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Time-of-Use Tariff Program in Saudi Arabia: Design, Implementation, and Evaluation

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Abstract. In Saudi Arabia, electricity consumption increases substantially during the summer months with residential, commercial and industrial customers accounting for the majority of the high summer load. Although the daily peak period occurs between 1 PM and 5 PM, loads exceeding 95% of the annual peak load only last for 0.3% of the total hours of the year; therefore, they are very expensive to serve. Large industrial and commercial customers are participating with the Saudi Electricity Company (SEC) in a Time-of-Use (TOU) tariff program. The objective of the program is to reduce SEC peak load growth and the associated additional generation and network capacity, and to provide the participating customers with financial and other benefits. SEC started its TOU tariff program in June 2006 in its Central Operating Area (COA) with 26 industrial and 9 commercial customers. In 2007, the program was expanded to its Eastern and Western Operating Areas to include an additional 89 industrial and 20 commercial customers.

This paper presents an overall evaluation of the TOU program implementation in the COA of Saudi Arabia through an analysis of the results of field visits to selected customers and technical data obtained from SEC. The paper includes the TOU program description, energy and demand impacts, economic benefits to SEC, and customer bill reductions. Success cases and problems encountered are addressed, and recommendations to strengthen the program are made.

1. Introduction

In 1961, the first department of electricity affairs in the Kingdom of Saudi Arabia (KSA) was established within the Ministry of Commerce. Its remit was to set rules and regulations, to issue permits and licenses to electric companies, and to encourage national investment in the electricity sector. The electricity sector in KSA is divided into five geographical regions: Eastern, Central, Western, Southern, and Northern. In 2000, after a number of restructuring processes, all electricity companies and electric projects in KSA were merged into a single company called Saudi Electricity Company (SEC). In 2001, the Electricity and Cogeneration Regulatory Authority (ECRA) was established to ensure electrical services are provided with high quality and reliability levels, and at appropriate prices.

KSA is blessed with an abundance of energy resources. It has the world's largest proven oil reserves, the world's fourth largest proven gas reserves, has abundant wind and solar renewable energy resources, and is the world's 20th largest producer and consumer of electricity. Almost all Saudi Arabia's electricity is produced from the combustion of fossil fuels, increasing demand for which was the major factor for domestic consumption of petroleum products to increase by 10% between 2002 and 2005; the country makes negligible use of its renewable energy resources. Despite attempts to diversify the economy, the oil and gas industry still accounts for approximately 75% of budget revenues, 45% of GDP, and 90% of export earnings (Ministry of Water and Electricity, 2004).

Exploitation of the natural resources has allowed the Saudi government to keep energy prices low through a system of direct and indirect subsidies. The

nation has benefited greatly from these policies, but together with increased prosperity and sophistication, a culture of wasteful energy usage has become established. KSA already uses much more energy per capita than other countries at similar stages of development, and the rapidly increasing demand due to the pace of economic and social development means its energy sector must urgently provide additional capacity (World Bank, 2007).

Together with the high rates of population growth and economic development, they are the main reasons for the rapid increase in demand for electric power. Population in 2006 stood at over 23 million increasing over the last decade by an average of 2.46% per annum; however, there was a 4% per annum average increase in per capita electricity consumption over the same period as shown in Fig. 1. Peak power demand is close to installed capacity leading to the possibility of enforced blackouts such as those of the summer 1999 (IEA, 2006). Demand for electricity is accelerating and is now increasing by over 6% per year, meaning an additional 35 GW of generating capacity will be needed by 2023 over and above the 2005-installed capacity of 34.4 GW; the estimated cost is SR 55 billion (SEC). These factors have led to a greater awareness of the finite nature of the Kingdom's fossil-fuel resources and the urgent need to take measures to conserve and manage what remains.

