

USING CUSTOMER PREFERENCES TO GUIDE CLIMATE- AND GRID-CONSCIOUS RATE DESIGN IN CALIFORNIA



NOV 14, 2023



ILLUME



WHAT WE'LL COVER TODAY

- Background and Methodology Overview
- Results Highlights
- Conclusions

Today's content is a small subset of a 2 hour, 67 slide presentation, available upon request

BACKGROUND AND METHODOLOGY OVERVIEW

BACKGROUND

- This RTP customer research study was adopted in D.22-08-022 to obtain residential, small business and agricultural customer input into PG&E's roadmap for dynamic rates and RTP.
- Key issues addressed from 11/2/22 DFOIR Phase 1 Scoping Memo and Ruling:

Rate Design

Track B, 3a. How should wholesale market price be incorporated into demand flexibility price signals? ?

Load & Bill Mgmt

Track B, 3b. What options should be provided to help customers plan and manage their bills?

Customer Segmentation

Track B, 3d. How should demand flexibility design consider the barriers and needs of low-income communities?

Track B, 4d. - 3rd party discussions

ROBUST QUANTITATIVE STUDY INFORMED BY QUALITATIVE PHASE

10 focus groups (4 Res, 4 SMB, 2 Ag)

- Qualitative research: Dozens of participants
- Showed sector average bills and bill impacts
- Helped inform key elements for the quantitative study
 - Research design: "What to test?"
 - Wording: "What language do customers use to discuss rates?"
 - Etc.

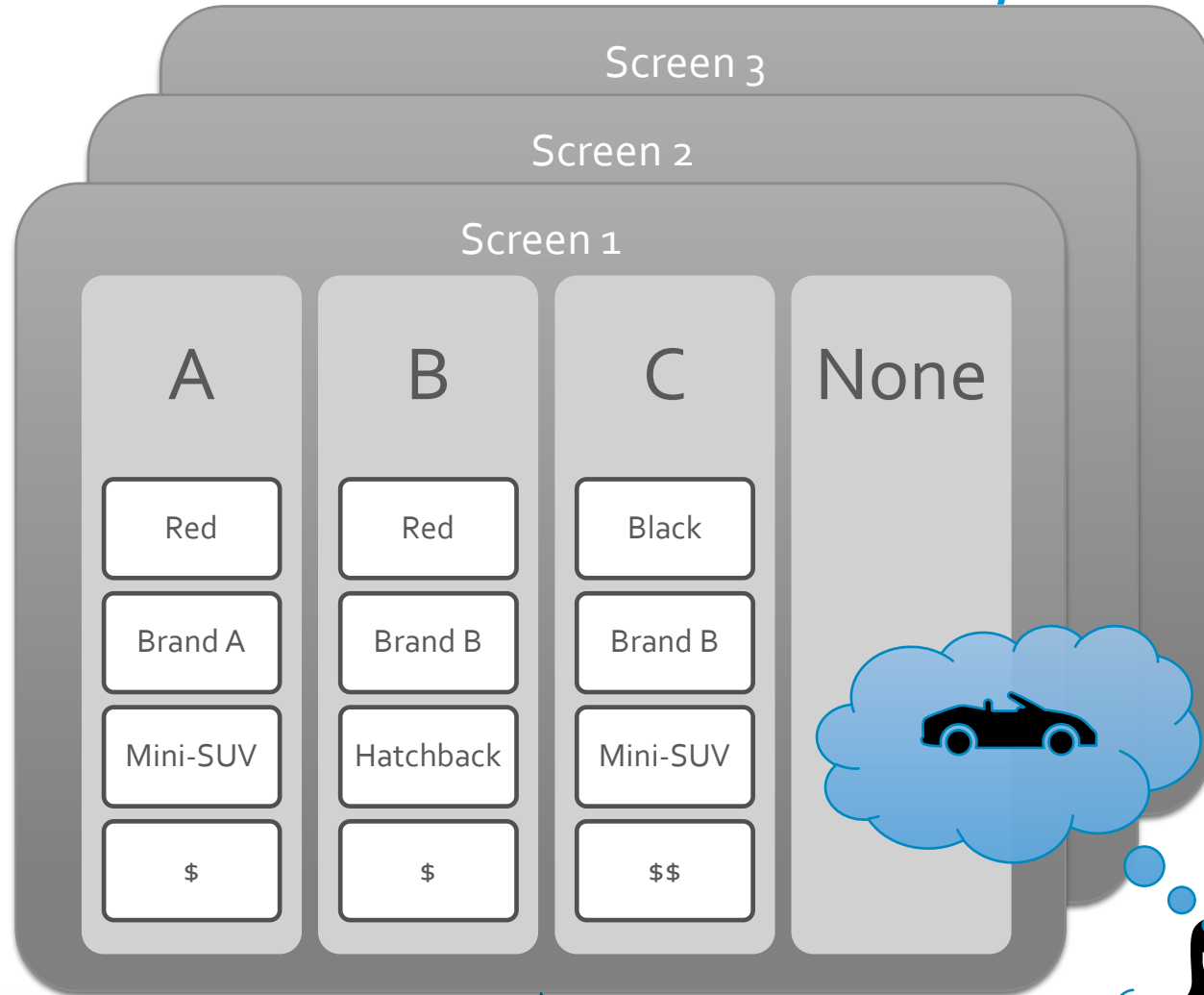
Choice Experiment (Conjoint) Survey

- Online quantitative: Residential N=2020, 6.6% complete rate*, Non-Residential N=889, 5.8% complete rate
- Showed respondent-specific bills and bill impacts
- Dynamically calculated bill impacts for choice concepts
- Tested live with customers before fielding to ensure clarity and usability

Novel design element, uses actual customer data

Median time in survey: ~22 min (Res, N=2020), ~20 min (SMB, N=611), ~24 min (Ag, N=278)

WHAT IS A CHOICE EXPERIMENT? (ALSO CALLED CONJOINT) GOLD STANDARD FOR PRODUCT / PROGRAM DESIGN



- In practice, customers may make one purchase / enrollment decision
- Simulates choice, presents multiple random choice sets to reveal drivers of customer choices
- Gold standard for product design, directly applicable to program design
- Produces data for dozens of combinations, can be used to identify optimal design for defined goals:
 - Maximize revenue? (participation)
 - Maximize profit? (net benefits)

