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Energy Environmental Economics
Responses from 19 September 2006 Technical Conference

This excel file provides responses to data requested of Energy and Environmental Economics during testimony on Tuesday, September 19, 2006

These responses are summarized as follows:

"Formula Proof" tab	In response to Dr Lazar's statements that the market return, Rm, is not the same in formulas 1-3 referenced in our presentation, and that Ra is not equal to WACC, we provide proof that Rm must be the same in all cases and that Ra and WACC are equivalent.
"Cannon WACC table" tab	In response to Dr Lazar's request, we have re-calculated after tax WACC per Cannon methodology assuming a debt rate of 5.8% in all cases. Dr. Lazar believed that the WACC would be lower with higher debt in the capital structure due to the effect of the debt tax shield. In fact, the decreased WACC is due also to the decreased percentage of equity in the capital structure. This is demonstrated by the use of pre-tax interest rates to calculate WACC.
"ROE all regulated" tab	In response to Dr Lazar's and Jay Shepherd's requests, we provide calculation of the 6.47% asset return and re-lever that asset return with 60% debt with a 6% interest rate to achieve an ROE of 10.4%. We prove that the weighted average of the resulting debt and equity betas equals the asset beta of 0.29 and that the weighted average of the ROE and debt rate equal the 6.47% WACC. These calculations prove the 10.4% ROE. While it has been stated that we would generally expect to see a utility equity beta of less than 1, it is important to note that the equity beta value is dependent upon capital structure. The 10.4% ROE described above is associated with a 60:40 capital structure, an equity beta of 1.07 and an after-tax debt beta of <0.23>. By way of comparison, the cohort companies, as shown on the"assetbetacalc" tab, have an average equity ratio of 51% and an equity beta of 0.78. Raising the debt to equity ratio from 51:49 to 60:40 increases the riskiness of and required return of equity. The resulting equity beta is therefore 1.07 and produces an equity return of 10.4%. Similarly, the comparable companies cohort, if we adjust for a 60:40 capital structure, would have an average equity beta of 1.07.
"assetbetacalc" tab	Calculates unlevered asset betas from observed equity betas, per appendix A. Also calculates levered equity betas and debt betas for each firm.

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In response to Lazar's proposition that Rm is different in formulas 1-3 below and that Ra is not equal to WACC, the analysis below proves that Rm must be the same in all cases and that Ra and WACC are equivalent. It does so by deriving formula 8 from formula 4 and formulas 1, 2, 3
Lazar and Prisman used formula 8 to calculate asset betas from observed equity betas
Formula numbers referenced correspond to the formula table in our presentation

1	Rd * (1-t) =	Rf + Bd * (Rm - Rf)
2	Ra =	Rf + Be * (Rm - Rf)
3	Re =	Rf + Be * (Rm - Rf)
4	WACC = Ra =	E * Re + D * (1- T) * Rd

In formula 4, replace Ra, Re, Rd with formulas 1, 2, 3:

Rf + Ba * (Rm-Rf) = D * (Rf + Bd * (Rm-Rf)) + E * (Rf + Be * (Rm-Rf))
This equation uses the relationship that Ra = WACC = Rf + Ba * (Rm-Rf)

The equation above can be rewritten as:

Rf + Ba * (Rm - Rf) = (D + E) * Rf + D * Bd * (Rm-Rf) + E * Be * (Rm -Rf)

Since D + E = 1, you can subtract Rf from both sides, then:

Ba * (Rm-Rf) = D *Bd *(Rm-Rf) + E*Be*(Rm-Rf)

Then divide both sides by (Rm-Rf):
This can be done because Rm and Rf are the same in all cases

Ba = D*Bd + E*Be

This says that the asset beta is the weighted average of the debt and equity betas
This is a similar relationship to that which we see in the WACC formula.

Because we are calculating the unlevered, all equity firm, we make the assumption that Bd = 0

Then Ba = Be * E

Rewriting the equity percentage E as equity divided by total firm value, we have:

Ba = Be * (E/[(1-T)*D + E]

Dividing numerator and denominator by E we have:

Ba = Be * (1/(1-T)*D/E + 1)

Which can be rewritten as:

Formula 8: Ba = Be/ [1+ (1-T)*D/E]
This is the formula for calculating the unlevered, asset beta from the observed equity betas

QED

Cannon WACC table Tab
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Table of Cannon After-Tax WACC (presentation slide 17)

