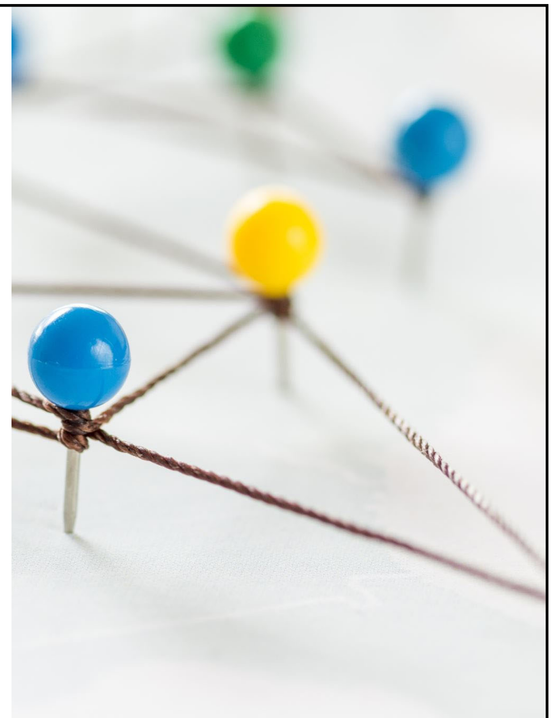
Mapping the Path to Resilience

The Critical Role of Hazard Vulnerability Assessments in Climate Change Preparedness

Jodie Gregory, UCSF Benioff Children's Hospital
Kathy Harris, Stanford Health Care



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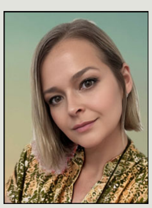
Presenter



Jodie Gregory, MSNPA, MBA, CATSM, CCI
Emergency Management & PBS Operations Manager
UCSF Benioff Children's Hospital

Ms. Gregory's health care emergency management experience follows a long-standing health care career. Over the last decade, her expertise included supporting hospital construction and activation projects, designing emergency training exercises, and coordinating responses to various incidents on both the East and West Coasts, including pandemics, natural disasters, and power outages.

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Presenter

Kathy Harris, MCRP
Executive Director
Stanford Health Care

Ms. Harris' emergency management experiences include supporting activation new hospital buildings, designing and directing emergency exercises, and coordinating response to many planned events and unplanned incidents including pandemic, work stoppage, utility outages, inclement weather, and wildfire. Prior to joining Stanford Medicine, she served at the University of Oregon, Environmental Protection Agency Region 10 Risk Management Program, Stanford University, and City and County of San Francisco Department of Emergency Management.

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Disclosure of Relevant Financial Relationships

Jodie Gregory, MSNPA, MBA, CATSM, CCI reports no relevant financial relationships or relationships she has with ineligible companies of any amount during the past 24 months.

Kathy Harris, MCRP reports no relevant financial relationships or relationships she has with ineligible companies of any amount during the past 24 months.

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Objectives & Agenda

1 Understand why

Develop a clear understanding of the significance of hazard vulnerability assessments (HVAs) in climate change planning to effectively identify and prioritize risks to hospital operations.

- Overview of Hazard Vulnerability Assessments (HVAs)
- Expanding the HVA Scope for Climate Change
- Consideration of Multi-Dimensional Hazards

2 Investigate and explore resources

Acquire practical skills in conducting comprehensive assessments to evaluate vulnerabilities and create targeted mitigation strategies that enhance emergency preparedness and response capabilities.

- Proposed Improvements to HVA Methodology
- Tools for Identifying Climate Change Risks
- Developing Targeted Mitigation Strategies

3 Prepare to take action

Apply knowledge gained from HVAs to formulate actionable emergency management plans that improve resilience in hospital operations against the impacts of climate change-related hazards.

- Case Studies: California's Climate Risks
- Creating Actionable Emergency Management Plans
- Conclusion and Q&A

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Hazard Vulnerability Assessments (HVAs) Overview

HVAs systematically identify and assess risks from climate-related hazards like floods, wildfires, and storms. These assessments are vital for healthcare facilities to recognize vulnerabilities and prioritize threats, especially in light of recent California incidents such as devastating wildfires and severe flooding. Through HVAs, facilities can develop strategies that enhance resilience, ensuring critical services continue during emergencies.

