Pacific Gas and Electric Company Securitization

A. 20-04-023

TURN HEARING EXHIBIT

TURN-41 Revised

TURN responses to

PG&E DR4, Q3(a) and (b)

PG&E DR7, Q4

PACIFIC GAS AND ELECTRIC COMPANY
Application 20-04-023
(Securitization)

TURN Response to PG&E Data Requests Set 4

PG&E Data Request No.:	PGE_TURN004
PG&E File Name:	Securitization2020_DR_PGE_TURN004
Date Requested:	November 16, 2020
Date of Response	November 23, 2020, Revised (Q11) November 25

Q 3: With respect to Table 3 of the revised Ellis Testimony dated November 10, 2020:

a. Confirm the following present value calculations:

	Net Present Value @ 6.00%	Net Present Value @ 7.34%	Net Present Value @ 10.25%
Ellis Table 3 Customer EV @ 2050	($330)	($330)	($330)
Periods (years)	30	30	30
Discount Rate	6.00%	7.34%	10.25%
PV @ 2020	($57.5)	($39.4)	($17.7)

The calculations shown in the table are correct. TURN does not agree that these numbers represent the net present value of the Trust to customers.

b. If TURN disagrees with any number in the table in part a, describe any mistake or error or disagreement, and provide what TURN believes is the PV amount of the negative $330 million shown on Row 23 of Table 3 using discount rates of 6.0%, 7.34%, and 10.25%.

TURN disagrees with PG&E's use of the present value of 2050 Customer EV as an indicator of the Trust's value to customers or the Trust's ratepayer-neutrality. Present value of expected future value is a meaningless and misleading metric because it violates several core financial principles – specifically risk-adjusted discounting and value additivity – and introduces systematic bias that is mathematically proved by Jensen's inequality. This bias significantly overstates the Trust's present value.

<u>Risk-adjusted discounting</u>

On page 10-4 of its rebuttal testimony, PG&E cites the "leading MBA finance text," *Principles of Corporate Finance* by Brealey, Myers, and Allen. This work discusses risk-adjustment of discount rates (p. 213-14):

> *Today most companies start with the company cost of capital as a benchmark risk-adjusted discount rate for new investments. The company cost of capital is the right discount rate only for investments that have the same risk as the company's overall business. For riskier projects the opportunity cost of capital is greater than the company cost of capital. For safer projects it is less.*
>
> …
>
> *The company cost of capital is* not *the correct discount rate if the new projects are more or less risky than the firm's existing business. Each project should in principle be evaluated at its* own *opportunity cost of capital. This is a clear implication of the value-additivity principle [emphasis in original].*

The Trust clearly has a different risk profile than PG&E's overall business: it has securities market exposure and is far more highly leveraged. PG&E's use of return on rate base to discount the Trust's net cash flows is entirely inappropriate, and they have presented no evidence to support using this rate.

