The Untapped Grid:

How Better Utilization of the Power System Can Improve Energy Affordability

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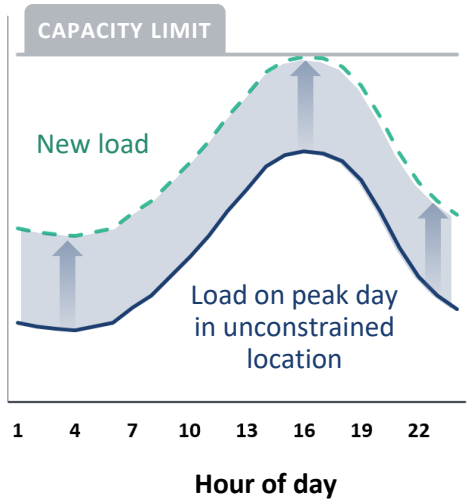


The Three Ways to Improve System Utilization

System utilization can be improved by adding new load when and where there is spare capacity.

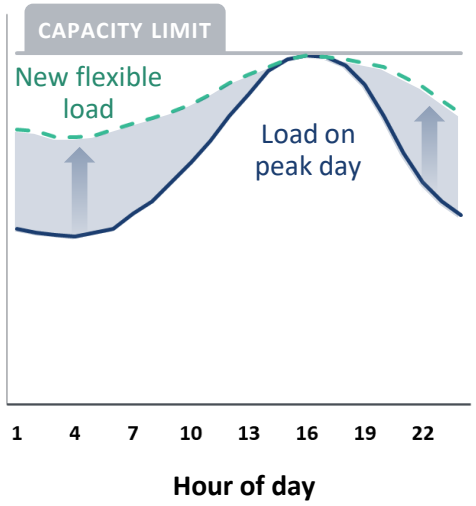
1

Add new load in **locations** where sufficient headroom already exists on the system.



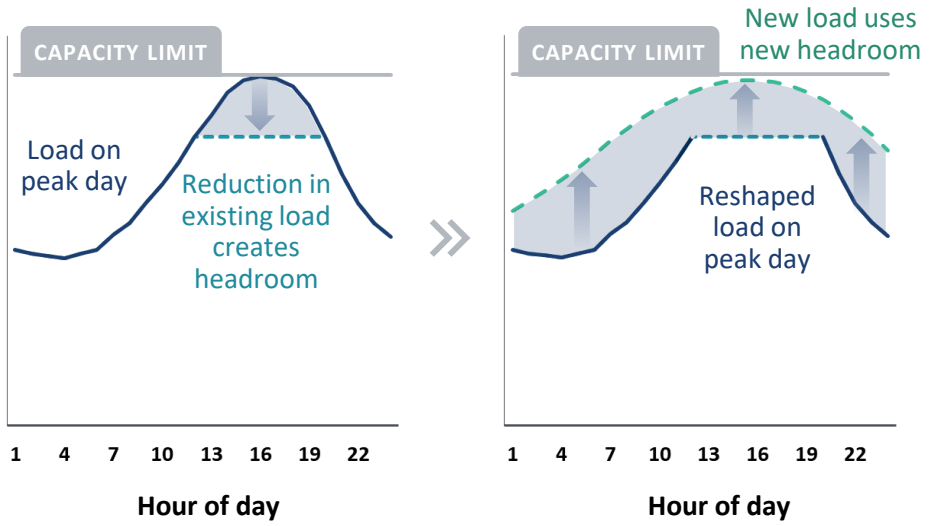
2

Add new load at **times** when there is spare capacity. This is possible if the new customers are flexible and/or can self-supply during peak conditions.



