

## *Memorandum*

To: Catherine Benham and Steve Klein, VT Joint Fiscal Office  
From: Ezra Hausman  
Date: **January 15, 2010**  
Re: Preliminary analysis of Power Purchase Agreement proposal from Entergy

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### **Executive Summary**

**On December 18, 2009 Entergy proposed an agreement to sell power from Vermont Yankee to Vermont utilities according to a specific price schedule; this agreement would replace part of the existing revenue sharing agreement. The new proposal may be worth more to Vermont than the agreement it would replace, but it has more risk: it could end up costing Vermont ratepayers more than no agreement at all.**

- **The proposed agreement, like the existing agreement, only provides benefits for Vermont if the market price of power is above the contract price; however, the new agreement will cost Vermonters money whenever the market price falls below this level.<sup>1</sup>**
- **The proposed agreement could be worth more to Vermonters than the existing agreement, but only if the plant operates close to full capacity for the next 20 years. If the plant shuts down early for any reason, the existing agreement is likely to be worth more in total.**

**In this preliminary memorandum we quantify and compare the benefits and risks associated with both the existing and proposed agreements between the Vermont Utilities and the plant's owners, Entergy Nuclear Vermont Yankee (ENVY).**

### **Background**

Entergy Nuclear Vermont Yankee (ENVY), owners of the Vermont Yankee Nuclear Power Plant, presented the outlines of a proposed Power Purchase Agreement (PPA) to sell power to Vermont utilities Green Mountain Power (GMP) and Central Vermont Public Service (CVPS) in a letter dated December 18, 2009. While many details of this proposal are unclear, there is enough information to begin to analyze the value of the proposed PPA for Vermont ratepayers by making a number of assumptions as detailed below.

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<sup>1</sup> Assuming that the proposed purchase agreement requires Vermont utilities to purchase power at the contract price whenever the plant is running.

The proposed agreement would replace part of a “Revenue Sharing Agreement” between ENVY and the utilities that was put in place through a Memorandum of Understanding (MOU) at the time ENVY purchased the plant in 2002. This existing revenue sharing provides for a payment of 50% of all revenues earned by Vermont Yankee during the first ten years of its relicense period in excess of a certain “Strike Price”. The strike price begins at \$61/MWh, on an average basis for all energy and capacity sold by the plant, and escalates thereafter according to certain predefined inflation indices.

Under the existing revenue sharing agreement, at least 55% of the proceeds would be paid to GMP and CVPS. 7.5% would be paid to Central Maine Power. The remaining 37.5% of the proceeds may belong either to the Vermont utilities or to out-of-state entities that were previously co-owners of Vermont Yankee—there is some ambiguity in the language of the governing MOU in this area that has yet to be resolved.

The proposed agreement addresses the 55% of the existing revenue sharing value that indisputably belongs to GMP and CVPS. This value would be forfeited by the utilities, to be replaced by an agreement for the round-the-clock sale of 115 MW of power from the plant to the two utilities, representing about 18.5% of the output of the Vermont Yankee.<sup>2</sup> The power would be sold at a price equal to the “strike price” for the existing revenue sharing agreement. In the December 18 letter, Entergy Nuclear Vice President Jay Thayer claimed that the value of the proposed agreement would “produce approximately \$500 million of benefit for Vermont’s ratepayers, far in excess of the benefits likely to be provided by the RSA.”

## **Analysis and Results**

As appendices to this memo, we have attached spreadsheet analyses of both the proposed agreement (PPA) and the original revenue sharing agreement (RSA). Because the new proposal specifically proposes to replace the 55% share of the existing agreement for which the beneficiary is uncontested, the analysis considers only this portion of the existing agreement. If there is additional value of the revenue sharing for Vermont ratepayers, it would accrue with or without the new Entergy proposed agreement in place.

