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Public Utility Commission of Texas

Memorandum

TO: Chairman Peter M. Lake
Commissioner Will McAdams
Commissioner Lori Cobos
Commissioner Jimmy Glotfelty

Interested Parties

FROM: Ben Haguewood, Market Analysis

DATE: September 16, 2021

RE: **Work Session for September 16, 2021**
Project No. 52268 – *Workshop Agenda Items Without an Associated Control Number*
Project No. 52373 – *Review of Wholesale Electric Market Design*

Attached are the slides for the Work Session being held September 16, 2021.

Overview of Demand Response in ERCOT

Kenan Ögelman
VP, Commercial Operations,
ERCOT

September 16, 2021

Various categories of Demand Response

Administered by ERCOT

- ✓ Load Resource Participation in ERCOT's Ancillary Services and Real-Time energy market
- ✓ Emergency Response Service (ERS)

Non-ERCOT Administered

- ✓ TDSP Load Management Programs
- ✓ 4-Coincident Peak (CP) Load Reduction
- ✓ Price-responsive Demand response
- ✓ Distributed Generation Price Response

Demand Response (administered by ERCOT)

Load Resource Participation in ERCOT's Ancillary Services and Real-Time energy market

- Controllable Load Resources (CLR) – Load Resources capable of following SCED base points
  - 6 CLRs ≈ 300 MW of registered capacity
  - Does not include Energy Storage (charging CLRs)
- Non-Controllable Load Resources – Blocky loads with both a 10-minute ramp capability for manual deployments and automatic deployment through Under Frequency Relay
  - 600+ Load Resources with ≈ 7,000 MW of registered capacity
  - General observation across Summer Peak
    - Willing Participation (Offers+Self Arranged) ≈ 3,100 MW
    - Actual Participation (Awards+Self Arranged) ≈ 1,380 MW
    - Available Quantity from Willing Participation ≈ 1,720 MW

Demand Response (administered by ERCOT)

Emergency Response Service (ERS)

- 4 ERS service types (Non-Weather Sensitive-10, Non-Weather Sensitive-30, Weather Sensitive-10, Weather Sensitive-30)
- Currently 3 four-month Standard Contract Terms (SCT) per year
  - December 2021, changing to 4 SCT's per year
- Procure 8 time periods per SCT
- $50 Million/yr spend limit
- ≈1000 MW and 24,000+ sites are typically participating
- Only procure Weather Sensitive types during peak time periods during Winter and Summer Standard Contract Terms

TDSP Load Management Programs

- Programs administered by the 4 Transmission and Distribution Service Providers (Oncor, CenterPoint, AEP, TNMP)
- Programs are available:
  - Weekdays only from June 1 through September 30
  - Between the hours of 1 p.m. to 7 p.m.
- Historically ≈ 250-350 MW available
- 2021 estimated at:
  - 303 MW Jun-Jul
  - 324 MW Aug-Sep
- Deployed through ERCOT instruction during Energy Emergency Alert Level 2

4-Coincident Peak (CP) Load Reduction

- The Four Coincident Peaks in ERCOT are the highest-Load 15-minute settlement intervals in each of the four summer months (June, July, August, September)

- Current estimated value of 1 MW 4CP load Reduction for a Transmission connected IDR customer on Oncor's system ~$38,000

4CP Days

Date	ESIIDs	NOIEs	HE 17 Reduce MW
8-Jun	3,711	20	1,880
13-Jul	3,429	19	2,765
13-Aug	3,691	20	2,416
1-Sep	5,200	20	2,803

NearCP Days

Date	ESIIDs	NOIEs	HE 17 Reduce MW
5-Jun	3,771	12	912
9-Jun	4,812	18	1,961
1-Jul	3,691	20	1,148
2-Jul	3,940	10	1,472
8-Jul	2,542	8	722
9-Jul	2,934	13	1,135
10-Jul	3,455	12	1,324
14-Jul	2,863	18	1,399
6-Aug	2,837	13	1,495
7-Aug	3,462	13	1,479
10-Aug	3,783	18	1,642
11-Aug	3,754	20	1,980
12-Aug	3,690	19	2,358
14-Aug	3,804	21	2,590
28-Aug	3,432	17	2,275

*The 4-CP days in the tables above are from 2020

REP/NOIE Demand Response + 4CP

- September 1, 2020 – Largest system wide DR response in 2020 - 2860 MW
- 4CP day with high prices in South Zone only
  - High price > $200
- Greatest contributor was 4CP response

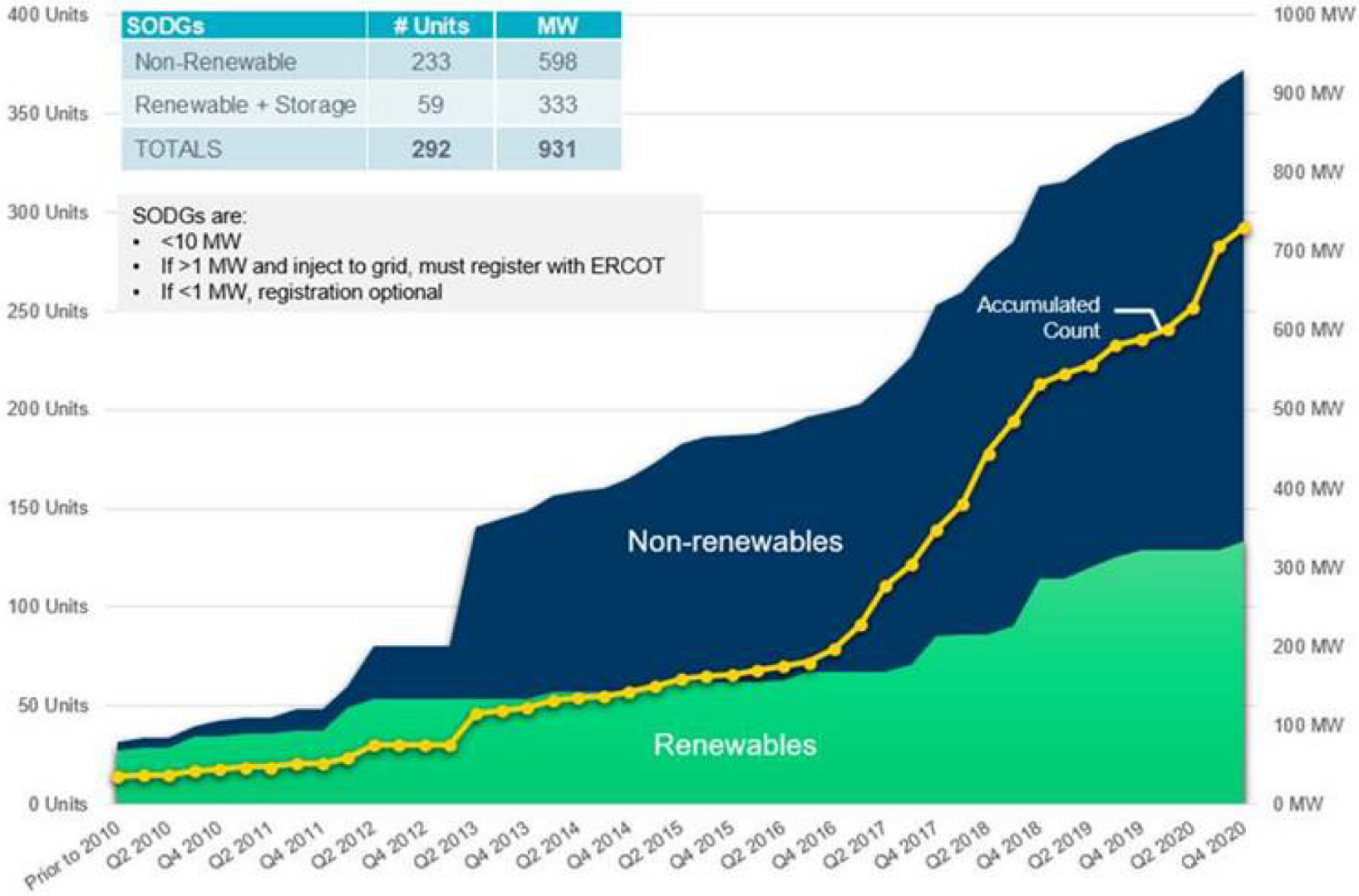
Day	Day Type	Total System DR	4CP Competitive	4CP NOIE	Indexed Real-Time (IRT)	Indexed Day-Ahead (IDA)	NOIE Price Response	Peak Rebate (PR)	Other Direct Load Control (OLC)	Category Total	Overlap
1-Sep-20	4CP, High Prices (South)	2,860	1,355	1,448	65	-	967	0	41	3,876	1,015

Observation: High price days rarely occur on 4CP days during years with greater reserve margin

Settlement-Only Distributed Generation in ERCOT 2010-2020

SODGs	# Units	MW
Non-Renewable	233	598
Renewable + Storage	59	333
TOTALS	**292**	**931**

SODGs are:
- <10 MW
- If >1 MW and inject to grid, must register with ERCOT
- If <1 MW, registration optional



FERC Order 2222

- This rule enables DERs to participate alongside traditional resources in the regional organized wholesale markets through aggregations, opening U.S. organized wholesale markets to new sources of energy and grid services.
- This rule also allows several sources of distributed electricity to aggregate in order to satisfy minimum size and performance requirements that each may not be able to meet individually.
- ERCOT has implemented rules pertaining to Distributed Generation separately from Demand Response
- ERCOT is closely monitoring development in other regions

Key Issues for Demand Response

- Price Responsive Demand Response misaligned with local reliability objective
  - Demand Response today responding to Zonal price versus Locational Marginal Price (LMP) signal
  - Demand Response can play more effective role in resolving local reliability issues
  - Misalignment may be exacerbated by sharp increases in localized loads (e.g., construction of large data mining facilities)
- 4-Coincident Peak (CP) Load Reduction
  - Historically, Peak Load hours and energy scarcity hours coincided
  - Scarcity hours in summer continue to shift from *Peak Load hours* to *Net-Peak Load hours,* which raises a question about the long-term efficacy of 4-CP Load Reduction
- Explore removal of 60% limit on Load Resources providing RRS
  - Requires NPRR
  - NPRR939 implementation needed to stagger NCLR Load Resource deployment
  - Minimum 1420 MW of RRS requirement will continue to remain

Recent Demand Response Developments

- Enable NCLRs to participate in Non-Spin
  - NPRR1093 Load Resource Participation in Non-Spinning Reserve has been submitted
- ERCOT Contingency Reserve Service (ECRS) implementation will enable more Load Resource participation
  - Current implementation schedule is post EMS Upgrade
- Implement NPRR939 to allow ERCOT to deploy Load Resources providing Responsive Reserve Service in multiple ~500 MW tranches
- Aggregated Load Resources
  - Recent interest from DR providers to aggregate residential or commercial loads like A/C or water heaters to provide Ancillary Services
  - Interest also includes adding rooftop PV & batteries
  - Most significant issues are around validation rules for performance and size of aggregation

Thank You!

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Public Utility Commission of Texas Work Session

Overview of Investor Owned Utilities' (IOU) energy efficiency portfolios, focusing on demand response offerings

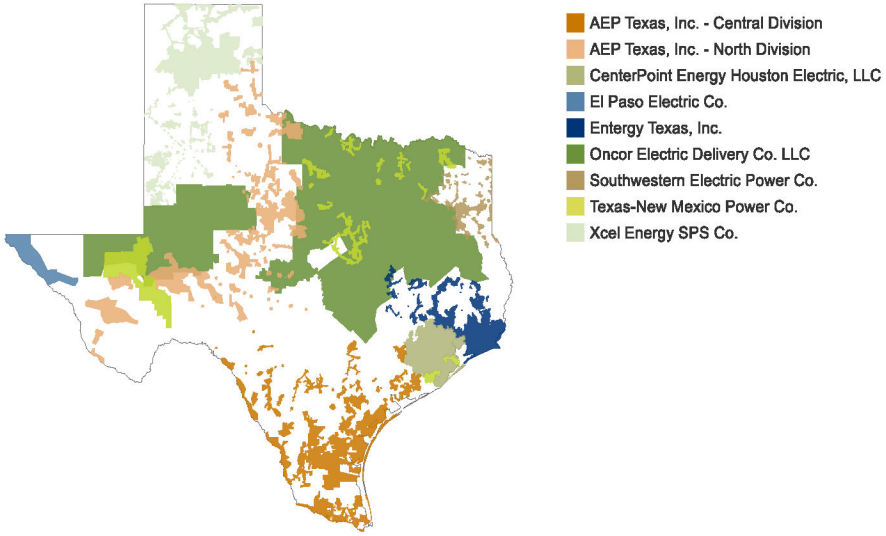
September 16, 2021

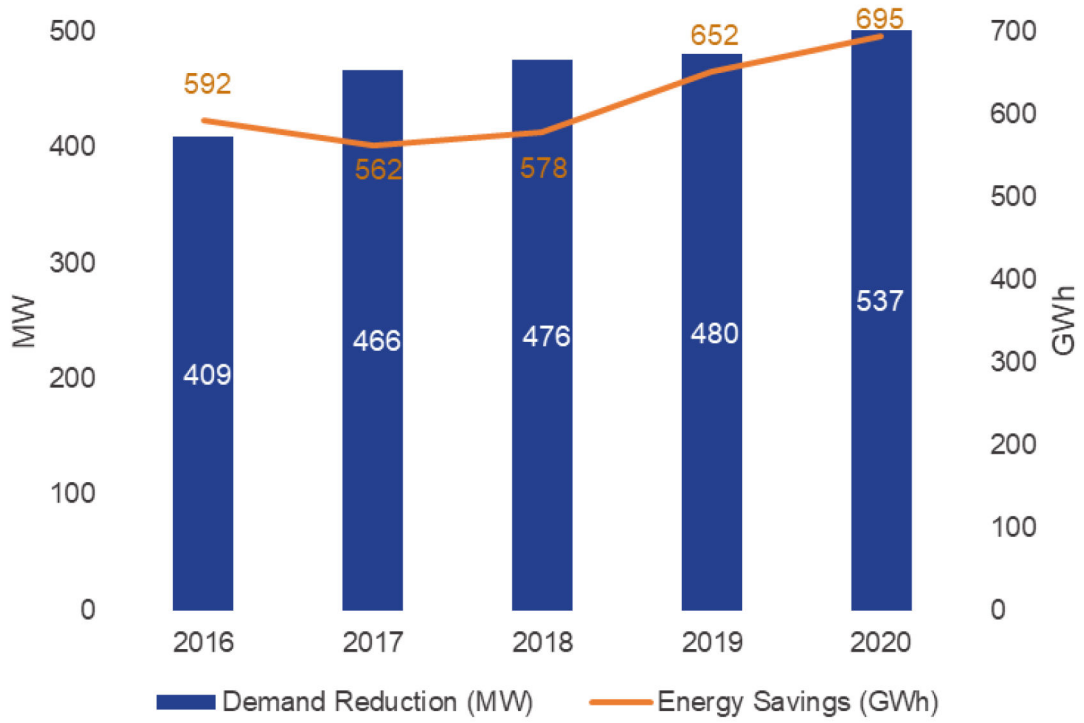



Cover photos: pixabay.com

Texas IOU Energy Efficiency History

- The Public Utility Regulatory Act (PURA) Section 39.905 first established long-term goals in 1999 for the IOUs
  - Since 2013, "floor" of 30 percent of demand growth or 4/10th of 1% of summer peak
  - Due to consistent demand growth, IOUs are generally pursuing larger kW and kWh reductions
  - 16 TAC § 25.181 relating to the Energy Efficiency Goal