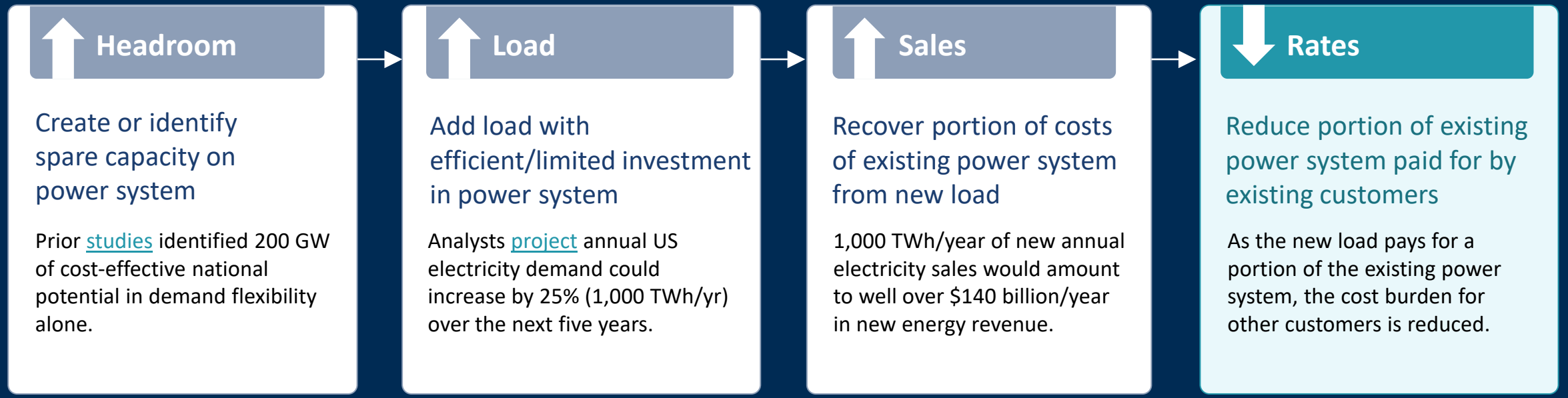
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Incentivize technologies and behavioral changes that reduce peak demand of existing load. This creates new headroom on the system, which can then accommodate the addition of new load.



Converting Utilization Improvements into Downward Rate Pressure

Improvements in system utilization enable capital-efficient load growth, which puts downward pressure on rates.



Tools for improving system utilization: Batteries, HVAC controls, EV charging controls, smart panels, time-varying rates, flexible interconnection policies, targeted energy efficiency, grid-enhancing technologies, data center flexibility, improved system planning…

Approach Overview

We analyze the rate impacts of adding load to an illustrative utility system for two scenarios: one scenario focuses on improving system utilization, and the other scenario does not.

1

Define illustrative characteristics of utility system and new load

- Illustrative mid-sized utility
- 3,000 MW of existing peak demand
- 14 cents/kWh average all-in retail rate
- Marginal costs exceed average costs
- 1,000 MW of new load:
- 500 MW transmission-connected (e.g., data center)
- 500 MW distribution-connected (e.g., transportation electrification).

2

Calculate rate impact of adding load *without* improving system utilization (status quo)

- Load growth served entirely through investment in traditional infrastructure
- Retail rate based on average costs; does not fully recover new incremental costs
- Costs not recovered from the new load are collected through a uniform rate increase for all customers

3

Calculate rate impact of adding load *with* focus on improving system utilization