HOW A CHOICE EXPERIMENT DIFFERS FROM A TYPICAL SURVEY

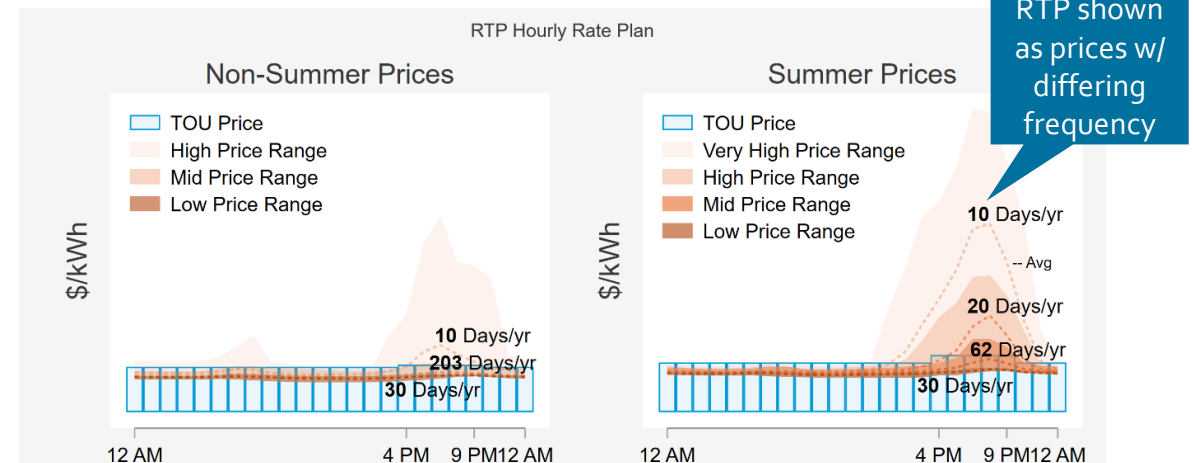
Typical Perception Based Study

- Perceptions only, no tradeoffs between options
- Simplistic rate visuals, no actual prices or price variations, no bill impacts
- Tend to produce exaggerated preferences / openness to new rates or concepts

PG&E RTP Research (DSA, 2023)

- Perception + choice experiment (randomized control trial)
- Visuals of actual prices, respondent specific, realistic dynamic bill impacts
 - Requested in focus groups
- Randomized control trial of actual tradeoffs
 - 876 Random rate plan configurations designed using 6 attributes tested

Similar visuals also shown for all rates tested



6 ATTRIBUTES INCLUDING RATE TYPE TESTED IN THE RESEARCH

Attribute	Levels	Short Description
Rate Type (Rate Option / Rate Plan)	<ul style="list-style-type: none"> o Time-of-Use o Time-of-Use + Grid Stress (two levels of adder from 5-8pm) o Day Type Hourly Pricing (7 predetermined 24 hour price curves) o Real Time Hourly Pricing (based on PG&E's DAHRTP design) 	Rate Plan: when and how prices differ
Price Peakiness (magnitude of price variation)	<ul style="list-style-type: none"> o Low (same variation as PG&E's DAHRTP) o Medium (multiplier of 1.5) o High (multiplier of 2) 	Displayed as "Estimated range of bill change". Note: Medium-High peakiness simulates adding T&D or marginal cost multipliers, resulting in up to double the time differentiation
Bill Stability Options	<ul style="list-style-type: none"> o None o Budget Billing o Limited Exposure (reflects LBNL 2-part subscription RTP) 	Bill Stability Options: options for avoiding bill swings
Bill Protection	<ul style="list-style-type: none"> o No bill protection o Include bill protection 	Bill Protection: try the new rate risk free for the first year
Price Response & Automation	<ul style="list-style-type: none"> o Limited usage shift o Moderate usage shift o Modest automated response o Substantial automated response 	Price Response & Automation: how you will change your usage in response to high price times
Support	<ul style="list-style-type: none"> o Self-managed (no additional support) o Utility / energy provider assisted o 3rd party assisted 	Support: services to help you implement your usage and shifting preferences

RESPONDENT-SPECIFIC BILL IMPACTS DYNAMICALLY CALCULATED FOR EACH RATE CONFIGURATION SHOWN

Please carefully consider each rate plan offer below. Hover or click the (i) symbol for more information.

Which would you choose if these three rate plans were available to you?

(6 of 8 screens)

- Conjoint choice experiment asked respondents to choose between 3 random rate plan configurations on each screen
 - 8 screens shown
- Analysis isolates the importance of each attribute and level
- Choice model combined with respondent characteristics, etc to model key metrics
 - Enrollment, peak load reduction, bill savings

Rate Type (i)	Time-of-Use (i)	Time-of-Use (i)	Real Time Hourly Pricing (i)
Bill Protection (i)	X	✓	X
Bill Stability Option (i)	Budget Billing (i)	Limited Exposure (i)	
Price Response & Automation (i)	Limited usage shift (i)	Modest automated response (i)	Moderate usage shift (i)
Support (i)	Utility / energy provider assisted (i)	3rd party assisted (i)	Self-managed (i)
Estimated Range of Bill Change green = savings	-10 to +9%	-7 to +3%	-15 to +2%
	Select	Select	Select

Tooltips showed rate visuals and level descriptions

Bill impacts dynamically calculated for each concept

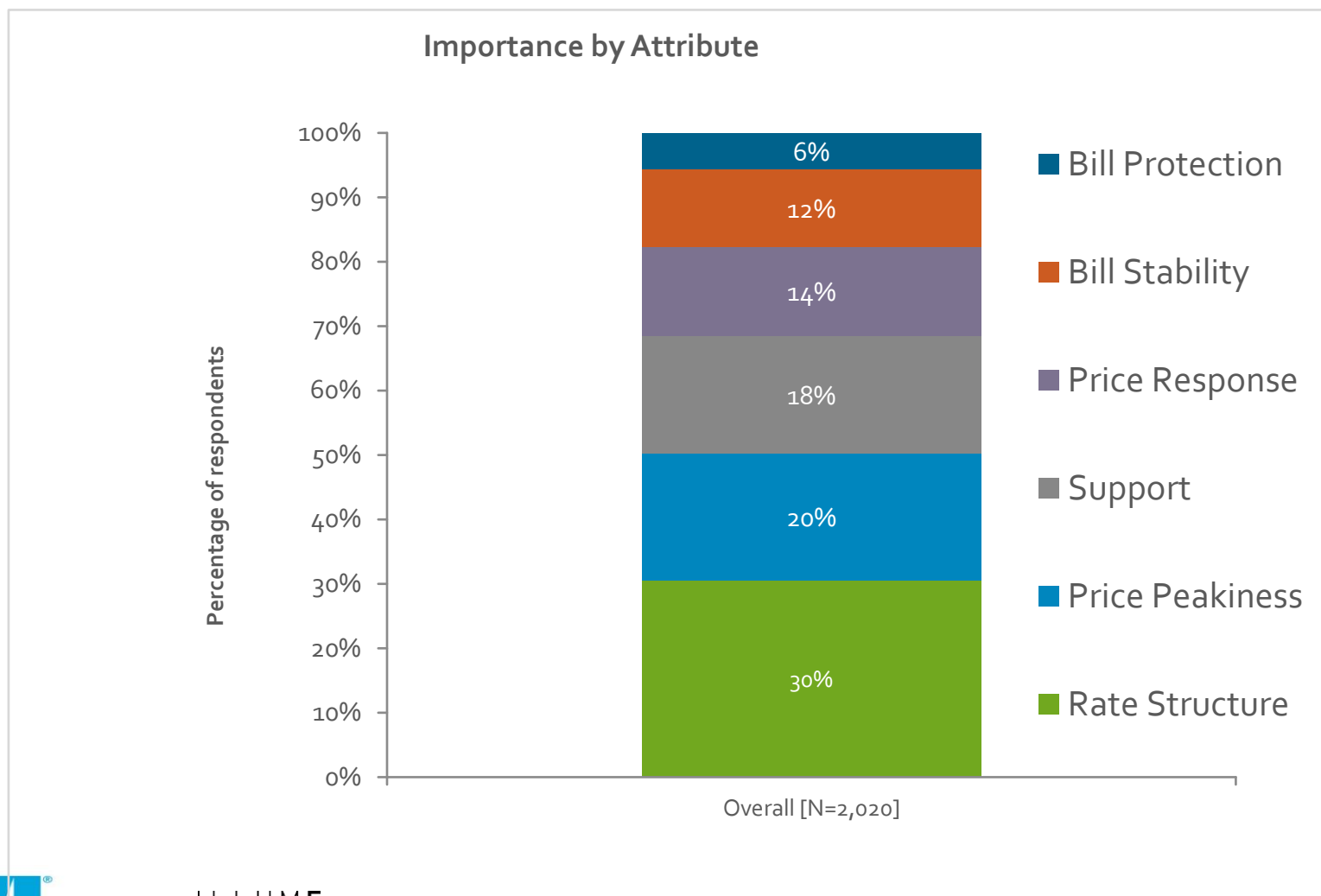
Respondents could choose to stay on their current rate

