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# Texas A&M – ERCOT Partnership on Demand Response and Energy Efficiency

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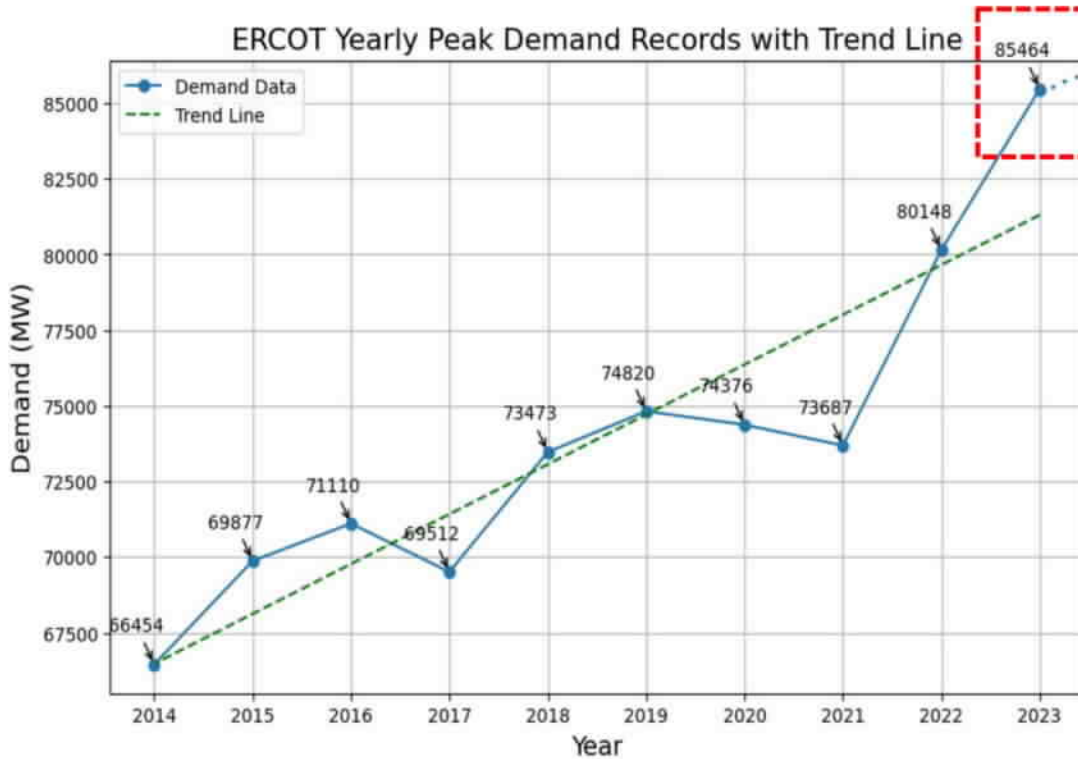
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*10 / 15 / 2024*

# Introduction



Need to break the upward trend by improving **Demand Flexibility**

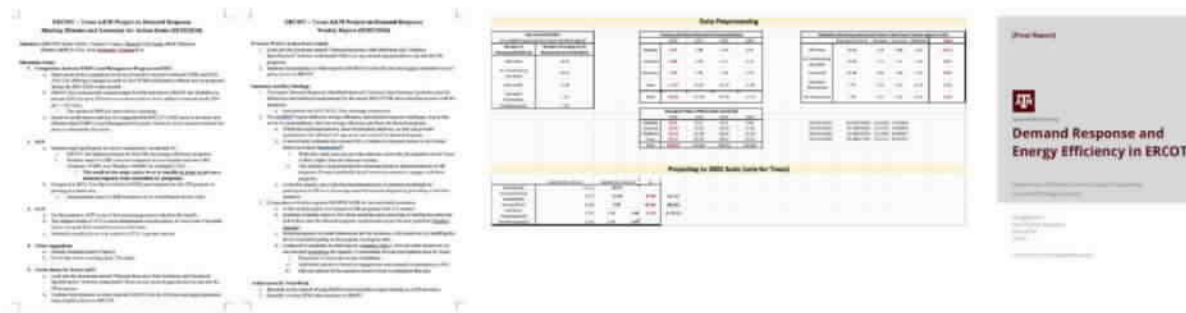
Duck's head down !!