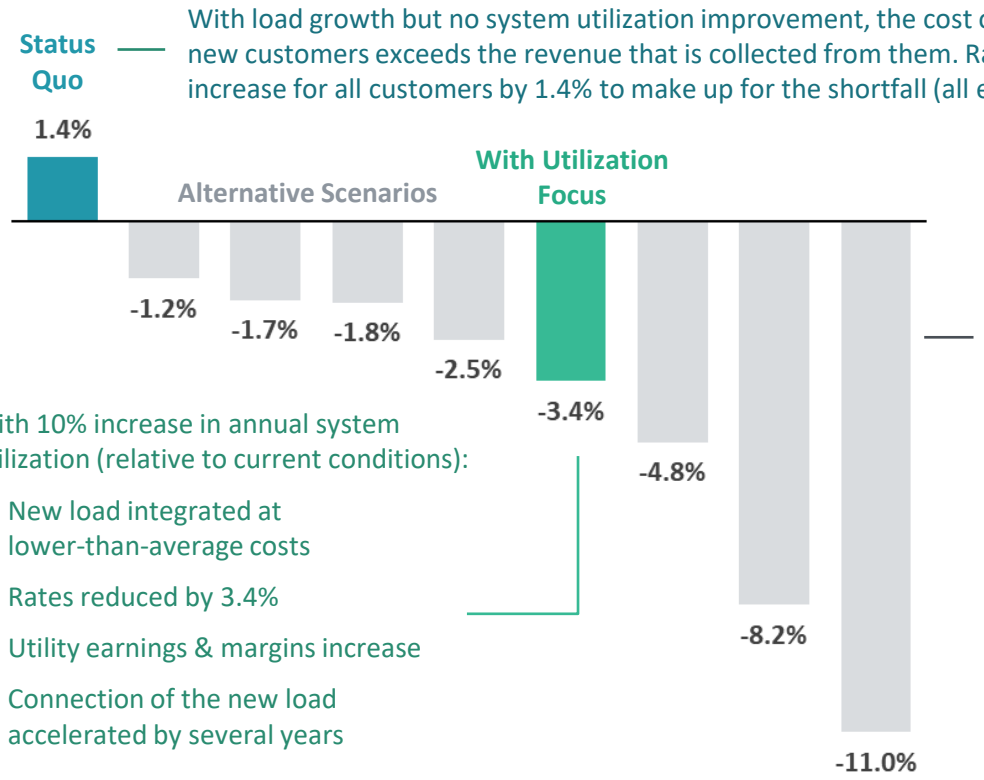
- Load accommodated with reduced investment in new infrastructure
- Half of new transmission-level load connects flexibly
- 500 MW portfolio of distributed energy resources is developed at average net cost to utility of $50/kW-yr.
- Capacity contribution of DERs is derated to reflect that it offsets only a portion of needed infrastructure

The Impacts of Improved System Utilization: An Illustrative Example

In this illustrative analysis, improving system utilization can reduce customer bills and accelerate the connection of new load while still allowing utility earnings to grow relative to current levels, all else equal.

All-in Average Rate Impact Due to Load Growth

For various characterizations of the power system



INTERPRETING THE RESULTS

Proof-of-concept. Tailored, jurisdiction-specific analysis is needed to understand the opportunities for any given system.

Other rate impacts. This study does not analyze other factors that could independently drive rate changes, such as the replacement of aging transmission and distribution (T&D) infrastructure or fluctuations in natural gas prices.

Rate design. In practice, rate design can also be an effective tool for mitigating cost shifts from new loads to existing customers.

Policy implications. This paper quantifies the impact of increased system utilization but does not propose specific policies or programs in this area.

National Implications

At a national scale, improving system utilization can be a win for consumers, utilities, and new loads.

Benefits to Consumers

- Scaling the utility-level findings to national load growth: **US consumers could save $110 to $170 billion over 10 years** on their electricity bills due to system utilization improvements.
- Participants in programs or rates earn **additional savings through enrollment incentives**.

Benefits to Utilities

- Improving system utilization lessens but **does not eliminate the need to invest in new infrastructure**.
- **Utility earnings grow relative to current levels**, and margins could increase with the introduction of new regulatory incentives.
- Utilities can focus capital deployment on the most critical infrastructure projects while also **enabling economic development**.

Benefits to New Loads

- New customers to connect to the grid **without shifting costs to other consumers**, addressing an escalating policy concern.
- DERs **mitigate the stranded asset risk of overbuilding the power system** if new load does not materialize as forecasted.
- DERs can be brought online more quickly than other options, **accelerating speed-to-market.**

Ensuring Beneficial Outcomes

As decision-makers develop policies or programs aimed at improving system utilization, the following considerations will increase the likelihood that the outcome reduces rates for all customers.

$$\text{System Utilization (\%)} = \frac{\text{Total energy delivered or produced on system over a given time period}}{\text{Available system capacity over the same time period}}$$

Key considerations

1. **System Fundamentals**
2. **Interaction with Rates**
3. **Cost-Effectiveness**
4. **Diminishing Returns**
5. **Reporting**
6. **Timescale**
7. **Applicable System**
8. **Geographic Granularity**
9. **Business Model Innovation**
10. **Weather Effects**
11. **Interaction with Decarbonization Goals**

See report for further discussion.