

Integrated Resource Planning Training for Decision Makers

Day 3, Session 6 – Tariff policy and DSM

10 March 2021

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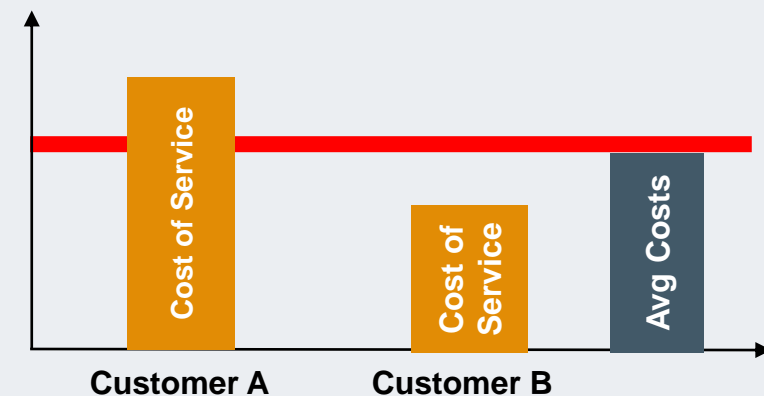
Basic tariff concepts

- ▶ **Electricity tariffs have two main aspects**
 - **Tariff structure**
 - *The ratios of charges (fixed and consumption-related) between customer categories and ratio of charges within each category.*
 - *To achieve economic efficiency tariff structures should reflect marginal costs.*
 - **Tariff level**
 - *The average level of tariff determined by the Required Revenues.*
- ▶ **The tariff structure (i.e. ratios among charges) can be kept constant to reflect economic costs while the tariff level can be scaled to ensure revenue recovery.**