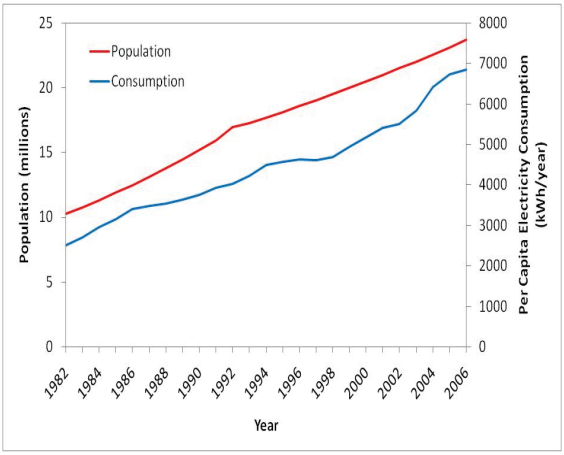

Fig. 1. Growth of population and per-capita electricity consumption of Saudi Arabia.

By the end of 2005, the total available generation capacity—taking into account the contribution made by desalination plants and large customers' power plants during peak-load periods—reached 32,301 MW. Of this total, 89.9% was provided by the electricity sector, 7.9% by desalination plants, and 2.2% by large customers. The energy generated by SEC's power plants was 150,214 GWh, up by 10.6% from 2004. This represented 85.3% of the total generated energy, with 11.9% supplied by desalination plants, and the remaining 2.8% by large customers. On a technology basis, SEC energy generation is 47.5% by steam turbines, 40% by gas turbines, 10.5% by combined cycle turbines, and 2% by diesel generators (CRE International, 2005).

The fuel types used by present generating units in the Kingdom are Natural Gas (NG), Heavy Fuel Oil (HFO), Crude Oil (CO) and Diesel Oil (DO). The general policy regarding the fuel is to use crude oil as the basic fuel for the gas turbines. However, in the Eastern Region, natural gas is used for most of the power plants. Diesel oil is used for some small gas turbines (Al-Ajlan *et al.*, 2006).

In order to deliver this power to its customers, especially during peak-load times, the national transmission and distribution networks have been expanded significantly over the last few years. In 2005, the peak load reached 28,317 MW in the interconnected systems, up 7.1% in 2004, and the peak load of the isolated networks reached 1 596 MW, up 13.4% in 2004. The total non-coincident peak load for the national network in 2005 was 29,913 MW, up 7.4% in 2004 (SEC).

Total consumption increased from 128,629 GWh in 2002 to 163,147 GWh in 2006, an average increase of 6.7% p.a., but as Fig. 2 shows, the increase in demand was not uniform across sectors. Although in absolute terms the increase in residential consumption during the period was greater than the combined total consumption of the agricultural and commercial sectors, expressed as percentages, the greatest average annual increase was in the commercial sector at 13.4%, followed by the residential sector at 7.9%. The smallest increase in consumption was in the industrial sector, which only increased by industrial consumption by 2.8% p.a. (UN, 2004).

The biggest problem facing the energy supply sector is the large seasonal variation in electricity consumption. In the hot summer season, there is increasing energy demand for air conditioning, especially by the residential and commercial sectors. Figure 3 shows a chart of the load profile of the Network Grid in the Central Region of the year 2006 and 2007. Peak load happened only during the summer months of June thru September.

The following features characterize SEC's electricity demand and power-system load-profiles:

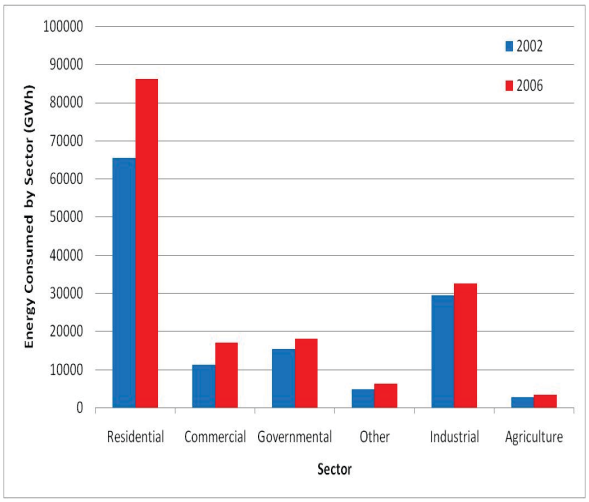

Fig. 2. Growth of energy consumption by sector in Saudi Arabia over the period 2002 to 2006.

