January 28, 2020

VERMONT PUBLIC SERVICE DEPARTMENT

RATE DESIGN INITIATIVE / DISTRIBUTED ENERGY RESOURCES STUDY
STAKEHOLDER ENGAGEMENT MEETING #2

NewGen Strategies & Solutions

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RATE DESIGN INITIATIVE

STAKEHOLDER ENGAGEMENT MEETING AGENDA

- Opening and Review Project Objectives and Progress
- Recap of Workshop 1 Outcomes
- Review Model Inputs, Considerations and Stakeholder Feedback
- Recap of LSAM and Use of Model for Breakout Exercises
- Breakout Exercise 1 – Using LSAM and Time of Use Rates
- Lunch
- Breakout Exercise 2 – Using LSAM and Time of Use Rates Continued
- Wrap Up and Next Steps

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RATE DESIGN OBJECTIVE

ADVANCED RATE DESIGN

The way in which customer interact with the electric grid and utilities is changing…….

Use utility **price signals, incentives, and other inducements** to **leverage technology and new business models** in order to better advance utility goals for **cost containment, renewables integration, and environmental performance** consistent with sector goals

STUDY OBJECTIVES

- Underlying factors influencing Study objectives
  - Define "innovative" rates
  - Engage utilities and stakeholders within Vermont to enhance success
  - Measuring successful outcomes:
    - Comprehensive Energy Plan
    - Alignment with VT Utility strategies
    - Define Key Performance Indicators (KPIs) and critical success factors

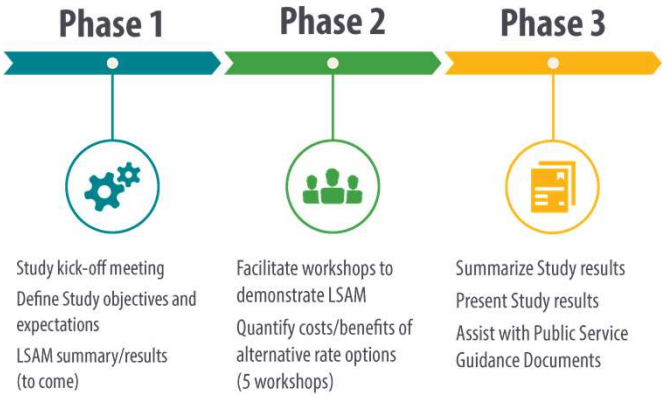
ANTICIPATED OUTCOMES

- Better load factors
- More responsive and managed loads (e.g., flexible loads)
- Maintaining, reducing average system costs/rates/bills
- Better integration of renewables
- New business models for sector
- Improving environmental outcomes

What is the cost of continuing "business as usual"?

STUDY TIMEFRAME

- September 15, 2019 – May 29, 2020



STAKEHOLDER ENGAGEMENT AND WORKSHOP PROCESS

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STUDY OBJECTIVES

- Develop a series of facilitated **stakeholder engagements** with utility management and staff, energy service companies, interested regulators, and consumer / environmental interests
  - Explore / model potential new retail rate designs
  - Quantify rate impacts to customer / utility / system
  - Summarize workshop discussions, decisions, and outcomes

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STAKEHOLDER WORKSHOP #1 - RECAP

DECEMBER 12, 2019

- Workshop #1: Focus on project objectives and soliciting insights from stakeholders
  - Subsequent workshops are more detailed and quantitative
- Objectives / outcomes
  - Develop common project understanding
  - Develop and share the "state of rates in Vermont"
  - LSAM© example and demonstration
  - Solicit strategic insights and feedback
  - Participant engagement

FUTURE STAKEHOLDER ENGAGEMENT EVENTS

- Event #2 (January 2020)
  - More hands-on, analytical
  - Evaluate rate options, impacts, benefits
- Event #3 (March 2020)
  - More hands-on, analytical
  - Evaluate rate options, impacts, benefits
  - Incorporate feedback
- Event #4 (April 2020)
  - Synthesis of the analytics
  - Discuss key insights / outcomes
- Event #5 (May 2020)
  - Summary of results
  - Accomplishment of Study objectives
  - Next steps

RECAP OF WORKSHOP 1

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STAKEHOLDER WORKSHOP #1 – GENERAL INSIGHTS

