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Energy Storage as an Equity Asset

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WI PSC/DOE Energy Storage Webinar Series:
Policy Issues and Equity

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Context

- There is already robust work around income, rates, and affordability – but bottom line, the trends are going in the wrong direction.
- Not all customers have the same needs of the energy system. Elderly and disabled populations use energy in different ways and have different vulnerability profiles. Climate will underscore exposure and inequity.
- Clear demand for explicit work and real stakeholder engagement.
- More analysis can be done around:
  - Differentiating needs & interactions by demographics (age, race, health, rural, deep poverty) and compound, cumulative effects
  - Understanding the relationships between policies and grid futures and people
  - Designing technologies to be safer and support well-being including life cycle implications
  - Recognizing the procedural limitations of energy system decision-making

Opportunity – How Energy Storage Fits

- Investigate opportunities for the development of storage solutions to stimulate additional public benefits, in particular equity, health, environmental, and integrated system benefits.
- Energy storage solutions are quickly being developed and deployed for many sectors and locations within the power system, but often public benefits are not considered.
- As implementation accelerates, we can explore how stationary electric grid-scale storage and associated policies and regulations can:
  - Enhance outcomes for all sectors of society and all consumers,
  - Improve conditions for vulnerable and disadvantaged populations, rural economies, and natural systems, and
  - Be designed to capture the full suite of public benefits.

Introduction to Energy Justice: Definitions

Energy Justice

"Integrating justice principles, fairness, and social equity into energy systems and energy system transitions."[1]

"The goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those historically harmed by the energy system ("frontline communities")."[2]

Just Transition

"A transition away from the fossil-fuel economy to a new economy that provides dignified, productive, and ecologically sustainable livelihoods; democratic governance; and ecological resilience."[2]

Tenets of Energy Justice

Distributive Justice (*where?*)

- The unequal allocation of benefits and burdens and the unequal distribution of the consequences.

Recognition Justice (*who?*)

- The practice of cultural domination, disregard of people and their concerns, and misrecognition.

Procedural Justice (*how?*)

- The fairness of the decision-making process.

Restorative Justice

- The response to those impacted by the burdens of energy projects.

Principles of Energy Justice

Availability	Transparency and accountability	Due process	Intergenerational equity
Affordability	Sustainability	Intragenerational equity	Responsibility

Dimensions of Inequities in the Power System

Key Term	Definition
Energy Burden	Percent of household income spent to cover energy cost.
Energy Insecurity	The inability to meet basic household energy needs.
Energy Poverty	A lack of access to basic, life-sustaining energy.
Energy Vulnerability	The propensity of a household to suffer from a lack of adequate energy services in the home.

Distributed Effects

Availability

Access to energy technologies across the socio-economic spectrum

- Tax credit-based incentives: Not favorable for communities with low or no tax liability.
- Production incentives: Not compatible with low-income communities because of high upfront cost or extended payback periods.
- Property ownership and split incentive challenges.

Energy storage for equity

Targeted incentives for households that cannot access energy technologies

- California PUC: Self Generation Incentive Program (SGIP) – rebates that lower cost of energy storage (almost free) to low-income and medically vulnerable households.

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Distributed Effects [Cont'd]

Affordability

- Low-income households spend a high percentage of their income on energy cost (three times higher).[3]
  - This is exacerbated by systemic inequities across demographic indicators: race, gender, ability status, age, health status, geography, income, education, etc.
- Underserved and vulnerable groups may face increased energy insecurity due to potential loss of electricity.
  - In 2015, 17 million households faced energy disconnection notices[4] and that risk could increase due to Covid19 as disconnection moratoriums are lifted.