% D	% E	Debt Rate	Tax Rate	After Tax Debt Rate	Equity Return	After Tax Asset Return
65%	35%	5.80%	36%	3.71%	9.00%	5.56%
60%	40%	5.90%	36%	3.78%	9.00%	5.87%
55%	45%	6.00%	36%	3.84%	9.00%	6.16%
50%	50%	6.25%	36%	4.00%	9.00%	6.50%

Table of Cannon After-Tax WACC (presentation slide 17) with debt rate constant 5.8% - Lazar's Question

% D	% E	Debt Rate	Tax Rate	After Tax Debt Rate	Equity Return	After Tax Asset Return	PreTax Asset Return
65%	35%	5.80%	36%	3.71%	9.00%	5.56%	6.92%
60%	40%	5.80%	36%	3.71%	9.00%	5.83%	7.08%
55%	45%	5.80%	36%	3.71%	9.00%	6.09%	7.24%
50%	50%	5.80%	36%	3.71%	9.00%	6.36%	7.40%

Dr Lazar proposed that the value of the debt tax shield would decrease the after-tax asset return, so
After Tax Asset Return would be lower with more debt in the capital structure.
In fact, the after tax asset return is declining (with increasing debt) not only due to the tax effect but also because the percent equity is decreasing
This is demonstrated by using the pre-tax debt interest rate to calculate the asset return.

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In Appendix A, the after-tax, unlevered betas are calculated per the following formula:

{ 1 } **Ba =** **[Be * E + Bd * D * (1-T)] / [E+ (1-T)*D]**

In order to calculate Ba, it is assumed that Bd equals zero, therefore the formula reduces to:

{ 2 } **Ba =** **Be / [1+ (1-T)*(D/E)]**

Where: **Ba =** unlevered, after tax asset beta
Be = levered equity beta
T = the tax rate
D = % debt
E = % equity

Using the above formula {2} for Ba, and using figures from the 60-month all rate-regulated scenario, we have:

Ba =	0.29	per Staff (see assetbetacalc tab for complete calculation)
T =	0.36	per Staff
E =	40%	per Staff
D =	60%	per Staff

Also using the formula {2} above, Staff calculates that:

Be =	0.57

NOTE THAT USE OF THE ABOVE FORMULA ASSUMES THAT THE DEBT BETA IS ZERO

We can use the formulas below to calculate Re, the equity return, and Ra, the asset return

{ 3 } **Ra =** **Rf + Ba * (Rm - Rf)**
{ 4 } **Re =** **Rf + Be * (Rm - Rf)**

Where:

Ba =	0.29	per Staff
Be =	0.57	per Staff
Rm =	10.06%	per Staff
Rf =	5.01%	per Staff

Then

Ra = WACC =	0.0647	This figure has been calculated per {3} above using Staff's assumptions
Re =	0.0787	per Staff, see calculation per {4} above

Then we can calculate the debt interest rate that yields Ra= WACC

{ 5 } **WACC = Ra =** **E * Re + D (1- T) * Rd**

Or, using the same formula, we have:

{ 6 } **Rd =** **[Ra - E * Re] / [D * (1-T)]**

Where:

E =	0.40
Re =	0.0787
D =	0.60
T =	36%
Ra =	0.0647

Then we determine that

Rd =	0.0865	This figure has been calculated per {6} above

Note that if we use an equity return of .0787 and a debt return of .06, we have
WACC = Asset Return = 5.46%
This result is not consistent with the asset return, or WACC we calculated of .0647 using an asset beta of 0.29
If we use an equity return of 7.87%, with debt rate at 6%, the distribution company will not be adequately compensated for its risk

NOTE WE HAVE DETERMINED THAT THE DEBT RATE STAFF USED TO CALCULATE AN EQUITY RETURN OF 0.0787 IS 0.0865
THIS IS AN INCONSISTENT RESULT BECAUSE DEBT IS LESS RISKY THAN EQUITY AND MUST EARN A LOWER RETURN
WITH A DEBT RATE OF 6%, AN EQUITY RETURN OF 7.87% DOES NOT PROVIDE ADEQUATE COMPENSATION
WITH A DEBT RATE OF 6%, AN EQUITY RETURN OF 7.87% IS INCONSISTENT WITH THE ASSET BETA OF 0.29
THEREFORE, THE CALCULATED EQUITY RATE IS NOT CORRECT

WE PROVIDE THE CORRECTED CALCULATIONS BELOW:

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{ 5 } **WACC = Ra =** **E * Re + D * (1- T) * Rd**

Or, using the same formula, we have:

{ 7 } **Re =** **[Ra - D * (1-T) * Rd] / E**

Where:

E =	0.40
Rd =	0.0601
D =	0.60
T =	36%
Ra =	0.0647

Note: Staff has not recommended a debt value in their current proposal; we use here Staff's previous recommended debt value of .0601

Then we determine that

Re = **0.1040**

This figure has been calculated per {7} above

We can calculate the equity and debt betas associated with this leverage structure:

Where:

{ 4 } **Re =** **Rf + Be * (Rm - Rf)** so **Be =** **(Re - Rf) / (Rm - Rf)**
{ 8 } **Rd * (1-t) =** **Rf + Bd * (Rm - Rf)** **Bd =** **(Rd * (1-T) - Rf) / (Rm - Rf)**

Then we calculate that

Per formula { 4 }	Be =	1.07
Per formula { 8 }	Bd =	-0.23

NOTE Be IS NOT EQUAL TO STAFF'S CALCULATION OF: 0.57

WE CAN CHECK THAT THESE CALCULATIONS ARE CORRECT:

Check that the betas calculated above are correct:

Ba = **D * Bd + E * Be**

Ba = 0.29

THIS CHECKS EXACTLY TO STAFF/L&P'S ASSET BETA VALUE

Check that the debt and equity rates yield the WACC

WACC = RA = 0.0647

THIS CHECKS EXACTLY TO THE CALCULATED ASSET RETURN

SO WHAT DOES ALL OF THIS MEAN ?

*** The methodology Staff used to calculate ROE is flawed. The flawed ROE is:**	**7.9%**
*** The flawed ROE is based on a debt rate of :**	**8.6%**
*** The flawed ROE is LOWER than the debt rate, which is contradicts standard risk and return theory**	
*** A more appropriate debt rate, per Staff's previous recommendation, is:**	**6.0%**
*** Using the more appropriate debt rate, the correct ROE is:**	**10.4%**
*** With the additional 50bp flotation and transaction cost, the correct ROE is:**	**10.9%**

Response to Shepherd Question:

1. If the WACC is 5.5% then we can calculate the ROE as follows:
   5.50% .6 * .64 * .06 + .4 * ROE

ROE = 7.99%

assetbetacalc Tab
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60 month, all rate regulated - 60:40 D:E

%D	%E	Rd	Rf	Rm
60%	40%	0.06	5.01%	10.06%

Equity Beta	Tax Rate	Equity	D/E	After Tax Unlev Beta	After Tax Debt Beta	After Tax Equity Beta
0.34	0.36	0.48	1.09	0.20	-0.232	0.85
0.28	0.36	0.43	1.33	0.15	-0.232	0.73
-0.43	0.36	0.98	0.02	-0.43	-0.232	(0.72)
0.09	0.36	0.34	1.95	0.04	-0.232	0.45
0.74	0.36	0.52	0.93	0.46	-0.232	1.51
0.59	0.36	0.46	1.18	0.34	-0.232	1.19
0.14	0.36	0.32	2.14	0.06	-0.232	0.50
0.27	0.36	0.33	2.04	0.12	-0.232	0.64
0.44	0.36	0.53	0.90	0.28	-0.232	1.05
1.1	0.36	0.59	0.69	0.76	-0.232	2.26
0.52	0.36	0.58	0.72	0.36	-0.232	1.24
1.61	0.36	0.60	0.67	1.13	-0.232	3.17
Averages	**0.474**	**0.360**	**0.513**	**1.139**	**0.289**	**-0.232**	**1.070**

60 month, all rate regulated - 50:50 D:E

%D	%E
49%	51%

Equity Beta	Tax Rate	Equity	D/E	After Tax Unlev Beta	After Tax Debt Beta	After Tax Equity Beta
0.34	0.36	0.48	1.09	0.20	-0.232	0.61
0.28	0.36	0.43	1.33	0.15	-0.232	0.52
-0.43	0.36	0.98	0.02	-0.43	-0.232	(0.61)
0.09	0.36	0.34	1.95	0.04	-0.232	0.30
0.74	0.36	0.52	0.93	0.46	-0.232	1.12
0.59	0.36	0.46	1.18	0.34	-0.232	0.88
0.14	0.36	0.32	2.14	0.06	-0.232	0.34
0.27	0.36	0.33	2.04	0.12	-0.232	0.45
0.44	0.36	0.53	0.90	0.28	-0.232	0.76
1.1	0.36	0.59	0.69	0.76	-0.232	1.71
0.52	0.36	0.58	0.72	0.36	-0.232	0.91
1.61	0.36	0.60	0.67	1.13	-0.232	2.42
Averages	**0.474**	**0.360**	**0.513**	**1.139**	**0.289**	**-0.232**	**0.784**