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**Policy Integrity**

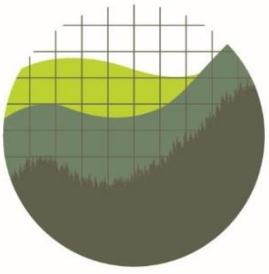
NEW YORK UNIVERSITY SCHOOL OF LAW

# Managing the Future of the Electricity Grid: Energy Storage and Greenhouse Gas Emissions

March 2019

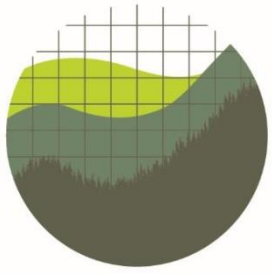
Richard L. Revesz

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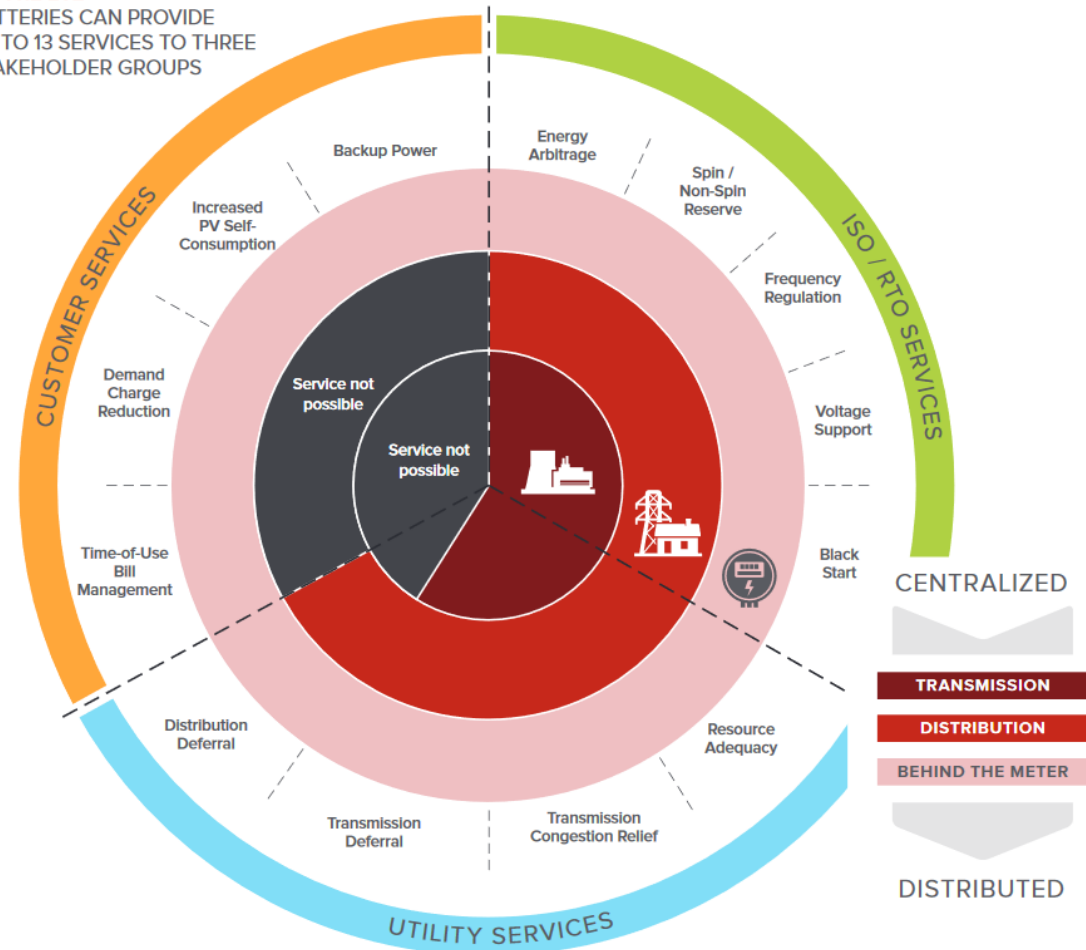
# Energy Storage Systems

