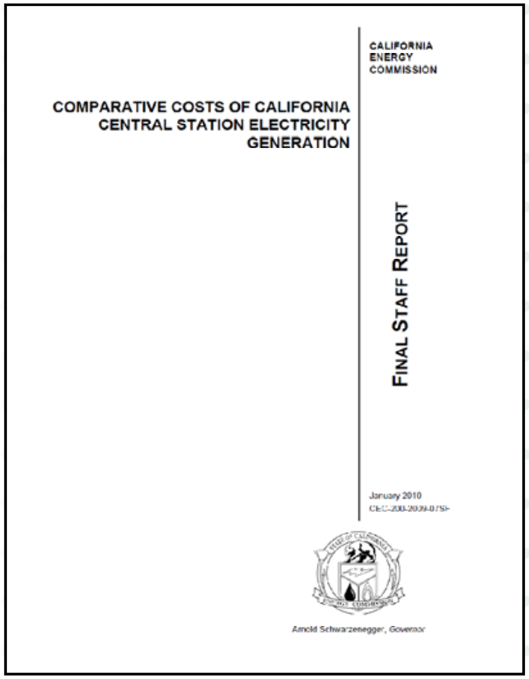
CEC Cost of Generation Workshop

16 May 2011

Michele Chait
michele@ethree.com
415 391 5100

Overview & Framework

- **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**


CALIFORNIA ENERGY COMMISSION

COMPARATIVE COSTS OF CALIFORNIA CENTRAL STATION ELECTRICITY GENERATION

FINAL STAFF REPORT

January 2010

Arnold Schwarzenegger, Governor

Proposition

- **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

Attribute	Examples
Location	California: weather, earthquakes, legal framework, power crisis history & power markets.
Technology	New or established. Presence of manufacturer, O&M guarantees.
Revenue Expectation	Merchant or contracted. Contract terms impacting revenue (i.e., availability). Credit quality of off-taker.
Cost Expectation	Contract terms impacting costs (i.e., take-or-pay).
Regulatory Uncertainty	Curtailment, cap & trade, once-through cooling.
Finance Market	Inflation, tenor.

COST OF CAPITAL CANNOT BE PRICED IN ABSENCE OF CONTRACT TERMS AND ASSET RISK SPECIFICS

LCOE Analysis: IPP Cost of Capital

- **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

a	b	c	d	e	f	g	h	i
Value Line Rating	Company Name	Value Line Beta	Zacks Beta	Standard & Poor's Beta	Average Beta	Company Tax Rate	Debt Equity Ratio [1]	Unlevered Beta [2]
	Merchant Generators							
B+	NRG Energy, Inc.	1.15	0.81	0.82	0.93	0.40	1.16	0.73
C+	GenOn Energy, Inc.	NMF	1.71	1.04	1.38	0.00	1.37	1.18
B	AES Corp.	1.20	1.42	1.38	1.33	0.30	1.86	0.70
C+	Dynegy, Inc.	1.45	1.13	1.12	1.23	0.00	3.27	0.46
	Mean	1.27	1.27	1.09	1.22	0.18	1.91	0.77
	Median	1.20	1.28	1.08	1.28	0.15		0.72
	Weighted				1.22	0.26		0.75
	Diversified Electric Utility							
A	Exelon Corp.	0.85	0.62	0.62	0.70	0.36	0.33	0.58
A	Duke Energy Corp.	0.65	0.44	0.43	0.51	0.33	0.58	0.38
A	Sempra Energy	0.85	0.60	0.58	0.68	0.31	0.43	0.54
B++	Xcel Energy Inc.	0.65	0.45	0.45	0.52	0.37	0.76	0.35
	Mean	0.75	0.53	0.52	0.60	0.34	0.53	0.46
	Median	0.75	0.53	0.52	0.60	0.34		0.46
	Weighted				0.60	0.34		0.47

Merchant Generators Relevered Beta based on 45% Debt Capital Structure	1.11 [3]
Diversified Electric Utilities Relevered Beta based on 40% Debt Capital Structure	0.65 [3]
Merrill Lynch Adjusted Beta Independent Power Producers	1.10

Sources: Columns a, b, c and g were extracted from the Value Line Investment Survey Reports.
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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

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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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Calculation of Equity Return

Calculation of <u>Equity Return</u>:

