URBAN ENERGY SERVICES PROGRAM SUSTAINABLE MUNICIPAL ENERGY SERVICES

ENERGY EFFICIENCY INCENTIVE MECHANISM FOR JORDAN

August 2010
This publication was produced for review by the United States Agency for International Development.
It was prepared by Nexant, Inc. under Contract EIPP-I-02-03-00007-00

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1. EXECUTIVE SUMMARY

Jordan's electric energy needs are predominantly dependent on foreign supply of oil and gas making energy efficiency (EE) an important option for the country's energy security and a tool to reduce vulnerability to changing global conditions. Improving electric demand-side efficiency by reducing unnecessary consumption and improving the efficiency of the consuming sectors where possible allows for existing supplies to serve a larger demand base, thus delaying investment in costly supply-side options. Avoidance or postponement of investments in generation, transmission and distribution of electricity provides benefits to Jordan's economic development while lowering electricity bills to end-use customers and reducing emissions of greenhouse gases.

The focus of this report is on assessing the technical and institutional viability of introducing an incentive scheme to increase demand-side efficiency without a major increase in consumer prices. It is important to realize however, that increasing demand-side efficiency requires an investment commitment and a programmatic approach. The main entities interfacing with the demand-side of electricity are the three electricity distribution companies (JEPCO, EDCO and IDECO) for the low voltage service, and the National Electricity Power Company (NEPCO) for the medium voltage customers. They are key players that could influence demand-side energy behavior and use patterns.

Unfortunately, the current rate methodology for the distribution companies does not encourage energy efficiency except for reducing technical losses. In fact, there are some disincentives for the distribution companies to reduce electricity sales, which in and of itself is a key barrier for enhancing demand-side efficiency. While this rate methodology decouples the companies' profits from electricity sales, there is an implicit but obvious incentive to sell more energy. Therefore, there is need to align their economic interests with increasing demand-side efficiency.

This report documents the results of an investigative effort sponsored by USAID, to assess whether a regulatory EE incentive mechanism can be introduced in Jordan. USAID initiated this effort in support of the Electricity Regulatory Commission (ERC) to encourage fast deployment of EE measures through the electricity transmission and distribution companies. Nexant Inc. was retained by USAID to conduct this assessment and to propose a mechanism suitable for Jordan.

The assessment led to the conclusion that in order for the electricity distribution companies and NEPCO to become effective agents for increasing demand-side efficiency, an incentive mechanism should be incorporated into their rate making whereby they are rewarded for actual implemented energy efficiency activities.

To explore the economic viability of such a mechanism, the following assumptions were used:

- A portfolio of EE programs is to be implemented through the transmission and distribution companies to reduce annual electricity consumption by 1% every year for 10 consecutive years starting in 2012.
- The EE program is to be financed by the transmission and distribution companies who will be allowed to recover their investment as well as the impact of the revenue loss associated with reduced sales through the electricity tariffs.
- Program implementation is assumed linear throughout the 10-year period even though in reality, program operations will be slower in early years until the market matures.
- The average life of the EE measures is assumed at 10 years since the program will cover a range of measures with a variety of operational lives.
- The EE program is assumed to offer a cash rebate component to the participating end users to cover, on average, 40% of the cost of the EE targeted measures.
- The EE program benefits start in 2013 while actual market activities begin in 2012.
- Program benefits are basically the avoided investment in generation, transmission and distribution as a result of the saved energy.
- Avoided costs are equivalent to the Long-Run Marginal Costs (LRMCs) that were developed and calculated jointly with NEPCO and the three distribution companies.

Based on current demand forecasts, the 1% program scenario will result in approximately 154,450 MWH of electricity savings and 26 MW of demand reduction in the 1st year (2013) with a target cumulative energy savings of 2,052 GWH and 347 MW of demand reduction by the end of the 10th year (2022) as shown in Table 1.

Table 1 *Summary of Benefits Associated with 1% EE Program Scenario*

Year	*2012*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*2022*
Cumulative Energy Savings MMWH		*154*	*319*	*494*	*680*	*877*	*1,086*	*1,307*	*1,541*	*1,789*	*2,052*
Cumulative Demand Reduction MW		*26*	*54*	*84*	*115*	*149*	*184*	*221*	*261*	*303*	*347*
Avoided Costs (JD Million)		*11.5*	*23.5*	*37.5*	*53.1*	*70.6*	*90*	*111.6*	*135.5*	*162.1*	*191.5*
Required Investment by the Distribution and Transmission companies (JD Million)	*20.5*	*23.1*	*26.0*	*29.0*	*32.3*	*36.0*	*40.0*	*44.4*	*49.2*	*54.5*	

The EE program is expected to require an investment of approximately JD 20.5 million in its first year of operation (2012) and then grow to reach JD 54.5 million by the 10th year as the load forecast increases and so is the 1% target. Avoided costs associated with the 1% program are predicted to be about JD 11 million in 2013, but continue to grow cumulatively until it reaches JD 191.5 million by the 10th year as shown in Figure 1.

The cumulative economic benefits to the energy system at large are those resulting from avoiding investments in future generation, transmission and distribution as a result of reducing energy consumption and peak demand over the life of the EE program.

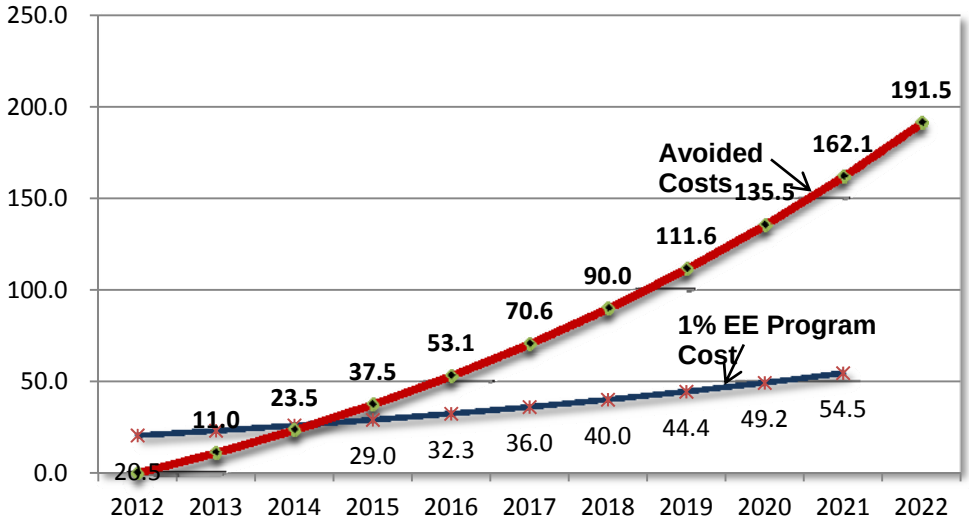

Fig. 1 *EE Program Implementation Costs Versus System's Avoided Costs for a 1% EE Program*

While the program is expected to last for 10 years, the avoided costs are calculated for 20 years since the installed EE measures in the last year of the program will have a 10-year life. Based on these assumptions, the net present values of program benefits and costs would amount to approximately JD 741.0 million NPV in benefits and JD 475.2 million NPV in costs, leading to a

net benefit of JD 265.8 million in NPV[1].