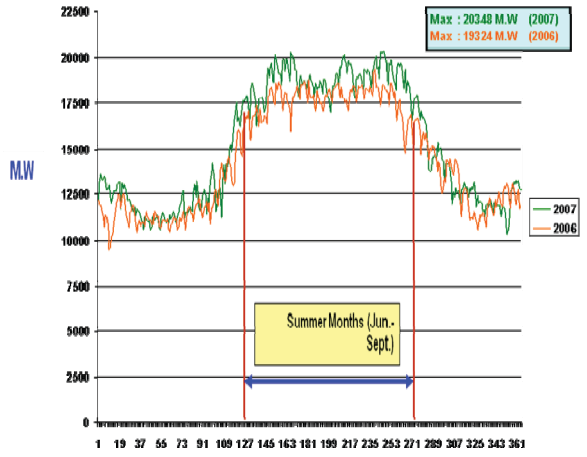

Fig. 3. Load profile of the Network Grid in Central Region during 2006 and 2007.

- Electricity consumption increases substantially during the summer months (June - September).
- Commercial and industrial customers account for the majority of the high summer load.
- Summer peak-period energy usage occurs during a short period of the day: 1 PM to 5 PM.
- Loads exceeding 95% of the annual peak load last for only 0.3% of the total hours of the year, making them very expensive to serve.
- Average annual load factors are: 0.65 for Eastern Operating Area (EOA), 0.55 for Central Operating Area (COA), 0.65 for Western Operating Area (WOA) and 0.60 for Southern Operating Area (SOA).

Large industrial and commercial customers were approached by SEC for participation in a Time-of-Use (TOU) tariff program. The objective of the program was to change the load profiles of the industrial and commercial customers in order to:

- Reduce SEC peak-load growth, to result in the slower addition of future generation and network capacities.
- Improve SEC load-factors with the use of better technical and economic operational methods.
- Reduce the cost of supplying electricity to the customers.

The program has also to achieve financial and other benefits to participating customers, including lower electricity bills, and sustainable connectivity to the electricity supply. This paper describes the SEC's TOU tariff program in the planning and the early implementation phases, and provides an evaluation of how participating customers' responded. Challenges and recommendations to strengthen the program are also described.

2. TOU Tariff Program

2.1. Tariff restructuring

Historically, tariffs have been heavily subsidized. The subsidy being the difference between the average cost of production and the tariff. Prior to 1984, there was single flat-rate tariff of 0.05 SR/kWh for industrial customers and 0.07 SR/kWh for residential customers. For tariff purposes, industrial customers also include agriculture, hospitals, and charities, while government is included with residential customers. Over the next decade, the flat-rate industrial tariff was unchanged, while residential usage was assessed according to a three-tier tariff. During this time, despite rising production costs, rather than raising tariffs or adjusting rates downward, they were adjusted upward, first in 1985 which saw the usage level at which the maximum tariff started double from 2,000 to 4,000 kWh/month, and again in 1992 when it was increased to 6,000 kWh/month. In 1995, a two-tier tariff was introduced for industrial customers, which effectively doubled charges as the higher tariff of 0.10 SR/kWh started at 2,000 kWh/month. At the same time, the maximum charge for residential users was increased from 0.15 SR/kWh to 0.20 SR/kWh with no adjustment in the level at which the highest tariff started. The major change in tariff structure occurred in 2000, with the introduction of 11 tiers in the tariffs for residential customers ranging from 0.05 SR/kWh to 0.38 SR/kWh, and the reintroduction of a flat rate tariff for industrial customers at the higher rate of 0.12 SR/kWh. The residential tariffs were in force for 7 months before being lowered to 0.05 SR/KWh to 0.26

SR/KWh; however, the number of tiers and usage was not changed. Table 1 summarizes the tariff structures (SEC).