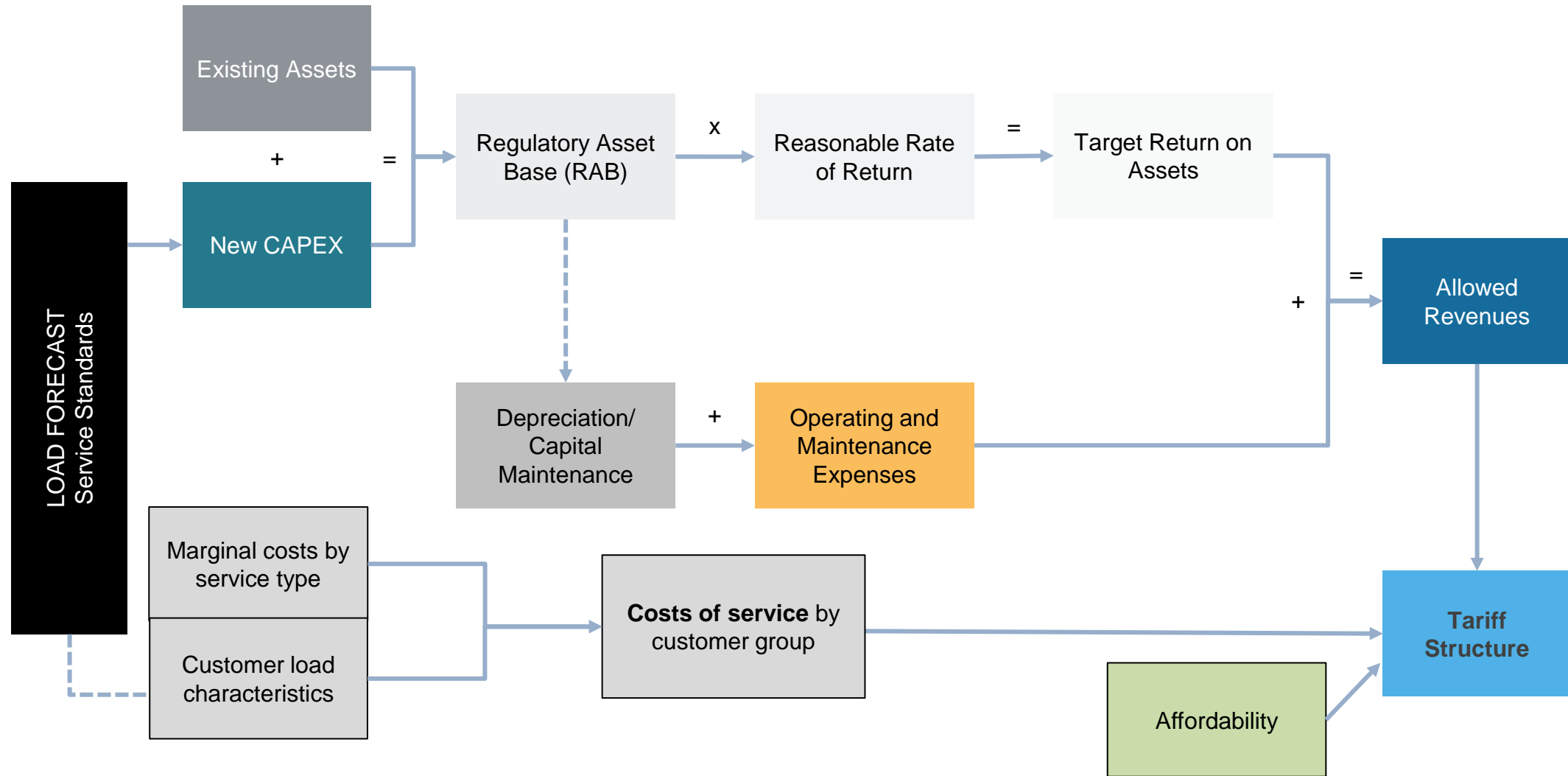
Key definitions

- **“Cost-recovery”**
 - *Revenues from tariffs fully recover efficient costs (Required Revenues)*
- **“Cost-reflective”**
 - *The tariffs charged to different customers reflect differences in the costs of service between those customers*

Cost-recovery ≠ Cost-reflective



Two parallel work streams in electricity tariff studies



ECA's tariff setting models

Required Revenues



- **Revenue Requirement model** – calculating the revenues that the utility requires to cover its costs and meet its financial covenants.

Tariff design



- **LRMC model** – estimating MC of supply for different tariff categories.
- **Tariff design tool** – design of seasonal time of day periods.

Revenue Simulation



- **RS model** – calculating forecast revenues by tariff category and on aggregate.

Adjustment



- **RS model** – calculating end-user tariffs, such that revenue requirement will be met while also reflecting the relative marginal costs of different customers.

Why it is important to try to change demand through demand side management?

- ▶ Pricing electricity on the basis of economic principles will ensure efficient use of the country's resources
 - The tariff informs consumers about the costs they are imposing on the system and encourages them to use electricity sparingly
 - Raising average tariffs to cost recovery levels will reduce the demand forecast growth
- ▶ The investment requirements in the IRP will thereby be reduced, typically at significant savings in costs
 - For the region as a whole, a 33% reduction in demand in the SAPP Pool Plan delivered a 23% saving in costs (US\$ 60 billion)
- ▶ Peak demand drives up both short-run and long-run costs
 - SR: capacity costs are concentrated in peak hours and energy supply is usually provided by the most expensive generators.
 - LR: it is the overall system peak (plus reserve requirement) that is the principal driver of IRP generation costs
- ▶ Time of Use (ToU) pricing imposes a higher rate for consumption during peak hours.
 - Efficient customers shift their consumption away from peak to reduce their electricity bills
 - Can also have different pricing for different seasons and combined seasonal time of day (STOD)

What is tariff design?

▶ **Tariff design elements**

Tariff categories

How to group customers?

General tariff structure

How to charge customers?

Relative levels of tariffs

What should be the relative level of tariffs determined in the general tariff structure?