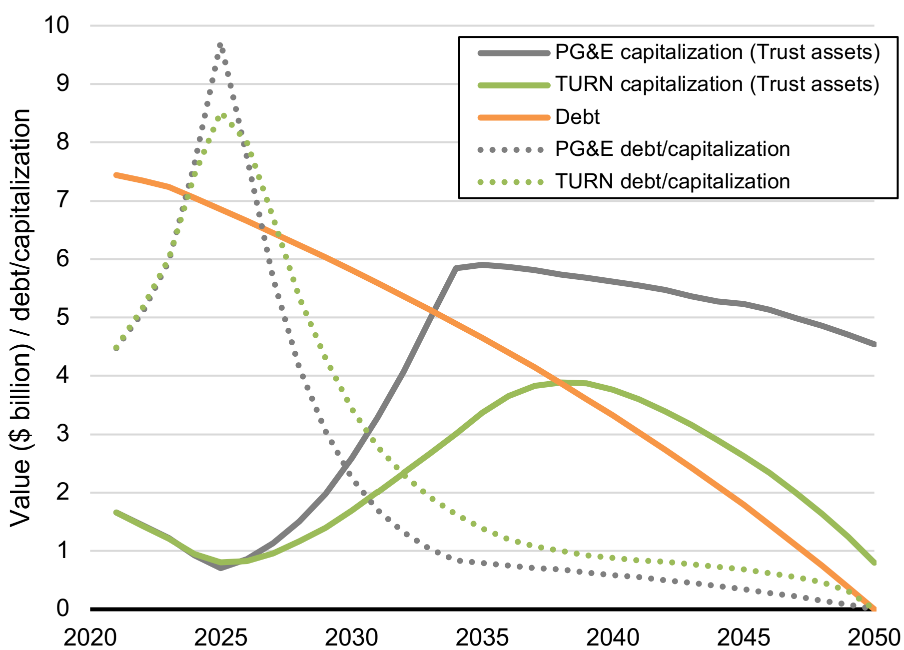
Value additivity

Value additivity is discussed elsewhere in the same text (p. 178):

> *The total value is the sum of its parts.*
>
> *This conclusion is important for corporate finance, because it justifies adding present values. The concept of value additivity is so important that we will give a formal definition of it. If the capital market establishes a value PV(A) for asset A and PV(B) for B, the market value of a firm that holds only these two assets is*
>
> $$PV(AB) = PV(A) + PV(B)$$
>
> *A three-asset firm combining assets A, B, and C would be worth PV(ABC) = PV(A) + PV(B) + PV(C), and so on for any number of assets. We have relied on intuitive arguments for value additivity. But the concept is a general one that can be proved formally by several different routes. The concept seems to be widely accepted, for thousands of managers add thousands of present values daily, usually without thinking about it.*

An additional reason, related to the first two, a weighted average cost of capital cannot be used to value the Trust is its changing capital structure, or ratio of debt to total capitalization (i.e., Trust assets) and debt, as shown in Figure 1.[1] As explained in a second reference cited by Dr. Cornell on p. 10-4, *Valuation* by Koller, Goedhart, and Wessels (p. 114 in the fifth edition), "If you discount all future cash flows with a constant cost of capital, as most analysts do, you are implicitly assuming the company keeps its capital structure constant at a target ratio of debt to equity."

Figure 1. Customer Credit Trust capital structure



Given the different risk profiles and, therefore, discount rates of the Trust's

[1] Even under PG&E's assumptions, the Trust's debt/capitalization ratio is greater than 1.0 – i.e., it is effectively bankrupt – until 2034.

various cash flow streams, as well as its changing capital structure, value additivity *must* be used to calculate the net present value of the Trust, i.e., we *must* “segment, and separately discount, [the different] elements of the securitization.”[2]

A simple example illustrates why. Assume we have two cash flow streams:

- A debt (D) of $50 that must be repaid in 10 years. The interest rate is 3%.
- A risky asset (A1) that has a 50/50 chance of paying $80 or $30 ($55 expected value) in ten years. The discount rate is 6%.

Table 1 summarizes these assumptions and the calculation of present value under the TURN’s and PG&E’s approaches.

Table 1: Illustrative model of TURN’s and PG&E’s valuation approaches

Cash flow stream	Future value	Probability	Expected value	Discount rate	Discount factor	Present value
TURN: sum of PV of EV						
D	-50	100%	-50	3%	0.74	-37.2
A1	80	50%	55	6%	0.56	30.7
	30	50%				
Total						-6.5
PG&E: PV of sum of EV			5	7%	0.51	2.5

When the individual future expected values are discounted at their corresponding discount rates to get their present values, we see that the total is negative (-6.5). Even though the future expected value of the risky asset is greater than that of the debt (55 vs. 50), its greater risk entails a higher discount rate, so its present value is less (30.7 vs. 37.2). The present value of the portfolio is simply the sum of their present values (-6.5). When the expected values are summed and then discounted at a single rate, the present value is positive (2.5). These two approaches to a seemingly simple analysis would produce two opposite decisions: reject in the first, accept in the second.

What happens if the risk of the risky asset is increased? A2 has a 50/50 chance of paying $110 or $0 (same $55 expected value) and a discount rate of 15%. Table 2 summarizes these revised assumptions and the calculation of present value under the two different approaches.