To understand the impact of the program features on the end results, tow key assumptions were changed. The EE measures' life and the period of implementation of the program were both reduced to 7 years instead of 10. Table 2 shows the costs and benefits of 2 scenarios 1) a 10-year program with average EE measures' life of 10 years, 2) a 7-year program with average EE measures' life of 7 years.

Table 2 *Cumulative Benefits and Costs for EE Program variations*

Program Scenario	10-Year EE Program with Avg. Measures life = 10 yrs	7-Year EE Program with Avg. Measures life = 7 yrs
Avoided Costs Benefits	JD 741.0	JD 402
Total Program and revenue Loss Costs	JD 475.2	JD 327
Net Benefits	JD 265.8	JD 75

Stakeholders Workshop

As a result of this preliminary assessment, it was necessary to discuss the outcome of this investigative assessment with all relevant stakeholders. Therefore, the ERC hosted a stakeholders meeting on April 27 to review the proposed energy efficiency incentive mechanism that Nexant had prepared and circulated to all participants in March. The meeting was chaired by H.E. Chairman Suleiman Al-Hafez who was joined by all three ERC commissioners, the managing directors/chairmen of the 3 electricity distribution companies, and a representative of the NEPCO managing Director. USAID/Jordan was represented by Mr. Ross Hagan and Mr. Ramzi Sabella from the Energy Office, and Nexant was represented by Emad Hassan, the lead person on this task, Mr. Terry Fry, Mr. Greg Rybka (from the U.S. team) and Dr. Fawwaz El Karmi, a local electricity sector expert.

The key results of this meeting was reaching consensus that the proposed mechanism would be beneficial to the system but caution should be taken to check all the various aspects as they pertain to the local conditions.

[1] A discount rate of 10% is used to calculate the net present value as suggested by ERC.

Executive Discussion

The proposed incentive framework has gained the attention of both H.E. the Minister of Energy and Mineral Resources and H.E. the Minister of Environment. In an executive presentation made to both Ministers on June 10th, they expressed strong advocacy to the use of such a mechanism to increase demand-side energy efficiency and reduce losses. They further requested that a 'policy package' be developed for use in discussions with the Senior Government officials and members of the Parliament when it is re-elected.

2. OVERVIEW AND OBJECTIVES

In mid 2009, the United States Agency for International Development (USAID) initiated a consulting assignment in support of the Electricity Regulatory Commission (ERC) to assess the economic viability and market possibility of developing an energy efficiency incentive mechanism to encourage fast deployment of electric energy efficiency on the demand side through the electricity transmission and distribution companies. Nexant Inc. was retained by USAID to conduct this assessment and to propose a mechanism that can be implemented in Jordan with identification of market gaps and areas in need of support in order to implement of such a mechanism.

The overall objective of the assignment is to search for an approach that could align electric utility incentives with the delivery of cost-effective energy efficiency and modify ratemaking practices to encourage energy efficiency investments. Energy efficiency should be utilized as a resource option to meet future demand by reducing current consumption and demand, but the existing framework of the electricity supply chain in Jordan does not offer adequate incentives for demand-side efficiency. In fact, some consider that there is more than one disincentive for the electric distribution companies to improve efficiency.

General View on EE Incentive Regulations

It has been internationally recognized that creating "policies to align utility incentives with the delivery of cost-effective energy efficiency" along with modifying "ratemaking practices to promote energy efficiency investments"[2] are key pieces to effectively managing the demand side of the electricity sector. The discussion can be framed in terms of the financial *disincentives* to implementing energy efficiency programs found in traditional utility regulatory policies and how alternative ratemaking can address these disincentives. The recommended alternatives - sometimes referred to as energy-efficiency or demand-side management incentive regulation - include mechanisms to address the following three issues:

- Ensuring energy efficiency program cost recovery.
- Eliminating the "throughput incentive" - i.e. the increased revenue, accrued by the utility, from increased energy consumption between rate cases - which is closely associated with

[2] *National Action Plan for Energy Efficiency;* US Department of Energy and US Environmental Protection Agency, July 2006.

the issues of lost revenue recovery.

- Providing performance-based incentives to utility shareholders.

Energy Efficiency (EE) or Demand-Side Management (DSM) programs' cost recovery mechanisms allow the electricity distribution utilities to be reimbursed for the direct program-related costs of implementing the efficiency measures. These mechanisms can include the recovery of administrative, marketing, financial rebates and post implementation evaluation costs. The most widespread means for utilities to recover their program costs are through (i) costs embedded in rates as part of the utility's resource procurement budget; (ii) special tariff riders that are approved by the regulator; and (iii) public purpose surcharges on electricity bills.[3]

Although the current ratemaking methodology in Jordan for the electricity distribution companies decouples their profits from electricity sales, there is an implicit but obvious incentive to sell more energy.

Rates are adjusted periodically by the ERC, and in the period between these adjustments, the distribution companies have a financial incentive to increase electricity sales relative to forecasted or historic levels for more than one reason. First, their profit is measured as a percent of their investment in distribution equipment and related work, which will obviously be less if consumption is reduced. Second, reduction in sales penalizes the operational cash flow they need for business until the next rate adjustment occurs. Third, by reducing revenue, the ratio of administrative costs will increase, which could lead to downward adjustment to their allowable ratio.

An important element of energy-efficiency incentive regulations is the financial incentives given to utilities for meeting and/or exceeding DSM program goals. Since utilities' returns are based on capital investment, the natural bias is toward investments in distribution equipment and hardware. Performance incentives seek to modify this behavior by providing equivalent or more rewarding financial returns on DSM investments. Forms of performance incentives include providing utilities with a "shared savings" financial bonus for achieving program targets and allowing for increased rates of return on DSM investments.

[3] Kushler, York, and Witte. "Aligning Utility Interests with Energy Efficiency Objectives." October 2006. ACEEE. Report No. U061.

3. THE EXISTING ENERGY CHALLENGE IN JORDAN

Jordan is challenged by the lack of local natural energy resources critical for social and economic development. Jordan's expanding economy, growing population, and rising standard of living all depend on energy services. Currently, Jordan imports 96% of its energy supplies from across its borders, and the electricity demand is projected to rise at a rate of 6.4% between the years 2010-2020[4]. Many issues arise due to these challenges:

- Growing demand stresses the current system, increasing energy costs and investment requirements;
- Economic growth is reduced due to high financial burdens on households and businesses;
- New supply-side investments are vulnerable to uncertainty of future prices; and
- Dependency on foreign sources increases vulnerability of the energy supply to factors outside of the control of the country.

