EGAT Office of Infrastructure & Engineering

Sustainable Municipal Energy Services Program (SMES)

Proposed Energy Efficiency Incentive Mechanism for Jordan's Electricity Sector

November 2010

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

EGAT Office of Infrastructure & Engineering

Sustainable Municipal Energy Services

Program (SMES)

Proposed
Energy Efficiency Incentives Mechanism for Jordan's Electricity Sector

November 2010

This publication was produced for review by the United States Agency for International Development. It was prepared by Nexant, Inc., Under Contract No. EPP-I-02-03-00007-00

DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development of the United States Government

Table of Contents

1. EXECUTIVE SUMMARY 4
2. CHALLENGES FACING THE ELECTRICTY SECTOR IN JORDAN 8
Financial Burden 8
Fast Growth 9
Regional Competitiveness 9
3. DEMAND-SIDE EFFICIENCY IS A COST-EFFECTIVE OPTION 11
The 'Avoided Costs' in the Distribution Sector 11
The 'Avoided Costs' in the Generation and Transmission Sector 11
4. BARRIERS TO INVEST IN DEMAND-SIDE EFFICIENCY 13
5. JORDAN OFFERS AN IDEAL CASE FOR ADOPTING AN EE INCENTIVE MECHANISM 14
6. THE CURRENT MARKET POTENTIAL FOR EE IN JORDAN 15
7. COMPARISON WITH PAST ENERGY EFFICIENCY TARGETS 17
8. ALIGNING THE INTEREST OF THE T&D UTILITIES WITH DEMAND-SIDE EFFICIENCY 19
Setting Targets 19
Creating an Incentive to T&D Utilities 19
9. ILLUSTRATIVE ENERGY EFFICIENCY INCENTIVE MECHANISM FOR JORDAN 21
Illustrative EE 1% Program Scenario 21
Program Technical Impacts 21
Program Long-term Economic Benefits 23
The 'Avoided Costs' of Generation, Transmission & Distribution in Jordan 23
Sharing the Benefits with Stakeholders 25
Program Environmental Benefits 26
Contribution to Job Creation 26
Proposed Implementation Timeline 27
10. IMPACT OF THE INCENTIVE MECHANISM ON ELECTRIC TARIFFS 28
11. IMPACT ON THE EXISTING REGULATORY FRAMEWORK AND TARIFF METHODOLOGY 29
12. REQUIRED UPDATES TO REGULATIONS 31
13. THE RISKS ASSOCIATED WITH ENERGY EFFICIENCY PROGRAMS 33
Technology risk 33
Market risk 33
Regulatory Risk 33
14. WHAT IS NEEDED TO ADOPT THE PROPOSED MECHANISM 34

1. EXECUTIVE SUMMARY

This policy proposition is presented to develop an incentive mechanism that promotes Energy Efficiency (EE) as a resource option to meet Jordan's evolving electricity needs. EE is the most cost-effective approach to addressing the country's growing demand on electricity. The implementation of a 10-year energy efficiency program could postpone the need to build a 340 MW power plant. The concept is based on using the cost avoidance of delivering electricity to consumers as a result of increasing demand side efficiency as a metric to calculate the benefits accruing to the systems. Once these benefits are validated, they can be shared with the implementation stakeholders such as the transmission and distribution utilities. End use customers who implement energy efficiency measures will benefit by reducing their electric bills.

Electricity consumption has been rising steadily in Jordan with consumption doubling up every ten years. By the end of 2010, electric consumption will have passed twice the recorded consumption in 2000, and future forecasts also suggest that it will double again by 2021. While this is a positive economic development indicator and a sign of rising standard of living, it is also alarming for a country that depends almost entirely on foreign supply of oil and gas to generate power. The 2007 '*National Energy Strategy*' provided an estimate of US $13.6-17.8 billion as capital investment needs during the period 2008-2020 to cover for oil shale exploration, nuclear electric generation, and expansion of the transmission and distribution grid. The total investment in the sector during the period 1998-2003 however, was approximately US$850 million, indicating a serious challenge.

EE is an important option to reduce vulnerability to changing global energy economics and an alternative to offset the rising demand for power. Energy efficiency has been identified in the 2007 Energy Strategy update as a tool to offset the expected increase in future consumption, thus delaying investments in power generation options. Avoidance or postponement of future investments in new generation, transmission and distribution of electricity frees up capital investments for other services while reducing inevitable increases in future rates. In addition to its contribution to the job market, EE investments also have a positive impact on the environment through reduction in Greenhouse Gas (GHG) emissions associated with the displaced power generation.

Despite the fact that electric utilities' profits are 'decoupled' from electricity sales, the current business model creates a disincentive for them to focus on EE options, especially the distribution channels as their profit is tied to the amount of capital investment put in their infrastructure. Electric utilities are key investors and market players that could influence the sector's demand-side usage patterns but the status quo situation lends no justification for them to pursue demand side efficiency – at least not for any economic reason. Therefore, there is a need to align their economic interests with increasing demand-side efficiency.

Over the past year, USAID led an investigative effort through its technical assistance firm Nexant Inc. to assess the economic and institutional viability of developing an incentive mechanism aimed at encouraging electric utilities to invest in demand-side energy efficiency. The objective was to

reach a conceptual structure of an incentive mechanism that rewards the utilities for investing in increasing demand-side efficiency without a major increase in electric tariffs. Issues that were reviewed and analyzed included future demands on electricity, long-run marginal costs of electricity production, the existing institutional and regulatory settings, current capabilities and EE expertise within the utilities organizations, market potential for EE and reliability and sustainability of EE measures as alternatives to power generation. Consensus was reached among all stakeholders on the main concept of the incentive mechanism, but final approval would require further definition of the mechanism and its design features.

EE Market Potential

Jordan's energy market was reviewed to determine the possibility of achieving efficiency over the 10-year period of implementing an incentive mechanism. Electric consumption is forecasted to grow at an average rate of 6% annually to reach 26,288 GWH by 2022. The achievable cost-effective savings is expected to start at 0.30% of annual consumption forecast in 2012 and grow rapidly for 3 years to reach 1% by 2015 then growth is expected to slow down until the saving penetration reaches 1.30% of the 2022 consumption forecast. The average annual achievable savings compared to baseline consumption is 1% across the span of the 10-year period.

An Illustrative EE Program during 2012-2022

To assess the economic and institutional viability of the proposed incentive scheme, an EE program scenario was assumed to be in operation and implemented by the electric utilities as of 2012 and to continue for 10 consecutive years targeting the achievable market potential described above. The utilities would fund the cost of implementation, each in its service territory or for its designated customers (as in the case of NEPCO) and would recover their investment through the electricity tariffs. A measurement and verification mechanism would be developed to annually assess the actual achieved energy savings and determine the long-term economic benefits. Utilities would then receive a performance-based reward in the form of a share of the actual benefits that they helped achieve. The long-run marginal costs for producing electricity were used to calculate the system's long-term benefits associated with energy and demand reduction.

Expected Economic Benefits

Figure 1 shows the long-term avoided costs attributable to the implementation of the illustrative program. The first year starts with approximately 2.9 million JD, which represents the total future generation, transmission and distribution costs avoided as a result of program activities in the first year 2012, which leads to reduction in energy consumption and peak demand over the following 10 years (2013-2022). This method was applied to the following years resulting into cumulative avoided costs by the 10th year of about 186 million JD.

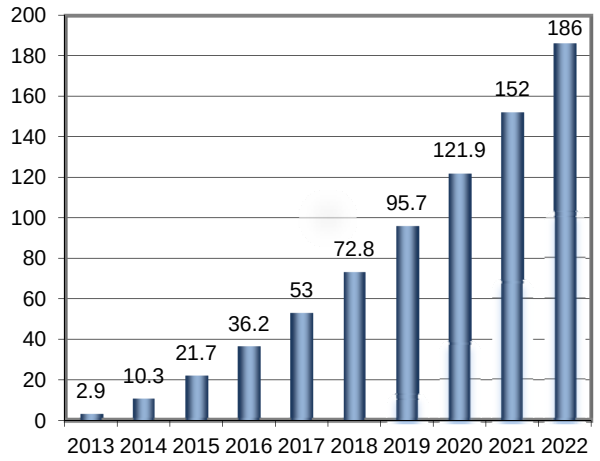

Figure 1- Annual System's Avoided Costs (million JD)

The implementation of the program will require an investment, which was estimated to begin at approximately 5.4 million JD in the first year and grows with the program to reach 63 million JD by the 10th year as the target savings increases with market expansion. Program implementation costs include administration, marketing, cash rebates and follow-up monitoring and verification activities. Figure 2 depicts annual investment

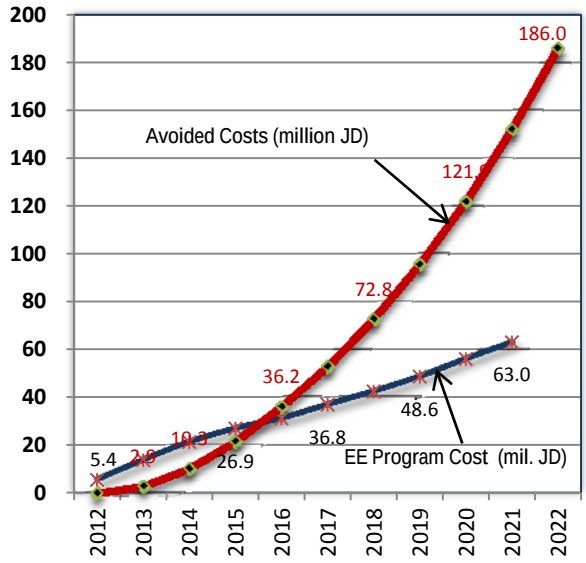

Figure 2- Implementation Vs. Avoided Costs (million JD)

needs versus avoided costs to implement the illustrative program over its 10-year life.