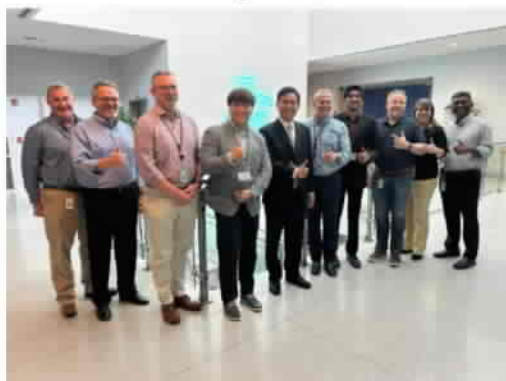
# Timeline of Interactions



Bi-weekly meeting with ERCOT



(2024. 4. 29)  
Visiting ERCOT



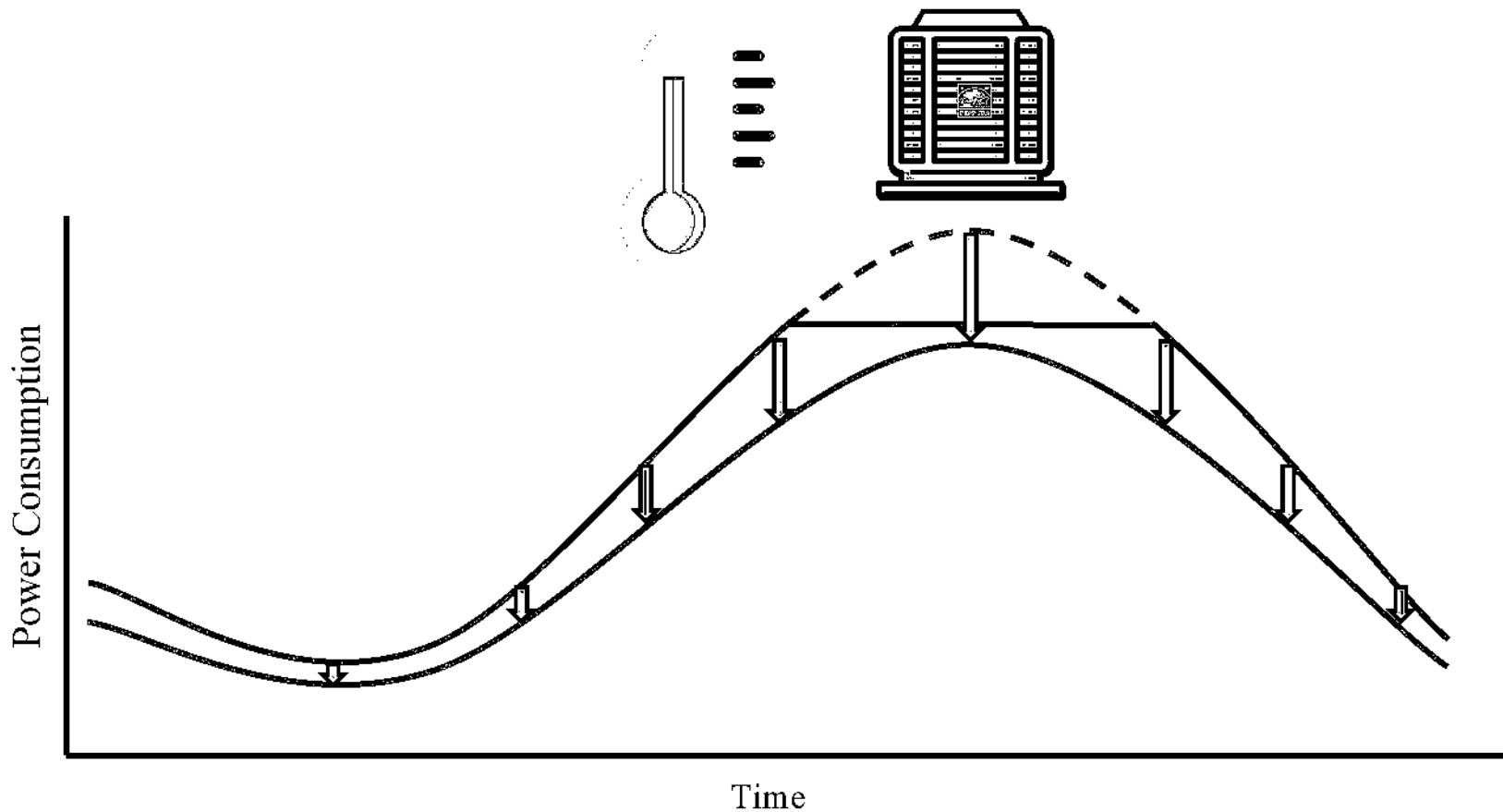
(2024. 5. 21)  
ERCOT Innovation Summit

(2024. 6. 4)  
Review with  
ERCOT

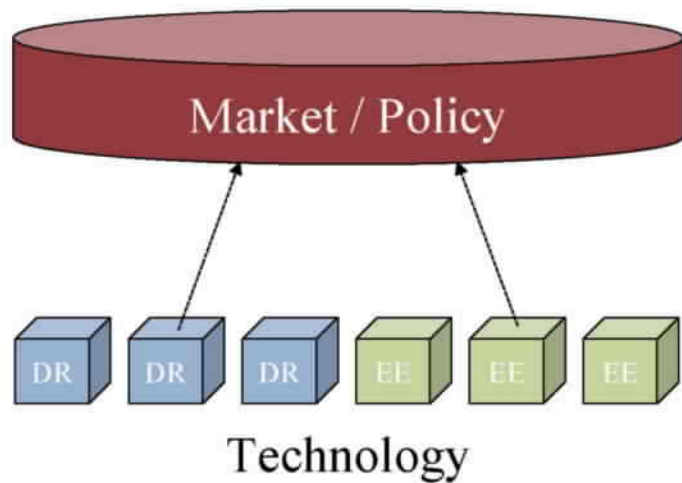
(2024. 7. 1)  
Visiting PUCT



# Energy Efficiency and Demand Response: An Illustration



# Executive Summary



- DR from A/C in Residential Sector with Smart-Thermostat
- Peak Shifting from Proactive EV Charging
- Large-Flexible-Loads as a DR Resources



- High-Efficiency Heat Pump
- Electrification



- Legislating Energy Efficiency Retrofits
- Increasing Market Size (Incentives, Rebates)
- Reforming Market (4 Net-CP, 6CP)
- TDU Energy Efficiency Programs
- Educating & Encouraging Customers

# Key Takeaways



	Potential Peak Reduction [GW]	Firm?	Easy to Install?	Reforming Policy Required?	Customer Fatigue?	Cost Competitive (CAPEX)
<b>CRITERIA TECHNOLOGY</b>	(Energy Efficiency Retrofit) <b>Heat Pump</b>	<input type="checkbox"/> $\cong 11.15$	<input type="checkbox"/>			<input type="checkbox"/>
	(Demand Response) <b>Residential A/C</b>	<input type="checkbox"/> $\cong 3.5$		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> : High <input type="checkbox"/> : Low	<input type="checkbox"/> : Permanent <input type="checkbox"/> : Temporary	<input type="checkbox"/> : Easy <input type="checkbox"/> : Complex	<input type="checkbox"/> : Trivial <input type="checkbox"/> : Substantial	<input type="checkbox"/> : Trivial <input type="checkbox"/> : Substantial	<input type="checkbox"/> : Highly <input type="checkbox"/> : Slightly



# Programs Analyzed

(Energy Efficiency)