Table 1. Electricity tariffs in Saudi Arabia 1974-present

Period	Ordinary Consumers†			Industrial Consumers‡
	Tariff tiers	Tariff (SR/kWh)	High tariff start (kWh/month)	Tariff (SR/kWh)
1974 – 1984	1	0.07	Flat rate	0.05
1984 – 1985	3	0.07 – 0.15	2000	0.05
1985 – 1992	3	0.07 – 0.15	4000	0.05
1992 – 1995	3	0.05 – 0.15	6000	0.05
1995 – 2000	4	0.05 – 0.20	6000	0.05 – 0.10*
2000¶	11	0.05 – 0.38	10000	0.12¶¶
2000 – present	11	0.05 – 0.26	10000	0.12

†Includes residential and governmental.
‡Includes industry, as well as agriculture, hospitals, and charities.
*High tariff starts at 2,000 kWh/month; all other periods have flat rate tariffs.
¶May – August.
¶¶For agriculture only, the previous 2-tier tariff remained in effect.

2.2. Design objectives

After reviewing best practices from a number of successful TOU tariff programs from around the world, rates were set for SEC's TOU tariff program with the following design objectives:

- TOU rates should not result in higher electricity bills for average customers.
- Electricity bills should not change for customers whose load shape remains typical of their rate class.
- Customers who reduce peak energy usage should save money through reduced electricity bills.
- TOU rates should create an opportunity mutually advantageous to customers and SEC.
- To achieve suitable financial benefits for participating customers, TOU rates should have a sufficiently high peak to off-peak rate ratio.

2.3. Main features and considerations

- The target customer groups for participation in the TOU tariff program were large customers in the industrial and commercial sectors with installed capacities of 1 MVA and above, and with annual consumptions over 600 MWh.
- The first stage of the program was Riyadh City, part of the COA.
- The TOU tariff was applicable during the summer months from June to September 2006 on a voluntary basis.
- The ordinary flat-rate tariff was applicable for the remainder of the year (October 2006 - May 2007).
- The TOU tariff was initially offered and applied to target customers on a voluntary basis.
- Locally manufactured TOU electronic meters were procured by SEC. The meters could be read automatically using telephone-line modems, or manually through handheld units.

2.4. TOU rates

The TOU rates had two daily summer-season pricing periods, and one during the winter. Summer had a peak and an off-peak period; winter was off-peak. The peak period applied for four months, June to September 2006, on weekday afternoons; that is, from Saturday to Wednesday, 1 PM to 5 PM. The remaining hours, days, and months were off-peak.

Since the TOU tariff program was voluntary, it was critical to select a peak to off-peak rate ratio that appealed to a wide range of customers and ensured a high rate of customer participation. Generally, the more customers shift or curtail their usage during peak periods, the greater the net benefits to both SEC and its customers should be. Several peak to off-peak rate ratios were proposed to SEC's large customers; most expressed interest in the 4:1 and 2:1 ratios, with the strongest preference being for a TOU rate with a 4:1 peak to off-peak rate ratio. The TOU tariffs were computed based on the Long Run Marginal Cost (LRMC) differentiated by the time-of-use (peak and off-peak periods).

(a) Tariffs for Industrial Sector

- Flat rate tariff:
  Peak Period: $R_{1p} = 0.12$ SR/kWh
  Off-Peak Period: $R_{1o} = 0.12$ SR/kWh

  $R_{1p} = R_{1o} = 0.12$ SR/kWh for all levels of consumption.

- Alternative TOU tariff:
  Peak Period: $R_{2p} = 0.35$ SR/kWh
  Off-Peak Period: $R_{2o} = 0.09$ SR/kWh

(b) Tariffs for Commercial Sector

- Flat rate tariffs:
  Each consumption bracket had its own rate. These ranged from 0.05 SR/kWh for less than 1,000 kWh/month to 0.26 SR/kWh for over 10,000 kWh/month.

$R_{1p} = R_{1o}$ in each consumption bracket.

- Alternative TOU tariff:
  Peak Period: $R_{2p} = 0.76$ SR/kWh
  Off-peak Period: $R_{2o} = 0.19$ SR/kWh

2.5. Billing method

Based on a survey of international practices, SEC selected the 'bill protection' method for the TOU tariff program, a method that guarantees that bills do not increase under TOU tariffs.

For each participating customer, two electricity bills were issued on a monthly basis, one based on the ordinary flat-rate tariff and the other on the optional TOU tariff. The monthly electricity bill with the lower value was paid.