NONE: I would stay on my current rate.

Select

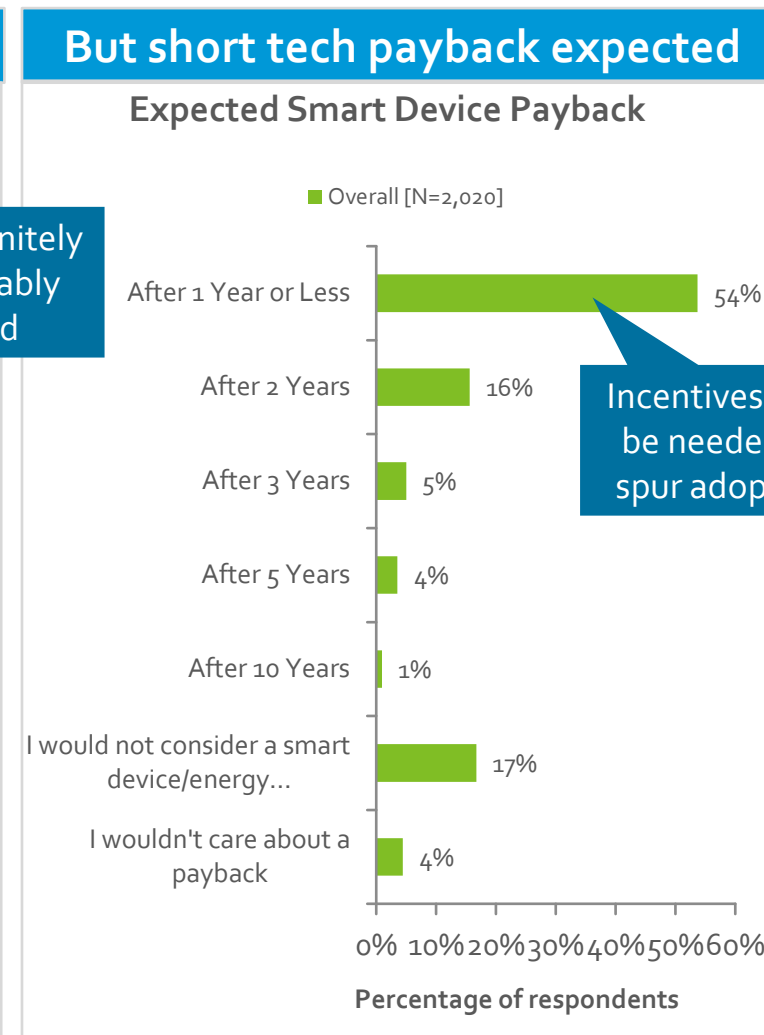
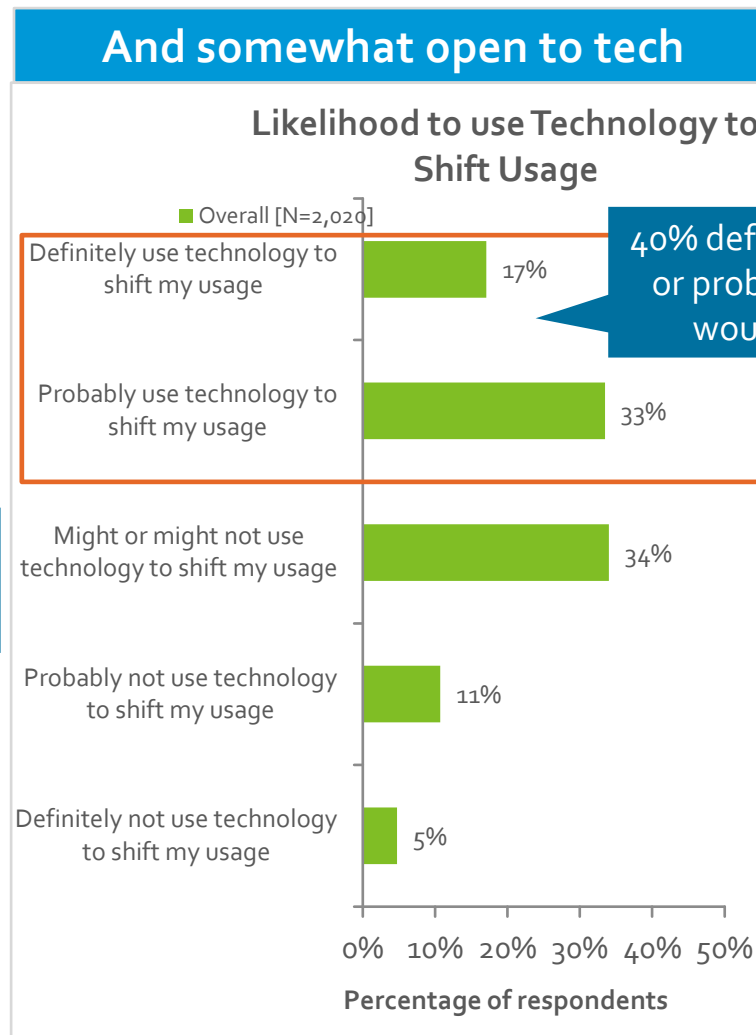
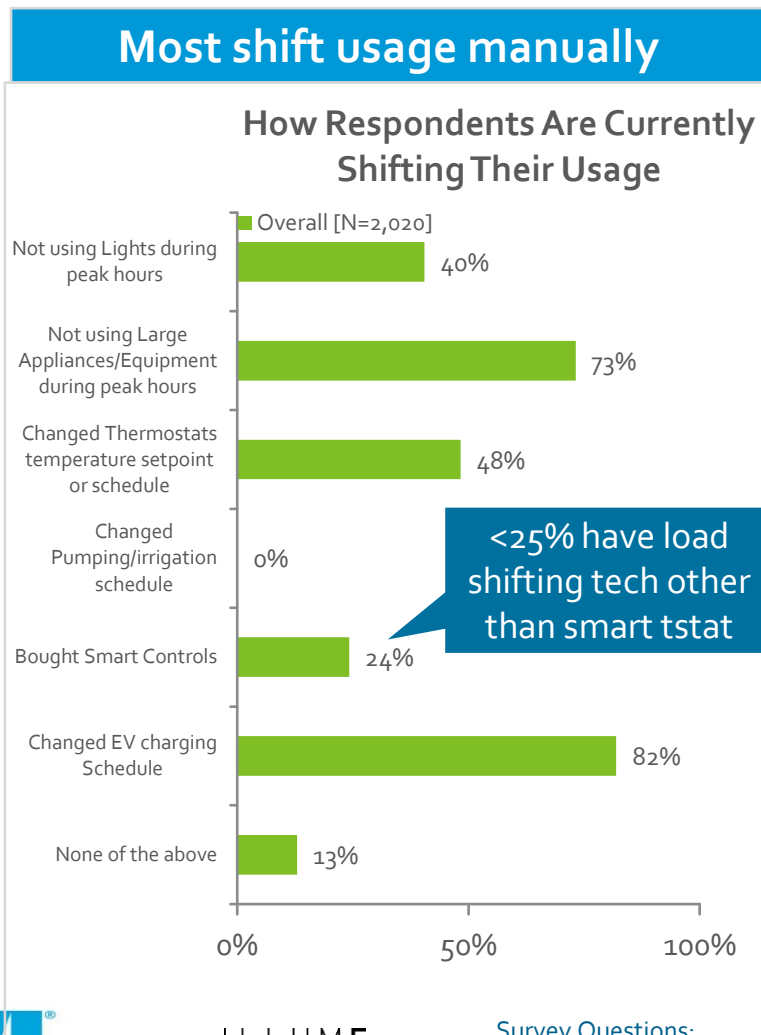
RESIDENTIAL RESULTS HIGHLIGHTS

