Jacquelyn Dadakis
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Energy Efficiency and Utility Decoupling

Towards the end of the 1990s, there was a drastic shift in the structure of US Utilities. In order to introduce a market for electricity, Utilities were forced to become either a generation utility, meaning a producer of energy, or a transmission utility with control of power lines and end-use customers. The transmission utilities now purchase electricity from the generating utilities, thus creating a price for wholesale electricity. This wholesale price is one of a number of factors that affect the consumer's final electricity rate.

Transmission utilities go through rate cases with the local regulating commissions setting electric rates for different sized consumers – from single-family homes to large industrial complexes. Included in this rate case are charges for maintenance of lines, emergency response and investment in future generation. Also included in the final rate is a fee to transmission utilities that had to divest themselves of generation assets. This fee will eventually sunset. These are just a few of the items that get tacked on the wholesale energy price as part of the rate case for the consumers. The transmission utility and the regulating agency can spend a year preparing for a rate case, each arguing over exactly what percentage of a cent per kilowatt-hour (kWh) is necessary for each additional fee. In addition to these charges, the rate case sets an amount above wholesale that the utility can charge to make a profit. So, for a transmission utility, its shareholders dividends are paid based on a fee per kilowatt-hour consumed. Thus, the transmission utility's interest is to see consumers use as much electricity as the system can handle. This is in direct conflict with the principles of efficiency and conservation.

Decoupling

In order to remove the utility's disincentive to invest in energy efficiency and conservation, regulators have encouraged the decoupling of utility profits from total energy consumed. As part of the rate case within a decoupled market, the utility and the regulator agree on a baseline level of profit for the utility company, normally set as the last year before decoupling is introduced. From there forward, the utility is essentially guaranteed a return to its investors within a window (often 10% above or below the baseline year). If in year three of decoupling, the utility sees its profit fall 25% from the baseline year, then in year four the utility can raise the price of electricity to make back 15% of the loss. Similarly, if the utility makes 25% above the base line year, the next year the price of electricity would be reduced.

Not an Incentive

While decoupling removes the economic disincentive for a utility to invest in energy efficiency, it does not create an incentive to make the investment. The utility is indifferent to increased efficiency in the system. Some regulators have thus taken the extra step of providing performance rewards to utilities for achieving a set level of efficiency and conservation.[i] The performance rewards allow the utility to recoup not just the difference between what the revenue would be without the efficiency, but also a return on their investment in efficiency. This is also added as a fee in the rate case and paid by the end consumer.

It makes sense why a privately held company would not want to invest in an area that would reduce their future profits. The question remains, if utility companies are not just disinterested in energy efficiency, but quite naturally against it due to the structure of their business, why then make them the main delivery vehicle for energy efficiency? This dilemma is highlighted in some of the major problems with a decoupled regime.

Problems with decoupling:

The Siloed Nature of Utility Companies

There are few organizations that match the bureaucratic nature of a utility company. The department that handles transmission line upgrades has little to do with the department that handles consumer relations which has even less to do with the department that plans for future increases in consumption. Getting all of these areas to work together is a behemoth task. Even under a decoupled regime, energy efficiency will never be the highest priority for a utility. Their priority is to make sure the lights do not go out. For over 100 years they have approached this task by adding more electricity to the system. It is a dramatic shift in perspective to expect the entire organization to think instead about how to reduce the demand for electricity in the system. This lack of flexibility greatly slows the utilities response to energy efficiency programs.

Permanence

For decoupling to truly work, it must be permanent. The utility does not invest in efficiency naturally because it will eventually reduce the total share of energy sold, and the total fee collected. This would negatively impact a privately held utility's share price.

In a decoupled regime, the utility is trusting that state will not reset its baseline year. But is it realistic to expect a utility to still use 2009 as the base year for their profits in 2029? In this scenario, consumers will continue to pay higher electricity rates indefinitely to make sure the utility sees no loss in profit.

A Permanent Consumer Tax

Decoupling regimes and performance incentives are all paid by the end the consumer. Thus, as a market uses less electricity, the price of electricity is increased to make the utility whole. Consumers that participate in the efficiency programs should not see an increase to their total end bill – but they also do not see the total savings from their investment. As the system becomes more efficient, the rate consumers pay per kilowat-hour increases in order to meet the decoupled baseline profit goals for the utility. Consumers who do not retrofit their buildings will see their total expenditure on energy rise.

An Alternative

As an alternative to utility based energy efficiency programs, there is the possibility for community based energy efficiency efforts to be classified as generators of power. Under the decoupled regime, it is the transmission utility that acts as the agent in the energy efficiency programs. As an alternative, energy efficiency can be sold on the wholesale generation market, competing with wind farms, nuclear plants, and natural gas facilities. If the regulating agency required that energy efficiency be treated as a source of energy, groups could commit to producing a set number of megawatt-hours for a system in set time period – similar to the financing of generation facilities. Under this system, the efficiency generating company has its incentives aligned to produce as much efficiency as possible, as its profits are tied to maximizing efficiency.