2.6. Program participation and inauguration

Agreements of electrical-energy sale based on TOU tariffs were signed with 35 customers utilizing a total of 45 meters. These comprised 26 industrial customers (34 meters) and 9 commercial customers (11 meters). Twenty-four meters were automatically read through telephone lines and the remainder were manually read with handheld units. The TOU tariff program started on 1 June 2006.

3. Customer Response

In order to assess customer response to the TOU tariff program, field surveys were carried out with six customers; three industrial and three commercial. An additional survey was made with a TOU-tariff-aware, but non-participating, industrial customer. The surveys were conducted between 12 and 17 September 2006 and relate to the period June to August 2006.

Two load-shifting survey forms were developed, one for industrial customers and the other for commercial customers, and the following information was collected:

- General information.
- Electrical supply.
- Electrical energy billing.
- Production (or services provided to clients).
- Installed loads and normal operational regime.
- Maintenance scheduling.
- Applications and potential of load shifting or peak clipping.
- Cost of applying load shifting or peak clipping.
- Problems facing the application of load shifting or peak clipping.
- Other proposals or opinions regarding the subject.

The survey results showed that the main procedures adopted by these customers to adapt to the TOU tariff program were:

- Early starts were made to the first shifts so that they ended before the peak-load period started at 1 PM, and the start of the second shift was delayed until the end of peak-load period at 5 PM.
- Greater use of Thermal Energy Storage (TES) was made. TES systems were operated during off-peak periods, thus reducing the use of chillers during peak periods.
- Air conditioning temperature set points were increased between 1°C and 5°C.
- More use was made of energy efficient fans for improving air quality.
- Increased use of building management systems (BMS) were made to optimize the daily operation of pumps.
- Lighting loads in non-essential areas were reduced; these included parking, corridors and service areas.

The following conclusions about the effect of TOU tariffs on customer bills can be drawn:

- As a percentage of each type of account in the trial, more commercial customers than industrial customers found the program resulted in reduced bills.
- Of the 45 accounts in the program, 5 customers had larger TOU tariff bills than non-tariff bills for each month of program participation; however, 17 customers had larger TOU tariff bills in June, 5 in July, and 14 in August.
- Over the month, the peak energy share should be lower than a specific percent of the total consumption in order to assure a bill gain for an industrial customer in light of the applied rates. Accounts benefiting most from the program had reference peak energy shares (peak energy share prior to TOU tariff implementation) $\leq 14\%$.
- Reductions in customer bills ranged from 0.04% to 8.73% compared to their TOU tariff bills.
- The total bill reduction for all customers over the period was 351,510 SR. Industrial customers accounted for 78,160 SR (22%), and commercial customers for 273,350 SR (78%).

3.1. Customer success stores

The participants from commercial and industrial sectors are benefited from the TOU tariff by utilizing different techniques. For instant, a commercial customer in Riyadh used the Thermal Energy Storage (TES) systems technique. The TES systems were operated during off-peak periods, thus reducing the

use of chillers during peak periods. The load profile of the customer during the days of 10th and 11th of June 2006 is shown in Fig. 4. The customer loading was 15.5 MW and the load reduction during the peak was 8 MW. So the customer was saving 51%.

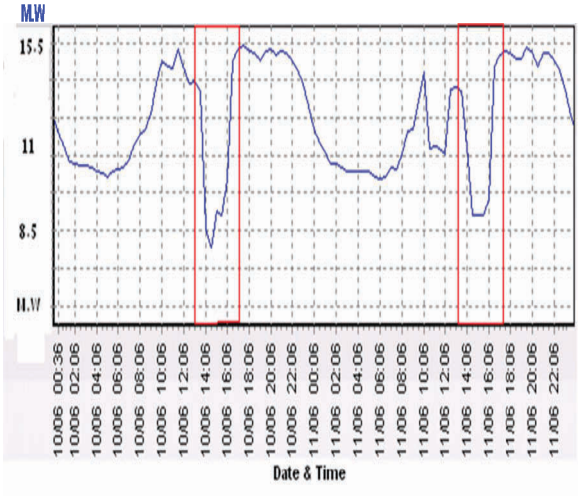

Fig. 4. Load profile of the commercial customer in Riyadh during 10-11 June 2006.

