Ameren Illinois Utilities (AIU) Portfolio Cost-Effectiveness Evaluation

Prepared for
Ameren Illinois Utilities

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Introduction

In November 2007, Ameren Illinois Utilities (AIU) filed its first three-year Electric Energy Efficiency and Demand Response Plan portfolio for residential and business programs, per Section 12-103 of the Illinois Public Utilities Act, 220 ILCS 5/12-103.[1] (the Act). The Act calls for an annual independent evaluation of the performance of the cost-effectiveness of the utility's portfolio of measures and of the Department of Commerce and Economic Opportunity (DCEO) portfolio of measures.[2]

AIU launched its 2008-2011 portfolio of programs on June 1, 2008. The Cadmus Group, Inc., (Cadmus) was engaged to perform an independent cost-effectiveness evaluation for Program Year One (2008-2009). This report summarizes the analytical approach and results of the cost-effectiveness evaluation performed by Cadmus.

Assessment of cost-effectiveness begins with a valuation of each program's net total resource benefits, as measured by (1) the electric avoided costs, (2) total incremental costs of measures installed, and (3) administrative costs associated with the program.

A program is cost-effective if its net "total resource" benefits are positive. That is,

$$\frac{\text{Total Resource Benefits}}{\text{Total Resource Costs}} \geq 1$$

where

$$\textit{Total Resource Benefits} = \text{PV}\left(\sum_{\text{year}=1}^{\text{measure life}}\left(\sum_{i}^{i=8760}\left(\text{impact}_i \times \text{avoided cost}_i\right)\right)\right)$$

and

$$\text{Total Resource Cost} = \text{PV}\left(\text{Incremental Measure Costs} + \text{Utility Costs}\right).$$

[1] Illinois Public Utilities Act. See section 12-103. http://www.ilga.gov/legislation/publicacts/95/PDF/095-0481.pdf

[2] The Cadmus Group worked independently and cooperatively with the DCEO independent evaluator (Summit Blue) to obtain data needed to perform AIU and DCEO TRC results.

Program Benefit Components

Benefits used in the TRC test calculation include the full value of time and seasonally differentiated generation, transmission and distribution, and capacity costs and also take into account avoided line losses. For each energy-efficiency measure included in a program, hourly (8,760) system-avoided costs were adjusted by the hourly load shape of the end use affected by the measure to capture the full value of time and seasonally-differentiated impacts of the measure.

Evaluated impacts were provided to AIU for the DCEO program. End-use load shapes were also employed in calculating peak load impacts for energy-efficiency measures in AIU programs. To calculate the peak load impacts from energy-efficiency measures, end-use load shapes were used to identify the average reduction in demand over AIU's top hours defined as summer weekdays from 3 p.m. until 7 p.m. Non-energy benefits such as water savings were not factored into the calculation. Additionally, consistent with The State of Illinois Commerce Commission Order 07-0539 (Order) Section 12-103(f)(5), gas benefits were not accounted for under the program.

TRC Scenarios

Two scenarios of the TRC are presented: the first uses discounted future benefits by 9% based on AIU's weighted average cost of capital (WACC); the second uses a 10-year T-Bill rate of 3.5% to discount future benefits. Using the 10-year Treasury bill as a discount rate for the TRC test recognizes that benefits accrue at societal level rather than solely for the utility or participants. Generally the weighted cost of capital is high for utilities, reflecting the cost of borrowing money and the associated risk. For society as a whole, the level of risk is low or almost non-existent making the Treasury bill rate more appropriate for a total resource perspective.

It is also important to note that program benefits are accrued over a long period of time and the use of a higher discount rate undervalues the benefits to future generations. Additionally, using a lower discount rate encourages depth of savings and promotion of emerging technologies. Using the weighted cost of capital for the TRC can promote focusing solely on high saving, low-cost measures ignoring other areas of substantial savings[3].

Line loss assumptions are specified in Table 1, on the following page.

[3] The State of Iowa specifies the use of a 12-month average of the 10-year and 30-year Treasury Bond rate for use as the TRC discount rate. Similarly, the Northwest Power Planning Council uses a societal discount rate in it's the TRC calculations of its ProCost cost-effectiveness model.