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

Equity return = Rf + βe * (Market risk premium)

- Equity return = 0.0437 + 1.118 * 0.067 = 11.86%
- Assumes 55% equity

SBE Makes Further Adjustments to Equity Return

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

	Modern Technology
2010 Recommended Rate	14.00%
CAPM - Ex Ante	10.19%
CAPM - Ex Post	12.41%
Risk Premium Analysis [1]	14.53%
2011 Recommended Rate	13.25%

Facility Type	Equity Recommended Rate	Equity Flotation Cost in %	Equity Adjusted Rate
Modern Electric Generation Technology [1]	13.25%	4.50%	13.87%

BOE Cap Rate Study Summary Conclusions

Facility Type	Ratings		Capital Structure		Rates of Return		Basic Cap Rate[3]
	Value Line Financial	Moody's Bond	Common Equity	Debt	Common Equity	Debt	
Modern Electric Generation Technology [1]	C++	B2	55%	45%	13.87%	7.83%	11.16%
Older Electric Generation Technology [2]	C++	B2	55%	45%	15.97%	8.85%	12.77%

+ 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?

Source	Asset Return
2009 MPR	8.25%
E3 33% RPS model	8.70%
COG – IPP Alternatives	8.45%
COG – IPP Fossil	10.46%

- **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?

Asset Return (Unlevered Return)	D Debt %	Debt Interest Rate (Rd)	Tax Rate (T)	E Equity %	Equity Return (Re)
8.5%	30%	6.0%	40.75%	70%	10.6%
8.5%	60%	6.0%	40.75%	40%	15.9%
8.5%	80%	6.0%	40.75%	20%	28.3%

- **One asset return can support <u>many potential equity returns</u>, depending on leverage assumptions:**
  - Formula: Asset return = E * Re + D (1-T) * Rd
- **<u>In theory</u>, 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).**
- **<u>Mathematically</u>, 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: DSCR = operating profit / 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**

Cost of Capital Summary

- 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

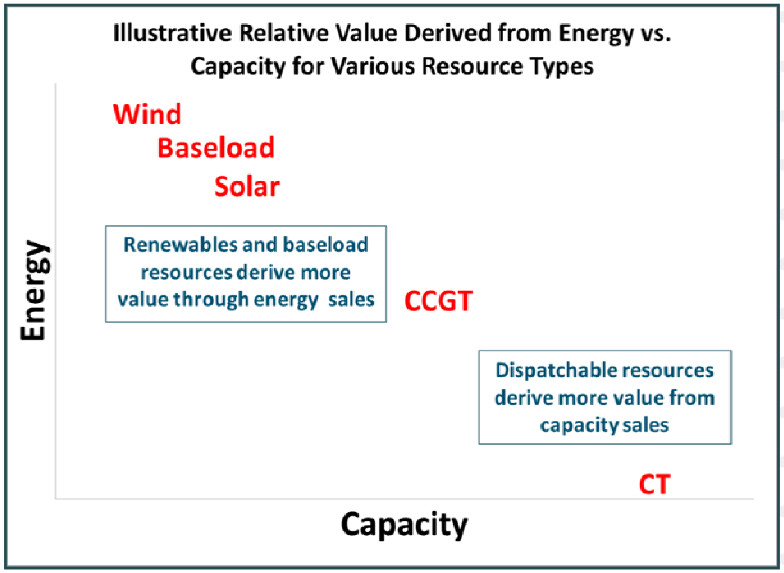
- **Project (non-recourse) financed assets have additional fees and reserve accounts that should be considered if the goal of the analysis is to model this type of structure.**
  - Reserve accounts: debt service, major maintenance
    - Funded upfront – increases capex funding requirements
  - Finance 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

Timing of Tax Benefits

- **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

Treatment of Dispatchable Resources

- **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

Thank you!

- **Energy and Environmental Economics, Inc. (E3) has provided consulting services and expert analysis on key issues facing electricity sector clients since its founding in 1989.**
- **Robust analytics combined with policy depth uniquely position E3 to provide clients with analytical, technical and regulatory expertise to maximize the value of their assets**
- **Michele Chait – Senior Consultant**
  - 15+ years in energy industry
  - Leads valuation, regulatory finance, project finance, contract structuring, utility cost of service, and tax.