4. ENERGY EFFICIENCY IS A COST-EFFECTIVE OPTION TO MEET THE CHALLENGE

With the majority of energy resources being supplied by foreign sources, the nation has limited influence on its supply of energy, but it could aggressively commit resources to the demand side of energy services. Numerous benefits can be received by focusing on increasing the efficient use of energy: customers can have lower energy bills; the cost is lower than only supplying new generation from new power plants; energy efficiency programs are modular and quick to deploy; and economic growth is increased by helping to create jobs as energy efficiency improvements are labor intensive. Securing the necessary investments to meet the growing demand creates a challenge that can be overcome. Energy efficiency is one resource that can assist in delaying the investment requirements for new power plants.

4.1 Benefits of Energy Efficiency

There are numerous obvious benefits for increasing electric energy efficiency that cannot be disputed, such as:

- *Lowers energy bills* – By decreasing energy consumption, as compared to what was expected, the average user will receive a lower energy bill.

[4] *Electricity Demand Forecast 2008*, NEPCO, January 2009

- *Lower cost* - Compared to supplying new generation only from new power plants. Energy efficiency programs can help defer investments in new plants and lower the total cost of delivering electricity.
- *Modular and quick to deploy* – Demand side management programs can be ramped up over one to three years to deliver considerable savings. Programs can target areas that are congested where providing new supply is difficult in the near term.
- *Environmental benefits* – Many of the negative environmental impacts of electricity generation are mitigated through energy efficiency: lowering air pollution, reducing greenhouse gas emissions and decreasing water use.
- *Economic development* – Investments in energy efficiency helps to create jobs and improve local economies. Energy bill savings often gets redirected towards activities that increase employment. Long-term economic value is increased through energy efficiency investments in long-lasting property improvements to buildings.

Changes in energy consumption practices and installed energy efficient measures utilized by the consuming sectors are what provide these benefits. These benefits are accrued by avoiding the costs of increasing capacity and supplying energy. As energy is reduced throughout the entire year, the supply curve is shifted downward, therefore reducing marginal energy and capacity costs.

4.2 Avoided Costs of Electricity Generation, Transmission and Distribution

The avoided marginal costs of energy and capacity are assumed to be equivalent to the long run marginal costs (LRMCs) of producing electricity. An analytical evaluation was carried out by Nexant and NEPCO to determine the LRMC for the three distribution companies (JEPCO, EDCO and IDECO) as well as the generation facilities and the transmission system. The analysis was closely coordinated with the distribution companies and ERC, consensus was ultimately reached on a set of avoided costs for the entire electric system.

The analysis produced LRMC results for capacity and energy that are voltage level-differentiated and time-differentiated, respectively. The benefits are ultimately avoided investments in peak capacity and energy production. Each of these has fixed costs (turbines, transmission & distribution wires, etc.) and variable costs (fuel, operation and maintenance, etc.), both of which are avoided.

Electricity is supplied to customers directly served by NEPCO at the medium voltage (MV) level

and to customers served by the distribution companies at the low voltage (LV) level. In Table 3, the annual marginal capacity is shown for these two voltage levels of electricity, which is the incremental cost saving that results from each unit of electrical capacity that will not have to be installed as a result of investments in energy efficiency.

Table 3 *2010 Annual Long Run Marginal Costs of Capacity*

Voltage Level	Marginal Capacity Cost (JD/KW-Month)	Annual Marginal Capacity Cost (JD/kW-Yr)
MV	9.79	117.5
LV	14.28	171.4

The LRMC of energy was separated into 'peak' (3 hours a day[5]), 'mid-peak' (13 hours a day) and 'Off-peak' (8 hours a day). Table 4, lists the long run marginal cost of each of these listed by time-of-day as well as the average level LRMC of energy for each voltage level.

Table 4 *2010 Long Run Marginal Costs of Energy for each voltage level*

Voltage Level	Time-of-Day			Average LRMC of Energy (JD/kWh)
	Peak (JD/kWh)	Mid-Peak (JD/kWh)	Off-Peak (JD/kWh)	
MV	0.062	0.038	0.029	0.038
LV	0.072	0.044	0.032	0.044

[5] From 8:00 pm to 11:00 pm

5. THE BENEFITS OF A LONG-TERM ENERGY EFFICIENCY PROGRAM

Utilities throughout the world have found that reducing forecasted annual energy sales by 1% each year through energy efficiency is achievable and this is believed to be a reasonable level of energy savings for Jordan without negatively impacting economic development or standards of living. This level of potential annual reduction in consumption is consistent with the 2007 Energy Strategy, which targets 5% savings of total electric demand by 2015[6].

Figure 2 illustrates: the forecasted electricity sales through 2022, which are expected to reach 26,288,000 MWH; and the impact on consumption with the implementation of a program that targets a 1% annual reduction in consumption to be implemented for 10 consecutive years. A cumulative 2,052 GWH can be reduced over the life of the EE program.

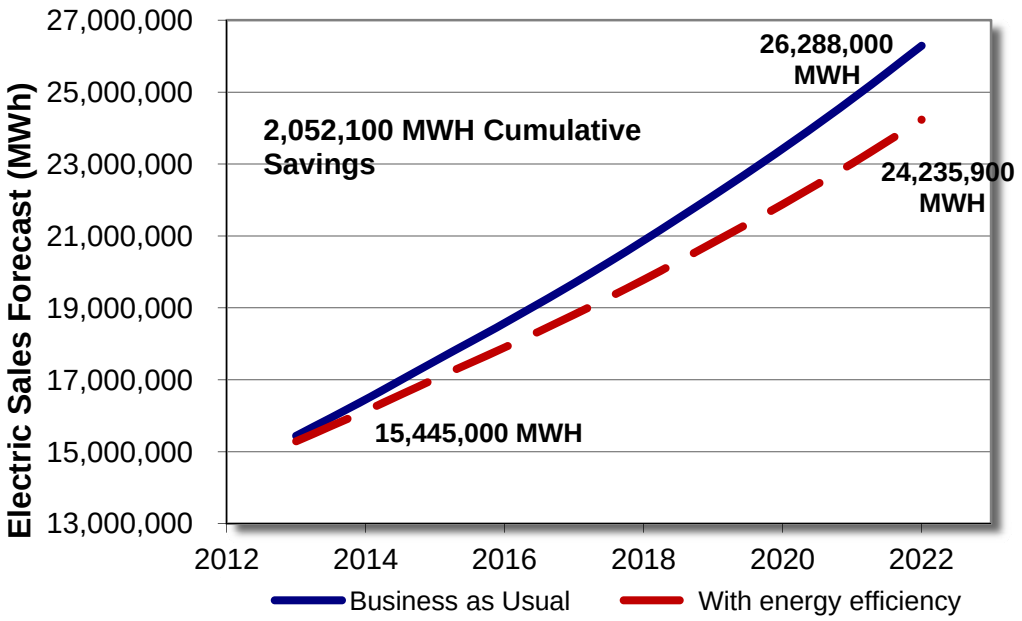

Fig. 2 *Forecasted Electricity Sales and Cumulative EE Savings Potential*

[6] Updated Master Strategy of Energy Sector in Jordan for the period (2007-2020), Hashemite Kingdom of Jordan, December 2007

