Committee on Energy Resources and the Environment

NARUC Summer Policy Summit

Committees on Energy Resources & the Environment and Consumer Affairs

What's the Charge to Charge? Rate Design Principles to Facilitate EV Charging

NARUC Summer Policy Summit

RAP Energy solutions for a changing world

Workplace Charging of Electric Vehicles

NARUC 2017 Summer Policy Meeting
San Diego, CA

Jim Lazar, RAP Senior Advisor

July 18, 2017

The Regulatory Assistance Project
50 State Street, Suite 3
Montpelier, VT 05602
Phone: 802-223-8199
www.raponline.org

Issues

Is workplace charging desirable?

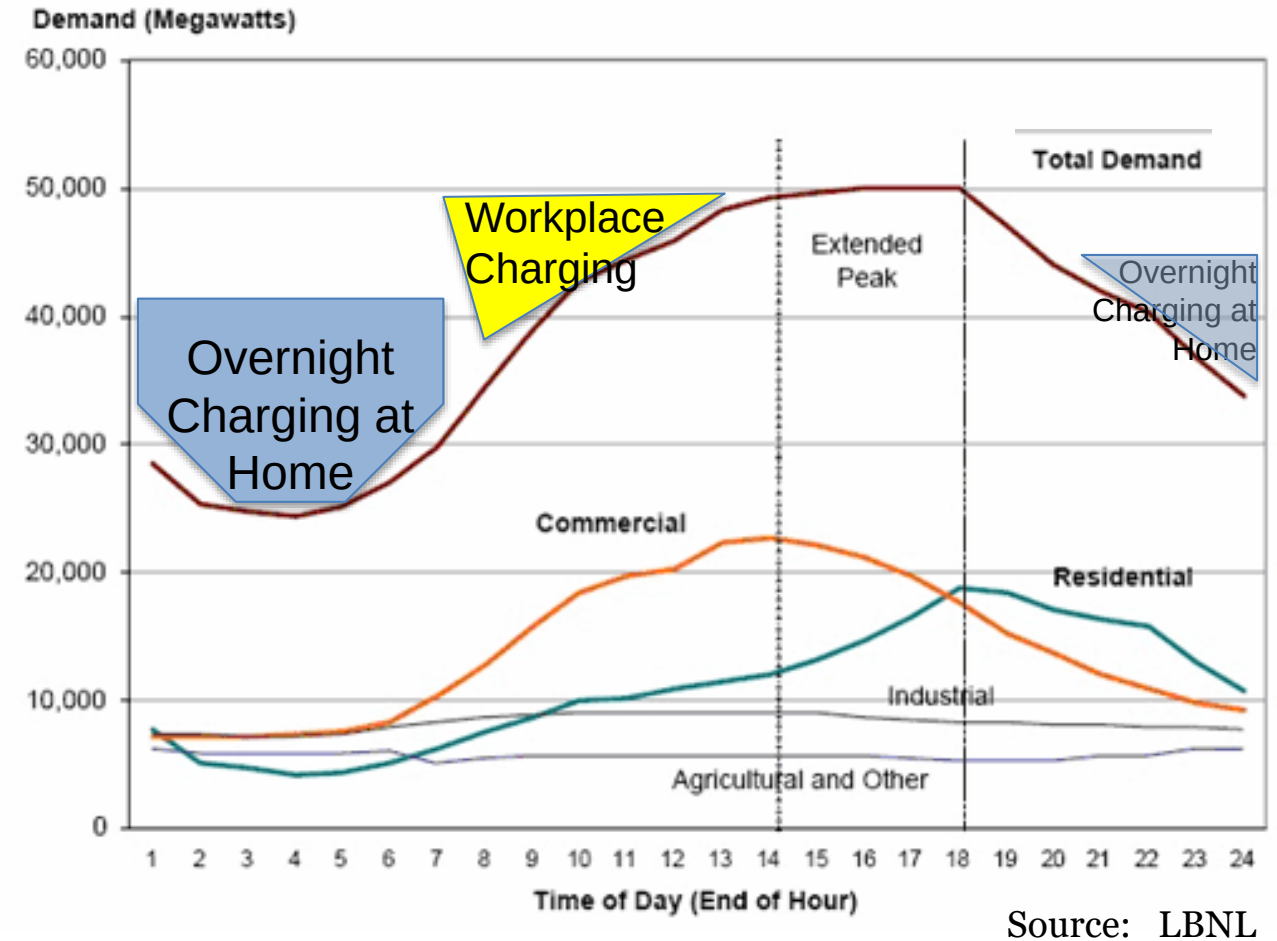
For the EV Owner?

For the grid?

Goals

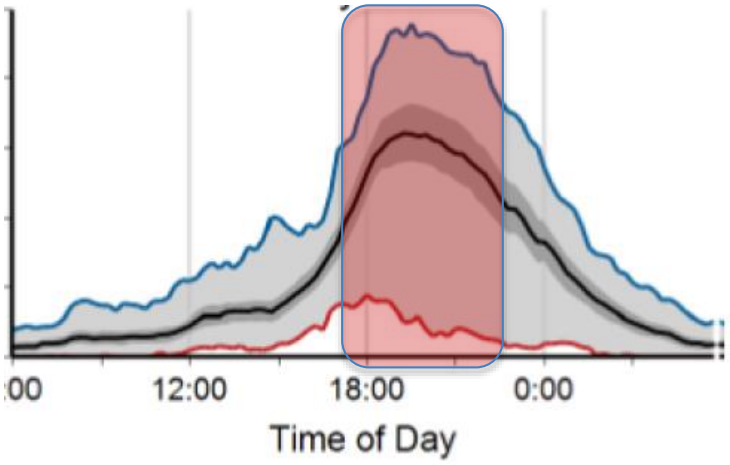
- Ensure people can charge when needed.
- Not all customers can charge at home.
- Reasonable cost to the consumer.
- Minimal or beneficial impacts on the grid.
- Workplace charging **may** be desirable.

Typical System Load Profile (without solar)