Table 2: Illustrative model of TURN’s and PG&E’s valuation approaches with a riskier

[2] PG&E Rebuttal testimony, p. 10-3.

asset

Cash flow stream	Future value	Probability	Expected value	Discount rate	Discount factor	Present value
TURN: sum of PV of EV						
D	-50	100%	-50	3%	0.74	-37.2
A2	110	50%	55	10%	0.39	21.2
	0	50%				
Total						-16.0
PG&E: PV of sum of EV			5	7%	0.51	2.5
			5	25%	0.11	0.5

Under TURN's approach the riskier asset has a higher discount rate, so its present value is lower (21.2), and the sum of the present values is even more negative (-16.0). Under PG&E's approach, the sum of the future expected values is unchanged, 5.0. Discounting at the same blended discount rate as in the previous example yields the same present value, 2.5 – *even though the risk is higher*.

But can't the discount rate be adjusted to compensate for the higher risk? No. Table 2 includes an additional line showing the present value of the expected value at a "risk-adjusted" discount rate of 25%. The result is smaller (0.5) but still positive. Because the expected future value is positive, the discount rate can be adjusted to (nearly) infinity, and the present value will remain positive.

Something is clearly wrong in a valuation methodology that is completely insensitive to risk. A mathematical principle known as Jensen's inequality explains why.

Jensen's inequality[3]

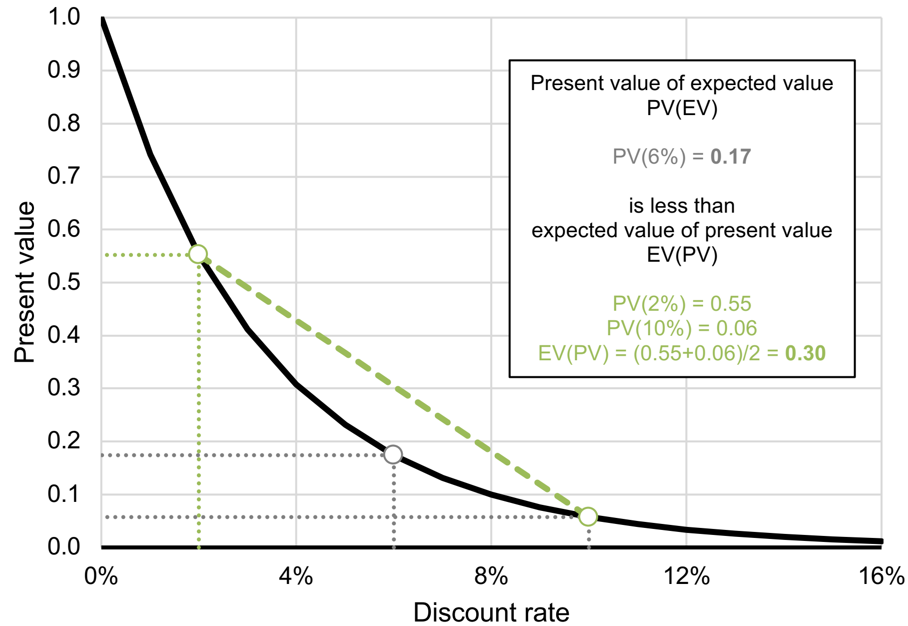
Jensen's inequality states that, for any convex function *g*, *g* of the expected value must be less than the expected value of *g*:

$$g(E[X]) \leq E[g(X)].$$

A function is convex if a line segment between any two points on the graph of the function lies entirely above the graph. Present value, $1/(1+r)^t$, is a convex function. As illustrated in Figure 1 below, Jensen's Inequality means that the present value of the expected value (PG&E's approach of discounting the Trust's final expected value back to today at a single discount rate) must be less than or equal to the expected value of the present value (TURN's approach of segregating the cash flow streams, discounting them to today, then summing them).

[3] See, for example, https://www.probabilitycourse.com/chapter6/6_2_5_jensen's_inequality.php.