Table 1. Line Loss Assumptions Used in Cost-Effectiveness Calculations

Sector	Energy Line Losses	Demand Line Losses
Residential	6.72%	7.83%
Commercial	5.75%	6.84%
Industrial	1.53%	2.08%

Avoided Costs

Annual avoided costs were adjusted to an hourly stream of costs using hourly system load data to capture seasonality and pricing differences. Avoided costs for the first five program years used for the analysis are summarized in Table 2.

Consistent with the Order, avoided costs include estimates for financial costs associated with legislation and regulation related to greenhouse gas emissions. The carbon costs are introduced in the 2014 (Program Year 6) costs, valued at $15 per ton. While the prices below are decreasing, the avoided costs increase at an average rate of 1.8% from year-to-year reflecting rising costs of generation and the added cost of greenhouse gas emissions.

Table 2. Summary of Avoided Costs

Program Year	Energy ($/MWh)	Capacity ($/kW)
Program Year 1	$60.69	$18.40
Program Year 2	$59.27	$29.34
Program Year 3	$57.89	$40.27
Program Year 4	$56.55	$51.20
Program Year 5	$55.92	$62.13

Program Cost Components

The cost component of the analysis considered incremental measure costs and direct utility costs. Incremental measure costs are the incremental expenses associated with installation of energy-efficiency measures and ongoing operation and maintenance costs, where applicable. These costs include the incentive as well as the customer contribution. Utility costs include any customer payments and the expenses associated with program development, marketing, delivery, operation, and evaluation, monitoring and verification (EM&V), and fall into the following categories.

Incentives

- Cost of residential energy assessment surveys and technical studies.
- Rebates or other incentives paid to customers for implementing measures.
- Direct program costs associated with customer products and services (e.g., CFLs, direct installation measures, appliance recycling)

Evaluation, Measurement and Verification

Activities associated with the determination and evaluation of current and potential energy-efficiency programs. These activities include (but are not limited to): benefit-cost ratio analysis, program logic models, cost per kWh analysis, efficiency product saturation analysis, customer research, and all other analyses that are necessary for program evaluation. In addition, any activities that pertain to regulatory compliance or reporting conducted by energy-efficiency group personnel or contract service providers would fall under this category. Expenses associated with evaluation include all internal and external costs (e.g., consultant contracts).

Labor

Incremental costs associated with performing program implementation tasks, including: lead intake, customer service, application processing, rebate application problem resolution, equipment installation inspections, rebate processing, and individual program reporting.

Portfolio Administration

- Costs to administer energy-efficiency programs include (but are not limited to) AIU or DCEO's fully-loaded incremental personnel costs. Activities associated with market research outside of evaluation, measurement, and verification. These activities and their associated expenses include: potential studies, customer surveys, and research into saturation and network and customer characteristics.
- Regulatory, legal, technical, and other consultants and contractors.

DCEO Administration

- Costs to administer the SEDAC program, which offers energy audits and design assistance to the commercial and industrial sector. Customers that participate in SEDAC are referred to the appropriate utility or DCEO incentive program.
- Costs to administer the LEAP program, which offers consulting, technical services and benchmarking to industrial customers.
- Costs to administer the Efficiency Training Program, which provides training services to professionals from various sectors of the building industry. Funding goes toward training workshops that apply to the residential, commercial, and industrial sectors.

Overall Portfolio Cost-Effectiveness Results

A summary of the energy savings, demand impacts and costs for AIU's entire energy efficiency portfolio, including DCEO implemented programs, are reported in Table 3. The table also shows TRC benefits, costs and benefit/cost ratios. Energy savings and capacity savings are reported in both gross and net terms. The portfolio passes the TRC with a benefit-cost ratio of 2.17 using the WACC discount rate reflecting that, from a total resource perspective, this portfolio of programs is cost effective.