5.1. Assumptions Used

The following assumptions were used in evaluating the impacts of the 1% EE program:

1. A portfolio of EE programs will be introduced to encourage the transmission and distribution companies to reduce annual electricity consumption by 1% every year for 10 consecutive years starting in 2012.
2. The EE program will target EE measures with an average 3-year simple payback (over the program life) before the incentive contribution. This assumption was made based on the likelihood that in early years, the program would capture the 'low-hanging fruits' or measures with short payback but in later years, less economically attractive measures would be included.
3. The EE program will be financed by the transmission and distribution companies who will be allowed to recover their investment as well as the impact of the revenue loss associated with reduced sales through the electricity tariff.
4. Program implementation will be assumed linear throughout the 10-year period even though in reality, program operations will be slower in early years then ramping with market maturity.
5. The average life of the EE measures is assumed at 10 years since the program will cover a range of measures with a variety of operational lives.
6. The average program contribution to end users would be to cover 40% of the cost of the EE targeted measures.
7. The EE program benefits start in 2013 while actual market activities begin in 2012.

5.2. Target Energy Savings and Demand Reduction

The 1% program scenario is expected to achieve 154,450 MWH of energy savings and 26 MW in the first year of the program (2013). With continued implementation of the program, the annual reduction in energy consumption will reach 262,880 MWH in the 10th year, providing a total of 2,052 GWH savings in energy consumption and 347 MW over the program 10-year span as shown on Figures 3 and 4.

It should be emphasized however, that in order to capture these potential savings, a review and analysis of energy use patterns in all consuming sectors is necessary to determine the approach recommended for each sector and priorities to be considered within each.

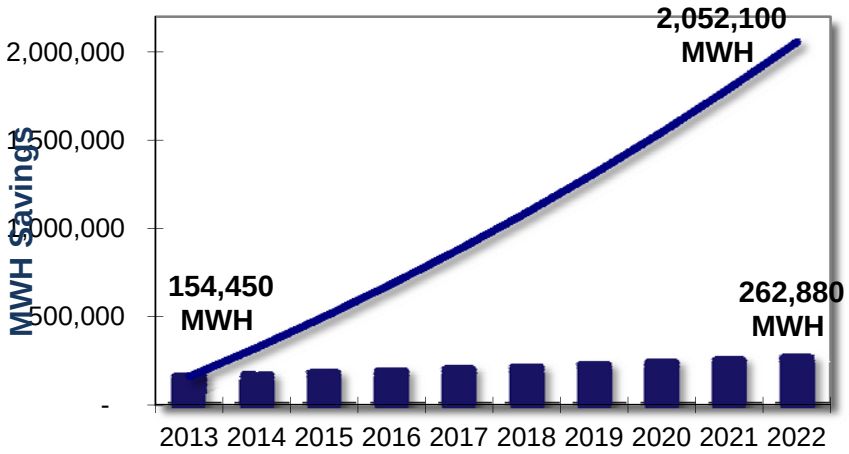

Fig. 3 *Annual & Cumulative EE savings*

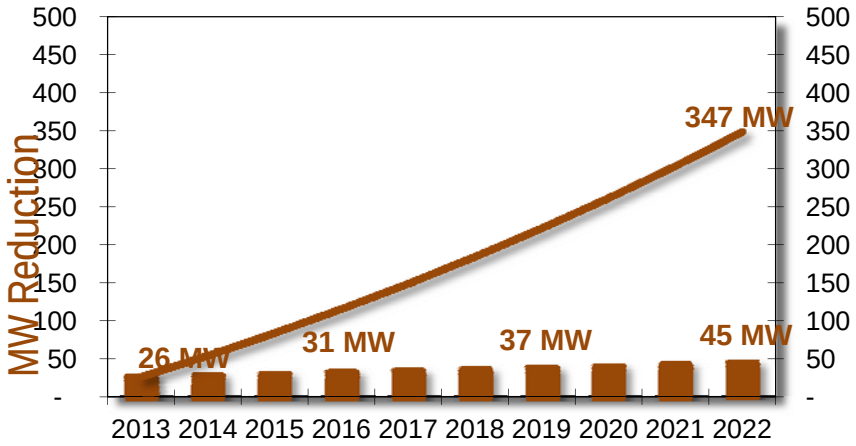

Fig. 4 *Annual & Cumulative Demand Reduction*

Investment needs, implementation approaches, technology availability and other relevant criteria may be different and therefore, designing customized EE programs is advisable to ensure maximum achievements.

Studies exist on energy use patterns in various sectors of the economy and energy efficiency potential, and some market activities have been implemented with the assistance of the Ministry of Energy and Mineral Resources (MEMR), the National Energy Research Center (NERC) and various donor organizations. We believe that although sufficient energy engineering skills are readily available in Jordan, experiences that are lacking include program portfolio planning, program design, program implementation (marketing, administration, management reporting,

etc.), and a measurement protocol and evaluation techniques to ensure effectiveness and sustainability. program design, program implementation (marketing, administration, management reporting, etc.), and a measurement protocol and evaluation techniques to ensure effectiveness and sustainability.

In designing this portfolio, it is important to consider diversification of target demand sectors, social balance, business climate, and institutional capacity of the electricity system. Energy efficiency can be found in the majority sectors such as household and commercial end users. Customers in the Industrial sector are fewer in number but use large amount of electricity, making them a key target for DSM programs. The Agricultural sector is another key area for savings as it constitutes around 15% of total energy use in Jordan. The government water sector is another key area that uses significant energy supplies for pumping.

5.3. Existing Barriers

Achieving more than naturally occurring energy efficiency requires a sustained programmatic commitment on the part of MEMR and ERC. Numerous barriers are present that prevent increase in the level of energy efficiency without investment, for example:

- *Market barriers* – The cost can be too high for small businesses or individuals to overcome to actually install energy efficiency measures.
- *Barriers for customers* – A shortage of funding to invest in energy efficiency; a lack of information on energy savings opportunities; not being aware of how energy efficiency programs make investments easier.

In order to implement programs that can achieve the available savings, a cost must be paid for by the utility to create and carry out such programs. Some of the tasks involved are:

- DSM portfolio planning
- Program design
- Program marketing.

In addition to the investment requirements to implement a national comprehensive DSM portfolio of programs, the above expertise and knowledge have to be properly instituted and strengthened within the system. The program costs can be recovered over time as net benefits are realized through the success of the programs. But it is important to wisely invest resources in programs in

a manner that is cost-effective for all stakeholders. A discussion on cost-effectiveness evaluation and tests follows below in Section 5.6.

