

# Clean Energy and Resilience Overview

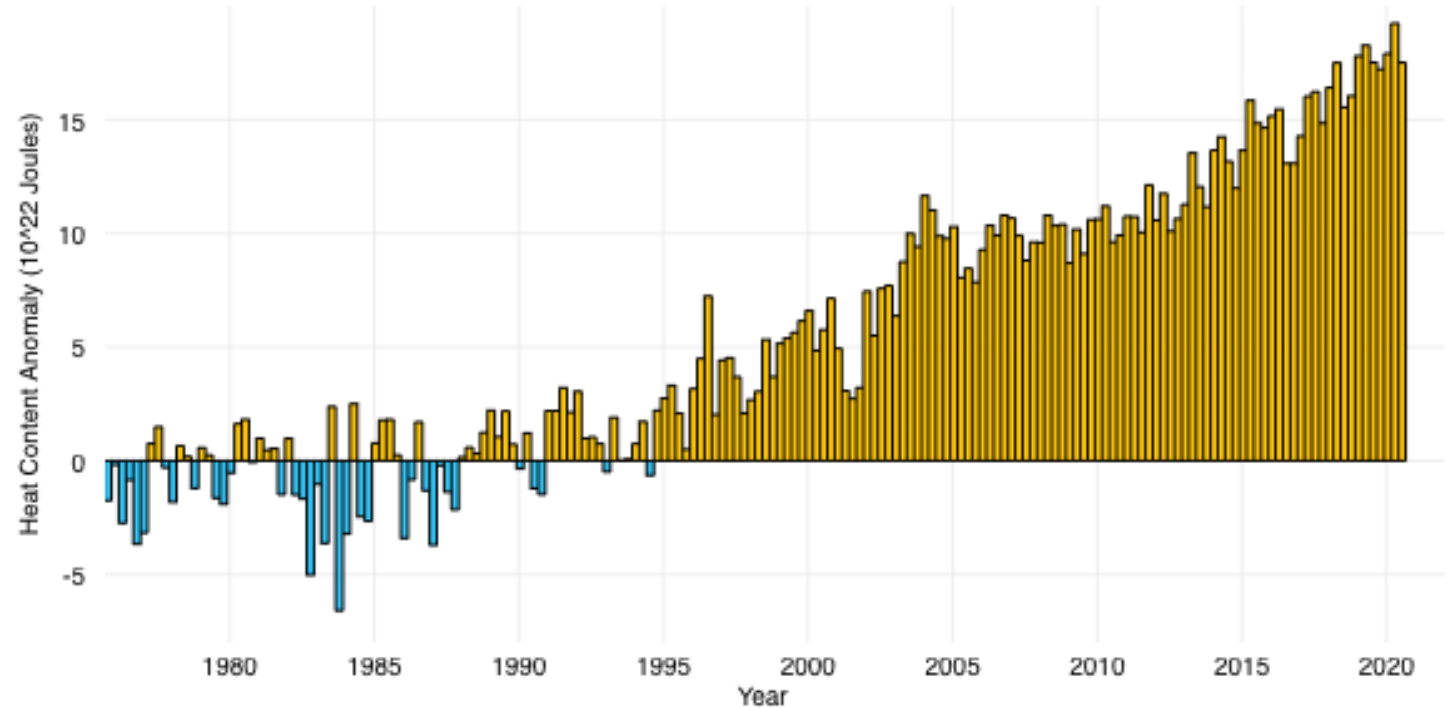
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- ▶ **What is Resilience?**
  - Each nation will have their own definition
  - Clean air, clean water
  - Rewarding jobs and thriving economy
  - Strong social services (education, health, help)
  - Equity is centered
  - Able to withstand issues, and recover swiftly
- ▶ **Redwood Coast / Humboldt County**
  - Eight (8) tribal nations within its boundary
  - ~140,000 people
- ▶ Rural, geographically isolated
- ▶ Tenuously connected to energy grids
- ▶ Energy supports all we do - in typical and emergency circumstances



