Introduction

My name is Richard Sedano. I am a principal with the Regulatory Assistance Project, and I run its US Program. RAP is a global non-profit organization with offices in the United States, China, Europe and India. RAP provides policy and strategic advice to government decision-makers. RAP is funded by foundations and governments. I joined RAP in 2001. From 1984 until 2001 I served with the Vermont Department of Public Service, and from 1991 until 2001 I was commissioner. I began my career with Philadelphia Electric Company as an engineer in power generation. I received an undergraduate engineering degree from Brown University and a graduate degree in engineering management from Drexel University.

My testimony is about how regulation in the United States is changing to reflect inexorable advances in technology and resulting changes in customer attitudes. These are supported in some states by nurturing policy. Federal policy has also been supportive, I will not be discussing federal policy in my prepared remarks.

I will try to define my terms and avoid assuming anything about what a reader knows. Electricity systems and regulation are pretty arcane.

I define the **power sector** as the twinned utility company and regulator. They are intertwined. Also, the term **resources**, as in Integrated Resource Planning, tends to mean sources of products, like energy or kWhs, capacity or kW, of ancillary services of several kinds, like reserves and voltage support, and also means resources that can avoid these (some people call these negaWatts). A utility can manage and plan for resources. The gas and water industry products are simpler.

The power sector is changing because technology is enabling fast processing and communicating of information and because the ability for customers to produce resources the grid needs has grown exponentially over the last two decades to the point where it is making a meaningful difference in resource acquisition and utility capital planning. By ability, I mean improvements in cost and convenience. In addition, natural gas-fired generation is inexpensive compared with coal-fired generation, and nearly zero marginal cost variable grid scale sources, wind and solar, are increasingly competitive, changing how the grid operates. Some states now say that the expect 80-100% of incremental resources to come from customer resources, that retiring central station resources can be replaced with smaller scale resources and that significant wires investments at both T&D levels can be delayed or avoided. Finally, decarbonization of the power sector is likely to be an increasing driver of future investment and regulatory choices with diminishing cost impacts.

This session focuses on how utilities are compensated, how they are motivated, and how regulators manage this system.

Business as Usual Utility Regulation

Today, investor owned utilities are able to post net earnings based on an allowance in the **revenue requirement**[1] to compensate equity investors for the capital they turn over to the utility in exchange for stock.[2] This allowance is calculated in several established ways, and each way may come out a bit differently. The regulator has to choose one answer, and it is always within the range created by the lowest and highest answer. Often it is in the middle. There is little science to this final step.

A utility bottom line can also be affected by whether revenues are higher or lower than anticipated when the revenue requirement was calculated, or if costs are higher or lower. Compared with the assumptions, reality always produces different results. First I will talk about *revenues*.

If revenues are higher than expected[3], the utility has no obligation to give this money back. It can do the following:

1) keep the money – if costs come in as anticipated, earnings will be higher than anticipated (overearning), the only issue is whether there is a public backlash about a monopoly overearning. If the overearning is still within the range of calculated returns, this outcome can be effectively justified;
2) ask the regulator for an accounting order that applies the overearning amount to write down capital accounts in the rate base – this reduces the amount of money that will be collected from customers in the future, a consumer benefit, and allows posted earnings to hit the target.
3) use the excess to offset unexpected cost increases – a cushion

If revenues are lower for the reasons above and also potentially due to customers demanding less electricity from the utility, there is no obligation to make up lost revenue.

Over the last thirty years, government has asked utilities to be the instrument of public policy to help customers use less electricity. Utility energy efficiency programs have saved money for society and for individuals by substituting more efficient end uses that are cost effective, and which deliver a combination of education, technical assistance and financial incentives to motivate customers to change. The accumulated effects of these energy efficiency programs and resulting customer actions reduces sales from what they otherwise would have been and avoid more expensive utility costs.

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[1] The revenue requirement gets decided in a rate case, it is the amount of money a utility needs to collect in a year in order to deliver safe and reliable service, meeting all state policy directives.

[2] Some of this money is returned to investors in dividends, other money is reinvested in the company, some goes to pay for expenses not typically allowed in customer rates like lobbying expenses or some employee bonuses.