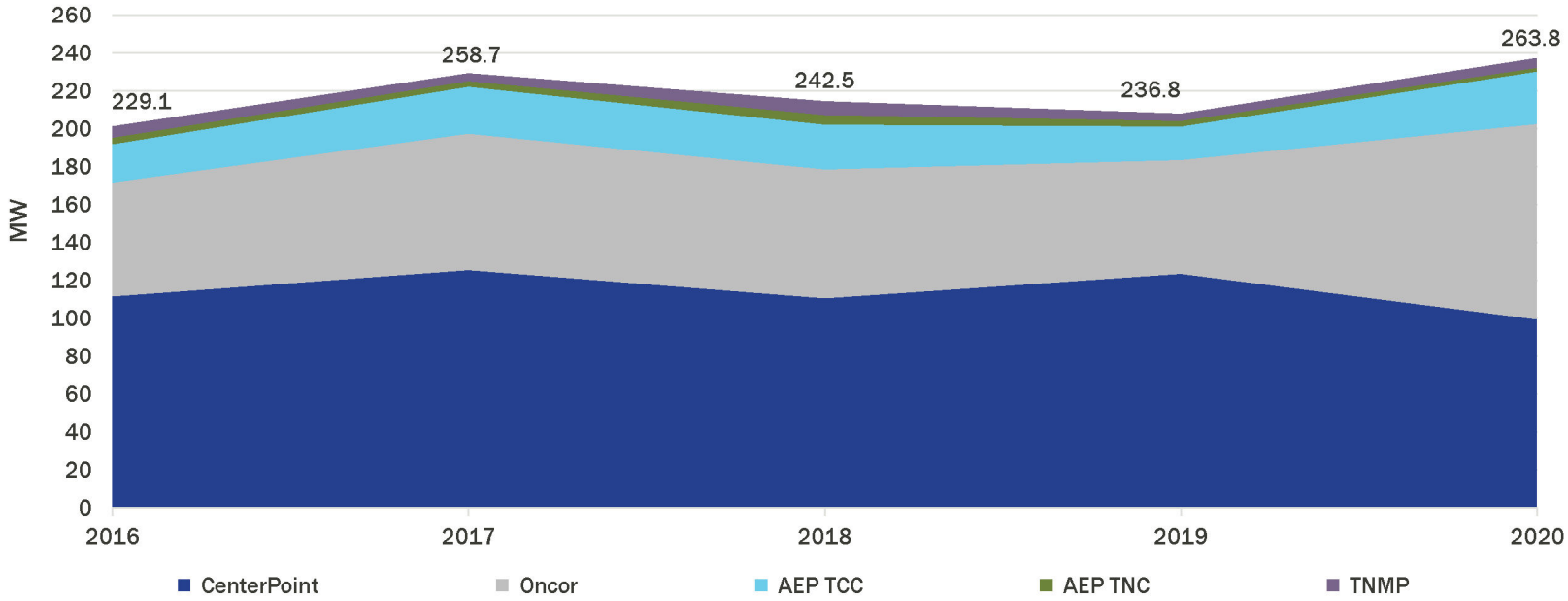
In 2020, IOU energy efficiency programs delivered 537 MW in peak demand reductions

328 MWs are from summer load management/ demand response

- Eighty percent of which is commercial programs

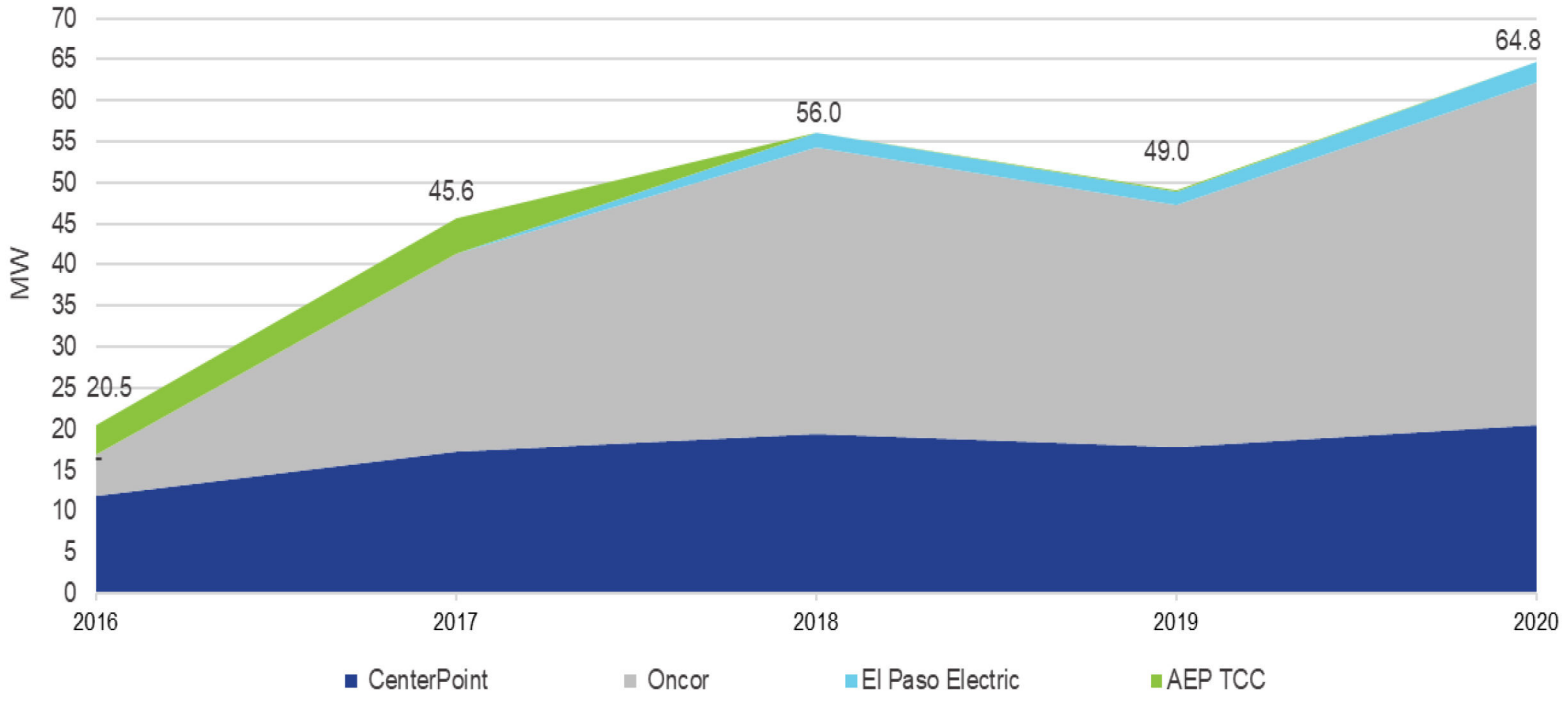
Lifetime savings cost are approximately $12 per kW.

ERCOT IOU Commercial Load Management Programs



Program Year	Participant Count
2016	561
2017	531
2018	474
2019	666
2020	705

IOU Residential Demand Response Programs



ENERGY EFFICIENCY EVALUATION, MEASUREMENT &VERIFICATION (EM&V)

Senate Bill 1125 2011

established the requirement for an EM&V framework

Rule-making 2012

Commission Energy Efficiency Rule 25.181

PUCT selects and oversees EM&V contractor

Annual EM&V since 2013

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Appendix:
IOU Load Management and Demand Response Programs Summary Information

Cover photos: pixabay.com

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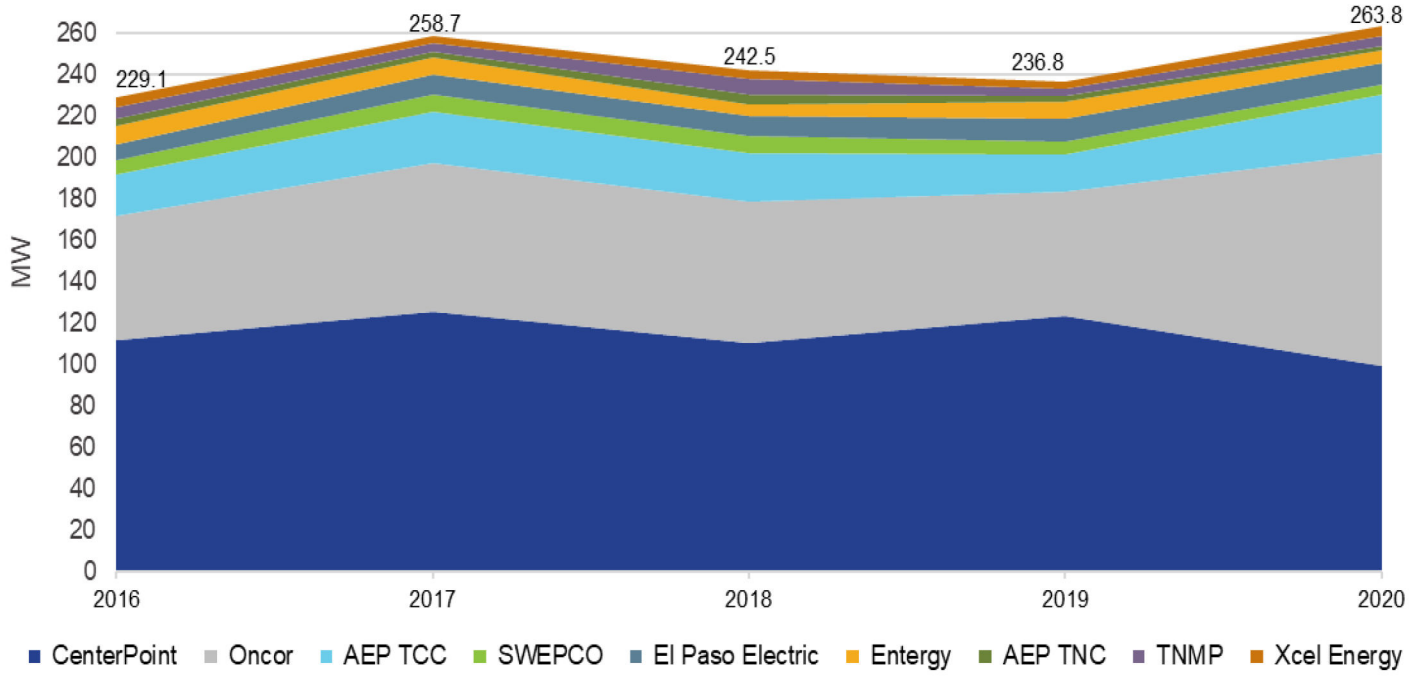
Commercial Load Management

Cover photos: pixabay.com

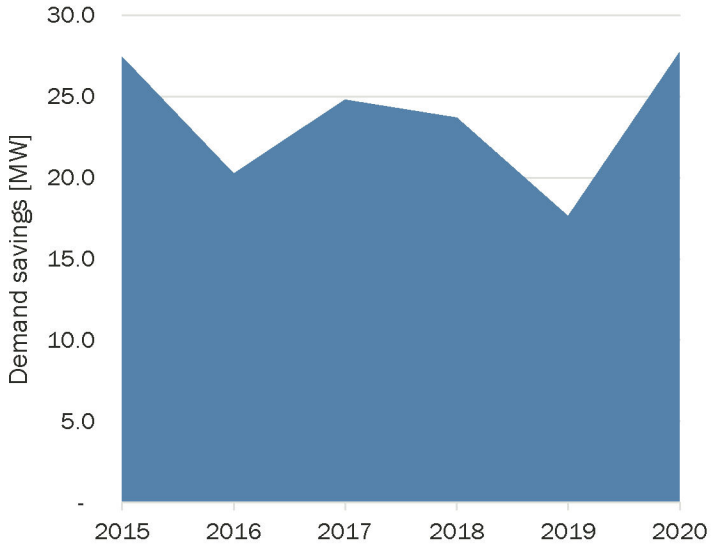
All IOU Commercial Load Management Programs



AEP TCC

Commercial Load Management Program

- Project Sponsors enter an agreement to deliver demand savings during summer peak demand.
  - 1-7pm
  - June – September
- Requires a scheduled 1 hour test interruption.
  - Takes place in May
  - Used for incentive calculation if there is no unscheduled interruption.
- Up to four unscheduled interruptions.
  - One hour minimum
  - Two to four hour maximum
- 30-minute advanced notice is given prior to the start of the interruption (new in 2020, previously an hour notification was provided).

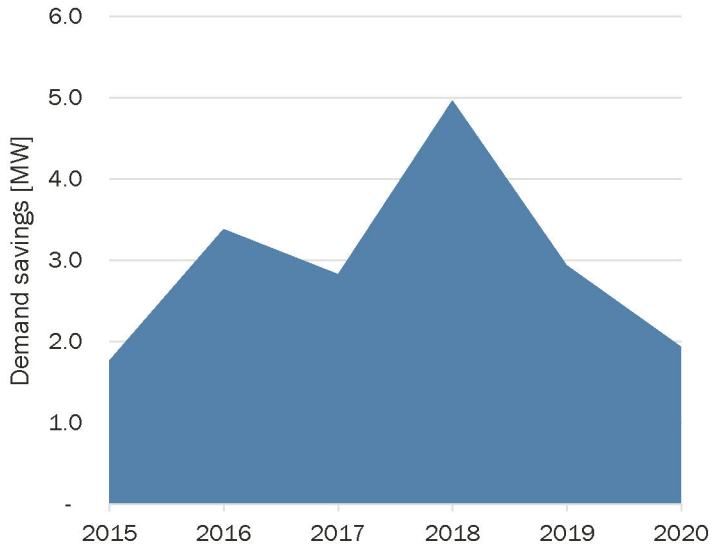


Program Year	Participant Count
2015	31
2016	62
2017	65
2018	61
2019	81
2020	82

AEP TNC

Commercial Load Management Program

- Project Sponsors enter an agreement to deliver demand savings during summer peak demand.
  - 1-7pm
  - June – September
- Requires a scheduled 1 hour test interruption.
  - Takes place in May
  - Used for incentive calculation if there is no unscheduled interruption.
- Up to four unscheduled interruptions.
  - One hour minimum
  - Two to four hour maximum
- 30-minute advanced notice is given prior to the start of the interruption (new in 2020).

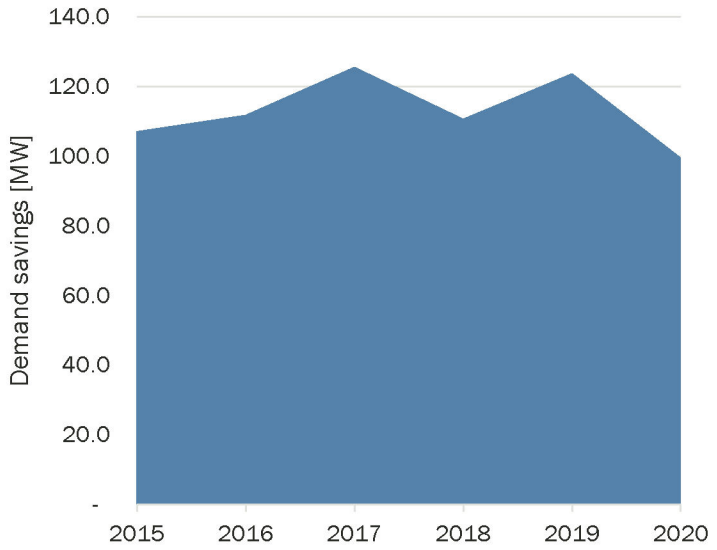


Program Year	Participant Count
2015	6
2016	17
2017	18
2018	21
2019	23
2020	21

CenterPoint

Commercial Load Management Program

- Project Sponsors enter an agreement to deliver demand savings during summer peak demand.
  - 1-7pm
  - June – September
- Scheduled interruptions
  - Maximum of two
  - One to three hour duration maximum.
- Unscheduled interruptions
  - Maximum of four
  - Up to four hour maximum per event.
- 30-minute advanced notice is given prior to the start of the interruption.

