Rate Design for Electrification and Activating Demand – Retail Rates

Presentation to the New England Restructuring Roundtable

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- Founded in 1996 by CEO Bruce Biewald
- Leader for public interest and government clients in providing rigorous analysis of the electric power and natural gas sectors
- Staff of 40+ includes experts in energy, economic, and environmental topics

Rate Design and Beneficial Electrification

- Rate design can help to:
  - Avoid grid upgrades by encouraging customers to alter their consumption patterns
  - Encourage beneficial electrification through making rates more cost-based, making beneficial electrification more affordable for customers

- Common rate elements:

Fixed Charge	$/month	Flat fee regardless of usage
Volumetric Rate	$/kWh	Based on volume of energy (kilowatt-hours) consumed over the course of the month
Demand Charge	$/kW	Based on the customer's maximum demand (kW) during month

- Within each of these elements, there are many design options with different implications for adoption of beneficial electrification technologies and impacting customer usage patterns

Rethinking Fixed Charges

Traditional Approach:

- High fixed charges (and low volumetric rates) reduce incentives for energy efficiency and conservation
- High fixed charges disproportionately burden lower-usage customers (who tend to be low income)

New approaches:

- Increase fixed charges to lower volumetric rates for beneficial electrification
  - Example: SDG&E's rate TOU-ELEC. Requires an EV, heat pump, or energy storage. Volumetric distribution rate is 28% lower due to $16 fixed charge.
- Address affordability issues through income-graduated fixed charges:
  - Example: California's proceeding R.22-07-005

Taking a Closer Look at Seasonality

Traditional Approach:

- Distribution rates do not vary throughout the year

New approaches:

- Recognize seasonality of loads on distribution system
  - Peaks tend to occur during summer, and will likely continue to do so for some time yet
- Establish seasonal variation in distribution rates
  - Example: Central Maine Power Seasonal Heat Pump Rate

Season	Heat Pump Rate	Standard Res Rate
Summer	$0.1582 / kWh	$0.0864 / kWh
Winter	$0.0041 / kWh	$0.0864 / kWh

Demand Charges

Traditional Approach:

- Non-coincident demand charges encourage flattening of loads across all hours of the day
  - Do not help manage system or feeder peaks
  - Challenging for low-load factor customers, especially EV DCFC

New approaches:

- Demand charge only applies during pre-defined on-peak hours

Example: Ameren Illinois eliminated its off-peak demand charge for a limited number of education facilities, transit facilities, or public charging facilities with demands greater than 150 kW. The standard demand charge still applies during on-peak hours.

- Higher volumetric rates in exchange for reduced or eliminated demand charges

*Example: NV Energy offers a temporary conversion of demand charges to **time-of-use** volumetric rates. The demand charge is gradually phased back in from 2020 – 2029.*

- Low load-factor rates

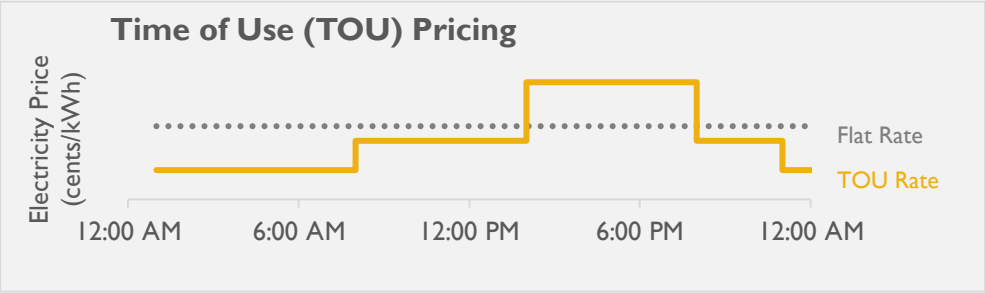
Example: In Massachusetts, National Grid's distribution demand and volumetric charges are set on a sliding scale, based on customer load factor. As load factor increases, the demand charge increases and energy charge decreases (to 15% LF).

Time-Varying Rates

Traditional Approach:

- Flat rates

New(ish) approaches:



- TOU rates relatively simple to understand
- Customers may be unwilling to enroll whole home load on TOU rate, but EV-only rates may require a separate meter or approved submetering
- On-peak to off-peak price ratio must be high enough to attract customers

- CPP rates more cost reflective and only target hours of system need
- Load is highly responsive
- Less familiar to customers

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Appendix

Load Attraction/Economic Development Rates for EV Charging Load

- Temporary discounted rates to encourage new load on system

Example: Alabama Power's Economic Development Incentive offers rate reductions to customers who add at least 250 kW of electric vehicle fleet load and who commit to a contract for a six-year or ten-year period. Under the ten-year contract, base rate charges are discounted by up to 45 percent in the first year, declining to 15 percent in the fifth year.