A second industrial customer in Dammam used backup motors technique. The motors were operated during peak periods. The load profile of the customer during the days of 29th and 30th of August 2007 is shown in Fig. 5. The customer loading was 650 KW and the load reduction during the peak was 650 KW and so the percent of saving was 100%.

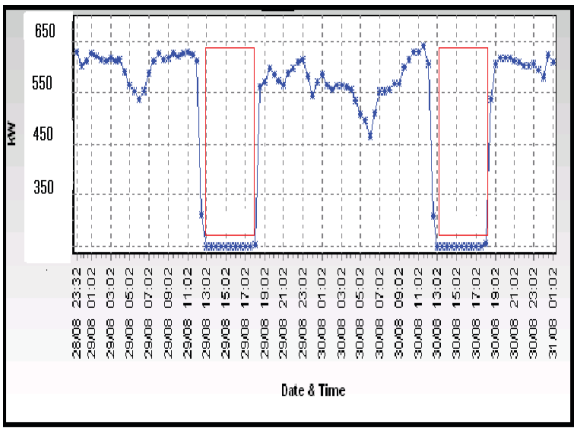

Fig. 5. Load profile of the industrial customer in Dammam during 29-30 August 2007.

A third industrial customer in Riyadh changed the shifting time technique. The factory was turned off during peak periods. The load profile of the customer during the days of 14th and 25th of August 2007 is shown in Fig. 6. The customer loading was 2 MW and the load reduction during the peak was 1.4 MW and so the percent of saving was 70%.

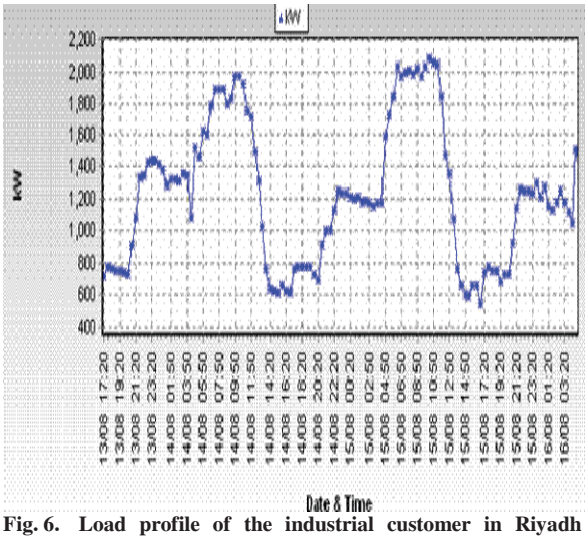

Fig. 6. Load profile of the industrial customer in Riyadh during 14-15 August 2007.

4. Economic Aspects

An analysis of the effect of the TOU tariffs on energy and load demand and the resultant economic benefits to SEC can be summarized as:

- The minimum reduction in the peak-period load was 2.6 MW in July 2006, and the maximum was 15.3 MW in June 2006.
- Reductions in customers' bills imply a direct revenue loss for SEC. During the program, a total of 2,494 MWh was shifted from the peak-load period at a cost to SEC of 351,510 SR; equivalent to 0.014 SR/kWh.
- The net benefits to SEC are the avoided capacity and energy costs minus the loss in revenue. Over the duration of the program this reached 6,676,390 SR.

5. Challenges

Based on the meetings with representatives of SEC's COA, KSA's National Energy Efficiency Program (NEEP), field visits to a number of participating and non-participating customers, and a review of available documents related to the TOU tariff program in KSA, the following problems highlighted the challenges that future TOU programs should seek to address:

- Inadequate marketing of program objectives and benefits.

- Lack of expertise among customers (mainly commercial) about energy efficiency measures.
- Inadequate customer communication and follow up.
- Some customers have reservations about program targets; they believe their benefits are secondary to increased SEC profits.
- Some customers fear that cooperation with SEC will be followed by mandatory TOU tariffs.
- Some customers have continuous production process that do not permit load shifting.
- Technical constraints for some industrial processes do not permit load shifting.
- Some industrial customers have competition considerations; they have doubts about SEC commitment to quantity and procurement times.
- Some commercial customers fear that employing specific DSM measures will disrupt provision of services to their clients.
- Ineffective self-generation by some customers due to full dependence on SEC supply.
- Most customers feel that the TOU rates are not optimum due to the very high peak rate or the high peak to off-peak rate ratio.
- Inadequate financial incentives are provided by SEC; i.e., limited bill reductions with TOU tariffs.