# Residential Energy Efficiency



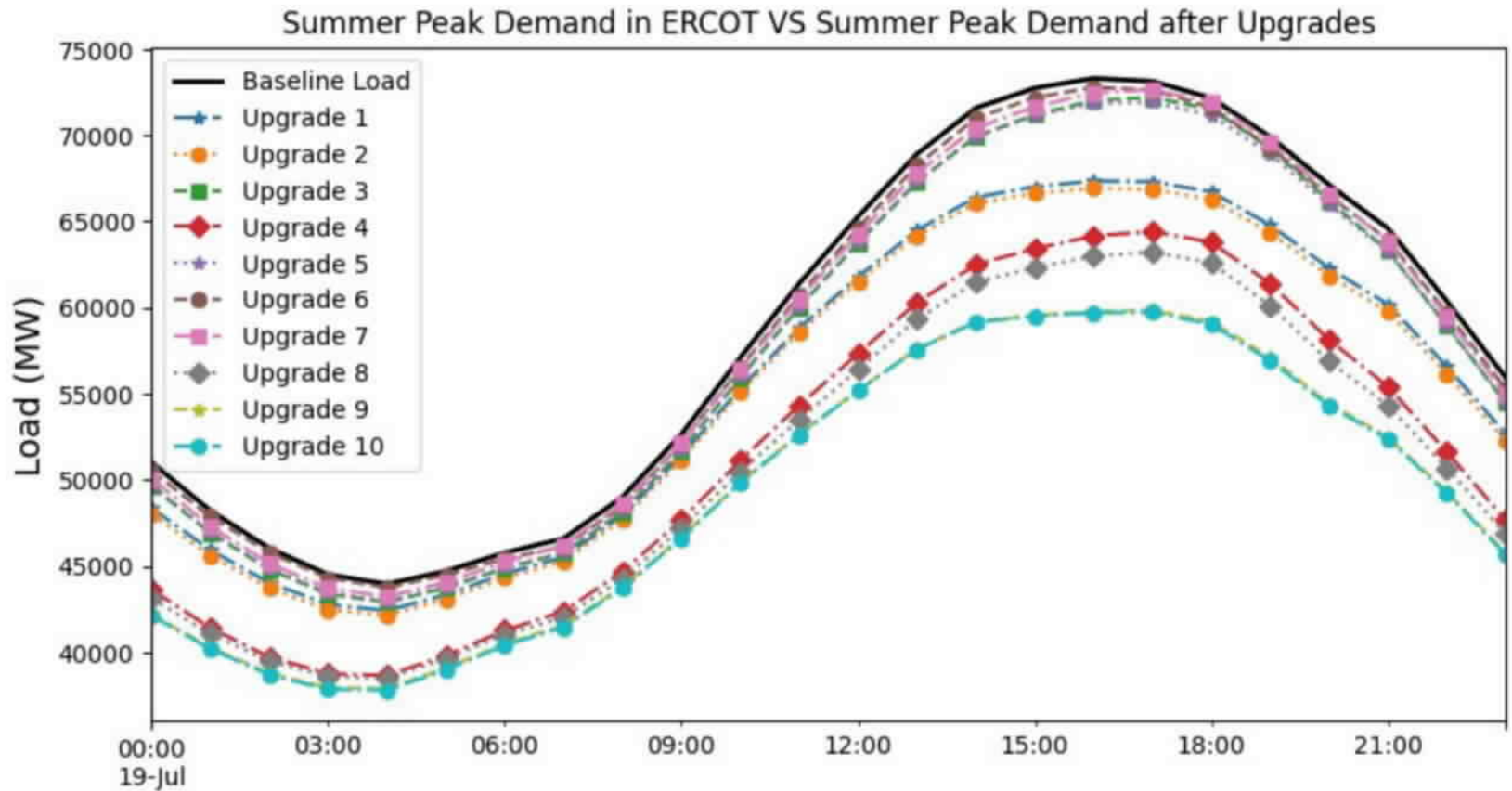
1. Basic Enclosure	2. Enhanced Enclosure	3. HP min Efficiency, Electric backup
4. HP high efficiency, Electric backup	5. HP min efficiency, Existing heat backup	6. HP water heaters
7. Whole home electrification – min efficiency	8: Whole-Home Electrification, High Efficiency	9: upgrade 1+8
10: upgrade 2 + 8		

[10] EUSS ResRound1 Technical Documentation.pdf (oedi-data-lake.s3.amazonaws.com)

# Summer Peak Day 2018



1. Basic enclosure
2. Enhanced enclosure
3. HP minimum efficiency, electric backup
4. HP high efficiency, electric backup
5. HP minimum efficiency, existing heat as backup
6. HP water heaters
7. Whole home electrification, minimum efficiency
8. Whole home electrification, high efficiency
9. Upgrade 1+8
10. Upgrade 2+8

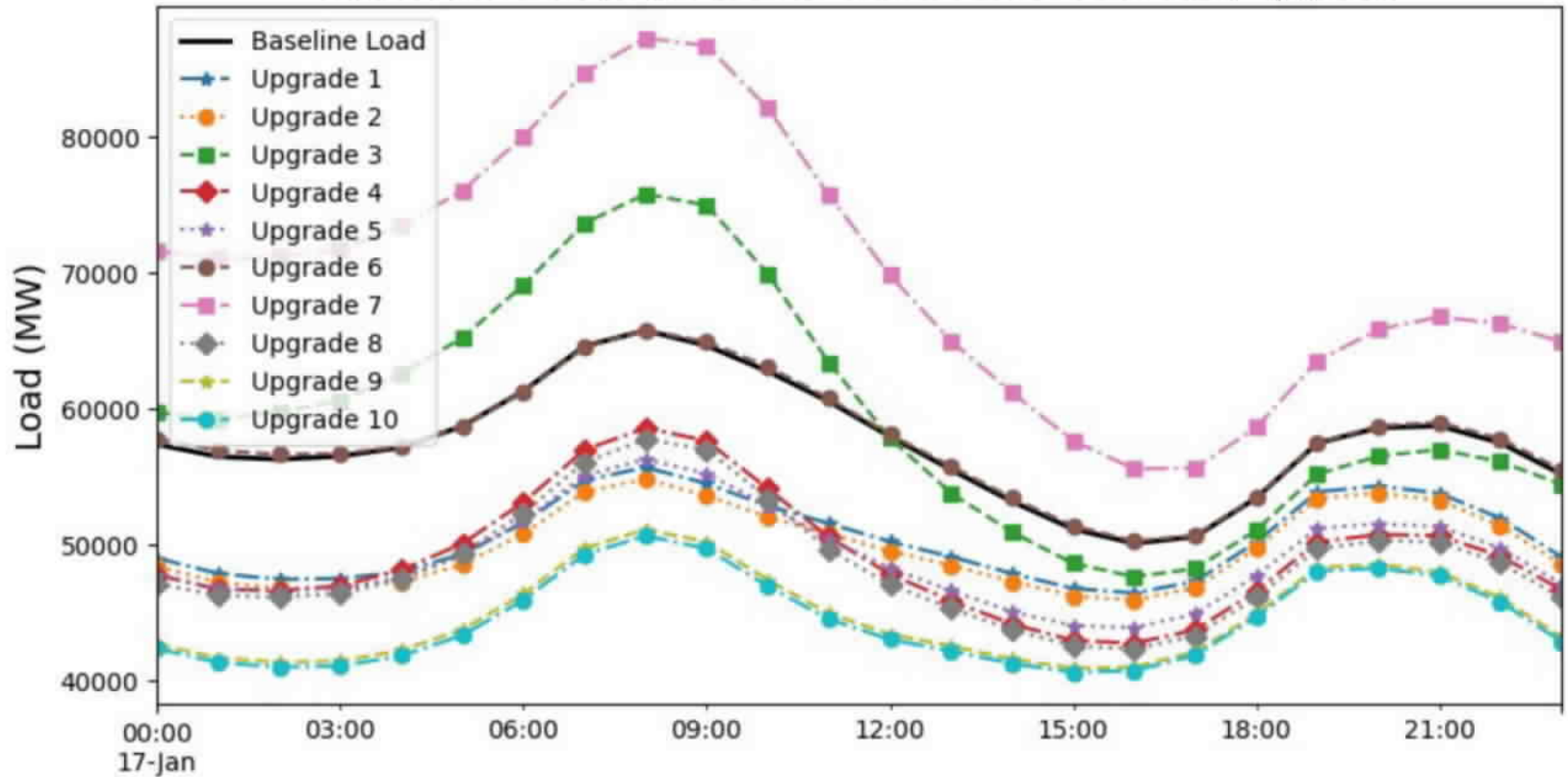


# Winter Peak Day 2018



1. Basic enclosure
2. Enhanced enclosure
3. HP minimum efficiency, electric backup
4. HP high efficiency, electric backup
5. HP minimum efficiency, existing heat as backup
6. HP water heaters
7. Whole home electrification, minimum efficiency
8. Whole home electrification, high efficiency
9. Upgrade 1+8
10. Upgrade 2+8