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Poll 1:

How do you conduct your hospital's annual hazard vulnerability assessment (HVA)?

a. In-person

b. Virtual meeting

c. Survey responses only

d. In a way more fun, interesting, and/or unique way

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Climate Change

Long-term shifts in temperatures and weather patterns

Warmer temperatures

+ Water scarcity / drought
+ Severe fires
+ Rising sea level
+ Flooding
+ Catastrophic storms

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Expanding Scope for a Changing Climate

Kaiser Permanente HVA Tool

Alert Type	PROBABILITY	ALERTS	ACTIVATIONS	SEVERITY = (MAGNITUDE - MITGATION)						RISK
				HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur			Possibility of death or injury	Physical losses and damages	Interuption of services	Preplanning	Time, effectiveness, resources	Community/Mutual Aid staff and supplies	* Relative threat
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	Number of Alerts	Number of Activations	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 =High 2 = Moderate 3 = Low	0 - 100%

Probability: Educated Forecasting

People: Injury vs. Health

Time: Past vs. Future

Place: Site vs. Community

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Multi-Dimensional Hazards: Extreme Heat

Temperature Extremes

+ HVAC Failure

+ Power Outage
  - Rolling Power Outages
  - Public Safety Power Shutoffs (PSPS)

+ *Community Impacts*

+ Drought

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Multi-Dimensional Hazards: Wildfire

Fire, External

+ Air Quality Issue

+ Power Outage

+ Mass Casualty Incident

+ Evacuation

+ Hazardous Materials Release

+ Landslide

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Multi-Dimensional Hazards: Inclement Weather

Inclement Weather / Hurricane

+ Flooding, External
+ Flooding, Internal
+ Power Outage
+ Transportation Failure
+ Supply Chain Shortage / Failure
+ Hazardous Materials Release
+ Water Contamination
+ Dam Failure
+ Landslide

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Poll 2:

What is the primary driver for risk scoring during your hospital's annual Hazard Vulnerability Assessment?

a. Overall consideration of the last 3 years
b. First-hand experience within the last year
c. External data sources
d. Other

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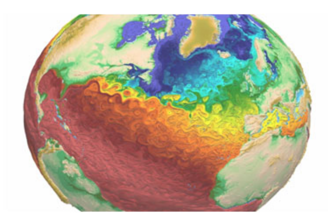
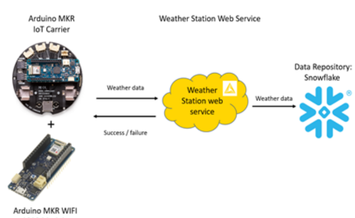
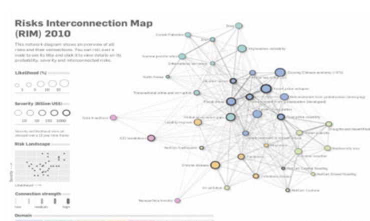
Proposed Improvements to HVA Methodology



Integrate Long-Term Forecasting
Use climate models to anticipate future risks beyond historical data.



Enhance Data Collection Methods
Adopt IoT and remote sensing for precise environmental data.



Focus on Interconnected Risks
Create frameworks to understand hazard interdependencies.

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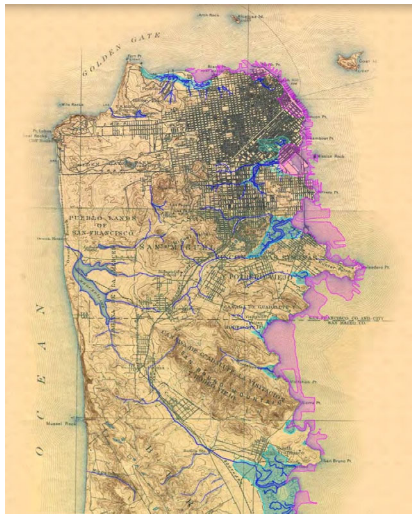
Looking Back to Move Forward

Artificial Fill

- Land created by piling up soil, mud, rocks, rubble and dirt
- Most often fill was put on top of low-lying areas or shallow wetlands and marshlands

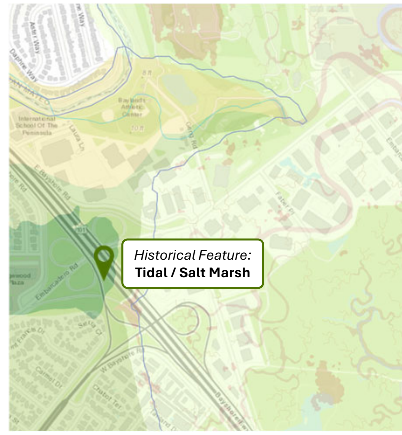
Historic Marshland and Creeks

- Building levees and draining marshes also modified the coastline to make room for more development



Oakland Museum of California c/o KQED

Historical Aquatic Resources and Terrestrial Plant Communities



EcoAtlas Landscape Profiles

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Hydrology Baseline

National Wetlands Inventory

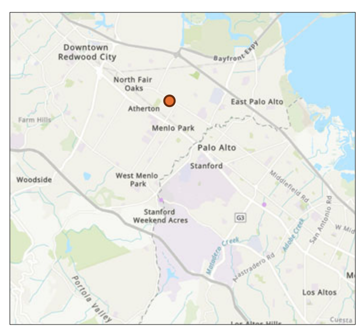
Wetlands

- Natural sponges that trap and slowly release water
- Slows the speed of flood waters and distributes them more slowly over the floodplain

CA Govt. "Best Available Map" (AB5)

Floodplains / FEMA Zones

- Flood Insurance Rate Map's Special Flood Hazard Areas
- 1% annual chance flood = "base flood" or "100-year flood"



EPA Creating Resilient Water Utilities

Streamflow

- Historical streamflow conditions on U.S. streams and rivers at United States Geological Survey (USGS) stream gages

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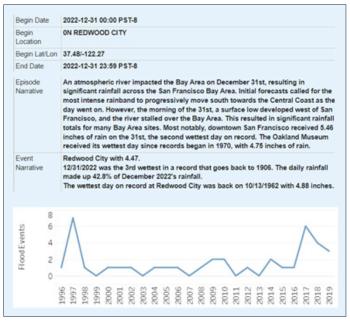
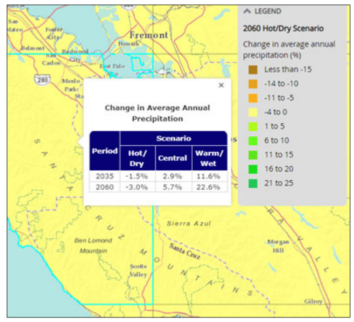
Rising Intensity with Climate Change



NOAA Storm Events Database

Past Storm Events

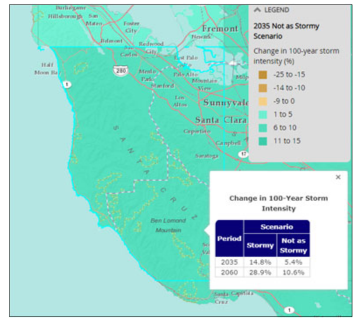
- Detailed data on prior storm events including heavy rain, flood, flash flood, and high wind



CREAT Climate Change Scenarios Projection Map

Precipitation Projection

- **“Dryer – but also wetter”** conditions anticipated



CREAT Climate Change Scenarios Projection Map

100-Year Storm Intensity

- More acute challenges to water resource management and infrastructure protection (e.g., strain reservoirs, flooding, health risks)

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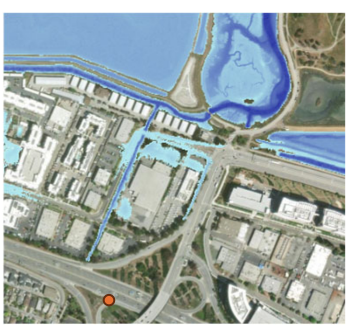
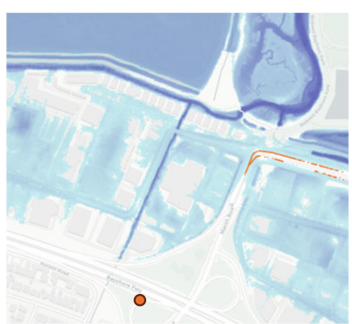
Sea-Level Rise + Tide / Storm Surge Events



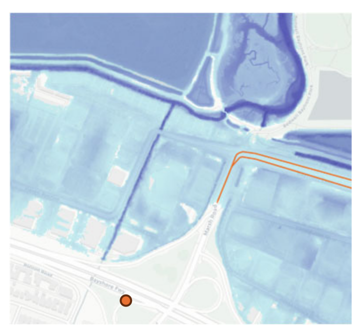
24” Sea Level Rise

(Without a Surge Event)



24” Sea Level Rise + King Tide

& Daily Vehicle Traffic Impacts



24” Sea Level Rise

+ 5-year Storm Surge

& Daily Vehicle Traffic Impacts

Adapting to Rising Tides: Bay Shoreline Flood Explorer

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Site-Specific Water Risk Profile

Location	3700 Haven Court, Menlo Park, CA (San Mateo County)
Primary Site Use	Business Occupancy – facilities shop, storage, and office spaces
Environmental Profile	Site itself does not have unique aquatic resources, but is located nearby Tidal Marsh and Pond
FEMA Flood Zone	100-Year and 500-Year FEMA Flood Hazard Zones in immediate proximity but not for building
Nearby Waterways	Following Marsh Rd north from the site leads to Westpoint Slough, then the San Francisco Bay
History of Flooding	The site itself is on higher ground and has not directly flooded, but the surrounding area
Compounding Factors	Intense rain events are often part of an atmospheric river storm that includes high winds, causing local power outages and impacts to transportation / access.
Timing Considerations	Precipitation in the area tends to be the greatest during the winter months when the health system also experiences higher patient volumes due to flu, etc.
Transportation / Access	The site is served only by Haven Ave which has historically flooded, cutting off access / egress. The site is located very close to main arterial Highway 101.
Response Considerations	Flood risk primarily relates to intensity and multi-day accumulation of precipitation combined with tide conditions – particularly King Tides; team regularly monitors conditions during weather events to evaluate need to deploy mitigation measures and/or evacuate site.
Climate Change Outlook	Sea-Level rise and storm intensity threatens to impact access to the site on a more frequent basis and could also result in future structure compromise.

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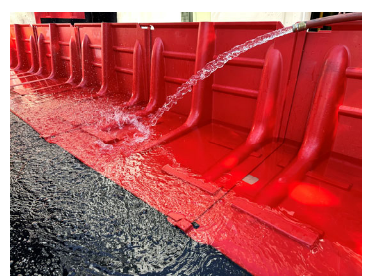
Mitigation Measures

Common Past Resort

- Messy, labor intensive
- Deployed from central city sites
- Don't seal out water
- Time-sensitive

High Absorbency Barriers

- Easily stored on site
- Compact storage
- Anyone can deploy (no training or high physical requirements)
- Reusable



More Robust, Solutions

- More robust solution
- Local or regional staging
- More easily deployed by fewer staff / without specialty vehicles
- Reusable / sustainable

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Case Study:
The Impact of Climate Change-Induced Temperature Increases on California's Utility Grids

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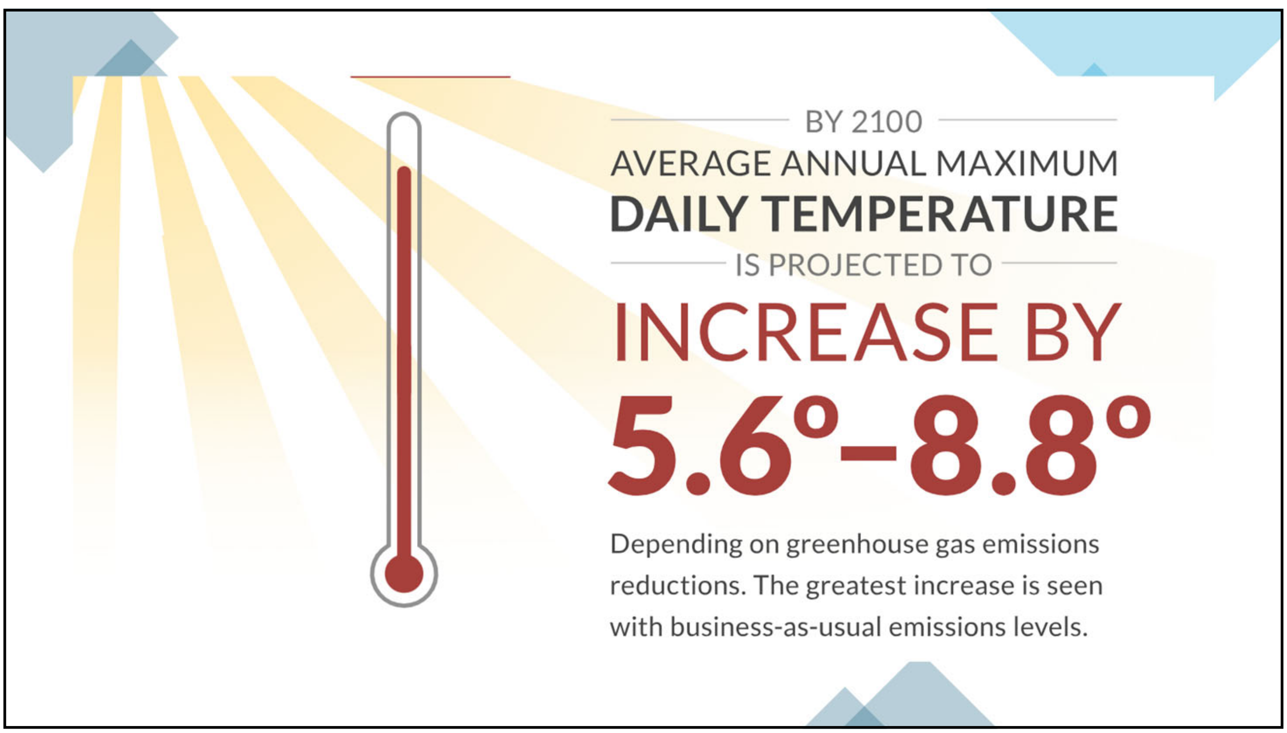

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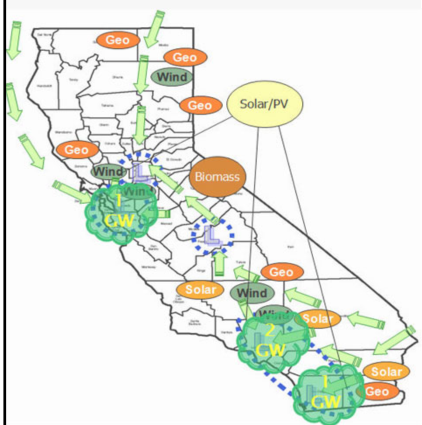

California's Electrical Grid

Key Functions and Climate Impact

- The electrical grid in California distributes power from a variety of sources including solar, wind, hydroelectric, and natural gas.
- Integration of renewable energy sources has increased, aiming for 100% clean electricity by 2045 to combat climate change effects.
- The grid must handle peak demand during heatwaves, which are becoming more frequent and intense due to climate change.
- Wildfires, exacerbated by climate change, pose significant risks to grid infrastructure, leading to potential blackouts.
- Advanced grid technology, such as smart grids, is being implemented to improve efficiency and resilience against climate impacts.

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Impact of Rising Temperatures on Energy Demand

Surge in Cooling Needs

Rising temperatures have led to a surge in demand for air conditioning, particularly during extreme heat events.

California's 2020 Heatwave

During August 2020, electricity demand in California spiked by over 10%, causing power shortages.

Stress on Electrical Grid

Increased cooling demand stresses California's grid, requiring utilities to manage peaks to prevent outages.

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Impact of Higher Temperatures on Power Generation

Reduced Efficiency of Power Generation

Higher temperatures lead to efficiency losses in many power plants. The Diablo Canyon Nuclear Power Plant has experienced reduced efficiency in its cooling systems during heatwaves. This inefficiency directly affects the plant's output capacity.

Consequences for California's Energy Supply

Reduced efficiency strains the electrical grid during peak demand. Power plants may struggle to meet electricity needs during extreme heat events, increasing reliance on less efficient sources.

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Increased Wildfire Risk

Impact of Higher Temperatures on Wildfire Risk

- Higher temperatures and prolonged droughts contribute to an increased risk of wildfires in California.
- In 2020, the California wildfires led to extensive damage to electrical infrastructure, resulting in significant power outages and costly repairs.
- The combination of extreme heat and dry conditions creates a perfect storm for wildfire ignition and spread, further threatening utility grids.

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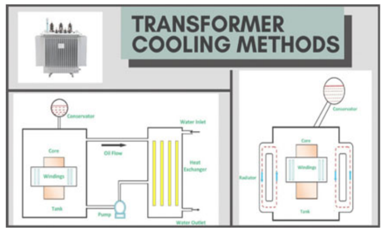
Infrastructure Upgrades in California



Modernizing Power Lines

California utilities are replacing aging power lines with higher-temperature-rated materials to withstand increased thermal stress.

Upgrading Cooling Systems

Utilities are also upgrading cooling systems for transformers to enhance performance during extreme heat events.

Investment in Infrastructure

These upgrades are part of a broader investment strategy to ensure reliability and resilience in the face of rising temperatures.

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Demand Response & Energy Efficiency

Peak Demand Management

Manage peak demand with consumer incentives to cut usage during critical times. California utilities offer rewards for reduced energy use during peak hours.

Energy Efficiency Programs

Implement programs to promote the use of energy-efficient technologies and practices among consumers. Leads to cost savings, less strain on the grid, and improved reliability.

Encouraging Participation

Promote energy-efficient appliances to lower overall demand on the grid. This leads to cost savings, less strain on the grid, and improved reliability.

Advantages of Demand Response

Provides cost savings, reduces strain on the grid, and improves reliability by balancing supply and demand during peak times.

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Expansion of Renewable Energy

Growth of Solar Energy

California is expanding its renewable energy capacity, particularly solar energy. This commitment has been beneficial as solar production aligns well with high-temperature periods.

Reduction of Thermal Reliance

The expansion reduces reliance on thermal power plants, which face efficiency losses during extreme heat. This shift is crucial for maintaining energy availability.

Environmental Benefits

Increased renewable energy usage contributes to lower greenhouse gas emissions, supporting California's climate goals. This is essential for building a sustainable future.

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Case Study: In Summary

The increasing temperatures driven by climate change present significant challenges for California's utility grids, particularly the electrical grid. Addressing these challenges requires a multifaceted approach, including infrastructure upgrades, demand response programs, renewable energy expansion, advanced grid management, and climate-resilient planning. By implementing these strategies, California aims to enhance the resilience and reliability of its utility infrastructure in the face of a warming climate.

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Developing Targeted Mitigation Strategies

Conduct comprehensive risk assessments through HVAs to identify specific vulnerabilities in hospital operations and prioritize mitigation efforts accordingly.

Implement targeted strategies such as enhancing infrastructure resilience, improving supply chain management, and training staff on emergency protocols to address identified vulnerabilities.

Utilize scenario planning and modeling tools to forecast potential climate-related hazards and simulate responses, ensuring preparedness for various emergency situations.

Engage stakeholders, including healthcare providers and community organizations, to collaboratively develop and refine mitigation strategies, ensuring a comprehensive approach to emergency preparedness.

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Creating Actionable Emergency Management Plans

Assess Vulnerabilities
Conduct a Hazard Vulnerability Assessment (HVA) to identify specific vulnerabilities in hospital operations related to climate change.

Develop Mitigation Strategies
Create targeted mitigation strategies based on HVA findings to address identified vulnerabilities, including infrastructure and training.

Integrate into Plans
Incorporate mitigation strategies into the hospital's emergency management plans, outlining roles and procedures for climate-related hazards.

Monitor & Improve
Establish a system for continuous monitoring of climate risks and the effectiveness of strategies, updating plans as needed.

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Conclusion

1 understand why

A Hazard Vulnerability Assessment (HVA) tool is a valuable *first* step in conducting a comprehensive risk assessment. The complex multidimensional nature of healthcare combined with compounding, interdependent hazard categories necessitates an equivalently diverse hazard assessment process.

2 investigate and explore resources

Review of past incidents combined with modeling tools based in scientific data afford valuable insight into how the severity of disaster scenarios will increase due to climate change.

3 prepare to take action

Effective mitigation planning requires comprehensive collaboration among community stakeholders. Just as mitigation often considers the longer-term investment, risk assessment must also explore beyond just the next year. Mitigation measures implemented now provide interim benefits even before the severity of climate change becomes fully apparent.

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Questions?

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Thank you!

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