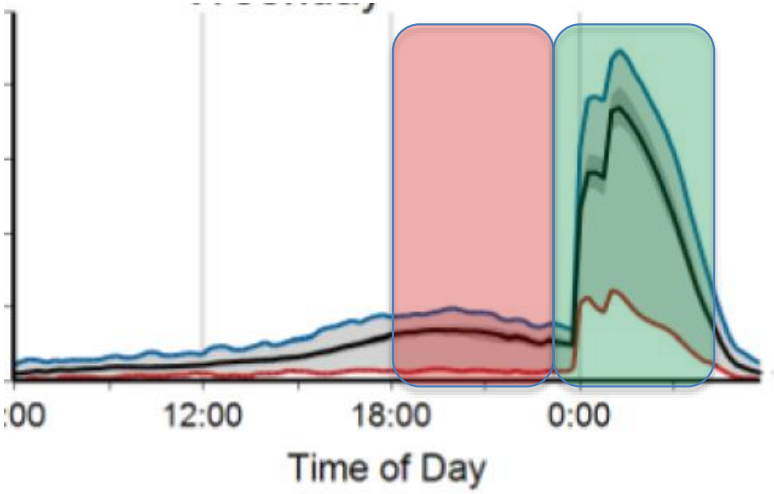


Source: LBNL

Price Can Influence <u>When</u> EVs Are Charged



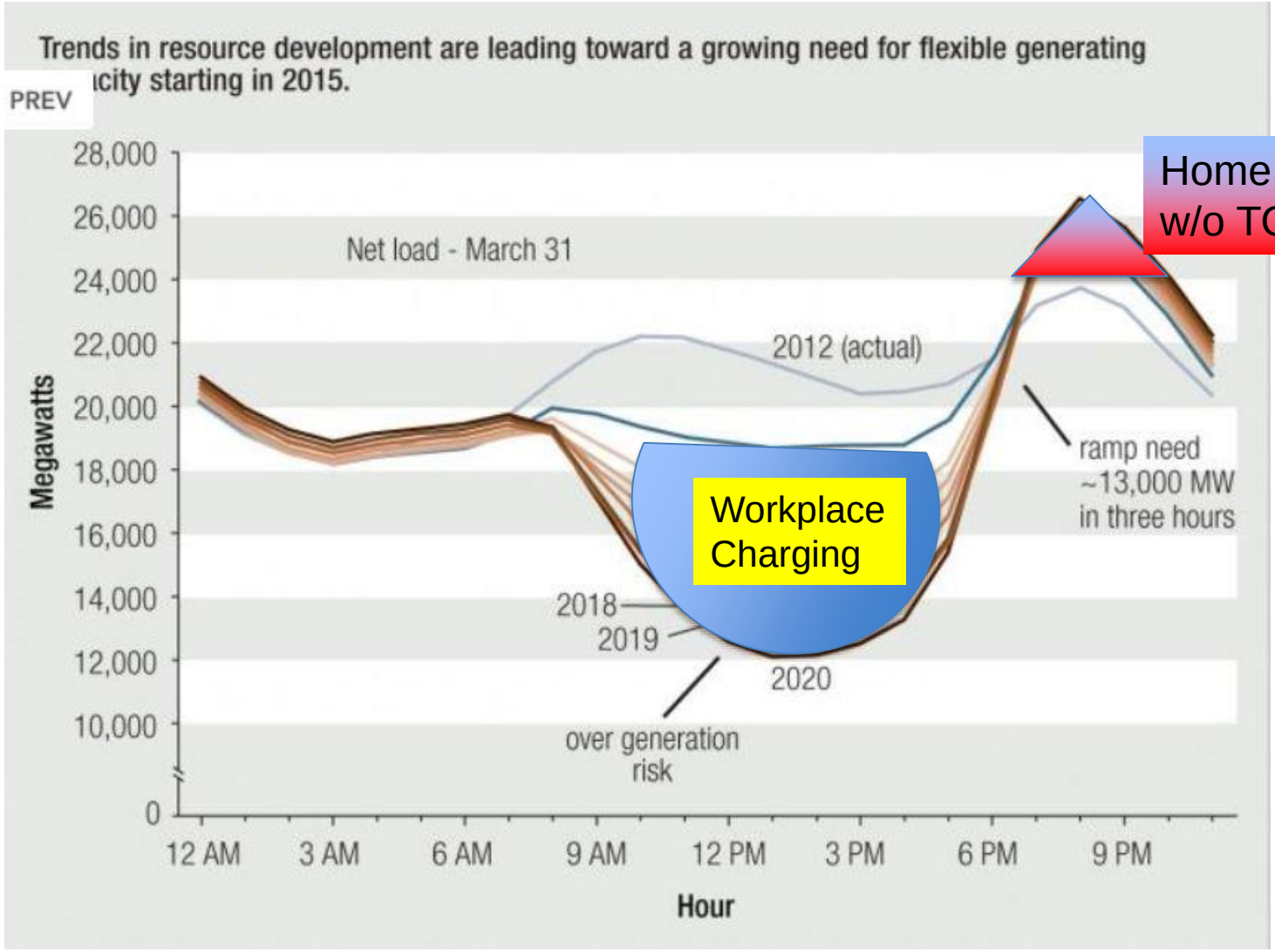
Dallas/Ft Worth
(standard rates)



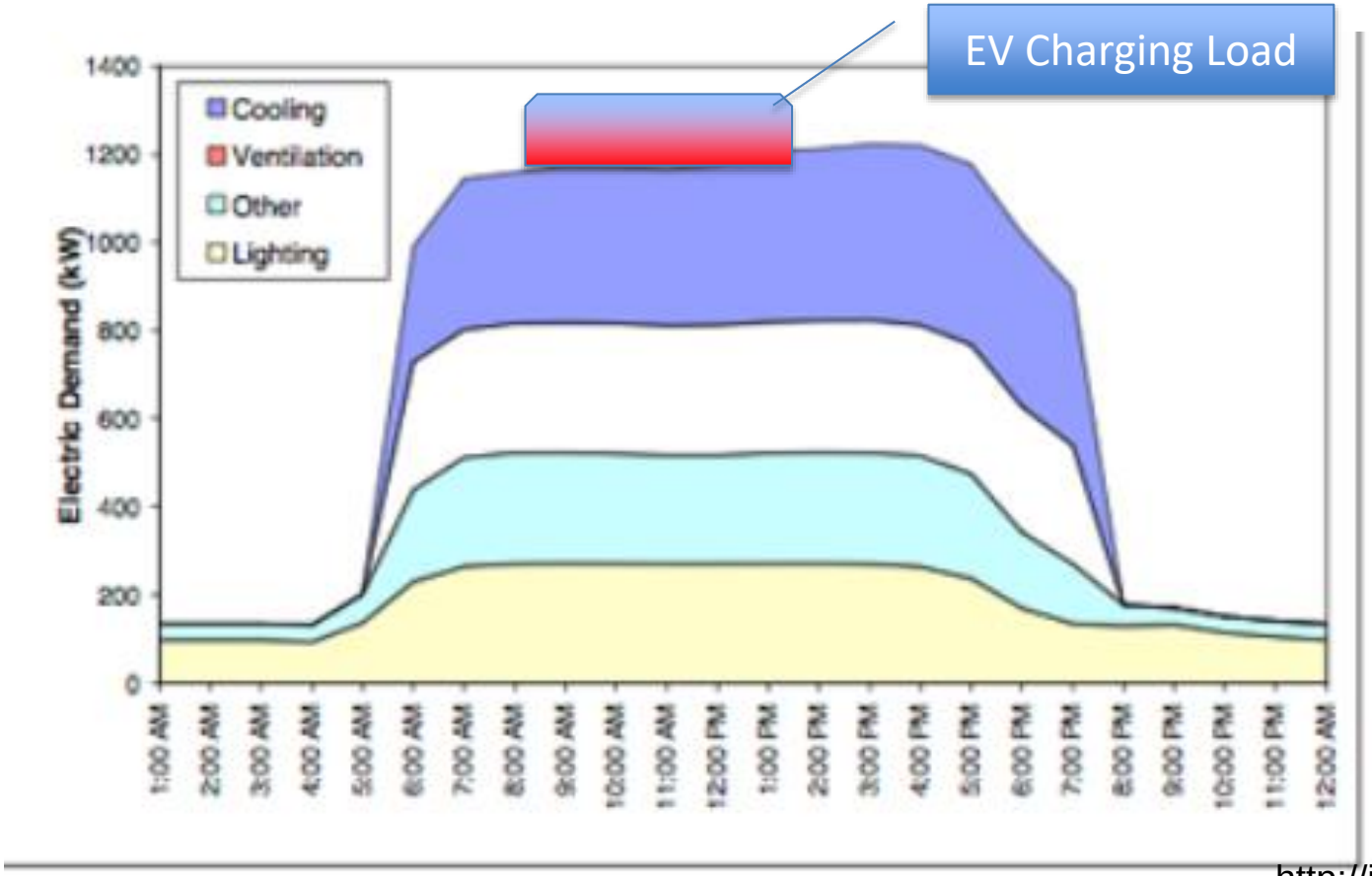
San Diego
(time-of-use rates)

Copied from: M.J. Bradley, 2017

Workplace Charging and the Duck Curve



Large Commercial Load Profile



http://jon.ochshorn.org

Key Rate Design Terms

- **(NCP)** Non-Coincident Peak Demand Charge: Monthly fee based on highest hour during the billing period.
- **(CP)** Coincident Peak Demand Charge: Monthly fee based on highest usage during the on-peak hours, e.g. 2 – 8 PM.
- **TOU:** Energy charge that varies by time of day in two or more periods.
- **CPP:** Critical peak pricing that applies only for short periods after notice.

Large Commercial Rate Design:
An Impediment to Workplace Charging

Eversource New Hampshire

(NCP) Demand Charge $13.75/kW

Energy Charge: ~$0.12/kWh energy

6.6 kW charger, 200 kWh/month:

$90 Demand + $24 energy = $114 =

= $0.57/kWh $5.70/gallon equivalent

Sacramento:
A CP Demand Charge Helps

Sacramento Municipal Utility District

NCP Demand Charge: $2.82/kW

CP Demand: (2 – 8 PM, summer): $6.91/kW

Energy Charges:

Off-Peak: $0.10

Mid-Peak: $0.13

On-Peak (2 – 8 PM, Summer): $.19

$18.61 Demand + $23 energy = $42

= $0.21/kWh $2.10/gallon equivalent

Southern California Utility w/TOU

Burbank Water and Power				
	Schedule D			Schedule C
Demand	$ 10.96			None
4 - 7 PM Mon-Fri	$ 0.215		$	0.260
Mid-Peak	$ 0.134		$	0.1625
Off-Peak	$ 0.107		$	0.130
EV Charging Cost				
Demand 6.6 kW	$ 72.34		$	-
Energy 200 kWh	$ 26.82		$	32.50
Total	$ 99.16		$	32.50
Average $/kWh	$ 0.50		$	0.16