However,

- The program is new; therefore, over time, communication with customers will strengthen.
- The program is voluntary; therefore, customers must be allowed more time in which to respond.
- Between 30% and 40% of participating customers provided feedback allowing a reasonable demand assessment on the SEC network to be made.

6. Recommendations

6.1. Marketing programs

To be successful, the TOU program needs a strong marketing effort. To this end, SEC should contract a professional marketing agency to help develop a marketing program.

The following procedures could be adopted.

(a) Expand the TOU program

- Customer follow-up surveys should be completed by making field visits to the remaining customers to identify their problems, needs, and points of view.
- SEC should seek to expand the program within SEC's COA. Eligible customers are those with a peak-energy share less than 14%, those indicating a positive response to the program, that have flexible or manageable process operations over the day, or have sufficient self generation.
- SEC should identify eligible customers within SEC's other operating areas. It would be advantageous for SEC to contract Energy Service Companies (ESCOs) to perform this task. This has dual objectives; (i) to support the TOU tariff program, and (ii) to support the ESCO industry in KSA.

(b) Conduct customer workshops

- SEC should organize and invite eligible customers from all its operating areas to attend periodical workshops. Greater effort needs to be made to ensure that SEC's message is understood by its customers.
- It is extremely important that SEC emphasize the critical generation status, and how, if reliable supplies are to be maintained, customer willingness to reduce peak demands is essential.
- Two regular workshops should be arranged each year; one during the winter and one during the summer. The objective is to identify customers' overall problems and requirements, and to cooperate with them in finding suitable solutions or program modifications.

(c) Establish cooperation with commercial and industrial associations

- SEC should cooperate with commercial and industrial associations such as the Saudi Chamber of Commerce and Industry. Direct meetings with their representatives should be arranged, and they should be invited to attend customer workshops and to form cooperation protocols. Through these associations, SEC could foster customer relationships and enroll new program participants.

(d) Establish indirect and remote contacts with customers

- A quarterly TOU-program newsletter could be issued and distributed during field visits and customer workshops.
- Program brochures could be included with the electricity bill; these should indicate program objectives, benefits, and recommended ways of reducing electricity bills by adjusting consumption patterns.

- A program website could be established to provide all the necessary information related to the program, and to facilitate a hot line for customer queries.

A professional marketing agency should help with these suggestions.

(e) Publicize customer success stories

- SEC should publicize success stories of the commercial and industrial customers that have benefited from the TOU tariff program.

6.2. Customer education, training, and support

It is very important that SEC provide its customers with education, training, and support. SEC should employ all the marketing tools listed in this section to provide customers with the knowledge necessary to benefit from the program. It would be advantageous for SEC to provide its customers with load profile data and other billing information. ESCOs contracted by SEC should also help customers find solutions to their technical problems.

6.3. Self-generation and thermal energy storage

SEC should encourage the use of TES and self-generation. A survey of suitable systems should be made available to customers to encourage them to adopt the technologies.

6.4. Evaluation of applied TOU rates

High peak to off-peak rate ratios provide good demand and bill reductions when customers change their working practices and energy usage to suit. However, some customers taking part in the TOU program did not obtain lower bills. This was due to process inflexibility resulting in a limited amount of shifted peak energy. The TOU peak to off-peak rate ratio need to be reevaluated; a ratio of 3 to 1 should be tried and customer acceptance evaluated.

6.5. TOU meter reading

TOU bills were not issued to some customers. In some cases, this was due to communication failures with the automatic meters, and in others the problem was with the actual meters.

Metering staff need to inspect the TOU meters regularly to replace malfunctioning meters, and to read meters with handheld units in case of communication problems.