The Present Value (PV) of the cumulative benefits expected to accrue over the 10-year implementation period were estimated at JD 686 million using a discount rate of 10% as suggested by ERC. When implementation costs (i.e., total program costs plus customer's additional cost of purchasing the EE equipment) incurred by society to achieve these benefits were accounted for, the net benefits were reduced to JD 252 million. A parametric analysis was performed using a range of program implementation periods and EE measure lives (7 to 10 years) to determine the impact on the target benefits. Table 1 lists the costs and benefits for two scenarios: 1) a 10-year program with average EE measure life of 10 years; and 2) a 7-year program with 7 years EE measure life.

Table 1- Cumulative PV 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 686	JD 331
Total program and revenue loss costs	JD 434	JD 235
Net benefits	JD 252	JD 96

Other Benefits

Over one million tons of carbon dioxide emissions can be mitigated as a result of reducing about 1,994 GWH over the life of the program. Additionally, the program would result in the generation

of between 150 and 190 jobs in the first year and reaching 1,200-1,500 by the final year as the program expenditures grow.

Sharing the Benefits with Stakeholders

If electric utilities are apportioned a 12% share of the proven and measured 'net benefits' as an incentive, they could receive approximately JD 30 million (PV) under the scenario used in this paper. This represents 15% return on the amount of investment they would be asked to provide, which is estimated to be approximately 201 million JD. In this scenario, the investment would be recovered annually after each year's implementation, and the incentive amount would be paid over the life of the program as benefits are validated via a measurement and verification protocol.

Impact on Tariffs

Unless there is a direct source for financing the EE program, the costs that are being financed by the utilities would be recovered through electricity tariffs. Moreover, the costs associated with revenue loss would also need to be collected from tariffs. The long-term avoided costs are considered a credit to the rates as it is a cost that would have been incurred in absence of the EE program. The net avoided costs less program costs and less revenue loss is what will end up being added to future rates. Over the period 2012-2022, the additional costs to the tariff would range from less than a fils/kWh in the first year to 4.2 fils/kWh in 2022 as shown in the Table 2.

Table 2- Estimated Annual Rate Increase per KWH

Year	*2012*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*2022*
Estimated Rate Increase (fils/kWh)	*NA*	*0.4*	*1.0*	*1.5*	*1.9*	*2.2*	*2.6*	*3.0*	*3.4*	*3.8*	*4.2*

Implementation Timeline

The proposed EE program is expected to begin in 2012 and run for 10 years through 2021, thus benefits start accruing as of 2013 and through 2022. Figure 3 illustrates the various the 3 key phases of program design, implementation and benefit verification.

Figure 3- EE Program Implementation Timeline

2. CHALLENGES FACING THE ELECTRICTY SECTOR IN JORDAN

Financial Burden

While the energy imports bill has declined in 2009 to approximately 12%[1] of the GDP from its 2007 high of 19%, Jordan is expected to experience a substantial increase in future bills due to projected rise in global fuel prices, growth in local demand and the possible reduction of natural gas supply from Egypt. It is worthy to mention that the decline in 2009 was primarily influenced by the drop in global oil prices. Demand growth is fueled by a combination of population growth and increased per-capita consumption, and is expected to increase these costs further in the future. The 2007 update of the '*National Energy Strategy*' provided an estimate of US $13.6-17.8 billion as capital investment needs during the period 2008-2020 to cover for oil shale exploration, nuclear electric generation, and expansion of the transmission and distribution grid. The total investment in the sector during the period 1998-2003 was approximately US$850 million, indicating a serious challenge to implement the national energy strategy. Unfortunately, the amount estimated for energy efficiency was between $93-153 million throughout 2020 as shown in Table 3.

Table 3- 2007 Energy Master Plan Investment Requirements

Sector	Investment Requirements ($ billion)
Oil	*$3.399*
Electricity	*$4.817 – $5.808*
Natural gas	*$2.461*
Renewable Energy	*$1.415 - $2.115*
Energy Efficiency	*$0.093 - $0.152*
Oil Shale	*$1.400 - $3.800*
Total	*$13.268 - $17.335*

Demand for electricity was expected to rise at a rate of 7.4% during 2007-20, reaching 32,000 GWH and requiring the addition of 4,100 MW of capacity. This was assumed under the 'Moderate Scenario' in which growth was set at 5.5% and the target total consumption was estimated to reach 15 MTOE by 2020.

[1] Estimated based on information from the Central Bank of Jordan's 2009 Annual Report.

Fast Growth

Electricity consumption has been doubling up every ten years in Jordan. By the end of 2010, consumption will have passed twice that recorded in 2000, and forecasts also suggest that by 2021, consumption will double again. While this is a positive economic development indicator and a sign of rising standard of living, it can also be alarming for a country that depends almost entirely on foreign supply of oil and gas to generate power. Figure 4 illustrates the increase in electricity consumption in Jordan from 2000 to 2022 using a combination of recorded and forecast published data.

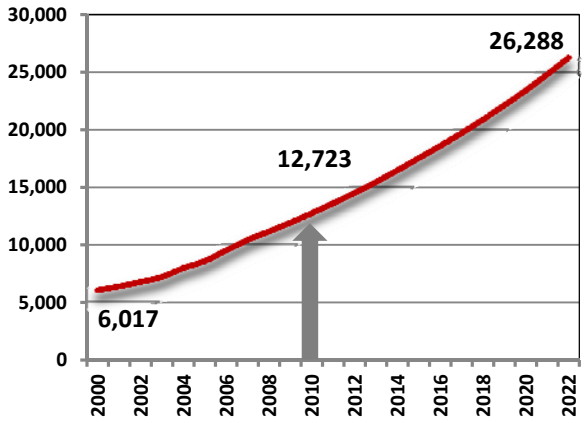

Figure 4 –Electric Consumption 2000-2022 (GWH)

Regional Competitiveness

According to the International Energy Agency (IEA), Jordan's *Energy Intensity* indicator is at 0.59 Mtoe per 1,000 dollars of its GDP output, placing it in a non-competitive position compared to other developing and neighbouring countries. Increasing demand-side efficiency without reducing economic productivity is one of the key explicit directions of the 2007 National Energy Strategy.

Continuing to add supply side capacities to meet demand growth will certainly compromise Jordan's energy security position, and cannot be sustainable for the following three reasons:

First, the system's inability to deal efficiently with sudden demand surges leads to high economic and social losses. The 2010 summer marked a critical period in which meeting electricity supply shortages stemming from a sudden spur in demand proved to be difficult. Experts estimated this summer's peak demand was 15% higher than the previous summer. The maximum peak has also reached 2,650 MW, exceeding the installed capacity by approximately 50 MW. Some believe that NEPCO was forced to resort to 'load shedding' in order to maintain stability. Consumers in the residential, commercial and industrial sectors suffered from repeated electricity outages and unstable power supply for periods lasting up to several hours, leading to major inconveniences.

Second, adding generation capacity with its associated transmission and distribution facilities to meet demand growth keeps adding upward pressure on electricity tariffs. Electricity demand is projected to rise at the rate of 6.3%[2] between 2010 and 2020, which is attributable to economic growth, population growth and rising standards of living. Meeting future demands on electricity translates to allocation of significant capital investment to build the infrastructure. While these

[2] Electricity Demand Forecast 2008, NEPCO, January 2009

investments are incurred by private Independent Power Producers (IPPs) and the T&D utilities, they are ultimately borne by the rate payers or by the Government through tariff subsidies. Even when electricity rates are subsidized for the low-income segments of the population, they are most affected by the increase in electricity tariffs through potential increases in the cost of products and services provided by the commercial and industrial sector when electricity rates are increased.

Third, the system's reliance on foreign supply of oil and natural gas continues to expose the country's energy security position and increases vulnerability to external factors. More than 60% percent of electricity generation in Jordan uses Egyptian natural gas, and in March 2010, Jordan experienced a significant reduction in natural gas supply as a result of technical challenges faced by the gas sector in Egypt to meet the contracted amounts. As a result, electric generation in Jordan increased the use of liquid fuel oil in its fuel mix, thus costing NEPCO around $700,000 a day in heavy fuel purchases.[3]

[3] The Report Jordan 2010, Oxford Business Group,2010

3. DEMAND-SIDE EFFICIENCY IS A COST-EFFECTIVE OPTION

Energy efficiency measures are designed to reduce the amount of energy consumed by customers, and consequently lower consumer's energy bills. Energy efficiency measures are, also, expected to benefit the electricity system by reducing or postponing the amount of capital invested in increasing the system's capacity to meet demand. For each kWh that is not consumed, one fewer kWh of electricity needs to be generated, transmitted and distributed, or one kWh is freed to serve a new customer.

The value of increasing the efficient use of energy to the system is therefore, the cost that would have been incurred to make available this energy to consumers, or the "avoided" cost to the electricity system. The "avoided" cost attributable to installing an energy efficiency measure such as a light bulb or an air conditioning unit is the full cost of generating and delivering the amount of energy that such a measure reduced. This includes the sum of generation, transmission and distribution costs, including transmission and distribution losses.