Energy storage for equity

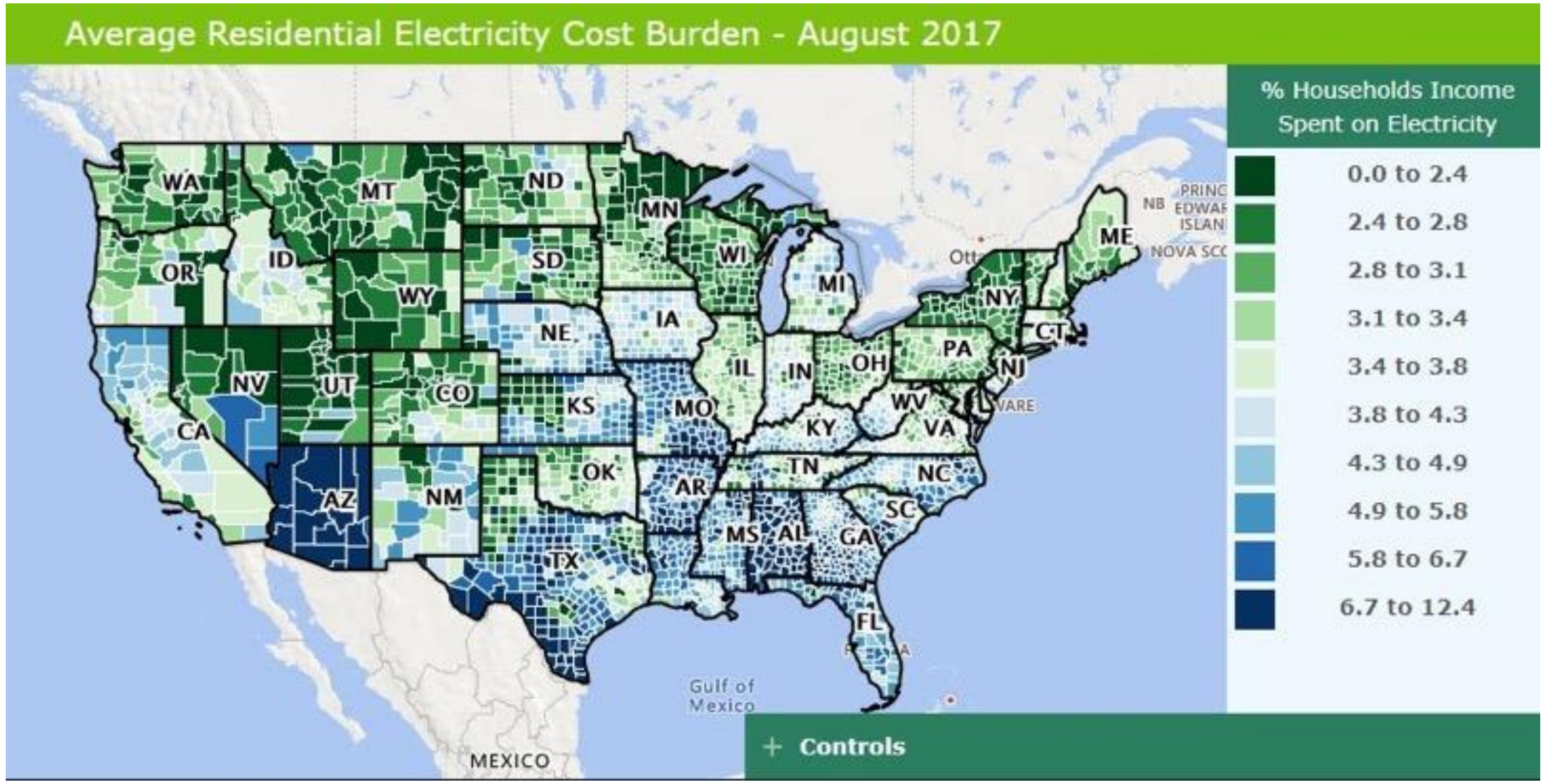
- Helps reduce energy burden
  - Curbing demand charges
  - Community-serving facility support
  - Affordable housing energy cost
- Helps decrease household energy insecurity
  - Supports grid reliability and resilience through backup power

Distributed Effects – Affordability

Electricity Affordability:
Provision of electric services at a cost below an accepted or deemed affordable cost burden. In other terms, electricity is affordable if households do not need to sacrifice other amenities or necessities to pay for electric service.

Electricity Affordability Metrics |
Grid Modernization Lab Consortium >>

- Mapping tool: https://gmlc.pnl.gov/affordability
- Affordability Metrics report: https://gmlc.doe.gov/sites/default/files/resources/GMLC1.1_Vol6_Affordability.pdf



Recognition and Procedural Effects

Recognition and Procedural

Fair representation in decision-making processes (due process, transparency, and accountability)

Energy system siting

- Sites of production vs sites of consumption
- Low-income and indigenous populations bear a disproportionate burden in energy production and power plant siting
- Renewable energy system efficiency and cost effectiveness can reinforce social imbalances

Energy storage for equity

Flip the disproportionate siting harm on marginalized groups

- Identify and deploy energy storage in underserved communities for energy reliability and lower energy cost
- Renewable resource-driven energy independence
- Storage based community wealth