Tariff categories

▶ Grouping customers by tariff categories

- **Customers with similar load profiles**
 - *Similar load characteristics*
 - *Coincidence load factor, Load factor, Diversity factor, etc.*
- **Customers with similar costs of electricity supply**
 - LV network usage?
 - MV network usage?
 - HV network usage?
 - Other
- **Special categories**
 - Subsidised customers
 - Interruptible supply, etc.

Tariff categories in Tanzania

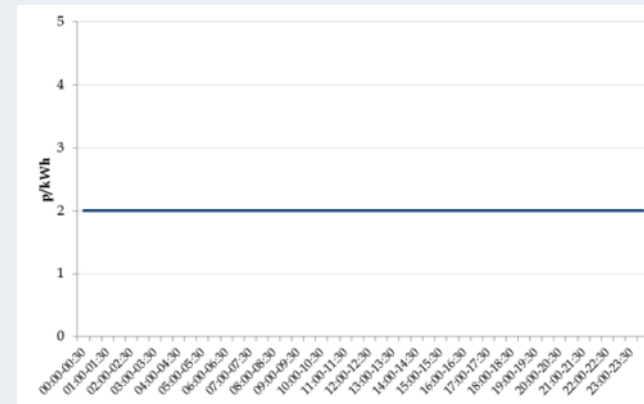
Tariff	
D1	Domestic
T1	General
T2	LV supply
T3	MV supply
T3	HV supply
T5	ZECO

Tariff structure

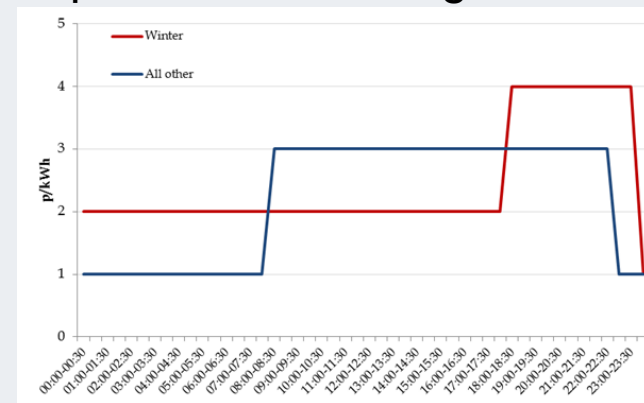
► Choose general structure of tariffs

- *Time-of-use (seasonal, time-of-day = STOD)*
- *Block tariffs*
- *Demand charges, kWh charges*
- *Fixed charges*
- *Reactive power charge*
- *Standing charge*
- *Minimum charge*
- *Combinations*

Example of fixed volumetric charge



Example of STOD charge



Basic principles for tariff structures

Ideally, tariff structures should reflect the drivers of costs. In practice, tariffs will deviate from this ideal structure for many reasons including issues of acceptability, simplicity and cost of metering relative to the benefits achieved from more complex tariff structures.

Capacity charges (\$/kW)

- Used to recover generation and network capacity costs. Should be based on demand (kW) at time of system peak, as this is the driver of investment needs.

Seasonal and Time-of-Day (STOD) energy charges (\$/MWh or c/kWh)

- Used to recover the variable costs of electricity supply in each interval.

Fixed or standing charges (\$/customer/month)

- Used to recover the costs of customer related activities such as metering, billing and collections which do not vary with customer demand or consumption.

Reactive power charges (\$/kVArh)

- Used to provide incentives for customers to improve their power factor and, therefore, reduce the costs of supplying them.