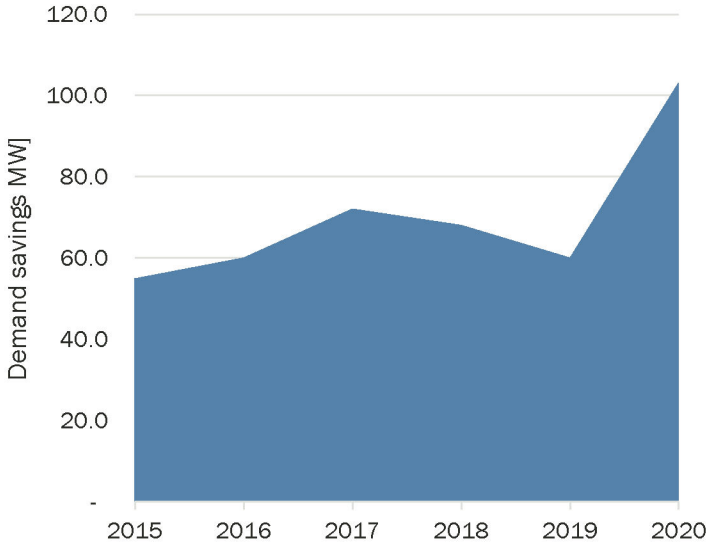


2	Participant Count
2015	264
2016	226
2017	239
2018	214
2019	238
2020	302

Oncor

Commercial Load Management Program

- Project Sponsors enter an agreement to deliver demand savings during summer peak demand.
  - 1-7pm
  - June – September
- Scheduled interruption
  - May or June
  - Maximum of one
  - Three hour duration maximum
- Unscheduled interruptions
  - No limit to number of events (maximum of 25 hours for the program year)
  - Up to four hour maximum per event
- 30-minute advanced notice is given prior to the start of the interruption.

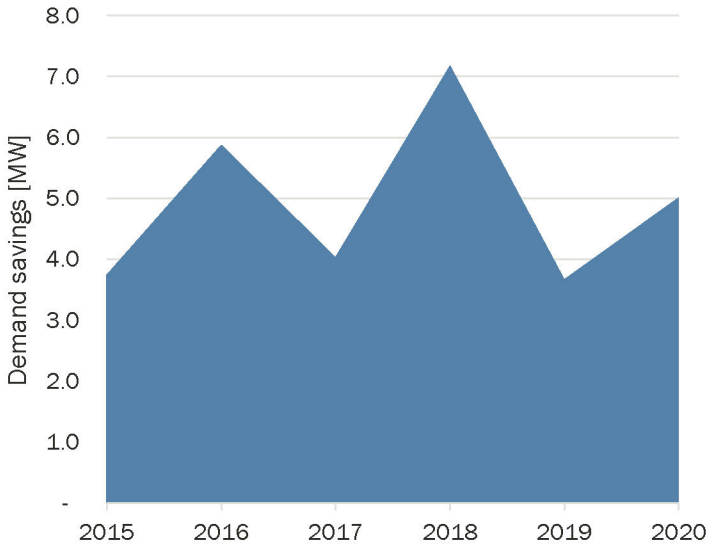


Program Year	Participant Count
2015	147
2016	161
2017	122
2018	139
2019	284
2020	256

TNMP

Commercial Load Management Program

- Project Sponsors enter an agreement to deliver demand savings during summer peak demand.
  - 1-7pm
  - June – September
- Scheduled interruption
  - Maximum of one
  - One-to-two hour duration maximum
- Unscheduled interruptions
  - Maximum of four
  - Up to four hour maximum per event
- 30-minute advanced notice is given prior to the start of the interruption.



Program Year	Participant Count
2015	81
2016	95
2017	87
2018	39
2019	40
2020	44

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Residential Demand Response

Cover photos: pixabay.com

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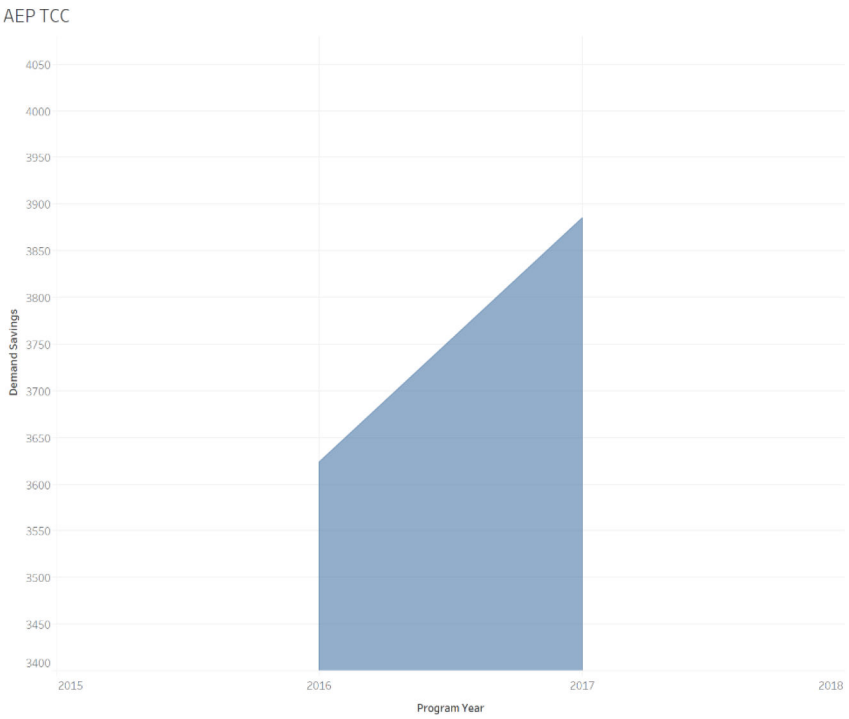
AEP TCC

Residential Demand Response Program

- This program ran in 2016-2017 but was discontinued for 2018.
- AEP TCC hired an implementer to deliver an integrated demand side management aggregation program.
- The implementer optimized smart thermostats to reduce HVAC load on days at the request of AEP TCC.
- Events were no longer than three hours long.
- At least one hour of notification was given.

Program Year	Participant Count
2016	2,578
2017	2,340

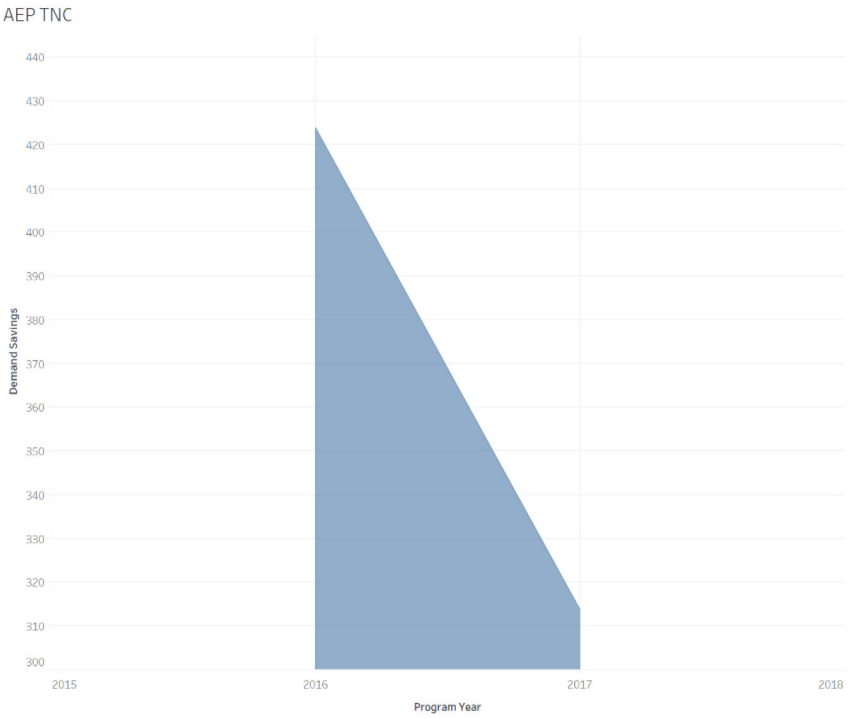


AEP TNC

Residential Demand Response Program

- This program ran in 2016-2017 but was discontinued for 2018.
- AEP TNC hired an implementer to deliver an integrated demand side management aggregation program.
- The implementer optimized smart thermostats to reduce HVAC load on days at the request of AEP TNC.
- Events were no longer than three hours long.
- At least one hour of notification was given.

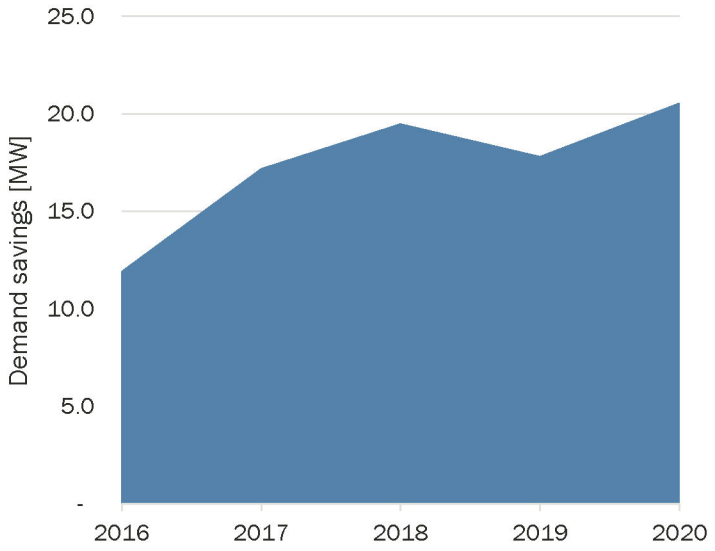
Program Year	Participant Count
2016	325
2017	304



CenterPoint

Residential Demand Response Program

- Program provides demand reduction during the summer peak period, when ERCOT issues an EEA2 emergency alert.
  - 1-7pm
  - June – September
- Scheduled interruption
  - Maximum of two
  - Up to four hour maximum per event
- Unscheduled interruptions
  - Maximum of five
  - Up to four hour maximum per event
- CenterPoint works with aggregators/vendors to enroll customers who wish to participate.
- Participants must bring their own Wi-Fi enabled smart thermostat.

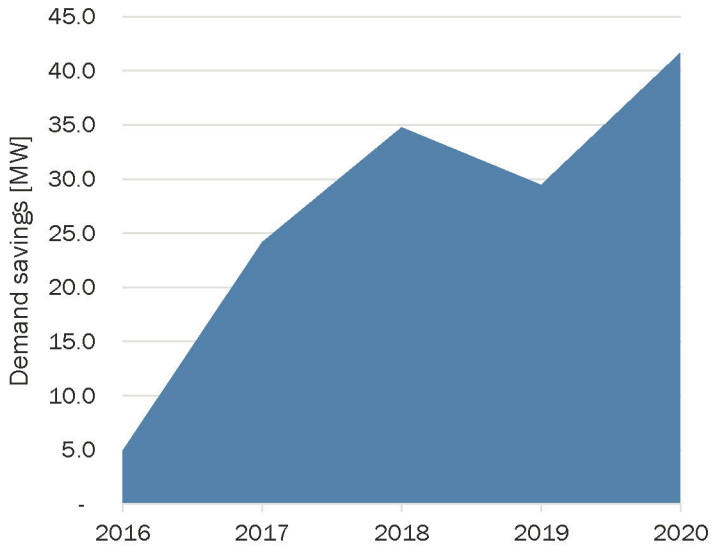


Program Year	Participant Count
2015	8,621
2016	10,874
2017	13,974
2018	15,143
2019	18,203
2020	18,790

Oncor

Residential Demand Response Program

- Program provides demand reduction during the summer peak period, when ERCOT issues an EEA2 emergency event or to prevent outages.
  - 1-7pm
  - June – September
- Scheduled interruption
  - May or June
  - Maximum of one
  - Three hour duration maximum
  - An additional scheduled event may be called in case of no unscheduled events
- Unscheduled interruptions
  - No limit to number of events (maximum of 25 hours for the program year)
  - Up to four hour maximum per event
- 30-minute advanced notice is given prior to the start of the interruption.



Program Year	Participant Count
2015	4,001
2016	7,062
2017	22,270
2018	26,482
2019	32,395
2020	34,578

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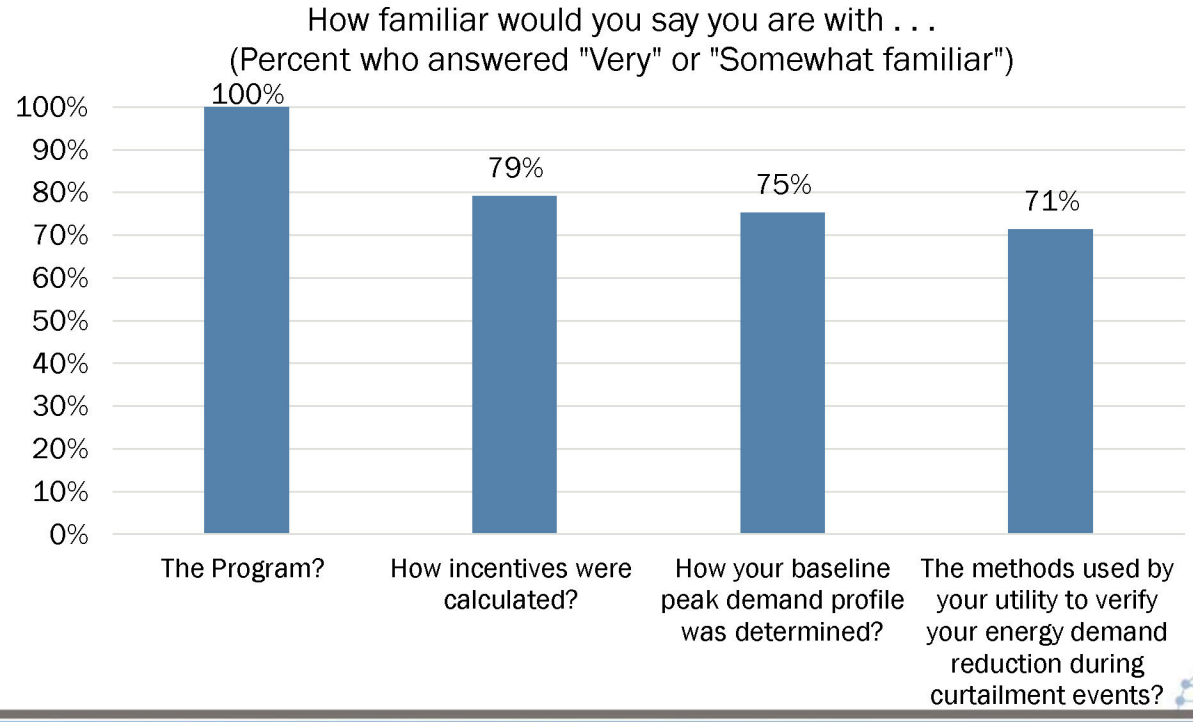
2019 Participant Survey Results

Cover photos: pixabay.com

Commercial Program Participation & Awareness

Commercial Load Management Program

- Nearly all respondents attributed their source of program awareness to three main sources (multiple sources were allowed): a previous participant (54 percent), their utility (33 percent), or their Energy Services Company (30 percent).
- All respondents reported being either “Very” or “Somewhat familiar” with the program overall, and most indicated they are familiar with program elements.