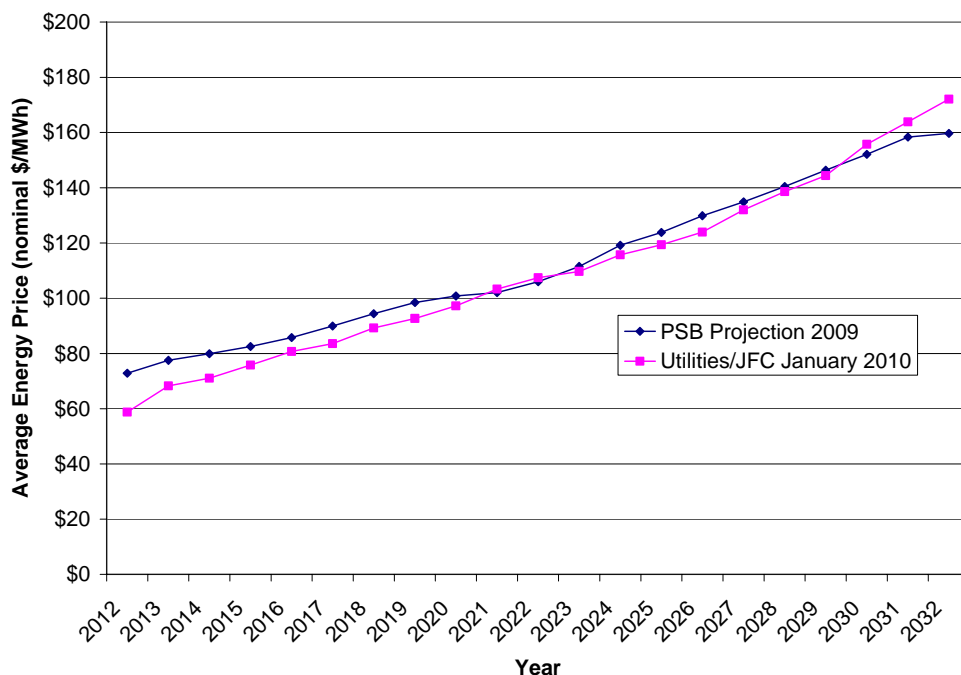
We have performed this analysis with two sets of price projections. The first is based on avoided electricity cost projections accepted by the Vermont Public Service Board (Appendix A).<sup>3</sup> It is our understanding that this set of projections was used by ENVY in forecasting the expected benefits for Vermont under their proposed agreement. The second set (Appendix B) comes from a recent modeling study undertaken on behalf of the utilities and the Joint Fiscal Committee in support of the economic analysis of

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<sup>2</sup> For this analysis, I assume that the PPA is *unit contingent*—that is, that the amount of power sold to the utilities is 18.55% of the output of the plant in each hour. This is the structure of the current PPAs between ENVY and Vermont utilities. Thus the average sale quantity would actually be less than 115 MW, on average.

<sup>3</sup> The Vermont Public Service Board (PSB) defines avoided cost as “what it would cost an electric utility to purchase and deliver electricity in the future”. These projections, available at <http://psb.vermont.gov/docketsandprojects/eu/avoidedcosts/2009>, are taken from the 2009 New England Avoided Energy Supply Cost (AESC) study. The PSB published avoided costs in constant 2009 dollars; The values used here have been inflated at an annual rate of 2.5%.

Vermont Yankee.<sup>4</sup> This second set of price projections are more up-to-date in terms of its underlying assumptions. The two sets of electricity price projections are shown graphically in Figure 1.



**Figure 1.** Comparison of PSB and Utilities/JFC electricity price projections.

While the forecasts were produced by different study groups using two different electricity market simulation models, it is likely that the difference between the two sets of numbers derives primarily from a significant downward revision of the U.S. Department of Energy’s expectation for future natural gas prices between the times that the two analyses were performed.<sup>5</sup>

The results of our analysis are summarized in Table 1. For the purposes of this analysis, we have assumed that the terms of the proposed agreement are “must-take.” This means that the utilities would be required to purchase the contract amount of power from Vermont Yankee at the contract price whenever the plant is operating, even if power could be purchased at a lower price on the wholesale market.<sup>6</sup> The existing agreement in contrast is structured more as an option—if market prices are below the strike price then the agreement has no value, but it does not become a liability. In addition, we have considered only energy revenues, and not capacity revenues, for analyzing both the

<sup>4</sup> The utilities/JFC projection is in nominal dollars, also assuming an inflation rate of 2.5%/year.

<sup>5</sup> The US Energy Information Administration produces long-term energy price forecasts that are updated at least annually, available at <http://www.eia.doe.gov/oiaf/aeo/index.html>. Long term projections of natural gas prices from this source have recently been revised downward to reflect the apparently greater availability and lower cost of domestic unconventional gas resources than had previously been assumed.

<sup>6</sup> This “must take” provision is consistent with the current power purchase agreement that expires in 2012. However, Entergy’s December 18 letter did not specify terms for the proposed contract to this level of detail.

proposed and existing agreements. The Entergy December 18 letter is ambiguous on this point.