Winter Peak Demand in ERCOT VS Winter Peak Demand after Upgrades

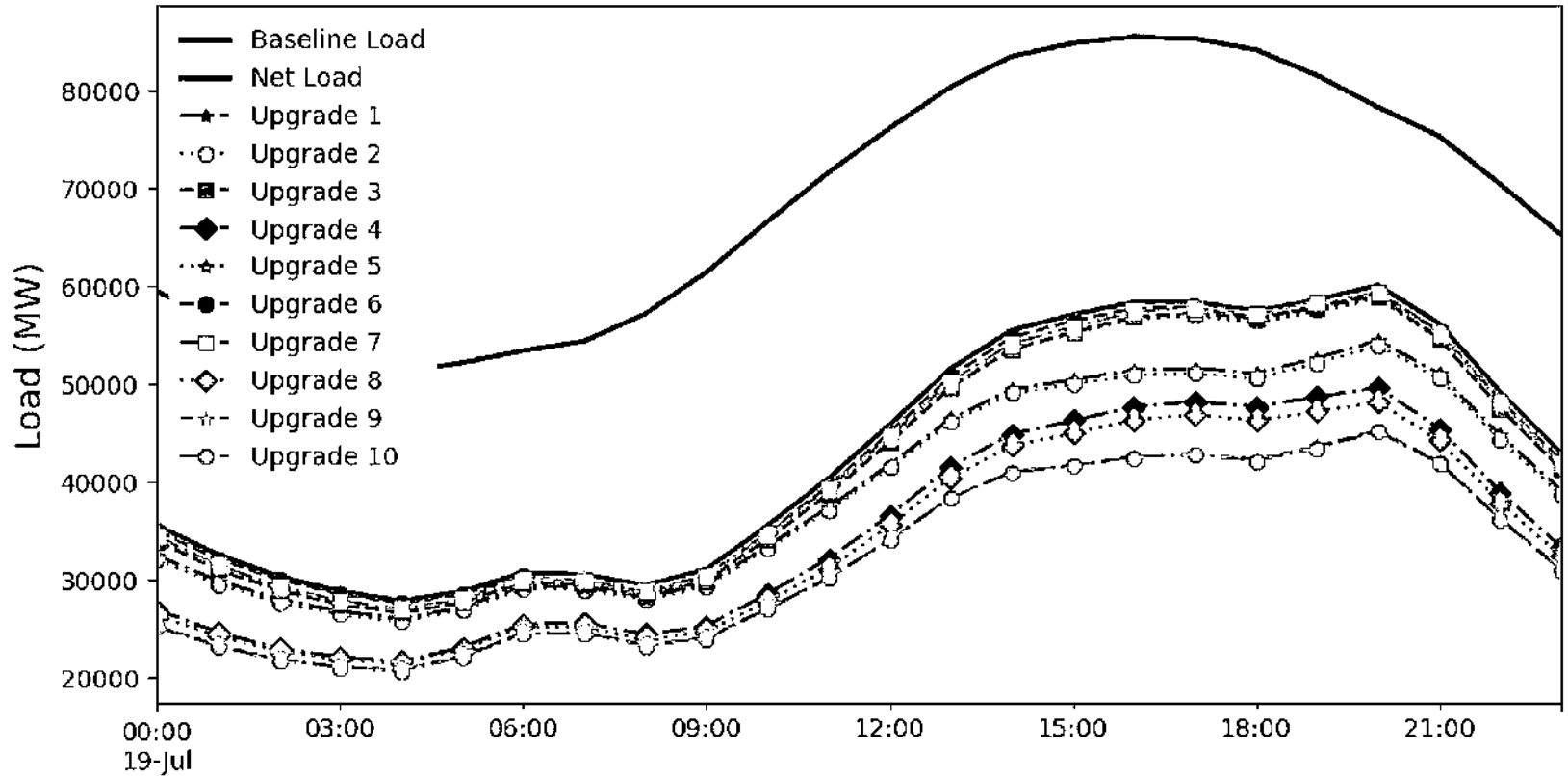


# Summer Peak Day 2023 - estimated



1. Basic enclosure
2. Enhanced enclosure
3. HP minimum efficiency, electric backup
4. HP high efficiency, electric backup
5. HP minimum efficiency, existing heat as backup
6. HP water heaters
7. Whole home electrification, minimum efficiency
8. Whole home electrification, high efficiency
9. Upgrade 1+8
10. Upgrade 2+8