The Participation Process

- We asked Commercial respondents to quantify how many curtailment events they thought were called this past summer.

Utility	Total Completes	PY2018 Cycling Events: Actual	PY2018 Cycling Events: Estimated
AEP TCC	13	2	12.9
AEP TNC	2	1	1.5
CenterPoint	18	2	6.6
El Paso Electric	8	2	2.6
Entergy	7	3	2.3
Oncor	13	1	2.0
SWEPCO	5	3	2.6
TNMP	6	1	4.2
Xcel SPS	5	1	1.8
Totals	77	16	4.1

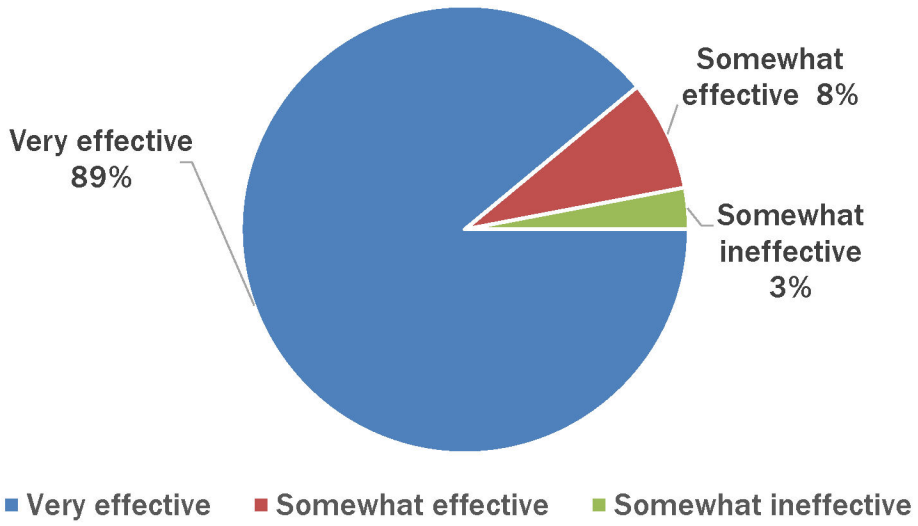
- One-third (34 percent) correctly identified the number of PY2018 program events. The mean respondent event estimate by utility appears in the table to the left.
- Over half (56 percent) indicated the number of events was “about what I expected”, while another 36 percent said there were fewer events than expected.

The Participation Process

Commercial Load Management Program

- We asked respondents to report how they were notified of curtailment events in PY2018. Respondents could select more than one notice method. Seventy-three percent of respondents confirmed they got program emails, while 62 percent received texts. Fifty-six percent received phone calls.

How effective was the process by which you were notified of curtailment events? (n=73)



- Ninety percent of respondents said that they were able to reduce their energy usage for all program events.

Program Satisfaction

Commercial Load Management Program

- We asked respondents to use a 0 to 10 scale, with 0 being “very dissatisfied” and 10 being “very satisfied”, to rate their satisfaction with the program and then with their utility.
- Overall program satisfaction is high. More than four out of every five respondents (87 percent) rated their overall program satisfaction an 8 or more.
- Nine out of every ten respondents (90 percent) rated their overall experience and satisfaction with their UTILITY an 8 or more.

Overall Program Sat Mean: 9.0

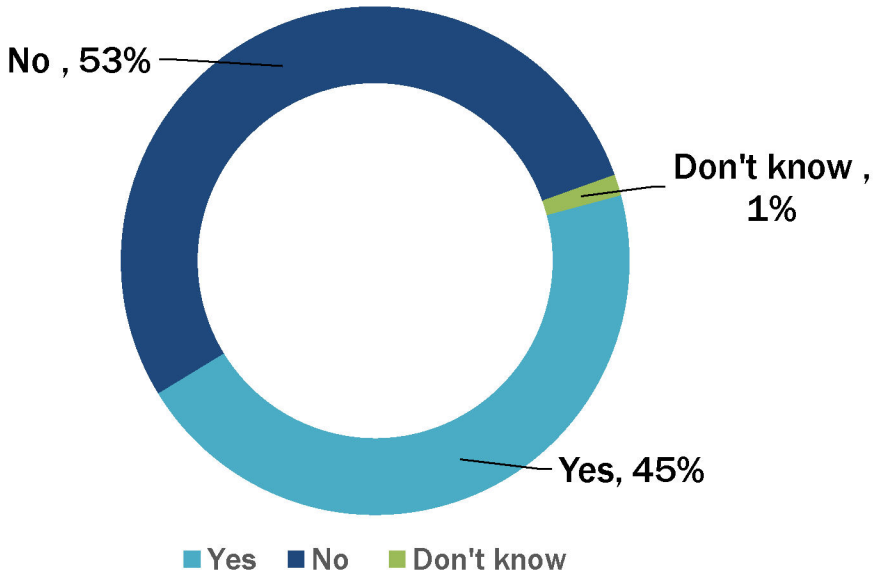
Overall Utility Sat Mean: 8.7

Additional Satisfaction Metrics

Commercial Load Management Program

- Despite generally high satisfaction with the program and their utility, the majority of respondents (53 percent) have not recommended the program to others.

Have you recommended the program to others? (n=77)



Residential Program Participation & Awareness

- Email, their smart thermostat vendor, or family and friends were the top three sources* of program awareness named among Residential Program respondents.

Email: 33%

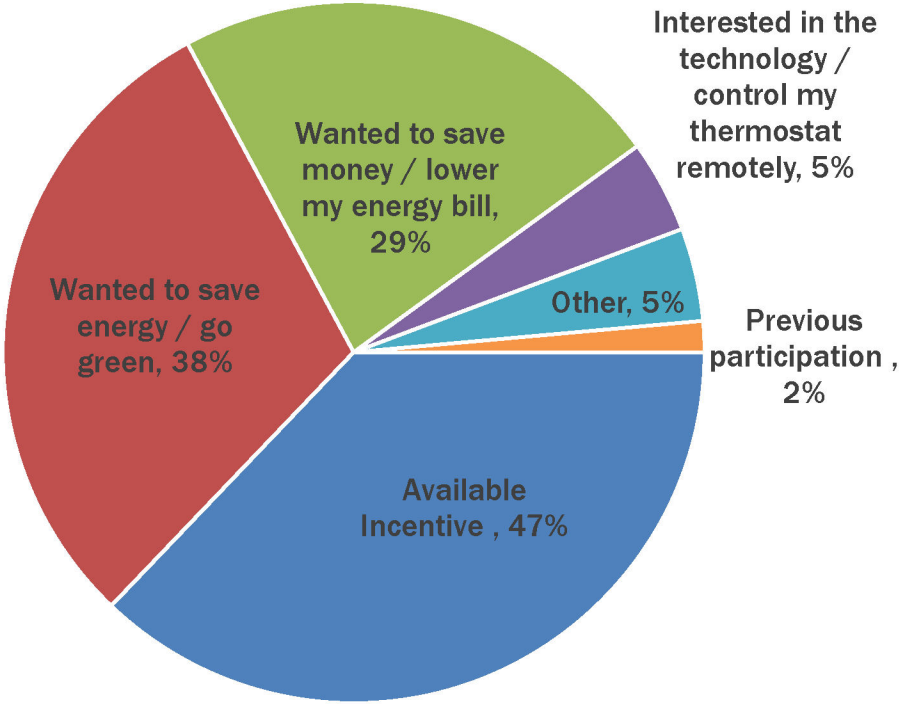
Smart Thermostat Vendor: 27%

Family or Friends: 17%

- At least five respondents each said they heard about the program through these sources: Other home energy or products vendor (i.e., Vivint, Reliant, Tri-Eagle Energy) and Other utility communication (i.e., email, social media, etc.)

* Multiple responses were allowed; responses total more than 100 percent.

Residential Program Participation & Awareness



* Multiple responses were allowed; responses total more than 100 percent.

Residential Participation Process

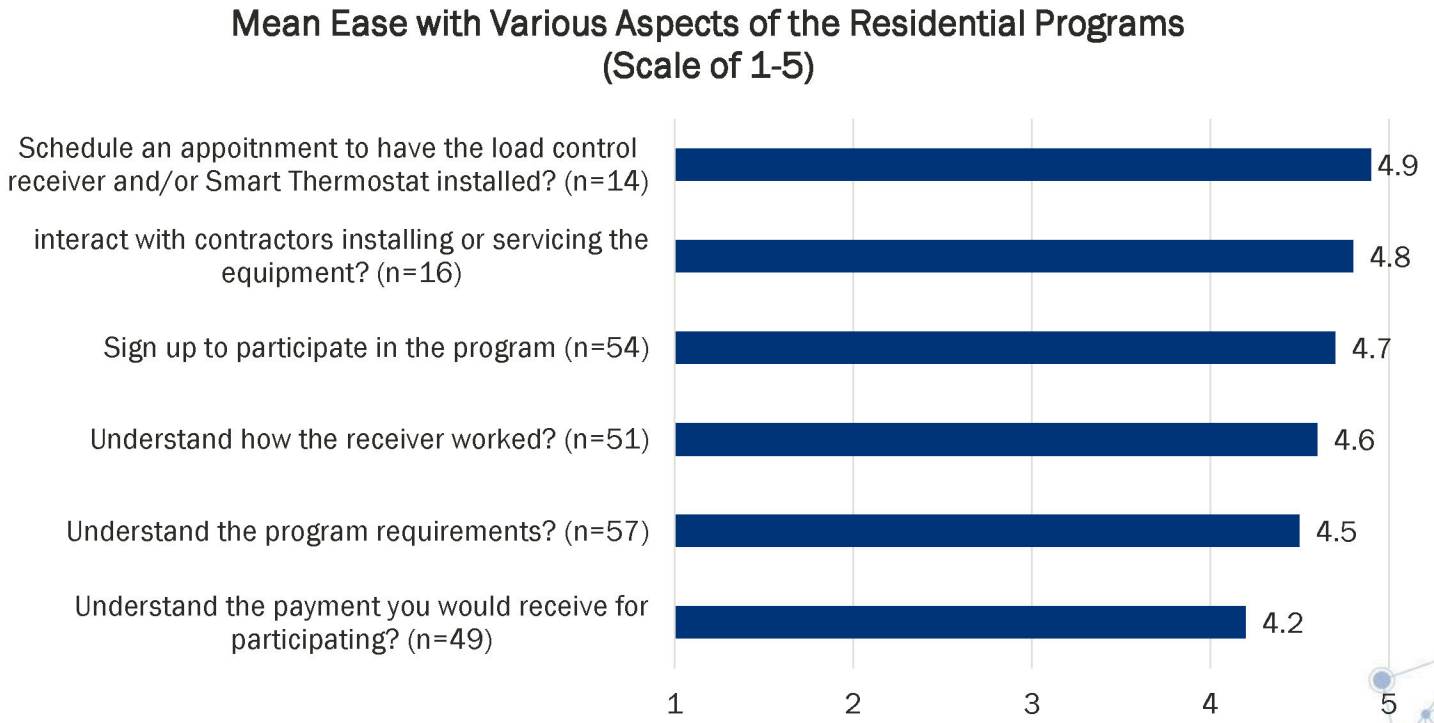
- We asked respondents to quantify how many cycling events they thought were called this past summer. Just over one-third (36 percent) reported they did not know.
- Respondents who did answer the question consistently chose a value higher than the number of actual cycling events for their utility territory.

Utility	Respondent (n)	PY2018 Cycling Events	
		Actual	Recalled (mean)
CenterPoint	14	2	16.5
El Paso	31	12	14.3
Oncor	14	1	3.1
Totals	**59**	**15**	**11.3**

Customers' perceptions of event quantities did not appear to impact their program experience. . .

Residential Participation Process

- We asked respondents to use a 1 to 5 scale, with 1 being "very difficult" and 5 being "very easy" to rate their experiences interacting with the program.

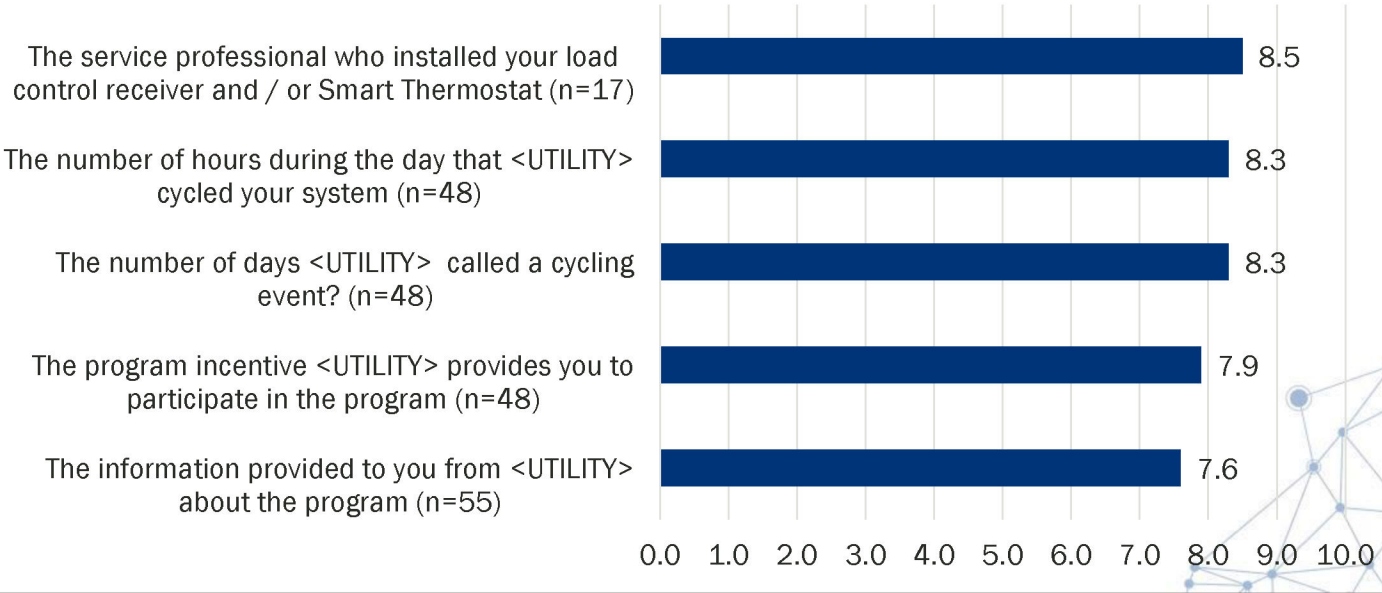


- Eighty-one percent of respondents said that they did not have any initial concerns about the program.

Residential Program Satisfaction

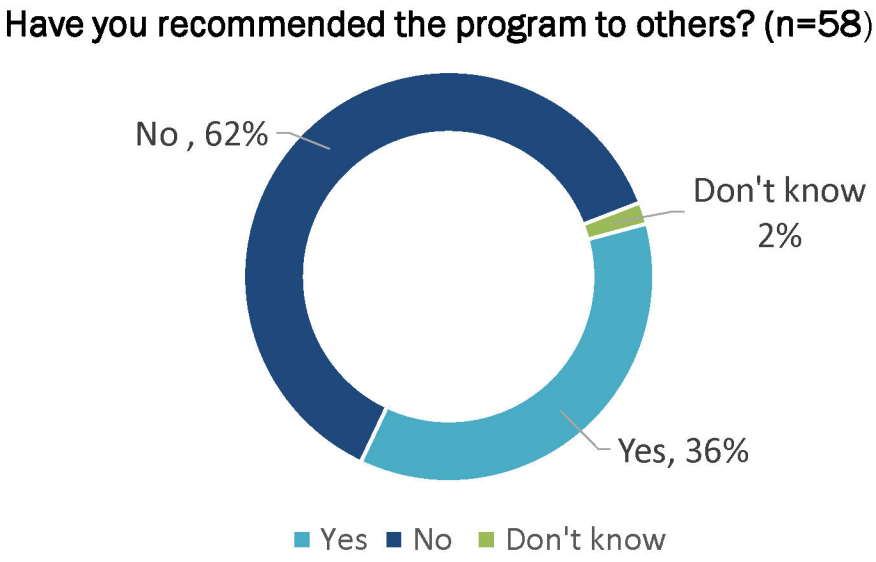
- We asked respondents to use a 0 to 10 scale, with 0 being "very dissatisfied" and 10 being "very satisfied" to rate their satisfaction with the program.
- Overall program satisfaction is high. Four out of every five respondents rated their overall program satisfaction an 8 or more, and respondents reported their mean program satisfaction at 8.5.

