Rate Design and Distributed Energy Resources

Before the Missouri Public Service Commission

Chris Villarreal

February 5, 2018

Purpose of Rate Design

- To recover a utility’s revenue requirement
  - System built to meet peak
- Rates differ by class
- Embedded subsidies
  - Intraclass
  - Interclass
- Send a price signal to consumers
- Reflect system costs/cost to serve
- Must also be equitable

Bonbright Principles

1) Should be economically efficient
   - Price signals based on long-term actionable marginal costs
2) Practical: simple, understandable, acceptable
   - Reasonable for busy or unsophisticated people
3) Uncontroversial as to interpretation
   - Clearly stated with support for non-English populations
4) Should meet revenue requirements
   - Yes, but never a guarantee
5) Should provide stable revenues
   - Shared level of stability
6) Should provide stable rates
   - Skeptical of constructs that can destroy a monthly budget
7) Fairness among customer classes
   - Minimize risk from non residential class policies and trends
8) Avoidance of undue discrimination
   - Ensure fair rate designs and recovery mechanisms– watch out for “Averages”

Goals of Rate Design

- Energy Efficiency
- Reduce peak
- Send a price signal/cost to serve
- Cost causation
- Recover utility authorized costs
- Simple to understand
- The regulator must balance these conflicting and competing goals

Existing utility bill

- Fixed charge
  - Recover costs that are considered “fixed”
  - Flat charge recovered from all customers
- Volumetric
  - Charged based on amount of kWh consumed
  - Recovers variable utility costs
- Other components
  - Fuel charge
  - Riders
  - Other non-bypassble charges/program costs
  - Taxes
  - Other

Variety of rate designs

- Blocks
  - Inclining/Declining
- Flat
- Time-Variant
  - TOU
  - CPP
- Dynamic
  - RTP
- Demand Charges
  - Usually accompanied by fixed charge
- Prepay
- We now have the technology!
- Decoupling

So, what’s the big deal?

- Growth of distributed energy resources
- Need for more active planning
- Uncertain load growth
- More technology
  - Utility
  - Customer
  - Data

Impacts on ratemaking

- Utilities make more money on capital investments than operations
- Disconnect means that utility is incentivized to build, build, build
  - Decoupling doesn't solve this, rather, it removes the incentive to sell more electrons to increase sales
- Customers increasingly using own funds to invest in new technologies
- States considering ways to "make up the difference"
  - Increasing ROE on operation
  - Increasing ROE on cloud
  - Allowing utilities to own or invest in specific products
  - Platform provider
- Rates
  - Currently use average cost ratemaking
  - Subsidies
  - Risk of cost recovery on fewer and fewer customers
  - Low income
- Importance of planning

What are Distributed Energy Resources?

- “A DER is a resource sited close to customers that can provide all or some of their immediate electric and power needs and can also be used by the system to either reduce demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load. Examples of different types of DER include solar photovoltaic (PV), wind, combined heat and power (CHP), energy storage, demand response (DR), electric vehicles (EVs), microgrids, and energy efficiency (EE)” (NARUC DER Manual at p. 45)

NARUC DER Manual

- Effort led by NARUC Staff Subcommittee on Rate Design
- Provide regulators with a document to assist policy development on rate design and DER
- Released November 2016 at NARUC Annual Meeting
- Variety of jurisdictions represented in drafting
- Sections
  - Rate Design
  - Technology
  - Why DER impacts rate design
  - Discussion of rate design and compensation options
  - Considerations for regulators on DER

Available at https://www.naruc.org/rate-design/

Rate Design Challenges

- Rates are used to recover a utilities authorized revenue requirement
- For residential, traditionally flat rate with a fixed charge
- Utilities increasingly looking to recover more of their costs via a fixed charge and/or demand charge, and less from variable
- Less reliance on variable eliminates price signals to customer and impacts conservation programs
- More reliance on variable puts utilities at risk of undercollection (or, perhaps overcollection) of authorized revenue requirement
- Unbundling of rates provides more clarity on costs of the system
- Need better rates that better reflect costs to serve at that time
  - Time variant rates
- What are true fixed costs and what are true variable
  - In short term, most costs are fixed
  - In long term, most costs are variable
- Note- Rates are different than compensation.