Table 3. AIU and DCEO Portfolio (Combined)

	Program Year 2008		
Benefit/Cost Component	**AIU**	**DCEO**	**Total**
Gross Savings (MWh)	113,691	13,998	127,689
Net Savings (MWh)	89,955	10,283	100,237
Gross Capacity Savings (kW)	15,363	1,633	16,996
Net Capacity Savings (kW)	11,522	1,245	12,767
Total TRC Costs	$20,185,827	$2,861,196	$23,047,022
Direct Participant Costs	$9,883,500	$157,078	$10,040,577
Direct Utility Costs	$10,302,327	-	$10,302,327
Incentives	$4,545,064	-	$4,545,064
Portfolio Level EM&V	$298,092	-	$298,092
Labor	$3,446,204	-	$3,446,204
Portfolio Administration	$2,012,967	-	$2,012,967
Direct DCEO Costs	-	$2,704,118	$2,704,118
Incentives	-	$2,058,144	$2,058,144
Portfolio Administration	-	$171,243	$171,243
DCEO Administration	-	$374,931	$374,931
DCEO EM&V	-	$99,800	$99,800
TRC - Weighted Cost of Capital			
NPV Benefits	$43,533,561	$6,381,720	$49,915,281
NPV Costs	$20,185,827	$2,861,196	$23,047,022
Benefit-Cost Ratio	**2.16**	**2.23**	**2.17**
TRC - Societal			
NPV Benefits	$55,335,035	$8,805,603	$64,140,638
NPV Costs	$20,185,827	$2,861,196	$23,047,022
Benefit-Cost Ratio	**2.74**	**3.08**	**2.78**

A summary of the energy savings, demand impacts, and costs for AIU's residential energy efficiency portfolio, including DCEO are reported in Table 4. AIU and DCEO Residential Portfolio (Combined)The table also shows TRC benefits, costs and benefit/cost ratios. Energy savings and capacity savings are reported in both gross and net terms. The portfolio passes the TRC with a benefit-cost ratio of 1.88 using the WACC discount rate reflecting that, from a total resource perspective, this portfolio of programs is cost effective.

Table 4. AIU and DCEO Residential Portfolio (Combined)

	Program Year 2008		
Benefit/Cost Component	**AIU**	**DCEO**	**Total**
Gross Savings (MWh)	39,526	2,351	41,876
Net Savings (MWh)	36,660	2,275	38,935
Gross Capacity Savings (kW)	2,655	455	3,110
Net Capacity Savings (kW)	2,307	448	2,756
Total TRC Costs	$6,130,438	$1,028,013	$7,158,451
Direct Participant Costs	$2,365,944	$20,258	$2,386,202
Direct Utility Costs	$3,764,493	-	$3,764,493
Incentives	$1,161,266	-	$1,161,266
Labor	$1,545,250	-	$1,545,250
Portfolio Administration	$1,057,978	-	$1,057,978
Direct DCEO Costs	-	$1,007,755	$1,007,755
Incentives	-	$914,350	$914,350
Portfolio Administration	-	$93,405	$93,405
TRC - Weighted Cost of Capital			
NPV Benefits	$12,055,064	$1,393,200	$13,448,264
NPV Costs	$6,130,438	$1,028,013	$7,158,451
Benefit-Cost Ratio	**1.97**	**1.36**	**1.88**
TRC - Societal			
NPV Benefits	$13,684,655	$1,889,690	$15,574,345
NPV Costs	$6,130,438	$1,028,013	$7,158,451
Benefit-Cost Ratio	**2.23**	**1.84**	**2.18**

The summary of the energy savings, demand impacts and costs for AIU's residential programs are reported in Table 5. The portfolio costs include three programs that were in the beginning stages of implementation during the analysis period and did not contribute savings to the portfolio. In spite of having administrative program costs without associated savings, the residential portfolio is cost effective.