The 'Avoided Costs' in the Distribution Sector

In the short-term, the impact of a reduction in energy consumption by end users on the three electricity distribution companies (JEPCO, EDCO and IDECO) is a reduction in their cost of purchasing this energy from NEPCO, however this will not reduce their fixed costs of investment in the distribution infrastructure.

In the long-term, costs associated with investments in future distribution facilities, e.g., new substations, transformers, wires, capacitors to accommodate system growth can be reduced or postponed. While reducing the amount of future investments in the distribution infrastructure is certainly a benefit to the system at large, it would not be considered an incentive to distribution companies as it reduces their opportunity of making a decent return on investment in this low-risk business.

The 'Avoided Costs' in the Generation and Transmission Sector

Over time, as demand grows and in the absence of energy efficiency programs, new generation plants would be required to meet the higher levels of demand. NEPCO pays for the capital costs of new generation through capacity charges under a purchasing power agreement (PPA) to the generation plant owner. Transmission facilities would also be built to transport the generation output to the customers. The costs of a new PPA (both capacity charges and fuel payments) and the new transmission facilities would in turn increase the Bulk Supply Tariffs.

If investment in a new generation plant, and associated transmission, can be avoided or postponed by reducing demand through energy efficiency programs, the bulk supply tariffs will be eventually be lower in the long-run than they would have been if NEPCO had to contract for new generation and transmission to expand the system.

An analytical evaluation was carried out by Nexant in collaboration with NEPCO, JEPCO, EDCO, IDECO and ERC on the development of the long-run marginal costs (LRMC) for the electricity system in Jordan. 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.

Table 4 – *2010 Annual Long Run Marginal Costs of Capacity*

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

Table 4 shows the annual marginal cost of capacity (per kW of demand) for the two voltage levels of electricity (medium and low). This reflects the incremental cost required to add the next KW of capacity on the existing system. The LRMC of energy was separated into 'peak' (3 hours a day[4]), 'mid-peak' (13 hours a day) and 'Off-peak' (8 hours a day). Table 5, 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 5 – *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)	
Medium	0.062	0.038	0.029	0.038
Low	0.072	0.044	0.032	0.044

These values of marginal costs of capacity and energy are then used with the results of the illustrative 1% program scenario to predict the long-term benefits to the sector attributable to the implementation of the program.

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

4. BARRIERS TO INVEST IN DEMAND-SIDE EFFICIENCY

The electricity distribution companies and NEPCO are important players in delivering EE services to energy end-users. Their link to end-use customers, whether for electricity supply or for ongoing operational issues, makes them rather influential on customers' energy investment decisions. Nevertheless, three key barriers discourage T&D companies from investing in EE activities:

a. ***The current ratemaking system offers no incentives for electric utilities to promote EE.*** Although the current ratemaking methodology for the 3 distribution companies '***decouples'*** their profits from electricity sales, there is an implicit but obvious incentive for them to sell more energy. Their profit is dependent on the amount of investment they put into their service territory to secure proper and safe services to end-users.

   Rates are adjusted periodically by 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.

b. ***EE activities and programs require specialized expertise not sufficiently available within the T&D utilities.*** Developing and delivering EE activities requires T&D utilities to build the internal capabilities to be able to manage program design, marketing, implementation and ongoing monitoring. This will require significant capital and human investment for a few years adding administrative burden to their existing and more familiar operation.

c. ***The risk associated with demand side efficiency investment is perceived to be greater than that of the business-as-usual system investments.*** The utility sector appeals to risk-averse investors that find investments in EE to be less attractive due to its lower return on investment when compared to business-as-usual system investments.

As a result of the aforementioned barriers, a successful EE program requires the introduction of an incentive mechanism that aligns the distribution companies' economic interest with the objectives of using energy efficiency as a resource option to meet future demand growth.

5. JORDAN OFFERS AN IDEAL CASE FOR ADOPTING AN EE INCENTIVE MECHANISM

While energy efficiency incentives have been tested in different forms and shapes in various countries, none has been implemented in the Middle East yet. However, certain elements of the electricity sector in Jordan lend strong justification to implementing an incentive mechanism to promote demand-side efficiency in the country. There are four key factors that make Jordan a good forum to implement the proposed incentive mechanism:

a. ***Jordan is almost fully dependant on imported fuel for electric power generation, making the value of cost avoidance of generation among the highest.*** The system's reliance on imported fuel, particularly natural gas, and the uncertainty concerning prices and amount of natural gas imports in the near future increases the value of the benefits associated with EE.

b. ***Jordan has a privatized electricity distribution sector.*** The restructured electricity sector allows for market forces and incentive mechanisms to influence investment decisions. A well designed EE incentive mechanism that allows investors to realize higher returns on EE than the normal transmission and distribution business model could create a strong momentum among the electric utilities.

c. ***The phasing out of a significant amount of the subsidy in the electricity tariff in 2008 has made EE more attractive.*** After the 2008 subsidy lifting, the electricity tariff in Jordan has come closer to the full cost of production and delivery of electricity then it used to be. This has created a strong incentive for both commercial, industrial end-users as well as residential end-users to invest in EE solutions to reduce electric bills, and, consequently, their operational costs. However, it is worth mentioning that when the price of fuel increased at a higher rate than electricity, consumers shifted their energy needs towards the latter.

d. ***The load growth in Jordan is concentrated in peak and seasonal demand rendering energy efficiency the most cost-effective solution.*** Peak demand in Jordan is rising faster than base-load demand. The daily base-load averages around 1,000MW, while peak demand is 2,300MW[5]. Peak demand grew by around 3.1% in 2009[6] due to a substantial growth in demand for air-conditioning as a result of the summer heat wave. Clearly, the sector's main concern relates to managing peak and seasonal demand making relatively low-cost and fast deployable EE technologies more attractive than investing in expensive and time consuming peaking power plants.

[5] Electricity Peak Demand, Electricity Regulatory Commission, 2009

[6] Electricity Peak Demand, Electricity Regulatory Commission, 2009

6. THE CURRENT MARKET POTENTIAL FOR EE IN JORDAN

To assess the potential gains that an incentive program is likely to achieve, it is necessary to develop an estimate of the achievable energy efficiency market penetration. Therefore, Jordan's existing energy market was investigated to understand the characteristics of the consuming sectors and to further identify and quantify the achievable, cost-effective electric energy efficiency opportunities over a 10-year period (2012-2022).

An adequate number of studies and market data were collected from various sources in Jordan and were reviewed for reasonableness and relevance. Market information was gathered from MEMR, ERC, NERC, NEPCO, EDCO, IDECO and JEPCO as well as from other Jordanian consultants who have had prior experience with energy efficiency market assessments. The information was used to understand how the energy consuming sectors are classified and gain a closer view on their consumption patterns. A thorough review of the long-term system-wide forecast was also performed to understand the anticipated growth patterns and demands on the electrical system.

Table 6- Sector-specific Energy Consumption Growth Forecast 2012-2022

Year	Residential	Commercial	Industrial	Water Pumping	Street Lighting	Total
Annual Growth	*7.0%*	*8.0%*	*5.0%*	*3.4%*	*3.3%*	*6.3%*

As shown in Table 6 above, the anticipated growth pattern in all of the primary consuming sectors is high, making energy efficiency an important component of Jordan's long-term energy resource planning. Growth is lead by the residential and commercial sectors; these sectors are forecasted to grow at an average annual rate of 8.0% and 7% respectively, exceeding the total annual growth level of 6.3%. Figure 5 shows the system-wide energy forecasts, including the impact of potential energy efficiency programs.

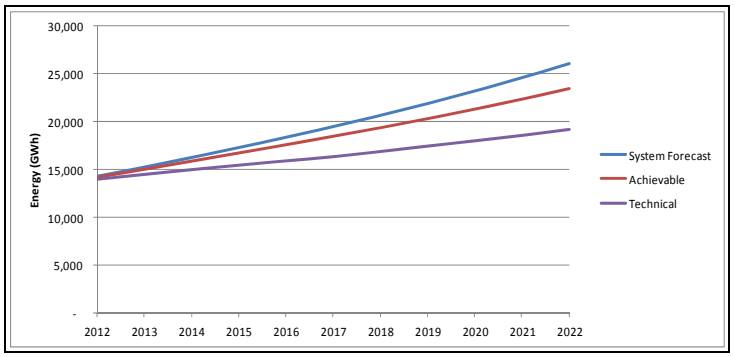

Figure 5- System Forecasts with Energy Efficiency Potentials

Although the proposal is based on sales forecast developed in 2008 by NEPCO, the recent EE potential was calculated based on the updated sales forecast in 2009, but the main objective was to assess the achievable savings penetration levels and not the absolute amounts.

The market information was processed using market potential models and a preliminary forecast of both the 'technical' and 'achievable' potentials were developed. The 'technical' potential represents the savings available if all *technically feasible* equipment is upgraded to the most energy efficient option. The 'achievable' potential however, represents the savings that can be achieved through energy efficiency programs, with considerations for cost-effectiveness, and market barriers (e.g. program delivery, customer preference, etc.). Therefore, and as shown on Figure 5, there is the technical potential to reduce the anticipated consumption in 2022 by 26.1%, but practically and economically, the target achievable potential in 2022 is about 9.8% of the consumption forecast for this year.