Rates Impact Adoption of DER

- Avoided Cost
- Load shifting
- Reduction in usage
- Technology specific
  - EV
  - Solar+Storage
- Fixed charges
  - What utility costs are fixed?
  - Long term vs short term
- Demand charges
  - Coincident or non-coincident peak
  - But storage!
- Transactive Energy
- Minimum Bills

Rate Design in a DER world

- Rate design no longer can be considered in a vacuum
- Rates will impact investment decisions by both utilities and customers
- Do you create separate rates for technology?
  - EV tariffs to encourage off-peak charging?
  - Separate rate classes?
- Technology is changing faster than regulatory process
- Regulators will take on new responsibilities
  - Better monitoring of adoption rates
  - Need to plan for evolution of rate design as DER impacts begin to show up
- Rate design will need to be informed by other planning processes
  - Distribution system planning

Monitoring and planning for DER

Understanding the system is vital

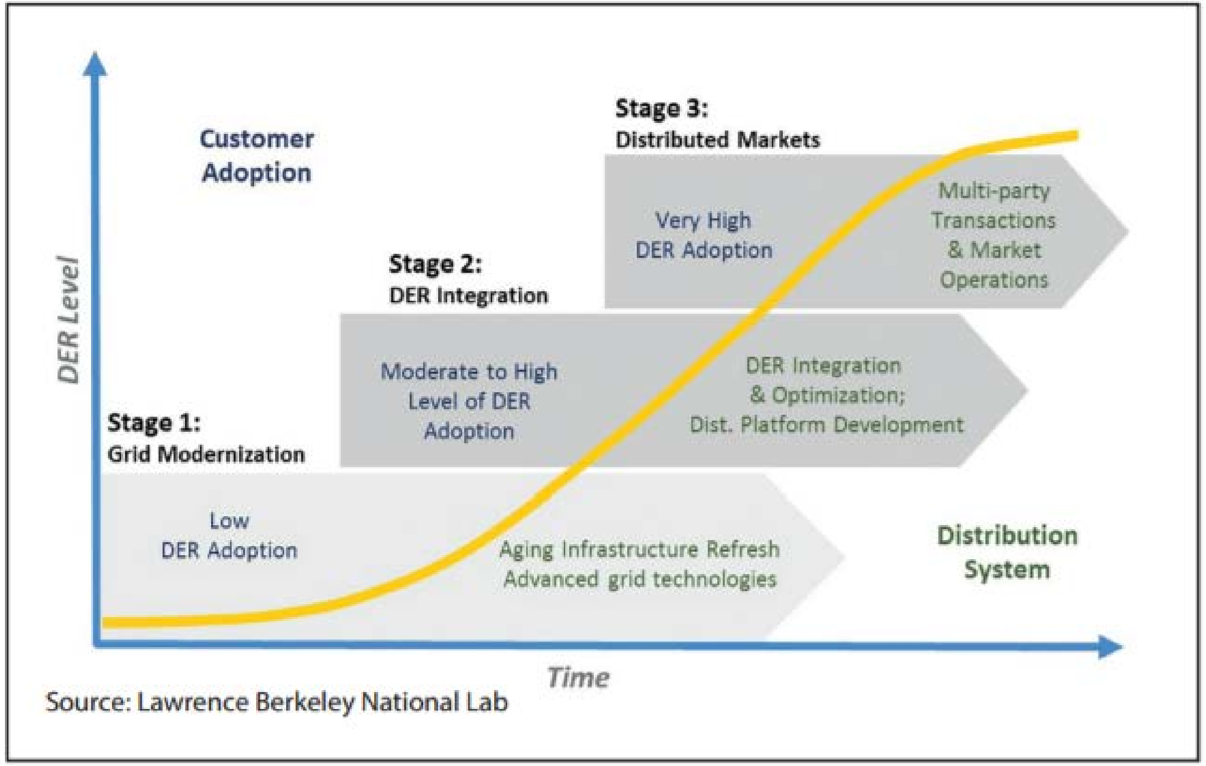
What are capabilities of current system?