RATE STRUCTURE & PEAKINESS ARE THE KEY DRIVERS FOR RATE SELECTION AND DRIVE 50% OF RATE SELECTION DECISION



- Relative importance = portion of preference decision driven by each attribute.
- Very strong 3 to 1 preference for TOU rate over RTP drove high rate structure importance
- Manual & automated price response, bill stability, and bill protection have low relative importance
- Very little variation across different subgroups

MOST RESPONDENTS ALREADY MANUALLY SHIFT USAGE AND SOMEWHAT OPEN TO LOAD SHIFTING TECH BUT EXPECT 1 YEAR PAYBACK



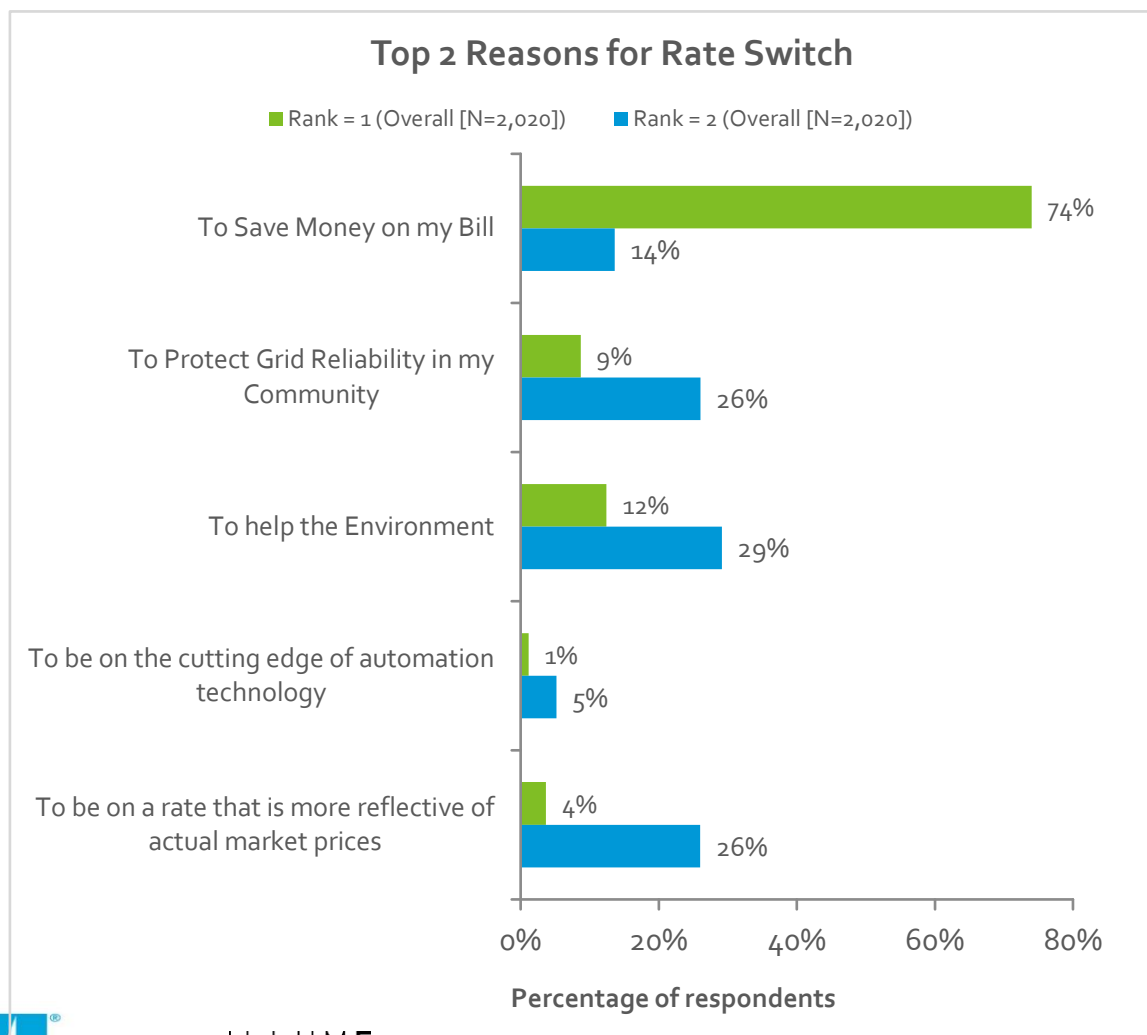
Survey Questions:

On your current rate plan, have you made any of the following changes to your energy use to avoid peak times?

Given the benefits above, how likely are you to consider using technology to help automatically shift your usage if you were on any of the rate plans presented?

