



# Differentiated Reliability

Future Power Markets Forum  
July 22, 2021

## WHO WE ARE

R Street Institute is a nonprofit, nonpartisan, public policy research organization. Our mission is to engage in policy research and outreach to promote free markets and limited, effective government.



## WHERE WE ARE

In addition to our D.C. headquarters, we have offices in Georgia, Texas, Ohio, California and Massachusetts.

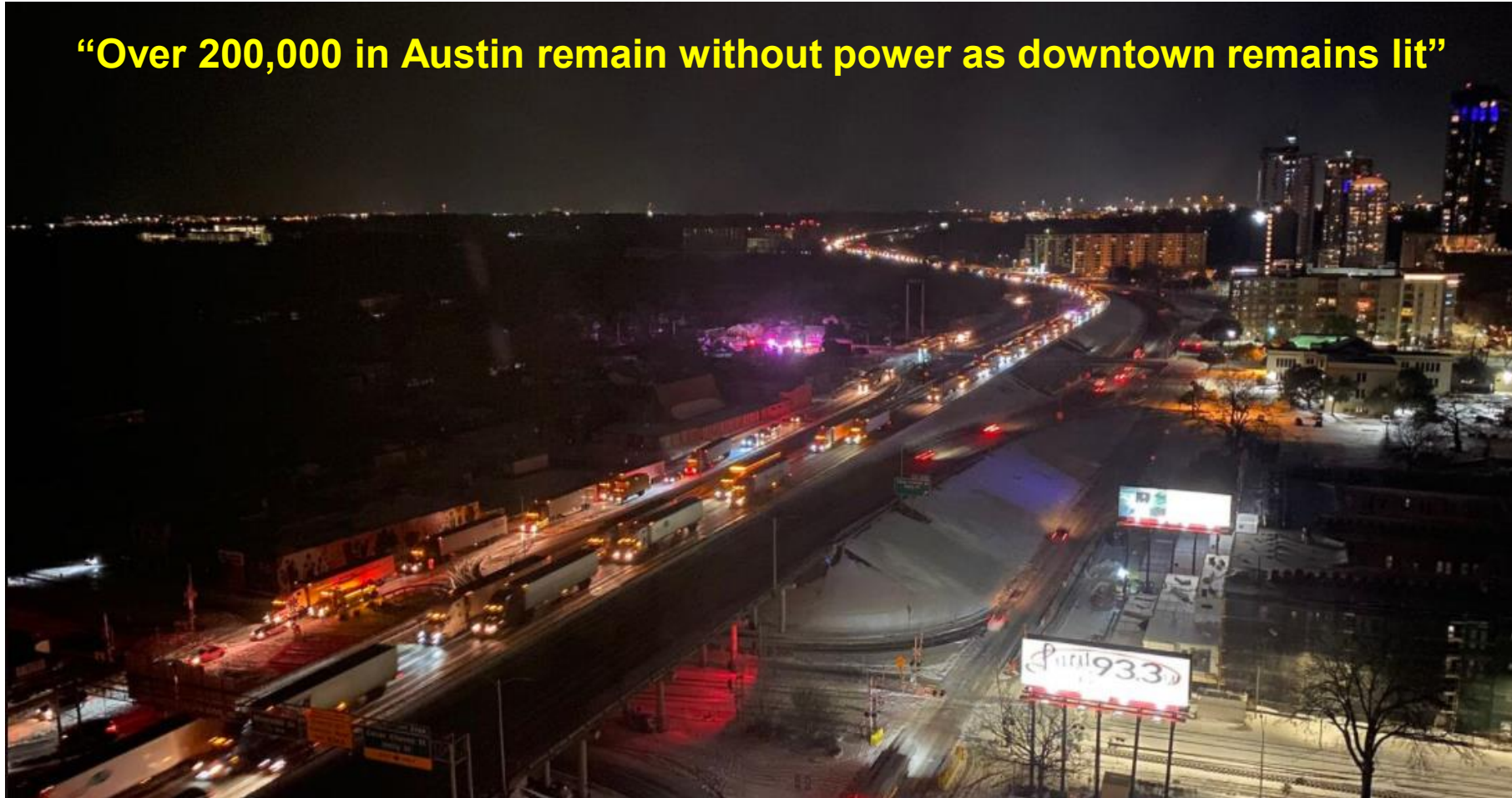




# (Bad) Differentiated Reliability

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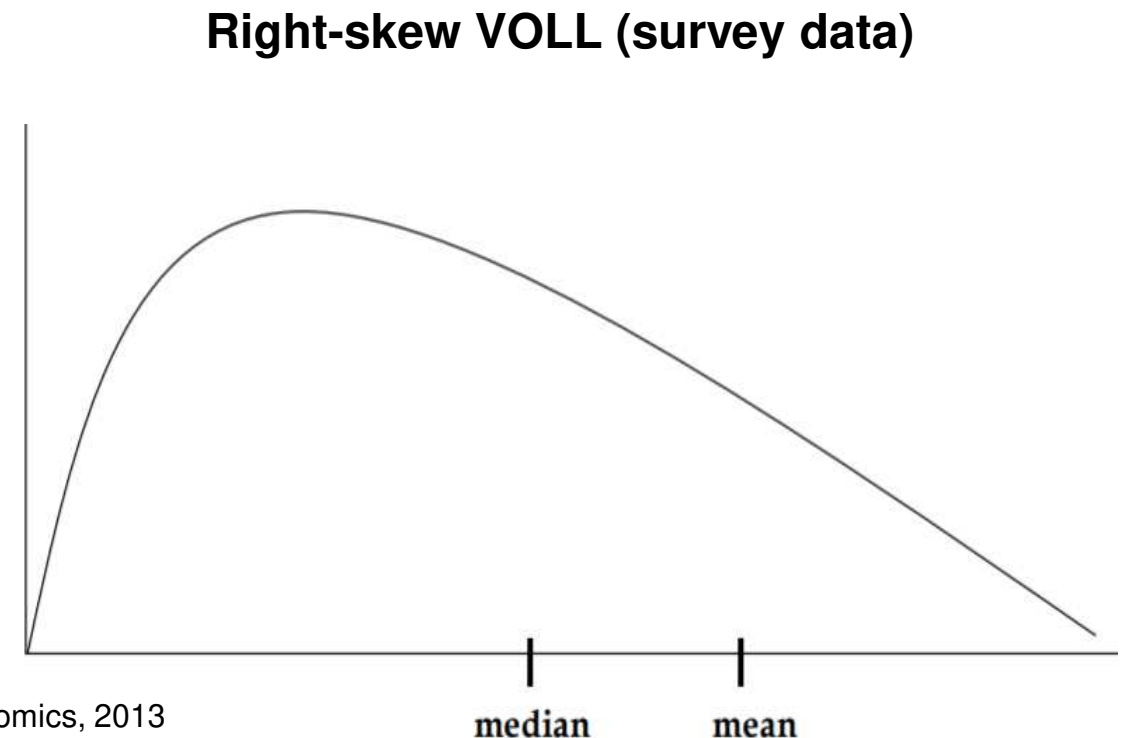
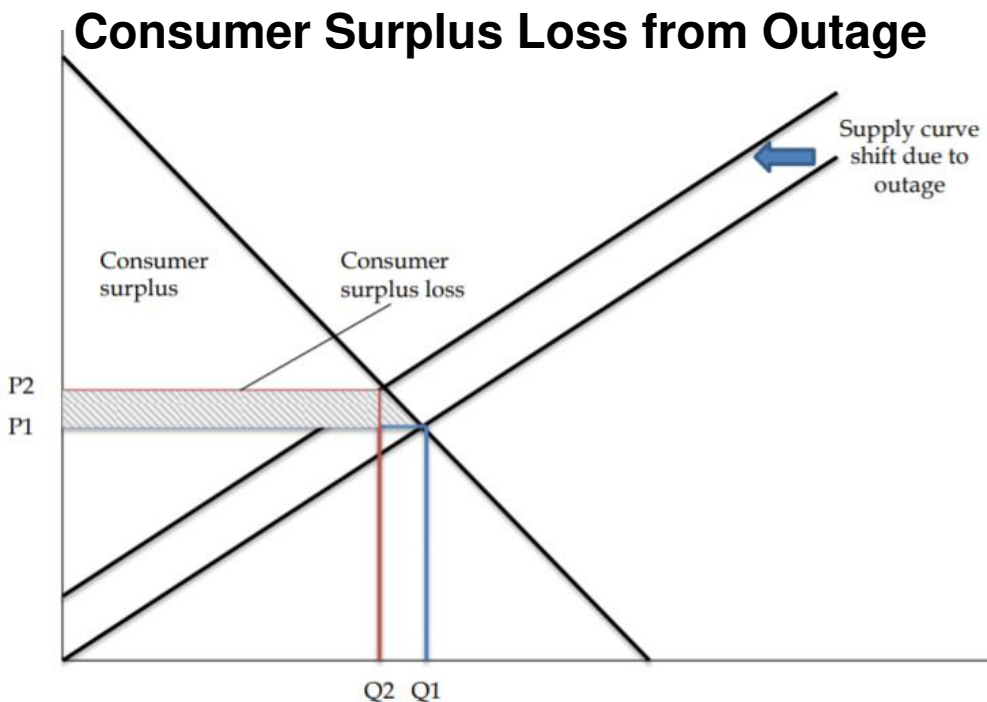
**“Over 200,000 in Austin remain without power as downtown remains lit”**



# (Good) Differentiated Reliability

“[R]eliability differentiation based on consumer outage costs” (Siddiqi & Baughman, IEEE, 1993)

- Societal welfare view → *heterogenous* value of lost load (VOLL)
- *Distribution* not just central tendency of VOLL



Source: London Economics, 2013

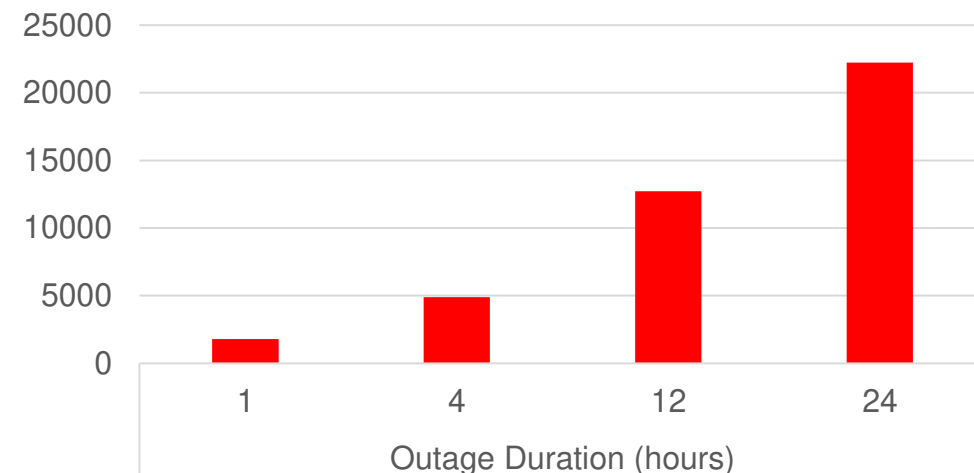
# VOLL Determinants

VOLL varies by 1+ orders of magnitude!

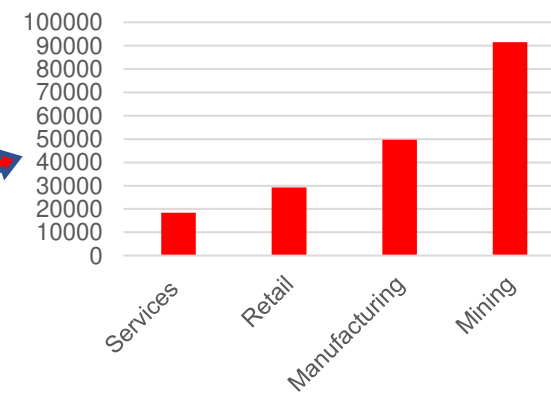
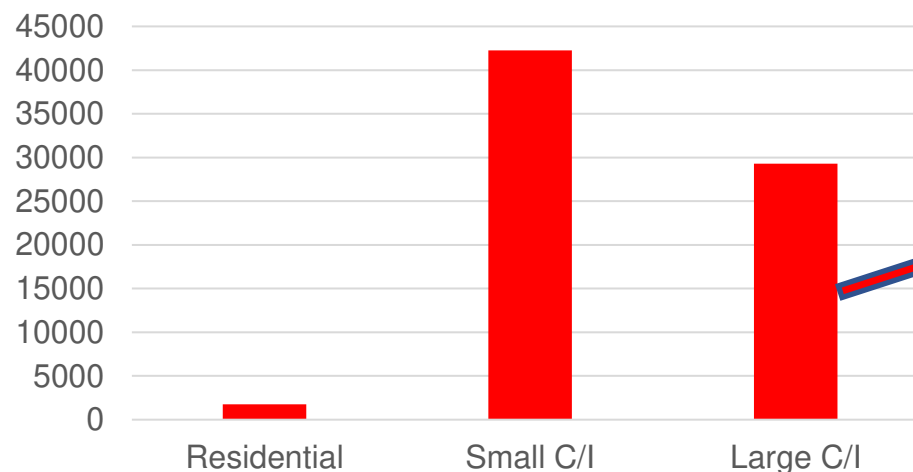
Estimate factors

- Time, season & duration of outage
- Number of consumers affected
- Customer profile and sector
- End use/device
- Advanced notification
- Mitigating measures

Austria Resid. VOLL Study (\$/MWh)



MISO VOLL Study (\$/MWh)



# Old Concept, Little Progress

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	Status Quo	Differentiated Reliability
Firm load treatment	Homogenous	Heterogeneous
Reliability policy basis	Engineering heuristics	Welfare economics
Reliability level	Exogeneous Static	Endogeneous Dynamic
Voluntary curtailment	Limited (e.g., DR) Conservation pleas	Extensive (i.e., demand curve reflects consumer WTP) Financial motive
Involuntary curtailment	Uniform	Differentiated
Reliability metrics	Outage pr, duration, length	Social benefits and costs
Reliability event cost	Mid VOLL	Min VOLL

Key policy questions:

- Is reliability a public good? Is resource adequacy a common good?
- Can resource adequacy be made excludable? Potential to redefine property rights?

# Revived interest

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## New Technology

AMI, sensors, monitors, flow controls, DERs

- Privatize resource adequacy (Bushnell et al 2017)
- On-site physical reliability hedge

## New Reliability Risks

Firm supply vs. de-firm demand

- Stochastic resource mix → decarbonization impact
- Common mode failure

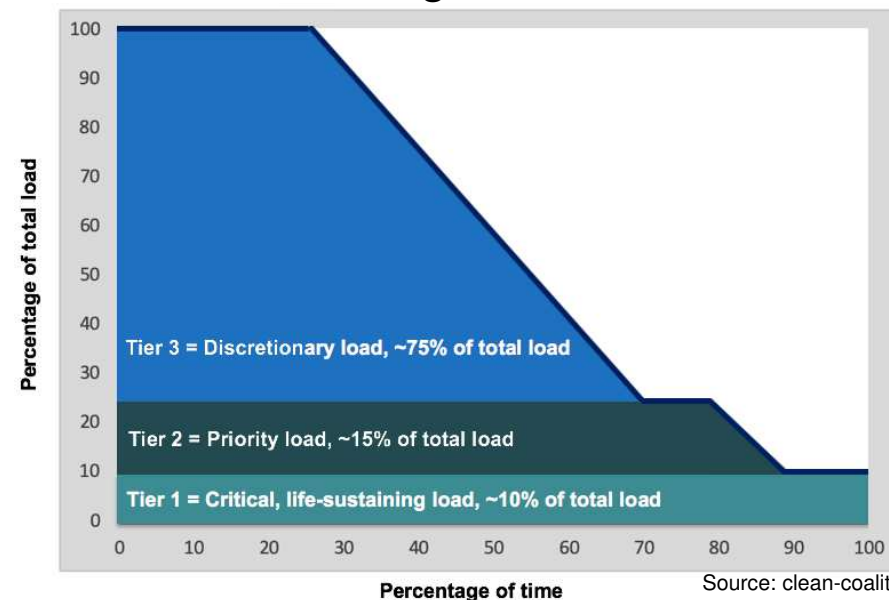


**Preliminary take: February TX storm cost ave.  
\$100,000+/MWh vs. \$9,000/MWh deemed VOLL**

## Ford F-150 Lightning Powers Home During Outage



## California Load Tiering & Prioritization Concept





# Bulk Reliability Policy Implications

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- Fundamental cultural change → redefine reliability leadership
  - Replace uniform NERC standards with consumer valuation targets
  - Distinguish short vs. long-duration outages
- Short-term reliability management reform
  - N-1: accommodate all flows w/o load curtailment
  - Integrate priority service and smart tech to reveal preferences
  - Ops cost decrease up to 43% potential (Ovaere 2019)
- Emergency procedures reform
  - Better alerts/notification
  - Deeper EEAs
  - Enable consumer participation in curtailment
  - Smart outage rotation
  - Load restoration transparency
- Planning standards reform
  - 1-in-10: arbitrary, inefficient basis
    - Implied uniform VOLL \$100,000/MWh or more
  - Remove exogenous RA constraints → enable market design

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**S&P Global**

**Climate disasters have  
rendered ‘one-in-10’ grid  
standard obsolete,  
experts say**

# Market Design Implications

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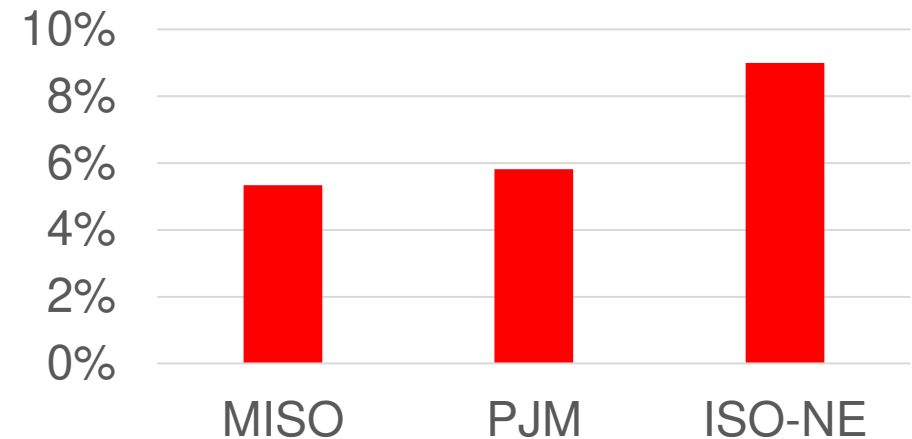
## Overarching Framework

- Up-size energy and ancillary service markets
  - Pricing reforms?
- Down-size capacity markets
  - Differentiated capacity products?

## Demand Incorporation

- Demand curves
  - Vertical admin → organic slope
  - At least approx. disaggregated VOLL
- Demand integrated into commitment/dispatch
  - Extend notification times
- Demand participation barriers overhaul
  - “Deep DR” as econ & emergency supply
  - Demand as... demand e.g., price-responsive

## Demand Response Share of Capacity Resources



Note: 2022-23 for PJM, 2021-22 for MISO, 2020/21 ISO-NE

# State Policy Implications

All states

- Repair wholesale-retail disconnect
- Granular curtailment prioritization by VOLL
  - Ideally consumer level (feeder vs. circuit)
  - Sectionalized distribution circuits

Restructured States

- Consumption paradox:  $VOLL < \text{price}$
- Remedy info deficiencies and transactions costs
  - E.g., Texas REPs manually calling large consumers to conserve
  - Option: aggregate preset, automated preferences

Cost of Service States

- “least cost reliable”  $\rightarrow$  cost = customer preference
- Translate into IRP, LSE-wholesale interface
- Require “deep DR”, or better...

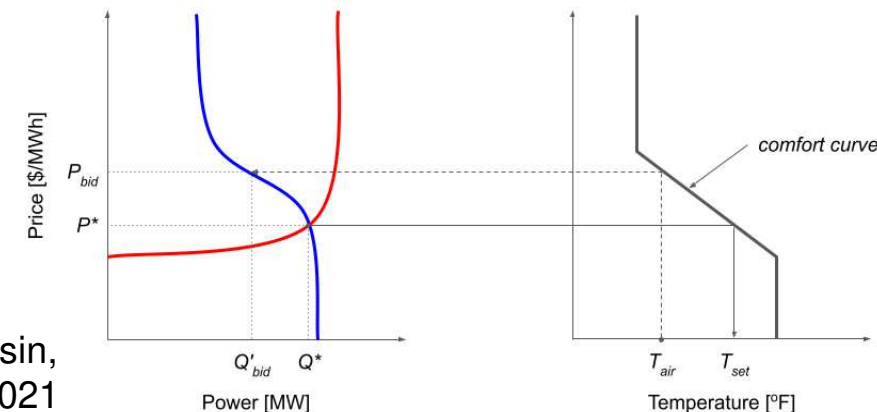


Implement retail choice! (properly)

**News Flash: ERCOT Prices  
Remain \$9,000/MWh**



**Solution: Transactive Systems**



Arlt, Chassin,  
Kiesling 2021

# Differentiated Retail Products

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## Barriers

- Limited AMI deployment
- TDU controls reliability & AMI info
- Limited AMI usability
  - e.g., meter curtailment and reenergization
- REPs face liability risk
- Consumer confusion and fraud risk

## Solutions

- Regulatory legitimization
- Product standardization vs. innovation
- Liberate AMI info access
- Enable REP meter-by-meter mngmnt
- Consumer information enhancement

Product Type	Default	Discount	Premium
Expected annual number of curtailments	2	2.5	1.8
Expected annual outage duration (hours)	6	6.5	5.8
Price (cents/kWh)	11	10	12



# Strategy

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## Fairness First

- Address equity concerns head on (e.g., Heylen 2018)
- Embrace, don't suppress, diversity
  - J&R = consumer WTP
- Analogize to other common retail services
- Net benefits increase for disenfranchised communities
  - Disprop. affected by outages
  - Avoids overcharging or underserving

## Appeal to Reliability Officials

- Perspective:
  - Gen standards 200x vs. T&D
  - Most outages routine D causes
- Political VOLL > econ VOLL
- Make small shortfalls mere inconveniences
  - E.g., ease reserve margin paranoia
- Reduce damages from large shortfalls
  - E.g., resource efficiency as humanitarian



**MORE:** low VOLL, short, voluntary reductions

**LESS:** high VOLL, widespread, long duration involuntary curtailments

# Thank you!

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