Benefits:

- Supports EV load growth while industry is nascent

Challenges:

- Must recover at least marginal costs in order to benefit other customers
- May be viewed as unfair by some
- If temporary, must be in place long enough to support business case for DCFC and fleets, or will not accomplish goals

Residential EV Subscription Rates

- Flat monthly fee
- Unlimited or pre-specified quantity of electricity during off-peak hours
- High price for on-peak hours

Example: Austin Energy's EV360 program provides unlimited charging during off-peak hours (7 pm-2 pm) for $30/month. On-peak charging is $0.40/kWh in summer and $0.14/kWh in winter. 99% of charging occurs during off-peak hours.

Benefits:

- EVs have an incentive to charge during off-peak hours
- Enhanced fuel cost savings
- Extremely simple to understand and stable bills

Challenges:

- Requires a separate meter or approved submetering
- Best for EV customers who drive a lot, not necessarily lower-usage EV customers

Residential EV TOU Examples

Utility	Rate	Season	On-peak to off/super-off-peak price ratio	Whole-house or EV only
SDGE (CA)	TOU-5	Summer	6.3:1	Whole-house
		Winter	4.2:1	
	TOU - 2	Summer	2.8:1	Whole-house
		Winter	1.9:1	
	EV TOU	Summer	2.8:1	EV Only
		Winter	1.9:1	
Con Edison (NY)	TOU Residential	Summer	14.2:1	Either
		Winter	5.2:1	
SCE (CA)	TOU Residential	Summer	3.7:1	EV Only
		Winter	2:1	
PSEG (NY, Long Island)	Short Peak - TOU Residential	Summer	1.7:1	Whole-house
		Winter	1.5:1	
		Shoulder	1.3:1	
	Early Peak -TOU Residential	Summer	1.6:1	Whole-house
		Winter	1.5:1	
		Shoulder	1.3:1	
Hawaiian Electric Company	TOU-RI, separately metered EV	No seasonal variation	2.2:1	EV only
Pepco (MD)	Plug-in Vehicle (PIV) TOU	Summer	1.4:1	EV Only
		Winter	1.8:1	
	Residential Plug-in Vehicle (R-PIV) TOU	Summer	1.3:1	Whole-house
		Winter	2.1:1	
Northern States Power – Xcel Energy (MN)	Electric Vehicle Home Service	Summer	8.2:1	EV Only
		Winter	7.2:1	
	Res. EV Svc (EV Accelerate at Home)	Summer	3.2:1	EV Only
		Winter	2.6:1	
PacifiCorp (OR)	Separately Metered EV Service	Summer	1.4:1	EV Only
		Winter	1.2:1	
Baltimore Gas & Electric (MD)	Residential EV TOU	Summer	2.3:1	Whole-house
		Winter	2.3:1	
Salt River Project (AZ)	Residential EV Price Plan	Summer	3.8:1	Whole-house
		Winter	1.6:1	
		Shoulder	3.3:1	

Off-Peak Charging Credits

- Provides a credit to customers who charge vehicles off-peak

Example: ConEdison provides a $0.10/kWh rebate for charging between midnight and 8 am. Customers can earn an additional $35/month for avoiding any charging during peak summer hours (2 pm – 6 pm).

Benefits:

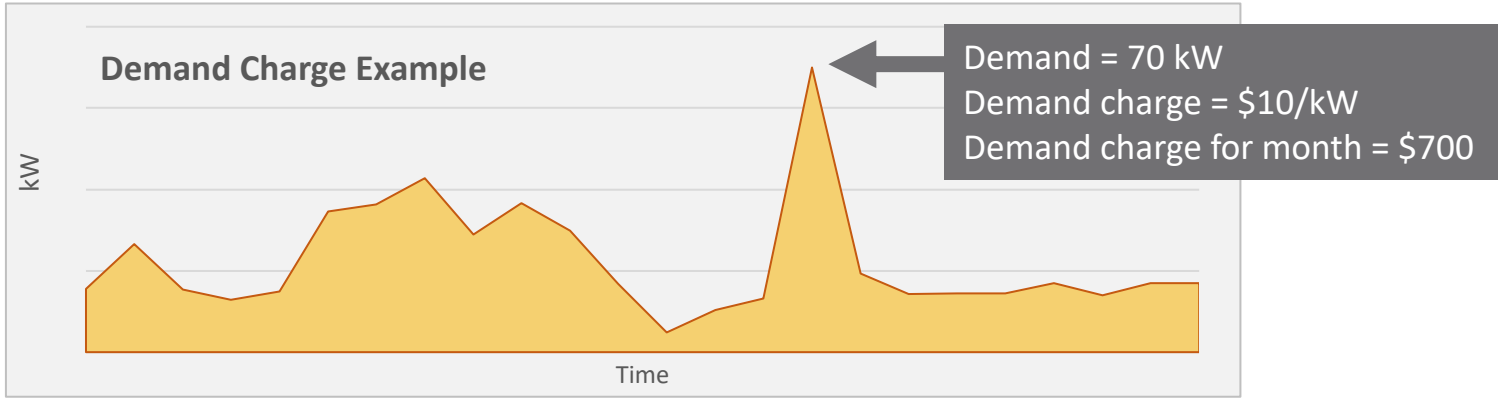
- EVs have an incentive to charge during off-peak hours
- Enhanced fuel cost savings
- Customers do not risk higher bills – they simply receive a credit
- Less stringent metering required to provide bill credits

Challenges:

- Submetering options can be expensive

Rate Design Barriers to EV Adoption

- **Lack of Fuel Cost Savings**
  - A key motivation for EV adoption is fuel cost savings
  - Flat rates do not provide lower electricity prices when costs on the grid are low, making charging more expensive than it could be
- **Demand charges** tend to pose the biggest barriers for commercial customers (including public DCFC and fleets)



Demand charges are difficult for customers with low load factors, where the quantity of electricity consumed (kWh) is low but the demand (kW) is high.

