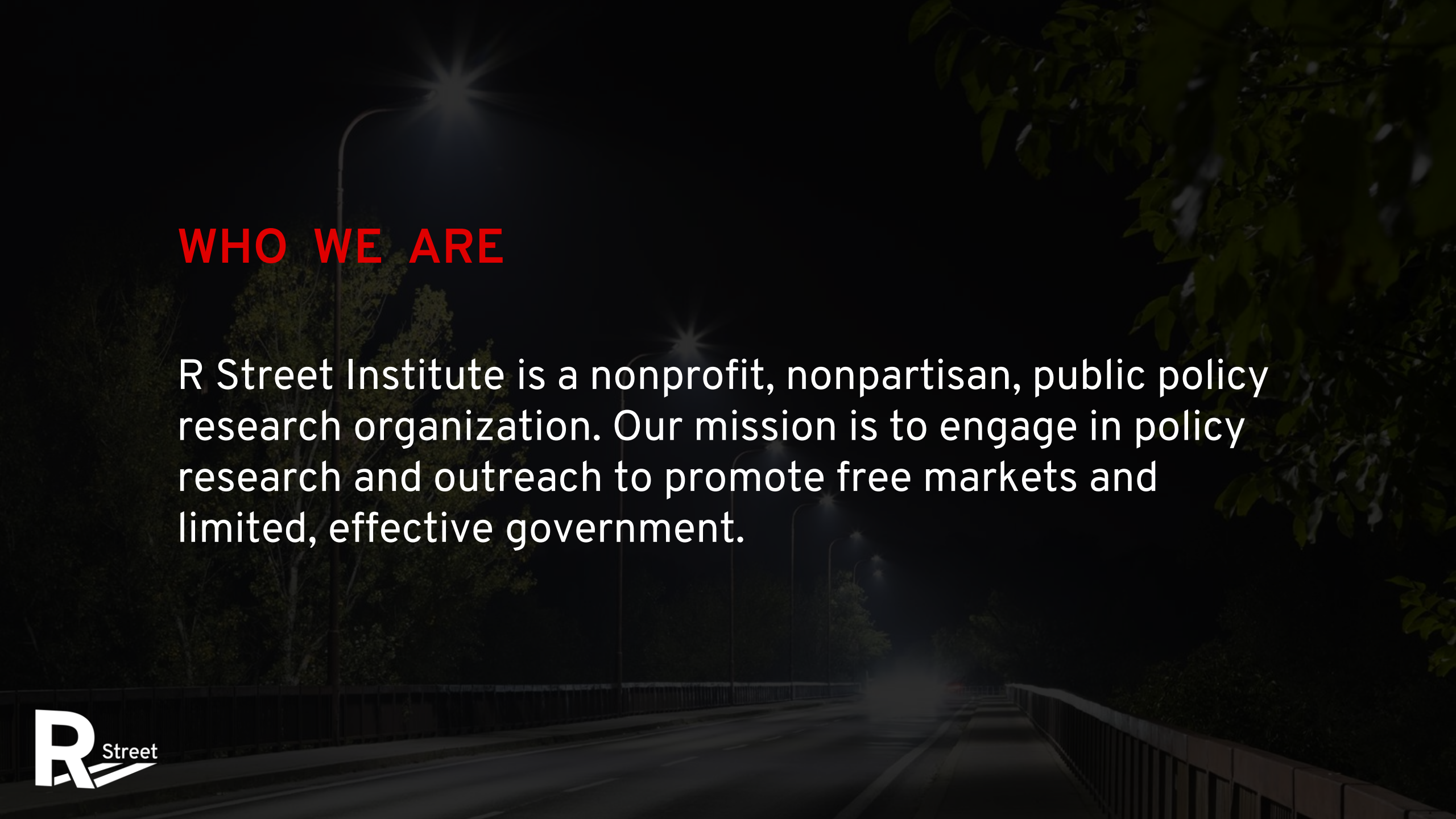
Differentiated Reliability

Future Power Markets Forum
July 22, 2021