Hawaii **Residential** TOU Rate Optional

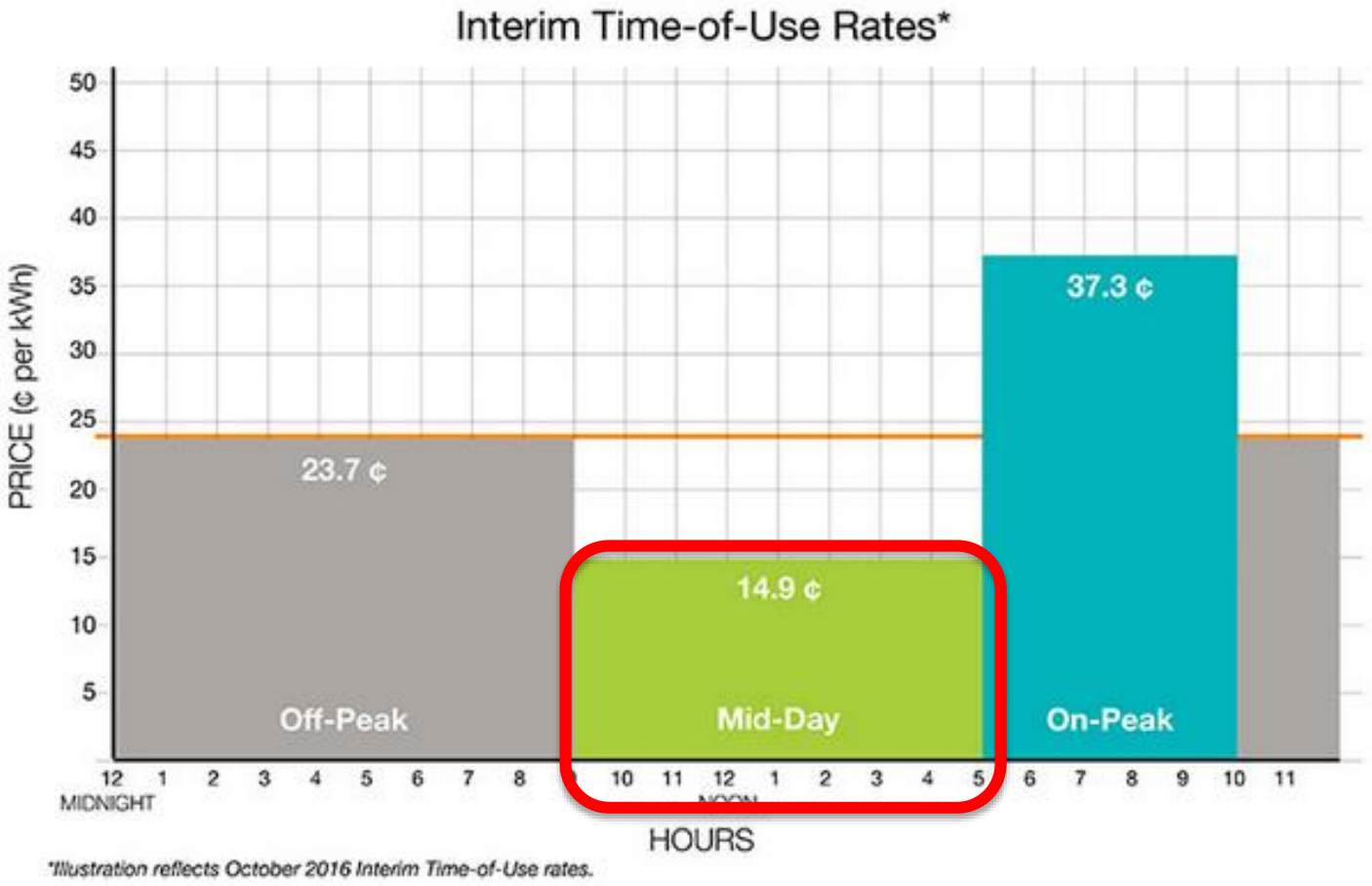
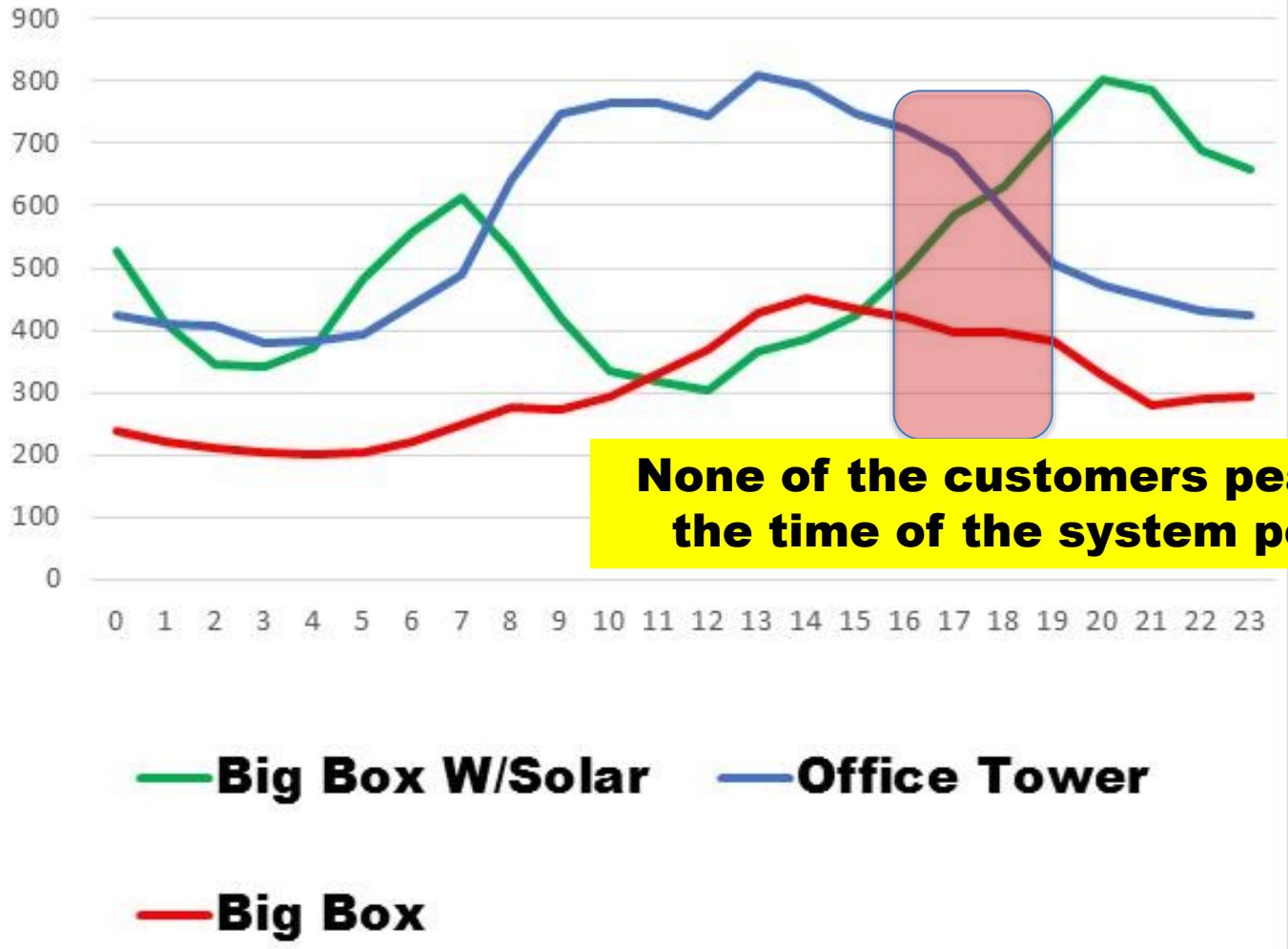


*Illustration reflects October 2016 Interim Time-of-Use rates.

Every Commercial Customer Is Different



None of the customers peak at the time of the system peak

Whose Valley Do You Want to Fill?

The customer's?

The System?