SDG&E TOU-DR1 vs. TOU-ELEC

SCHEDULE TOU-DR1										Schedule WF-NBC + DWR-BC Rate	Schedule EECC Rate	Total Electric Rate
Energy Charges ($/kWh)	**Transm**	**Distr**	**PPP**	**ND**	**CTC**	**LGC**	**RS**	**TRAC**	**UDC Total**			
Summer												
On-Peak	0.07340	0.15068	0.02546	0.00007	0.00153	0.01383	0.00003	(0.00748)	0.25752	0.00530	0.57043	0.83325
Off-Peak	0.07340	0.15068	0.02546	0.00007	0.00153	0.01383	0.00003	(0.00748)	0.25752	0.00530	0.25697	0.51979
Super Off-Peak	0.07340	0.15068	0.02546	0.00007	0.00153	0.01383	0.00003	(0.00748)	0.25752	0.00530	0.09233	0.35515
Up to 130% of Baseline Adjustment Credit	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	(0.11724)	(0.11724)			(0.11724)
Winter												
On-Peak	0.07340	0.15068	0.02546	0.00007	0.00153	0.01383	0.00003	0.17309	0.43809	0.00530	0.19307	0.63646
Off-Peak	0.07340	0.15068	0.02546	0.00007	0.00153	0.01383	0.00003	0.17309	0.43809	0.00530	0.10855	0.55194
Super Off-Peak	0.07340	0.15068	0.02546	0.00007	0.00153	0.01383	0.00003	0.17309	0.43809	0.00530	0.08402	0.52741
Up to 130% of Baseline Adjustment Credit	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	(0.11724)	(0.11724)			(0.11724)
Other Charges/Discounts												
Minimum Bill	0.000	0.380	0.000	0.000	0.000	0.000	0.000	0.000	0.380			0.380

Notes:
1) The total rates presented reflect the UDC rates associated with service under Schedule TOU-DR1 and the generation rates associated with Schedule EECC, in addition to the rates associated with Schedules DWR-BC and WF-NBC. The UDC rate-by-rate components presented are associated with service under Schedule TOU-DR1 as presented in the utility's tariff book.
2) Unbundled customers are those who take generation from other providers, such as Direct Access (DA) or Community Choice Aggregation (CCA). Unbundled customers do not pay SDG&E's commodity rates. The Total Energy Charge for an unbundled customer includes UDC, WF-NBC, DWR-BC and Power Charge Indifference Adjustment (PCIA) rates. PCIA rates by vintage are included below. Please see Schedules DA-CRS or CCA-CRS for more information regarding PCIA rates.

SCHEDULE TOU-ELEC										Schedule WF-NBC + DWR-BC Rate	Schedule EECC Rate	Total Electric Rate
Energy Charges ($/kWh)		**Transm**	**Distr**	**PPP**	**ND**	**CTC**	**LGC**	**RS**	**TRAC**	**UDC Total**			
Summer													
On-Peak		0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228	0.00530	0.51568	0.74326
Off-Peak		0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228	0.00530	0.14644	0.37402
Super Off-Peak		0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228	0.00530	0.09785	0.32543
Winter													
On-Peak		0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228	0.00530	0.27460	0.50218
Off-Peak		0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228	0.00530	0.13323	0.36081
Super Off-Peak		0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228	0.00530	0.08905	0.31663
Other Charges/Discounts													
Monthly Service Fee	($/month)	0.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00			16.00

Notes:
1) The total rates presented reflect the UDC rates associated with service under Schedule TOU-ELEC and the generation rates associated with Schedule EECC, in addition to the rates associated with Schedules DWR-BC and WF-NBC. The UDC rate-by-rate components presented are associated with service under Schedule TOU-ELEC as presented in the utility's tariff book.
2) Unbundled customers are those who take generation from other providers, such as Direct Access (DA) or Community Choice Aggregation (CCA). Unbundled customers do not pay SDG&E's commodity rates. The Total Energy Charge for an unbundled customer includes UDC, WF-NBC, DWR-BC and Power Charge Indifference Adjustment (PCIA) rates. PCIA rates by vintage are included below. Please see Schedules DA-CRS or CCA-CRS for more information regarding PCIA rates.

Different use cases; different rates

- **Public DCFC:**
  - Demand charges very difficult to translate into prices charged to EV drivers
  - Very difficult to throttle customers' charging
  - May not have space or economics to install storage to manage demand charges

- **Fleets:**
  - May be able to easily shift charging to overnight hours to avoid certain demand charges (e.g., coincident peak demand charges)
  - May be good candidates for demand response programs (direct load control, V2G)