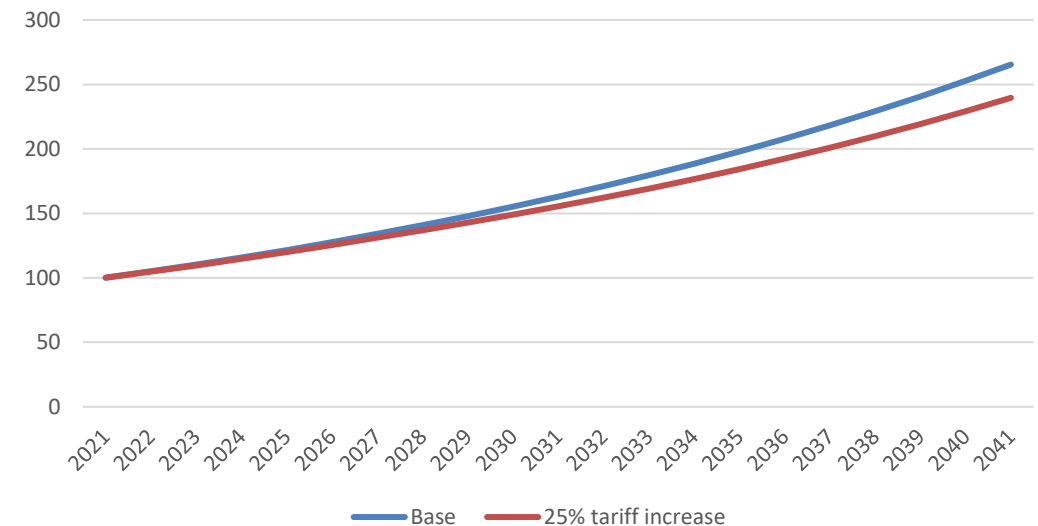
Impact on demand of moving to cost recovery tariffs

- ▶ In quite a few SADC countries, there has been a policy to keep electricity tariffs low
 - In more precise terms, tariffs have been below the level required to recover the costs of supply
 - Electricity has been subsidised (explicitly or implicitly)
 - This has continued notwithstanding the commitment on cost reflective tariffs by SADC Ministers of Energy in 2007
- ▶ If there is a decision to move to cost recovery tariff levels, what will be the impact on demand and hence on the IRP?
 - Need to make use of the **price elasticity of demand**
 - Impact of 25% increase for load growth would be to **reduce annual growth from 5% to 4.4% or equivalently ~10% reduction by 2041**

▶ **Elasticity** is the responsiveness of quantity to a change in price

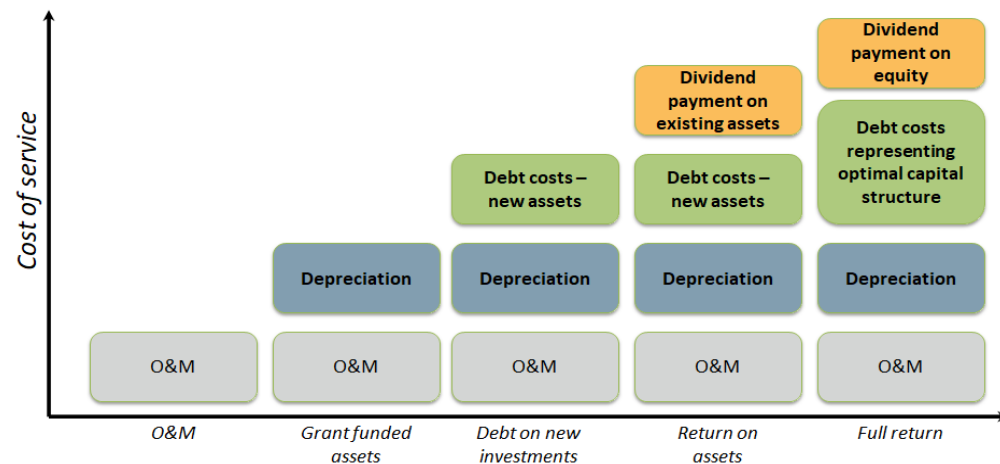
- price elasticity of demand (PED) is the percentage reduction in quantity resulting from a percentage increase in price
- typical electricity PED is -0.2 in the short run, -0.7 in the long run

Load growth after 25% tariff increase in 2021



Questions on cost recovery and price elasticities

- ▶ Does your country have a policy of tariffs covering the costs of electricity supply and is this policy carried out?
- ▶ If yes, what costs are recovered?
- ▶ If no, how is the revenue shortfall for the utility made good?