Summer Net Peak Demand in ERCOT VS Summer Peak Demand after Upgrades

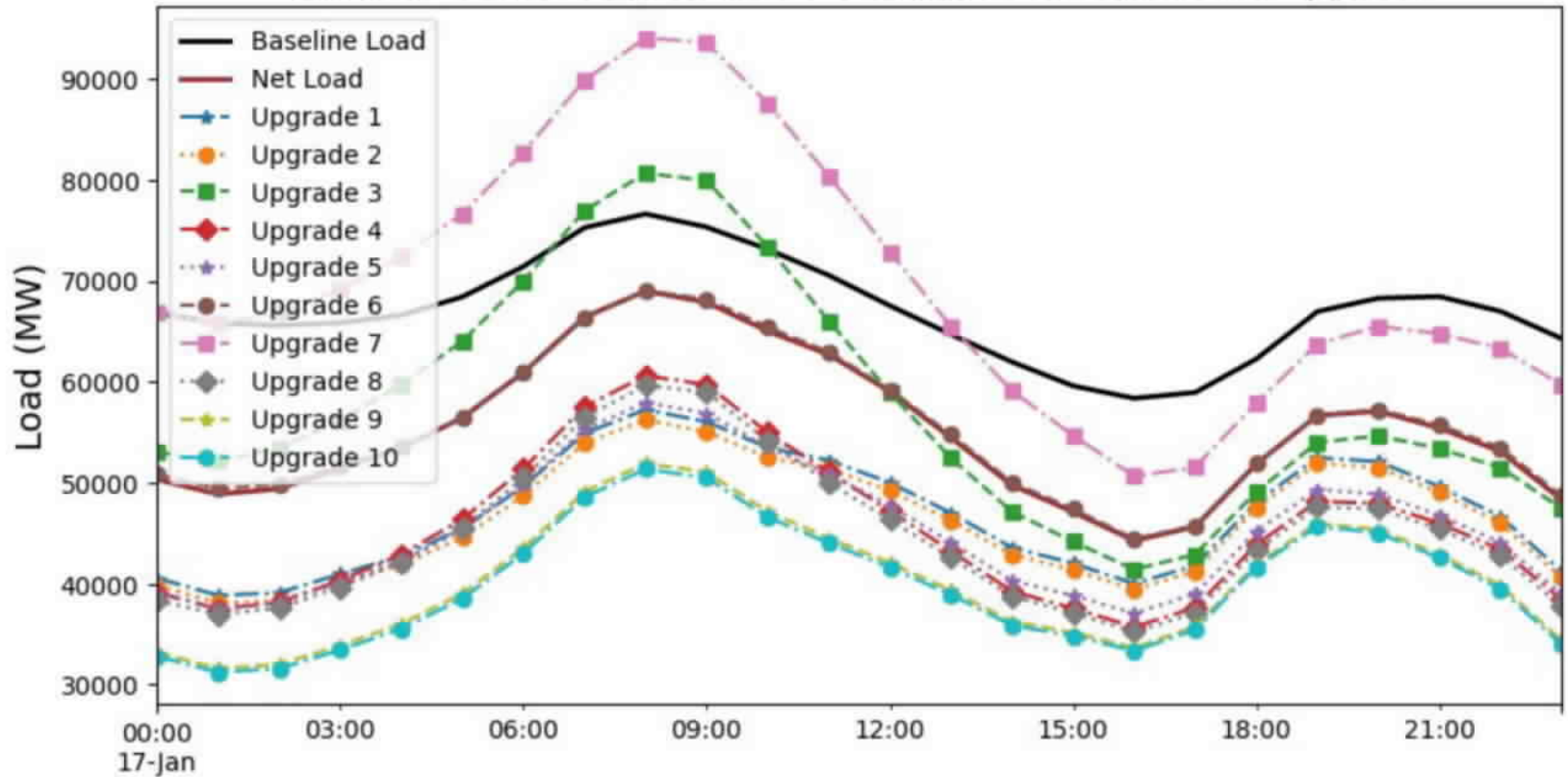


# Winter Peak Day 2023 - estimated



1. Basic enclosure
2. Enhanced enclosure
3. HP minimum efficiency, electric backup
4. HP high efficiency, electric backup
5. HP minimum efficiency, existing heat as backup
6. HP water heaters
7. Whole home electrification, minimum efficiency
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9. Upgrade 1+8
10. Upgrade 2+8

Winter Net Peak Demand in ERCOT VS Winter Peak Demand after Upgrades



# Heat Pumps



Not all Heat Pumps are the same

Heat Pump	Type	Summer (GW)	Winter (GW)
	Min Efficiency, Electric backup	1.48	-6.90
	Min Efficiency, Existing Heat as backup	1.68	13.66
	High Efficiency, Electric backup (SEER* 24, HSPF** 13)	11.15	13.96

Max peak demand savings potential of heat pumps

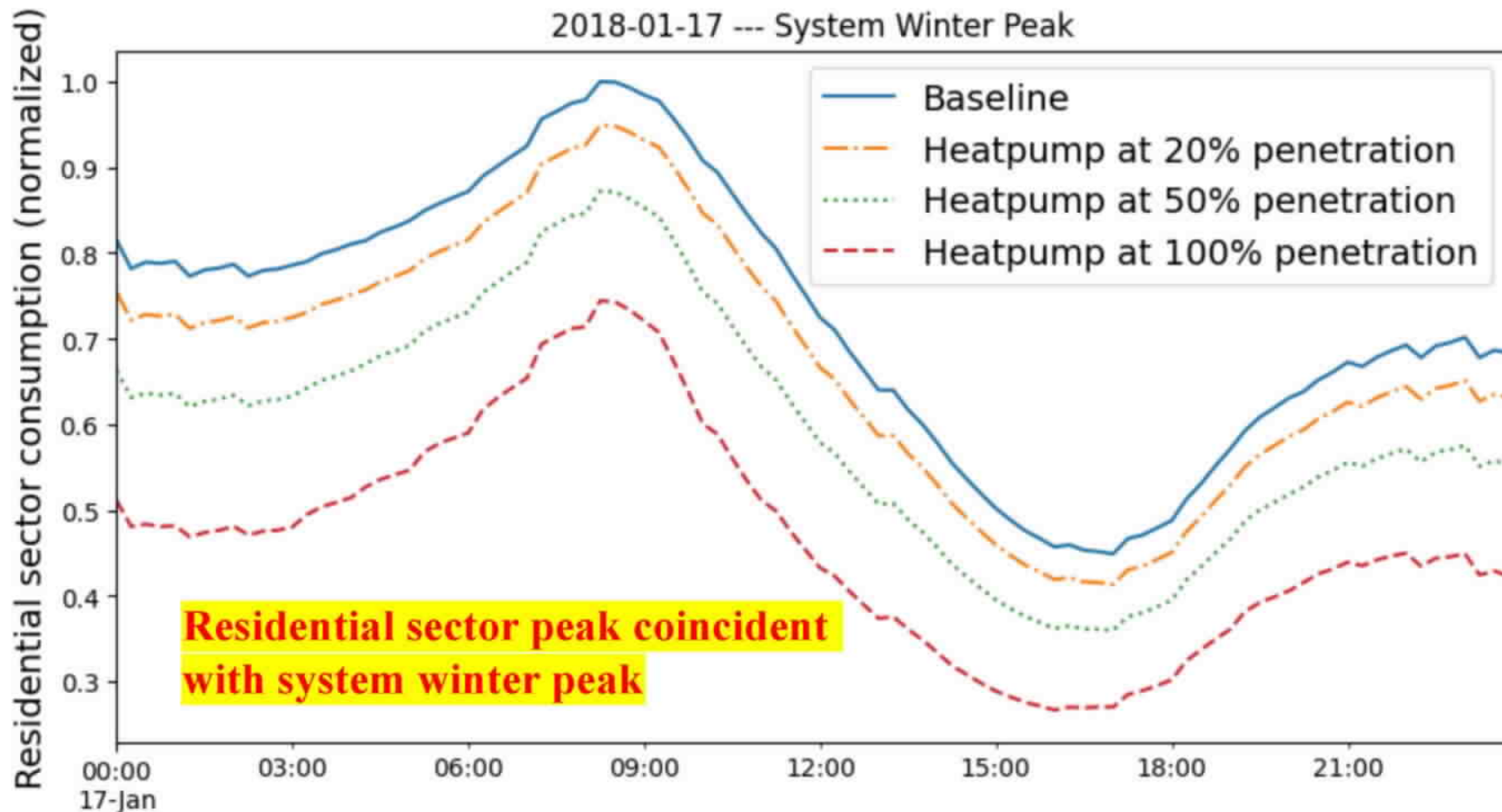
SEER\* : Seasonal Energy Efficiency Rating