[3] This can happen because of extreme weather, a growing economy, robust sales of excess power to neighboring utilities or other random events.

Utilities have observed that some of the revenue to cover embedded costs from the last revenue requirement disappear when associated sales disappear. There are the following solutions:

0) do nothing – the utility manages the risk of uneven earnings
1) recalculate the revenue requirement – an annual rate case is effective, but is expensive – if underlying costs don't change much, this is a lot of work to reconfirm what the last revenue requirement concluded;
2) create a lost revenue adjustment – this is not very effective because while it accounts for savings counted in utility efficiency programs, it does not count other changes plus and minus and leads to significant error;
3) **decoupling** – an effective solution that relies on the revenue requirement found in the last rate case – utility revenue above or below target is reconciled with an upward or downward adjustment;[4]
4) raise the monthly customer charge to cover all embedded fixed costs – this is effective, but has negative side effects[5]:
    a) having service becomes much more expensive, especially for low volume users
    b) removes significant opportunity for the customer to manage the total utility bill;
    c) distorts and minimizes the value of customer resources compared with utility resources,[6] and
    d) violates a long standing practice of rate design of using the customer charge for anything more than the cost of connection.

I promised to talk about what would happen if *costs* are higher or lower than anticipated in the last revenue requirement calculation. Let's assume revenues came out on target. If costs are lower, the utility overearns. See the prior discussion about

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[4] The customer can see this on the bill as a rider, or it can be buried in the rate. The effect of each is the same. Since customers tend to view the rider as extraneous information, burying it in the rate is my preference. Some do not trust decoupling because it changes the rate without a full investigation of the revenue requirement.

[5] Full implementation of this idea would put the customer charge for an electric utility at around $60-70 per month. Some utilities have made modest increases in the customer charge, to $20 to $30 per month. This approach causes less of the impact from the side effects listed here, but also renders the idea ineffective in actually addressing the core concern, which is utility revenue stability.

[6] This session is not about rate design. However, since rate design and utility compensation are related by this option, I will note the following. If customers are to be a key grid resource, then the investment signals seen by the utility and customer should be consistent to achieve optimal investment balance. Thus, the price signal the customer sees, the incremental cost of using or saving the next unit of energy, should be consistent with the value embedded in utility resource decisions around acquiring power or building capital assets. If this balance is off, customers will be motivated to over or under invest – if the customer charge goes up high, the energy charge is reduced, under-valuing customer resources – more expensive utility resources ensue, and the overall cost of utility service in Missouri is higher than it needs to be, essentially a drain on the Missouri economy that would rather use excess money for better purposes. Further, a very high customer could motivate some customers to fully self-supply, exiting or defecting from the grid. New customer options create a constraint on rate design that did not exist before.

overearning. Hopefully, this outcome was produced by savvy utility management, and the benefits will be captured in a future rate case. It could also have been driven by forces outside the utility control (weather, the economy). Hopefully, it was not produced by cost cutting that sooner or later will compromise reliability or customer service, though there are instances in utility management in the US when this occurred and performance problems did ensue.

If costs are higher (driven by forces already discussed, or perhaps unexpected health care or labor costs), the utility underearns. Structural cost increases will lead the utility to petition to reset the revenue requirement higher.

The remedies discussed operate in distinct ways on each of these situations. Decoupling is the only one that addresses all these events while minimizing the need for revenue requirement cases and leaving rate design unaffected.[7]

One of the most annoying things I recall from my experiences in government was the utility executive speech, often to shareholders, hoping for a hot summer or a cold winter in order to achieve higher earnings. This underscored an attitude incompatible for a company affected with the public interest that extreme weather, which may cause problems for its customers and communities was good news for the utility. Utilities are not like other businesses, for whom volume is always good.

When volume of sales affects utility earnings in this way, the **throughput incentive** is present. The utility is motivated to increase sales, whether or not that is good for the state, and to discourage reductions in sales. In the 1960s, each added sale was provided by low cost sources, growth was equated with prosperity and pollution and other externalities were unrecognized. Today, each added sale has quite different marginal cost and environmental implications.

States that have achieved the highest results from energy efficiency programs have managed to eliminate the throughput incentive. Decoupling is widely used among these states.