- Energy Storage Technologies
  - Mechanical
  - Electro-chemical
  - Thermal
  - Electrical
- All with different capacity, duration of discharge, and, of course, costs



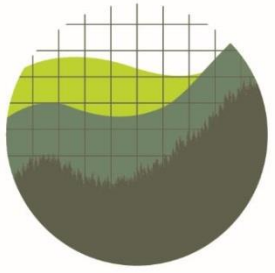
# Benefits of Energy Storage

**FIGURE ES2**  
BATTERIES CAN PROVIDE  
UP TO 13 SERVICES TO THREE  
STAKEHOLDER GROUPS



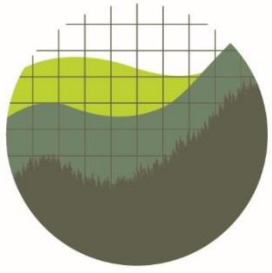
THE ECONOMICS OF BATTERY ENERGY STORAGE | 6

Source: Rocky Mountain Institute, The Economics of Battery Energy Storage



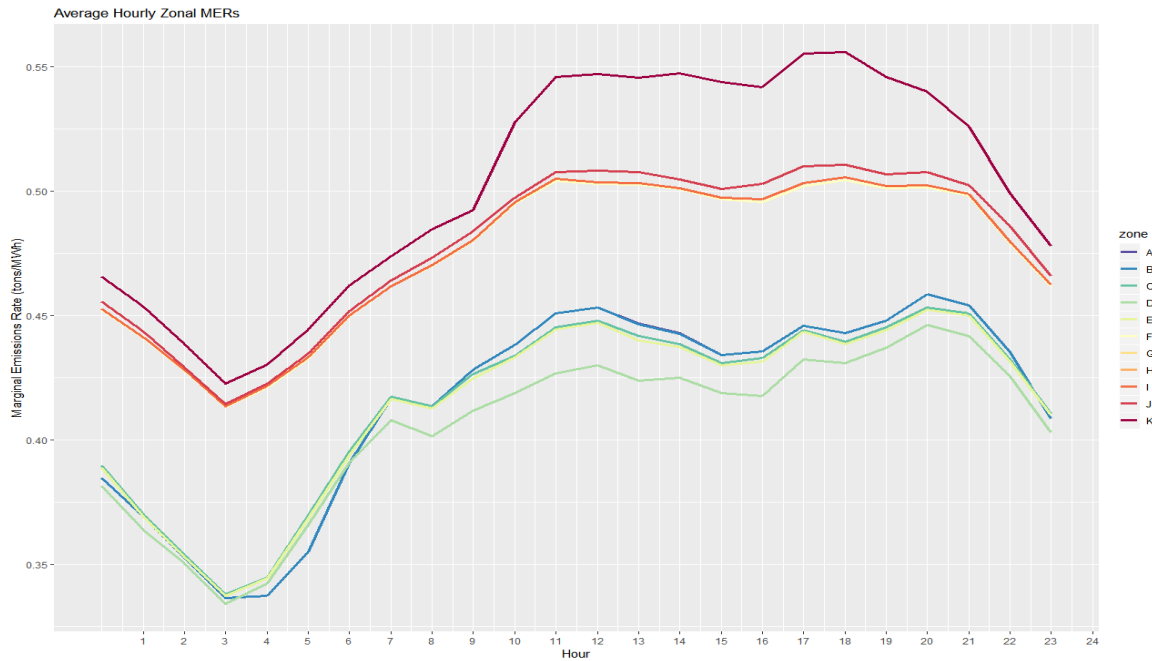
# Potential for Unintended Consequences

- Energy storage can increase emissions if policies are not designed carefully
  - Marginal Emission Rates
    - The additional pollution caused by using one more unit of electricity generation at a particular time and place
    - Vary by time and location
  - Efficiency Losses