Table 5. AIU's Residential Programs

	Program Year 2008				
Benefit/Cost Component	**Appliance Recycling**	**Multifamily**	**Home Energy Performance**	**Light and Appliance**	**Total**
Gross Savings (MWh)	5,555	1,074	265	32,631	39,526
Net Savings (MWh)	3,011	817	202	32,631	36,660
Gross Capacity Savings (kW)	692	108	15	1,840	2,655
Net Capacity Savings (kW)	374	82	12	1,840	2,307
Total TRC Costs	$559,728	$229,781	$184,223	$4,020,530	$6,130,438
Direct Participant Costs	$0	$27,052	$4,206	$2,334,687	$2,365,944
Direct Utility Costs	$559,728	$202,729	$180,018	$1,685,843	$3,764,493
Incentives	$134,680	$74,956	$24,255	$926,925	$1,161,266
Labor	$425,048	$127,773	$155,763	$758,918	$1,545,250
Portfolio Administration	-	-	-	-	$1,057,978
TRC - Weighted Cost of Capital					
NPV Benefits	$1,260,454	$346,177	$64,930	$10,383,503	$12,055,064
NPV Costs	$559,728	$229,781	$184,223	$4,020,530	$6,130,438
Benefit-Cost Ratio	**2.25**	**1.51**	**0.35**	**2.58**	**1.97**
TRC - Societal					
NPV Benefits	$1,491,218	$418,235	$73,412	$11,701,790	$13,684,655
NPV Costs	$559,728	$229,781	$184,223	$4,020,530	$6,130,438
Benefit-Cost Ratio	**2.66**	**1.82**	**0.40**	**2.91**	**2.23**

The summary of the energy savings, demand impacts and costs for the DCEO implemented residential programs are reported in Table 6. The residential DCEO portfolio passes the TRC with a benefit-cost ratio of 1.36 using the WACC discount rate; however, at the program level the Home Improvement program does not pass the TRC test.

Table 6. DCEO Residential Programs

	Program Year 2008				
Benefit/Cost Component	**Home Improvement**	**Weatherization**	**EEAHC**	**Lights for Learning**	**Total**
Gross Savings (MWh)	152	1,516	306	377	2,351
Net Savings (MWh)	152	1,516	306	302	2,275
Gross Capacity Savings (kW)	54	173	193	35	455
Net Capacity Savings (kW)	54	173	193	28	448
Total TRC Costs	$284,137	$310,105	$346,054	$87,717	$1,028,013
Direct Participant Costs	$0	$0	$0	$20,258	$20,258
Direct DCEO Costs	$284,137	$310,105	$346,054	$67,459	$1,007,755
Incentives	$279,115	$301,735	$333,500	$0	$914,350
Portfolio Administration	$5,022	$8,370	$12,554	$67,459	$93,405
TRC - Weighted Cost of Capital					
NPV Benefits	$135,392	$756,537	$355,146	$146,125	$1,393,200
NPV Costs	$284,137	$310,105	$346,054	$87,717	$1,028,013
Benefit-Cost Ratio	**0.48**	**2.44**	**1.03**	**1.67**	**1.36**
TRC - Societal					
NPV Benefits	$200,087	$946,269	$560,896	$182,439	$1,889,690
NPV Costs	$284,137	$310,105	$346,054	$87,717	$1,028,013
Benefit-Cost Ratio	**0.70**	**3.05**	**1.62**	**2.08**	**1.84**

A summary of the energy savings, demand impacts and costs for AIU's commercial and industrial energy-efficiency portfolio, including DCEO, are reported in Table 7. The table also shows TRC benefits, costs and benefit/cost ratios. The portfolio passes the TRC with a benefit-cost ratio of 2.41 using the WACC discount rate reflecting that, from a total resource perspective, this portfolio of programs is cost effective.

Table 7. AIU and DCEO Commercial and Industrial Portfolio (Combined)