# Resilience Investment Rationale – Global to Local

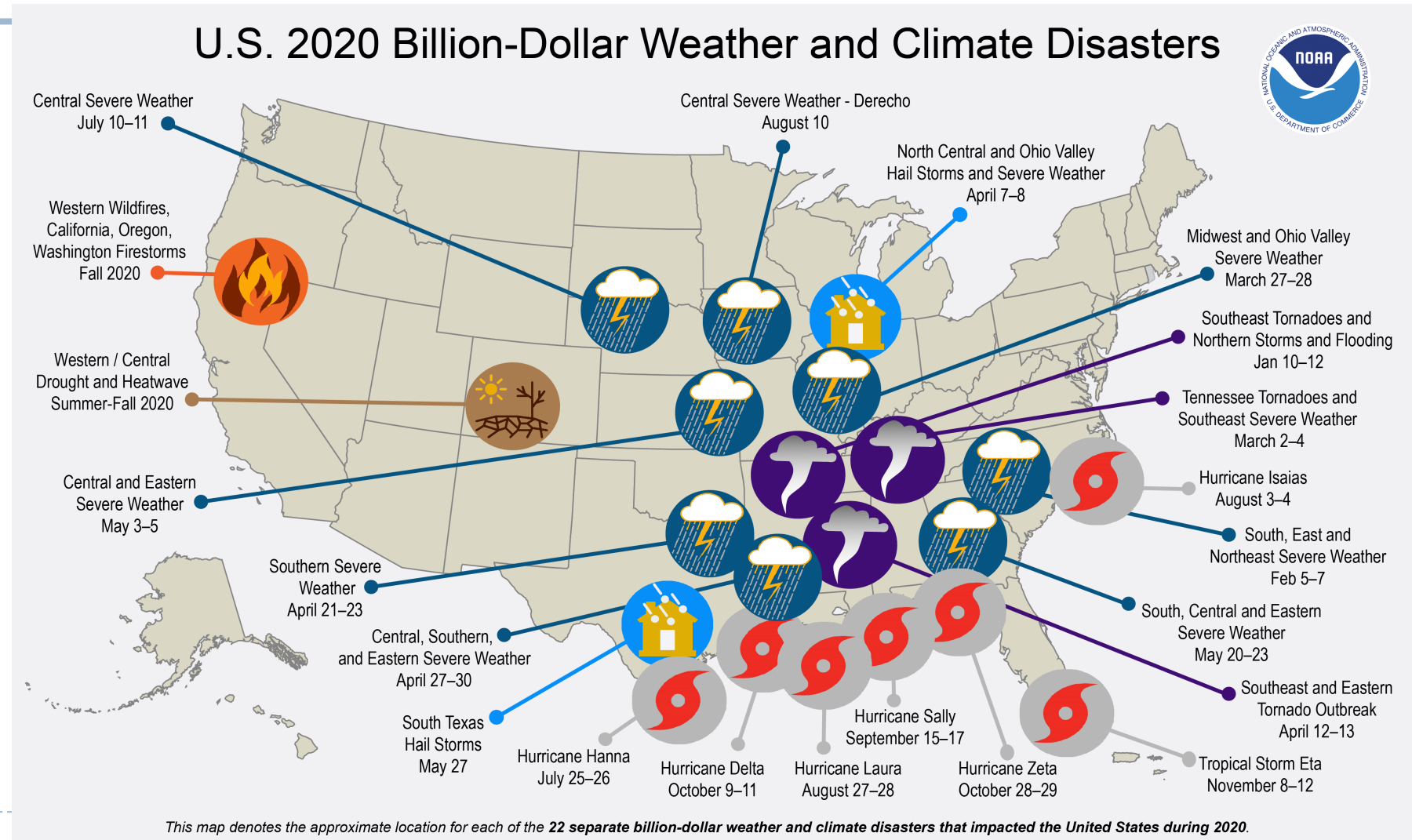
- ▶ Global climate change *amplifies and cascades into* local conditions
- ▶ Increasing temperatures on land and in oceans
  - Pacific ocean “warm blobs” in 2014, 2019
  - Oceans absorbed ~90% of warming between 1971-2010
- ▶ Unpredictable, volatile weather, extreme storms
  - ▶ Nuisance power outages are common, but worsening