In all cases shown in Table 1, we have reduced the actual quantity of energy delivered under the proposed agreement from the nominal 115 MW, to reflect the unit availability. This follows the assumption (not stated in Entergy’s letter) that the proposed agreement is unit contingent, and that if the unit is operating below its maximum capacity (or not operating) then the quantity to be delivered under the proposed agreement would be reduced pro rata.

**Table 1. Summary of Analysis Results for total discounted (2009 \$) ratepayer benefit.**

<b>Total Net Present Value for Vermont Ratepayers, \$Million</b>						
<b>Price Forecast Source</b>	<b>Plant</b>		<b>Existing Agreement</b>	<b>Proposed Agreement</b>	<b>Difference</b>	
	<b>Operating Life (years)</b>				<b>(\$M)</b>	<b>Difference (%)</b>
PSB 2009	20	\$	122.28	\$	148.20	\$ 25.92 21.2%
PSB 2009	10	\$	122.28	\$	87.70	\$ (34.58) -28.3%
Utilities/JFC 2010	20	\$	64.47	\$	93.39	\$ 28.92 44.9%
Utilities/JFC 2010	10	\$	64.47	\$	46.86	\$ (17.61) -27.3%

Table 1 illustrates that, while potentially providing greater savings to Vermont ratepayers, the proposed agreement also entails a much greater degree of risk. If the plant only operates for 10 years, the Net Present Value (NPV) of the proposed agreement would be severely reduced, to well below the value of the existing revenue sharing agreement. Not shown in the table is the additional risk that, if electricity prices remain below the strike price, the proposed agreement would actually present a liability to Vermont ratepayers, while the existing revenue sharing agreement would simply have no value.

For perspective, we project (based on the utilities/JFO price projections) that the *total net costs* to the Vermont ratepayers for energy and capacity during this period (2012-2032) will have a net present value of almost \$4 billion.<sup>7</sup> Based on the utilities/JFC price projections and assuming continued operation of the plant at full capacity for 20 years, the value of the proposed agreement may be about 2.4% of the utilities’ total net costs; the difference between the proposed agreement and the existing agreement is about 0.7% of procurement costs under the most favorable assumptions.

We have assumed that the “strike price” for both the existing agreement (RSA) and the proposed agreement escalates at a rate that is 0.75 percentage points greater than the rate of inflation, for a total of 3.25% per year nominal escalation in the strike price.

We have used a nominal discount rate of 10% to calculate 2009 NPVs. This is a typical nominal discount rate for utility planning purposes; however, we believe it to be a conservative discount rate in this case given the risks associated with unit availability, especially in the later years.

<sup>7</sup> This value represents the net present value cost of all energy and capacity either procured or produced by Vermont utilities over the 20-year period, based on the recent utilities/JFC modeling results. We have used a nominal discount rate of 10% per year, as we have throughout this analysis.

The spreadsheets shown in the Appendices highlight the net present value projections for the expositing and proposed agreements, which provide the most appropriate and meaningful basis for comparison. We have also summed the projected nominal dollars associated with each agreement, for comparison with how we believe Entergy's value claims were calculated. It is important to note that we do not believe that this is a meaningful or reasonable way to express the value of an annuity such as the existing or the proposed agreement.

We find this sum of nominal dollar benefits for the proposed agreement to be \$538 Million based on the PSB-derived prices and assuming the plant operates at full capacity for 20 years, or \$383 Million based on the Utility/JFC price forecast. Again, however, these nominal dollar totals represent undiscounted streams of revenue over 20 years and are inappropriate for assessing the value of utility investments, and would not be accepted as meaningful or appropriate by any utility commission in the country. The more meaningful, discounted benefits from the proposed agreement are \$148 Million using the 2009 PSB avoided cost projections and \$93 Million using the utilities/JFC forecast, net present value, for the period 2012 through 2032. These are compared to the existing revenue sharing agreement in Table 1.

Please don't hesitate to contact me with any questions regarding this analysis.