Community storage systems: local or virtual ownership/participation business models

Storage in Power Plant Decommissioning

Manatee Power Plant, Florida (1970s – 2021)

- Florida Power & Light Company (FPL)
- Manatee Energy Storage Center — 409 MW/900 MWh battery storage facility
  - ~ $100 million savings to ratepayers, 1 million tons of CO_2 emissions reduction, improved service reliability, increased clean energy penetration, and approximately 70 new jobs created during construction

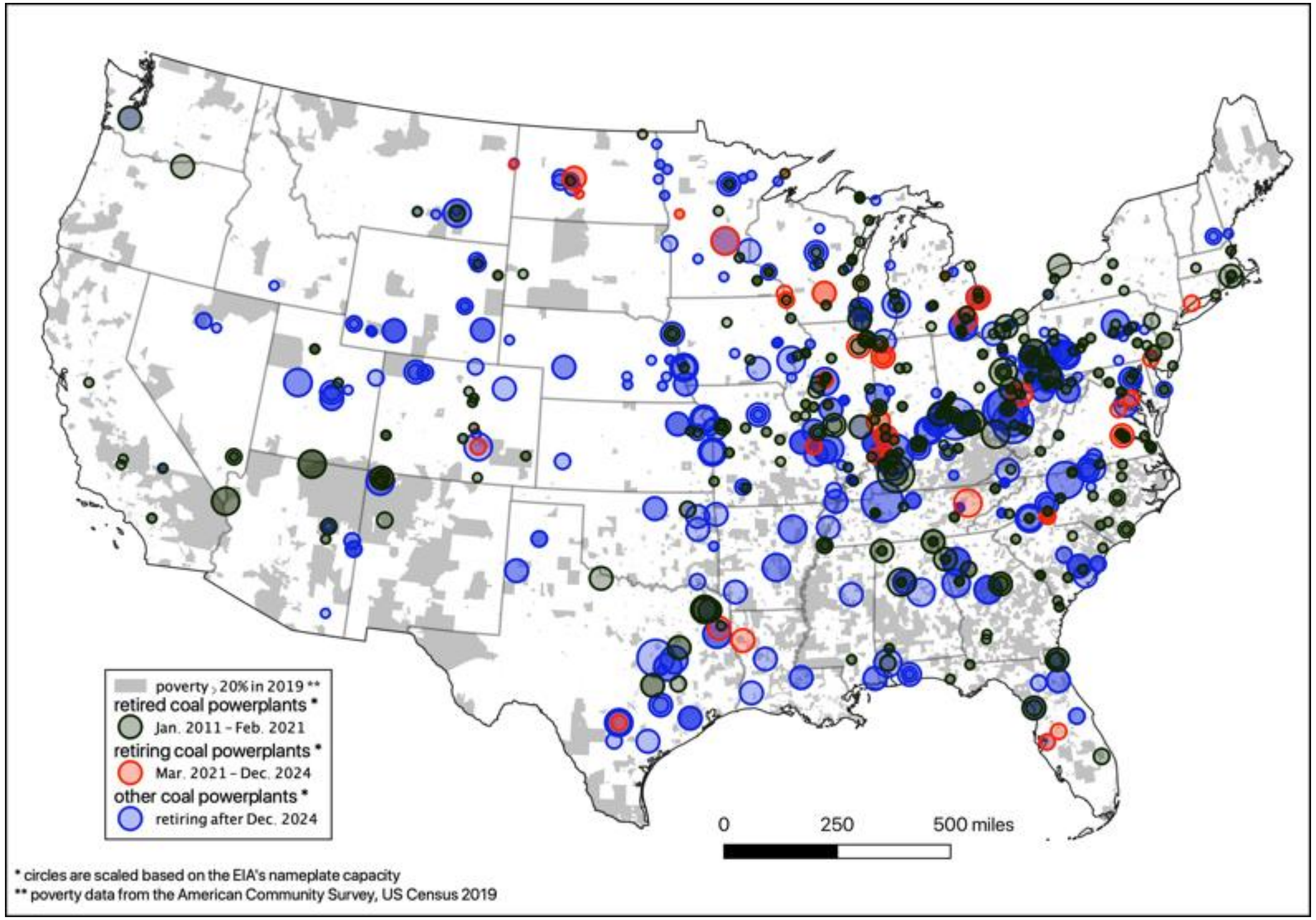
Source: https://www.gvip.io/p/manatee-energy-storage-center