Graph: differences from long-term average global ocean heat content (1955-2006) in the top 700 meters of the ocean. Image credit: NOAA climate.gov

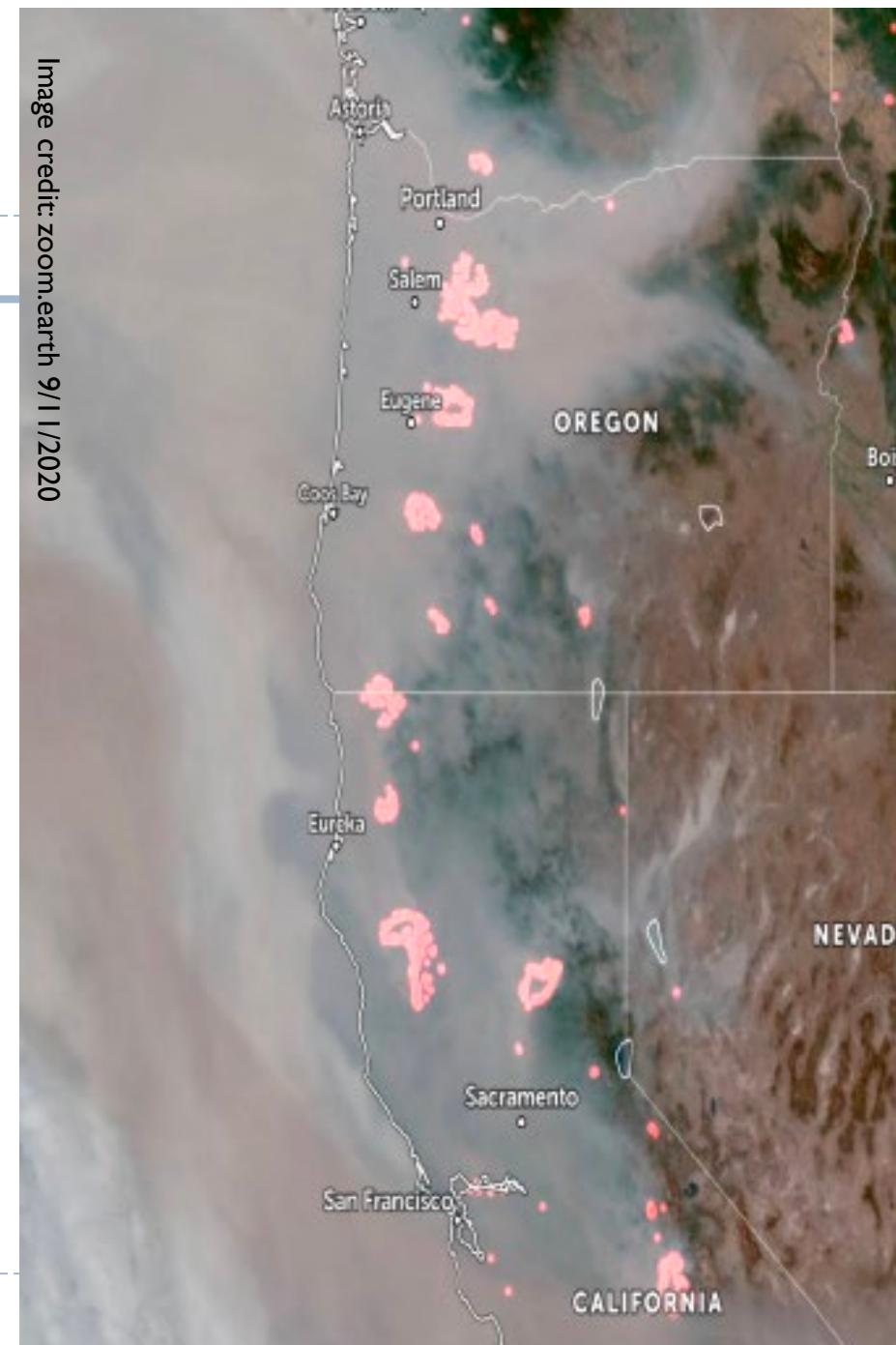
# Resilience - Economic Context

- ▶ 2020 – highest rate of billion-dollar disasters from climate and weather in U.S. ever
- ▶ Much of that damage was to infrastructure, including utilities.
- ▶ 2021 – Texas utility damages ~\$140 B and counting



# Resilience Investment Rationale

- ▶ Increased wildfires and air pollution
- ▶ Amplified by climate emergency
  - Historically Low Fuel Moisture Content
    - In forests, at woodland/urban interface (WUI)
- ▶ “Public Safety Power Shutoffs” (PSPS)