Appendix:

An explanation of how decoupling works

Let say the State of Massachusetts decouples NSTAR's revenues based on the year 2008. We will say for the example that in 2008, NSTAR has $3.4 Billion in revenue. To set electric rate for single family homes, NSTAR and the public utility commission would do something resembling the following process:

Year	Baseline Revenue Requirement	Previous Year's revenue	Difference	Annual Sales at Meters (kWh)	Cost of EE Program	System Benefits Charge	Average Rate before Decoupling	Expected Energy Savings at Meters (kWh)	Lost Base Revenue from Savings (Decoupling)	Rate Impact	Resulting Rate	Actual Energy Savings at Meters (kWh)	Annual Revenue	Total Energy Saved from Base Year	Expected Energy Savings
2009	$3,400,000,000	$3,400,000,000	0.00%	120,000,000,000	$15,000,000	$0.0001	$0.0285	2,400,000,000	$68,300,000	$0.0006	$0.0290	4,800,000,000	$3,345,306,122	4.00%	2.00%
2010	$3,400,000,000	$3,345,306,122	-1.61%	115,200,000,000	$15,000,000	$0.0001	$0.0290	2,304,000,000	$121,600,000	$0.0011	$0.0301	2,304,000,000	$3,400,000,000	5.92%	3.92%
2011	$3,400,000,000	$3,400,000,000	0.00%	112,896,000,000	$15,000,000	$0.0001	$0.0301	2,257,920,000	$68,000,000	$0.0006	$0.0307	1,693,440,000	$3,417,346,939	7.33%	5.80%
2012	$3,400,000,000	$3,417,346,939	0.51%	111,202,560,000	$15,000,000	$0.0001	$0.0307	2,224,051,200	$51,000,000	$0.0005	$0.0312	2,224,051,200	$3,400,000,000	9.18%	7.65%
2013	$3,400,000,000	$3,400,000,000	0.00%	108,978,508,800	$15,000,000	$0.0001	$0.0312	2,179,570,176	$68,000,000	$0.0006	$0.0318	3,269,355,264	$3,365,306,122	11.91%	9.47%
2014	$3,400,000,000	$3,365,306,122	-1.02%	105,709,153,536	$15,000,000	$0.0001	$0.0318	2,114,183,071	$102,000,000	$0.0010	$0.0328	2,114,183,071	$3,400,000,000	13.67%	11.23%
2015	$3,400,000,000	$3,400,000,000	0.00%	103,594,970,465	$15,000,000	$0.0001	$0.0328	2,071,899,409	$68,000,000	$0.0007	$0.0335	2,071,899,409	$3,400,000,000	15.40%	12.96%
2016	$3,400,000,000	$3,400,000,000	0.00%	101,523,071,056	$15,000,001	$0.0001	$0.0335	2,030,461,421	$68,000,000	$0.0007	$0.0342	1,015,230,711	$3,434,693,878	16.24%	14.65%
2017	$3,400,000,000	$3,434,693,878	1.02%	100,507,840,345	$15,000,002	$0.0001	$0.0342	2,010,156,807	$34,000,000	$0.0003	$0.0345	1,005,078,403	$3,434,693,878	17.08%	16.33%
2018	$3,400,000,000	$3,434,693,878	1.02%	99,502,761,942	$15,000,003	$0.0002	$0.0345	1,990,055,239	$34,000,000	$0.0003	$0.0349	995,027,619	$3,434,693,878	17.91%	17.99%
2019	$3,400,000,000	$3,434,693,878	1.02%	98,507,734,323	$15,000,004	$0.0002	$0.0349	1,970,154,686	$34,000,000	$0.0004	$0.0352	1,970,154,686	$3,400,000,000	19.55%	19.63%
2020	$3,400,000,000	$3,400,000,000	0.00%	96,537,579,636	$15,000,005	$0.0002	$0.0352	1,930,751,593	$68,000,000	$0.0007	$0.0359	2,955,232,030	$3,363,182,007	22.01%	21.24%
2021	$3,400,000,000	$3,363,182,007	-1.08%	93,582,347,606	$15,000,006	$0.0002	$0.0359	1,871,646,952	$104,081,633	$0.0011	$0.0371	1,871,646,952	$3,400,000,000	23.57%	22.80%

In this scenario, NSTAR's rate is adjusted every year to keep its profits in line with 2008. For the sake of simplicity, I am assuming there is no inflation. In this model, the "Lost Base Revenue from Savings" is the # of kWh conserved that year multiplied by the price for a kWh. To determine the rate impact, this number is then divided by the total # kWh consumed in that year. This is added to the previous rate and is thus the new rate for the next year.