HSPF\*\* : Heating Seasonal Performance Factor

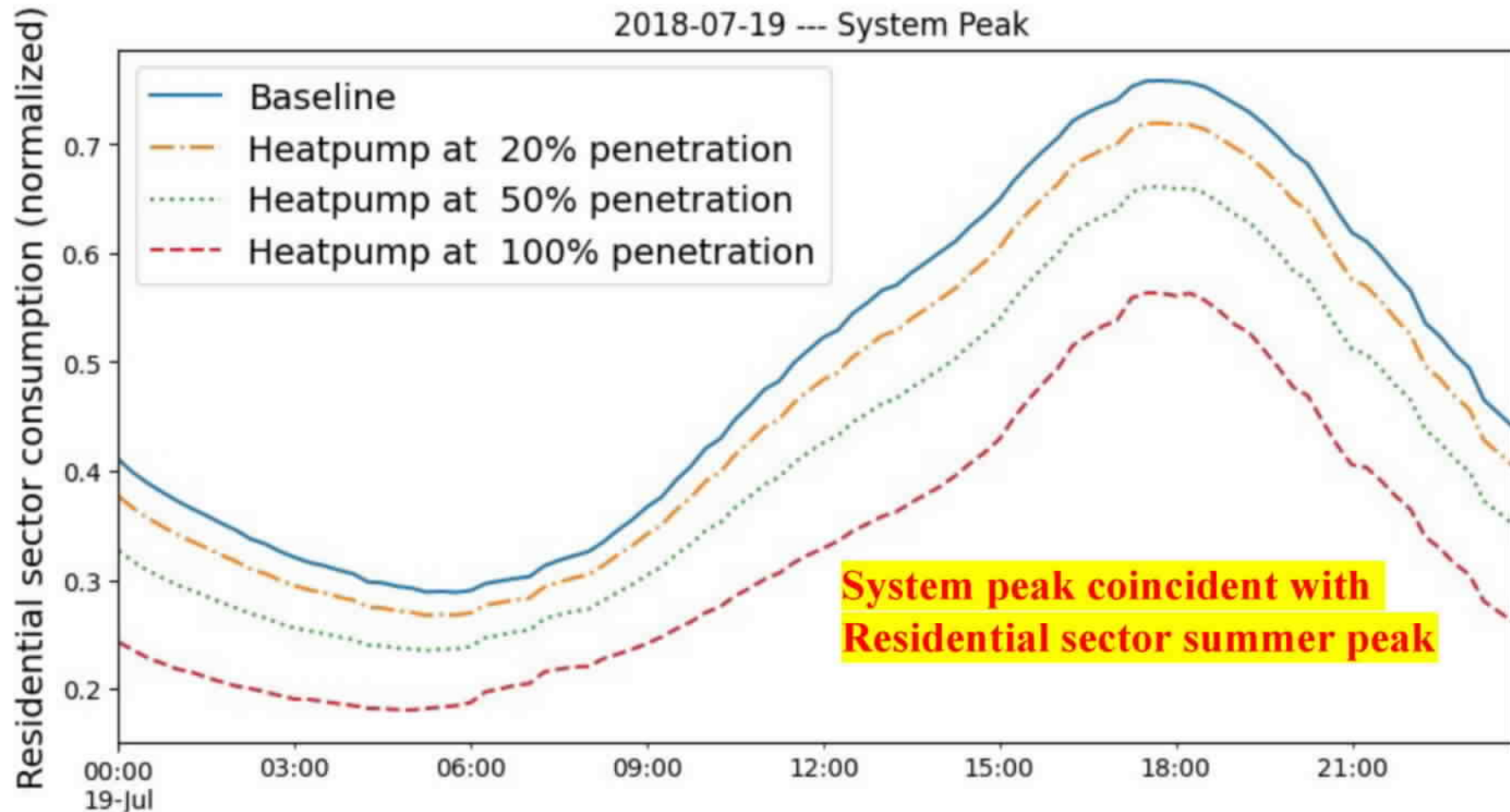
## High Efficiency Heat Pumps

[11] [Efficiency requirements for residential central AC and heat pumps to rise in 2023 - U.S. Energy Information Administration \(EIA\)](#)

# Impact on winter peak load



# Impact on summer peak load





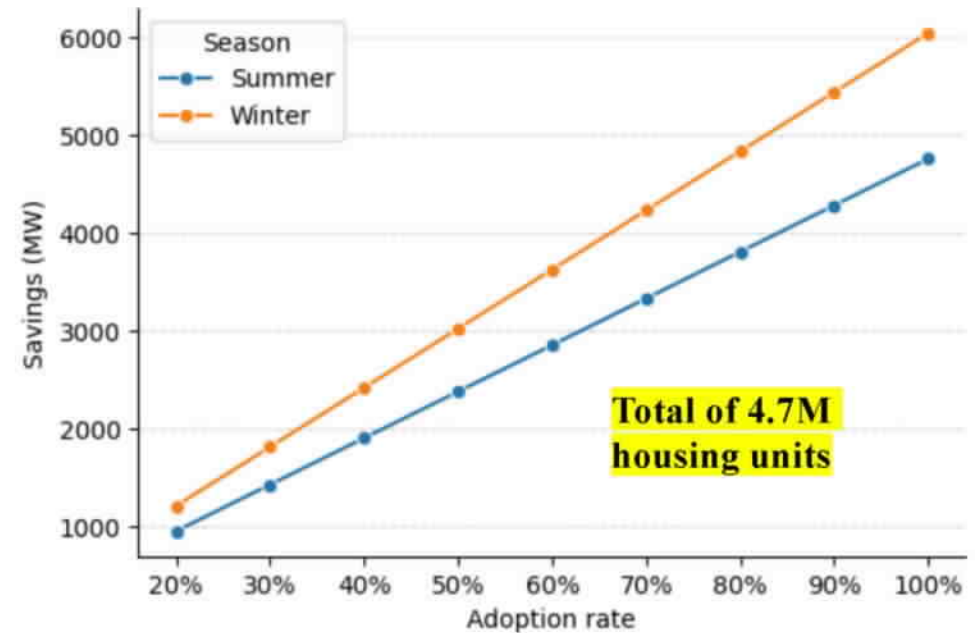
# A practical approach



Fuel type

HVAC Cooling Type	Heating Fuel Type					
	Electricity	Fuel Oil	Natural Gas	None	Other Fuel	Propane
Central AC	44.90	0.01	27.06	0.04	0.26	2.11
Heat Pump	10.72	0.00	0.00	0.00	0.00	0.00
None	2.48	0.01	2.23	0.00	0.02	0.21
Room AC	4.76	0.00	4.76	0.02	0.04	0.38

Savings for units with electric fuel



**Units with electricity as fuel for cooling and heating needs**



**Programs Analyzed  
(Demand Response with Residential A/C)**

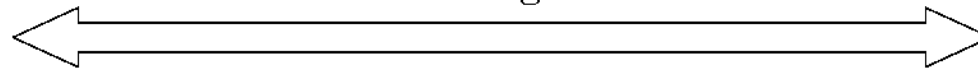
# ERCOT Demand Response Program Overview



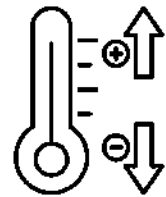
# Smart Thermostat Incentive Programs



Contract / Agreement



Residential Customers



Demand Response



Incentives / Rebates

\$ for Device

\$ for Enrolling

Nest **Honeywell** sensi  
ecobee LUX™  
amazon smart thermostat

Smart Thermostat Provider



Smart Thermostats

# Smart Thermostat Incentive Programs



Representative Providers		Austin Energy (Austin)	CPS Energy (San Antonio)
Name of Program		Power Partner <sup>[2]</sup>	WiFi Thermostat Rewards <sup>[3]</sup>
Adjustment Period		<ul style="list-style-type: none"> <li>• ~ 4°F adjustment</li> <li>• ~ 3 hours (3 ~ 6 pm), Jun - Sep</li> <li>• ~ 3 times/week, ~ 25 times/yr (in extreme weather, ~ 5 times/week)</li> </ul>	<ul style="list-style-type: none"> <li>• Summer : ~ 4 hours (3 ~ 7pm)</li> <li>• <b>Winter : ~ 4 hours (6 ~ 10am)</b></li> </ul>
Incentive	Program Enrollment	<ul style="list-style-type: none"> <li>• <b>\$50</b> bill credit/enrolled (already have Smart-thermostat)</li> <li>• Annual incentives of <b>\$25</b></li> </ul>	<ul style="list-style-type: none"> <li>• Annual incentives of <b>\$30</b></li> <li>• <b>Winter WiFi Thermostat Rewards: +\$20 bill credit</b></li> </ul>
	Device	<ul style="list-style-type: none"> <li>• <b>\$30</b> rebate for buying &amp; installing smart-thermostat</li> </ul>	<ul style="list-style-type: none"> <li>• <b>\$85</b> bill credit for each thermostat</li> </ul>

[2] [Power Partner<sup>SM</sup> Thermostats, Rebates & Incentives, Austin Energy.](#)

[3] [WiFi Thermostat Rewards, CPS Energy.](#)

# An example of Residential A/C for Peak Reduction



Time of Day	June	July	August	September	Summer Average
...	...	...	...	...	...
15	0.44 kWh	0.52 kWh	0.45 kWh	0.34 kWh	0.44 kWh
16	0.50 kWh	0.58 kWh	0.51 kWh	0.39 kWh	0.49 kWh
17	0.55 kWh	0.62 kWh	0.56 kWh	0.41 kWh	0.54 kWh
18	0.58 kWh	0.65 kWh	0.57 kWh	0.37 kWh	0.54 kWh
19	0.59 kWh	0.65 kWh	0.58 kWh	0.38 kWh	0.55 kWh
...	...	...	...	...	...

## ❑ Energy savings per thermostat

- Data extracted from over 5,500 smart thermostats participating in DR events during summer, 2022 <sup>[4]</sup>
- (Key Message) Energy savings vary by month and time of day
  - The energy savings are greater during peak hours than other times of the day

[4] [CenterPoint Energy 2022 Demand Response Impact Evaluation, Final Report \(March 8, 2023\)](#)

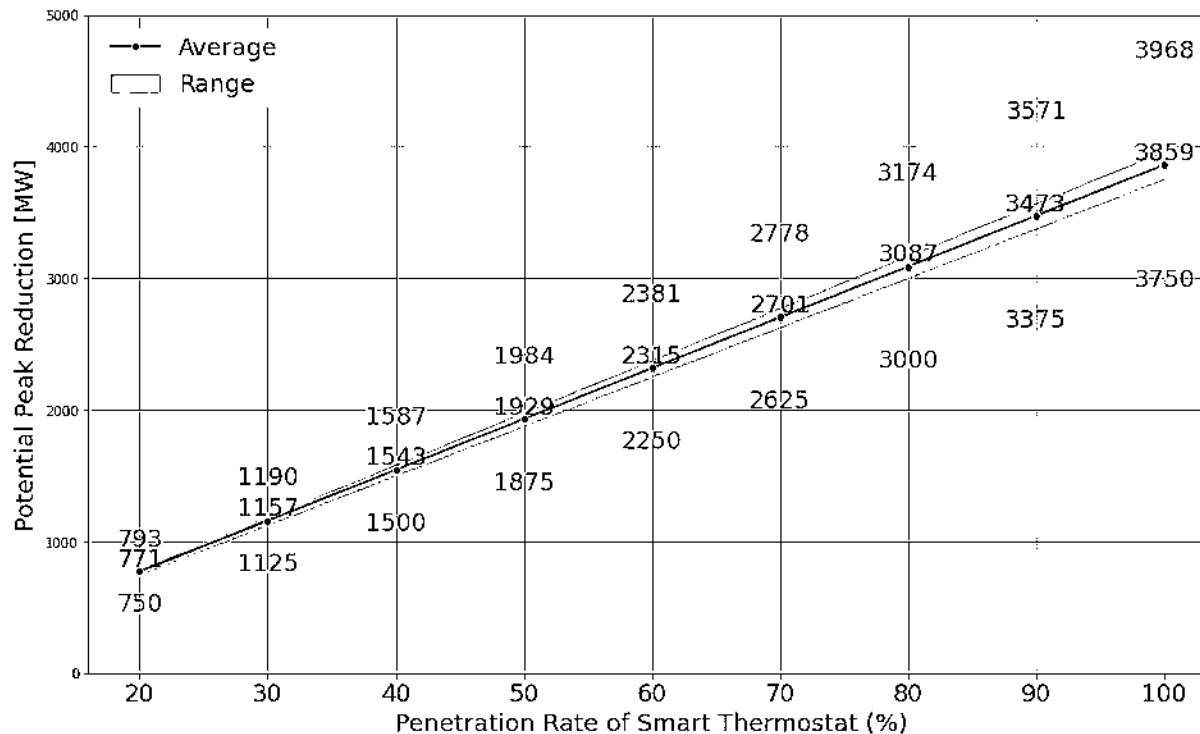
# Peak Reduction with Residential A/C



❑ Number of Smart Thermostat Installation in Texan Housing Units : 1.88 mil. [5-7, Appendix]

- Approximately, 20% of entire Texas's households with central A/C [Appendix]

❑ Proportion of customers **willing to engage in Demand Response** : 76% [8]



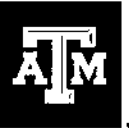
[5] <https://www.census.gov/quickfacts/fact-table/TX/BDU685222>

[6] [2020 Residential Energy Consumption Survey](#)

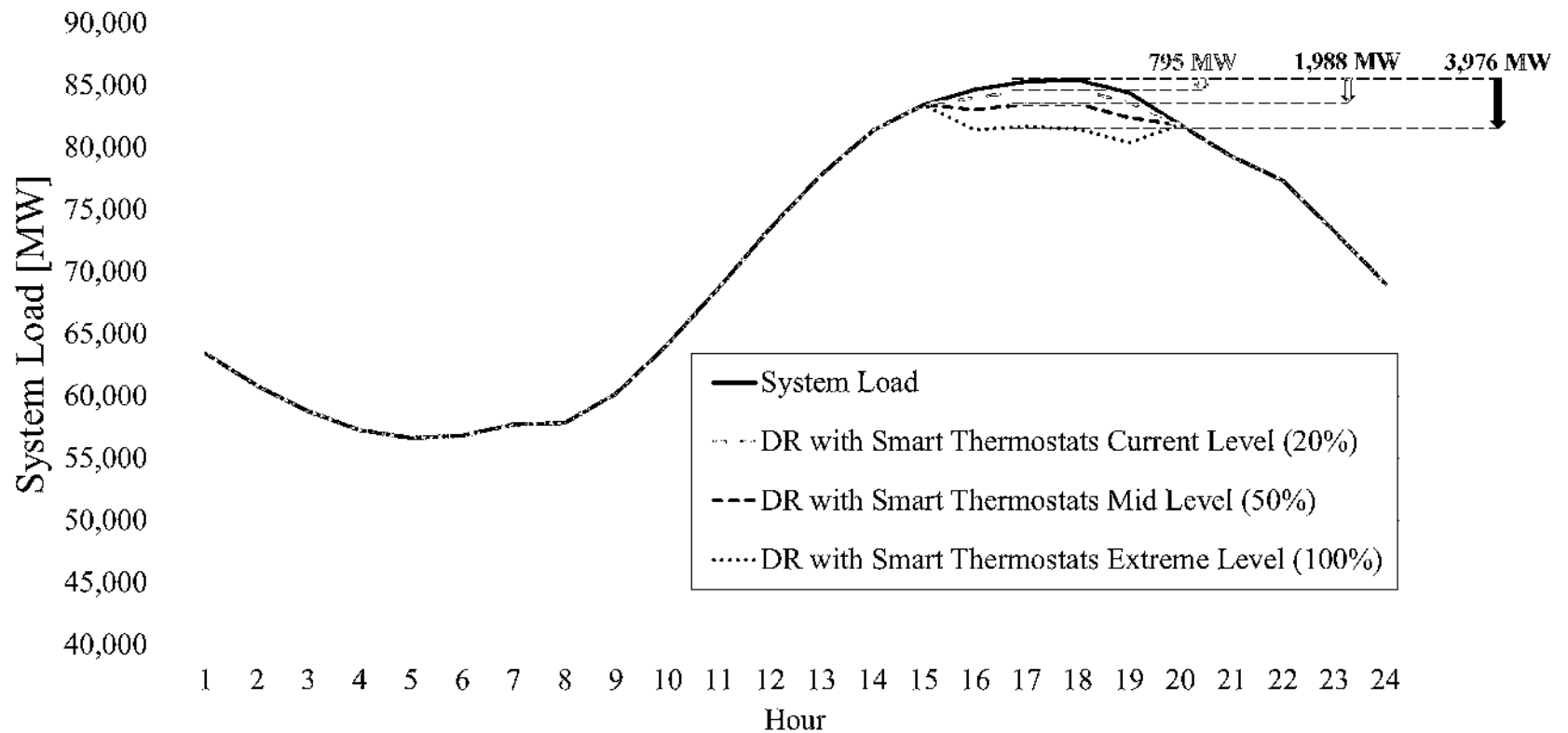
[7] [Household Energy Use in Texas](#)

[8] [Cooling High Summer Electric Bills Survey](#)

# 2023 All-Time Peak : 85,464 MW



August 10, 2023





# Social Program as Incentive



## ❑ Octopus Energy offers HAPPY HOUR <sup>[9]</sup>

- Octopus Energy hosts happy hours during peak hours to customers who set their thermostats to **80 degrees**



[9] <https://octopus.energy/blog/results-big-dirty-turn-down-trial-paid-off-peak-energy/>



# Potential Policy Recommendations

# Potential Policy Recommendations



- ❑ Legislating Energy Efficiency Retrofits
- ❑ Increasing the Demand Response Market Size
  - Improving Communications for end-user's participations in ADER Projects
  - REPs need to strengthen demand response program in residential sectors
  - Strengthen incentives for continued enrollment (including counterfactual penalties)
- ❑ Reforming the Energy Market
  - 4CP to 4 Net-CP, 4CP to 6CP
  - Valuing capacity on the demand side
- ❑ Educating & Encouraging Customers
  - Educating consumers about the importance of energy conservation



**Thank you**

# References



- [1] [2023 Annual Report of Demand Response in the ERCOT Region](#)
- [2] [Power Partner<sup>SM</sup> Thermostats, Rebates & Incentives, Austin Energy](#)
- [3] [WiFi Thermostat Rewards, CPS Energy](#)
- [4] [CenterPoint Energy 2022 Demand Response Impact Evaluation, Final Report \(March 8, 2023\)](#)
- [5] <https://www.census.gov/quickfacts/fact/table/TX/EDU685222>
- [6] [2020 Residential Energy Consumption Survey](#)
- [7] [Household Energy Use in Texas](#)
- [8] [Cooling High Summer Electric Bills Survey](#)
- [9] <https://octopus.enerresults-big-dirty-turn-down-trial-paid-off-peak-energy/gy/blog/>
- [10] [EUSS\\_ResRound1\\_Technical\\_Documentation.pdf \(oedi-data-lake.s3.amazonaws.com\)](#)
- [11] [Efficiency requirements for residential central AC and heat pumps to rise in 2023 - U.S. Energy Information Administration \(EIA\)](#)