Peak Loads On Circuits Are Concentrated

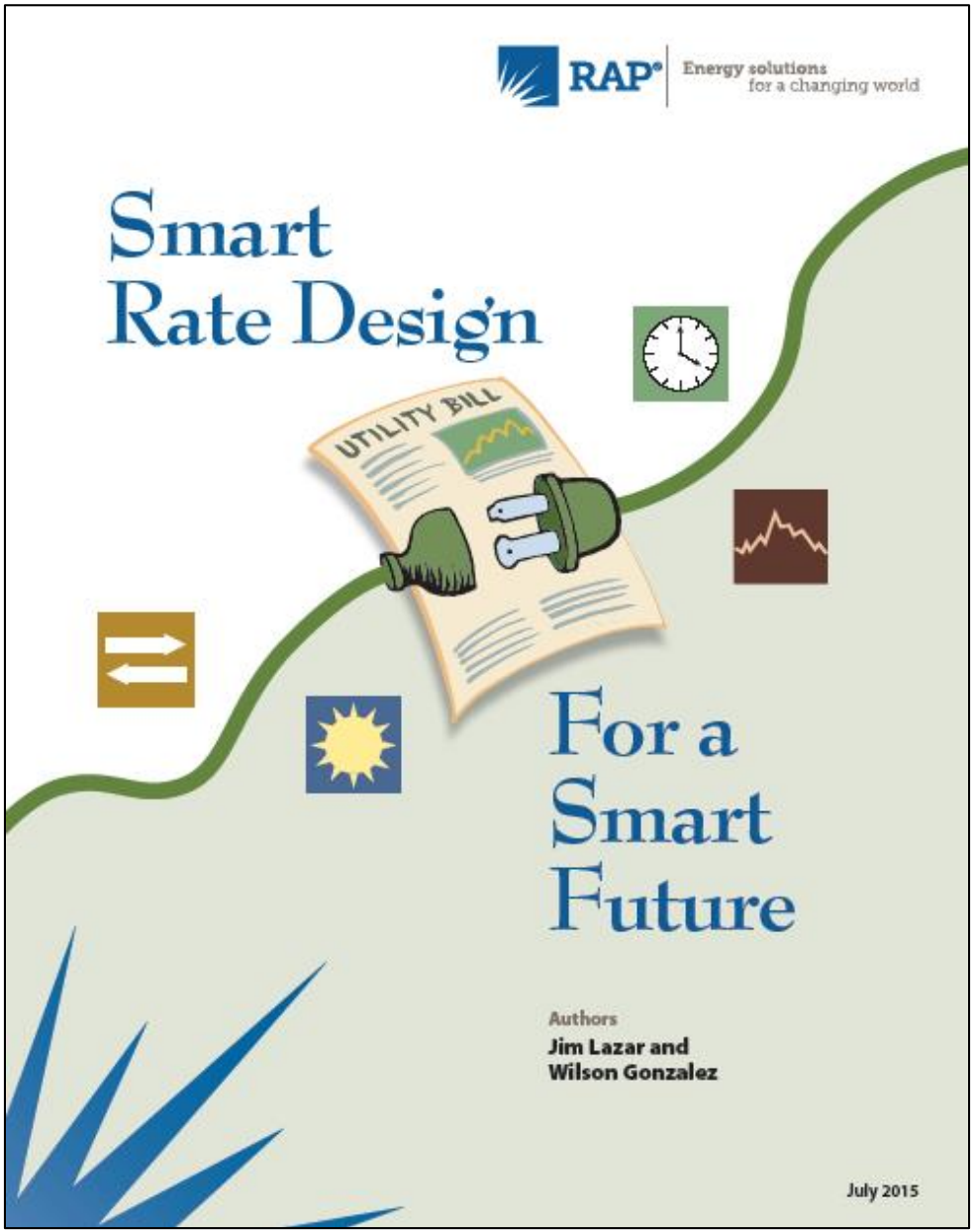
Hour	1	2	3	4	5	6	7	8	9	10	11	12
1	-	-	1	-	-	1	-	1	-	-	-	4
2	-	-	1	-	-	-	-	-	-	-	1	4
3	-	-	1	-	-	1	-	1	-	-	-	5
4	-	-	1	-	-	-	-	-	-	-	1	5
5	1	1	1	-	-	1	-	-	-	-	1	-
6	2	-	-	-	-	-	-	3	-	-	3	4
7	3	6	1	1	1	2	-	7	1	2	2	4
8	2	2	3	4	2	3	5	7	2	3	-	4
9	11	5	1	2	2	2	14	9	4	2	1	9
10	9	1	3	3	-	12	26	19	19	3	4	8
11	5	6	2	2	1	3	64	50	47	3	4	3
12	2	2	2	7	13	3	89	78	75	5	5	3
13	4	4	4	11	8	3	114	86	82	8	6	-
14	3	6	4	2	1	2	112	59	91	5	5	-
15	1	2	3	2	2	13	48	23	36	5	5	-
16	3	1	2	2	-	2	22	9	19	4	7	2
17	2	1	2	-	-	-	7	2	7	1	2	-
18	2	5	2	2	-	-	7	6	6	1	4	4
19	1	5	1	2	-	-	2	4	2	2	3	11
20	2	3	1	2	3	1	8	5	-	1	2	4
21	3	-	-	-	-	-	4	-	-	-	4	4
22	2	-	1	1	-	1	1	1	-	-	3	-
23	3	-	1	-	-	2	-	2	1	1	-	-
24	2	1	1	-	-	-	-	1	-	1	-	2

Smart Charging: A Better Choice

- Beyond TOU: Dynamic Pricing
- Utility or Aggregator Control
- Flexible Charging

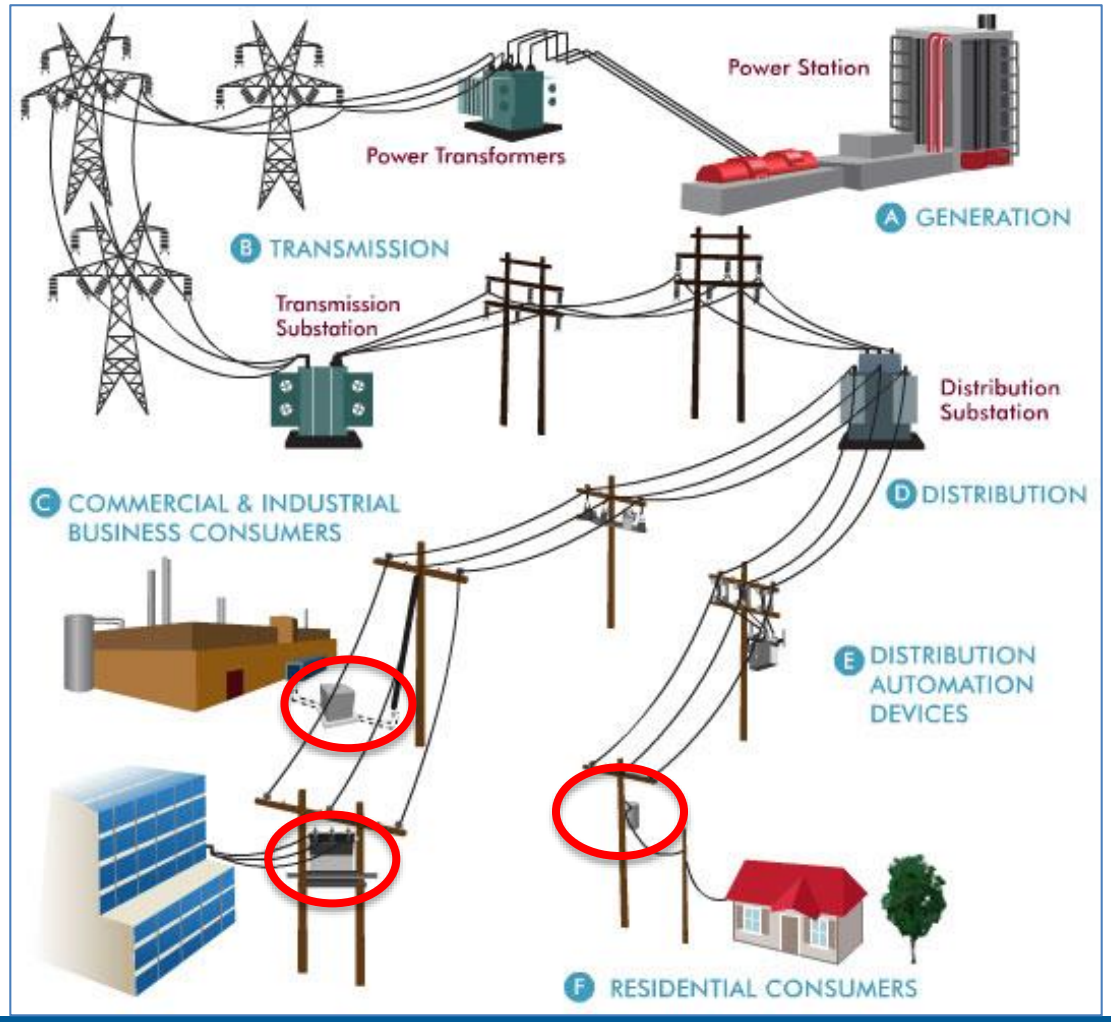
Smart Rate Design:

Rate design as though the future is important.