The Future Utility Looks Different from the Past, What Should Regulation Look Like?

Recently, the trends I cited earlier, technology and more and varied customer resources, have caused significant rethinking about the ways utilities are compensated, and even about the role the utility plays in civil society.

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[7] This session is not about rate design. However, part of power sector reform discussions in those states where the subject is active is about whether flat rates should be replaced by rates that convey information about the time-differentiated value of electricity, time-varying rates. Decoupling is compatible with this change.

Regarding the utility role, if populations of customers are now a meaningful resource, a resource we want to learn to count on, the utility is not so much "producing" a result, which customers "receive," but "enabling" a result, in which customers are "participating." This is quite a change! Some think this idea is hyped or overblown, and some express the "if the grid is not broken, don't fix it by letting society get too dependent on these new technologies." My own view as a trained engineer is that you don't stop technology. So words like "adaptive" and "integrating" become more important to characterize what is going on. Some say that these changes will not come to low cost states, a state like Missouri. My own view is that it is just a matter of time before the attractiveness of new resources and technologies becomes ubiquitous. While experts may not know all the ways these changes will manifest, I think they are real, irreversible, and can be beneficial if the power sector evolves to accommodate them.

Among the states, the field is stretched out. At one end are states like Hawaii, with huge penetration of solar PV and strong participation in energy efficiency. There, change is happening faster than the state can respond. Other states, such as Arizona, California and Rhode Island, are starting to see significant effects on system planning and operations. New York is taking a comprehensive reassessment of the power sector in a magnum docket known as New York Reforming the Energy Vision, or NY REV. California has similar ambitions, though the approach there is a series of dockets representing puzzle pieces that are coming toward a whole vision. Smaller states, among them Rhode Island and Minnesota, are taking on bite size challenges with the long term trends in sight.

At the other end are states where solar PV deployment remains less that 0.1% of customers, not yet registering as a force of change.[8]

Aside from maintaining bedrock utility functions in reliability, safety and service, should there be changes in the role of the utility in light of the changes we have discussed so far?

Briefly, many say yes, though there is divergence about the nature of the change. Here are two points toward the ends of a continuum:

1) In one view, the utility retains its delivery role, but operates as an enabler for customers to make contact with companies that will help them generate power, store power for use later, or manage their end uses to produce value for the grid (demand response). This represents a strict interpretation of the utility monopoly as the delivery company. For a vertically integrated state, this would seem to be a radical shift, though the utility would retain the job of being a backstop provider of resources for customers.

[8] Though some utilities in this situation have taken steps to change rate design to protect against sales declines that have not yet occurred.

2) In the other view, the utility maintains control of the customer relationship and becomes the catalog for validated services the customer can use. The term used for this is "**intermediation**." The utility intermediates between the customer and the many service providers that might provide value. This represents using the economy of scope of the utility to accelerate deployment of new services. Note that service providers failing to impress the utility will have to find another way to reach customers. For a vertically integrated state, this would seem to be an evolutionary shift.

Within the continuum represented by these, the government can allow a utility into some businesses and keep them out of others.

In all cases, the utility becomes interested in helping to deliver **services** that customers want. This provides an opportunity for the utility to reap revenue and net income from these activities, a new opportunity. This may feel unfamiliar to utility regulators, though regulators of the 1990s had to deal with similar disruptive forces with telecommunications companies. To assure focus and alignment on value-driven services, it is beneficial if the throughput incentive has been removed.

Compensating the Utility

Another way the power sector of the future has developed is to consider whether compensating utility investors through a return on capital investment alone, the current approach[9] is consistent with public policy. What does public policy suggest? Some capital assets are large, expensive and risky (from permitting risk, siting risk, construction risk, risk of having been the wrong investment and more). While the utility experiences these cost risks at first, in most cases, customers eventually pay for everything. Some capital assets can be avoided with customer resources. Customer resources tend to be small, avoiding some risks endemic to large utility projects. Also, a significant share of the cost of customer resources is paid for by someone other than the utility, so these costs do not go into rates. Summarizing trends, the costs of customer resources seem to be dropping (while capabilities are rising) while many utility resources costs are rising.