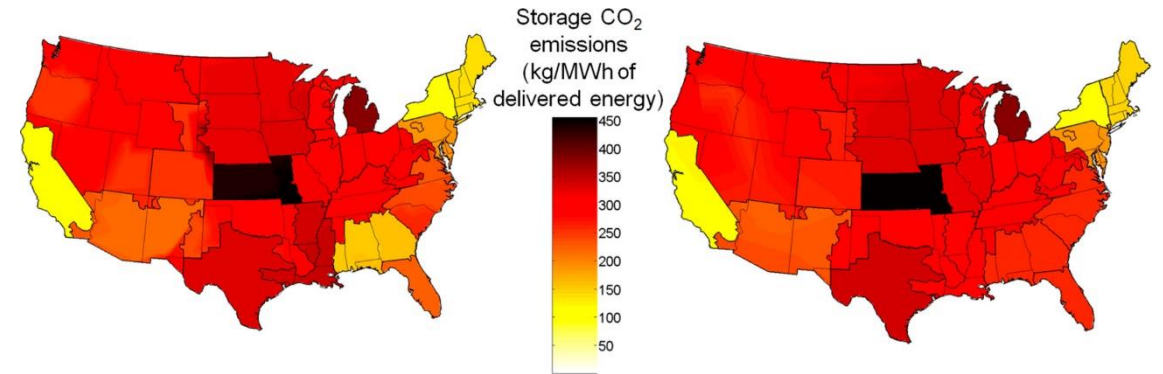
# Potential for Unintended Consequences

## NYISO Average Hourly Zonal Marginal CO2 Emissions Rates

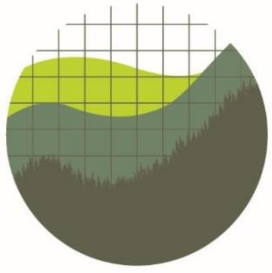


Data Source: NYISO

Emissions in units of kg of CO<sub>2</sub> per megawatt-hour of delivered energy from the storage

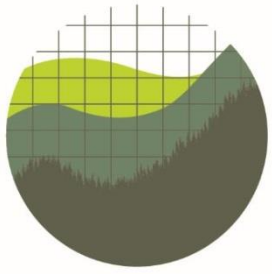


Source: Eric Hittinger; Inês M. L. Azevedo; *Environ. Sci. Technol.* **2017**, *51*, 12988-12997.  
DOI: 10.1021/acs.est.7b03286  
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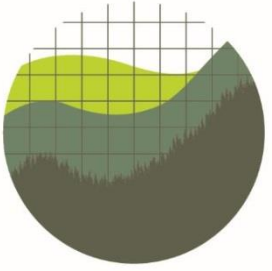
# Inadequacy of the Current Regulatory and Policy Landscape

- Inadequacy of direct investment incentives
  - To distinguish between potentially beneficial and potentially harmful energy storage
    - CA Self-Generation Incentive Program
  - To achieve efficient incentives for all types of energy storage
- Inadequacy of indirect price incentives
  - FERC rules on energy storage compensation
  - State rules on energy storage compensation



# Policies Needed to Achieve Efficient Incentives

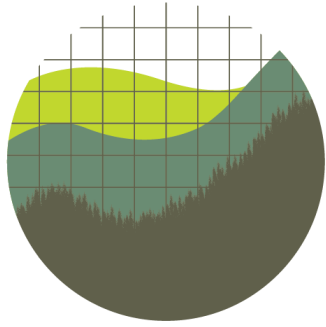
- Achieving efficiency
  - Internalizing the externalities
  - Eliminating barriers to entry
    - Order 841
  - Eliminating barriers to earning multiple value streams
- Jurisdictional roles
  - Roles for FERC
  - Roles for States



# Conclusion

- Energy storage holds a key to the clean energy future
  - BUT, there are circumstances under which they can have undesired consequences
  - Policies should be designed to
    - Internalize the externalities
    - Eliminate entry barriers
    - Guarantee accurate price signals that can value all the benefits
- energy storage systems have the technical ability to provide





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