5.4. Societal Benefits

For the purpose of this assignment, and to evaluate the economic viability of an EE incentive mechanism, the following assumptions were used for estimating the avoided costs attributable to the achievements of the 1% EE program:

- *Forecasted electricity sales – Forecasted* sales were based on NEPCO's electricity demand forecast of 2008. This included the following sectors: Households, Street lighting, Commercial, Industry, Water pumping and Industry-Bulk Supply.
- *Energy savings* - The calculated annual energy savings was based on 1% of forecasted sales. This is a reasonable number based on other utilities being able to achieve this level of savings. The energy savings is then cumulative for the average measure life. The savings persist until the measures installed in the final years of the program have come to their end of life.
- *Capacity savings* - As it is assumed there will be energy saved throughout the year, there will also be a reduced level of capacity required of 1%. The demand reduction accumulates for the life of the average measure. The capacity savings is assumed to have the same load shape as the load shape of the entire grid. So the peak level of capacity saved coincides with the peak period of the grid. This capacity reduction will persist as long as the energy savings persists.
- *Length of savings* – The average measure life was assumed to be 10 years. There will be a mixture of energy efficiency measures that have varying end use lives, e.g., a lighting installation in a residential building may last for 5 years while air conditioning units in a commercial facility may last for 20 years.
- *Escalation rates* - It was assumed that the long run marginal cost as well as tariff rates would increase at a rate similar to the rate of inflation. The escalation rates were assumed to be 3%.
- *Load factor* - The grid level load factor was calculated to be 67.4%. This is based on data from the 2008 ERC annual report and calculated as the average load factor from the years

1998 to 2008.

- *Discount rate* – 10% was used in the analysis.

The long run marginal costs shown in Table 3 and Table 4 were used to calculate the avoided cost to the country, shown in Equation 1:

$$\text{Avoided Cost (NPV)} = \sum_{0}^{i=20} \frac{kW_i \times LRMC_{capacity,i} + kWh_i \times LRMC_{energy,i}}{(1 + DiscountRate)^i}$$

The marginal costs of reduced capacity and energy saved were added to calculate the avoided cost for a given year. This was performed for each year that energy efficiency measures are to be installed, which would be 20 years in the analysis. Each year of cost savings was then discounted and summed to determine the net present value of the total avoided cost.

The results of this analysis of the economic benefits showed that annual avoided costs of generation, transmission and distribution, as a result of achieving 1% reduction in energy consumption for 10 consecutive years, would reach JD 191.46 million after the 10th year of program implementation.

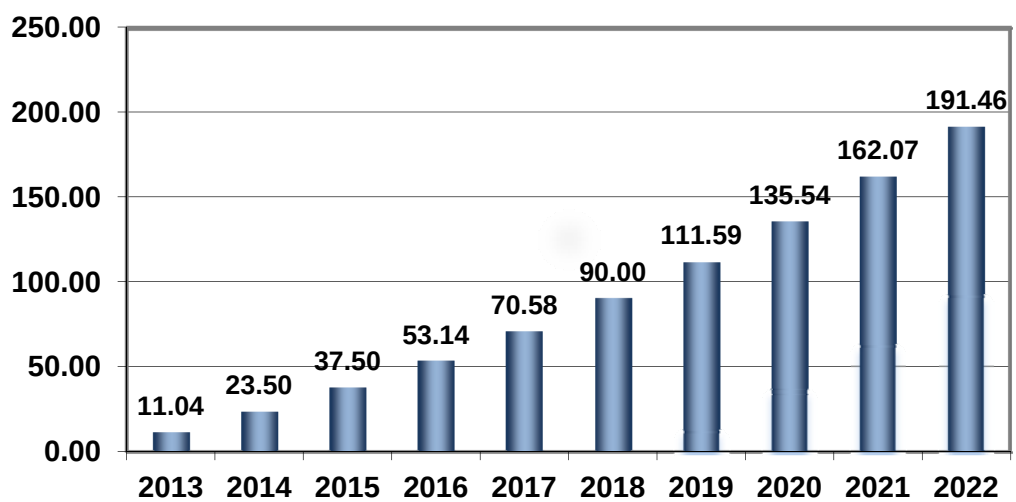

Fig. 5 *Annual System's Avoided Costs for 1% EE Program*

Table 5 provides a summary of the savings achievements, investment costs and potential economic benefits associated with the assumed EE program to be implemented over a 10-year program.

Table 5 *Summary of Benefits Associated with 1% EE Program Scenario*

Year	2012	13	14	15	16	17	18	19	20	21	2022
Cumulative Energy Savings MMWH		154	319	494	680	877	1,086	1,307	1,541	1,789	2,052
Cumulative Demand Reduction MW		26	54	84	115	149	184	221	261	303	347
Avoided Costs (JD Million)		11	23.5	37.5	53.1	70.6	90	111.6	135.5	162.1	191.5
Required Investment by the Distribution and transmission companies (JD Million)	20.5	23.1	26.0	29.0	32.3	36.0	40.0	44.4	49.2	54.5	

The EE programs are expected to require an investment of approximately JD 20.5 million in its first year (2012) and grow to reach JD 54.5 million by the 10th year as the load forecast increases and so does the 1% target. Avoided costs associated with the 1% program are predicted to be approximately JD 11 million in 2013, and also growing with the program to reach JD 191.5 million by the 10th year of the program as shown in Figure 6.

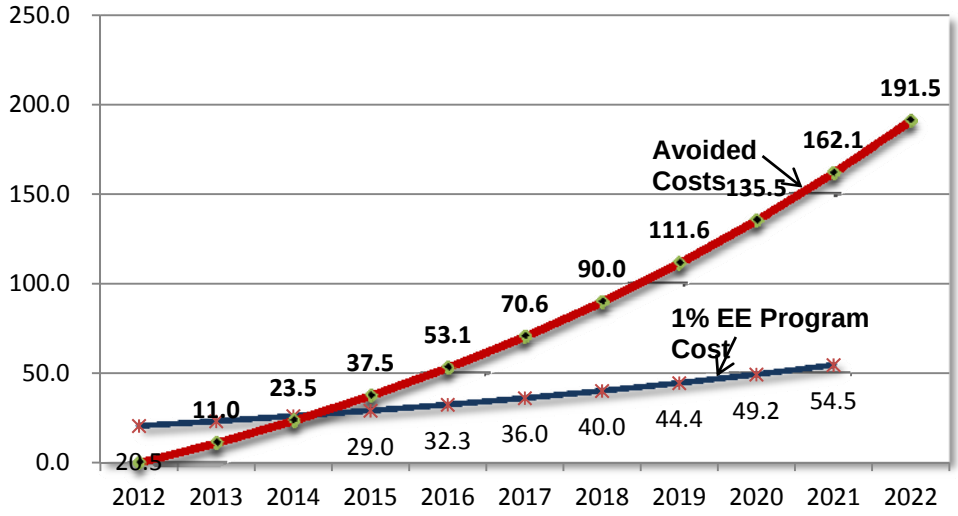

Fig. 6 *EE Program Implementation Costs Versus System's Avoided Costs for a 1% EE Program*

The present value of the cumulative benefits that are expected to accrue over the 10-year implementation period were estimated at JD 741.0 million using a discount rate of 10%[7]. When implementation costs (i.e., total program costs plus net customer equipment costs) incurred by society to achieve these benefits were deducted, the net benefits were reduced to JD 265.8 million NPV.