Mean Satisfaction with Various Aspects of the Residential Programs
(Scale of 0-10)



Additional Satisfaction Metrics

- Nearly all respondents (95 percent) plan to continue their participation in the Residential Demand Response Programs into this next program year.
- Despite generally high satisfaction with the program and the experience, respondents do not widely report recommending the program to others.



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Questions?

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Energy Efficiency, Demand Response and Distributed Energy Resources in ERCOT: Tools and Opportunities to Help the Public

Cyrus Reed, Conservation Director, Sierra Club

September 16, 2021

Workshop, Public Utility Commission of Texas

Don’t forget the public: Focusing on Demand-side is just one good first step

- People’s livelihoods, health and in some cases their lives were put on the line by what happened during and after Winter Storm Uri
- As the Public Utility Commission of Texas, we can not forget the public, and in particular residential consumers who will bear the brunt of failures, particularly those living in older homes or apartments, who have limited incomes, and may have underlying health conditions, or be faced with other threats from climate impacts or pollution
- Sierra Club and many others ask that before you take any major reforms, you consider deliberate polling to see what residential consumers want to see in any changes
- We ask you have at least one “open” workshop at which any member of the public can make brief comments or presentations
- This hearing is evidence you are taking the demand-side of our electric grid seriously
- Focusing on demand side is very important: half the equation and in particular impacts residential consumers
- More than half of peak load is residential and small commercial heating and cooling.

PUC: Many tools in the toolbox

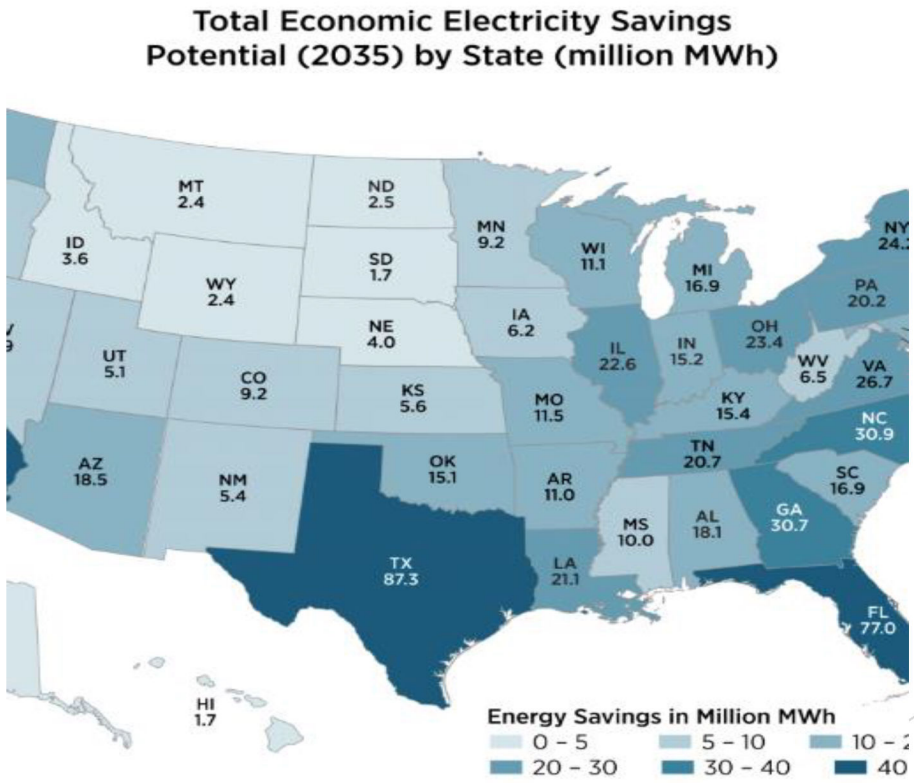
Category	TDU Energy Efficiency/Load Management Programs	ERS (Emergency Response Service)	Ancillary Services	Market/Other
Residential DR	Yes, but limited capability and summer only	Very limited in ERS program	Commercial and industrial only, though efforts like non-controllable loads in non-spin could be expanded.	Limited Price-Responsive, some NOIE programs, limited use of SMART meters
Energy Efficiency	Based on 20% capacity factor of 0.4 percent peak goals	NA	NA	NOIE programs, Federally-funded weatherization programs, SECO Building Code efforts
Distributed Generation	N	Yes	Mainly Storage	NOIE programs, new investments in storage, community solar
Behind-the-meter Distributed Generation	Some limited solar/storage incentives	Yes	NA	NOIE, New entries to market

What does the Energy Efficiency Rule say?

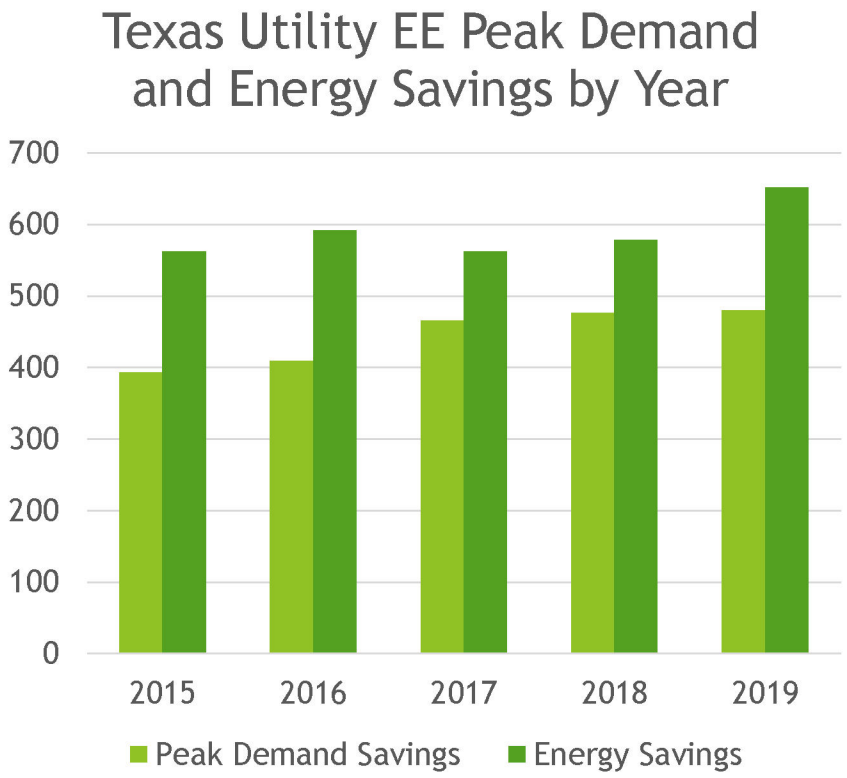
- **". . . ensure that all customers, in all eligible customer classes and all areas of an electric utility's service area, have a choice of an access to energy efficiency alternatives that allow each customer to reduce energy consumption, peak demand, or energy costs. . . ."**

We can't have a resilient, reliable grid without focusing on where people live and work: residential and small commercial buildings

- Texas was first state to enact an Energy Efficiency Resource Standard (EERS) – a required goal for transmission and distribution utilities - but is now ranked 29th of all states on EERS policy
- Texas IOUs help reduce peak demand by nearly 600 MWs (a coal plant worth) but our potential is much greater
- Texas' goal is based on 0.4% of peak demand, and currently only achieves 0.19% energy savings
- **If Texas were to adopt a median goal of what other states do (1%) we would quintuple the amount of savings from our programs**
- NOIEs are required to report DR and EE programs but have limited programs as well, though CPS Energy and Austin Energy have been leaders and meet a 1 percent goal



Texas Energy Efficiency Goals & Programs: Big Success but Room for Growth



- In 2020, Tetra Tech, which evaluates all Public Utility Commission IOU Utility efficiency programs, found Texas utilities in 2019:
  - Reduced peak demand by 479,912 Kilowatts at lifetime savings cost of $16.94 per kW.
  - Reduced overall energy use by 651,950,647 Kwhrs at lifetime cost of $0.01 per kWh.
  - In highest rated programs, residential consumers saw energy use reduced by 10%
  - In highest rated program, low-income consumers saw 20% reduction in energy use
  - Previous studied have found a six-to-one benefit to the economy compared to cost of programs
  - Tens of thousands of jobs have been created through the EE programs, which include solar rebates, and are implemented by private, third-party independent businesses known as ESCOs

EE: Our First Fuel?

EE programs reduce the likelihood of a grid emergency by reducing peak demand. In the case of a grid emergency, or failure, EE programs keep people safer in their homes longer.

Another focus for Texas must be building codes.

PUC has the authority to change goals and programs.

EE and DR are two sides of the coin – EE reduces overall load, and DR deals with peaks. We need both.

- PUC programs have focused on commercial DR program that are mainly focused on 4-month summer period, even though rules allow for winter peaks
- Low-income and Hard to reach are limited but could be expanded
  - "Savings achieved through programs for hard-to-reach customers (consumers with incomes below 200% of federal poverty guidelines) shall be no less than 5% of the utility's annual demand reduction goal."
- Energy goal based on a 20% load factor. Very little energy savings and mainly focused on summer peak reduction. Can change to focus on energy savings.
- Energy Efficiency Cost Recovery Factors (EECRFs) Cost ceilings. Can change.
- PUC can refocus programs on energy saving and winter peak, including use of new technologies like storage, solar, and water heaters

Smart Meter Texas: Open it Up

- Texas – ie ratepayers --have invested literally billions in SMART Meters, yet most residential consumers have not been able to take advantage of programs which use this technology;
- Better and more timely access for retail electric providers, third-parties and customers, including through Home Area Networks, would expand the use of demand response;
- SMART Meters could be key to opening up economic Demand Response.

ERS: Double and Focus

- Emergency Response Service (ERS) includes both distributed generation as well as demand response programs
- Residential DR programs including 30-minute weather-sensitive load program that can be aggregated, have been very limited.
- Removing or doubling the cap, and growing weather-sensitive loads for reliability could help develop price-responsive programs in addition to reliability programs

Creating a market for residential DR

- Very limited residential DR In market, beyond ”Nights and Weekends Free”
- Texas retail focus is on low cost not flexible management programs
- PUCTX could create a requirement that all Load Serving Entities offer DR programs and create a statewide reliability requirement
- Just as we have created energy efficiency and renewable goals, we could create a statewide goal for all LSEs, including NOIEs and REPs, with trading allowed
- A 5% winter and summer peak residential DR goal is achievable

New Technologies at the Distributed Scale?

- PUCT and ERCOT have taken steps to create visibility on distributed generation but we have not yet taken steps to fully integrate DG in our markets and ancillary services. Allowing aggregation of DR and DG to fully participate could lead to a more resilient, flexible grid.

Category	Registration	Compensation	Unit Size	Amount, 2019
Unregistered DG	N	N	Less than 1 MW	850 MWs
Settlement-Only Distributed Generation	Y	Y on energy but only at settlement price	Less than 10 MW	850 MWs
Distribution Generation Resource	Y	Y on energy and ancillary	Less than 10 Mw	2 MWs in 2019 but more coming through storage

Comments on Residential DR

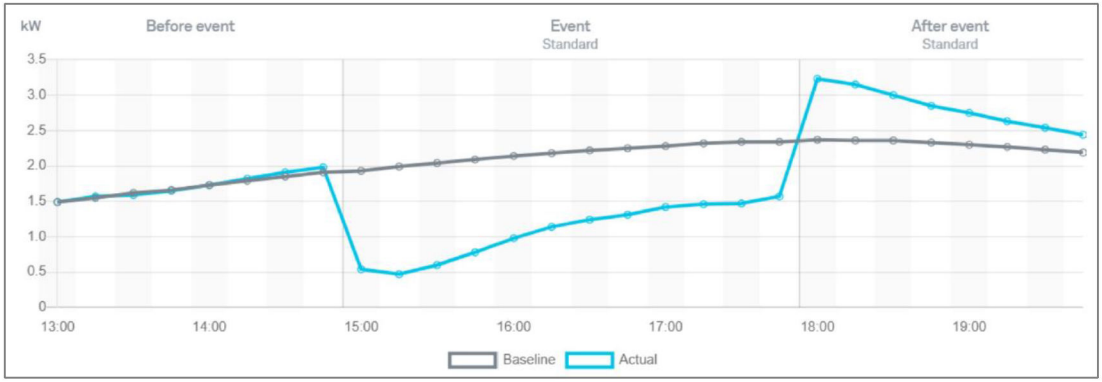
PUC Work Session, 9/16/2021

Our experience with DR

- What works
  - Device DR, where a device such as a thermostat is controlled and where a customer retains override capability
    - Very effective but is limited to customers who have that device
    - Customers want to retain the option to control/override
  - Behavioral DR, where a customer is given an incentive to conserve or shift their electricity usage
    - Depends on the customer to take action, and it can be used by a wide range of customers. Behavioral DR benefits from predictable high market prices, but is generally ineligible for other programmatic incentives (such as TDU EE/DR payments)
  - With either Device or Behavioral, load reductions of participating customers is consistently 20%-25%, or about 1 kW per customer
- What doesn't work – customers find these unattractive:
  - Detailed TOU rates – complicated and requires too much attention by the customer
  - Critical Peak Pricing – prospective customers back away from the prospect of paying $1.00/kWh or more for any period of time

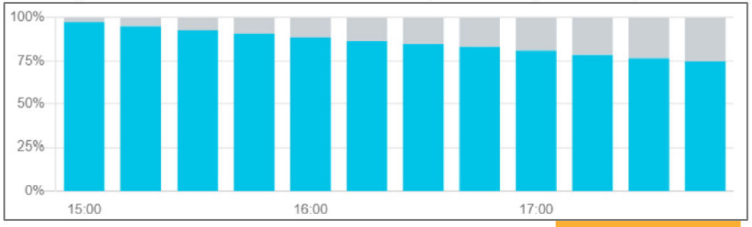
reliant.

Smart Thermostat DR is a very effective resource with a limited duration



Average load reduction for a DR event in 2020

Long DR events eventually lose participants



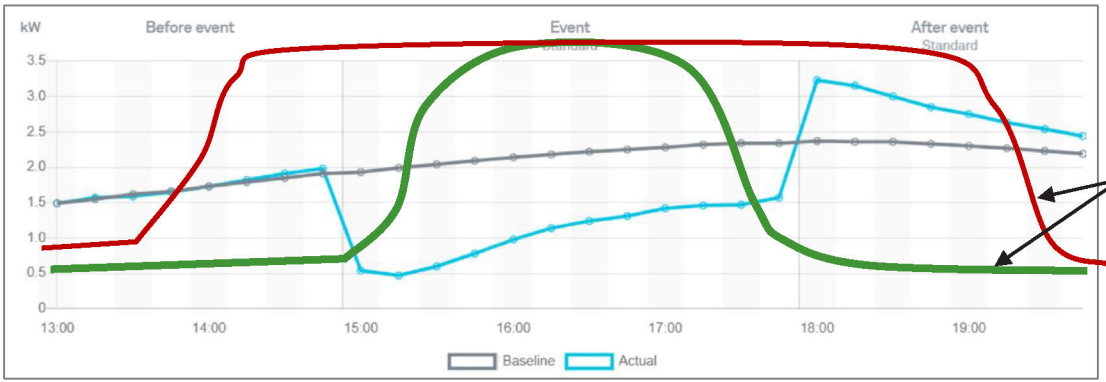
96% started the event
69% completed the event

reliant.