  - Planned outages to prevent wildfires from electrical grid; projected to last 2-10 days; two PSPS events in 2019, 2020
- ▶ Seeing drought and wildfire – and wildfire smoke – in new areas
- ▶ ‘Heat dome’ over entire western U.S. in 2020



# Resilience Investment Rationale - Local

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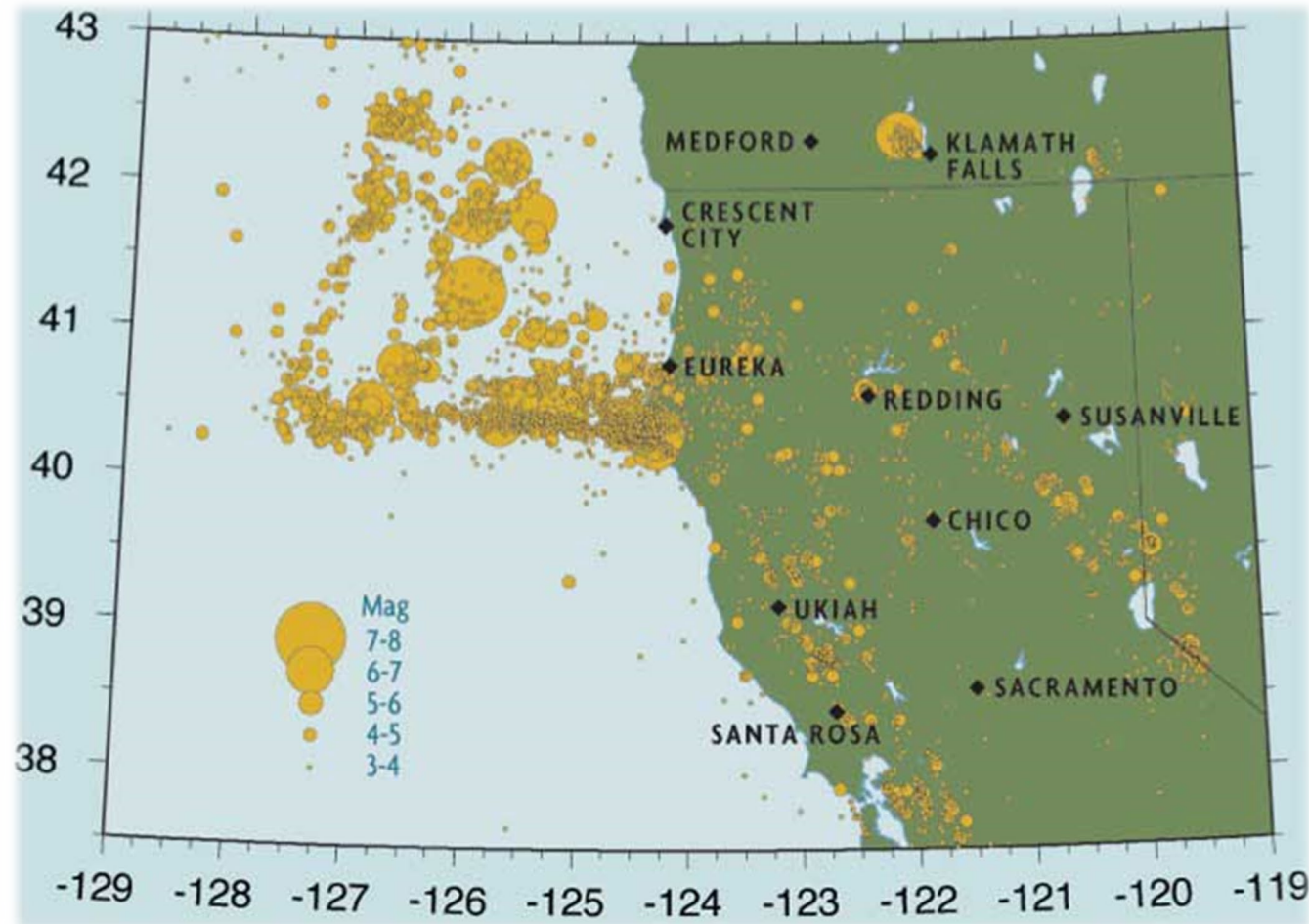
- ▶ Sea Level Rise (SLR), Groundwater Inundation and Flooding
  - ▶ Humboldt County is experiencing the fastest rate of SLR on the Pacific Coast
    - Combination of land subsidence and warming temperatures
  - ▶ Impacts to local infrastructure
  - ▶ Threatens anchor natural gas power plant
  - ▶ Threatens local nuclear waste repository



