Microgrid investments can be a key component of wildfire resilience.

Large upfront investments in disaster resilience protect against low-probability, high-consequence events.

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Microgrids and Wildfire Resilience: A Case Study of California Fires

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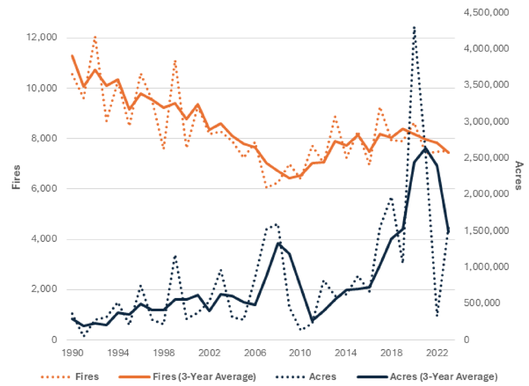
Wildfires Are Becoming More Destructive and Unpredictable

Changing temperature, precipitation, wind patterns, and vegetation condition have led to more intense wildfires, creating difficult choices for utilities and policymakers. Should they de-energize power lines or risk igniting a fire?

California Wildfires and Acres Burned



The Solution: Microgrids as a Cost-efficient Energy Strategy

Microgrids provide localized energy independence, reducing the need for large-scale power shutdowns during wildfire events.

- Microgrids can keep essential services running when the main grid is de-energized.
- Depending on community needs, other distributed energy resources may also be effective.
- This approach is applicable beyond wildfires, including flood mitigation and coastal resilience.

What is a Microgrid?

[A microgrid] is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.

(Ton and Smith 2012)

Our Approach: Measuring the Value of Microgrid Investments

We used real wildfire case studies to quantify resilience benefits.

- **Analyzed past wildfire damages** (Camp, Thomas, and Witch Fires) in terms of:
  - Direct capital losses
  - Health impacts
  - Economic disruptions
  - Fire suppression costs
  - Fatalities
- **Calculated wildfire probabilities** and applied an expected value framework
- **Estimated microgrid benefits** in mitigating damages during high-risk wildfire periods
- **Determined financial feasibility** based on net benefits, payoff periods, and benefit-cost ratios.

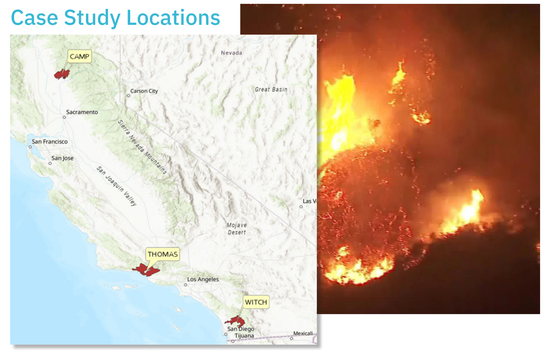
Cumulative Discounted Costs and Benefits

All values are reported as millions of 2024 dollars.

Cumulative Discounted Costs			
Wildfire	**Camp**	**Thomas**	**Witch**
Microgrid construction	$4.7	$7.7	$1.4
Operations and maintenance	$2.5	$4.2	$0.8
Land acquisition	$0.7	$1.2	$0.2
Total	$8.0	$13.1	$2.4

Cumulative Discounted Benefits (Avoided Losses)			
Wildfire	**Camp**	**Thomas**	**Witch**
Direct capital impacts	$1,105.2	$253.9	$213.8
Health impacts	$1,279.7	$294.0	$247.6
Indirect economic losses	$3,431.8	$788.5	$664.0
Fire suppression	$16.6	$26.1	$2.4
Deaths	$98.7	$2.3	$2.3
Total	$5,932.0	$1,364.9	$1,130.2

Case Study Locations

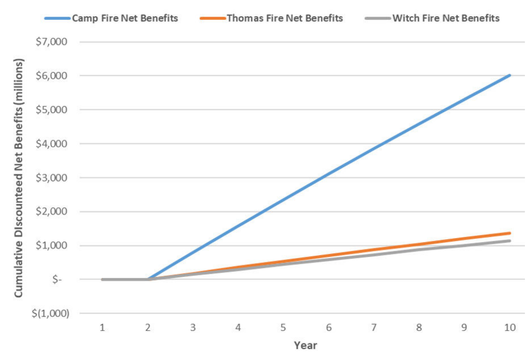


Key Findings: Are Microgrids Worth the Investment?

Even under conservative assumptions, microgrids can be cost beneficial within a short time frame.

- **High-value assets** ≠ best microgrid locations
  - Strategic placement matters for environmental and energy justice.
- **Individual facilities and communities may benefit from direct microgrid implementation.**

Estimated Net Benefits



Conclusion

- Microgrids can mitigate economic, health, and safety impacts of wildfires.
- The benefits far exceed the costs in most cases, even under conservative assumptions.
- Future resilience planning should integrate microgrid solutions as a proactive defense against extreme weather events.