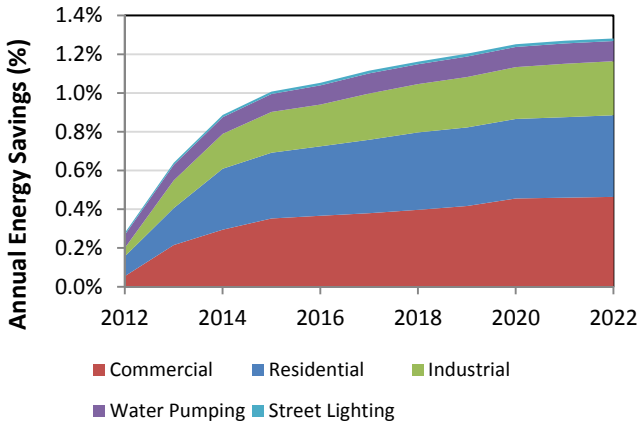

Figure 6- Achievable Energy Savings (%) of Baseline Forecast

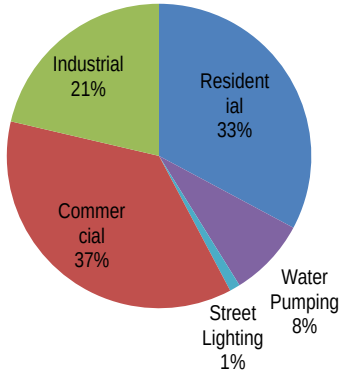

Figure 7- Achievable Savings in 2022 by Sector

As shown in Figure 6, the achievable energy efficiency potential is expected to follow a pattern where penetration is lower in the first 3 years of the program starting at 0.3% of annual consumption. As the market matures and new programmatic efforts quickly bring equipment stock up to efficient levels reaching approximately 1% penetration by 2015, then followed by slower growth through 2022 when the penetration level reached 1.3%. The average reduction is about 1% across the 10-year period.

In addition to assessing the energy savings potential by market segment (Figure 7), the market potential analysis also provided a view on the contribution of the various end-use types in the anticipated achievable savings by 2022. Figure 8 shows the breakdown of energy savings by primary end-use (motors, lighting, HVAC, appliances, plug loads, etc) in 2022. Energy-efficient motors and lighting are expected to provide two-thirds of the anticipated energy savings by 2022.

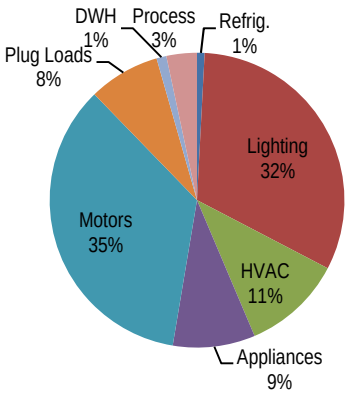

Figure 8 - Energy Savings by End-Use in 2022

7. COMPARISON WITH PAST ENERGY EFFICIENCY TARGETS

As mentioned earlier, the 2007 update of the 2004 'Jordan's Energy Strategy' provided a forecast of electricity generation of 32,000 GWH by 2020 compared to 12,830 GWH in 2007 under the 'Moderate Scenario'.

In a different but related report by the National Energy Research Center (NERC) in 2007 titled "Renewable Energy and Energy Efficiency Current Situation and Possible Contributions", energy efficiency was highlighted as a key tool to manage demand growth on energy resources. However, NERC used the 'High-end Scenario' for forecasting energy consumption by 2020 with 16,733 Mtoe compared to the 15,084 Mtoe used in the 'Moderate Scenario'. The higher scenario showed a forecast electricity generation of 35,679 GWH by 2020. Energy efficiency was expected to reduce the 2020 forecasted demand from 16.73 to 13.25 Mtoeh a 3.48 Mtoe or 21% of the business as usual scenario. This high potential estimated by NERC, although applies to all energy forms, is closer in magnitude to the electricity 'technical' potential savings of 26.1% calculated by Nexant in the preliminary version of the 2010 EE potential study, but almost twice as high as the 'achievable' potential of 9.8%.

The use of renewable energy measures would further reduce this level to 12.08 Mtoe per the NERC referenced report (Figure 9).

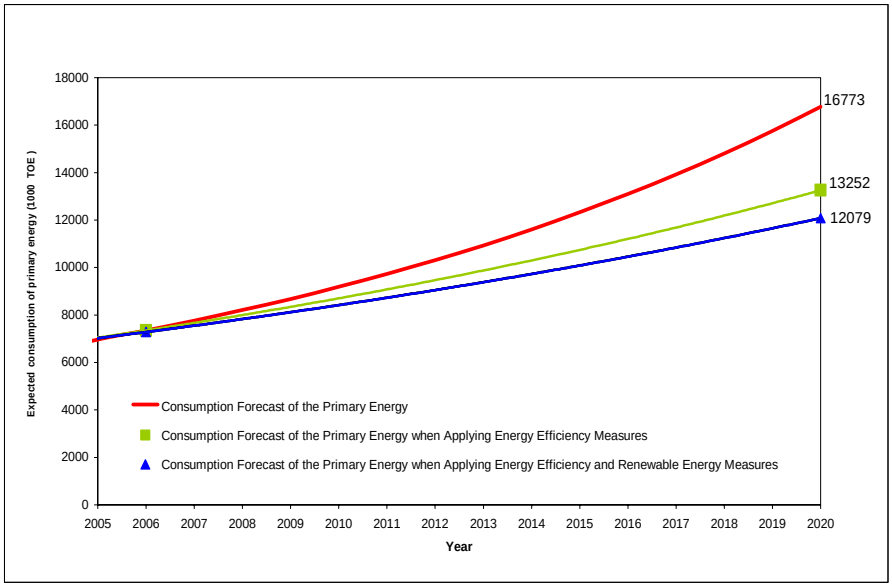

Figure 9- NERC Forecast of Primary Energy Consumption with RE & EE Applications 2007- 2020

Electricity savings were addressed in the 2007 update of the Energy Strategy with a target of 5% of national consumption by the year 2015. It is not clear however, whether this 5% target was measured against the actual 2007 consumption or the forecasted 2015 consumption level.

The following table provides a listing of the annual achievable savings potential for energy efficiency between 2012 and 2022.

Table 7- Annual Forecast of Energy Consumption and Energy Efficiency Potential 2012-2022

Achievable Potential Energy Savings					
	Forecast Base case	Annual Savings		Cumulative Savings	Forecast w/ EE
Year	Meter Level (GWH)	GWH	%	GWH	Meter Level (GWH)
2012	14,502	NA	0.28%	NA	14,502
2013	15,445	40.6	0.64%	40.6	15,404
2014	16,457	98.8	0.89%	139.4	16,318
2015	17,524	146.5	1.01%	285.9	17,238
2016	18,581	177.0	1.05%	462.9	18,118
2017	19,691	195.1	1.12%	658.0	19,033
2018	20,870	220.5	1.16%	878.5	19,991
2019	22,123	242.1	1.20%	1,120.6	21,002
2020	23,423	265.5	1.25%	1,386.1	22,037
2021	24,808	292.8	1.27%	1,678.9	23,129
2022	26,288	315.1	1.28%	1,994.0	24,294
2023		336.5		1,953.3	

In order to draw a comparison between these results and the national target of 5% that was established in the 2007 update of the 'Energy Strategy', the forecasted potential for energy efficiency in the year 2015 should be compared to the consumption level of 2007 as a base year. The 'Energy Strategy' listed 2007 consumption as 12,830 GWH at the generation level, but actual consumption at the meter level (as listed in the sales actual and forecast data prepared by NEPCO) was 10,400 GWH. Assuming that that the proposed EE program is implemented, the cumulative achievable savings by 2015 will be 285.9 GWH or 2.8% of the 2007 electric consumption, and 1,994 GWH by 2022 or 19.2% of the 2007 consumption.

8. ALIGNING THE INTEREST OF THE T&D UTILITIES WITH DEMAND-SIDE EFFICIENCY

For the reasons discussed earlier relative to the electric utilities' disincentives to increase demand-side efficiency, an attractive incentive mechanism is critical to encourage the three electricity distribution companies and NEPCO to promote energy efficiency measures to their clients. 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 to deliver proven results.

The intervention of the T&D utilities is critical to develop and effectively implement an energy efficiency program for many reasons. First, their ongoing relationship with end-use consumers allows them to discuss and influence their energy use patterns. Second, the size of investments needed to achieve such a large national goal sustainably for a number of years can only be taken by large enterprises with established financial credit worthiness, making the electric utilities a perfect choice for this initiative. Finally, changes in the energy use pattern on the demand-side can technically impact the operation and efficiency of the T&D system as a whole and therefore, it is more appropriate to have them promote efficiency to maintain the technical integrity of the system.

Setting Targets

An energy efficiency program should be designed and implemented by the electric utilities with specific targets of savings and demand reduction that are closely coordinated with the Ministry of Electricity and Energy and the Electricity Regulatory Commission. Such a program should aim for at least three (3) tiers of goals that are to be monitored during and after each phase of implementation:

- *System wide goals* of reduction in energy consumption and demand reduction below an agreed-upon baseline. For example, an average of 1% reduction per year for 10 years reaching a cumulative energy and demand reduction by a target year.
- *Utility-specific goals* in energy and demand reduction taking into consideration the type of load and client base in each of the separate service territory.
- *Sector-specific goals* that might include certain EE measures, number of customers, or energy and demand reduction per sector…etc.