Photo Credit: Tim and Rose Hanan

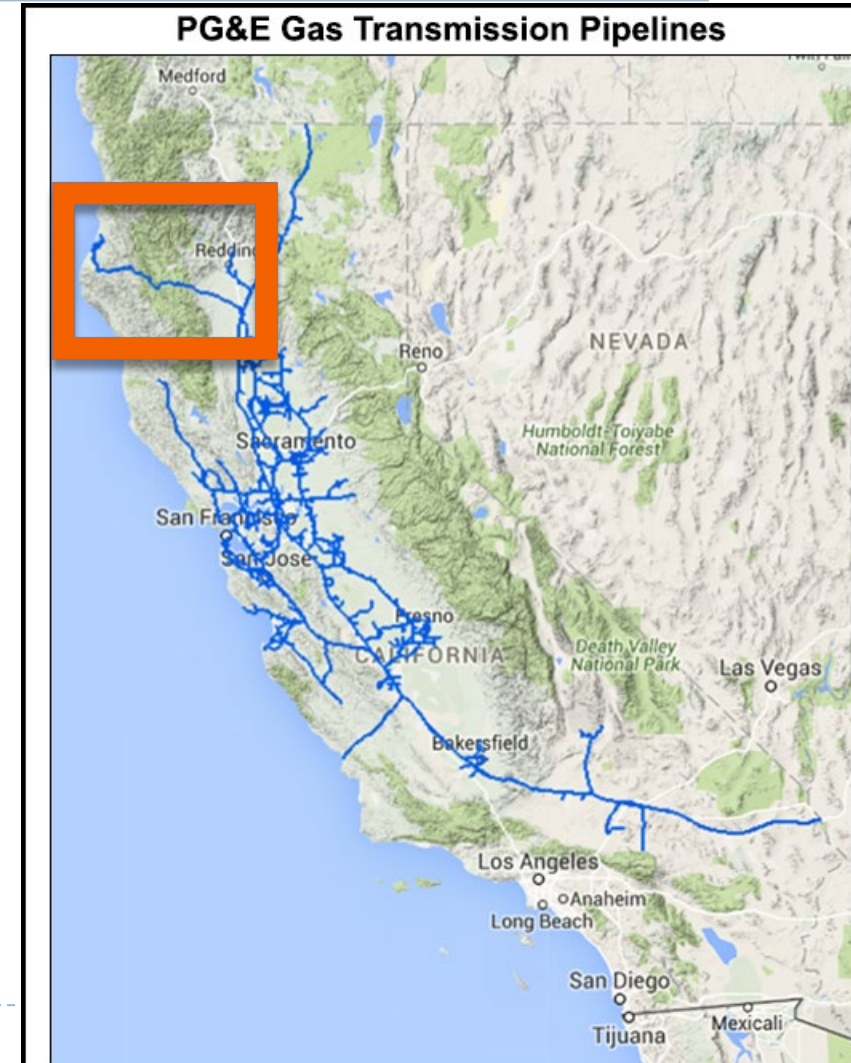
# Resilience Investment Rationale - Local