DR is most valuable if market price is predictably high for a window of a few hours

Market price signals that last longer than a few minutes but less than many hours is optimal for DR

Stretching high prices over several hours is not useful for most DR



Illustrative wholesale prices

reliant.

A few things that can help expand DR

- Making participation in the program simple and through a trusted resource that is reachable for questions/concerns
- Incentives that can help reduce the customer's cost of devices, perhaps enabling REPs to provide through Energy Efficiency dollars as part of energy plan offers
- Reduce administrative hurdles
  - Most DR programs managed by TDUs and ERCOT are inflexible with regard to adding new customers during the DR season, and don't reflect that fact that REPs are continually enrolling new customers

reliant.

PUCT Work Session

Oncor Residential Demand Response

Liz Jones, Vice President Regulatory Affairs
September 16, 2021

Residential Demand Response (RDR)

- RDR is offered through ERCOT, TDUs, REPs, third-party competitive service providers, and aggregation groups.
- ERCOT TDUs presently can offer RDR only through energy efficiency programs.
- ERCOT TDUs are prohibited from directly offering energy efficiency programs to customers. Rather, Oncor must contract with vendors, who in turn offer the programs to customers.
- Most RDR program designs focus on reducing electric consumption of large household devices, such as air conditioners, water heaters, and pool pumps, by remotely adjusting temperature settings and turning off devices for short periods of time.

Oncor Energy Efficiency RDR Program Design

- Oncor's RDR program engages third-party competitive service providers and aggregation groups to provide demand response capability using remotely controlled load control devices in homes (usually smart thermostats).
- Oncor does not control the agreements between third-party providers and residential customers. The providers may use promotions such as free thermostats or sweepstakes to gain residential customer participation.
- Oncor pays energy efficiency incentives to third-party providers, who curtail electric demand during (1) a scheduled curtailment event and (2) ERCOT or Oncor curtailments throughout the **summer peak period**.
- With the exception of scheduled curtailment events, curtailment will be called during or in anticipation of an ERCOT Energy Emergency Alert (EEA) Level 2 event *or* to assure Oncor grid stability during grid emergencies.
- A scheduled curtailment event is a three-hour scheduled event, typically in May or June, designed to test the participants' ability to curtail demand by the instructed amount.

General RDR Program Limitations

- Number and type of devices available in a home that can be remotely controlled and are available for load reduction.
- Aggregation and disaggregation requirements depending on whether a pricing or reliability event is localized, regional, or system-wide.
- Average pricing on residential plans that diminishes price sensitivity.
- End-user/customer behavior including overriding demand response events, signing up for multiple programs from various participants, or signing up to receive promotions and opting out of events.
- Device automation and customer awareness.

TDU Energy Efficiency RDR Program Limitations

- All TDU Energy Efficiency programs must be cost-effective and are subject to the Texas Technical Reference Manual.
- Current Energy Efficiency load management programs are:
  - Limited to summer peak periods. TDUs can sponsor additional RDR programs if the summer restriction is removed and performance metrics are established to measure year-round programs.
  - System-wide in nature. RDR programs that are more targeted in nature could be deployed more discretely for local or regional emergencies.
- TDU RDR programs are unlikely to fully fund the RDR program opportunities that exist in ERCOT. Depending on PUC objectives for load management in Texas, a layered or tiered approach could address market needs as well as conserve grid resources.
- TDU RDR programs may be more effective if they are offered direct-to-customer rather than through a third-party.

RDR Program Requirements

- **Customer Value:** RDR on a programmatic level will be unsustainable unless the customer finds value in the program or the economic incentive can change customer behavior.
- **Market Impact:** The PUC must determine RDR size and scope of participation in the wholesale market, how it will be priced, and what if any obligations RDR providers will have to share revenues with residential customers.
- **Real-time Deliverability:** RDR programs must be capable of addressing specific grid needs in response to ERCOT instructions.
- **Accountability and Compliance:** RDR should not be relied on for emergency events without guaranteed performance and penalties for non-performance. TDU metering cannot provide real-time signals but may be used to verify compliance with instructions.
- **REP/TDU/Third-Party/ERCOT Coordination:** Ensure RDR program participants do not "double-dip" for the same capacity in multiple programs.

OVERVIEW OF CPS ENERGY'S DEMAND RESPONSE PROGRAMS

PRESENTED BY:

Rick Luna
Director, Technology & Product Innovation

September 16, 2021

Informational

STEP PROGRAM

ENGAGING CUSTOMERS IN EFFICIENCY

- CPS Energy's Demand Response programs are an integral component of our Save for Tomorrow Energy Plan (**STEP)** program.
- **STEP** was created in 2009 with a goal of reducing 771 MW of demand, equivalent to a large power plant.
- **STEP** incentivizes customers to save energy through adoption of efficient technologies & behavior changes.
- The original **STEP** goal was achieved a year early & under budget. With an extension, the program has now saved 926 MW of energy demand.

STEP PROGRAMS

Weatherization/Casa Verde

Residential Energy Efficiency (EE)

- Home Efficiency
- New Home Construction
- Home Energy Assessments
- Schools 2 Home
- Cool Roof

Demand Response (DR)

- Commercial & Industrial DR
- Automated DR
- Smart Thermostat
- My Thermostat Rewards
- Power Players

Commercial Energy Efficiency

- Commercial & Industrial Solutions
- Schools & Institutions
- Small Business Solutions
- High Efficiency Tune-Ups
- Direct Lighting Program

Solar

- Solar Rebates
- Big Sun Solar
- SolarHostSA

Electric Vehicle Charging

- ***Flex*EV**SM Smart Rewards
- ***Flex*EV** Off-Peak Rewards

CPS ENERGY

CLEAResult

FRANKLIN ENERGY

EnergyHub

Nest

bsag BUILD SA GREEN

ecobee

BIG SUN SOLAR

Honeywell

PowerFin Partners

resideo

Our STEP program delivers a diverse set of options for customers through industry leading partnerships.

DEMAND RESPONSE

PROGRAM TYPES

Behavioral

- Peak day alerts to 320k customers
- Broad awareness through social media, digital billboards & TV news.
- Includes tips on how to trim energy use
- Savings feedback delivered via email & phone calls the next day

Thermostats

- 150k devices in customer homes & businesses
- Customers earn a rebate for enrolling their device in DR program
- Customer always has the option to opt out of any single event
- Customers earn annual retention incentive

Commercial & Industrial

- 750 of our largest customers
- Earn a rebate for reducing load on peak days
- Customers receive 30 minutes to 2 hour advance notice to curtail

A VALUABLE TOOL

- DR is a valuable tool for supporting grid reliability
- DR helps us to manage our native peak load & reduce exposure to high prices in the real time market.
- Customers are willing to participate in DR programs, the key is to offer incentives, flexibility, & multiple paths to participation.
- Overall program performance is consistent. Even with back to back DR events, customers stay with the programs.

DR IN ACTION

Summer 2020:

- 19 event days
- 2.5 hour average duration
- Dispatched for all CP days
- Overall summer performance:
  - 273 MW non-coincident peak reduction
  - 231 MW reduction at CPS Energy peak

WINTER STORM URI

We deployed our first-ever Winter curtailment of thermostat programs between the evenings of Feb. 14 to Feb. 19.

- In addition, some of our largest customers with back-up generators voluntarily agreed to reduce load.
- The curtailment ran continuously for over 100 hours. This compares with ~60 hours of curtailment in the typical four month summer DR season.

93% of thermostats enrolled in our summer WiFi Thermostat Rewards were dispatched during the Winter event.

Thank You

September 16 PUCT Market Design Work Session

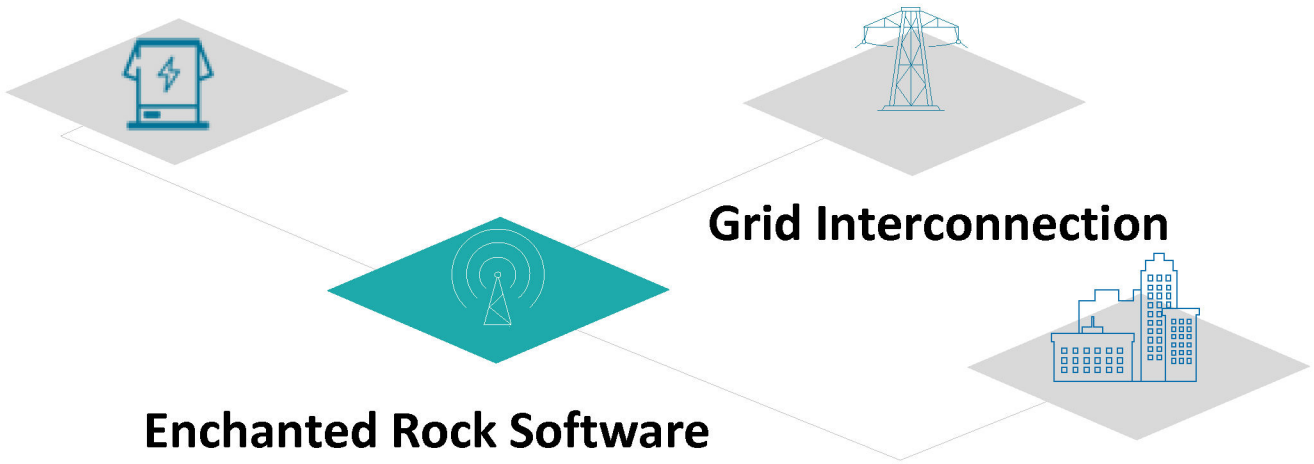
Corey Amthor
President, Enchanted Rock

ENCHANTED ROCK
The Power is On.

Enchanted Rock Overview

ENCHANTED ROCK
The Power is On.

Cleanest Resiliency Genset in the Market



Enchanted Rock's Dual Purpose Natural Gas Microgrid solves two problems with one asset.

- **Lowest Cost Resiliency**
- **Fully Dispatchable Grid Services**

We've Pioneered the Dual Purpose Microgrid

Performance of Dual Purpose Microgrids in 2021 Storms

ENCHANTED ROCK
The Power is On.

Winter Storm Uri

200+ Dispatchable Microgrids

operating over 8-day period in ERCOT

143 Sites Protected

from grid outages (water facilities, senior living homes, and large grocery store chains)

5,000 Outage Hours at >97% Reliability

as microgrids were not impacted by gas pressure issues

70-140 MW of Grid Supply

provided throughout 8-day period

Hurricane Nicholas

>465 Outage Hours at 42 Sites with 99.7% Reliability

Aggregate Reliability

ENCHANTED ROCK
The Power is On.

- Distributed resources provide aggregate reliability, unlike large, individual generators.
  - Distributed Generation Resource Model
    - Upcoming implementation will be helpful
    - Improvements can be made to facilitate more DGR/DESR participation
      - Allow DGR/DESR participation even if connected to curtailable circuit
        - Current requirements don't align with system-level procurement of Ancillary Services
    - Allow aggregations of resources to participate as a single DGR/DESR, including portfolio-level Current Operating Plans

Dispatchable Resources & ERS

ENCHANTED ROCK
The Power is On.

- Focus on incentivizing additional dependable dispatchable capacity on a technology-neutral basis.
  - Allow technologies to compete, rather specifying fuel types and storage requirements
- ERS
  - $50M ERS budget cap needs an update as the PUCT considers incentivizing additional demand response
  - Dispatch ERS resources earlier in an emergency event
    - Specifically, EEA1 deployment for all ERS resources
  - Differentiate compensation for higher value 10-minute resources

Market Access

ENCHANTED ROCK
The Power is On.

- With any reforms, prioritize equal market access for distributed resources.
  - Transparency and consistency in interconnection requirements will facilitate more efficient development of distributed resources
    - e.g., Metering
  - Consider cost-sharing policies for upgrades that benefit utility customers and subsequent interconnections
    - e.g., Transfer Trip

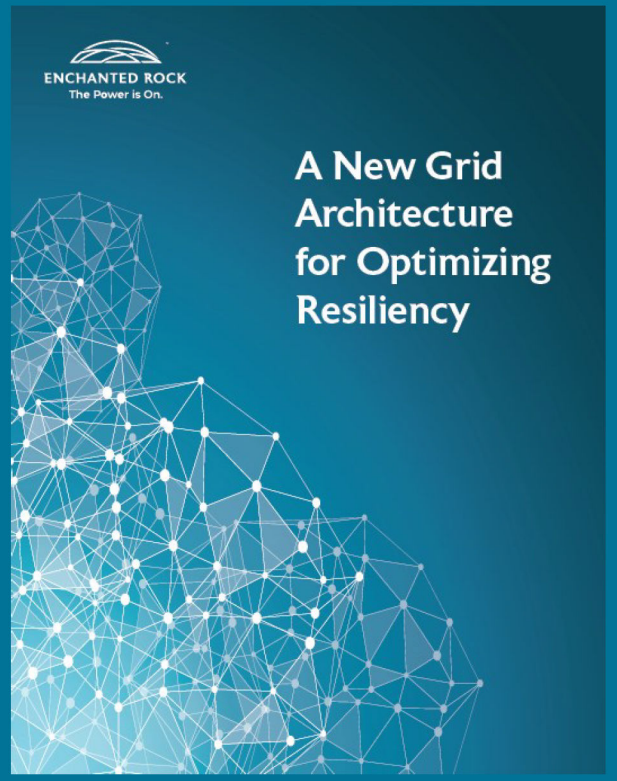
ENCHANTED ROCK™

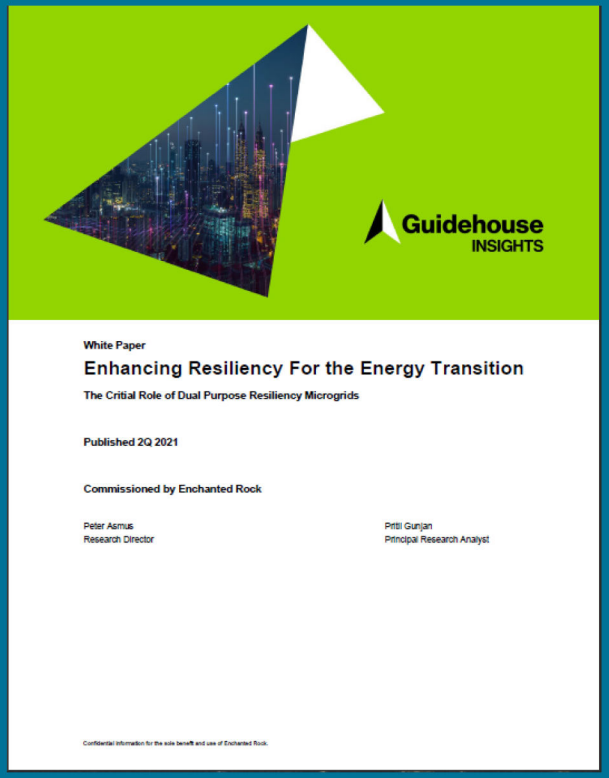
The Power is On.

camthor@enchantedrock.com

info@enchantedrock.com

Additional Resources on www.EnchantedRock.com





PUCT Work Session Demand Response Programs

SEPTEMBER 16, 2021 | AMY HEART

sunrun

Demand Response

Aggregated DERs are a critical resource to increase stability for the grid and Texas families

DERs as Demand Response

- Leverage Customer-Sited Solar+Storage
- Technology Neutral Allows for Future
- Aggregate Load Reduction, But Results Can Still Be Targeted
- How to Overcome Barriers
  - Easier to participate
  - Minimize costs to participate
  - Enhance compensation
  - Ensure technology can respond - day ahead signals today

Expanding Demand Response Should be a Part of Overall Market Design Strategy to Fully Utilize Benefits of Customer-Sited DERs

Back-Up Power to Homes or Businesses = Peace of Mind

Demand Response

Aggregated DERs can reduce load in scheduled peak time periods and for critical calls.

