DOMESTIC TIME OF USE TARIFF DETERMINATION

ELEXPERT (PTY) LTD

Maximise the value of your energy inputs.

Hendrik Barnard
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INTRODUCTION
Government Gazzet 31250 requires smart meters >1000 kWh/m.

Utilities have installed smart meters with TOU.

Many of these tariffs leave much to be desired for.

This paper will illustrate the requirements and features of a quality domestic / small commercial TOU tariff.
OBJECTIVES

Smart meters with load management features on TOU tariffs:

- To apply electricity tariffs which reflect the cost of supply as accurately as possible in respect of the all various type of costs.
- To encourage and support load shifting by customers in an economically efficient way.

Message:

- Load shifting not at all cost
- but be in response to the economically efficient price signals.
- Essential that the price signals will provide the critical drivers to ensure optimal load shifting.
EPP STIPULATIONS
Efficient electricity prices would lead to:

- a. the optimum allocation of scarce resources including financial, human and natural resources;
- b. the optimum usage of electricity;
- c. the optimum usage of the different energy forms (e.g. electricity, gas, oil and coal); and
- d. a financially viable industry.
a) Cost reflective tariffs shall reflect all the following cost components as far as possible:

Energy costs in c/kWh: The energy cost from the bulk supplier or other sources differentiated by:

- the bulk supplier TOU periods;
- or, with non-TOU metering, the relevant portion of the various TOU costs; and
- plus the losses on the relevant transmission and distribution networks.
Network demand charges in R/kVA/period

Network capacity charges in R/kVA/month or R/Amp/month based on annual capacity:

Customer service charges in R/cust/month: costs of providing the services to serve the customer.

Point of supply costs R/POS/month: costs from the point of common coupling and metering;

Cost of poor power factor: the avoided costs to restore the power factor to the optimum level.
a) Cost reflective tariffs are considered the most effective pricing signal to be provided to customers. Any additional pricing signals over and above the costs must be motivated specifically and be approved by NERSA.
a) TOU tariff energy charges must be differentiated by:
- All the components as reflected by the WEPS.
- In addition a super peak rate to reflect the short terms costs could be applied during emergencies in which case customers need to be informed in advance.
a) Domestic tariffs to become more cost-reflective, offering a suite of supply options with progressive capacity-differentiated tariffs and connection fees:

A. Single energy rate tariff with no basic charge, limited to 20 Amps and nominal connection charge;

B. Basic charge, customer service charge, capacity charge and energy charge.

C. TOU tariffs must be instituted on the same basis as above, but with TOU energy rates.
DOMESTIC TOU TARIFF STRUCTURE
DOMESTIC TOU TARIFF STRUCTURE

- Basic charge (Rand/customer/month). This to be set as close as possible to the fixed / customer services costs associated with a domestic TOU customer. This should be differentiated for 1 and 3 phase customers and Bulk Domestic.

- Capacity Charge (Rand / Amps / month). This is to be based on the installed capacity per customer (set per 10 Amps) and be set as close as possible to the network costs which must include capital provision and maintenance.
DOMESTIC TOU TARIFF STRUCTURE

- Energy charges (c/kWh) This to be as close as possible to the WEPS (Eskom Megaflex).
  - Peak, Standard & Off-peak.
  - High demand / Low demand seasons.
  - All periods to be the same as the Eskom TOU periods.
  - Reactive energy charge.
TARIFF LEVEL
Domestic TOU tariff not to change the cross-subsidisation between different tariff categories.

Revenue neutrality for target domestic TOU customers.

Change of cross subsidisation between tariffs must be deliberate phased approach.

Within the domestic TOU customers the intra-tariff cross subsidisation will be removed:
- In respect of average usage.
- In respect of Load factor.
- Relative usage in TOU periods.
Current revenue of target customers.

Per unit costs: basic, network & energy.

Quantities: 1 and 3 phase, capacities & TOU energy.

Revenue using per unit costs and the usage quantities.

Adjust to achieve revenue neutrality:

- Increase the TOU energy rates by the same c/kWh surcharge for all periods.
- Retain all other charges as per cost calculations.

This will imply that the cross subsidisation to other customers (big reason for any increases) will be covered in the energy charges.
CONVERSION STRATEGY

- Give choice. Not in line with the EPP and other government stipulations and also causes only those customers who will save to convert.

- No choice. This is the preferred route. Obviously not all domestic customers using more than 1000 kWh/m have Smart meters installed and therefore not all can be converted to TOU at once.

- It is suggested that all customers for whom Smart meters have been installed be converted as from the start of the new financial year. If customers are converted during the year, the municipality will almost always lose revenue.
| Tariff Name        | Code | R/C/m   | ENERGY CHARGE | R/A/m | GE/C/m | DC/C/m | R/A/m |_markup|Markup
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TOU DOMESTIC CUSTOMER IMPACT

% IMPACT (+ INCREASE, - DECREASE)

Load Factor

% 80%

-15.00% -10.00% -5.00% 0.00% 5.00% 10.00% 15.00% 20.00% 25.00% 30.00%

INTRODUCTION
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LOAD SHIFT IMPACT

Load shift loss in revenue matched with equal savings in purchase cost. Bottom line not impacted.
ISSUES

- 2 period vs 3 TOU day periods.
- Treatment of Public holidays
- Reactive energy charges.
- Domestic Bulk Supplies.
- Demand vs Access charge.
- Load control by utility.
- Time periods / seasons different from Eskom.
- Method of mark-up for revenue neutrality.
- Cross-subsidy, renewable energy levy.
- Pre-payment vs. conventional payment.
- Load shifting support.
- Capacity costs / fixed costs in energy charges.
2 period vs 3 TOU day periods.