Only Component Sized To Customer Demand

Final Line Transformer



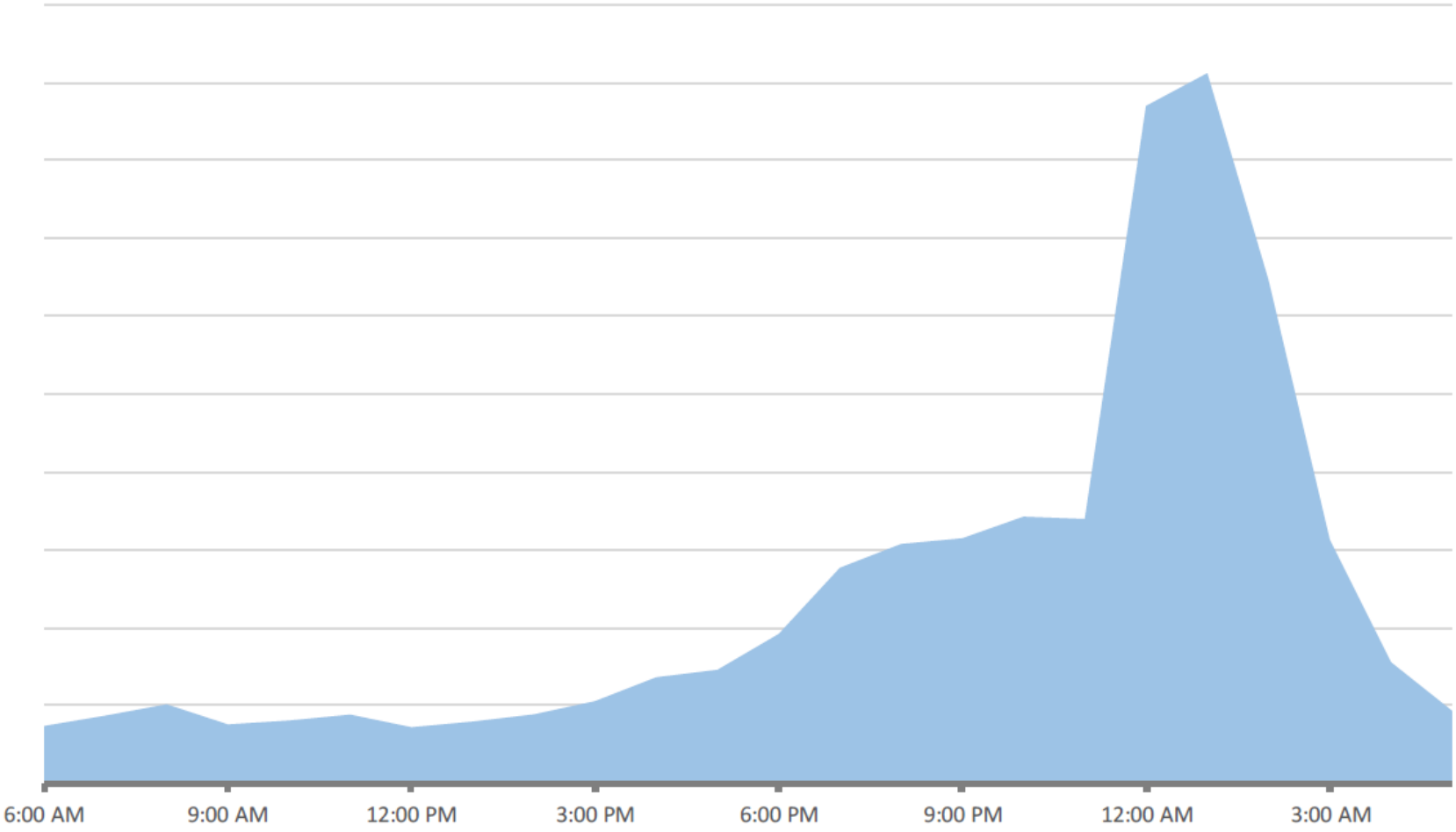
Bottom Line: Smart Rates

Customer-Specific Charges		
Customer Charge	$/Month	$ 3.00
Transformer:	$/kVA/Mo	$ 1.00

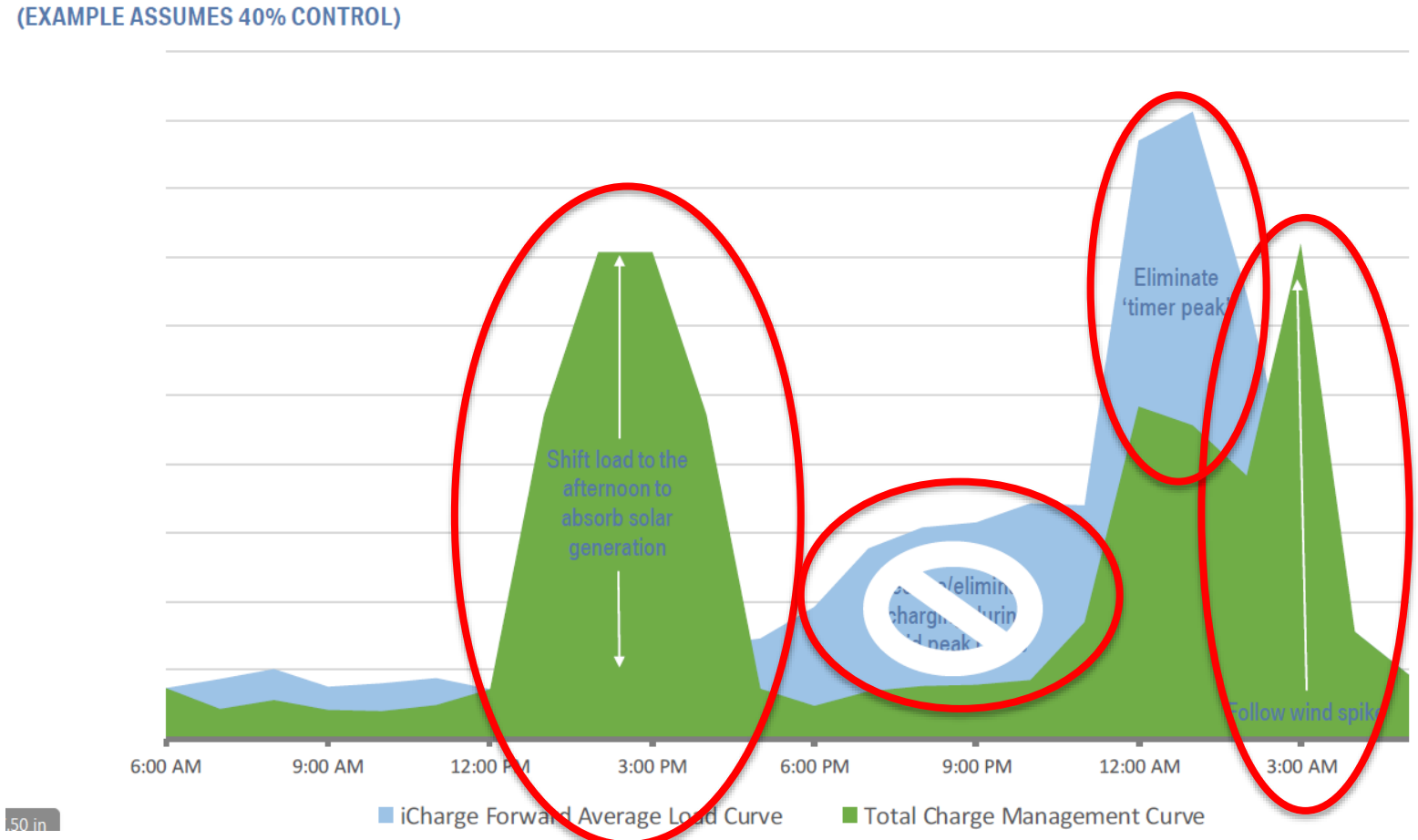
Energy Charges

Off-Peak	$/kWh	$ 0.08
Mid-Peak	$/kWh	$ 0.12
On-Peak	$/kWh	$ 0.18
Critical Peak	$/kWh	$ 0.75