What are adoption trends?

Where is DER showing up?

This is an evolution.

Technology investments



Multiple Scenarios for Planning

- Distribution planning typically deterministic regarding load characteristics
- With growth of DER, load becomes more variable and uncertain, including two way flows of electricity
- Adoption levels vary across service territory

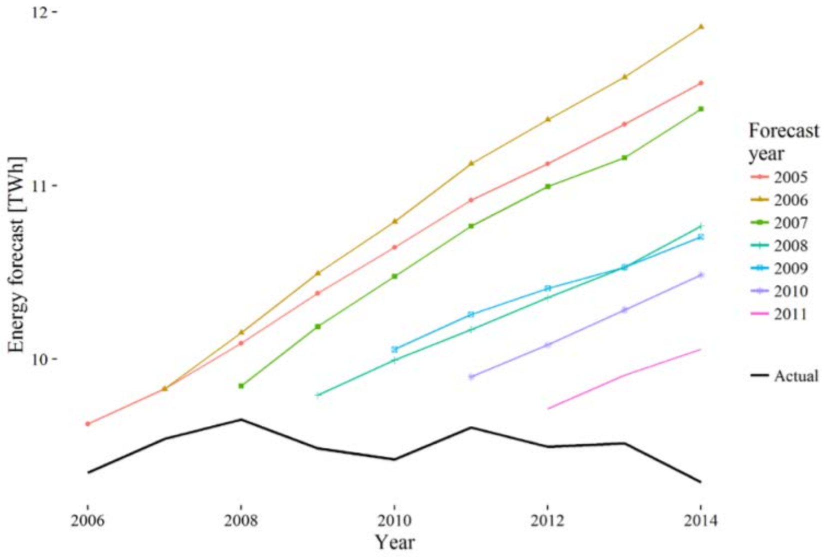
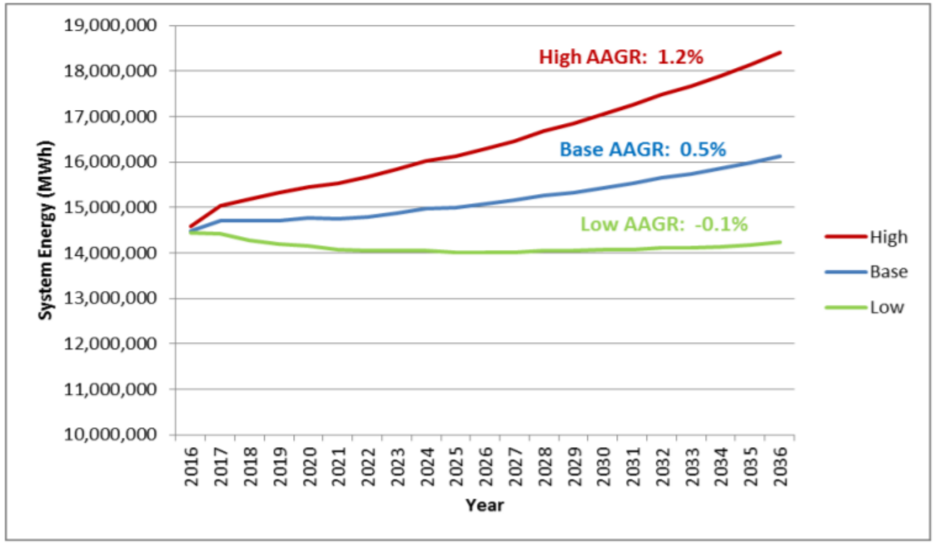