Creating an Incentive to T&D Utilities

In order for the utilities to take on such an elaborate and more complex business compared to their existing low-risk investment model, they would need to be assured that their capital and human resource investments would be 1) relatively secured and 2) offer a larger reward than business as usual, otherwise, the justification for doing it may be not convincing if seen from a shareholder perspective. At the same time, and assuming that certain regulatory protection would be in place to encourage these utilities to direct their investment to EE and DSM activities and assume the

associated risk, accountability for delivering the target goals (energy and demand reduction) has to be a key element of the proposed mechanism.

A performance-based incentive mechanism is therefore, proposed to encourage utilities to take on the capital investment and build the necessary knowledge in EE and DSM to achieve the target goals. A possible earnings incentive is to allow the electric utilities to earn a portion of the benefits attributable to achieved energy efficiency as a result of their involvement. It is important to use the proper '*metric*' that would provide both an incentive and allow for the accountability to be in check. It is recommended to use the '*net benefits*' as a metric to meet this objective of offering a performance-based incentive mechanism. This mechanism is tied to benefits that are truly realized, not just planned or promised.

The net benefit metric is in fact the value of the long-term avoided costs of generation, transmission and distribution less the costs of implementing energy efficiency programs and the loss of revenue associated with such efficiency. A percent of this value can be assigned to the utilities, making them a true partner in the pursuit of increasing demand-side efficiency.

The following section presents an illustrative example of a national program designed to achieve an average of 1% reduction in consumption per year for 10 years and implemented by the utilities, each in its service territory or client base.

9. ILLUSTRATIVE ENERGY EFFICIENCY INCENTIVE MECHANISM FOR JORDAN

Last year, Nexant, in cooperation with the staff of ERC, NEPCO, JEPCO, EDCO and IDECO developed a forecast of electricity consumption through 2022. The forecast started in 2012 with annual consumption of 14,502 GWH and reached 26,288 GWH by 2022. While the energy efficiency market potential task is still being finalized, preliminary results indicated that the potential for savings would range from approximately 0.30% to 1.30% of annual consumption over a 10-year period starting in 2012. This non-linear rise in potential is a function of some relevant variables such as market acceptance, technology development and changes in electricity tariffs. The savings potential translates to an average of 1% per year over a span of 10 years.

Illustrative EE 1% Program Scenario

In order to better understand how the proposed incentive mechanism would work, an illustrative case was developed and is described in details in this section. However, it is important to realize that this case is by no means a proposed program design, as the latter would require more in depth analyses and design features that are beyond the scope of this conceptual proposal. The illustrative case required a set of assumptions as to the size of EE activities that could be undertaken in Jordan. The range of market penetration of 0.3%-1.3% was applied to the forecasted annual consumption from 2013-2022 since the EE program is expected to be implemented in 2012 but savings will likely materialize beginning with 2013.

Program Technical Impacts

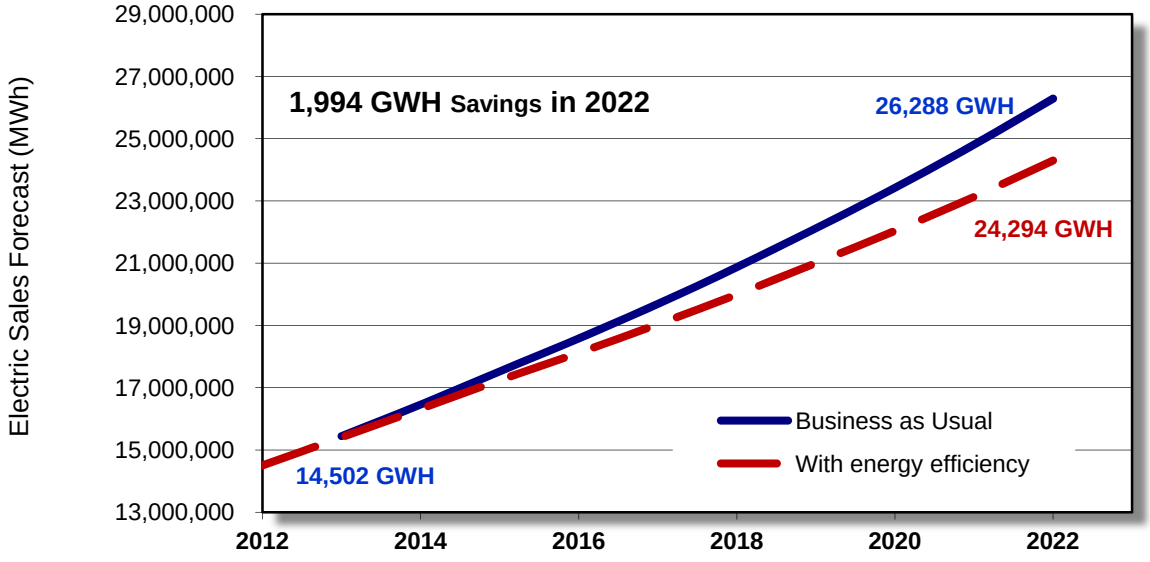

Figure 10- Electricity Forecast 2013-2022 (MWH)

Figure 10 illustrates the energy forecasted consumption in a business-as-usual case (starting at 15,445 GWH in 2013 and reaching 26,288 GWH by 2022), and the forecasted consumption with the implementation of the EE program for 10 years -- a reduction of approximately 7.6% of the

2022 consumption forecast or 1,994 GWH. In the first year, the annual consumption is expected to be reduced by approximately 41 GWH and ramping up to reach 1,994 GWH by 2022 (Figure 11).

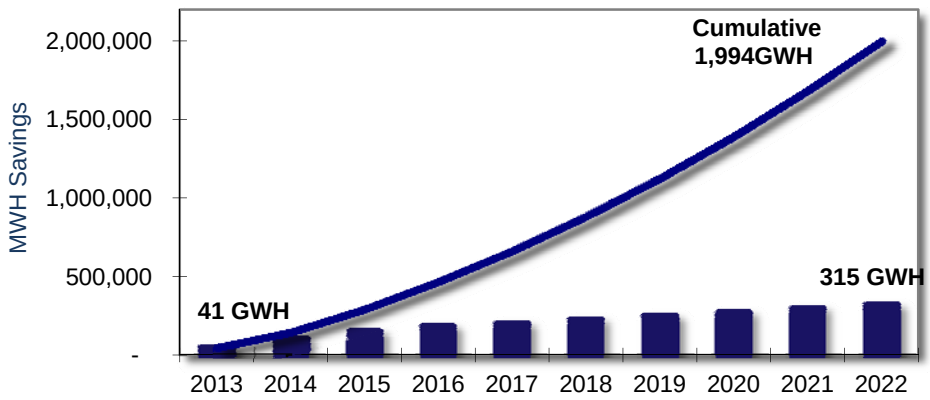

Figure 11- Annual & Cumulative Energy Savings (MWH)

Following the same assumption with regard to demand reduction, a total of 338 MW can be reduced from the annual peak demand after 10 years of EE activities (Figure 12).

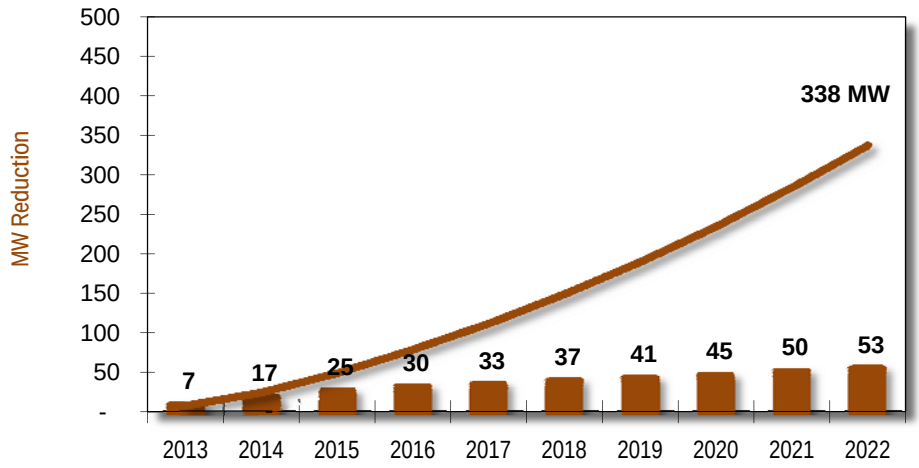

Figure 12- Annual & Cumulative Demand Reduction (MW)

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. 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 conducted by MEMR and NERC and various donor organizations over the past decade. Although sufficient energy engineering skills are readily available in Jordan, experiences are lacking in EE portfolio planning, program design, market

implementation, development of measurement protocols and conductance of evaluation techniques to ensure effectiveness and sustainability.

Program Long-term Economic Benefits

The marginal costs of reduced capacity and energy saved are used to calculate the long-term avoided costs 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 since the measure life is assumed to be 10 years and the program is implemented over a 10-year period. .

The 'Avoided Costs' of Generation, Transmission & Distribution in Jordan

The values of marginal costs of capacity and energy are used with the expected technical impacts of the program to predict the long-term benefits to the sector attributable to the implementation of the EE measures.