R Street



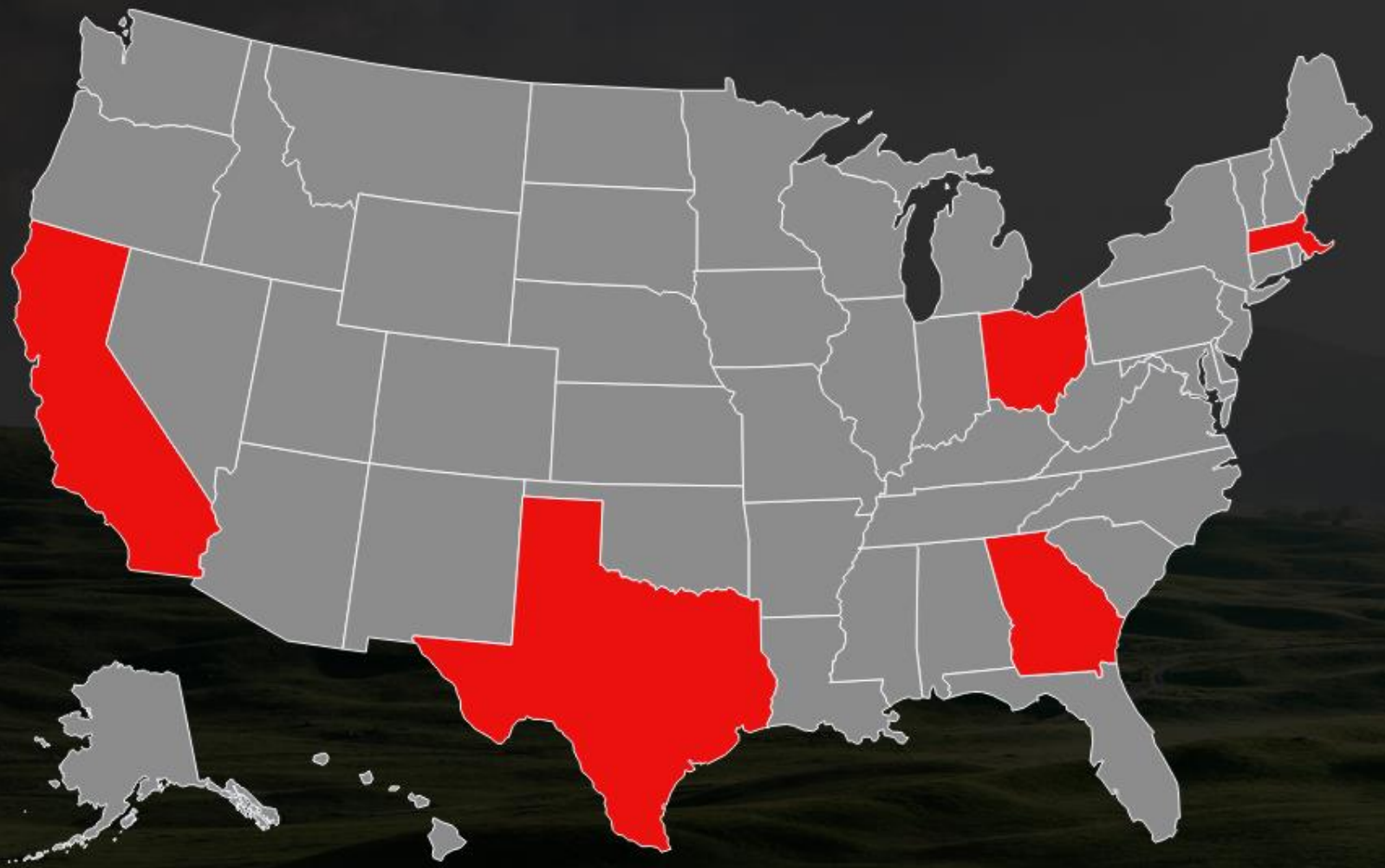
WHO WE ARE

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.