[7] Suggested by ERC

5.5. Benefits and Costs under Different Program Scenarios

In order to understand the impact of various assumptions used in this proposed incentive mechanism, a parametric analysis was conducted focusing on two key assumptions: 1) the program EE implementation period and 2) the average EE measure's life.

When the average installed EE measure life and the program implementation period were shortened to 7 years instead of 10 (program to run from 2012 to 2018), the net benefits were significantly reduced to approximately JD 75 million compared to JD 266 million that would accrue from the base case scenario of 10 years of implementation.

Table 6 lists the costs and benefits for each of the 2 scenarios mentioned above, 1) a 10-year program with average EE measure life of 10 years, 2) a 7-year program with average EE measure life of 7 years. All values are in NPV million Jordanian Dinars.

Table 6 *Cumulative Benefits and Costs for EE Program variations*

Program Scenario	10-Year EE Program with Avg. Measures life = 10 yrs	7-Year EE Program with Avg. Measures life = 7 yrs
Avoided Costs Benefits	JD 741.0	JD 401.5
Total Program and revenue Loss Costs	JD 475.2	JD 326.9
Net Benefits	JD 265.8	JD 74.6

5.6. Cost-Effectiveness Criteria from All Stakeholders' Perspectives

To measure the effectiveness of an energy efficiency portfolio, standard metrics are used internationally. There are three common metrics, or 'tests', recommended for use to determine whether a DSM portfolio should be approved for implementation. These are the "Total Resource Cost" test, the "Utility Cost" test, and the "Rate Impact Measure" test. Each of these provides insight into the effectiveness of DSM though each is able to uniquely answer different questions.

The ***Total Resource Cost (TRC)*** test measures the net costs of demand-side management programs as a resource option based on the total costs of the programs, including both the participants' and the utility's costs. The benefits used in the analysis are the avoided costs of JD 741 million, which have been previously discussed. The costs are those incurred by the utility (program costs and customer rebates) and the customers (the amount of incremental investment the customer has to contribute to purchase and install the EE measures), totaling JD 475.2 million. Obviously, the TRC has to exceed 1.0 in order for a program to be cost-effective and be recommended for implementation.

The ***Utility Cost (UC)*** test is an important indicator of the viability of an energy efficiency program from the perspective of the utility. It measures whether the utility's revenue requirements (amount of revenue to be collected in bills) will decrease or increase as a result of the program portfolio. The benefits used in this test are also the avoided costs previously described; JD 741 million. Because customer costs are not included in this test, the total costs accounted for are only JD 220.6 million. Similar to the TRC test, the UC test has to exceed 1.0 to be cost-effective.

The ***Rate Impact Measure (RIM)*** test is a measurement of the rate adjustment that needs to be made in the first year of the programs' implementation that would adjust for the programs' costs and the lost revenue (i.e., the amount of authorized fixed costs that would ordinarily be under-recovered as a result of the programs' impacts). The rate impacts are small, amounting to an adjustment of well under 1 piaster. It is anticipated that the impact on non-participants will be minor, though it will be important to take equity considerations into account when developing a portfolio of DSM programs. The revenue impact of most DSM programs is in an increase in rates simply to compensate for under-recovery of amortized historical investments. The question is at

what level can this rate increase still be tolerated and whether it can be absorbed to avoid an increased burden on rate payers.

As seen on Table 7, the TRC test for the 1% EE program yields 1.7, showing that the benefits outweigh the costs by 70%. As for the UC test, the benefit/cost ratio is 3.6. The impact on rates is shown through the RIM test as JD 0.002/kWh or 2 Fils/kWh.

Table 7 *Results of the Cost-Effectiveness Tests*

	Total Resource Cost TRC test	Utility Cost UC test	Ratepayer Impact Measure RIM test
Benefits (JD million)	JD 741	JD 741	JD 741
Costs (JD million)	JD 475	JD 221	JD 1,211
Net Benefits (JD million)	JD 266	JD 520	(JD 470)
B/C Ratio	1.6	3.4	0.6
LRI-RIM (JD/kWh)	n/a	n/a	(0.002)

*All values are NPV

Table 8 shows the important question that is answered by each test.

Table 8 *Key Indications from the Cost-Effectiveness Tests*

Test	Total Resource Cost TRC	Utility Cost Test UCT	Ratepayer Impact Measure RIM
Key Question	Will the total cost of energy in the utility service territory decrease? YES	Will utility bills decrease? YES	Will utility rates increase? Yes, Very Slightly

6. SHARING THE BENEFITS WITH THE STAKEHOLDERS

Electricity distribution companies and NEPCO are very important players in delivering energy efficiency to energy end users. Their natural link to end-use customers, whether for electricity supply or for ongoing operational issues, makes them rather influential on customers' energy investment decisions. Their previously discussed inherent disincentive in the current ratemaking to reduce sales is a key barrier for expanding energy efficiency. It is essential to align their economic interest with the objectives of using energy efficiency as a resource option to meet future demand growth.

In the current tariff methodology set by ERC, the electricity distribution companies' profit is dependent on the amount of investment they put into their service territory to secure proper and safe services to the end users. These investments require pre-approval of the ERC as to the reasonableness of the investment before they can be rate-based. While this rate methodology does not make the distribution companies' profits dependant on electricity sales, there is an implicit but obvious incentive for these companies to sell more energy.

As mentioned earlier, electric rates are changed periodically by the ERC, and in the period between rate adjustments, the distribution companies have a direct financial incentive to increase energy sales to support their operational cash flow needs. Another implicit incentive to increase sales is to reduce the ratio of administrative costs to overall revenues. These motives are obviously contrary to energy efficiency and significant barriers to be removed.

One must realize also that if investing in energy efficiency would be treated from an earnings perspective, similar to that of the supply side or distribution equipment, the distribution companies would be biased to the latter given their comfort and knowledge of its technical and market aspects. Introducing energy efficiency will require more personnel and appropriate training in the distribution companies and NEPCO, as EE activities require capacities that are currently almost non-existent within the utility organizations. Additionally, the risk associated with demand side efficiency investment is perceived to be greater than that of the business-as-usual system investments.

For the above reasons, an attractive incentive mechanism is critical to encourage the electricity distribution companies and NEPCO to become agents for increasing demand side efficiency.

This will turn the main barrier into a driver for more efficiency. Of course, an attractive incentive should be associated with a level of accountability for delivering the benefits and therefore, it is recommended that such an incentive mechanism be designed as performance-based.

A possible earnings mechanism is to share a portion of the net benefits of achieved energy savings (as measured by the Total Resource Costs) with the distribution companies. In the TRC test, both the providers and consumers of electricity are accounted for, so using the net benefits achieved for both stakeholders is an appropriate metric to use for a performance incentive.