Figure 13 shows the long-term avoided costs associated with the adoption and implementation of a 10-year EE program that targets an average reduction in consumption of 1% per year. The avoided costs associated with the first year's program activities are 2.9 million JD. This represents the total future generation, transmission and distribution costs avoided as a result of program activities in the first year 2012 which will have a 10-year impact into the future (2013-2022). This method was applied to every year of implementation resulting into cumulative avoided costs of 186 million JD by the 10th year.

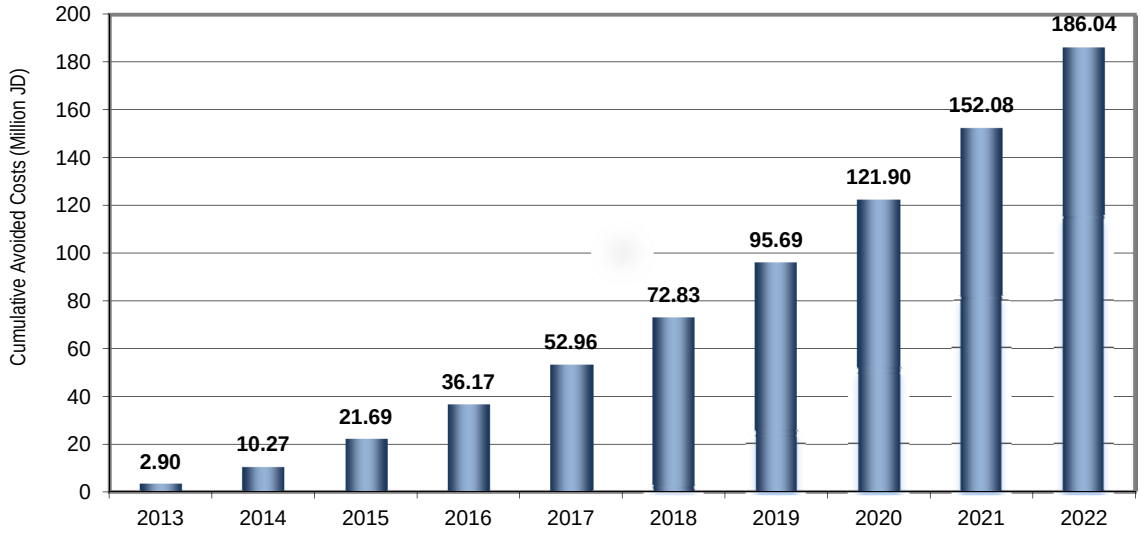

Figure 13- Annual System's Avoided Costs for 1% EE Program

The illustrative EE program is expected to require an investment to cover implementation-related administrative, marketing and cash rebate expenditures. These costs have been estimated at approximately JD 5.4 million in the first year, increasing over time to reach JD 63million by the 10th year as the load forecast increases and so does the penetration level. Figure 14 depicts the

annual investment requirement to implement this program scenario versus the expected avoided future costs during the 10-year proposed implementation period.

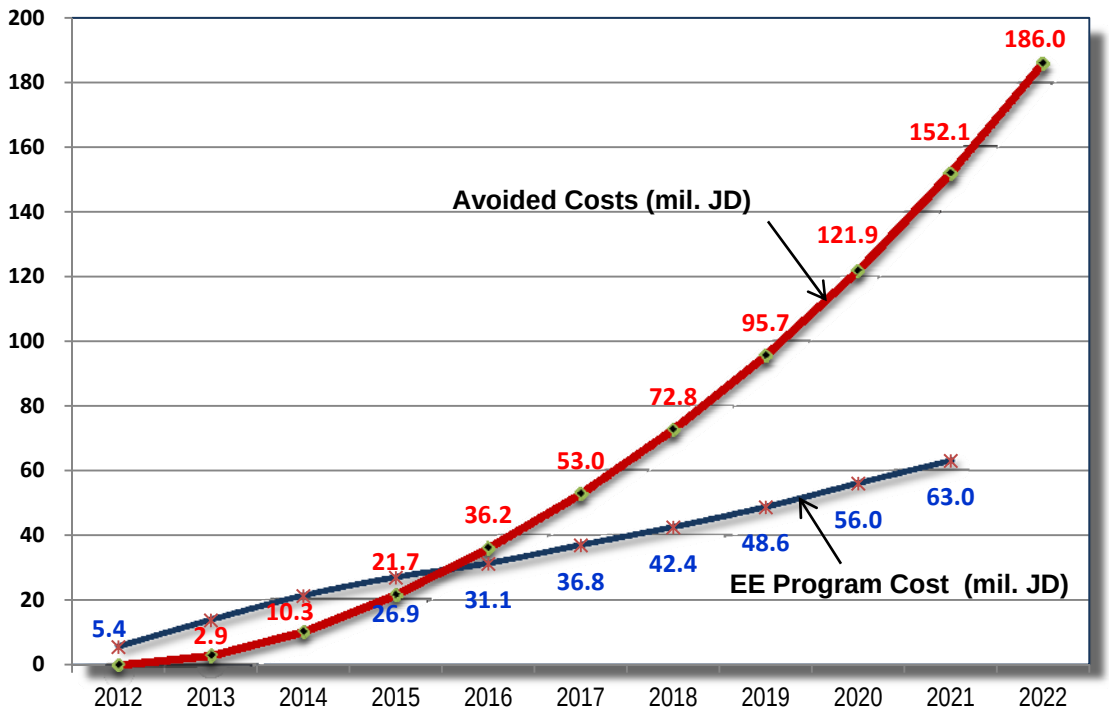

Figure 14- *EE Program Implementation Costs Versus System's Avoided Costs for the 1% EE Program*

Table 8 provides a summary of the expected savings, investment costs and potential economic benefits associated with the illustrative EE program scenario.

Table 8- *Summary of Benefits Associated with the Illustrative 1% EE Program Scenario*

Year	*2012*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*2022*
Cumulative Energy Savings MMWH	*NA*	*41*	*139*	*286*	*463*	*658*	*879*	*1,121*	*1,386*	*1,679*	*1,994*
Cumulative Demand Reduction MW	*NA*	*7*	*24*	*48*	*78*	*111*	*149*	*190*	*235*	*284*	*338*
Avoided Costs (JD Million)	*NA*	*2.9*	*13.7*	*21.2*	*26.9*	*31.1*	*36.9*	*48.6*	*56*	*152*	*186*
Required Investment by Utilities (JD Million)	*5.4*	*13.7*	*21.2*	*26.9*	*31.1*	*36.8*	*42.4*	*48.6*	*56.0*	*63.0*	*NA*

The Present Value of the cumulative benefits that were expected to accrue over the 10-year implementation period was estimated at JD 686 million using a discount rate of 10% as suggested by ERC. 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 252 million NPV.

Changing Program Parameters

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 96 million compared to JD 252 million that would accrue from the base case scenario of 10 years of implementation. Table 9 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 9- *Cumulative Benefits and Costs for EE Program variations (million JD)*

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 686	JD 331
Utilities + Customers Costs	JD 434	JD 235
Net benefits	JD 252	JD 96

Sharing the Benefits with Stakeholders

In order to create an attractive incentive for the utilities while ensure accountability for delivering the target savings, it is recommended to use the 'net benefits' metric to establish the level of incentives paid. The 'net benefits' to the system as a whole is the total avoided costs of generation, transmission and distribution less the costs incurred to achieve these efficiency targets. The cost component should account for both the utility investment plus the additional investments incurred by the participating customers to improve their efficiency.

In the illustrative EE 10-year program scenario, the present value of the avoided costs of generation, transmission and distribution is 686 million JD and the total costs incurred by the utilities and the program participating customers are 434 million JD, leading to a 'net benefits' of 252 million JD. If the utilities are apportioned a 12% share of this 'net benefits' as an incentive, they would receive approximately JD 30 million (PV). This represents 15% of the amount of investment they would be asked to provide, which is estimated to be approximately 201 million JD. In this scenario, the investment would be recovered annually as the program implementation costs are incurred, and the incentive amount would be paid over the life of the program as benefits are validated via a measurement and verification protocol.

With the guarantee of program cost investment recovery, the level of financial risk borne by the utilities would be extremely limited. This attractive reward mechanism is intended to encourage the utilities to maximize the net benefits. The difference between the avoided costs of 686 million

JD and the amount recovered by utilities (201 million JD) is the future investment that will be avoided if the EE activities are delivered as planned.

Program Environmental Benefits

There are negative environmental impacts associated with conventional, non-renewable generation of electricity. The most concerning impact is the release of carbon dioxide into the atmosphere which contributes to climate change. For every 1 kWh of electricity generated and used in Jordan using non-renewable sources, 0.47 kg of carbon dioxide is released into the atmosphere. Considering a cumulative energy savings of 1,994 GWH resulting from implementing an energy efficiency program, Jordan will avoid releasing 937,000,000 kg of CO2 into the atmosphere, which is approximately one million tons equivalent.

Contribution to Job Creation

An additional benefit of energy efficiency programs is the potential for creating additional jobs in the local market. Job creation has direct and indirect components. First, the EE programs themselves will generate jobs, as they are quite labor-intensive for program implementation staff, contractors and others involved in equipment sales and implementation. This contrasts with investments in power generation and distribution facilities that are often capital-intensive and most of the equipment is imported; hence the majority of jobs will accrue to the manufacturing country, rather than to Jordan.