R Street

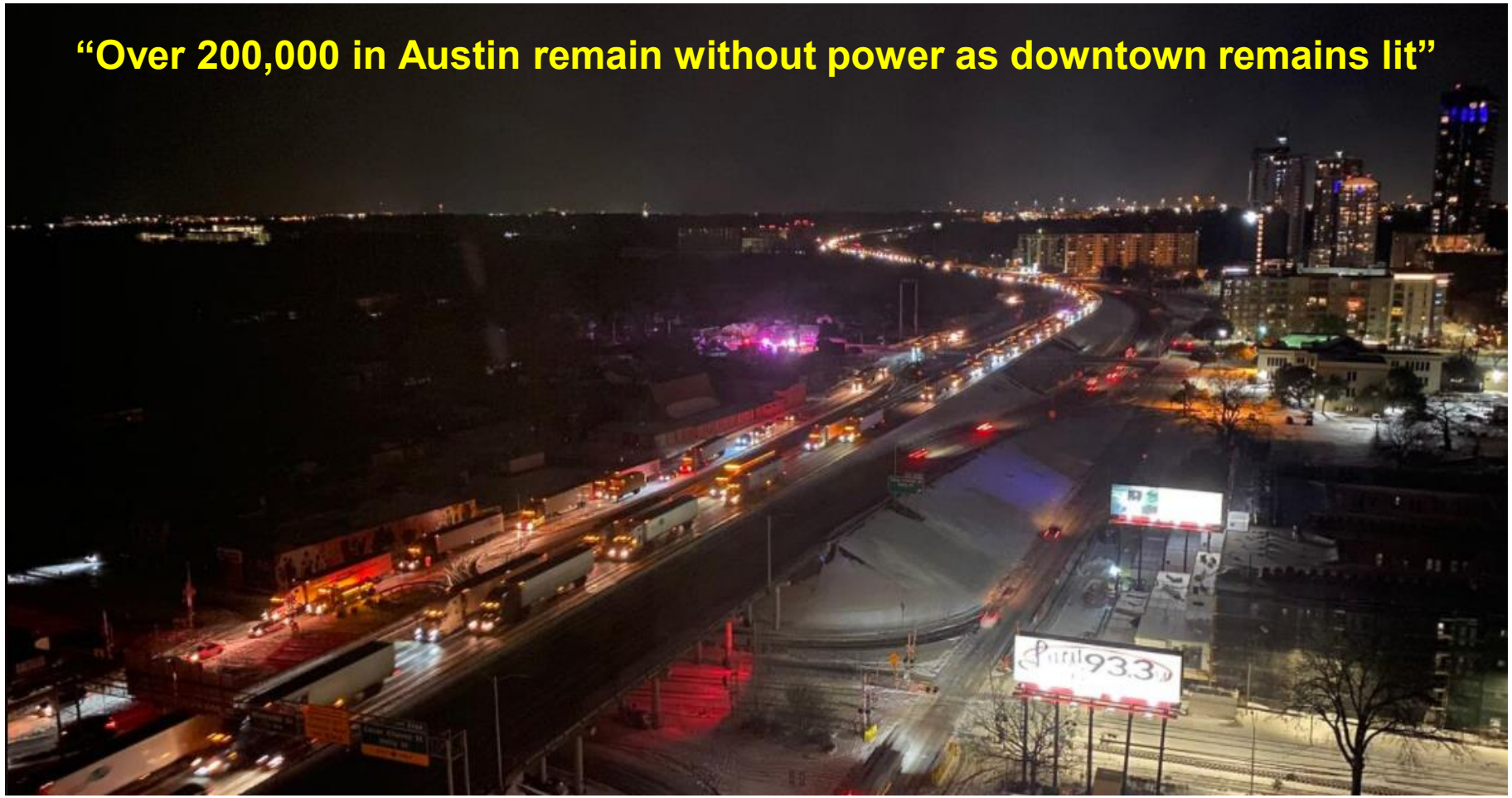
WHERE WE ARE

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



R Street

(Bad) Differentiated Reliability



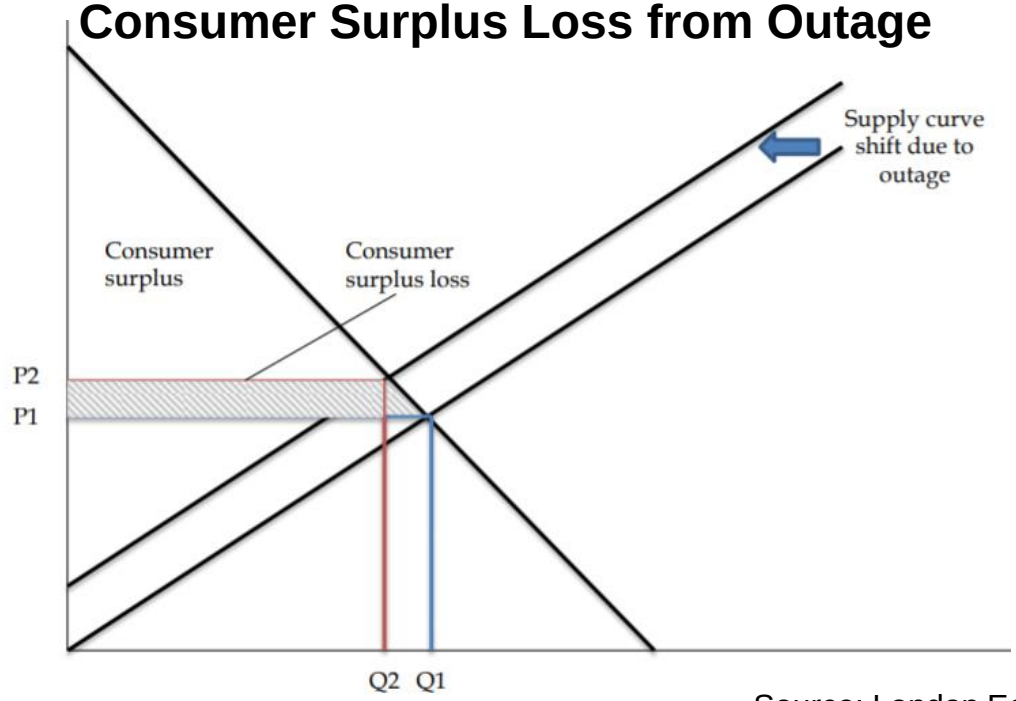
Source: CBS Austin https://cbsaustin.com/news/local/gallery/over-200000-people-in-austin-remain-without-power-while-downtown-remains-lit#photo-1

(Good) Differentiated Reliability

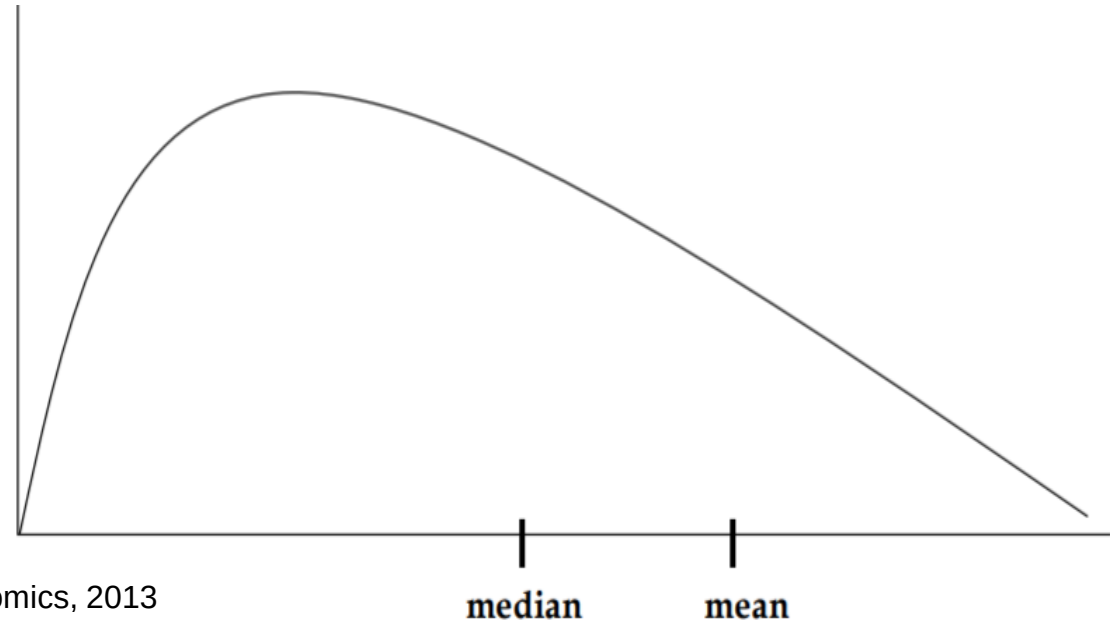
"[R]eliability differentiation based on consumer outage costs" (Siddiqi & Baughman, IEEE, 1993)

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

Consumer Surplus Loss from Outage



Right-skew VOLL (survey data)



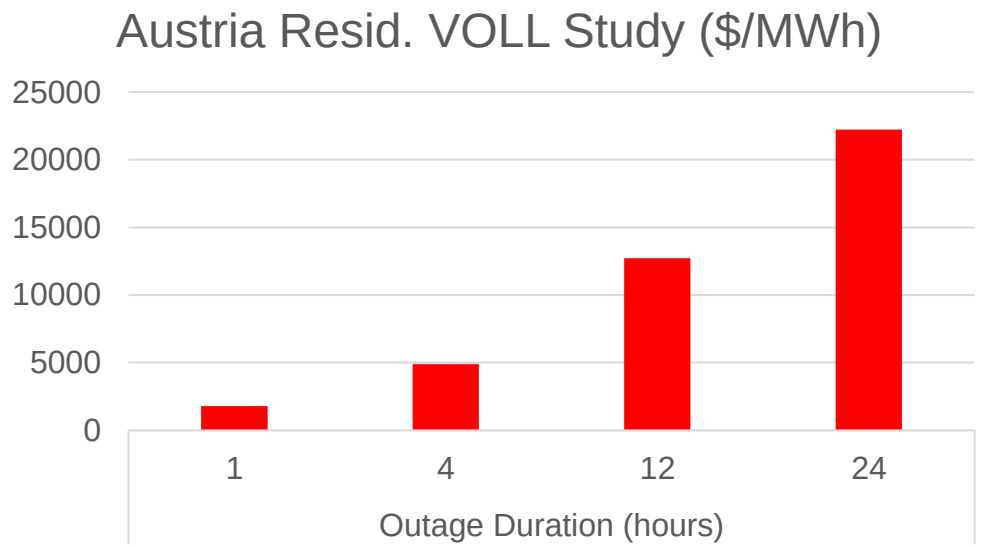
Source: London Economics, 2013

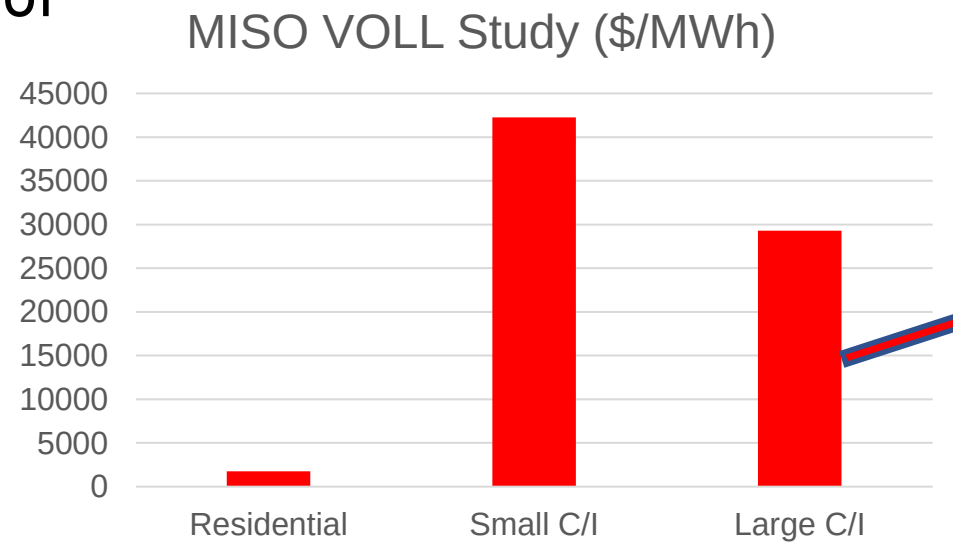
VOLL Determinants

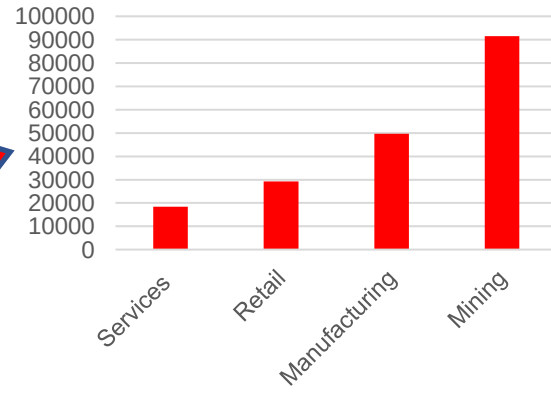
VOLL varies by 1+ orders of magnitude!

Estimate factors

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







R Street

Old Concept, Little Progress

	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

New Technology

AMI, sensors, monitors, flow controls, DERs

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

New Reliability Risks

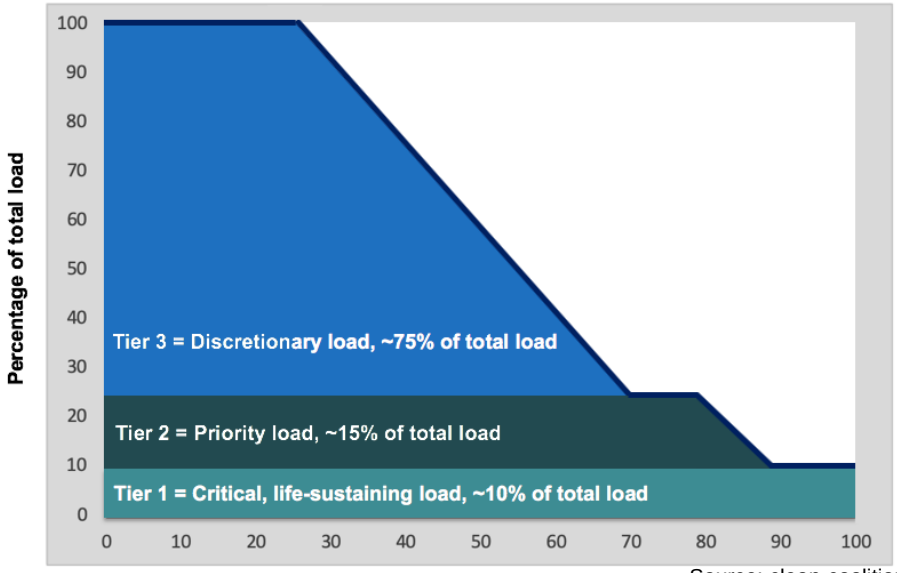
Firm supply vs. de-firm demand

- 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



Source: clean-coalition.org

Bulk Reliability Policy Implications

- 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

S&P Global

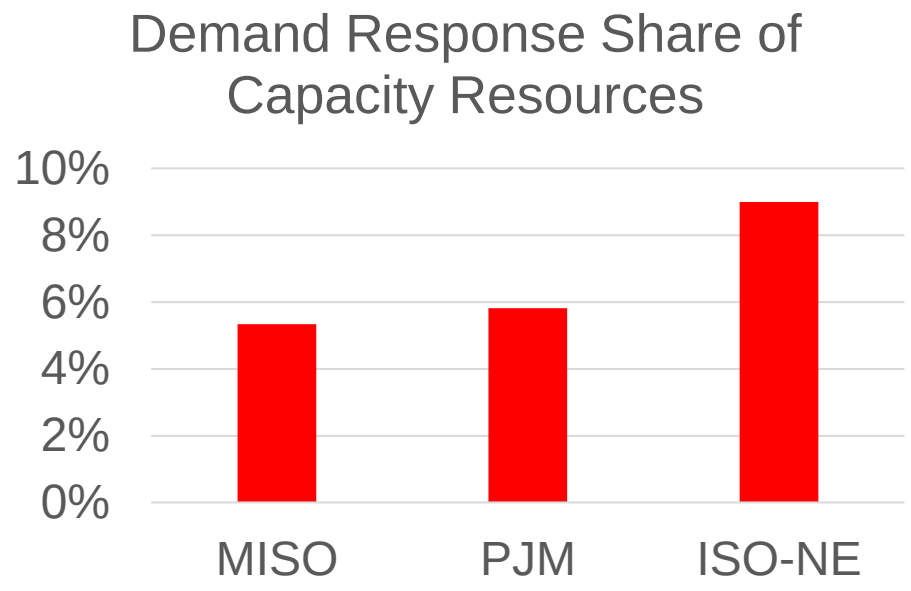
Climate disasters have rendered 'one-in-10' grid standard obsolete, experts say

R Street

Market Design Implications

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



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

R Street

State Policy Implications

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

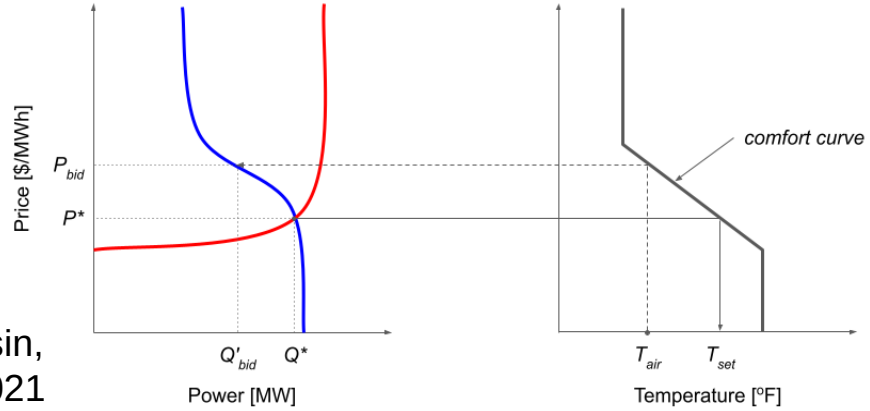
Restructured States
- Consumption paradox: VOLL < price
- Remedy info deficiencies and transactions costs
  - E.g., Texas REPs manually calling large consumers to conserve
  - Option: aggregate preset, automated preferences

Cost of Service States
- "least cost reliable" → 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

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

R Street

Strategy

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

R Street

Thank you!

Devin Hartman
dhartman@rstreet.org

www.rstreet.org
Twitter: @RSI

R Street