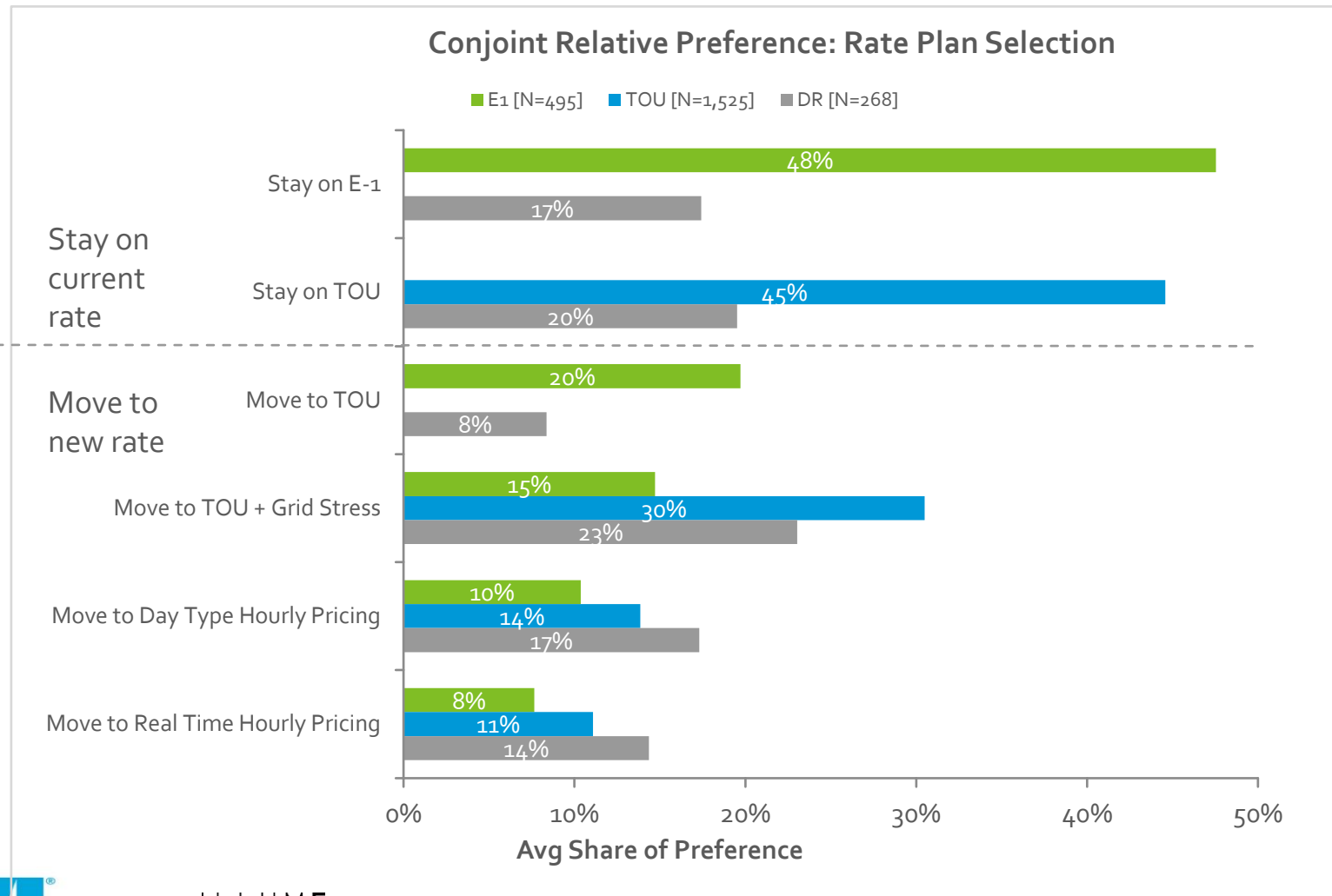
If you were to purchase a smart device, how quickly would you expect the device to "pay for itself" by delivering bill savings?

TOP RANKED REASON FOR SELECTING HOURLY RATES IS SAVING MONEY ON BILLS, AND ENVIRONMENT WAS THE SECOND CHOICE



- Adding environmental benefits increased openness (“definitely consider”) to the idea of Dynamic Rates by 18% (from 38% to 45%)
- Customers with significantly higher openness when environmental benefits were added included:
 - Customers currently on a TOU rate
 - CARE customers
 - CCA customers
 - Customers who own an EV (regardless of rate)
- Reliability framing also increased openness, but less than did environmental framing
- Majority of customers (73%) would shift in spring in response to lower prices; highest for customers on an EV rate (80%)

THE MORE TIME VARYING A RESPONDENT'S CURRENT RATE, THE MORE OPEN THEY ARE TO DYNAMIC RATES

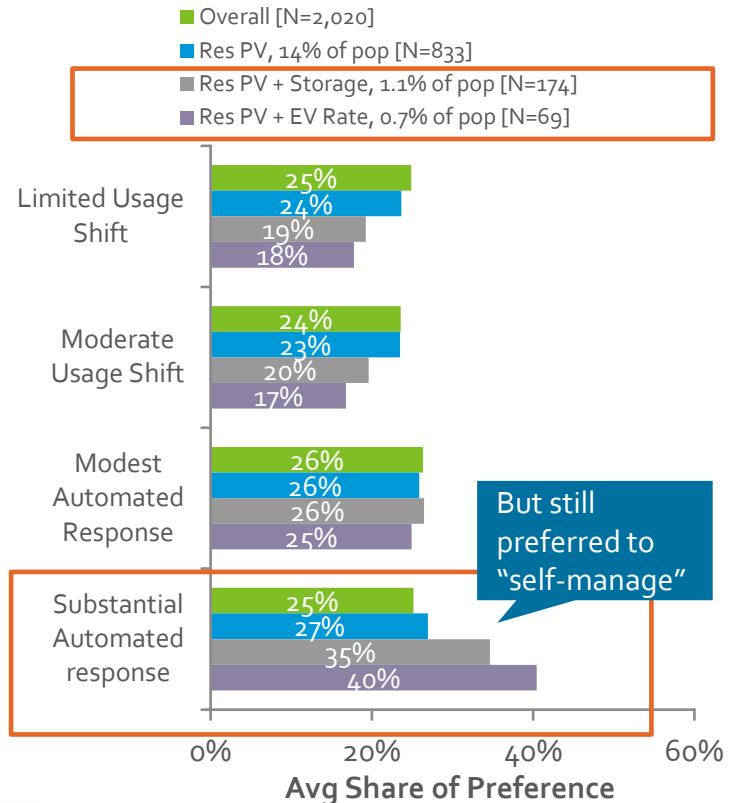


- Preference in a survey overstates likely uptake
- Though both E1 & TOU respondents strongly prefer their own rate, TOU respondents much more open to new dynamic rates
- DR respondents more open to hourly rates
 - 37% preference for current rate vs 14% for RTP
- TOU + Grid Stress preferred among new rates

TINY "TECH EARLY ADOPTER" POPULATION (PV + ES, PV+EV RATE), OPEN TO AUTOMATED LOAD SHIFTING, BUT THINK RATES TOO COMPLICATED