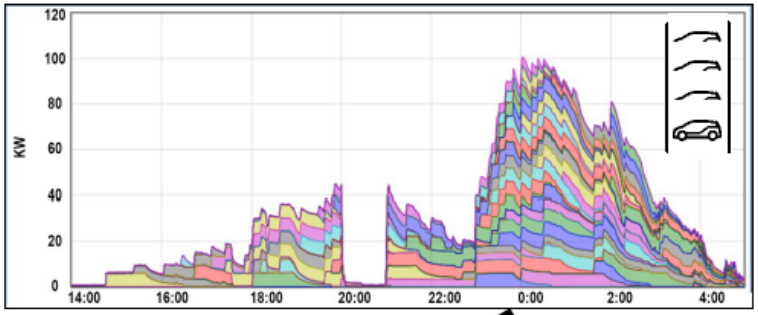
BMW Charge-Forward With TOU Rates

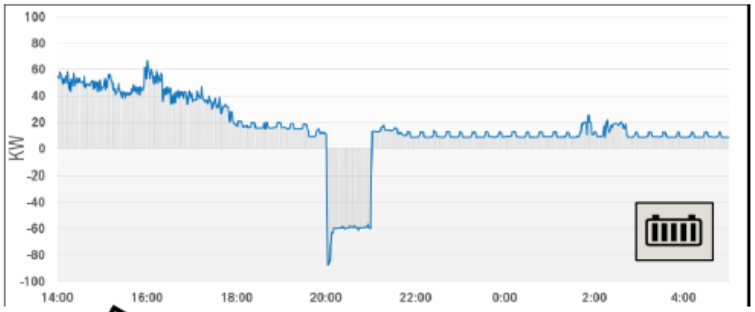


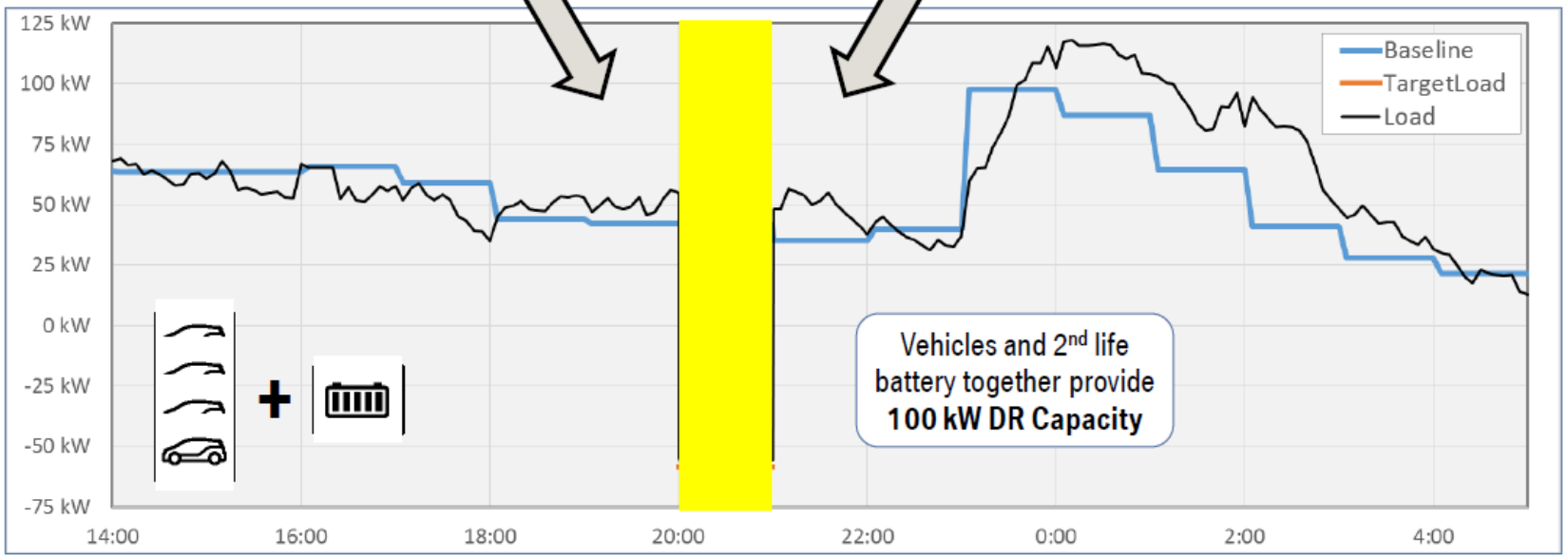
BMW Smart Charging With 40% Under Control



DEMAND RESPONSE
EXAMPLE DR EVENT 10/21, 8:00-9:00 PM







BMW i ChargeForward, Feb 2016

Summary

- Workplace Charging **may** be desirable
- NCP demand charges make workplace charging infeasible
- Good: CP demand charges
- **Better:** TOU rates
- **Best:** Smart rates and smart charging
- And now, let's hear from a utility that has done some smart stuff.

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

Jim Lazar jlazar@raponline.org

The Regulatory Assistance Project
Beijing, China • Berlin, Germany • Brussels, Belgium • **Montpelier, Vermont USA** • New Delhi, India
50 State Street, Suite 3 • Montpelier, VT 05602 • *phone:* +1 802-223-8199 • *fax:* +1 802-223-8172
www.raponline.org

SOUTHERN CALIFORNIA EDISON®
An *EDISON INTERNATIONAL*® Company

Electric Transportation and Rate Designs at SCE

Russell.Garwacki@sce.com
Director – Pricing Design and Research

NARUC Summer Policy Summit, July-2017
San Diego, CA

Electric Transportation – State Policy Direction

The California Legislature (SB350) and, subsequently, the CPUC had some very specific transportation electrification (TE) rate guidance:

- *Since the TE findings in Pub. Util. Code § 740.12(a)(1) include,* ***"reducing fuel costs for vehicle drivers who charge in a manner consistent with electrical grid conditions,"*** *the TE applications may propose projects to* ***change the rate structures, including demand charges****, that are currently in effect for electric vehicles used in commercial applications. However, the utilities should keep in mind that simply* ***shifting costs to other ratepayer classes does not comport with cost causation rate design principles*** *and may not be a viable solution.*

September 14, 2016 Assigned Commissioner Ruling, R.13-11-007, page 20.

<Emphasis added>

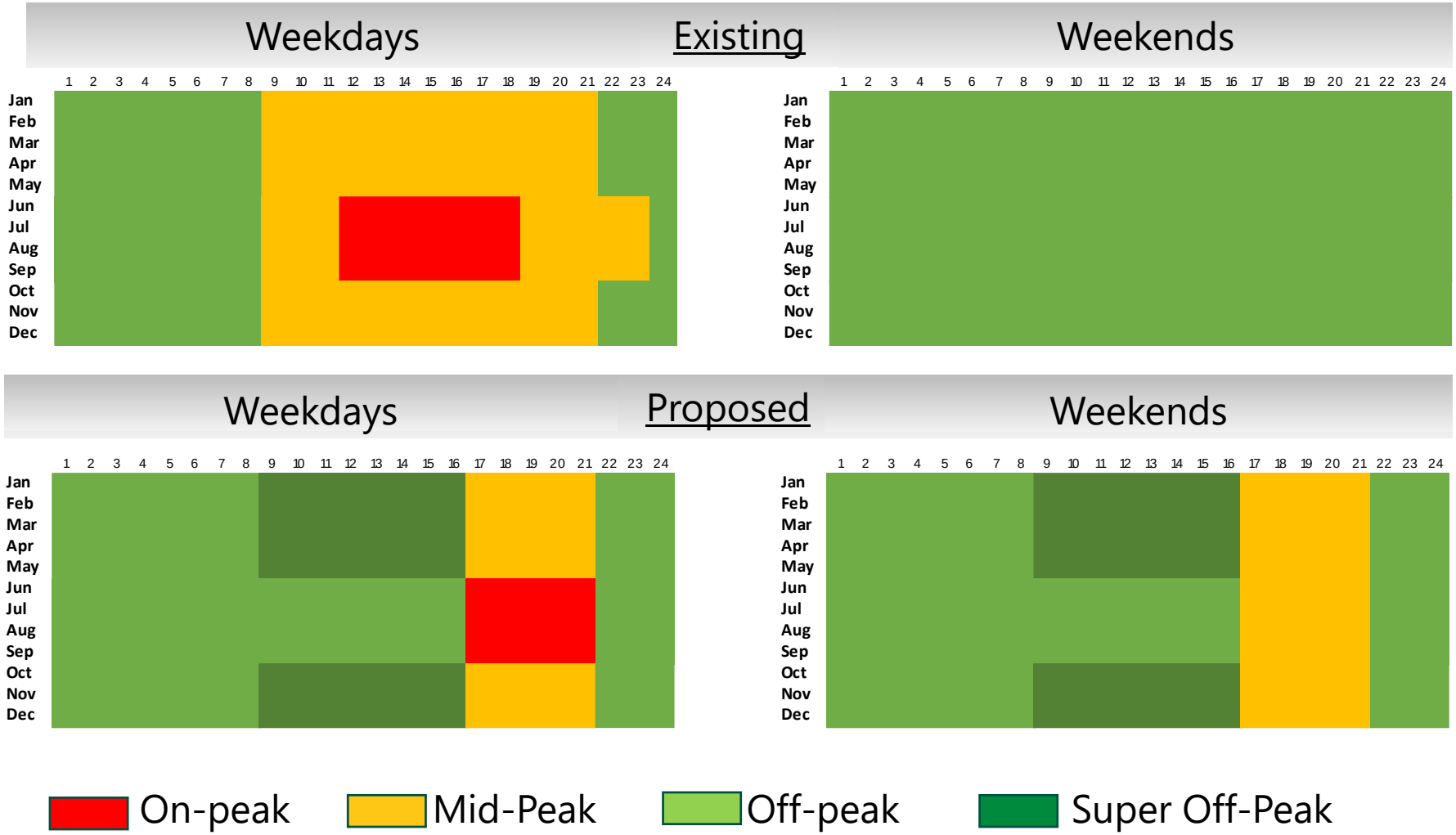
"Consistent with Grid Conditions"
- SCE's Pending Time-of-Use (TOU) Period/Rate Proposals