Figure 4 **Intermediate energy consumption forecasts for Avista 2005-2011.**

Load Forecasting in Electric Utility Integrated Resource Planning, LBNL, 2016

Figure 4.5 – Base, High and Low System Energy Forecasts (Excluding Future DSM Program Savings*) with Average Annual Growth Rates ("AARG")

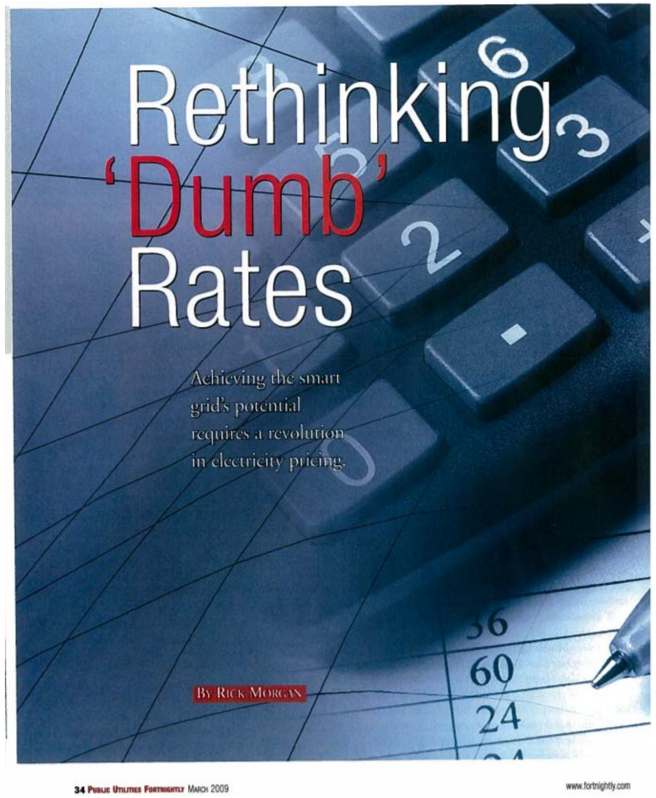


*Future DSM program savings as selected by the Capacity Expansion Model in this IRP are not included in these forecasts.

IP&L 2016 IRP

Metering and Rates

- "There's no point in having smart meters if you're still going to have dumb rates." Rick Morgan, former DC PSC Commissioner (2009)
- AMI business cases include implementation of dynamic pricing
- TOU, CPP, RTP all require AMI
- Behavioral changes
- Better understanding of customer activity
- More information
- More data



AMI

“Advanced metering infrastructure (AMI) is an integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities and customers. Customer systems include in-home displays, home area networks, energy management systems, and other customer-side-of-the-meter equipment that enable smart grid functions in residential, commercial, and industrial facilities.”

https://www.smartgrid.gov/recovery_act/deployment_status/sdgp_ami_systems.html

More about the meter

Depending on utility needs, digital meter collects and stores kwh readings between 15-60 minutes.