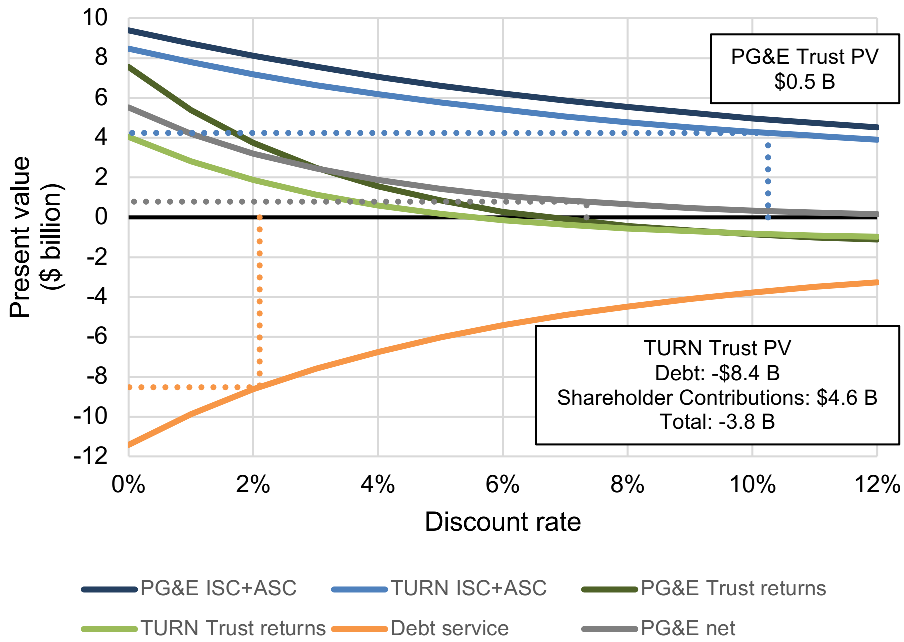
Figure 2. Jensen's inequality and present value



From this chart, it might be concluded that PG&E's approach *understates* the true value of the Trust relative to TURN's. But this is not correct, because the Trust is made of several cash flow streams, not all of which are positive; the Recovery Bonds, in particular, are an outflow (negative cash flow) from the Trust and dominate its valuation. A corollary of Jensen's inequality is that for any concave function (for example, the present value of a negative value, $-1/(1+r)^t$), the expected value of the present value must be *greater* than the expected value of the present value. By implicitly discounting the Recovery Bonds' cash flows at the return on rate base, PG&E significantly *understates* their true cost to customers.

Figure 2 redraws Figure 1 with the present value of each of the Trust's cash flow streams under both PG&E's and TURN's assumptions as a function of the discount rate, as well as the net under PGE's assumptions. There are separate lines for TURN's and PG&E's Shareholder Contributions, due to their differing forecasts (although they both have the same nominal value at $r = 0\%$). The dotted lines indicate the present values at the respective discount rates assumed by both TURN and PG&E.

Figure 3. Present value of Trust cash flow streams as a function of discount rate



The present values (on the *y*-axis) all tie to those PG&E and TURN have presented in testimony.[4] The Trust returns, which include both positive and negative values, cross the *x*-axis (are equal to zero) at the Trust's expected after-tax return (~5.9% for PG&E, ~5.0% for TURN).[5] The two Shareholder Contribution lines are very close to each other. While PG&E and TURN disagree sharply about their timing, the difference in valuation is due more to the discount rate assumption (PG&E's implicit 7.34% vs. TURN's 10.25%) than their timing.

This chart demonstrates how the different risk profiles of the different cash flow streams, reflected in the different discount rates in TURN's approach, affect the Trust's value. Under the principle of value additivity, the Trust's true NPV is the sum of the NPVs of these separate cash flow streams.

Under PG&E's approach of summing the cash flows then discounting, it is impossible to have a negative present value as long as the nominal (undiscounted) cash flows of the Trust sum to a positive number. Positive expected value, a metric that *completely ignores both risk and the time-value-of-money,* is a meaningless and, indeed, misleading indicator of ratepayer-neutrality.