Another scenario sets a buffer around the baseline revenue. In this model, the utilities rate is only adjusted when the annual revenue is 10% above or below the baseline year.

Year	Baseline Revenue Requirement	Previous Year's revenue	Difference	Annual Sales at Meters (kWh)	Cost of EE Program	System Benefits Charge	Average Rate before Decoupling	Expected Energy Savings at Meters (kWh)	Lost Base Revenue from Savings (Decoupling)	Rate Impact	Resulting Rate	Actual Energy Savings at Meters (kWh)	Annual Revenue	Total Energy Saved from Base Year	Expected Energy Savings
2009	$3,400,000,000	$3,400,000,000	0.00%	120,000,000,000	$15,000,000	$0.0001	$0.0285	2,400,000,000	$68,300,000		$0.0285	4,800,000,000	$3,278,400,000	4.00%	2.00%
2010	$3,400,000,000	$3,278,400,000	-3.58%	115,200,000,000	$15,000,000	$0.0001	$0.0285	2,304,000,000	$187,168,000		$0.0285	2,304,000,000	$3,212,832,000	5.92%	3.92%
2011	$3,400,000,000	$3,212,832,000	-5.50%	112,896,000,000	$15,000,000	$0.0001	$0.0285	2,257,920,000	$251,424,640		$0.0285	1,693,440,000	$3,164,639,520	7.33%	5.80%
2012	$3,400,000,000	$3,164,639,520	-6.92%	111,202,560,000	$15,000,000	$0.0001	$0.0285	2,224,051,200	$298,653,270		$0.0285	2,224,051,200	$3,101,346,730	9.18%	7.65%
2013	$3,400,000,000	$3,101,346,730	-8.78%	108,978,508,800	$15,000,000	$0.0001	$0.0285	2,179,570,176	$360,680,205		$0.0285	3,269,355,264	$3,008,306,328	11.91%	9.47%
2014	$3,400,000,000	$3,008,306,328	-11.52%	105,709,153,536	$15,000,000	$0.0001	$0.0285	2,114,183,071	$451,859,799	$0.0042	$0.0327	2,114,183,071	$3,387,590,834	13.67%	11.23%
2015	$3,400,000,000	$3,387,590,834	-0.36%	103,594,970,465	$15,000,000	$0.0001	$0.0327	2,071,899,409	$80,160,983		$0.0327	2,071,899,409	$3,319,839,017	15.40%	12.96%
2016	$3,400,000,000	$3,319,839,017	-2.36%	101,523,071,056	$15,000,001	$0.0001	$0.0327	2,030,461,421	$146,557,763		$0.0327	1,015,230,711	$3,286,640,627	16.24%	14.65%
2017	$3,400,000,000	$3,286,640,627	-3.33%	100,507,840,345	$15,000,002	$0.0001	$0.0327	2,010,156,807	$179,092,185		$0.0327	1,005,078,403	$3,253,774,221	17.08%	16.33%
2018	$3,400,000,000	$3,253,774,221	-4.30%	99,502,761,942	$15,000,003	$0.0002	$0.0327	1,990,055,239	$211,301,263		$0.0327	2,985,082,858	$3,156,160,994	19.57%	17.99%
2019	$3,400,000,000	$3,156,160,994	-7.17%	96,517,679,084	$15,000,004	$0.0002	$0.0327	1,930,353,582	$306,962,226		$0.0327	1,930,353,582	$3,093,037,774	21.18%	19.59%
2020	$3,400,000,000	$3,093,037,774	-9.03%	94,587,325,502	$15,000,005	$0.0002	$0.0327	1,891,746,510	$368,822,981		$0.0327	2,895,530,373	$2,998,352,945	23.59%	21.17%
2021	$3,400,000,000	$2,998,352,945	-11.81%	91,691,795,130	$15,000,006	$0.0002	$0.0327	1,833,835,903	$461,614,114	$0.0050	$0.0377	1,833,835,903	$3,389,701,760	25.12%	22.70%

In this model, the rate is not adjusted on an annual basis, but when it is adjusted in jumps large increments. This design is what was adopted in Massachusetts. The benefit of this scenario is it allows a start up period for the efficiency program to reach more people before the public sees the rate impact. Conversely, the first jump will likely come as a shock to many consumers. It may also cause less participation in the program since the penalty of not participating is not immediately apparent, but comes in increments. The utility also loses more money under this scenario, raising questions of whether this is actually removing their disincentive.

The final model explores what happens if the utility uses more energy in a year.