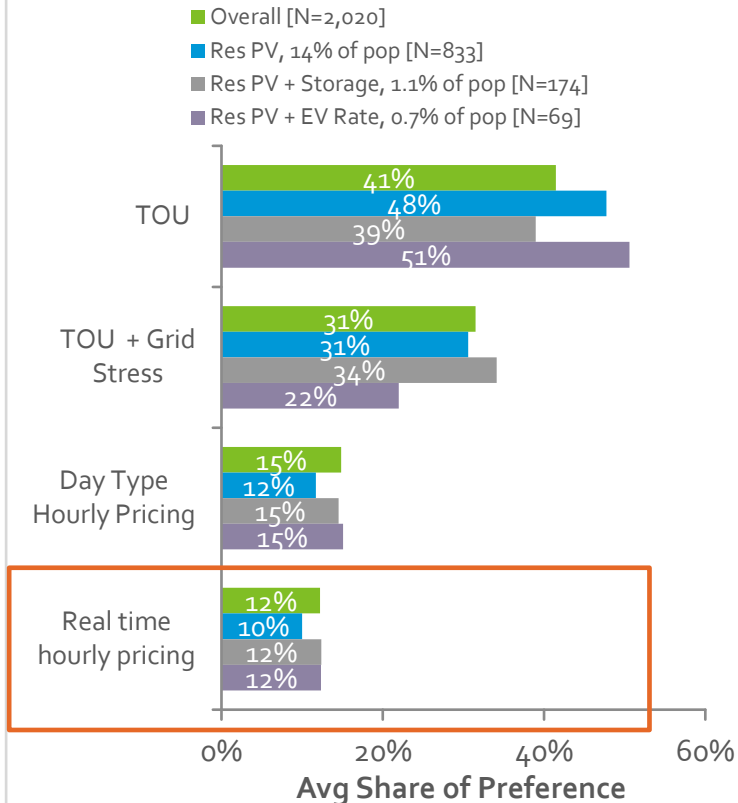
Prefer substantial automation

Conjoint Relative Preference: Price Response & Automation



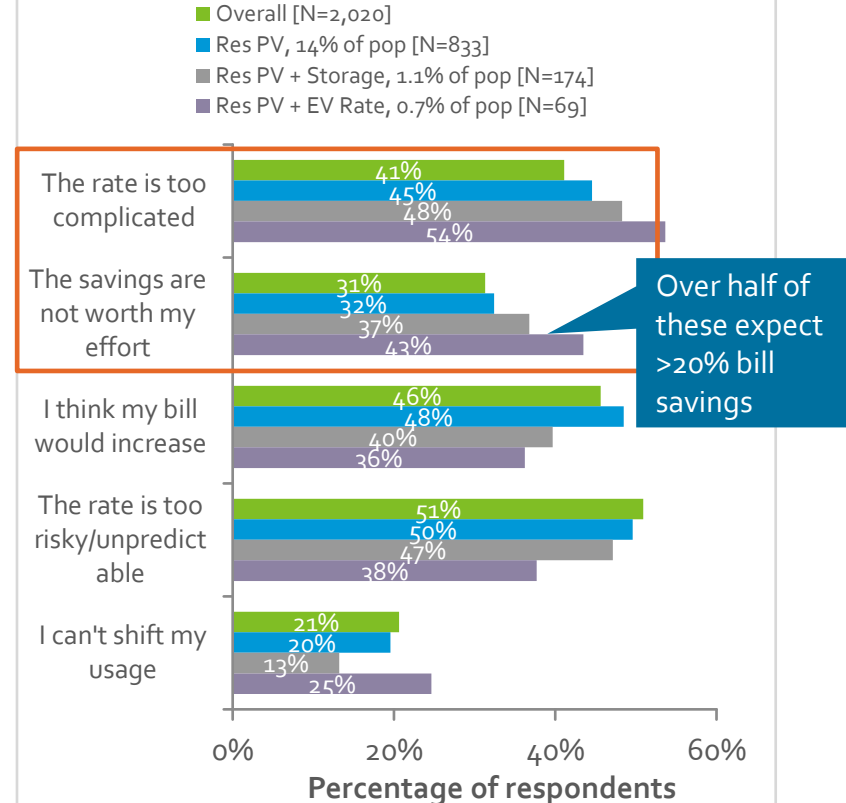
But not more open to hourly rates

Conjoint Relative Preference: Rate Structure



Find hourly rates too complicated

Why you WOULD NOT consider an hourly rate plan



RESIDENTIAL COMPARISON TO NON-RESIDENTIAL TAKEAWAYS

KEY SIMILARITIES: RESIDENTIAL & NON-RESIDENTIAL TAKEAWAYS

Rate design

- **Rate structure & peakiness** are the key drivers for rate selection
- Most respondents **prefer to stay on their current rate**, TOU + variable grid stress charge is the preferred new rate, a minority is open to hourly rate plans
- Most respondents **prefer less peaky rates**, though some are open to more peaky rates
- **TOU + Grid Stress Charge with medium to high peakiness** expected to produce most balanced outcomes
- **One size doesn't fit all**: offering multiple dynamic rates expected to maximize load reductions and enrollment

Load and Bill Management

- Top ranked reason for considering adopting hourly rates is **saving money**
- Respondents generally **prefer to manage their own loads**, but would prefer utility assistance to 3rd party assistance
- Most respondents already manually shift usage and somewhat **open to load shifting tech but need 1 year payback**
- Most respondents prefer **less frequent price notifications**, 1 day in advance with a longer price forecast, but just 11% wanted to lock in prices

Segmentation

- Preferences for rate design, load and bill management **generally the same across sectors**
- **Respondents with PV tend to have more technology but tend to prefer TOU** rate due to being structural non-benefiters on dynamic rates

KEY DIFFERENCES: RESIDENTIAL & NON-RESIDENTIAL TAKEAWAYS

Top barriers for hourly rates:

- Res: the rate being too risky (51%) and concerns about increased bills (46%)

Openness to dynamic rates and to RTP:

- Res: 10% preference for moving to RTP, 24% preference for being on a non-hourly dynamic rate

Adding “grid reliability” and “environmental” framing has different effects:

- Res: 10-20% increase in “Definitely” would consider dynamic rates

“Early / potential tech adopters” more open to automation, differing openness to load shifting when shown bill impacts

- Res: early tech adopters (PV+EV Rate or PV+Storage, 2% of population) 50% more open than average to substantial automated shift

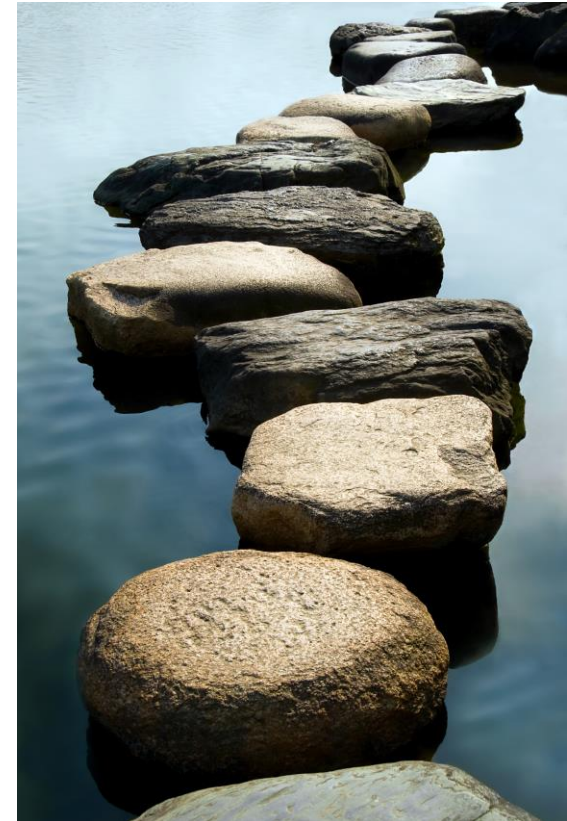
Relationship between structural bill impacts and openness to RTP:

- Res: Interest in moving to hourly rates not really differentiated by RTP bill impacts, but structural losers prefer TOU rates

OVERALL CONCLUSIONS

CONCLUSION: STEPPING STONES NEEDED TO LEAD TO RTP

- Very small subset of respondents are open to hourly RTP, but too small to define so intermediate stepping stones are needed to move customers towards RTP
 - Respondents on TOU and especially DR somewhat more open to RTP >> Expanding default TOU population and publicizing DR may yield greater openness to RTP in the long run while providing immediate grid benefits
 - Most respondents have strong preference for TOU + Grid Stress over hourly rates, especially SMB >> Likely to get bigger aggregate load shift with this in the short term (possible default opt-out for some in medium term)
- Focus dynamic price offerings to get most bang for the buck:
 - RTP + Low Peakiness + Subscription: low risk / moderate reward (Subscription may be necessary for NEM, needs further study)
 - TOU + Grid Stress + High Peakiness: best balance of appeal, load reduction potential, especially for structural losers
 - Most likely adopters already on TOU / DR
 - Customers that can provide the most load shift: those with energy storage or EVs
- Respondents are open to automation technology but not to automated response:
 - Significant investment needed to bring customer through the steps (1. comfort with tech, 2. comfort with automation) and develop meaningful automated response by customers
 - Ag seems to be the most open to this



QUESTIONS?



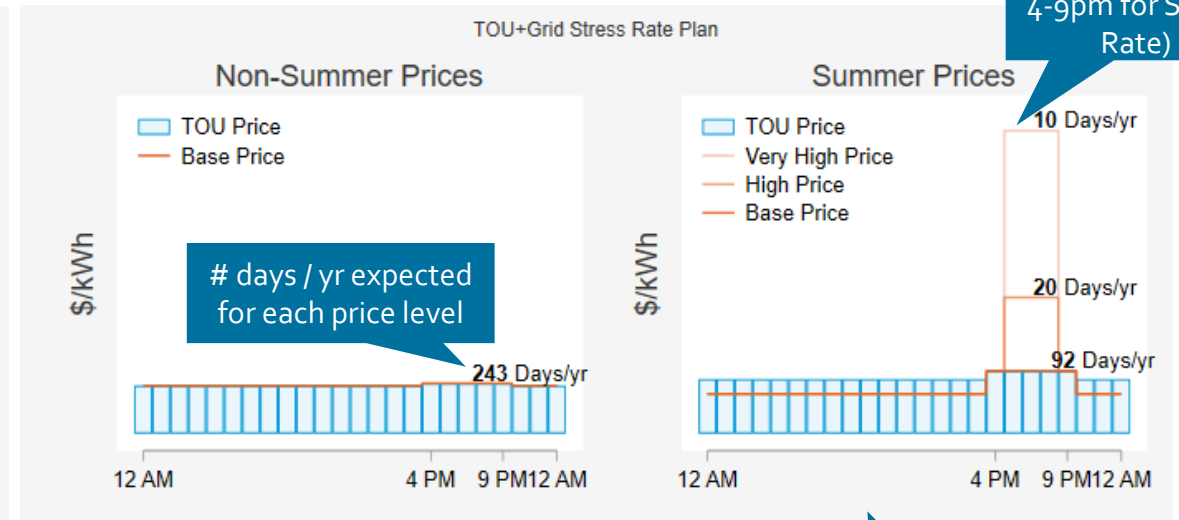
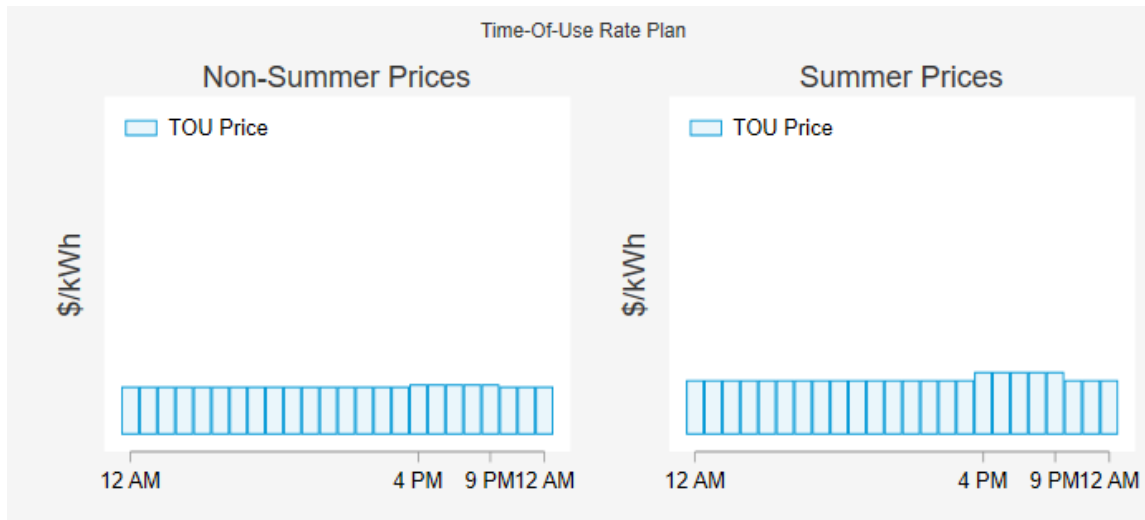
Alana Lemarchand
Partner
Demand Side Analytics
alana@demandsideanalytics.com
408.454.8158