	Program Year 2008		
Benefit/Cost Component	**AIU**	**DCEO**	**Total**
Gross Savings (MWh)	74,166	11,647	85,813
Net Savings (MWh)	53,295	8,007	61,302
Gross Capacity Savings (kW)	12,707	1,178	13,886
Net Capacity Savings (kW)	9,214	797	10,012
Total TRC Costs	$13,757,297	$1,358,452	$15,115,749
Direct Participant Costs	$7,517,555	$136,820	$7,654,375
Direct Utility Costs	$6,239,742	-	$6,239,742
Incentives	$3,383,798	-	$3,383,798
Labor	$1,900,954	-	$1,900,954
Portfolio Administration	$954,989	-	$954,989
Direct DCEO Costs	-	$1,221,632	$1,221,632
Incentives	-	$1,143,794	$1,143,794
Portfolio Administration	-	$77,838	$77,838
TRC - Weighted Cost of Capital			
NPV Benefits	$31,478,497	$4,988,519	$36,467,017
NPV Costs	$13,757,297	$1,358,452	$15,115,749
Benefit-Cost Ratio	**2.29**	**3.67**	**2.41**
TRC - Societal			
NPV Benefits	$41,650,380	$6,915,913	$48,566,293
NPV Costs	$13,757,297	$1,358,452	$15,115,749
Benefit-Cost Ratio	**3.03**	**5.09**	**3.21**

The summary of the energy savings, demand impacts and costs for AIU's commercial and industrial programs are reported in the Table 8. Similar to the residential sector portfolio, the commercial and industrial portfolio analysis includes administrative program costs that do not have associated savings since some programs were in the early stages of implementation for the analysis period. In spite of that, this portfolio of programs is cost effective.

Table 8. AIU's Commercial and Industrial Programs

	Program Year 2008			
Benefit/Cost Component	**Prescriptive**	**Custom**	**Retro Commissioning**	**Total**
Net Savings (kWh)	36,659,979	10,282,774	1,022,292	46,942,753
Gross Savings (MWh)	22,033	51,111	1,022	74,166
Net Savings (MWh)	13,677	38,596	1,022	53,295
Gross Capacity Savings (kW)	3,720	8,434	553	12,707
Net Capacity Savings (kW)	2,306	6,355	553	9,214
Total TRC Costs	$2,836,640	$9,821,874	$85,345	$13,757,297
Direct Participant Costs	$1,122,548	$6,395,007	$0	$7,517,555
Direct Utility Costs	$1,714,091	$3,426,868	$85,345	$6,239,742
Incentives	$1,128,223	$2,255,575	$0	$3,383,798
Labor	$585,869	$1,171,292	$85,345	$1,900,954
Portfolio Administration	-	-	-	$954,989
TRC - Weighted Cost of Capital				
NPV Benefits	$7,640,531	$23,433,438	$404,528	$31,478,497
NPV Costs	$2,836,640	$9,821,874	$85,345	$13,757,297
Benefit-Cost Ratio	**2.69**	**2.39**	**4.74**	**2.29**
TRC - Societal				
NPV Benefits	$9,934,135	$31,268,051	$448,194	$41,650,380
NPV Costs	$2,836,640	$9,821,874	$85,345	$13,757,297
Benefit-Cost Ratio	**3.50**	**3.18**	**5.25**	**3.03**

The summary of the energy savings, demand impacts and costs for the DCEO implemented commercial and industrial programs are reported in the Table 9. The commercial and industrial DCEO portfolio passes the TRC with a benefit-cost ratio of 3.67 using the WACC discount rate.

Table 9. DCEO Commercial and Industrial Programs

	Program Year 2008		
Benefit/Cost Component	**Public Sector Standard**	**Public Sector Custom**	**Total**
Gross Savings (MWh)	4,204	7,443	11,647
Net Savings (MWh)	2,649	5,359	8,007
Gross Capacity Savings (kW)	568	610	1,178
Net Capacity Savings (kW)	358	439	797
Total TRC Costs	$666,834	$691,618	$1,358,452
Direct Participant Costs	$141,108		$136,820
Direct DCEO Costs	$525,726	$695,906	$1,221,632
Incentives	$473,834	$669,960	$1,143,794
Portfolio Administration	$51,892	$25,946	$77,838
TRC - Weighted Cost of Capital			
NPV Benefits	$1,707,121	$3,281,399	$4,988,519
NPV Costs	$666,834	$691,618	$1,358,452
Benefit-Cost Ratio	**2.56**	**4.74**	**3.67**
TRC - Societal			
NPV Benefits	$2,371,892	$4,544,021	$6,915,913
NPV Costs	$666,834	$691,618	$1,358,452
Benefit-Cost Ratio	**3.56**	**6.57**	**5.09**