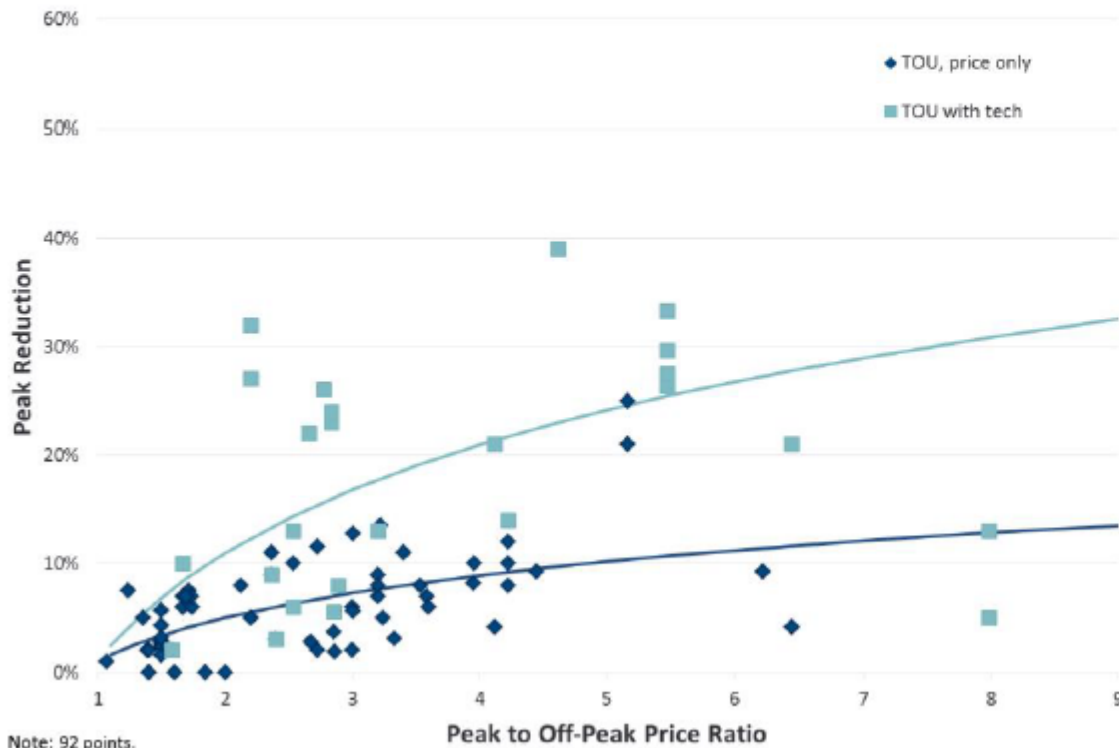
- ▶ Have there been studies of the price elasticity of demand in your country?
- ▶ What PED values were reported?
- ▶ Are changes in the level of future tariffs factored into load forecasts in your country?
 - Note that it is only changes in the real level which count
 - In nominal terms, to keep the utility financially viable tariffs should keep pace with inflation (a pre-determined and automatically applied indexation formula is beneficial)

Impact on peak demand of DSM tariff structures

- ▶ In times past, DSM was limited to maximum demand penalty charges
 - The charge was levied on the peak demand of the customer in the previous month
 - Large customers could easily incur heavy penalties for occasional mistakes – charging mechanism was very unpopular
- ▶ Modern smart metering makes it easy and economic to include all customers in time of use pricing
 - A variety of different structures can readily be programmed such as STOD
 - Real time pricing can also be implemented
- ▶ The impact depends on the PED of different customer categories at different times of the day and in different seasons
- ▶ International experience indicates that the effectiveness of DSM pricing goes up as:
 - the ratio of peak to off peak prices is increased
 - smart metering and other technological enablers become more available
- ▶ Graphs on next slide for TOU and ‘dynamic pricing’
 - Example is “smart hour” variable peak pricing implemented in Oklahoma (130,000 customers control their thermostat settings)
 - Peak load dropped an average of 40%, customer bill savings are 20%

