Demand response in provision of electricity service: matching technical possibilities with consumers convenience

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What is demand response?

- Offer consumers pricing options that more accurately reflects true costs of **efficient** service provision.
  - Time of use (TOU) tariffs
  - Dynamic pricing: pass through wholesale energy costs to retail customers
  - Prepayment

Potential benefits of demand response for consumers and utilities

- For consumers: optimized efficiency in energy use and financial savings
- For utilities: optimized system planning and operation
  - A flatter system-wide load should lead to greater reliability and cost reductions

Actual experiences in developed and emerging countries

- Time of use (TOU) tariffs with demand and energy charges in each block widely used in developed and emerging countries in the last 3 decades:
  - **Usually mandatory for large and medium industrial and commercial users**
  - **Optional (customer's choice) for residential consumers**
- Recent technological developments (advanced metering infrastructure (AMI) or "smart metering") provide two-way communications and functionalities enabling all types of demand response programs
  - **TOU**
  - **Dynamic pricing: pass-through of wholesale prices to retail consumers**
  - **"Reversible" prepayment using AMI + commercial software**

Actual experiences in AMI based demand response in developed countries

- Most cases of massive deployment of “smart meters” in the United States
- Several “smart meters” deployment programs involving mandatory application of TOU tariffs promoted by utilities (particularly in those under “rate of return” regulation)
- Until recently, actual experience in dynamic pricing limited to a set of pilot tests
  - 2010 report by Brattle Group summarizes scope and results of 15 cases (pilot, experiments, full scale deployment)
  - 2010 study on the smart energy market sponsored by many energy and technology companies in the US and conducted by Kema examined residential customer awareness, acceptance and value of smart grid enabled electricity offers, home energy technologies and rate plans (“smart energy”).
- Salt River Project (SRP) in Metropolitan Phoenix (case study of the National Action Plan on Demand Response (NAP) launched by FERC in 2010

Experience in developed countries – The Salt River Project

- National Action Plan on Demand Response (NAP) published by the Federal Energy Regulatory Commission (FERC) in June 2010
- NAP called for the development of case studies that would illustrate “lessons learned”
- Own plan by the “Association for Demand Response and Smart Grid (ADS)”
- ADS chose Salt River Project (SRP) for Case Study #2

Experience in developed countries – The Salt River Project

- SRP is a municipal utility established in 1903
- Currently it provides electricity to 950,000 retail customers in a 2,900 square mile area in metropolitan Phoenix
- Has been a pioneer in time-based pricing and prepay since 1980
- The concept of consumer choice is embedded in their culture and programs
- As of May 2012, SRP has installed smart meters for 86 percent of its total customers in the greater Phoenix metropolitan area
- Case study #2 “examines the role that consumers choice plays when presenting pricing options”

Top lessons learned by The Salt River Project

- Make programs voluntary. Make the process easy and pleasant –nothing onerous- and let customers out of the programs if they change their minds at any point
- Offer pricing programs that help people develop new daily habits and routines that fit their schedules, and that can be communicated visually
- Offer prepay to everyone, not just customers with credit issues. Do not apply service charges per payment, regardless of the frequency or amount of payments
- Help people choose the programs that are right for them by asking simple questions that reflect their living situations and concerns
- Deployment of smart meters can allow a utility to build on an existing platform of trust and customer satisfaction, introduce new pricing programs that can appeal to more customers, and allow them to potentially achieve greater cost savings

Experience in developed countries – Conclusions of The Brattle Group report

- **Demand responses vary from very modest to substantial, depending on a variety of factors**
  - Controllable: electricity prices; enabling technologies
  - Non-controllable: design of experiment and its location
- **"Conclusive evidence" that residential customers respond to higher prices by lowering usage**

Experience in developed countries – Conclusions of The Brattle Group report

- **Magnitude of price response on several factors**
  - Magnitude of price increase
  - Presence of central air conditioning
  - Availability of enabling technologies (two-way programmable communication thermostats and always-on gateway systems allowing multiple end-uses to be controlled remotely
  - Design of studies, tools used to analyze data, geography of the assessment
- **Across the range of experiments studied:**
  - **TOU rates induce a drop in peak demand ranging 3-6 percent**
  - **Critical-peak pricing tariffs induce a drop in peak demand ranging 13-20 percent (27 to 44 percent if accompanied with enabling technologies)**

Emerging lessons from experience in developed countries

- **Several mandatory TOU tariff systems failed because they implied increases in bills paid by customers**
  - Negative reaction
  - Doubts on the accuracy of smart meters and fairness of the new system obliged regulators to react (meters tests, etc.)
  - In some cases new systems were eliminated

- **2010 study on the smart energy market conducted by Kema**
  - Main conclusion: success of demand energy depends on customer acceptance.