- ▶ **Serious earthquake / tsunami risk**
  - ▶ Cascadia Subduction Zone, Mendocino Fault, Gorda Plate, Pacific Plate, North American Plate all converge at the 'triple junction,' directly offshore from Humboldt County.
  - ▶ Can achieve >9.0 earthquake
  - ▶ Entire Pacific Coast can be simultaneously impacted
  - ▶ Due to relatively low population, our region may be lower priority for response



# Resilience Investment Rationale - Local

- ▶ Tenuous Connection to **Natural Gas Grid**
  - ▶ Region is served by a single 10-inch natural gas pipeline
    - Runs through seismically unstable landscape
  - ▶ Serves region's anchor natural gas power plant
    - Provides most of our *actual* electrons used here
    - Located directly across from the mouth of Humboldt Bay, vulnerable to tsunami
    - Plant site will be inundated by sea level rise *and groundwater intrusion* from sea level rise by ~2050-2070
  - ▶ Serves all our natural gas uses (cooking, heating)



Source: Pacific Gas and Electric Co.

# Resilience Investment Rationale

- ▶ **Tenuous connections to Electrical Grid**
  - ▶ Region is served by a single transmission line
    - With one redundant line
  - ▶ Runs through wildfire country
  - ▶ Import restricted to 70 megawatts, less than half the local use
    - Humboldt's typical use is 140-180 megawatts
    - Anchor natural gas power plant provides most *actual* electrons
      - ▶ Clean energy use is contractual, not actual.
  - ▶ Need cleaner and more resilient local grid
    - Humboldt "island" created in 2020 is a band-aid