- State of rates in Vermont:
  - Actively pursuing more innovative rate options
  - Active in EV rate options
  - High PV penetration and growing behind the meter storage
- Customers in Vermont are becoming more interested in being "part of the solution" – value in participating
- Regional Network Service (RNS) savings associated with DER may be temporal and misrepresented by some in the market

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STAKEHOLDER WORKSHOP #1 – OPPORTUNITIES AND CHALLENGES

Opportunities	Challenges
• Customer value realized as "part of the solution" • Electrification (EVs and Home) • Renewables/storage offerings • Increasing market participants (3rd parties) • Awareness high, follow through lacking	• CIS / Billing systems lagging • Increasing complexity, administrative needs • Equity • More flexible loads • Data management • Generating interest with limited bill savings

STAKEHOLDER WORKSHOP #1 – DESIRED OUTCOMES AND KPI FEEDBACK

- Compare and benchmark to baselines (status quo)
- Maximize flexible loads
- Evaluate / consider total energy burden
- GHG emissions may increase on electric system but aggregate may decline
- KPIs:
  - Power supply costs | Load factor | GHG | Average system costs

STAKEHOLDER WORKSHOP #1 – CREATION OF TECHNICAL WORKING GROUP

To support the integration and use of LSAM within the project and workshops, a Technical Working Group was created to allow a subset of the participants greater access and use of the model.

- Purpose of the group:
  - Gain experience with LSAM, evaluate the model, become familiar and provide feedback throughout process
  - Test local utility conditions and rate options
  - Develop capacity with participants, initial model leaders for breakout exercises

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LSAM MODEL INPUTS AND FEEDBACK FROM WORKSHOP 1

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NEWGEN'S LOAD SHAPE ANALYSIS MODEL (LSAM)

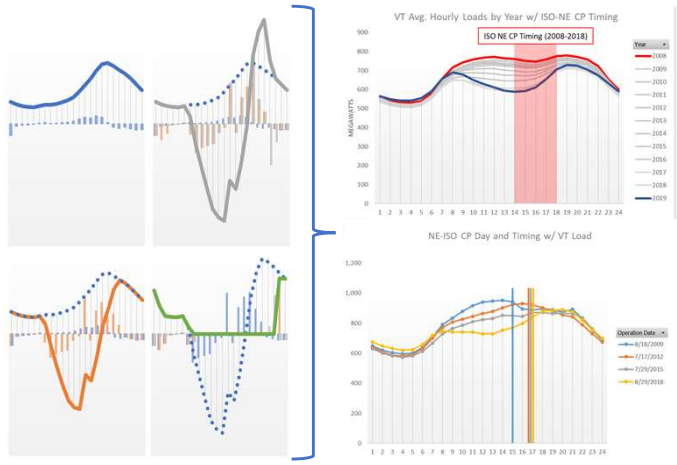
- Dynamic model designed to facilitate strategic decision-making
  - Forward-looking model supporting short-, medium-, and long-term planning
- Integrates rate design, financial planning, and resource planning
- Discretely adjusts forecasted load and billing determinants based on:
  - DER adoption
    - Solar / PV
    - Electric Vehicles
    - Energy Storage
  - Dynamic and/or flexible loads
    - Customer responsiveness to pricing signals
    - Utility-controlled DSM/DR

LSAM'S ROLE IN THIS STUDY

- LSAM allows study stakeholders to evaluate the impacts of new and innovative rate designs on
  - DER adoption
  - Load shapes and forecasts
  - Power supply costs
  - Revenue recovery and financial performance of the electric utility
- LSAM also allows for instantaneous evaluation of numerous scenarios and sensitivities

LSAM MODEL INPUTS: FORECASTING DERS, OTHER ELECTRIFICATION TECHNOLOGIES, AND POLICY IMPACTS

- PV
  - How much and by when?
- EV
  - How many, by when, charged where, at what voltage, and at what time?
- Other Electrification Tech
  - How much, by when, and at what impact?
- Storage
  - How much, by when, and how will it be charged/discharged?



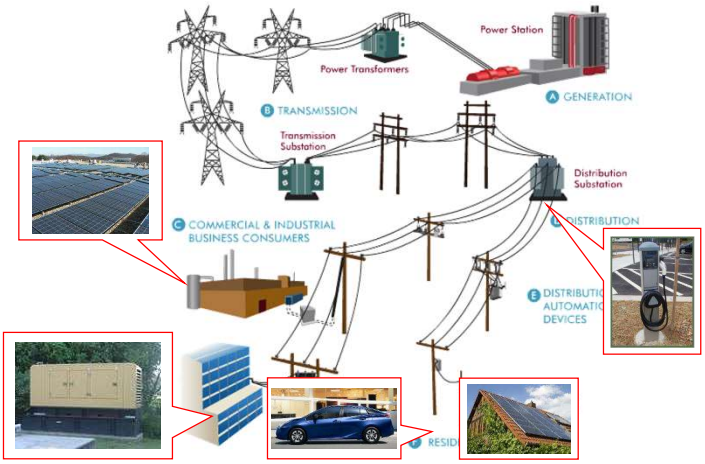
LSAM INPUTS AND OUTPUTS

FORECAST INPUTS	OUTPUTS (Pre and Post Inputs)
• PV – Econometric adoption forecast – Rates + policy + installed costs • EV – Adoption: Base and High Cases – Charging: Travel data for Northeast • Electrification (CCHP, Elec. H2O) – Input % of Residential Customers • Flex Load / Energy Storage – Input MW and duration (Workshop 3)	• ISO-NE Costs – Energy and Capacity • Renewable Compliance (RECs) – Scenarios for different RES policies • Regional Network Transmission – Currently based on embedded transmission rate for VT + 12CP load • Distribution capacity costs • Retail energy sales (rate pressure) • Carbon emissions and savings

WORKSHOP 1 FEEDBACK FOR LSAM OUTPUTS

SYSTEM LOAD ADJUSTMENTS AND IMPACTS TO DISTRIBUTION CAPACITY COSTS

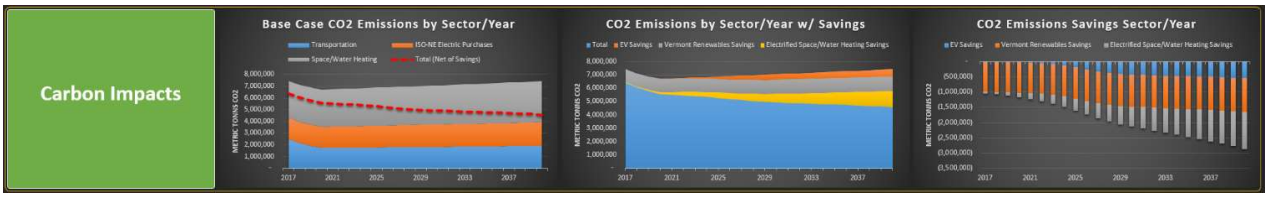
- Feedback from Workshop 1:
  - Distribution system upgrades are necessary to integrate all the DERs; potential fatal flaw.
  - What are and at what cost are the upgrades?



WORKSHOP 1 FEEDBACK FOR LSAM OUTPUTS

CARBON ACCOUNTING

- Carbon accounting is tracked for technologies within the scope of LSAM
  - Electric purchases from the ISO
    - Pre- and Post-adjustments for LSAM technologies (PV, EV, CCHP, Elec. H2O)
  - REC purchases based on input RES targets
    - Selectable policy scenarios: 75% by 2032, or 100% by 2030
  - Converting internal combustion engine vehicles to EVs
  - Converting natural gas / propane-fired space and water heating to electric



RECAP OF LSAM AND USE IN BREAKOUT EXERCISES

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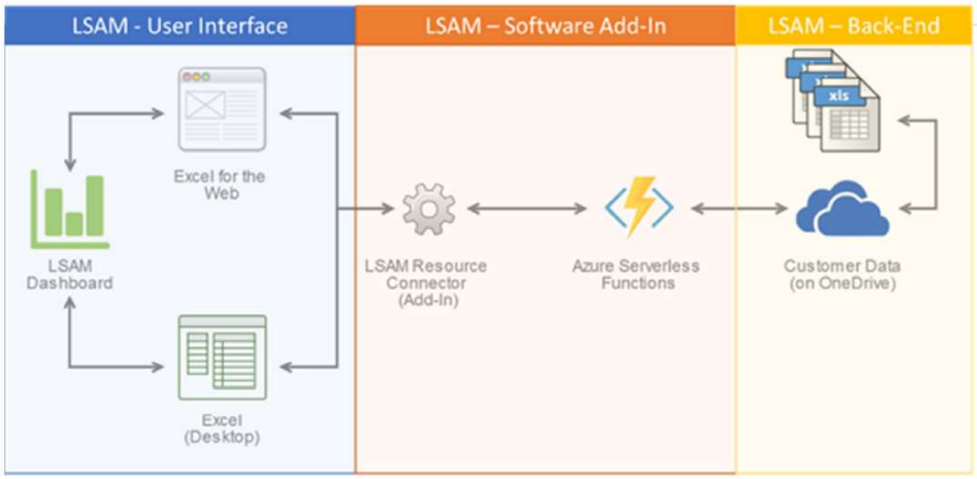
LSAM OVERVIEW – MODEL STRUCTURE



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LSAM OVERVIEW – MODEL STRUCTURE

- The user interacts with the User Interface and LSAM Add-In
- The User Interface is comprised of:
  - Three dashboards
  - Several tabs of other information and detail on:
    - EV forecast and impacts summary
    - Solar forecast and basis for impacts
    - Electrification assumptions
    - Carbon accounting
    - Other bases for input assumptions to the forecast

LSAM OVERVIEW – USER INTERFACE DASHBOARDS

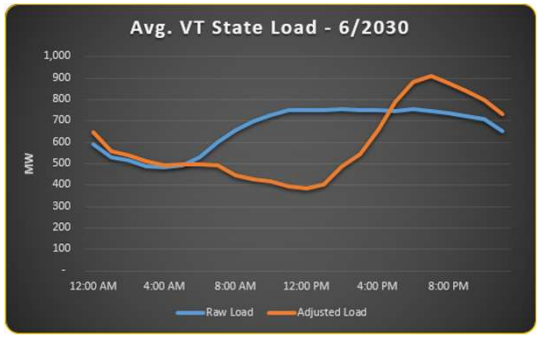
- Within the LSAM User Interface, there are three Dashboards:
  - Status Quo – Dash
    - User can view the system's dynamics in different years and different seasons
  - Rate Design – Dash
    - User can design Time-of-Use rates
    - Flexible interface
      - Seasonal, On-, Off-, and Mid-Peak demand and energy rates
  - Flexible Load – Dash
    - More to come in Workshop 3

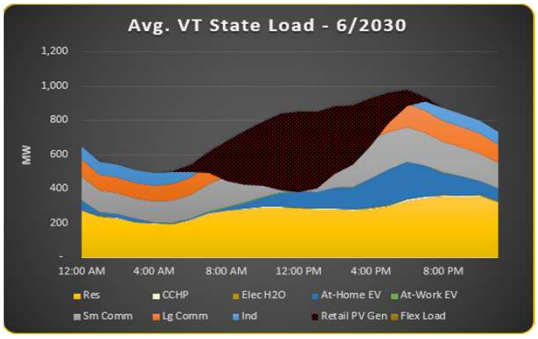
Across all Dashboards, the user can select the year and month to see the system's KPIs in the nearer or more distant future

LSAM OVERVIEW – LSAM ADD-IN INPUT ASSUMPTIONS

- Numerous input assumptions may be toggled, with key assumptions highlighted in royal blue:
  - Ongoing rate design policy (current vs. TOU/Flexible)
  - Ongoing Solar Net Metering policy (multiple options)
  - Solar cost projections (base vs. low cost)
  - Electric vehicle adoption forecast (base vs. high)
  - Electric vehicle charger voltages
    - 1.8 kW, 7.2 kW, and 12 kW
    - Market share can be changed over the forecast period

LSAM EXAMPLE – 2030 FORECAST WITH LSAM DEFAULTS





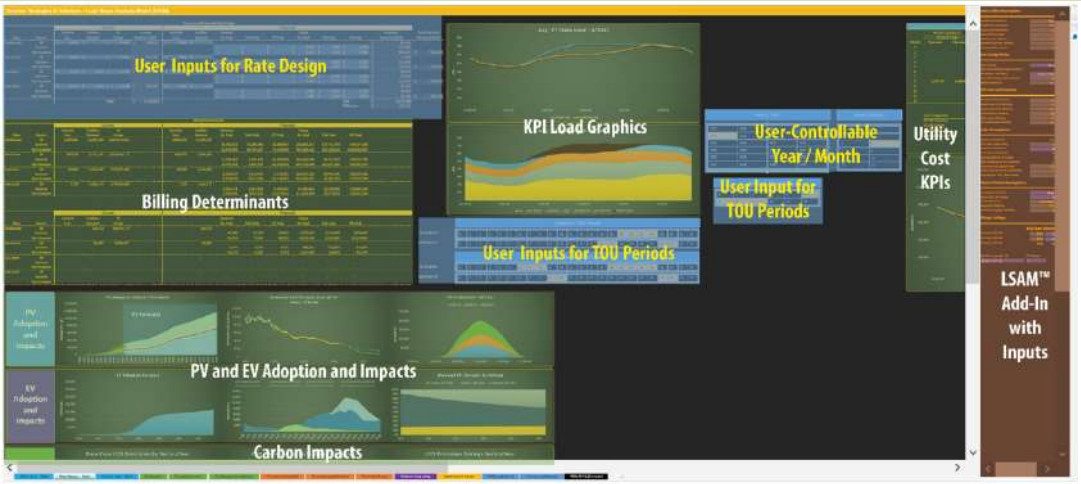
- Continued solar adoption has led to low load during the day, and fewer retail energy sales
- Electric vehicles charged at-home charging has increased the evening peak

LSAM EXAMPLE – 2030 FORECAST WITH LSAM DEFAULTS

	Cost Component	Billing Determinants Raw Load	Billing Determinants Adj. Load	Diversity Factor	Forecast Rate	Cost ($000) Raw Load	Cost ($000) Adj. Load	% Difference
	ISO-NE Capacity	1,113,645	1,335,644		$6.16	$6,859	$8,226	19.9%
RES %	ISO-NE Energy	6,305,120	6,371,387		$48.96	$308,703	$311,947	1.1%
71.0%	RES Compliance Costs	4,476,635	4,523,684		$9.18	$41,095	$41,527	1.1%
	RNS Capacity	994,970	1,302,078		$158.52	$157,721	$206,404	30.9%
	Distribution Capacity	1,225,700	1,521,981	80%	$12.00	$11,767	$14,611	24.2%
					Total Cost	$526,145	$582,715	10.8%
					Retail MWh	6,305,120	6,379,073	1.2%
					Avg. Rate	$0.083	$0.091	9.5%

- Capacity peaks (ISO-NE Capacity, RNS, and Distribution) have increased
- Retail energy sales have not increased at the same rate
  - PV has decreased retail sales, CCHP and EVs have increased retail sales
- Net result is modeled +9.5% rate pressure in addition to inflationary pressure and other cost changes

LSAM EXAMPLE – RATE DESIGN DASH FOR SCENARIOS



LSAM EXAMPLE – RATE DESIGN DASH FOR SCENARIOS

		Current				Proposed								
Class	Season	Monthly Cust	Facilities Demand	All Energy	Current Revenue ($000)	Monthly Cust	Facilities Demand	Demand On-Peak	Demand Mid-Peak	Demand Off-Peak	Energy On-Peak	Energy Mid-Peak	Energy Off-Peak	Proposed Revenue ($000)
Residential	All	$ 14.40	$ -	$ 0.1645	$ 630,331	$ 14.00	$ -							$ 67,200
	Summer							$ -	$ -	$ -	$ 0.400	$ 0.250	$ 0.099	$ 209,509
	Non-Summer							$ -	$ -	$ -	$ 0.400	$ 0.200	$ 0.085	$ 401,094
Sm Comm	All	$ 19.05	$ -	$ 0.1618	$ 262,333	$ 19.05	$ -							$ 11,430
	Summer							$ -	$ -	$ -	$ 0.400	$ 0.260	$ 0.110	$ 117,170
	Non-Summer							$ -	$ -	$ -	$ 0.380	$ 0.240	$ 0.090	$ 181,454
Lg Comm	All	$ 31.62	$ 16.74	$ 0.1708	$ 205,201	$ 31.62	$ 16.74							$ 42,400
	Summer							$ -	$ -	$ -	$ 0.420	$ 0.220	$ 0.100	$ 69,575
	Non-Summer							$ -	$ -	$ -	$ 0.400	$ 0.210	$ 0.090	$ 106,052
Industrial	All	$ 31.62	$ 16.74	$ 0.1708	$ 140,328	$ 31.62	$ 16.74							$ 24,153
	Summer							$ -	$ -	$ -	$ 0.400	$ 0.220	$ 0.100	$ 38,443
	Non-Summer							$ -	$ -	$ -	$ 0.380	$ 0.220	$ 0.092	$ 75,152
				Total	$ 1,238,194								Total	$ 1,343,631
													Difference	$ 105,437

	Summer TOU Hours																							
On-Peak Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Mid-Peak Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

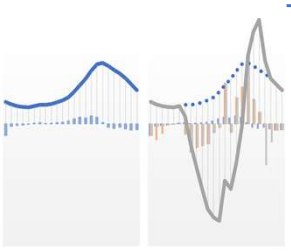
	Non-Summer TOU Hours																							
On-Peak Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Mid-Peak Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

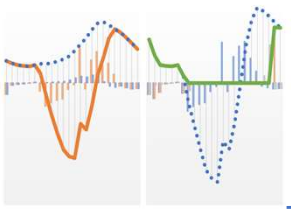
Summer Months					
1	2	3	4	5	6
7	8	9	10	11	12

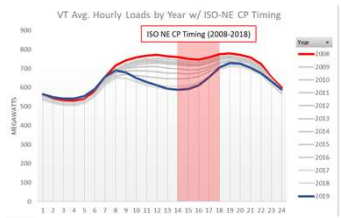
LSAM EXAMPLE – RATE DESIGN DASH FOR SCENARIOS

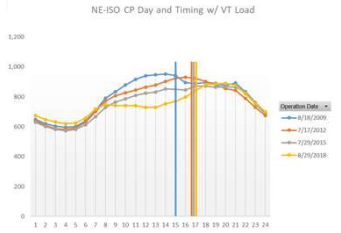
"Rates as a Resource"

Use rates to send a price signal to customers with an incentive to manage load and mitigate adverse impacts on utility cost KPIs









BREAKOUT EXERCISE #1:
TIME OF USE RATES UNDER 2030 CONDITIONS

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EXERCISE #1: DESIGN TOU RATES UNDER 2030 SYSTEM CONDITIONS

Instructions:

- Workshop will break into groups (by table)
- At least one "Technical Working Group" Representative per table (local LSAM user)
- Use LSAM to design TOU rates:
  1. Use/refer to instructions and load LSAM and related conditions/assumptions.
  2. Design TOU rates under 2030 conditions to better manage and optimize DER impacts to the system.
  3. Document results, outcomes on the handout sheets.
  4. Select 'spokesperson' to report findings to workshop

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LUNCH BREAK

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BREAKOUT EXERCISE #2:
TIME OF USE RATES UNDER 2040 SYSTEM CONDITIONS

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EXERCISE #2: DESIGN TOU RATES UNDER 2040 SYSTEM CONDITIONS

Instructions:

- Workshop will break into groups (by table)
- At least one "Technical Working Group" Representative per table (local LSAM user)
- Use LSAM to design TOU rates:
  1. Use/refer to instructions and load LSAM and related conditions/assumptions.
  2. Update LSAM from prior exercise to the year 2040.
  3. Design TOU rates under 2040 conditions to better manage and optimize DER impacts to the system.
  4. Document results, outcomes on the handout sheets.
  5. Select 'spokesperson' to report findings to workshop

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SESSION WRAP-UP

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SESSION WRAP-UP – SYNTHESIS OF BREAKOUT EXERCISE RESULTS

Outcomes / Lessons Learned:

General Feedback on LSAM:

SESSION WRAP-UP

- Workshop 3: March 17, 2020
  - Expanded, more complicated system conditions and rate design
  - Battery storage, flexible loads and application of CPP, RTP, etc.
- Next steps for Stakeholder Groups
  - Technical Working Group continued use of LSAM, collaboration with PSD and Consultant Team
  - Updates to LSAM inputs, conditions if needed (e.g., distribution costs)