Many experts and utility executives agree that there is a bias in utility problem-solving to use capital assets preferentially. It's understandable given the rules. The utility earns on capital assets and does not earn on routine expenses. Even when a portfolio of expenses to help customers use their newly available resources to solve a grid system problem is optimal, the utility may not study it or consider it and the capital solution will tend to be advanced.[10] This capital bias raises costs higher than

[9] If the throughput incentive has eliminated the opportunity to profit from higher sales.

[10] A now well-known example of this is the Brooklyn-Queens Demand Management project in the Con Edison service area. Briefly, the utility brought a conventional sub-station upgrade to New York regulators. The regulators, however, challenged the utility to solve the problem with customer

they otherwise need to be while causing missed opportunities to invest in customers' buildings, systems and processes.

If we want to consider another way of compensating, what would that be? The answer many are working on is to create a return on performance. How would that work?

First, we decide what important societal objectives the utility can influence. A sample list: reliability, universal service, resilience,[11] environmental/health quality, safety, economic development.

Utilities do many things that further these societal objectives. What are they? And how might they be changing in reaction to these technology and customer trends? Whatever they are, to the extent that utility performance can be measured cleanly, we encounter another question: is there an increment of performance beyond what would be considered compliant that has incremental value to the state?

For some **metrics**, better performance is better for society, for others no. Next question: for those metrics where more is better, why should the utility try to achieve more?

Under traditional regulation, achieving more performance adds cost, with no revenue. This leads to underearning.

With the throughput incentive resolved, there is still no reason for the utility to produce more than adequate results.[12]

Some argue that if better performance is possible, the utility should deliver it. Readers can judge whether this is credible. In my experience, utilities are experts in identifying and delivering compliance.

The terms **performance regulation** or **output regulation** are used to describe a system of utility regulation in which *enough* of the utility net income is riding on performance that it changes the way the company is managed to find the best solutions. Enough can be money. Enough can be a public report card that tells everyone how they did. A combination of both, where many metrics are measured and reported, and a subset produces a return, is likely to be best.

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resources. The upgrade has been shelved and the utility is gathering customer resources to solve the problem. The regulator agreed to a favorable regulatory treatment for the associated expenses that will allow the company to earn a return on them over ten years.

[11] Resilience is an emerging term referring to the ability of a network to continue operating despite assault from natural or human attack AND the ability of the network to recover quickly after such an attack causes a loss of service.

[12] Some utilities target performance in the second quartile, on logic that resonates in Lake Wobegon, that above average, though perhaps not exceptional or innovative is the objective.

In this way, the utility return reflects its success in delivering societal objectives (not just how much money it invested), and the vital importance utilities contribute to civil society can be seen more clearly. Drucker said "you manage what you measure," readers can judge how often this is true.

What should happen to the return on capital? Some suggest that it should be removed, but I think this path is not realistic. It remains important for regulation to offer a return on capital since the lifeline to financial markets requires it. But it can be lower, perhaps at rate equivalent to utility debt. Regulators can offer a return on selected expenses that avoid more costly capital assets. Performance and perhaps service profits can make up the difference. In my work with states, I suggest they consider that they permit earning at least up to the top of the range of returns to motivate utilities to excellence through innovation or whatever added effort is needed to achieve superior results.

Performance regulation has challenges. Regulators must sift through metrics already used by utilities and consider the need for new ones to decide what to measure. Rewards should be associated with exemplary, beyond normal performance – is there a continuous scale for reward or a threshold well beyond business as usual that yields a significant reward? How shall the regulator assure that the utility will not overlook performance in areas of the company not subject to a performance reward or report card? Will the commission and the utility be able to convince financial market analysts that performance based regulation is superior to business as usual?

Other changes to state regulation are likely to emerge individually or in packages. Among these include:

- **enhanced distribution planning** in order to reveal sources of value that customer resources can address and introduce new methods to reflect a two-way system;
- **rate design** changes that motivate in customers value-based investments and operating choices;
- improved processes for customers to **access** the grid and valuable services;
- improved access to **data** including customer data for them to use, and aggregated data for service providers to use for marketing with utilities getting more involved in data analytic methods to create insight and intelligence out of the data reservoir they control.[13]

Note that all of these have in common the idea that there is unrealized value in the system today, and that more opportunities for value will emerge.