## Appendix A: Projected values for Existing and Proposed Agreements: Electricity prices based on VT PSB avoided cost projections

Year	Existing Revenue Sharing Agreement						Proposed Power Purchase Agreement					
	RSA MWh	Average Price	Strike Price	Excess revenue	VT Share (55% * 50%)	VT Share NPV	PPA Price (\$/MWh)	Market Price (\$/MWh)	PPA Quantity (MW)	Hours in year	PPA Savings (\$)	PPA Savings NPV
2012	3,937,248	\$73.25	\$61	\$ 48,233,414	13,264,189	9,965,581	\$61	\$73	103.5	7,056	8,946,520	6,721,653
2013	4,888,080	\$78.15	\$62.98	\$ 74,120,012	20,383,003	13,921,866	\$62.98	\$78	103.5	8,760	13,748,067	9,390,115
2014	4,888,080	\$80.68	\$65.03	\$ 76,487,325	21,034,014	13,060,468	\$65.03	\$81	103.5	8,760	14,187,165	8,809,113
2015	4,888,080	\$83.48	\$67.14	\$ 79,861,906	21,962,024	12,396,990	\$67.14	\$83	103.5	8,760	14,813,095	8,361,606
2016	4,901,472	\$86.95	\$69.33	\$ 86,385,544	23,756,024	12,190,597	\$69.33	\$87	103.5	8,784	16,023,125	8,222,397
2017	4,888,080	\$91.34	\$71.58	\$ 96,598,555	26,564,603	12,392,583	\$71.58	\$91	103.5	8,760	17,917,474	8,358,634
2018	4,888,080	\$96.10	\$73.90	\$ 108,481,434	29,832,394	12,651,847	\$73.90	\$96	103.5	8,760	20,121,556	8,533,504
2019	4,888,080	\$100.42	\$76.31	\$ 117,889,824	32,419,702	12,499,198	\$76.31	\$100	103.5	8,760	21,866,661	8,430,544
2020	4,901,472	\$102.98	\$78.79	\$ 118,589,391	32,612,083	11,430,336	\$78.79	\$103	103.5	8,784	21,996,419	7,709,611
2021	4,888,080	\$104.45	\$81.35	\$ 112,945,198	31,059,929	9,896,651	\$81.35	\$104	103.5	8,760	20,949,513	6,675,160
2022	950,832	\$108.68	\$83.99	\$ 23,478,675	6,456,636	1,870,257	\$83.99	\$109	103.5	8,760	22,387,946	6,484,990
2023	-	\$114.61	\$86.72	\$ -	-	-	\$86.72	\$115	103.5	8,760	25,283,820	6,658,020
2024	-	\$122.73	\$89.54	\$ -	-	-	\$89.54	\$123	103.5	8,784	30,173,987	7,223,413
2025	-	\$127.78	\$92.45	\$ -	-	-	\$92.45	\$128	103.5	8,760	32,034,749	6,971,695
2026	-	\$134.27	\$95.45	\$ -	-	-	\$95.45	\$134	103.5	8,760	35,197,974	6,963,731
2027	-	\$139.71	\$98.56	\$ -	-	-	\$98.56	\$140	103.5	8,760	37,315,578	6,711,535
2028	-	\$145.73	\$101.76	\$ -	-	-	\$101.76	\$146	103.5	8,784	39,976,862	6,536,536
2029	-	\$152.18	\$105.07	\$ -	-	-	\$105.07	\$152	103.5	8,760	42,712,901	6,349,001
2030	-	\$158.49	\$108.48	\$ -	-	-	\$108.48	\$158	103.5	8,760	45,337,285	6,126,453
2031	-	\$165.30	\$112.01	\$ -	-	-	\$112.01	\$165	103.5	8,760	48,323,119	5,936,301
2032	-	\$166.98	\$115.65	\$ -	-	-	\$115.65	\$167	103.5	1,728	9,181,760	1,025,402
<b>Nominal Sum:</b>	48,907,584			\$ 943,071,278	259,344,601	122,276,375			2173.5		538,495,575	148,199,414
<b>2009 NPV:</b>		\$ 719.07	\$ 549.31	\$ 444,641,363	\$ 122,276,375		\$ 549	\$ 719			\$ 148,199,414	
<b>Levelized 2012-2032:</b>		\$ 83.14	\$ 63.51	\$ 51,411,386	\$ 18,826,055		\$ 64	\$ 83			\$ 17,135,467	

Notes: All monetary figures are in nominal dollars, based on 115 MW at 90% capacity factor  
Discount rate = 10.0% (nominal)  
RSA Escalation Premium = 0.75%  
2012 Represents only April-Dec; the period after the current operating license  
2032 Represents only Jan-Mar. VY retires March 2032

## Appendix B: Projected values for Existing and Proposed Agreements: Electricity prices based on La Capra “Relicense” scenario