The following scenario is provided for illustrative purposes only. If the transmission and distribution companies are apportioned a 15% share of the TRC net benefits, they would receive approximately JD 40 million in NPV. This represents an 18% return on the costs that are expected to be spent by the utilities (JD 220.6 million) to implement the 10-year program. However, it is worthy to mention that since the proposed mechanism is based on program cost recovery by the utility, the level of financial risk borne by the utilities would be limited. This attractive reward is intended to encourage the transmission and distribution companies to maximize the benefits of the EE program.

Table 9 *Illustrative Profit Sharing of Net Benefits*

Illustrative Profit Sharing of Net Benefits of the EE 1% Scenario	
Illustrative 15% share of TRC net benefits to T&D Companies(NPV Million)	JD 40
Utility Cost (NPV Million) – Program Cost	JD 221
Rate of Return	18%
Illustrative 85% -- Jordan's Economic Benefits (NPV Million)	JD 226

7. ISSUES TO BE CONSIDERED IN DEVELOPING A DSM PORTFOLIO

Program design is a critical part of effective DSM implementation and would appropriately be conducted by the responsible utilities which stand to benefit from superior efforts. Energy-efficiency *portfolio* planning and design, however, would best be managed by the Ministry of Energy and Mining Resources. This is because—in addition to planning to achieve the most cost-effective level of savings—equity considerations of fairness to the entire national economy need to be taken into account. As noted above implementing a DSM portfolio decreases the *average* energy bills in future years, but there will be some customers who do not participate in programs and whose rate adjustment (estimated by the Rate Impact Measure test) may lead to slight increases in bills for those end-users. To proactively minimize the number of DSM program non-participants, all customer sectors should be accounted for in developing a fair and economic portfolio of DSM programs.

The following functional needs are critical from an institutional perspective in order to develop a comprehensive EE portfolio and to ensure the ability to maintain the program and adjust its structure, approaches and overall objectives as market conditions change:

- DSM planning
- Program design
- Program marketing
- Measurement & verification
- Program evaluation

8. RECOMMENDATIONS

8.1 Reach Stakeholders Consensus on an Incentive Mechanism (Stakeholders Workshop)

- Sharing the benefits
- Setting the goals
- Management and institutional responsibilities

8.2 Identify the Necessary Implementation Steps

- Ratemaking
- Revenue collection
- Distribution company incentives

8.3 Assess and Develop the System's Institutional Capacity

- ERC's needs – Planning, ratemaking and M&V protocol
- MEMR – Portfolio design and overall coordination and monitoring
- NEPCO's needs – System planning
- The three distribution companies' capacity – Program design, marketing, implementation, tracking, and reporting

APPENDIX A

INTERNATIONAL EXPERIENCES WITH ENERGY EFFICIENCY INCENTIVES

Internationally there has been an increasing interest in energy efficiency since the 1970s. Throughout that time, a variety of successes and lessons learned have taken place. Much of this learning process occurred within utilities in North America. Overtime, it has become clear that stakeholder interests must be aligned in order for the successful implementation of energy efficiency measures. The information reported below is for nine states that are actively using incentives directed at utilities. In addition to this summary of those nine states, four of those states have also decoupled there electricity sales from their revenue. More detailed information on those four states is provided, including information on their program structure, performance incentive and decoupling/lost revenue mechanism.

Table A-1 *Summary Table of Performance Mechanisms*

State	Performance Incentive Type	Basis for Performance Metric	Max Compensation (as % of program expenses)	Process/Ease of Application
Arizona (AZ)	Specific financial reward	Share of net benefits	10% of program budget	Funding cycle not completed yet; part of general rate cases.
California (CA)	Risk/Reward Mechanism	Energy savings performance	9% or 12% of net benefits (if 85% to 99% or over 100% of goals are achieved, respectively)	More complex than most. Contentious track record.
Connecticut (CT)	Specific financial reward	Savings goals and other program goals	Up to 8% of program costs before taxes	Fairly straight-forward. Good track record.
Massachusetts (MA)	Specific Financial reward	Multi-factor performance targets: savings, value, and performance	Up to 9% of program costs before taxes (5.5% after taxes)	Fairly straightforward good track record
Minnesota (MN)	Proportion of overall net benefits	Energy savings goals	Up to 30% of program costs for reaching 150% of program targets	A little more complex than most. Good track record.
Nevada (NV)	Increased rate of return on equity	Program spending goals	Extra 5% return on equity for EE investments	Somewhat complex.
New Hampshire (NH)	Specific financial reward.	Savings and cost-effectiveness goals.	8-12% of program budgets.	Fairly straight-forward. Good track record.
Vermont (VT)	Non-utility: specific financial reward	Multi-factor performance targets: program results, market effects, and activity milestones	About 2% of total contract	Assessed and awarded over length of contract – 3 years
Wisconsin (WI)	Allowed to earn same rate of return as for supply-side investments	Determined in rate cases; not specified	Not available	Part of much larger process – general rate cases.

Summary of states that have decoupling and utility incentives

1. *California*

Overall energy efficiency program approach and structure

California has been a leading state for a long time for its utility-sector customer energy efficiency programs, which date back to the 1970s and have grown and evolved substantially over three decades. Its programs and related energy efficiency policies have had a significant impact on per capita electricity use, which has remained essentially constant over the past 30 years.

In California, the political move toward a new administrative structure for implementing energy efficiency has been led by the regulatory body, the California Public Utilities Commission (CPUC). The CPUC provides overall energy savings targets and policy guidelines for the creation of the program portfolio.

The Independently Owned Utilities (IOUs) are responsible for program choice. Each IOU, in coordination with its Program Advisory Group (PAG), a public group of energy professionals that provides inputs representing perspectives of various stakeholders, design a comprehensive portfolio of programs to meet the long-term needs of their resource portfolios and consistent with the CPUC policy guidelines. The portfolio plan specifies which programs in the portfolio will be devoted to third-party implementation through competitive bids. Each utility also has a Peer Review Group (PRG), which then provides feedback on third-party bids and on the adequacy of the program portfolio within the framework of CPUC policy guidelines.

The CPUC also chose to assign portfolio administrative responsibilities to the IOUs. The alternative of hiring administrators through open solicitations was rejected out of concerns for high start-up costs and the considerable burden that the selection process would put on CPUC staff. Moreover, the CPUC feared possible overlaps between different programs due to a possible lack of coordination between different administrators. The CPUC chose to have the IOUs administer the program portfolios because of their historical performance in meeting aggressive savings goals.

Performance Incentives

The California Public Utilities Commission defined a Risk/Reward Mechanism for investor-owned utilities in the Energy Efficiency Proceeding. In October 2007, it was established that a minimum performance standard for the utilities under which incentive earnings accrue only if the

IOU energy efficiency portfolio of programs achieves at least 85% of the CPUC's goals. The incentive formula calls for utilities to receive 9% of net benefits if they achieve between 85-99% of savings goals, and 12% of net benefits if they meet or exceed savings goals up to the earnings caps established for each utility. In addition, utilities can earn a percentage of their incentive earnings before evaluation procedures verify their impacts.