Tarekegne, B. & Michener, S. Energy Storage for Social Equity: Capturing Benefits from Power Plant Decommissioning.
https://www.pnnl.gov/sites/default/files/media/file/Energy%20Storage%20for%20Social%20Equity%20Case%20Study.pdf

Storage in Power Plant Decommissioning [Cont'd]

EO 14008,[5] Empowering Workers through Revitalizing Energy Communities

- Coal-dependent communities, brownfields
- Long-duration energy storage
  - For example: A DOE funded study is assessing the possibility of converting coal units into storage facilities — Malta Inc & Duke Energy [6]



5 Executive Order 14008 of January 27, 2021: Tackling the Climate Crisis at Home and Abroad https://www.govinfo.gov/content/pkg/FR-2021-02-01/pdf/2021-02177.pdf
6 https://news.duke-energy.com/releases/malta-teams-up-with-duke-energy-to-study-possibility-of-converting-coal-units-into-clean-energy-storage-facilities

Distributed Effects – Non-Energy Local Effects

Benefit Title	Benefit Category(ies)	Description
Emissions reduction	Environmental	The emissions reduction impact of storage installations is dependent on how the storage system is charged. Storage facilitates the removal of fossil fuels from the grid and renewable energy expansion, resulting in significant emissions reduction.
Energy costs	Economic, social	For storage that is replacing fossil-fueled systems, utilities can minimize safety-related emergency calls and avoid fines related to environmental compliance. Peak demand currently results in demand charges to time-of-use (TOU) rates. Storage creates a resource to manage peak demand. Both instances reduce the cost to provide energy and the utility can pass on saved costs to ratepayers. As energy becomes more affordable to the ratepayer, the utility also saves costs by avoiding ratepayer collections and terminations.
Equity enhancement	Social, economic	Storage systems, if implemented with appropriate strategies, can provide targeted benefits to underserved communities including revenue generation and energy independence to improve energy affordability and reduce energy burden.
Increased property value	Economic	For ratepayers with storage installed in buildings, storage provides the capability to keep heating and cooling systems reliably operational and may decrease energy costs leading to an increased property value.

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Distributed Effects – Non-Energy Local Effects [Cont'd]

Benefit Title	Benefit Category(ies)	Description
Job creation	Economic, Social	Storage creates job opportunities across the asset's lifecycle, including battery manufacturing, operation, maintenance, and management. The California Energy Storage Alliance (CESA) reported that energy storage projects in California have supported approximately 20,510 jobs and they project that number might increase up to 113,190 jobs in the next decade.
Less land use	Environmental, Social	Utilizing energy storage to manage increasing power requirements (baseload and peak demand) decreases the need to build new or maintain existing power plants. Decreasing the land required for power plants allows communities to use the now available land for alternative public-serving uses.
Resilience benefits	Social, Economic	The main resilience benefit is avoided energy outages and the resulting avoided disruption costs (financial and otherwise). For ratepayers, the avoided disruptions are in day-to-day life activities. For example, power outages can create life-threatening risks for vulnerable customers that rely on electronic devices, such as the elderly who require refrigerated medication.

Tarekegne, B. & Michener, S. Energy Storage for Social Equity: Capturing Benefits from Power Plant Decommissioning.
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Measuring Equity — Metrics

Equity categories and relevant metrics:

- Target population identification – community descriptive metrics
- Investment decision-making – investment distribution metrics
- Program impact assessment – program results metrics

Current equity indicators to collect baseline measurements:

Income	Energy access	Access to renewable energy	Program eligibility
Age	Energy use intensity	Energy assistance	Education programs
Race, ethnicity, language	Energy burden	Access to public services	Community engagement
Geographical location	Energy efficiency	Incentive accessibility	Grid resilience
Urban/rural	Energy affordability	Heat island mitigation features	Internet and communications
Building type/ownership	Customer cost savings	Disaster frequency/cost	Transportation

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Measuring Equity – Target Population Identification