APPENDIX

4 RATE STRUCTURES TESTED, INCLUDING 2 TOU RATES

TOU

TOU + Grid Stress Charge



2 levels of adders from 5-8pm (vs 1 level 4-9pm for Smart Rate)

days / yr expected for each price level

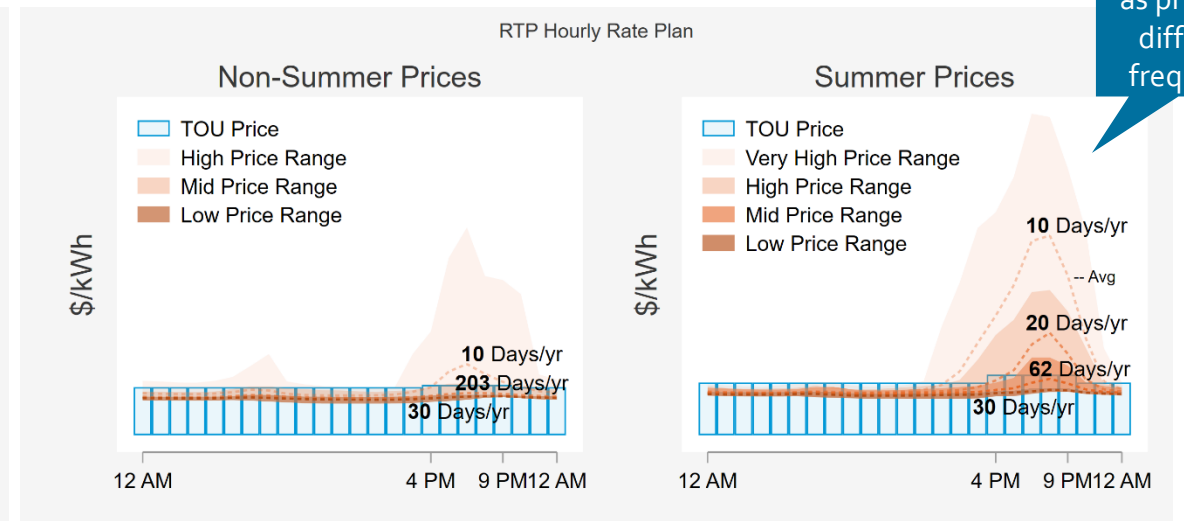
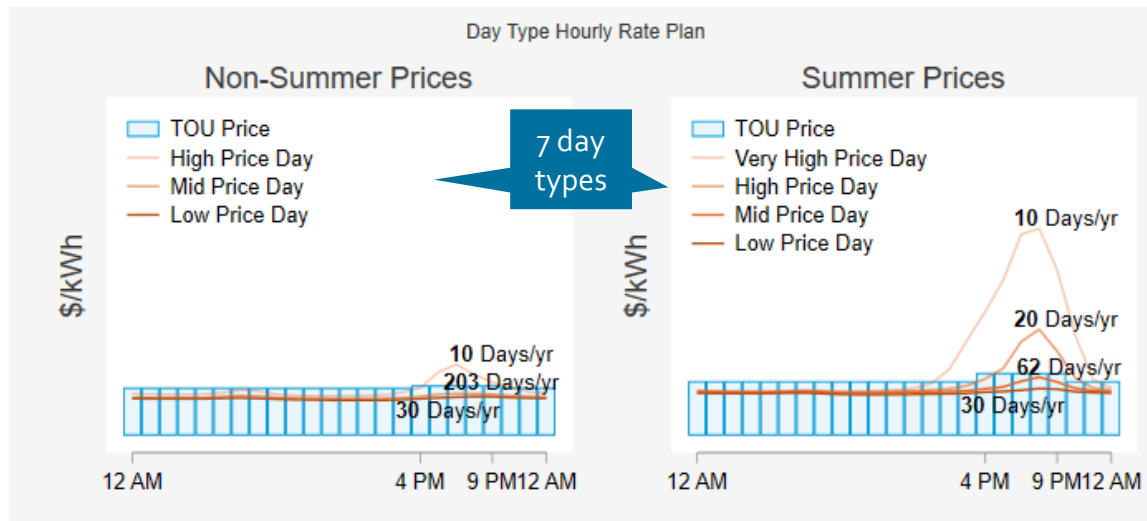
Same scale used for all visuals to ensure comparability

Scale reflects actual prices

4 RATE STRUCTURES TESTED, INCLUDING 2 HOURLY RATES

Day Type Hourly Day Ahead Pricing

Real Time Hourly Day Ahead Pricing



RTP shown as prices w/ differing frequency

Same scale used for all visuals to ensure comparability

days / yr expected for each price level

RATE DESIGN KEY TAKEAWAYS

Rate structure (rate option) & peakiness (magnitude of price variation) drive 50% of rate selection decision

Inertia: strongest preference for staying on current rate, TOU preferred to hourly rates among new rate options

- Preference in a survey overstates likely uptake
- Sharing accurate rate visuals and individualized bill impacts with rate attribute trade-offs helps respondents make realistic rate choices
- Respondents who understand RTP better are not more likely to select it

Most respondents prefer less peaky rates, though some are open to more peaky rates

- All else equal, residential respondents have a preference for the peakiness of current rates (low peakiness) vs higher peakiness
- Low peakiness preference is stronger for PV, DR, weaker for structural non-benefitters

TOU + Grid Stress Charge with high peakiness expected to produce most balanced outcomes (load reductions, bill savings, and enrollment) among 12 rate designs tested

- One size doesn't fit all: a portfolio of time-varying rate plans could maximize load reductions

LOAD & BILL MANAGEMENT KEY TAKEAWAYS

The top ranked reason for selecting hourly rates is saving money (74% of respondents ranked it as their top reason). Adding environmental benefits increased openness (e.g., “definitely consider”) by 18% (from 36% to 45%)

Top concern around hourly rates is risk of bill increases; bill stability options did not resonate

Respondents strongly prefer to manage their own loads; also preferred utility assistance over 3rd party assistance

Most respondents already manually shift usage and somewhat open to load shifting tech but expect 1 year payback

- Higher level of openness to using automation among current DER participants

Most respondents prefer less frequent price notifications, 1 day in advance with a longer price forecast, but just 11% wanted to lock in prices

CUSTOMER SEGMENTATION KEY TAKEAWAYS

The more time varying a respondent's current rate, the more open they are to dynamic rates including hourly rates

- Respondents on TOU are ~20% more open to TOU + Grid Stress Charge than Respondents on Tiered rates
- Respondents in DR programs are the most open to hourly rates, but prefer TOU + Grid Stress among new rates

Interest in moving to hourly rates not really differentiated by RTP bill impacts, but structural losers prefer TOU rates

- Similar preferences for respondents with very low load factors and structural bill increases above 5% on RTP (both highly correlated with PV)
- Some structural losers more willing to accept peakier (riskier) rates because peakier rates provide more opportunity to save

PV respondents strongly prefer to stay on current rate, would need a subscription type rate to reduce structural losses (because their current rate is less cost reflective / includes a subsidy)

- Though respondents with PV 2-3x as likely to have automation, they are not more open to automated response

Respondents who preferred RTP the most tended to be structural benefitters and more open to shifting tech

Tiny "early tech adopter" population (PV + ES, PV+EV Rate, 2% of population) not more open rates, and about half of them still think hourly rates are too complicated and that the bill savings are "not worth it"

- These early tech adopters reported double the average openness to shifting technology

EV Respondents more open to idea of dynamic rates and to using tech, but those actually on an EV rate turned off by higher bills

- 44% on an EV rate have solar and therefore structural losers. Those on an EV rate prefer less peaky rates and limited exposure (reducing losses but also benefits)

Despite being structural benefitters CARE respondents were no more open to RTP than were other respondents, and would prefer bill management

- CARE respondent preferences similar to non-CARE: strong preference for current rate, low interest in hourly rates
- On average, CARE respondents are structural benefitters on RTP and more interested in utility assistance, bill protection, and budget billing, but somewhat less open to shifting tech (except smart thermostats)