Other employment effects are associated with (1) the indirect economic effects of program participants whose lower energy bills will enable energy consumers to redirect their spending to other goods and services, and (2) the induced effects associated with the stimulus effects of increased economic activity due to direct and indirect effects. These additional impacts will also have positive job creation effects. Nexant however, did not estimate the job creation impacts of these secondary effects, as there is too much uncertainty regarding the employment impact. Therefore, the job creation estimates are likely to be more conservative than the actual impact.

The job multiplier estimates come from US sources; the estimates for Jordan could be higher, as such activities are likely to be less capital intensive and more labor intensive than in the US.

Table 10- Job Creation Estimates by Energy Efficiency Program Type

Program Type	Jobs per $M Range	Applicability for Jordan
Residential		
Home Performance Audit	18-25	High
Residential Energy Audit and Direct Installation	18-25	High
Residential Efficient Air Conditioning	11-20	High
Non-Residential		
Retrofitting	11-15	Moderate
Custom Incentives	15-18	Moderate
Benchmarking	11-15	Moderate
Prescriptive Rebates	8-11	Moderate

For the purposes of this analysis, Nexant assumed that:

- These job creation estimates, applicable to the US, were probably low for Jordan, where the programs are likely to be more labor intensive;
- The majority of the program expenses will be incurred in the residential sector;

Based on the above observations, Nexant estimated that an average range of job creation per $1 million spent on energy efficiency programs was 20-25 jobs. So if $7.6 million (5.4 million JD) are spent in the first year on EE, a range of 150-190 jobs would be created. As expenditures increase over the life of the program, the number of added jobs would reach 1,200-1,500 by 2022.

Proposed Implementation Timeline

A review of the current capabilities of the relevant stakeholders revealed that some work is needed in order to have all market forces ready to adopt and implement the program. However, it is quite possible to have a program ready for market testing and pilot implementation as early as January 2012. This will require that the following elements be covered during 2011:

- Program design including setting up goals and specific targets (Jan-Mar 2011)
- Capacity building for the relevant stakeholder organizations (Mar-Nov 2011)
- Amendment to the existing utilities ratemaking methodology to account for the new mechanism (Mar-Sep 2011)
- Preparation of a measurement and verification mechanism (Jul-Dec 2011)

Figure 15 illustrates the various activities that should be undertaken until the program operation is streamlined for the 10-year period.

Figure 15- EE Program Implementation Timeline

10. IMPACT OF THE INCENTIVE MECHANISM ON ELECTRIC TARIFFS

Increasing demand-side efficiency through utility programs typically comes with a cost that leads to short-term tariff increases to allow for recovery of the investment in these programs. Tariff increases are directly related to cost recovery of the following cost items through electricity tariffs:

- Administrative costs incurred by the utilities including any financial incentives offered to end-users to subsidize their incremental cost to increase efficiency.
- Revenue loss as a result of reduced kWh sales.
- Incentives paid to T&D utilities for realizing the long-term system's benefits based on monitored and proven results.

The above items will certainly post upward pressure on tariffs in the short-term, but with a properly designed portfolio of EE programs, future rates should be lower than otherwise would have been in the absence of the energy efficiency activities. The net avoided costs less program costs and less revenue loss is what will end up being added to future rates. In the illustrative EE program over 2012-2022, the additional costs to the tariff is expected to start at less than a fils/kWh in the first year and rise to reach 4.2 fils/kWh in 2022 as shown in the Table 11 below.

Table 11- Estimated Annual Rate Increase per KWH

Year	*2012*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*2022*
Estimated Rate Increase (fils/kWh)	*NA*	*0.4*	*1.0*	*1.5*	*1.9*	*2.2*	*2.6*	*3.0*	*3.4*	*3.8*	*4.2*

<u>Managing the short-term tariff increase</u>

Participants in energy efficiency programs administered by the utility are likely to see lower bills despite the higher per kWh tariff, and the impact of tariff increases will be more likely non-existent if their reduced consumption outweighs the higher tariffs. For other customer classes, such as those at the lowest consumption levels, e.g., below 300 kWh per month, there would be little return on investing in energy efficiency programs, since their consumption is already minimal. In addition, this group of customers would struggle most with affordability of any tariff increases.

For social equity, any tariff increase should be targeted to those customer groups that have the ability to incur the energy efficiency investment and are most likely to participate in the energy efficiency programs (participants) to lower their bills. For example, residential customers in the highest consumption blocks, commercial facilities, hotels and large industrial facilities are more likely to participate. These customer groups also offer the highest potential for energy and demand reduction making the investment in EE programs more rewarding to the system while allowing them to reap the benefits of lower bills. A key element to the success of energy efficiency programs is making end use consumers aware of the basic distinction between tariffs and bills. It is also critical for customers to know that energy efficiency programs account for only a small portion of total tariffs, especially when compared to bulk supply costs, which comprise approximately 75% of the total distribution tariff.

11. IMPACT ON THE EXISTING REGULATORY FRAMEWORK AND TARIFF METHODOLOGY

Many electric utility companies shy away from aggressively expanding their energy efficiency efforts when their shareholders' fundamental financial interests may be placed at risk due to various variables including the impact of energy efficiency measures on revenues and profitability. Thus, when developing incentive mechanisms and supporting tariff structures to encourage distribution companies, a key element would be to reduce the potential risk associated with demand-side efficiency. A viable business model for rate payers-funded energy efficiency programs should address 1) recovery of prudently incurred program costs, 2) under-recovery of fixed cost revenues between tariff adjustment periods due to reduced sales from energy efficiency, and 3) development of a shareholder incentive that provides an opportunity for energy efficiency to become a "profit center" for the distribution companies.

True-up for Under-recovery of Fixed Costs due to Reduced Consumption

The distribution companies fixed costs are collected volumetrically in tariffs, on a JD/kWh basis, from customers. If sales are reduced because of energy efficiency efforts, the distribution company collects less revenue between tariff review periods which results in an under-recovery of their fixed costs. Alternatively, if sales increase more than forecast (e.g. due to a booming economy), the utility collects more revenue, which completely offsets fixed costs and adds to their profits. A lost fixed cost recovery mechanism attempts to directly reimburse the utility for the reduced revenue associated exclusively with energy efficiency program savings.

Distribution companies however, should be allowed to recover not the entire revenue shortfall (the difference between actual revenue and the distribution companies' revenue requirement) but only the portion designed to recover fixed costs. The tariffs are designed to recover operating costs (both variable (bulk supply costs) and fixed), other fixed costs, such as depreciation, and a rate of return on the asset base. The distribution company should be allowed to recover only the amount of the revenue shortfall that covers their fixed costs (excluding the Bulk Supply Energy costs from NEPCO), since they never incurred the cost of purchasing bulk supply energy). This is referred to as "fixed cost recovery" or "lost revenue margin recovery", and is calculated by multiplying the difference between expected kWh's sold and actual kWh's sold times the portion of the per-kWh rate that covers fixed costs.

The disadvantage to this approach is that it is not easy to identify the amount of reduction in consumption that was due to energy efficiency measures as opposed to other reasons. Weather and economic conditions can each have a strong influence on distribution company sales, and these effects would also be captured and mitigated by the rate adjustments. Thus, one option is to limit guaranteed revenue recovery to only the amount of revenue lost as a result of the distribution company's energy efficiency programs. However, this lost revenue adjustment method is difficult to calculate on the part of the distribution company and difficult to oversee on the part of the ERC. It gives the distribution company an incentive to overestimate savings from energy efficiency

programs, but does not provide any motivation to promote energy efficiency or implement effective programs.

Rate of Return Adjustment

The approach above (Revenue Requirement adjustment) only eliminates the distribution companies' disincentive to promote energy efficiency programs. An alternative approach would be to provide positive financial incentives for the companies to invest in energy efficiency measures. Proposed incentives include an increased rate of return on investments in energy efficiency programs (or on the entire regulated asset base) and sharing the savings (between customers and shareholders) of the avoided costs from energy efficiency programs.

One way to encourage investment in energy efficiency measures by the distribution companies is to increase their allowable ROI. The distribution company could earn a higher rate of return on the investment in assets associated with energy efficiency programs that is higher than what the gain on distribution equipment. For example, if the standard rate of return is 10% of the regulatory asset base, a distribution company could earn 10-15% on their investments in energy efficiency programs provided that such returns are performance-based. This provides a return to shareholders for carrying out energy efficiency programs that are certainly more risky than simply investing in the infrastructure side of electricity distribution.

Another approach to providing incentives to distribution companies is to permit them to retain a share of the benefits from the energy efficiency investments. The benefits from the energy efficiency investments are the avoided costs from the reduced electricity consumption minus the cost of the investment, i.e., the rebates. The distribution company would be entitled to recover a percentage of these net benefits in the annual revenue requirement. In this way, the benefits of energy efficiency arising from the reduced financial burden on the entire system are shared between the customers and the distribution companies, providing a strong incentive to the distribution companies to support the energy efficiency investment program.

