The Economics of Demand Flexibility

Business models to deliver customer value in an integrated grid

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Context: rising costs, flat demand

Utilities plan to invest $1.4 trillion in infrastructure upgrades through 2030, but sales have declined 5 out of the last 7 years, and growth forecasts have been systematically lowered.

Grid investment forecast, 2015-2030

- Generation: $505 billion
- Transmission: $300 billion
- Distribution: $580 billion
- Total: $1,385 billion

Source: DOE QER 2015; EEI; EIA EPM and AEO

EIA electricity consumption projections

Actual and Forecasts
Consumers have expanding options
To meet demand for electricity, utility customers used to buy it, but it is increasingly easy and cost-effective to make it, avoid it, or shift it.

**Table ES1**

<table>
<thead>
<tr>
<th>Category</th>
<th>Demand Flexibility Capability</th>
<th>Grid Value</th>
<th>Customer Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td>Can reduce the grid’s peak load and flatten the aggregate demand profile of customers</td>
<td>Avoided generation, transmission, and distribution investment; grid losses; and equipment degradation</td>
<td>Under rates that price peak demand (e.g., demand charges), lowers customer bills</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td>Can shift load from high-price to low-price times</td>
<td>Avoided production from high-marginal-cost resources</td>
<td>Under rates that provide time-varying pricing (e.g., time-of-use or real-time pricing), lowers customer bills</td>
</tr>
<tr>
<td><strong>Renewable energy integration</strong></td>
<td>Can reshape load profiles to match renewable energy production profiles better (e.g., rooftop solar PV)</td>
<td>Mitigated renewable integration challenges (e.g., ramping, minimum load)</td>
<td>Under rates that incentivize onsite consumption (e.g., reduced PV export compensation), lowers customer bills</td>
</tr>
</tbody>
</table>

**FIGURE ES1**

**Grid Purchases**
Buy kWh from the grid as and when needed.

**Distributed Generation**
Generate electricity, changing the profile of net grid demand while reducing total grid demand.

**Energy Efficiency**
Reduce demand whenever load is operated, thus lowering the daily load curve.

**Demand Flexibility**
Shift eligible loads across the hours of a day to lower-cost times, reshaping the daily load curve.

Source: RMI The Economics of Demand Flexibility
Harnessing DER: demand response vs. demand flexibility

Underlying technology is the same, but demand flexibility business models build on and complement the traditional demand response paradigm.

<table>
<thead>
<tr>
<th>Demand Response</th>
<th>Demand Flexibility</th>
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<tbody>
<tr>
<td>Grid focused</td>
<td>Customer focused</td>
</tr>
<tr>
<td>Wholesale drivers: price, reliability</td>
<td>Retail drivers: tariffs, DER integration</td>
</tr>
<tr>
<td>Slow to scale</td>
<td>Consumer value increases scalability</td>
</tr>
<tr>
<td>Infrequent / emergency</td>
<td>Frequent / always on</td>
</tr>
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</table>
Trends in rate design value demand flexibility

Nationwide, 65 million customers are already eligible to opt in to time-of-use pricing rates, and an increasing number of utilities are proposing non-volumetric default rates.

<table>
<thead>
<tr>
<th>Trend</th>
<th>Overview</th>
<th>Examples</th>
</tr>
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<tbody>
<tr>
<td>Time-varying energy pricing</td>
<td>Prices for energy change, as often as hourly, depending on time of day.</td>
<td>ComEd, Ameren (IL), California, Massachusetts, &gt;600 others</td>
</tr>
<tr>
<td>Demand charges</td>
<td>Customers pay a fee corresponding to maximum demand during a given period (e.g. monthly)</td>
<td>Salt River Project, Arizona Public Service, PG&amp;E*, SDG&amp;E*, Westar Energy, OG&amp;E*, 10+ others</td>
</tr>
<tr>
<td>Reduced export compensation for PV</td>
<td>Exported PV is compensated at less than the retail rate</td>
<td>HECO, Alabama Power, Xcel*, Tucson Electric*, SCE*, SDG&amp;E*</td>
</tr>
</tbody>
</table>

*proposal
Demand flexibility supports on-site PV use
Load can be scheduled to coincide with PV generation in the absence of net energy metering.

Uncontrolled load profile

Flexible load profile

Move load into PV production hours

Source: RMI The Economics of Demand Flexibility
Customers save 10-40% net with DF

Under rates that exist today, residential customers can achieve 10-40% annual bill savings. Across just four markets, there is an $800 million/y savings potential for eligible customers.

![Diagram showing savings per customer and market size](image-url)

Source: RMI The Economics of Demand Flexibility
Case details: Salt River Project

- DF reduces peak demand by 48%
- PV customer saves 41% net on bills
- A new customer breaks even, including cost of PV at today’s prices
- >350,000 eligible customers
- $240 m/y savings for eligible customers
- Unlocks $6 billion rooftop PV market

Source: RMI The Economics of Demand Flexibility
New business models can scale this resource

Utility tariffs and programs can line up incentives for new business models to deliver what the customer values, while also lowering bills and reducing grid costs with demand flexibility.

Customers want many things...

- Lower bills
- Increased comfort
- More control
- Self-generation
- Green attributes
- Shiny objects
- Social engagement
- Security
- ...

... and companies are innovating to deliver it
Developers and utilities have a role to play

Good retail pricing and new business models can unlock massive value from demand flexibility, and reduce customer bills while lowering grid costs.

<table>
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<th>DER developers</th>
<th>Utilities &amp; regulators</th>
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<tbody>
<tr>
<td>✤ Take advantage of <strong>business opportunities that exist today</strong> across the US and abroad</td>
<td>✤ Capture the grid value of flexibility + PV with <strong>rate design that aligns incentives</strong> by lining up customer prices with utility costs</td>
</tr>
<tr>
<td>✤ Focus on <strong>delivering what the customer wants</strong>, but seek to monetize additional grid values of demand flexibility</td>
<td>✤ Seek <strong>partnerships to unlock innovation</strong> and drive the scale of the flexibility resource</td>
</tr>
</tbody>
</table>