Usually transmits the data back to the utility a couple times a day

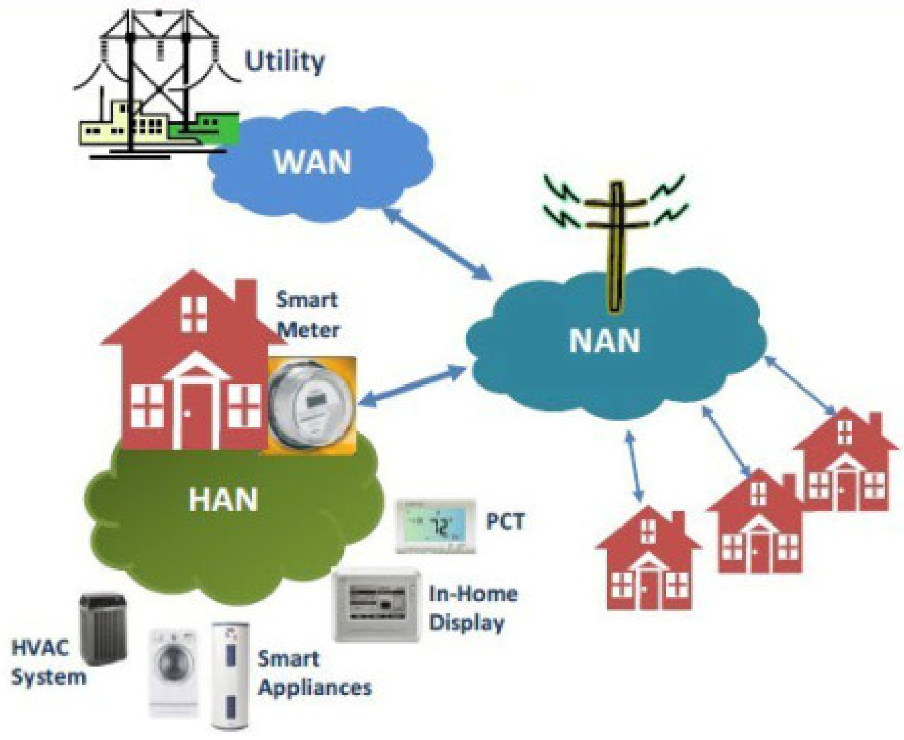
Meter can collect more than just kwh! Meter monitors kw, current, volt, var, to name a few.

Access to this information often restricted by the utility for……

- Business reasons
- Meter memory and processing
- Communication network bandwidth

Even more!

- Meter usually comes with 2 radios
- First radio (900 Mhz) is to communicate back to the utility (over a mesh network)
- Second radio (2.4 Ghz) is to communicate locally into the home



Advanced Metering Infrastructure with Home Area Networking

Data Needs

- Data is vital
- Grid data
  - Hosting Capacity
  - ADMS/DERMS
  - AMI
- Customer data
  - AMI
  - Solar
- Ability to share data
  - Privacy and Security
  - Click-through
  - Customer consent

- Privacy Needs
  - Customer controls access
- Protocols
  - EDI
  - Green Button
  - Orange Button

What about the customer?

- All the above has been about the utility, but customer behavior and expectations are changing
- Automation
- Third parties
- Data and technology will help customers meet changing customer needs
- How to protect low income/at risk customers?
  - Subsidize the rate?
  - Provide bill credits?
- Customer education is vital
- Studies routinely show customers understand TOU

Considerations for Implementation

- For pilots, opt-in or opt-out?
  - In pilots, opt-in results less reliable due to selection bias
  - For opt-out, pilots show customers like TOU, and even CPP (SMUD)
- Education
- Shadow billing/bill protection
  - For first year, customer no worse off than under default tariff
  - Bill calculator shows customer bill under different rate designs
- Peak Time Rebate
  - Customer saves if responsive
  - Requires a baseline
- Who is subsidizing whom?

A Brief Word on Distribution System Planning

As noted in section 1, there are many related and worthwhile topics that are not covered in this Manual because they are considered as out of scope for this particular discussion. One such topic is distribution system planning. It is clear that distribution system planning is a topic of great interest in many jurisdictions, and it exists regardless of market structure across jurisdictions. Distribution system planning will increasingly be more important over time as DER continues to grow across the country; having a framework in place that builds in consideration and integration of DER can help a jurisdiction and utility meet this growth. Jurisdictions such as Minnesota, Rhode Island, Maryland, New Hampshire, Vermont, and the District of Columbia have opened proceedings investigating how best to plan for DER, including looking specifically at distribution system planning. The first step in any discussion of distribution system planning is knowing how well the distribution utility knows its own system; without such knowledge, planning can be frustrated.