12. REQUIRED UPDATES TO REGULATIONS

Implementation of the proposed incentive mechanism would require the following changes in laws and regulations:

General Electricity Law: No changes in the General Electricity Law would be required to provide incentives to distribution companies to support investment in energy efficiency programs and recover these costs in tariffs:

- Article 47 C states the following: "When determining the tariff methodologies, the following shall be taken into consideration:
    - 1- allow a licensee that operates efficiently to recover the full costs of its business activities and to earn a reasonable return on the capital invested in business;
    - 2- provide incentives for the continued improvement of the technical and economic efficiency with which the services are provided, and for the continued improvement of quality of services;
    - 3- give to consumers economically efficient signals regarding the costs that their consumption imposes on the licensee's business;
- **1** – investing in energy efficiency programs would be consistent with "*a licensee that operates efficiently*", and the distribution companies would be entitled to earn a reasonable rate of return on the money invested in these programs. The definition of reasonable is open, but could be defined as a level necessary to encourage the distribution companies to carry out the desired level of investment. This rate of return could be higher than for other activities. Second, to the extent that energy efficiency programs reduce consumption (but fixed costs remain unchanged), the law would permit tariffs to increase "*to recover the full costs of its business activities*"
- **2** – providing incentives to invest in energy efficiency programs would meet the criteria of "*continued improvement of the ….. economic efficiency with which services are provided*"; Energy efficiency programs would also meet the criteria of "*continued improvement of quality of services*" by reducing peak demand, and reducing probability of outages.
- **3** – Increasing tariffs to account for the costs of energy efficiency programs is consistent with the requirement to give "*consumers economically efficient signals regarding the costs that their consumption imposes on the licensee's business*"

Licenses: No changes would be required in the Distribution and Retail Supply Licenses to implement energy efficiency Programs. Energy Efficiency programs would be characterized as a "Core" activity of the Distribution Licensee. Since the license defines only "Non Core" activities, the default is that any activity that is not defined as a "Non Core" activity is by definition a "Core" activity.

Data required by the ERC to audit the implementation of energy efficiency programs could fall under the data listed in Article (35) (e) "*Any other financial data the ERC may specify prescribe in*

directives issued from time to time". The ERC should consider issuing a directive to specify the data requirements for auditing the implementation of energy efficiency programs.

Article (36) describes the tariffs that the Distribution Licensee may charge. Tariffs are determined by the Tariff Methodology. While the Tariff Methodology will require updating, no changes will be required to Article (36).

Distribution Tariff Methodology: Providing incentives to Distribution Licensees to invest in energy efficiency programs and recover those costs in the retail tariffs will require changes to the Distribution Tariff Methodology. This tariff methodology must be consistent with the requirements of the General Electricity Law, and approved by the Board of the ERC. It does not require approval by parliament.

The following updates would be required to the Distribution Tariff Methodology to implement the various approaches described above:

- **Definition of Core Activities:** energy efficiency programs should to be included in the definition of core activities of the Distribution Licensees. This means that costs associated with the programs can be recovered in the retail tariffs;
- **Operating and Maintenance Expenses:** The definition of Operating and Maintenance Expenses that may be recovered in are to be updated to include administrative expenses related to energy efficiency programs;
- The value of Rebates provided to customers for energy efficiency investments will be included in the Regulatory Asset Base, net of any grant monies received from the Jordan Renewable Energy and Energy Efficiency Fund;
- **Rate of Return:** If the distribution companies are to be provided with an incentive to invest in energy efficiency measures through an increased rate of return (either on energy efficiency investments only, or on the entire Regulatory Asset Base), the methodology for calculating the rate of return would need to be updated (section II.7.2 of the Distribution Tariff Methodology). ;
- **ERC approval of investment programs:** Investment programs as part of energy efficiency measures to be included in the list of approved investment types;
- **Load Forecasts:** The load forecasts for the tariff review period should incorporate the expected load reduction arising from energy efficiency programs, to ensure that all fixed costs are recovered during the tariff review period

Renewable Energy Law: No changes required.

13. THE RISKS ASSOCIATED WITH ENERGY EFFICIENCY PROGRAMS

Like any other activities that involve market interaction, EE programs could also pose certain amounts of risk to the implementation utilities. These risks are classified as follow:

Technology risk

Utilities can be at risk if any of the program targeted technologies fail to deliver the expected savings whether due to mal function, lower technical specifications than desired or due to changes in their operational conditions such as change in the occupancy patterns or in how the EE measures are controlled and managed. For example, savings attributable to using automatic lighting controls may be reduced if the controls are not properly adjusted.

Market risk

Market risks cover issues related to the penetration of the EE measures in the market and whether energy consumers would accept the proposed EE measures. In addition to behavioral and customer choices, there is also the impact of the energy services chain (contractors and products/service suppliers) on market acceptance. The energy service industry in Jordan is not well established with limited experience with EE technologies. Profitability, technical competence and other aspects could cause contractors or technical and marketing professionals to promote or 'kill' a certain EE measure. Market prices could also be gamed to benefit from the utility cash incentives to customers. Some if not most of these market-related issues can influence the target incentives for which utilities would consider getting involved in promoting demand-side efficiency.

Regulatory Risk

There are two areas where the distribution companies may face regulatory risk in program implementation:

Tariff Adjustments: The distribution companies will rely on the ERC to ensure that the revenue requirements and tariffs include the costs associated with the energy efficiency programs. The distribution companies will be exposed to potential regulatory risk, if for whatever reason the ERC does not make the necessary adjustments to the tariff methodology to incorporate the costs incurred in the energy efficiency programs. While the expectation is that the regulatory changes will be made in a timely manner, consistent with the distribution companies cash flow requirements, there is a risk that, due to political pressures, tariff increases are postponed.

Evaluation of program impact: The ERC will monitor the impact of the programs in order to include certain compensation programs in tariffs. There is a risk that the ERC will conclude that energy savings, as a result of the energy efficiency programs, fall short of what the implementers estimated, and for which they incurred costs.

14. WHAT IS NEEDED TO ADOPT THE PROPOSED MECHANISM

Nexant conducted an assessment in mid 2010 of the EE relevant stakeholder organizations in Jordan with regard to their ability to implement a national EE program supported by the proposed EE incentive mechanism. The conclusion of this assessment was that none of the stakeholder organizations was capable to play the role expected of them without elaborate capacity building efforts. While NEPCO currently has an energy efficiency unit, it is neither ready, nor properly staffed to implement a national program for the medium voltage level customers. Furthermore, none of the three (3) electricity distribution companies could effectively develop and deliver energy efficiency programs to the market under the proposed incentive mechanism. There is a need to build the capacity within their organizations to be able to:

- assess the market potential for energy efficiency activities in their service territory
- design energy efficiency programs that respond to the assessed demand profile
- deliver and implement energy efficiency programs to end users
- evaluate the impacts of these programs

There was consensus however among all stakeholders that a key driver to consider investing in demand-side efficiency is the possibility of increasing profitability through the proposed shareholder incentive mechanism. However, all agreed that some key implementation issues and questions need to be resolved prior to the development of the mechanism.

The development of an effective EE program in Jordan requires government and stakeholders to undertake and support efforts to facilitate market development of energy efficiency activities in Jordan. These efforts must focus on three key aspects:

1. ***Setting the institutional and organizational framework that supports the development, monitoring, and implementation of EE activities in Jordan.*** The current setting of the market in general, and the electricity sector in particular, does not provide the necessary framework to meet the country's energy efficiency objectives mentioned in the 2007 update of Jordan's National Energy Strategy. A review of the energy electricity sector and its institutional, policy and regulatory settings indicated that adopting an EE incentive mechanism would require 1) an elaborate strengthening of the existing knowledge and skill base within the existing energy institutions with clear definition of the roles and responsibilities of each including the MEMR, ERC , NEPCO and the Three distribution companies; 2) development of policies supporting the advancement of EE practice as a resource option for the electricity sector; 3) setting well defined goals for EE programs; and 4. a program design that supports effective implementation, evaluation and monitoring.

2. ***Building the enabling capacity within the entities interfacing with demand-side management including NEPCO, the three distribution companies and ERC.*** In order for each of the stakeholders to have a sustainable EE operation after the development of an organizational setting, it is critical to develop a capacity building program that enables workforce planning for

delivering EE activities in the case of T&D companies, and for overseeing the entire incentive mechanism and assessing its effectiveness in the case of ERC.

T&D companies lack the technical and financial resources needed to develop and deliver EE sercies to the market. Most importantly, these organizations lack the knowledge-base and human capital necessary to support EE practices within their organizations. For these reasons, T&D companies need technical assistance to support the development of the following key functions within their organizations: 1. Load research tools and skills; 2. Program planning and establishment of overall goals and targets; 3. Program design with specific target end-use sectors and promotion of certain energy efficient technologies; 4. Program administration, market delivery and customer interface; 5. Program monitoring and verification of savings including technical, economic and behavioral assessment of how programs are effective.

The current organizational structure of ERC needs to be amended to include an EE unit capable of addressing EE as a resource and to monitor the development of the EE activities and their impact on future investment in power generation. The ERC requires technical assistance to support the development of the following functions: 1. Integrated resource planning; 2. Overall planning and establishment of goals and targets for the incentive mechanism; 3. Developing and updating of the LRMC and the avoided costs of the entire electricity sector; 4. Evaluation of cost-effectiveness of the EE program; 5. Monitoring and verification of savings ; 6. Program evaluation of economic and operational impacts; 7. Integrating the incentive mechanism into the rate-making and rate recovery mechanism; 8.Program reporting.

3. ***Designing an effective incentive mechanism to support the EE program.*** This will involve transforming the concept of the EE incentive mechanism into a full fledge design by refining its features. Designing the full fledged incentive mechanism scheme will require technical assistance that supports data management efforts, training programs that support the use of specific technologies and setting up interactive workshops that benefit from international expertise in EE programs.

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov