Valuing Resilient Distributed Energy Resources: Combined Heat and Power & the Modern Grid

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Regional Climate Action Plan Implementation Workshop: **Resilient Energy Systems**

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American Council for an Energy-Efficient Economy

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Our research explores economic impacts, financing options, behavior changes, program design, and utility planning, as well as US national, state, & local policy.

Our work is made possible by foundation funding, contracts, government grants, and conference revenue.

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Agenda

- Why do we need to value resiliency?
    - Resiliency metrics
    - Risks & costs of poor energy performance
    - Stakeholders & misallocation of capital
- Leaders in valuing resiliency
- The Distributed Energy Resource Resiliency Value
- Next steps

Resiliency metrics

- Resiliency:
  - Ability of an energy system to withstand “high-consequence, low-probability” events & regain normal operational activity
- Reliability:
  - The degree to which a resource is available
  - Ability to withstand “low-consequence, high probability” events
  - Distribution system performance metrics already exist on interruption frequency & duration (called SAIFI, SAIDI, & CAIDI)
- Power quality:
  - The degree to which an electricity supply maintains its voltage & frequency and is free of distortions

Risks of poor energy performance

Category	Risk metric examples
Resiliency	Lost lives
	Lost confidence in a city or region
	Costs of energy lost to critical facilities
	Transportation system losses
Reliability	Lost revenue
	Increased personnel time
Power quality	Damaged equipment
	Lost data

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Costs of Poor Energy Performance

Study Author	Cost category	Cost ($ billion/year)
Galvin Electricity Initiative	Losses due to power outages	$150
Hartford Steam Boiler	Power outages	$100
Institute of Electrical & Electronics Engineers	Poor power quality	$119-188
Electric Power Research Institute	Outages to whole US economy	$120-$190
Congressional Research Service	Weather-related outages longer than five minutes	$25-$70

Misallocation of capital

- CHP systems require large upfront capital investments
- Returns from increased energy efficiency can be marginal
- Data to evaluate risk of poor grid performance are limited

Resiliency benefits are not fully considered in project cost screenings.

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Stakeholders in valuing resiliency

- Utilities: resource planning
- Cities: resiliency planning
- Investors & shareholders
- Individual facilities
  - Example: Agricultural company
- Industries
  - Accounting industry
  - Example: Data centers

Stakeholder: Insurance industry

- Shifting risk analyses to changing risks
- Energy disruptions trigger the need for insurance products
- Interviews with 12+ insurance companies:
  - Zero products that explicitly reflect reduced risk from CHP

No clear guidance exists on how to value avoided downtime.

Leaders in valuing resiliency

- Identifies opportunity zones for resilient infrastructure
- Provides a clear cost-benefit analysis framework
- Provides funding for selected microgrid & CHP projects

Selected NY Prize resiliency metrics

Metrics for the value of a hospital staying online during a disaster	Metric type	Exemplary value
Likelihood of backup generation failure	Percentage	15%
Annual emergency visits per capita	Visits/capita	0.40
Increase in emergency visits during a natural disaster	Percentage	25%
Cost of time	2007 dollars/hour	$28.11
Death rates per capita from unintentional injuries	Deaths/person/year	0.000509
Value of a statistical life	2008 dollars	$5.8M

Leaders in valuing resiliency

- Performance Excellence in Electricity Renewal
- Sustainability Accounting Standards Board
- Hartford Steam Boiler insurance company
  - Markets & blackout risk model
  - “Energy shortfall” risk underwriting

The Distributed Energy Resource Resilience Value (DERRV)

- Calculate:
  - Probable downtime associated with relying on the grid:
    - (Probability that *X type of event* will happen in *location Y*) × (Probability that *X type of event* will cause downtime) × (Estimated length of downtime)
  - Probable downtime associated with relying on CHP:
    - (Probability that *X type of event* will happen in *location Y*) × (Probability that *X type of event* will cause downtime with CHP in place) × (Estimated length of downtime with CHP)
- Compare the two values

Data needs for the DERRV

Category	Data & metrics	Outstanding data needs
Reliability of the electric grid	• Weather models • SAIFI/SAIDI/CAIDI & major event data • Models of weather impact on specific systems • Models of other threats & impacts to grid	Localized disaster impacts
Reliability of backup generators	• Typical backup generator performance • Data on fuel delivery constraints	Attributes influencing generator performance
Costs of downtime	• Industry & facility-led estimates • Insurance company models • National estimates • Utility cost of service studies	Guidance to value avoided downtime
CHP & microgrid performance & costs	• CHP & microgrid program performance and evaluation reports • CHP & microgrid developer case studies	**Major gaps remain**

Next steps

- Fill in data gaps & increase data sharing
- Engage stakeholders
- Apply the DERRV!
- Continue to refine the metric & process

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Report at **http://aceee.org/white-paper/valuing-der**

Upcoming ACEEE Conferences

Behavior, Energy, and Climate Change Conference	October 7	Washington, DC
2018 Rural Energy Conference	October 22	Atlanta, GA
National Convening on Utilities and Electric Vehicles	November 14	Atlanta, GA

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