2. Massachusetts

Overall energy efficiency program approach and structure

The utility industry in Massachusetts has been restructured, as it now has competitive generation and retail markets. The distribution companies are required by regulator to offer energy efficiency and other DSM programs. The distribution utilities administer their own energy efficiency programs with collaborative input and oversight from the state government's energy related entities.

The energy efficiency and low-income programs are funded by a monthly charge (i.e. a system benefits charge) on customers' electric bills, approximately 2.5 mills/kWh. The money is collected by the distribution utilities and sent to a trust fund. Each distribution company estimates how much money it will collect each year. This determines how much they have to spend on energy efficiency programs that year. Any discrepancy between the forecasted level and the actual amount spent is corrected for the following year. Based on the budget, each company submits an annual energy efficiency program proposal. The companies work with a group of stakeholders in developing their plans. A government agency (Department of Energy Resources) is tasked with assisting in designing the plan, and allocating funding to the various sectors. The plan is then reviewed by the state's utility regulatory authority for cost-effectiveness. The utility companies manage and implement the actual programs.

Performance Incentives

There is an incentive of about 5% of program costs for meeting established energy efficiency program goals, which is directed towards shareholders. The program savings is measured by the utilities, after the programs are implemented. The incentive is based on the results of this M&V phase. Energy savings, benefit/cost ratio, and market transformation results are some of the elements that are used in calculating the incentive.

The incentive is earned for each program, not the portfolio as a whole, so it is not an all-or-nothing mechanism. All costs associated with program implementation are included in the calculation of the incentive, including marketing, administration, and evaluation. In 2003, an energy efficiency program collaborative and the utilities negotiated a revised shareholder incentive proposal. The distribution utilities agreed to more stringent goals (including energy savings, acquisition efficiency, and market incentives) and accountability in return for a more reasonable shareholder incentive.

3. Minnesota

Overall energy efficiency program approach and structure

Minnesota statutes mandate a specified spending by regulated natural gas and electric utilities on energy efficiency programs. Not all utilities are required to spend equal amounts: Xcel Energy must spend 2% of gross operating revenues (GOR) on programs; all other electric utilities must spend 1.5% of GOR; and Natural gas utilities must spend 0.5% of GOR.

Cost recovery for energy efficiency programs is performed through rate cases, which include evaluating program costs and incentives. A part of the rate case is determining the appropriate "conservation cost recovery charge" (CCRC), which is part of base rates. The state also uses a "conservation cost adjustment," which is used for annual true-up and tracking of program expenses. Utilities establish a "tracker account" to show how much of the energy efficiency program budgets are recovered through rates. Program plans are made and approved on a 2-year cycle. Approved energy efficiency program expenses are trued up annually.

Performance Incentives

In 1999, the Minnesota Public Utilities Commission agreed to a performance-based incentive for utility energy efficiency programs. Utilities are rewarded with a specific percentage of net benefits (as measured by the utility cost-effectiveness test) created by their actual investments in energy conservation. The incentive level operates on a tiered system such that, the percentage of net benefits awarded increases as the percentage of energy-savings goal achieved increases. The incentive is calibrated so at 150% of the energy-savings goals, the utility would receive about 30% of the utility's conservation expenditure budget as required by statute. Under the incentive design, utilities are also rewarded for delivering their programs more cost-effectively. Ratepayers fund the incentive during the following year when the Public Utility Commission adjusts rates.

This incentive mechanism has been working well to encourage spending above statutory requirements. Utilities informally have indicated that their management is more supportive of energy efficiency investments because: (a) recovery of the conservation investment is guaranteed including a carrying charge on these investments, as well as an annual automatic adjustment to recover these investments, and (b) the performance incentive makes additional investments more attractive.

4. Vermont

Overall energy efficiency program approach and structure

Since 1990, Vermont has had a broad set of energy efficiency programs. These programs were originally run by the state's utilities under jurisdiction of the Public Service Board (PSB). In 1999, the PSB transferred the energy efficiency operations over to Efficiency Vermont, a statewide "energy efficiency utility". Efficiency Vermont is supported by public benefits charges and is operated by a competitively selected contractor, currently it is the Vermont Energy Investment Corporation (VEIC).

Efficiency Vermont now provides a comprehensive portfolio of services and has achieved significant success in meeting its objectives. In 2007 and 2008, savings from these energy efficiency programs more than offset the average underlying rate of electricity load growth.

Performance Incentives

VEIC is eligible to receive a performance incentive for meeting or exceeding performance goals established in its contracts. The contractor does not receive compensation until the achievement has been confirmed by the Department of Public Service. For the 2000-2002 contract, Efficiency Vermont was able to earn up to $795,000 (JOD 1.1 million) over the three years period.

Contracts since this time between the PSB and VEIC have focused more on superior performance, as opposed to achieving expected goals. The aim of the incentive is to provide an interest in achieving "stretch goals" as opposed to simply achieving goals that have now become expected to achieve.

Decoupling and Lost Revenue Recovery

Table A-2 below provides information on the decoupling and lost revenue mechanisms that are used in four highlighted stats: California, Massachusetts, Minnesota and Vermont. These states were selected based on their policies of both decoupling and performance incentives.

Table A-2 *Summary of Decoupling and Lost Revenue Recovery Mechanisms*

State	Description	Codes, Orders & Resources
California (CA)	California has had some for of decoupling since 1982. The current "decoupling plus" program, approved in 2007, is a revenue decoupling program combined with performance incentives for meeting or exceeding energy efficiency targets (performance-based rates). Revenue requirements are adjusted for customer growth, productivity, weather, and inflation on an annual basis with rate cases every three or four years (varies by utility). The incentive structure caps penalties/earnings for energy efficiency programs at $450M.	*CA Code Sec. 9 Section 739(3) and Sec. 10 Section 739.10 as amended by A.B. XI 29; Decisions 98-03-063 & 07-09-043*
Massachusetts (MA)	Gas an electric utilities in Massachusetts must include a decoupling proposal in their next rate case. Target revenues are determined on a utility-wide basis (full decoupling) and can be adjusted for inflation or capital spending requirements if necessary. The Massachusetts Department of Public Utilities expects that all utilities will have fully operation decoupling plans by 2012.	*MA Docket 07-50*
Minnesota (MN)	A decoupling statute has been put in place allowing for electric and gas utilities to implement decoupling pilot programs of no more than three years. Utilities are required to submit proposals to the state Public Utilities Commission for the structure of recovery mechanisms and frequency of true-ups. Annual status reports are to be given to the state legislature once the programs are in place.	*MN Statute 216B.2412*
Vermont (VT)	A Revenue-per-Customer (RPC) decoupling program was approved for Green Mountain Power under the Alternative Regulation Plan. Rates can be adjusted up to four times per year with an annual reconciliation on allowed earnings. Changes in base rates cannot exceed ~2% per year. The Central Vermont Public Service (CVPS) was also approved for decoupling in 2008.	*VT Dockets 7175, 7176 & 7336*

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