A goal of distribution system planning is how to build a distribution system that can interact, engage, and utilize DER in a more effective manner that minimizes service quality and reliability impacts. In essence, if the DER is in place, how can a distribution utility use that resource and, potentially, compensate it? This Manual addresses the compensation part of the equation, but the planning, impacts on the utility business model, and future business opportunities remain outside this document. Even though this Manual does not go into greater detail on distribution system planning, it is undoubtedly an important part of this conversation. As noted to the Minnesota Public Utilities Commission in a recent paper, the "integrated grid will evolve in complexity and scale over time as the richness of systems functionality increase and the number of distributed resources extend to hundreds of thousands and possibly millions of intelligent utility, customer and merchant distributed resources. To address this evolution, robust planning processes and engineering methods are required to advance distribution planning." ICF International, "Integrated Distribution Planning" (paper prepared for the Minnesota Public Utilities Commission; ICF International, Fairfax, VA, August 2016), 19–20.

Lastly, pairing distribution system planning with integrated resource planning will be vital to ensuring that efficiencies gained from the use of DER are not lost. For a fuller discussion on the importance of resource planning, ***see*** Fredrich Kahrl, ***et al.***, "The Future of Electricity Resource Planning," *Future Electric Utility Regulation*, Report No. 6 (Berkeley, CA: Lawrence Berkeley National Laboratory, September 2016).

Aggregation

In some instances, the services and benefits of DER are more valuable when aggregated into larger numbers. Many states, however, do not allow aggregators to participate in their jurisdictions. For example, in the MISO market, only Illinois allows for third-party aggregators to operate in their jurisdiction. In non-organized markets, development of retail markets may be a path; in this instance, a utility would be allowed to procure additional services from a third-party aggregator to meet local, retail needs. A single DR customer may not provide much of a response, but when aggregated with many customers can provide benefits at both the retail and wholesale side. Lastly, aggregation can result in a more direct compensation by tying it directly to wholesale prices or, potentially, a distribution locational marginal price.

Keeping People Connected

It is believed that keeping people connected to the grid creates additional value to the customer, the utility, and society in general. This belief mimics a variety of so-called "laws," such as Metcalfe's law and Reed's law, which all posit that the value of a network increases the more things (or people) that are connected to it. On the electric utility side, it seems apparent that having more devices connected to the grid inherently enhances the value of the grid and the devices connected to it. If nothing else, having less people connected to the grid would seem to decrease the value of the grid. This is important because if customers decide to disconnect from the grid due to policies discouraging DER or erecting barriers to entry for DER, the costs of maintaining that system falls onto fewer and fewer customers; thus, the value of the grid is minimized. Therefore, it is important to recognize that there is a value from the grid not only for the provision of electric service, but also for enabling and integrating a greater number of devices that can be utilized by a greater number of other devices and customers connected to the grid.

Whether to Act Based on Adoption Levels

While it is important to take the time to accurately assess the appropriate structure of rates for DER (as well as other) customers, regulators should not tarry too long in establishing what they feel is an appropriate rate structure and compensation mechanism for DER customers. A very important factor in customers' decisions on DER installation is the price signals sent by the rate design. If those price signals do not appropriately reflect a jurisdiction's policies on cost-causation, the result will likely be an economically or socially inefficient amount of DER. Waiting too long to set up an appropriate pricing structure can also make grandfathering and equity considerations between future and existing DER customers more of an issue than they otherwise would be. Setting up an appropriate pricing and compensation structure should be done as soon as feasible, but there should not be so much urgency that the decision is made without all of the appropriate information. The results from such uninformed actions could be worse than no action at all. Adoption levels may, however, affect the amount and types of costs and benefits that accrue from DER installations. It is important to decide if different rate structures and compensation methodologies are appropriate for different stages of adoption, or if a single structure should be put in place that can deal with the differential impacts of various penetration levels. To the extent that it is decided that different rate structures are appropriate at different adoption levels, it should be made clear to customers whether grandfathering will apply so that the decisions on DER installation can take into account the potential for future rate changes.

Questions?

Thank you!

Chris Villarreal

Plugged In Strategies

chris@pluggedinstrategies.com