	Season	Existing	Proposed
On-Peak	Summer	Weekdays: 12:00 p.m. - 6:00 p.m.	Weekdays: 4:00 p.m. - 9:00 p.m.
Mid-Peak	Summer	Weekdays: 8:00 a.m. - 12:00 p.m.; 6:00 p.m. - 11:00 p.m.	Weekends: 4:00 p.m. - 9:00 p.m.
	Winter	Weekdays: 8:00 a.m. – 9:00 p.m.	Weekdays and Weekends: 4:00 p.m. - 9:00 p.m.
Off-Peak	Summer	Weekdays: 11:00 p.m. – 8:00 a.m. Weekends: All hours	Weekdays and Weekends: All hours except 4:00 p.m. – 9:00 p.m.
	Winter	Weekdays: 9:00 p.m. - 8:00 a.m. Weekends: All hours	Weekdays and Weekends: 9:00 p.m. - 8:00 a.m.
Super Off-Peak	Winter	N/A	Weekdays and Weekends: 8:00 a.m. – 4:00 p.m.

- Peak periods shifted to later in the day.
- Establishes new flexible generation capacity cost component (aka "ramping", all days).
- Introduces a "peak" time varying component in distribution rates.
- Super off-peak energy prices occur in the middle of winter weekdays/weekends.

"Consistent with Grid Conditions"

- SCE's Pending Time-of-Use (TOU) Period/Rate Proposals



SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

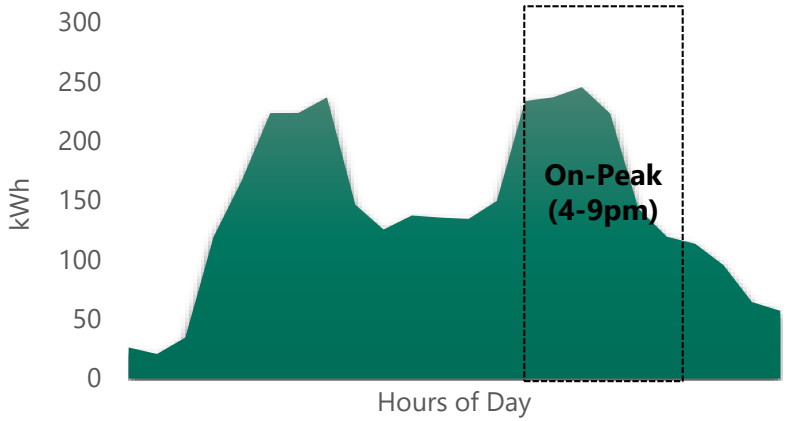
"Change the Rate Structures, including Demand Charges"

- Motivation Behind Demand Charges
  - Designed to recover longer term capacity related costs, thereby reducing the volumetric rates to their short-run marginal cost levels.
  - This structure encourages efficient consumption levels and load (energy) growth for a given peak demand level.
  - Works reasonably well for the typical range of customer load profiles.
- What's Changed?
  - AMI metering allows for detailed study of relationships between coincident and non-coincident peak demands and peak period energy and demands.
  - New electric transportation entrants have very low load factors, at least initially.

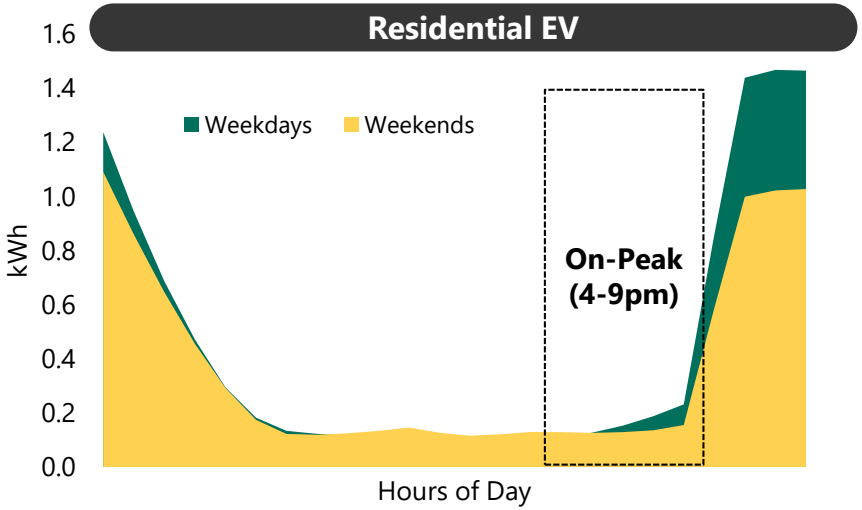
Serving Many Load Profile Masters

Illustrative

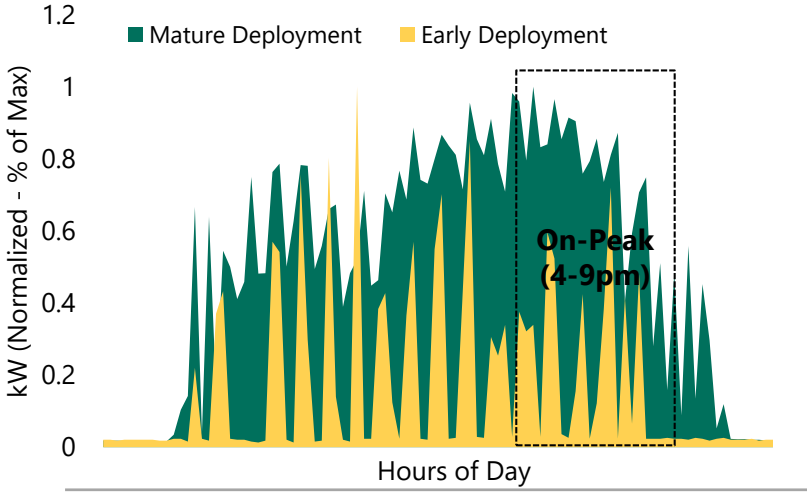
Rail



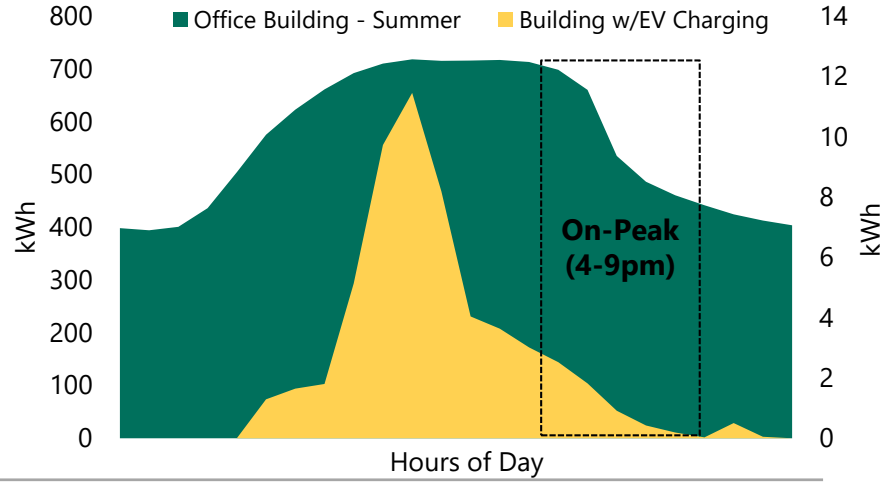
Residential EV



Mass Transit



Workplace Charging



SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

"Shifting Costs to other(s). . . does not Comport with Rate Design Principles"

- SCE adopted an Economic Development Rate mentality for its TE Application.
- Encouraging new growth is not a "shift" of costs as long as the price is above the marginal cost floor.
- SCE proposed a 5-year introductory period without demand charges followed by a 5-year phase-in of demand charges to facilitate this infant industry.
- End-state TE rate structures envisioned to be consistent with remaining customers' rate structures.