Energy Market

Aggregated DERs like solar+storage can provide reliable generation into the energy market.

Grid Services

Utilities can tap into grid benefits of DERs, such as frequency regulation, volt/var, foregoing expensive upgrades, and back-up power at substation level.

Octopus Energy

Michael Lee

octopus energy

Octopus is already reinventing energy.

Utility of the Year

Utility Brand of the Year

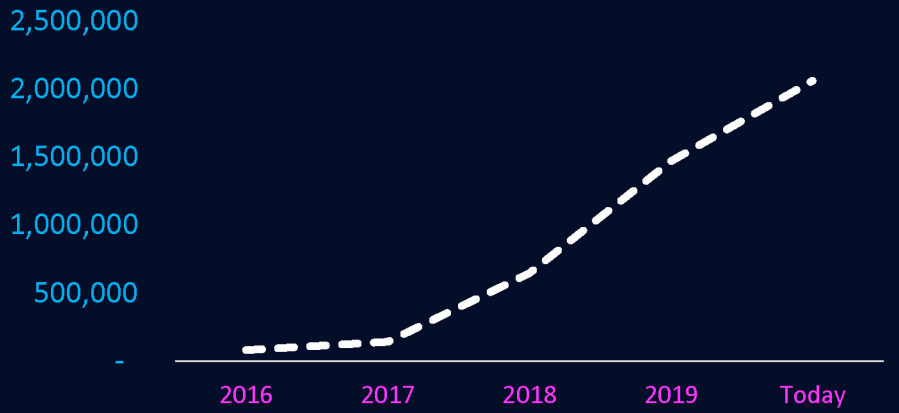
Supplier of the Year

Utility of the Year

% of customers who would be “very disappointed” to no longer be customers

Source: Octopus survey of 2,000 Traditional Customers & 4,500 Octopus Energy customers. Published survey of 731 Slack users

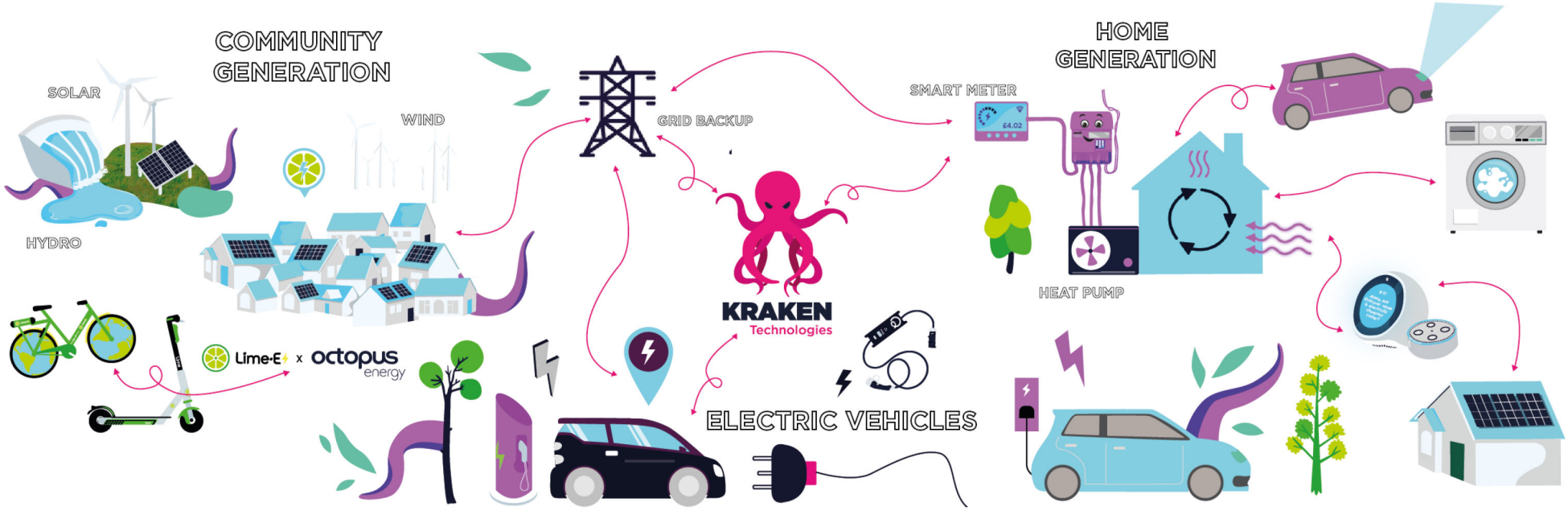
Global Customer Meter # Growth Over 5 Years



Unicorn

~~octopus~~ energy

Our Kraken Software Allows Us to Reimagine the Energy System



World's first index + software rate

'Cheaper EV charging seen under UK's first half-hourly tariff'

Bloomberg
26 October 2018

'World first smart tariff could see customers paid to use energy'

Utility Week
23 February 2018

Alexa, what time of day will be energy be cheapest?
Octopus teams up with Amazon and will PAY customers to use electricity at off-peak periods'

Daily Mail
19 March 2019

Balancing the grid

Creating Electricity, Paying You to Use It

By STANLEY REED

The coronavirus pandemic has played havoc with energy markets. Last month, the price of benchmark American crude oil fell below zero as the economy shut down and demand plunged.

And now a British utility this weekend will actually pay some of its residential consumers to use electricity — to plug in the appliances, and run them full blast.

So-called negative electricity prices usually show up in wholesale power markets, when a big electricity user like a factory or a water-treatment plant is paid to consume more power. Having too much power on the line could lead to damaged equipment or even blackouts.

"Power systems all around the world are entering completely unprecedented territory," Mr. Staffell said. It used to be that energy use soared Monday through Friday, and then slumped on Sundays.

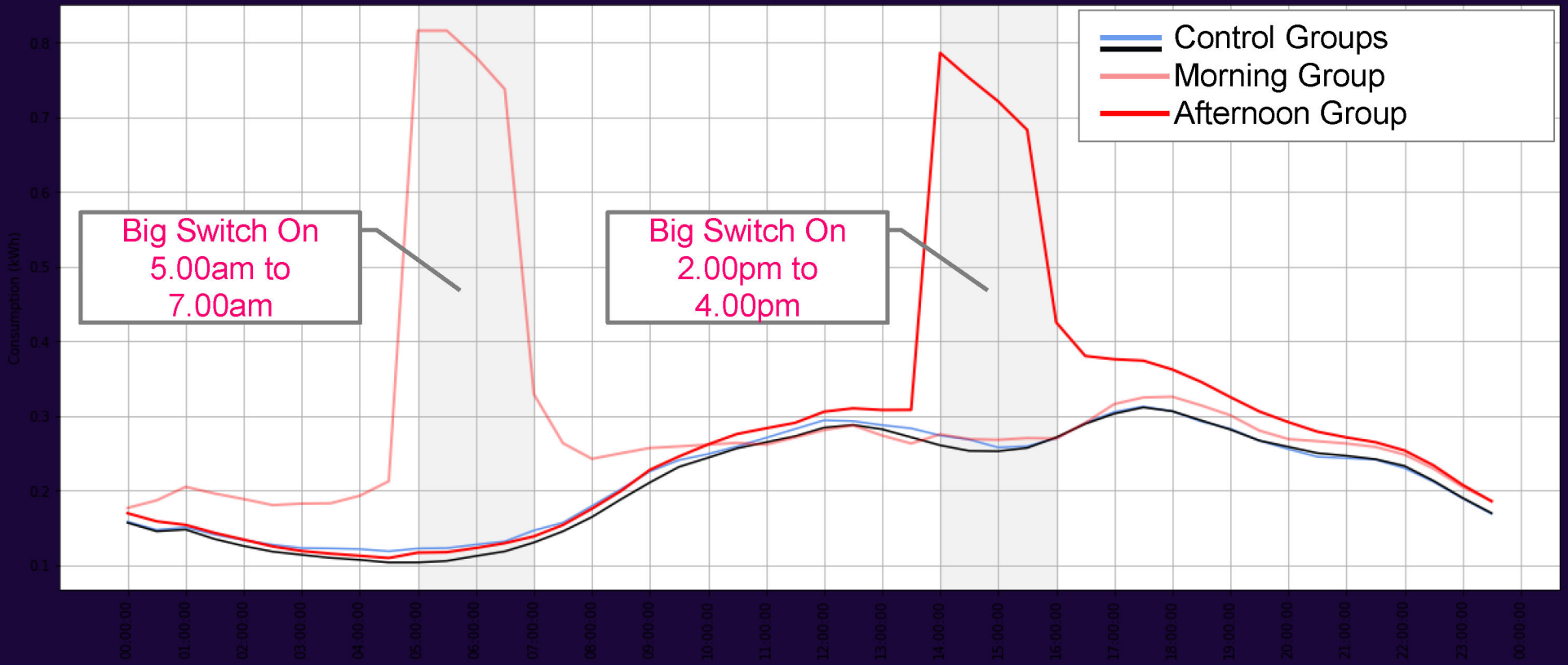
Now, Mr. Staffell said, "working days are now all Sundays."

These factors could be seen at work on Friday when British power prices reached as low as minus 70 pounds ($85) per megawatt-hour, which is enough electricity to light up several hundred homes for an hour. Demand was low on the eve of a three-day weekend during lockdown, while wind farms and nuclear plants were generating an unusually high proportion of power, accord-

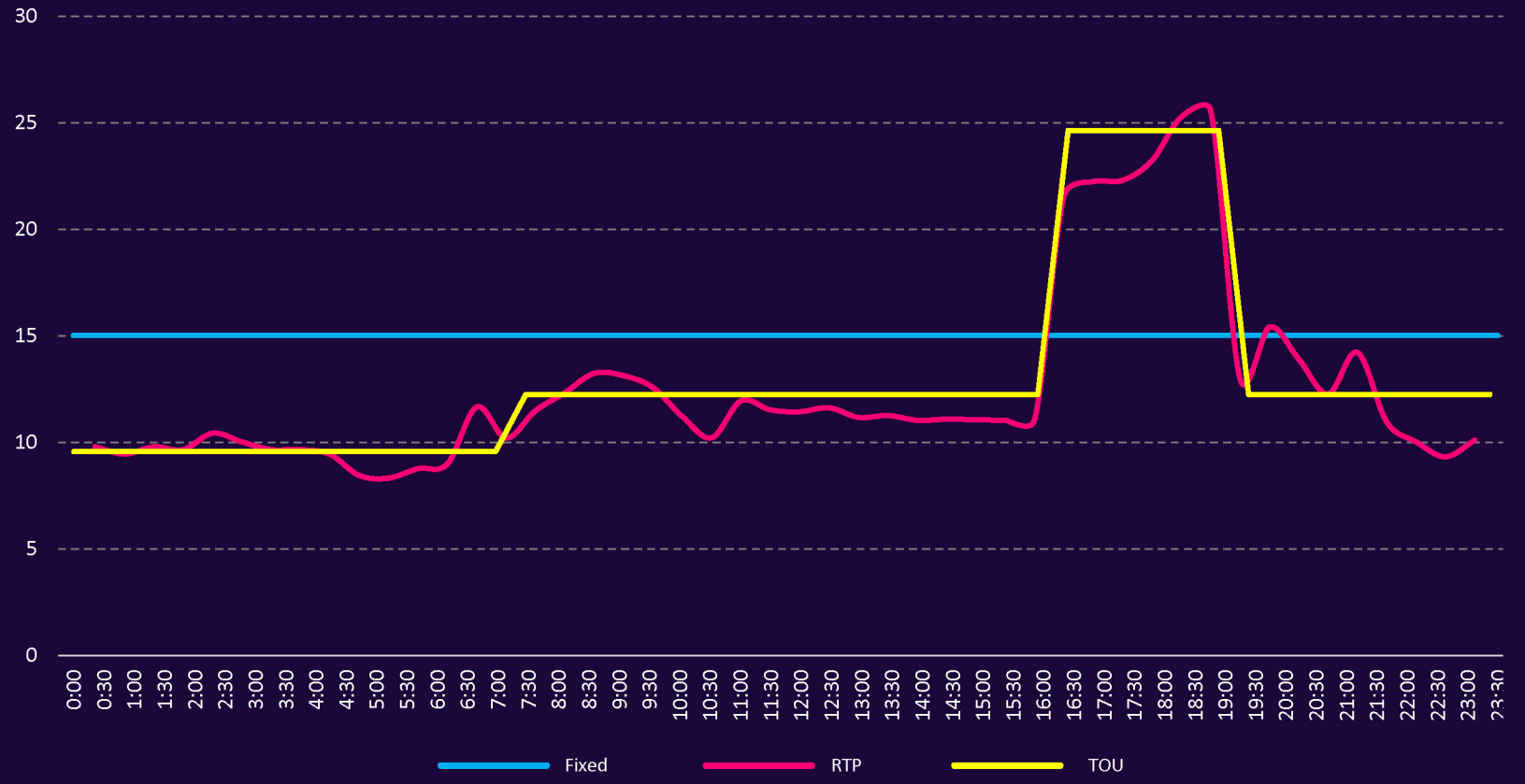
Octopus Energy customers told to 'use more electricity' ahead of May bank holiday demand slump

Octopus Energy customers to be paid to use electricity on Sunday afternoon to help grid deal with excess supply