[13] Cybersecurity is a concern today, as routine headlines indicate. Utility regulators are already becoming part of the nation's mesh defense against attacks. There remain reasons to get the most benefit out of data collected by utilities.

Designing Innovation into Utility Regulation

My final point will be evident to anyone who has been in a fast changing environment. Failure is not only possible, it is likely. Some ideas will not work as we hoped they would. How does utility regulation react to failure? Generally, utility regulation punishes any failure it finds. Inaction is generally not found out and not punished. Inaction is safe in traditional regulation, where the safest plan is to do next year what we did last year. There tends in utility regulation to be no structural learning from failure.[14]

With the changes I have talked about here, innovation will be necessary to bridge the gap between today and tomorrow. Does regulation have to change to accommodate innovation?

Regulation can add structure to innovation by paying attention to demonstrating how new trends in technology and customer options can manifest for real in real communities with real people doing real things and making real investments with the real help of the utility. This is regulation being "adaptive" to "integrate" new ideas. Demonstrations are expensive. They can engage communities and produce value. They generate learning and experience through success and failure that can be deployed at full scale. In a utility of significant size, meaningful demonstrations can represent a small percentage of the revenue requirement, and may be seen as analogous to the high risk part of an investment portfolio, an investment in the learning that can only come from pushing beyond what we know for sure.

Progress and Outlook

What are other states doing? No state is moving with more purpose in the direction of embracing the future than New York. Regulatory reform there is in the midst of adopting performance regulation. The commission there issued a series of policy and implementing orders, and is now implementing it all in the first subsequent utility revenue requirement case. Demonstrations of integrated innovations in technology, customer engagement and utility compensation are underway in the territories of all investor owned utilities, nurtured by regulation.

No state is moving with more urgency than Hawaii. With rates as high as they are there and policy to end the state's dependence on fuel oil, customers have been quick to deploy options as they have become available. The pace of change on the islands has outpaced the utility's response (without going into what they should have done, there were no performance standards) and the commission has said that

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[14] I want to credit the good utility employees who do take initiative out of dedication to their profession. I was once in these ranks. Regulation does not acknowledge this and many utilities are seen as places where innovation is the exception, not the rule.
I also want to note the that over-spending for power generation in the 1980s and resulting bankruptcies are an example of failures leading to structural changes, but these were catastrophes, not intentional experiments.

performance standards are necessary to help guide the evolution of the utility. The commission is managing very fast change in catch up mode.

No state has had more legislative push toward reform than California. Regulatory reforms underway are implementing a series of laws to affirmatively rely on customer resources first. The commission there is mightily trying to create a coordinated procession of policy reform dockets to implement state policy. Performance regulation has not yet emerged on the regulatory agenda there, though they have a robust community choice aggregation initiative – towns reflect their judgment of utility performance if they decide to source their resources themselves.

Several other states are studying the role of the utility and utility compensation to better "**align**" (another word often used in this context) utility performance with societal priorities (performance regulation) and customer interests (services). Washington DC and the states of Maryland, Rhode Island, Massachusetts and Minnesota have processes underway sponsored either by the commission or by stakeholders to look at these questions, and I am aware through my work with states that others are actively working on it in advance of public activity. Vermont's dominant investor-owned utility is using latitude in regulation to experiment with technology and offer a range of new services to customers.

Americans are also paying attention to a performance regulation system put in place by the United Kingdom utility regulator to apply to all distribution and transmission companies. The system is known as RIIO, revenue = innovation + incentives + outputs and is in its first cycle.

In nearly every case, progress is moving in a **collaborative** setting. Innovation seems more conducive to this approach compared with the evidentiary process that commissions typically use.

Conclusion

This is a time of change driven by technology and customer attitudes. Decarbonization is likely to add fuel to the change engine. These changes are likely to roll through the US over the next decade. States are wise to be intentional about utility regulation in this cusp of time, making sure to the extent possible it promotes alignment with the objectives of policy and reaping new benefits. Beginning a process in Missouri for assuring this alignment is how I interpret the charge of this committee and how I have approached assembling these dense remarks. I appreciate the opportunity to deliver them to the committee.