Year	Baseline Revenue Requirement	Previous Year's revenue	Difference	Annual Sales at Meters (kWh)	Cost of EE Program	System Benefits Charge	Average Rate before Decoupling	Expected Energy Savings at Meters (kWh)	Lost Base Revenue from Savings (Decoupling)	Rate Impact	Resulting Rate	Actual Energy Savings at Meters (kWh)	Annual Revenue	Total Energy Saved from Base Year	Expected Energy Savings
2009	$3,400,000,000	$3,400,000,000	0.00%	120,000,000,000	$15,000,000	$0.0001	$0.0285	2,400,000,000	$68,300,000		$0.0285	4,800,000,000	$3,278,400,000	4.00%	2.00%
2010	$3,400,000,000	$3,278,400,000	-3.58%	115,200,000,000	$15,000,000	$0.0001	$0.0285	2,304,000,000	$187,168,000		$0.0285	2,304,000,000	$3,212,832,000	5.92%	3.92%
2011	$3,400,000,000	$3,212,832,000	-5.50%	112,896,000,000	$15,000,000	$0.0001	$0.0285	2,257,920,000	$251,424,640		$0.0285	1,693,440,000	$3,164,639,520	7.33%	5.80%
2012	$3,400,000,000	$3,164,639,520	-6.92%	111,202,560,000	$15,000,000	$0.0001	$0.0285	2,224,051,200	$298,653,270		$0.0285	2,224,051,200	$3,101,346,730	9.18%	7.65%
2013	$3,400,000,000	$3,101,346,730	-8.78%	108,978,508,800	$15,000,000	$0.0001	$0.0285	2,179,570,176	$360,680,205		$0.0285	3,269,355,264	$3,008,306,328	11.91%	9.47%
2014	$3,400,000,000	$3,008,306,328	-11.52%	105,709,153,536	$15,000,000	$0.0001	$0.0285	2,114,183,071	$451,859,799	$0.0042	$0.0327	2,114,183,071	$3,387,590,834	13.67%	11.23%
2015	$3,400,000,000	$3,387,590,834	-0.36%	103,594,970,465	$15,000,000	$0.0001	$0.0327	2,071,899,409	$80,160,983		$0.0327	2,071,899,409	$3,319,839,017	15.40%	12.96%
2016	$3,400,000,000	$3,319,839,017	-2.36%	101,523,071,056	$15,000,001	$0.0001	$0.0327	2,030,461,421	$146,557,763		$0.0327	(1,015,230,711)	$3,353,037,408	14.55%	14.65%
2017	$3,400,000,000	$3,353,037,408	-1.38%	102,538,301,767	$15,000,002	$0.0001	$0.0327	2,050,766,035	$114,023,341		$0.0327	(1,025,383,018)	$3,386,567,782	13.70%	16.36%
2018	$3,400,000,000	$3,386,567,782	-0.40%	103,563,684,784	$15,000,003	$0.0001	$0.0327	2,071,273,696	$81,163,574		$0.0327	(3,106,910,544)	$3,488,164,815	11.11%	18.09%
2019	$3,400,000,000	$3,488,164,815	2.59%	106,670,595,328	$15,000,004	$0.0001	$0.0327	2,133,411,907	-$18,401,519		$0.0327	(2,133,411,907)	$3,557,928,111	9.33%	19.86%
2020	$3,400,000,000	$3,557,928,111	4.64%	108,804,007,234	$15,000,005	$0.0001	$0.0327	2,176,080,145	-$86,769,549		$0.0327	(3,200,117,860)	$3,662,573,056	6.66%	21.68%
2021	$3,400,000,000	$3,662,573,056	7.72%	112,004,125,094	$15,000,006	$0.0001	$0.0327	2,240,082,502	-$189,321,595	-$0.0021	$0.0327	2,240,082,502	$3,589,321,595	8.53%	23.54%

Whether through higher consumption in the state or through a disinvestment in the efficiency program, a utility could see profits above its baseline year while also seeing the state efficiency level fall. Once again, this raises the question of the effectiveness of both decoupling and the utility as the delivery vehicle for energy efficiency. I have included the rate impact in the final year, even though the rate would not be reduced in 2021 because the utility is still with in the 10% buffer.

This model, as noted a few times, is extremely simplified. My goal was to try to diagram as simply as possible how decoupling the utility's revenue from the total usage of electricity would effect electricity prices if this were the only variable. Actual energy prices are far more complicated to model and would obscure that actual change in kWh prices that decoupling may cause. It is of note that in the last scenario, consumers see the price of electricity increase 15% while the state only sees an energy usage drop 8.5% over the 12 years modeled.

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Additionally, much of this paper was informed by interviews in the Spring 2007 Energy Efficiency Practicum in the Department of Urban Studies and Planning at the Massachusetts Institute of Technology.