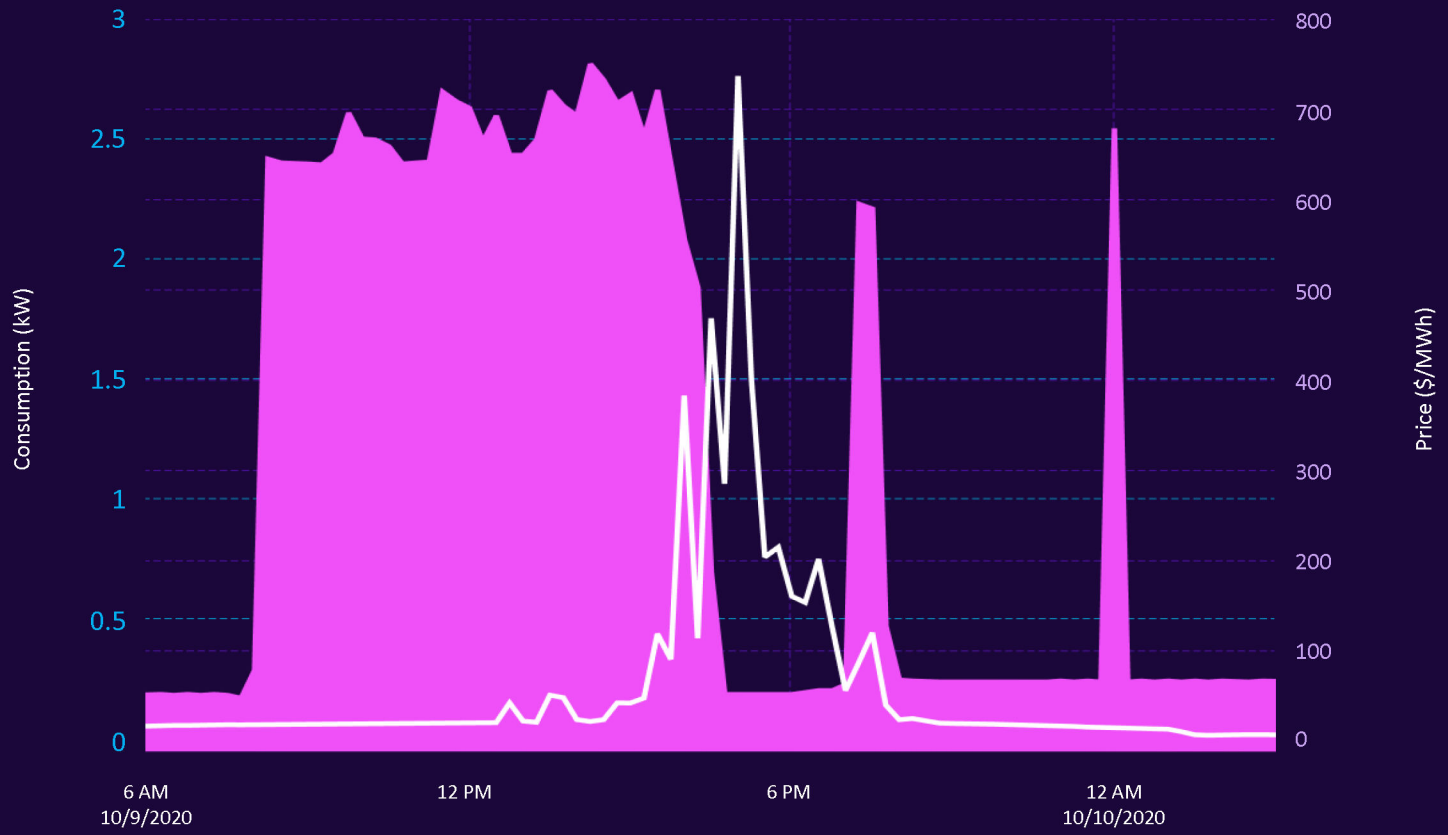
The Big Switch On to use excess wind – NYT



World beyond fixed rates…



The impact of dynamic rates



This chart shows the power consumption of a Texas customer who ran an air conditioner until the energy price spiked, then turned it off until the price spike had ended.

Power Consumption

Power Price

Two types of demand response

1. Economic Self-interest
   - Technology centric retailers
   - Strong customer relationship and trust
   - Value needs to be shared between retailer & customer
   - Price Responsive Demand - muted if HCAP is lowered
   - Aligned to reliability because it's sync'd to market incentives
2. Command and Control
   - Increased visibility and certainty
   - Needs specific financial incentives
   - Grouped by zone, extra incentive for nodal
   - Forward value certainty is helpful so customers can be aggressively acquired

ERCOT is the perfect market for demand response

1. Retailers settle on actual loads, not generic load profiles
2. Energy-only creates direct value
3. Electricity is the largest utility expense for residential households
4. Controllable loads (Thermostats / EVs / etc) make up large % of overall cost exposure

Cultural limitations in the status quo

1. Current business models focus on customer “forgetting” so that variable rates can be charged
   - Trust is broken… Demand Response = Trust
   - *Recommendation: monthly notifications of variable rates will significantly engage market – fundamental to price discovery, low cost for REPs, and easy to do*
2. Feedback loops need to be short
   - Customers need to see immediate reward
   - SMT real-time data support is good direction but needs improvement
3. Customers are “Powerless” – “the bill is the bill” mindset
   - Invisible product
   - No other consumer product bills you 15-30 days after you consumed their product
   - Partly due to business models and partly due to lack of REPs being tech-centric

Technology limitations of SMT-real time pulls

1. Limited to 2 calls per meter per hour (need more)
2. Limited to 24 calls per meter per day (not immediately a barrier but can become one if multiple events per day)
3. Limited to 3,000 calls to TDU
4. Usability and API support can use improvement

Recommendation: Increase limits; improve/modernize usability; consolidate at ERCOT

Oppty for DERs

1. Thermostats – Octopus even supports manual thermostats
   - Energy efficiency significantly amplifies the impact of thermal controls
2. EVs – OCPP is a common standard that enables dynamic charging and V2G
3. Residential Storage – grid reinforcement & self-resiliency

All are used for economic self-interest demand response – could be used for aggregation – but no great ERCOT platform yet – ERS, ALR, sched, etc.

Walled Gardens create risk that customer value is captured/reduced, leading to lower adoption rates – interoperability essential to promoting competition

Recommendation: Require IEEE 2030.5 for inverter-based resources (in conjunction with IEEE 1547), OCPP for Level 2 chargers and open APIs for thermostats that participate in ERS/Command & Control

Solar & Storage = resiliency for customers & grid

- Current process creates customer friction
  - Generally sufficient interconnection time – pockets of friction and low schedule visibility
- Multi-party problem – No advance notice to retailers about the upcoming interconnection; retailers cannot call as an agent on behalf of their customers
- Load profile update in ERCOT/TDU unnecessary slow and creates large frustration with customer – imagine spending $10k+ on something that is interconnected and it still “doesn’t work” for another 2 months for no clear reason

Recommendation: When original interconnection request is received by the TDU a notice is sent to REP of record AND new profiles are loaded into ERCOT in advance of PTO/commissioning

Three macro trends we are leading forward

1. The grid is changing
2. Retail is changing
3. The customer is changing

September 16th, DR Work Session

Aaron Berndt, Head of Energy Industry Partnerships

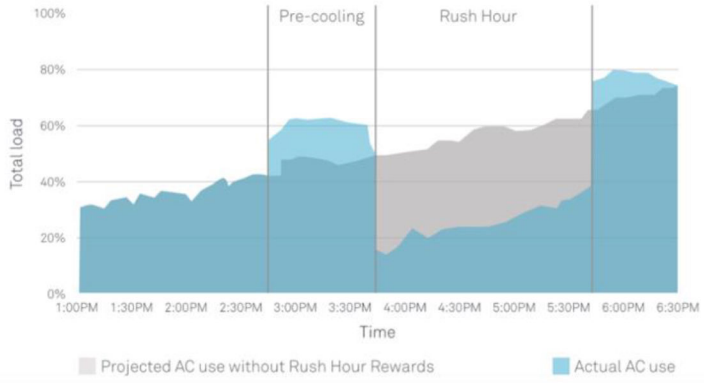
Rush Hour Rewards: Making Demand Response Easy

Smart Thermostats are Reliable, Effective, and Dispatchable

Maximize load reductions while *optimizing* customer satisfaction

Custom algorithms for each home

Customers always in control



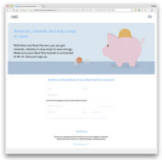
Summer test events conducted by Centerpoint showed above 1.25 kW of summer load reduction per household.

Customer Experience

Enrollment

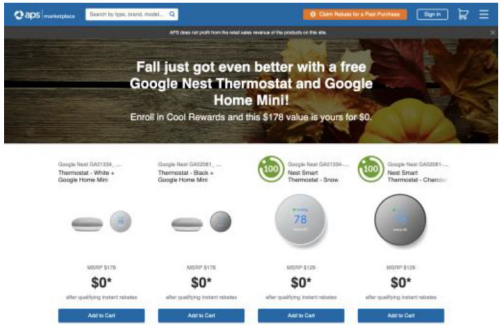
Enrollment of Thermostats Already Installed

Landing Page



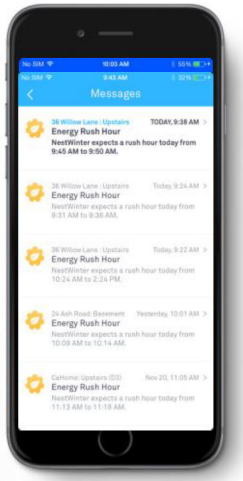
Customer Info and Program Terms

Option for New Thermostat customers



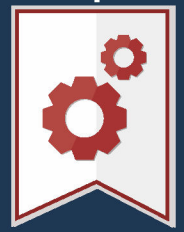
Enroll in a DR program and get a significantly discounted thermostat

Dispatched Events



Recommendations

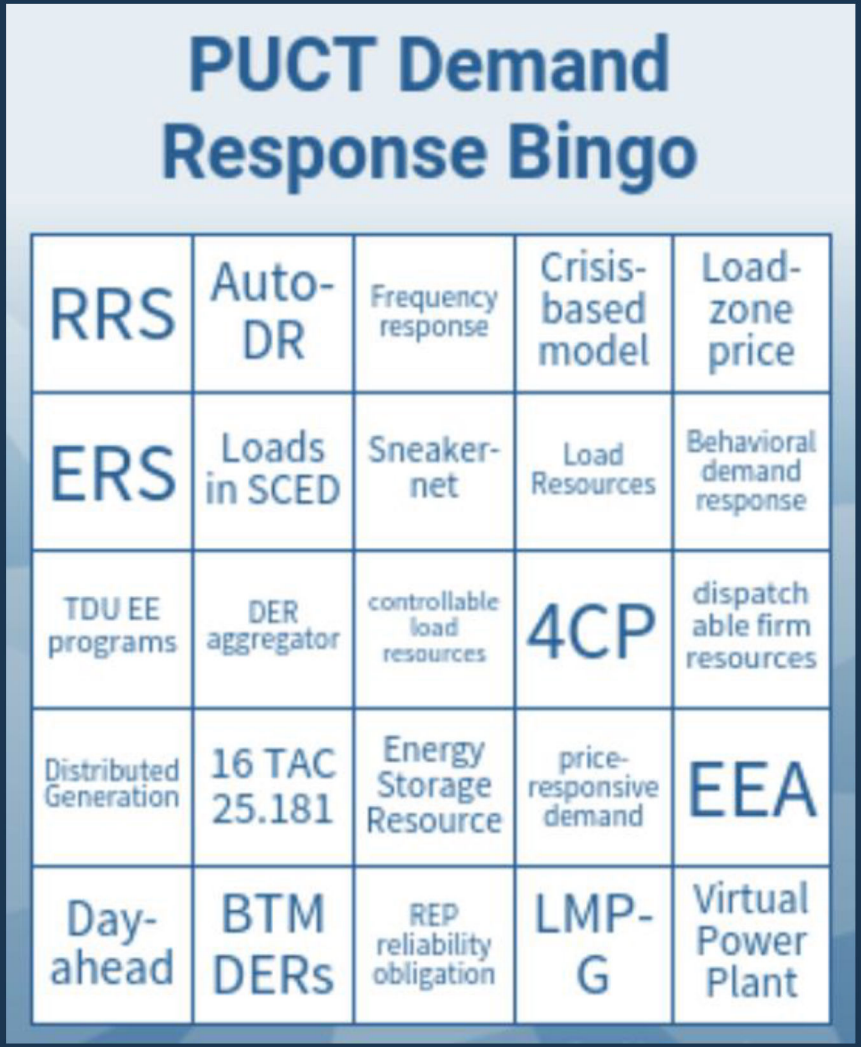
- **The Commission should increase budgets for TDU DR programs and the ERCOT ERS**
  - Increase the cost cap for the TDU load management programs administered pursuant to Rule §25.181 and payment per kW of the TDSP programs
  - Expand the ERCOT ERS program beyond the $50M budget cap and increase the ERS payment structure to the value delivered by DR resources
- **The Commission should set DR goal to enhance reliability**
  - Adopt an interim goal of developing DR programs that total at least 10 percent of system residential peak load. Leverage incentive mechanisms under PUC Subst. R. 25.181 to encourage adoption of DR-capable devices by residential customers who would then participate in demand response programs whether offered by a REP or a third-party aggregator of DR
- **The commission should conduct a demand response potential study and explore the creation of additional reliability ancillary services for demand response**
  - To understand the magnitude of the potential and design an service or set of programs to to meet ERCOT's that can take advantage of the full stack of value that smart thermostats and other enabling technologies are able to provide



ERCOT Demand Response Summary & Cheat Sheet

Alison Silverstein
Alison Silverstein Consulting
PUCT Demand Response Work Session
September 16, 2021

MY FIRST DRAFT …



DR & energy efficiency deliver many benefits

Reliability

- DR, demand flexibility like dispatchable peakers
- Energy efficiency like baseload that never breaks
- Lower peak loads so lower reserve margin & supply requirements
- Constructively shape load pattern
- Often faster than generation
- Facilitates intermittent generation, can fill in for part of gen and Tx contingency losses

Other benefits

- Checks supply- & fuel-driven price hikes
- Cost-competitive with supply options
- Reduce customers' electricity bills
- Reduced T&D capital costs and line losses
- Improve community and facility resilience
- Lower carbon & pollution
- Protects human health
- Create many jobs

Ways to use DR and demand flexibility

Load-shifting

- Peak-shaving
- Valley-filling
- Battery/EV charging
- Load smoothing

Bill & portfolio management

- 4 CP avoidance
- Price hedging
- Portfolio management
- Bill reduction

Ancillary services

- Spinning reserve
- Non-spinning reserve
- Load-following
- Load-shifting
- Local grid support
- Ramping offset

Texas EE, DR potential is HUGE

Elements for structuring DR products and controllability

Time options
- When to use it (time of day, season)
- How to use it -- planned, contingency or emergency
- Event lead-time/advance notice
- Duration of event
- Duration of usage for participating customers

Management options
- Price-responsive
- Aggregated and automated (e.g., smart thermostats)
- Direct load control
- Internal customer decision (automated or sneaker-net)
- Behavioral
- Automated relay operation (e.g., under-frequency relay)

Source
- Customer load
- Behind-the-meter generation
- Behind-the-meter storage
- Electric vehicles

Who directs use
- Grid operator
- Aggregator or QSE
- REP or LSE
- TDU
- Customer

Compensation
- Capacity (as from ERCOT)
- Energy payment
- Recruitment or subscription payment
- Equipment (e.g., smart thermostat)
- Bill savings (e.g., 4CP bill savings)

DR/DF barriers

Purpose

- Summer peak focus plus some ERCOT ancillary services & emergencies
- Over-restrictive, un-creative usage options

Compensation & cost restrictions

- Minimal DR funding in TDU energy efficiency programs, and little for residential customers
- Total $ limit too low for TDU energy efficiency program funding
- ERS payments about $14/kW but no energy payment, way too low relative to market value and customer effort

Participation restrictions

- Limits on who's allowed to offer DR into which products
- Limits on how much DR for particular products (e.g., cap on ERS)
- TDU energy efficiency goals too low

Technology restrictions

- Costly DR metering & telemetry requirements
- Insufficient customer access to energy use and price data and aggregator access to SMT data

Common DR/DF recommendations

1. DR & EE complement each other. Increase EE goal (to 1% or higher) and funding
   - Increase DR share of EE programs and broaden provider scope
   - Increase EE and DR required from residential & multi-family & low-income customers
   - Set DR reliability obligations (e.g., 10% of residential peak load and 10% of total summer & winter peak load) on all LSEs w/ possible trading of DR capabilities between LSEs.
2. Raise ERS participation cap, raise compensation, activate before EEA, add additional DR products
3. Create new technology-neutral ancillary service products that leverage DR speed and dispatchability and potential for aggregating diverse resources
4. Widen and loosen options for DR/DF provider and customer compensation
5. DR technology enablers
   - Loosen & streamline BTM DG and storage restrictions and update inverters
   - Residential & small customers need automation for greater DR capability
   - DR technology and programs should leverage technical standards and be provider-agnostic
6. Rethink resource adequacy meaning and math
7. Set provider accountability and customer protection & communication requirements
8. Conduct DR potential study