Community Descriptive Metrics		
Metric	**Needed Data Points**	**Data Sources and Description**
Program equity index	Energy assistance offered	Program data; distribution of program benefits across populations
Program accessibility	Eligible population data, income data	Program data; distribution of program eligibility across population groups
Energy cost index	Median annual energy bill	EIA, utility records; distribution of energy cost across populations
Energy burden index	Median annual energy bill and annual median income	EIA, utility records, census; distribution of energy burden across populations (i.e., 6% high, 10% severe)
Late payment index	Late energy bill payment rate	Utility records, LIHEAP; distribution of late bill payment habits across populations
Appliance performance	Appliance maintenance cost (lifespan, energy profiles)	Appliance purchase records, audit template; distribution of access to energy efficiency measures
Household-human development index	Health status, education level, income	NIH, EPA, EJScreen; distribution of HDI scores across population subgroups

Preziuso, D., Tarekegne, B., & Pennel, G. Metrics for an Equitable and Just Energy System. https://www.pnnl.gov/sites/default/files/media/file/Metrics%20for%20Energy%20Equity_0.pdf

Measuring Equity – Investment Decision-making

Investment Distribution Metrics		
Metric	**Needed Data Points**	**Data Sources and Description**
Community acceptance rating	Numeric representation of community satisfaction	Surveys of community acceptance and support for investment
Program funding impact	Percent budget for advancing equity	Program data; percent of investment funding supporting disadvantaged communities
Energy use impacts	Health and environmental impacts due to investment	Distribution of health and environmental impacts of energy investments across populations
Energy quality	Investment impact on frequency of electric outages, energy capacity	EIA; utility data
Workforce impact	Investment generated jobs	DOL; community benefits from investment (participation from low-income groups, local business contracts, etc.)

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Measuring Equity – Program Impact Assessment

Program Results Metrics		
Metric	**Needed Data Points**	**Data Sources and Description**
Profits	Revenue, cost of program	Access to profits for communities (wealth creation), benefits and cost distribution across demographic groups
Program acceptance rate	Percent of population enrolled in program	Program data; program enrollment after receiving information (i.e., information dissemination, transparency, community trust, etc.)
Energy savings (MWh)	Energy use over time	EIA, utility records; Energy use savings in disadvantaged communities after program implementation
Energy cost savings ($)	Energy cost over time	Energy cost savings in disadvantaged communities after program implementation
Energy burden change	Household income, energy bill	EIA, utility records, census; percent reduction in energy burden after program implementation (EE, weatherization, rate design, wage changes, etc.)
Change in HDI score	Household income, quality of life	EIA, NIH; wellbeing and quality of life improvement after program implementation

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Immediate Opportunities and Recommendations

Enhance capabilities to map and track inequities

- Identify target populations (i.e., where are the disadvantaged communities?)
- Quantify and compare inequities across population

  Modify measurement and visualization tools such as EJScreen,[7] LEAD,[8] PNNL Electricity Affordability Metrics

Assign appropriate scales for equity measurement

- Measuring dimensions of time – different time scales of benefits/burdens
- Measurement levels – at what level to assess equity effects (i.e., societal, community or neighborhood, household, or individual)

  Enhance data granularity based on desired measurement level (run community surveys to build new datasets)

7 Environmental Justice Screening and Mapping Tool (EJScreen) https://ejscreen.epa.gov/mapper/
8 Low-income Energy Affordability Data (LEAD) Tool https://www.energy.gov/eere/slsc/maps/lead-tool
Preziuso, D., Tarekegne, B., & Pennel, G. Metrics for an Equitable and Just Energy System. https://www.pnnl.gov/sites/default/files/media/file/Metrics%20for%20Energy%20Equity_0.pdf

Contact and Acknowledgments

Please engage with us!

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https://www.pnnl.gov/projects/energy-equity

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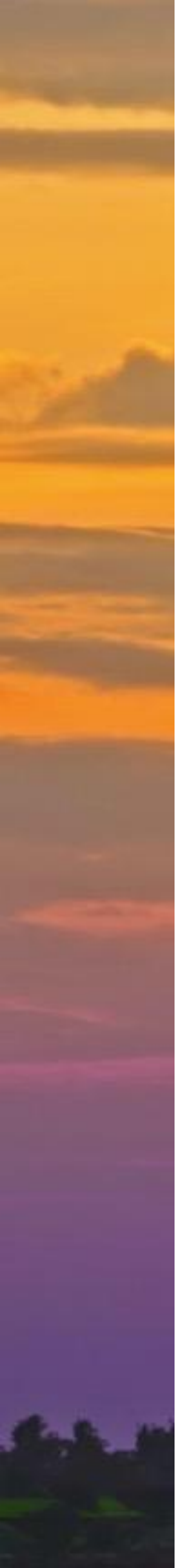

Thank you

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