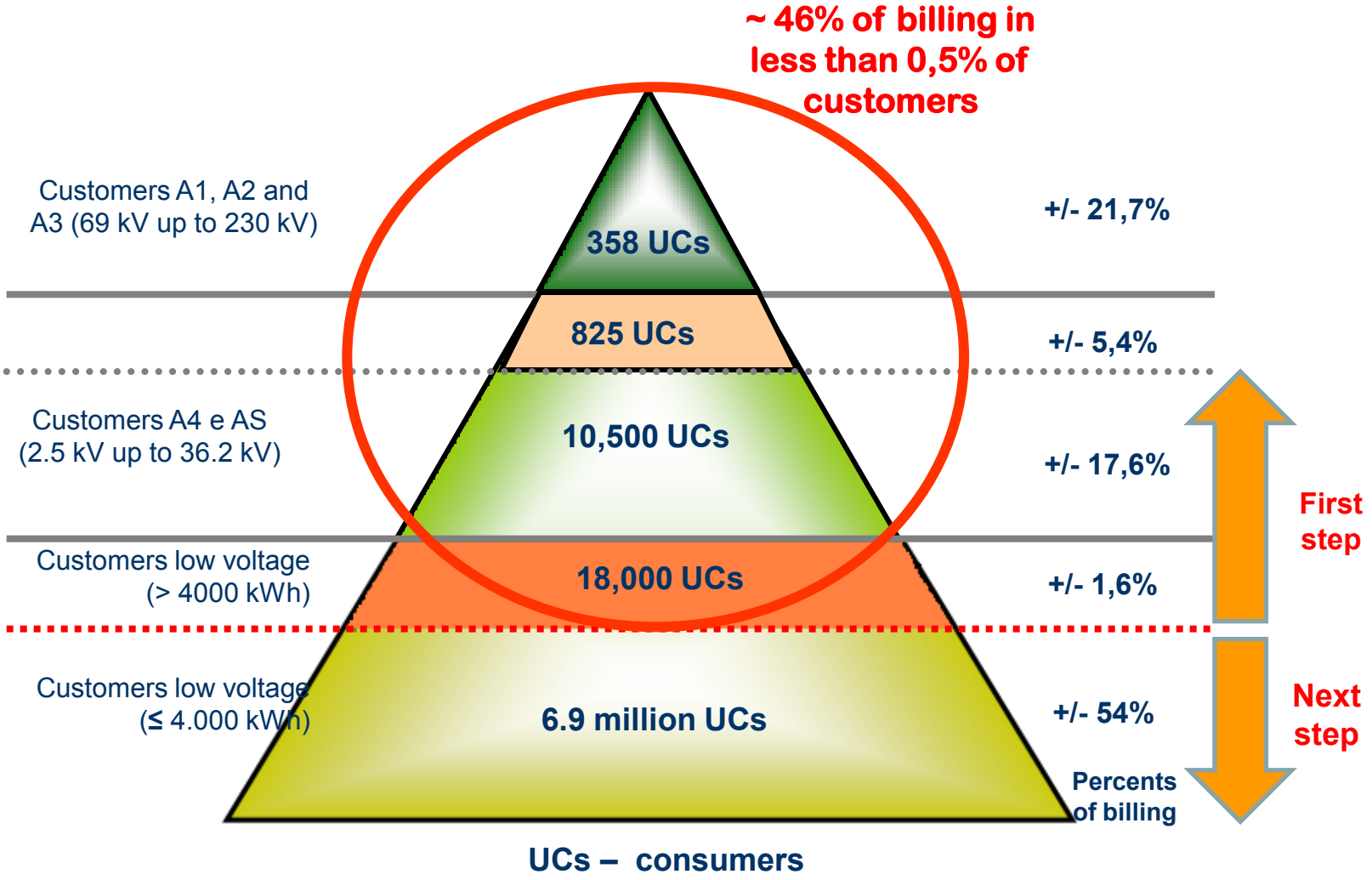
- **Commissioner Nancy Ryan of the California Public Utilities Commission ("Metering America" conference in March 2010):**

  "**It's imperative that the installation of smart grids and smart meters be seen as something done for customers and not something done to customers".** Utility rates based on time-of-day pricing related to the cost of producing electricity must be coupled with extensive customer communications and education campaigns, or the effort to align consumers and true market costs will be wasted".

Experiences in AMI based demand response in emerging countries

- **Prevailing conditions of electricity sector in emerging countries**
  - **Service quality not always good**
  - **Affordability: high impact of prices on family's budget**
  - **Access**
- **Application of AMI or "smart metering" is limited but increasing sharply: "revenue protection programs (RPP)" targeting large and medium consumers:**
  - **Usually around 50 percent of sales and revenues concentrated in less than 3 percent of total number of users ("high value" segment)**
  - **AMI based programs ensure that all units consumed in that segment are metered and billed on a permanent manner: systematic monitoring of consumption to detect potential irregularities and adopt consistent corrective field action**
  - **Assessment of load curves (consumers and key network equipment) for the design/improvement of TOU regimes**

Revenue protection program in CEMIG Brazil



CEMIG's Integrated Metering Center

Emerging lessons from experience in emerging countries

- Large and medium commercial and residential consumers are very responsive to high price increases
  - Electricity rationing in Brazil in 2001-02
  - Supply crisis in Chile in 2008
- AMI based RPPs are extremely effective tools to:
  - Reduce non-technical losses (if existing) and keep them low on a permanent basis
  - Part of the formerly unmetered consumption becomes reduced demand (up to 60 percent in medium and large commercial and residential users)
  - Improve service quality to target consumers
- RPPs help to create the conditions and provide key information for the application of demand response programs
- RPPs improve utility's operational performance and enhance corporate governance

Final remarks

- Technical ability is just a necessary condition for effective implementation of demand response programs
- But any demand response program will fail if not perceived by target consumers as beneficial for them
  - **Quite obvious statement for businesses developed in actually competitive markets, but not so evident in monopoly sectors**
  - **When consumers are captive users, there is an actual risk of abuse of dominant position by the service utility**
  - **Bad service quality (both in electricity supply and commercial attention), mandatory tariff regimes that do not benefit users are typical cases**
  - **Monopoly providers sometimes forget that customers are the only reason for the existence of any commercial company**
  - **The best way to protect a well performing service utility against external factors (political interference, etc.) is a strong partnership with satisfied customers**