- EPP stipulates close as possible to the WEPS.
- 2 rate period negates very high peak price signal.
- Ability to move load effectively is negated:
  - Solar water heaters.
  - Customer with solar panels for their swimming pools.
  - Washing machines and dishwashers.
  - Various applications not possible to switch them off for the whole day from 07h00-22h00.
- Complex tariff setting every year.
Different treatment is the more cost reflective but is more complex.

Unlikely that domestic customers would make maximum use of the cheaper power during some public holidays.

If public holidays are not treated differently the P/S/O-P quantities should be calculated.

If a Smart Meter System without remote ability to load the public holidays as different days is used, it is not advised because of the need to visit the meter and reprogrammed it annually.
Reactive energy charges.

- Domestic loads are more reactive:
  - Less resistive loads.
  - More loads with bad power factor.

- Customers best way of managing the power factor:
  - By the equipment they purchase.
  - By using motor driven appliances such as heat pumps mostly during the off-peak times.

- Studies for Domestic customers using more than 1000 kWh/m power factor is worse than the expected 0.85%.
Domestic Bulk Supplies.

- Municipal and National Legislation requires that all customers within a municipal boundary be treated fairly.
- IBT tariff to customers using less than 1000 kWh/m, received massive cross-subsidies.
- Generally Domestic TOU tariff calculated for revenue neutrality for domestic customers using more than 1000 kWh/m is applied to reseller, the revenue from the IBT would be significantly less than the price at the Domestic TOU tariff.
Do not apply a Domestic TOU tariff to these resellers but charge an IBT where the blocks sizes are multiplied by the number of units supplied in that complex.

Offer a Bulk domestic TOU tariff where the c/kWh markup is set at a level which would bring the average price to the same level as the IBT tariff within the complex.
Demand vs Access charge.

- Better for the utility if the customers’ maximum load is limited rather than to charge demand charges.
- Domestic customers not have the sophistication or time to manage their loads on an hourly basis.
- Customers are aware of their capacity limits and do take measures to remain within.
- Proposed R/Amp/month charge in steps of 10 Amps.
Load control by utility.

- The capacity charge and the TOU energy rates provide a very strong signal for customers to avoid the Eskom peak times and the local peaks.

- When utilities now manage some of these loads remotely the following questions arise:
  - Will it not compromise the customer’s TOU energy or capacity cost?

- The key message: care would need to be taken in doing the system setup closely with customers.
Pre-payment vs. conventional.

- Pre-payment to domestic TOU tariffs with smart meters presents new challenges in this respect.
- Current pre-payment meters customer pays in Rand but receives a token for kWh. Problem with high price changes.
- It is therefore proposed that Rand amounts are transferred to the meter. The meter will contain all the tariff charges and will thus deduct the associated amount from the available credit on the meter.
Pre-payment vs. conventional.

- At end of the month the basic charges plus capacity charge is deducted that the customer could go into a negative credit available.

- With no purchases, the amount due will increase every month.

- Maybe fixed charge be recovered by way of a debit order and only vending the energy.

- These aspects need detailed consideration in deciding the payment approach.
Load shifting support.

- Customers need support in load shifting:
- A consumption / requirement audit should be undertaken per household.
- The customer need to be recommended what the optimal load management regime would be optimal.
- A joint decision be made and the system then be configured to operate in terms of this regime.
- Customers need to be informed about the impact on electricity costs and their bills.
Capacity costs / fixed costs in energy charges.

- This distorts the price signals / conflict with EPP.
- No signal for customers to improve their load factor.
- This causes customers to increase network capacity / system peak for a few incidents during the year.
- Customers with irregular consumption will not pay their fair cost of supply.
- Utility is more exposed to consumption changes when the utility network costs remain the same but experience big revenue losses.
IMPLEMENTATION

- New system have teething problems. Thus proposed:
  - Smart meters be installed and be run as a simple non-TOU tariff initially.
  - Because of the big difference in rates between the seasons customers be converted to TOU at start of financial year.
    New customers can be charged at TOU from the beginning.
  - When a customer that is currently on pre-payment, converts to the new smart meter in conventional mode, a deposit may to be levied for that customer.
The development of a TOU tariff for domestic customers is a complex subject. This paper highlights some of the key considerations.

Municipalities are advised not to just jump in and do their own thing. Thorough analysis and various practical and ideological issues need careful analysis and considering.

It is hoped that this paper has provided useful guidance that can be used by all electricity utilities.
DOMESTIC TIME OF USE
TARIFF DETERMINATION

THANK YOU!
ANY QUESTIONS