Year	Existing Revenue Sharing Agreement							Proposed Power Purchase Agreement					
	RSA MWh	Average Price	Strike Price	Excess revenue	VT Share (55% * 50%)	VT Share NPV	PPA Price (\$/MWh)	Market Price (\$/MWh)	PPA Quantity (MW)	Hours in year	PPA Savings (\$)	PPA Savings NPV	
2012	3,568,146	\$ 58.74	\$61	\$ (8,074,443)	-	-	\$61	\$59	93.8	7,056	-1,497,679	-1,125,228	
2013	4,432,603	\$ 68.28	\$62.98	\$ 23,482,982	6,457,820	4,410,778	\$62.98	\$68	93.9	8,760	4,355,714	2,975,011	
2014	4,887,931	\$ 71.05	\$65.03	\$ 29,434,727	8,094,550	5,026,079	\$65.03	\$71	103.5	8,760	5,459,667	3,390,024	
2015	4,429,181	\$ 75.75	\$67.14	\$ 38,127,297	10,485,007	5,918,513	\$67.14	\$76	93.8	8,760	7,071,999	3,991,959	
2016	4,445,995	\$ 80.72	\$69.33	\$ 50,667,256	13,933,495	7,150,086	\$69.33	\$81	93.9	8,784	9,397,959	4,822,639	
2017	4,887,931	\$ 83.59	\$71.58	\$ 58,728,710	16,150,395	7,534,279	\$71.58	\$84	103.5	8,760	10,893,228	5,081,771	
2018	4,429,032	\$ 89.20	\$73.90	\$ 67,762,422	18,634,666	7,902,917	\$73.90	\$89	93.8	8,760	12,568,836	5,330,414	
2019	4,432,603	\$ 92.68	\$76.31	\$ 72,562,773	19,954,763	7,693,425	\$76.31	\$93	93.9	8,760	13,459,224	5,189,114	
2020	4,901,323	\$ 97.21	\$78.79	\$ 90,284,141	24,828,139	8,702,111	\$78.79	\$97	103.5	8,784	16,746,252	5,869,459	
2021	4,429,032	\$ 103.31	\$81.35	\$ 97,257,299	26,745,757	8,522,022	\$81.35	\$103	93.8	8,760	18,039,660	5,747,992	
2022	862,232	\$ 107.44	\$83.99	\$ 20,220,980	5,560,769	1,610,757	\$83.99	\$107	93.9	8,760	19,281,591	5,585,190	
2023	-	\$ 109.75	\$86.72	\$ -	-	-	\$86.72	\$110	103.5	8,760	20,876,529	5,497,443	
2024	-	\$ 115.71	\$89.54	\$ -	-	-	\$89.54	\$116	93.8	8,784	21,567,070	5,162,985	
2025	-	\$ 119.39	\$92.45	\$ -	-	-	\$92.45	\$119	93.9	8,760	22,148,053	4,820,062	
2026	-	\$ 123.98	\$95.45	\$ -	-	-	\$95.45	\$124	103.5	8,760	25,867,774	5,117,801	
2027	-	\$ 132.01	\$98.56	\$ -	-	-	\$98.56	\$132	93.8	8,760	27,483,735	4,943,191	
2028	-	\$ 138.57	\$101.76	\$ -	-	-	\$101.76	\$139	93.9	8,784	30,354,270	4,963,166	
2029	-	\$ 144.37	\$105.07	\$ -	-	-	\$105.07	\$144	103.5	8,760	35,635,648	5,297,012	
2030	-	\$ 155.76	\$108.48	\$ -	-	-	\$108.48	\$156	93.8	8,760	38,839,185	5,248,361	
2031	-	\$ 163.86	\$112.01	\$ -	-	-	\$112.01	\$164	93.9	8,760	42,632,006	5,237,170	
2032	-	\$ 172.07	\$115.65	\$ -	-	-	\$115.65	\$172	22.9	1,728	2,233,303	249,411	
<b>Nominal Sum:</b>	45,706,010			\$ 540,454,143	150,845,361	64,470,967			1957.444		383,414,025	93,394,946	
<b>2009 NPV:</b>		\$ 665.10	\$ 549.31	\$ 228,373,432	\$ 64,470,967		\$ 549	\$ 665			\$ 93,394,946		
<b>Levelized 2012-2032:</b>		\$ 76.90	\$ 63.51	\$ 26,405,539	\$ 9,926,153		\$ 64	\$ 77			\$ 10,798,734		

Notes: All monetary figures are in nominal dollars, based on 115 MW at 90% capacity factor  
Discount rate = 10.0% (nominal)  
RSA Escalation Premium = 0.75%  
2012 Represents only April-Dec; the period after the current operating license  
2032 Represents only Jan-Mar. VY retires March 2032