[4] The TURN present value in this chart includes the foregone value of the interest tax deduction but excludes the loss of value due to Surplus Sharing and the Customer Credit shortfall tax gross-up.
[5] The returns shown are *excess returns*, the return on the Trust balance in excess of the assumed discount rate. Without this adjustment, the present value would double-count the returns. The calculation of geometric mean return in Callan's model only includes values when the Trust balance is positive and therefore understates the return needed for the Trust excess returns to have an NPV of zero. As a result, the Trust return lines in the chart cross the *x*-axis at slightly higher values than those calculated in Callan's model.

PACIFIC GAS AND ELECTRIC COMPANY
Application 20-04-023
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TURN Response to
PG&E Data Requests
Set 7

PG&E Data Request No.:	PGE_TURN007
PG&E File Name:	Securitization2020_DR_PGE_TURN007
Date Requested:	November 25, 2020
Date of Response	December 4, 2020

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q 4: Does TURN agree that if State Street Global Advisors is not included in Figure 9 that the average return for US Fixed Income in Line 3 of Table 1 of the revised Ellis Testimony would be 2.84% instead of the 2.62% currently shown in that table, and the median return for US Fixed Income would be 2.82%?

There are no grounds to exclude State Street from the average or median 30-year return calculation. As the table in their report indicates (p. 4), their long-term forecasts are for “10+ years”, i.e., inclusive of 30 years. In previous years State Street published 1-, 3-, 5-, 10-, and 30-year forecasts; more recently, their forecasts have been consolidated into “short-term 1 year,” “intermediate term 3-5 years,” and “long-term 10+ years.” If State Street’s current “long-term 10+ years” forecast were intended to be *only* through 10 years, it would be so labeled.

State Street, and several other forecasters, have updated their forecasts since Mr. Ellis completed his survey, as summarized in the following table (Excel file “Securitization2020_DR_PGE_TURN007 Q4.xlsx” and source reports attached).

CMA updates

		Previous				Update				Difference			
	Forecaster	BlackRock	JP Morgan	Research Affiliates	State Street (arithmetic)	BlackRock	JP Morgan	Research Affiliates	State Street (arithmetic)	BlackRock	JP Morgan	Research Affiliates	State Street (arithmetic)
	Nominal horizon	30	10	10	10+	30	10	10	10+				
	Previous date	6/20	3/20	9/20	3/20	9/20	9/20	10/20	9/20				
Asset class	**Return**												
Broad US equity	Near-term												
	Equilibrium												
	30-year												
US large cap	Near-term			2.31%			4.10%	2.23%				-0.08%	
	Equilibrium			5.12%			7.05%	5.11%				0.00%	
	30-year	7.16%			6.20%	6.82%			5.70%	-0.34%			-0.50%
US small cap	Near-term			4.19%			4.60%	5.21%				1.03%	
	Equilibrium			5.76%				5.65%				-0.10%	
	30-year	7.51%			6.70%	7.46%			6.20%	-0.04%			-0.50%
Non-US equity	Near-term												
	Equilibrium												
	30-year								6.60%				
Developed ex-US	Near-term			7.18%			6.50%	7.30%				0.13%	
	Equilibrium			6.62%				6.69%				0.07%	
	30-year	7.37%				7.27%			5.80%	-0.10%			
Emerging	Near-term			9.15%			7.20%	9.25%				0.10%	
	Equilibrium			7.51%			8.90%	7.66%				0.15%	
	30-year	8.95%			9.90%	8.62%			8.60%	-0.33%			-1.30%
US fixed income	Near-term			0.87%				1.02%				0.15%	
	Equilibrium			1.99%				2.12%				0.13%	
	30-year	2.55%				2.53%				-0.02%			
Gov't	Near-term		2.20%				1.60%				-0.60%		
	Equilibrium		3.20%				3.00%				-0.20%		
	30-year				0.20%				0.10%				-0.10%
IG corp	Near-term		3.80%				2.50%				-1.30%		
	Equilibrium		4.70%				4.50%				-0.20%		
	30-year				1.10%				0.50%				-0.60%

Based on the data in Mr. Ellis's workpapers previously provided to PG&E ("MEllis workpapers 111020.xlsx"), TURN arrives at a fixed income median of 2.81%, 1 bp lower than PG&E's estimate.

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