Rate Proposal

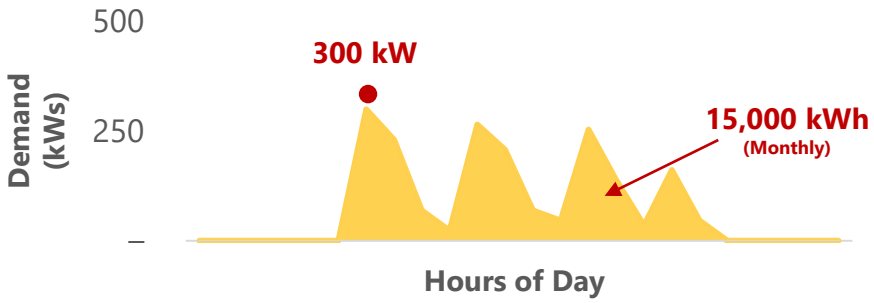
Illustrative

Sample Rates

	Short Term	Long Term (Cost Based)
Demand ($/kW)	X	$10.00
Energy ($/kWh)	$0.15	$0.10

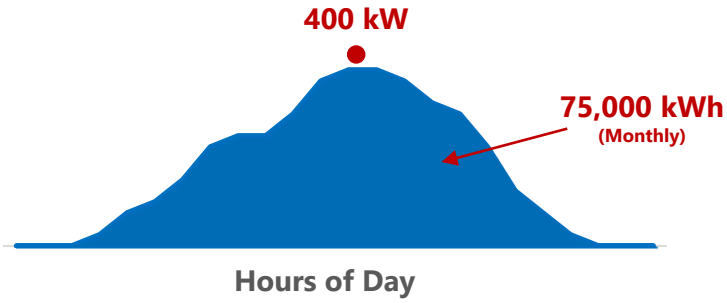
Early Deployment Stage

X 5



Full Deployment with Load Management

X 20



Monthly Bill

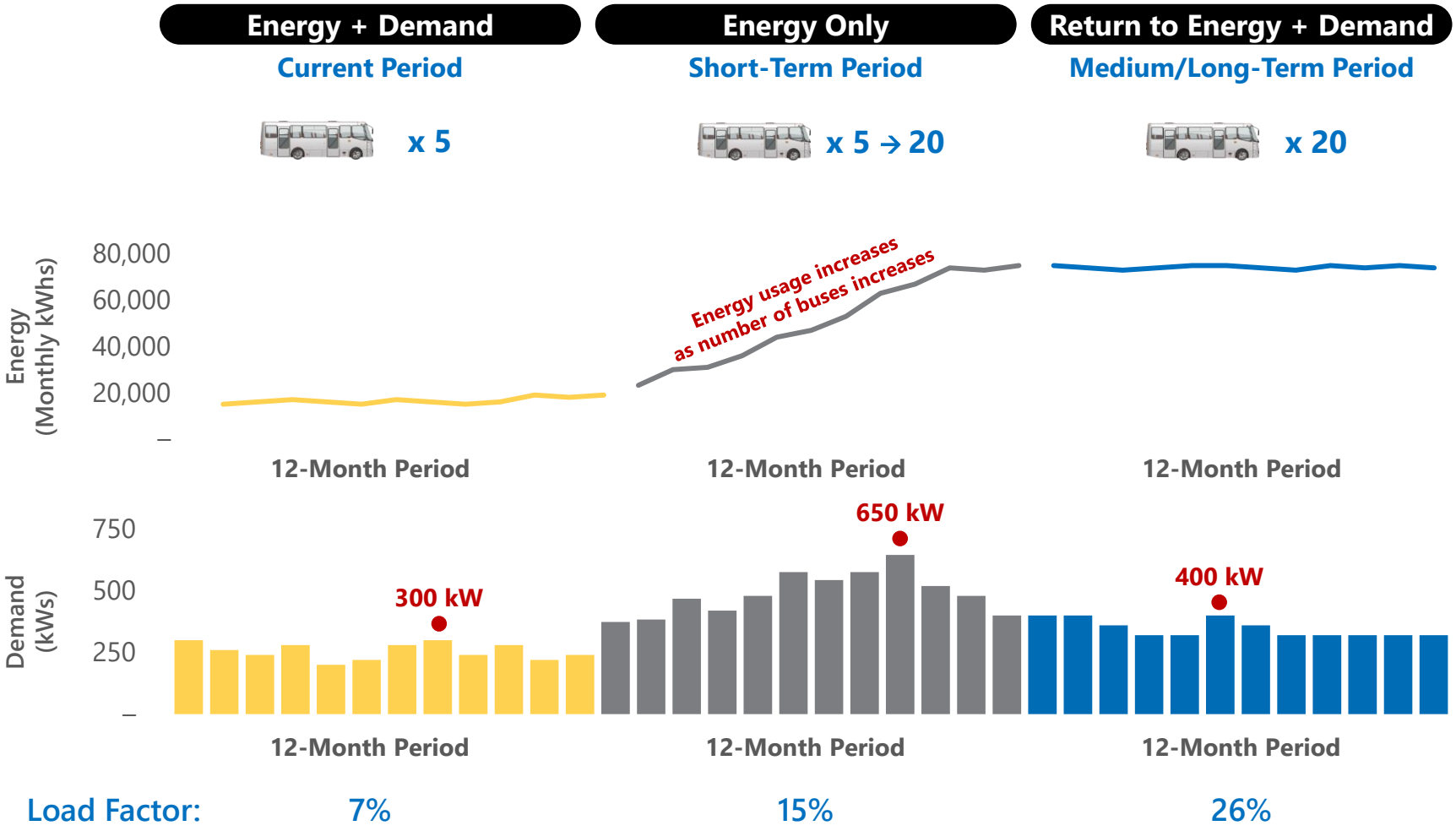
Bill Component	Short Term	Long Term	Short Term	Long Term
Demand Charge	X	$3,000	X	$4,000
Energy Charge	$2,250	$1,500	$11,250	$7,500
Total Bill	**$2,250**	**$4,500**	**$11,250**	**$11,500**

50% Energy Bill Savings on Short Term Energy Only Rate

Customer will be indifferent as higher load factor (flatter load curve) is achieved

Life Cycle Schematic of ET Rate Proposal

Illustrative



SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

So We Ditch Demand Charges? – Not so fast!!

Consider the Supply-side Analogy

- A reliability must-run generator is paid based on their availability to provide capacity irrespective of how often they're actually called.
- If this structure did not exist, these services would not be provided.

All customers should pay a "fair-share" of capacity elements

- Energy-only Rates encourage uneconomic by-pass, especially after a scaling up of rates to recover the authorized functional revenue requirement.
- One way to address this issue is to extend the partially resourced customer treatment (e.g. Stand-by rate structure with its own separate rate group) currently in place for large cogeneration customers to other partially resourced customers.
- Basis of an Arizona Decision (2016) and near all-party Settlement (2017).

Questions?

Appendix

SCE's Optional Rate Designs Favorable for Electric Transportation

Rate Schedule	Maximum Demand (Voltage Level)	Applicability	Rate Structure
TOU-EV-3	≤ 20 kW	Applicable for businesses solely for the charging of EVs on a premise or public right of way where a separate SCE meter to serve EV charging facilities is required	• Customer Charge; • TOU Energy Charges; • Time-related Demand Charge (TRD); • Facilities-related Demand Charge (FRD); • Option B includes a FRD Charge Offset 3/
TOU-EV-4	21 -500 kW		• Customer Charge; • TOU Energy Charges; • FRD Charge; • Includes a FRD Charge Offset 3/
TOU-EV-6	> 500 kW (Secondary, Primary, Subtransmission)		
TOU-EV-7 1/	≤ 20 kW		• Customer Charge; • TOU Energy Charges; • 5-year intro period w/ no demand charge, followed by 5-year phase-in of demand charges; • At the end of the 10th year, rate will include FRD demand charge to collect 60% of all distribution capacity costs; the remaining 40% will be collected through TOU energy charges
TOU-EV-8 1/	21 -500 kW		
TOU-EV-9 1/	> 500 kW (Secondary, Primary, Subtransmission)		

SCE's Optional Rate Designs Favorable for Electric Transportation (cont.)

Rate Schedule	Maximum Demand (Voltage Level)	Applicability	Rate Structure
TOU-8-Option A	> 500 kW (Secondary, Primary, Subtransmission)	Applicable to customers who participate in Permanent Load Shifting (PLS), Cold Ironing pollution mitigation programs or the charging of zero emissions electric transportation intended for the transport of people or goods.	• Customer Charge; • TOU Energy Charges; • FRD Charge
TOU-EV-1	N/A	Applicable to residential customers exclusively for the charging of electric vehicles on a separate meter	• Customer Charge; • TOU Energy Charges
TOU-D-C [2/]	N/A	Applicable to residential customers; whole-house rate targeted for higher-usage customers, including those with EVs.	• Customer Charge; • TOU Energy Charges

1/ Pending CPUC approval in SCE's Transportation Electrification Application (A.17-01-021).

2/ Pending CPUC approval in SCE's 2018 GRC Phase 2 Application (A.17-06-030).

3/ Waives demand charges for EV charging if the EV demand does not exceed the demand of the associated facility. This structure helps the customer control their electricity costs associated with demand charges.

Committee on Energy Resources and the Environment

NARUC Summer Policy Summit