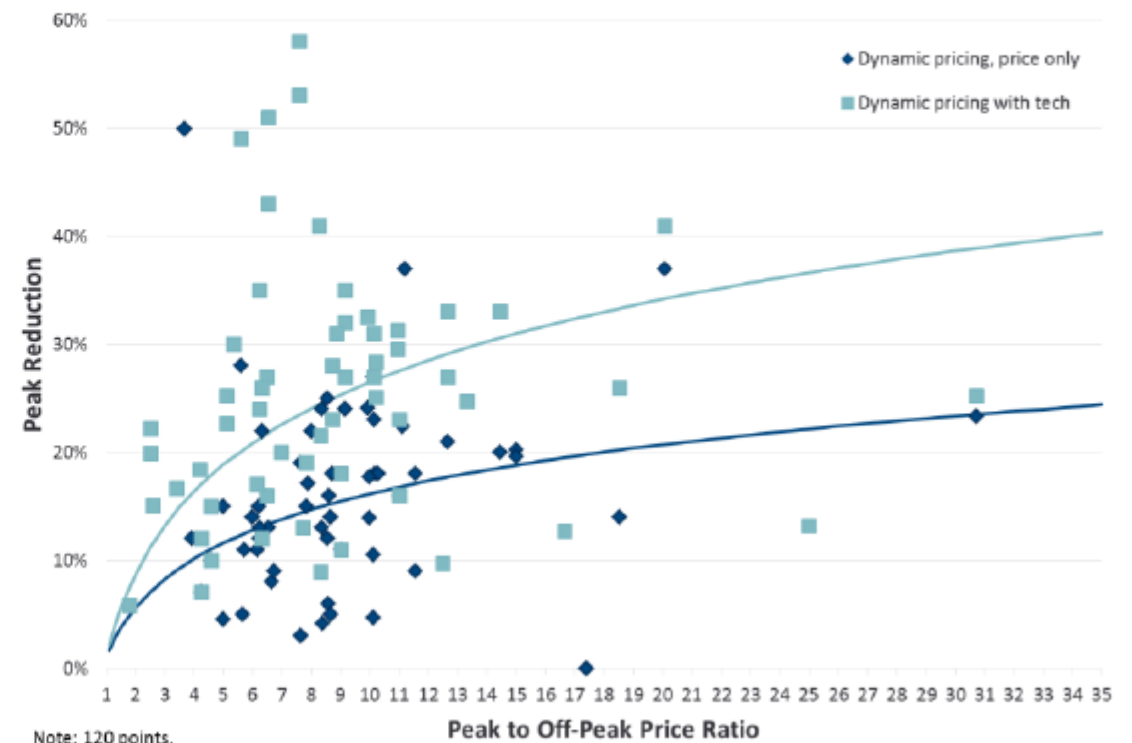
Impact on maximum demand of DSM tariff structures

TOU Impacts



Source: Faruqui, Ahmad. "Arcturus." The Brattle Group.

Dynamic Pricing Impacts



Source: Faruqui, Ahmad. "Arcturus." The Brattle Group.

Questions on DSM tariff structures

- ▶ Has your country had maximum demand charges in tariff structures in the past?
- ▶ What was the experience in applying MD charges?
 - Were they effective in reducing MD costs for the utility?
 - How were they received by the customers?
- ▶ With the advent of low cost smart meters is your country moving to more sophisticated tariff structures?
- ▶ What has been the experience with these so far?

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