7. Status of TOU Tariff Program in 2007

Customers targeted for the TOU program in 2007 were large customers in the industrial and commercial sectors with installed capacities of 1 MVA and above, and with annual consumptions exceeding 600 MWh. Agreements were made with 89 industrial and 20 commercial customers in the EOA and the WOA of SEC, bringing the total number of agreements to 182; 146 industrial customers and 36 commercial customers.

8. Conclusions

The second year of the TOU tariff program involved an expansion of its customer base. By virtue of the lessons learned during the first year of the program, the second year resulted in greater peak-period load reductions for customers; these ranged from 86 MW in June 2007 to 66 MW in July. Larger reductions in customer bills should be possible, and in addition, greater market penetration would increase the benefit to the SEC network.

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References

Al-Ajlan, S. A.; Al-Ibrahim, A. M.; Abdulkhaleq, M. and Alghamdi, F. "Developing Sustainable Energy Policies for Electrical Energy Conservation in Saudi Arabia." *Energy Policy*, Vol. 34, (2006), 1556-1565.

CRE International. "Presentation on TOU Rates." *Time-of-Use Rates Workshop*, Riyadh, Saudi Arabia, (October 2005).

IEA. *Energy Balances of OECD Countries*. 2006 edition, Statistics Division, International Energy Agency; Saudi Electricity Company, 2005 Annual Report.

Ministry of Water and Electricity. *Electricity: Growth and Development in the Kingdom of Saudi Arabia*. 2004 Annual Report.

SEC. Agreements of Electrical Energy Sale Based on Time-of-Use.

World Bank. *World Development Indicators 2007*. World Bank, Washington, D.C., (2007).

برنامج التعريفة المتغيرة في المملكة العربية السعودية: تصميم وتطبيق وتقييم

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(قدم للنشر في ٢٠٠٨/٢/١٩م؛ وقبل للنشر في ٢٠٠٩/٣/٣م)

الكلمات المفتاحية: برنامج التعريفية المتغيرة، المنافع الاقتصادية، التأثير على الطلب، تخفيض الفاتورة.

ملخص البحث. يستمر استهلاك الطاقة الكهربائية في المملكة العربية السعودية في الزيادة خلال فترة الصيف في القطاع السكني والتجاري والصناعي حيث تشكل هذه القطاعات أكبر حصة في الحمل الكهربائي. إن فترة الحمل اليومي تحدث ما بين الساعة الواحدة والخامسة مساء، حيث إن الحمل يشكل نسبة ٩٥٪ من حمل الذروة السنوي لمدة ٠,٣٪ من إجمالي الساعات في السنة. عليه، فإن تكاليف تقديم الخدمة باهظة. يشترك بعض المصانع الكبيرة والعملاء التجاريين مع الشركة السعودية للكهرباء في برنامج التعريفة المتغيرة، حيث يهدف البرنامج إلى تقليل ازدياد حمل الذروة في الشركة السعودية للكهرباء، وما يرافقه من إضافة توليد وتوزيع من أجل تزويد العملاء المشاركين في البرنامج بمنافع مالية وغيرها. بدأ تنفيذ برنامج التعريفة المتغيرة في يونيو عام ٢٠٠٦م في المنطقة الوسطى وشارك فيه ٢٦ مصنعاً وتسعة عملاء من القطاع التجاري. وفي عام ٢٠٠٧م، تم توسيع نطاق تطبيق البرنامج ليشمل المنطقتين الشرقية والغربية، ليزداد المشاركون في البرنامج بإضافة ٨٩ مصنعاً و٢٠ عميلاً تجارياً.

تستعرض الورقة العلمية تقييماً شاملاً لتطبيق برنامج التعريفة المتغيرة في المنطقة الوسطى من خلال تحليل نتائج زيارات حقلية إلى شريحة مختارة من المشاركين في البرنامج ودراسة النتائج الفنية من الشركة السعودية للكهرباء. وتشمل الورقة وصفاً لبرنامج التعريفة المتغيرة، والطاقة وتأثيرات الطلب، والمنافع المالية للشركة السعودية للكهرباء، وأيضاً تقليل فاتورة العميل. بالإضافة إلى استعراض بعض قصص النجاح والمشاكل المصاحبة، وبالإضافة إلى توصيات تهدف لتقوية برنامج التعريفة المتغيرة.