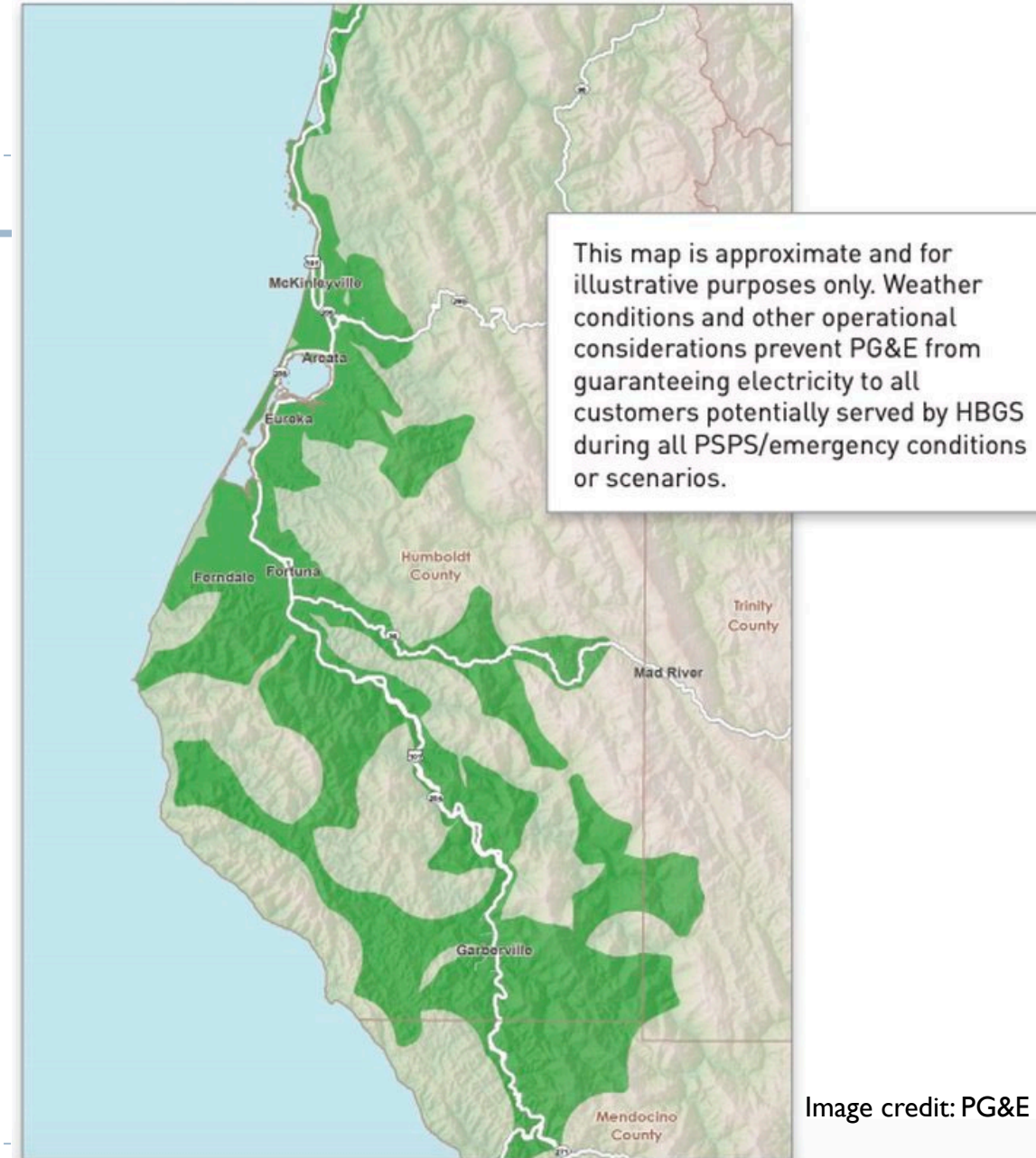


Image credit: PG&E



# BLR Resilience Strategy

- ▶ Transition to “Climate-smart” Infrastructure ASAP
  - ▶ Improve continuity of operations (COOP), community health, resilience
  - ▶ Economy-enabling investments; lower, predictable costs; more local capacity and jobs
- ▶ “Lifeline Sector” Priorities
  - ▶ **Energy:** efficiency, microgrids; supports all lifeline sectors
  - ▶ **Water:** smart water grid; super efficient, latest monitoring tech, phase one emergency water supply
  - ▶ **Transportation:** electric fleets and charging stations; biodiesel manufacturing
  - ▶ **Communications:** broadband, information technologies (IT), emergency communications
  - ▶ **Food:** local production, storage, distribution



# BLR Resilience Strategy

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- ▶ **Zero-carbon Solutions**
  - ▶ Pairing climate mitigation + adaptation = zero greenhouse gas emissions by 2030
  - ▶ Mitigation = reducing climate-forcing emissions
  - ▶ Adaptation = dealing with impacts already here, with zero carbon solutions *to avoid making the underlying climate problem worse.*
- ▶ Began with energy, because energy supports all sectors.



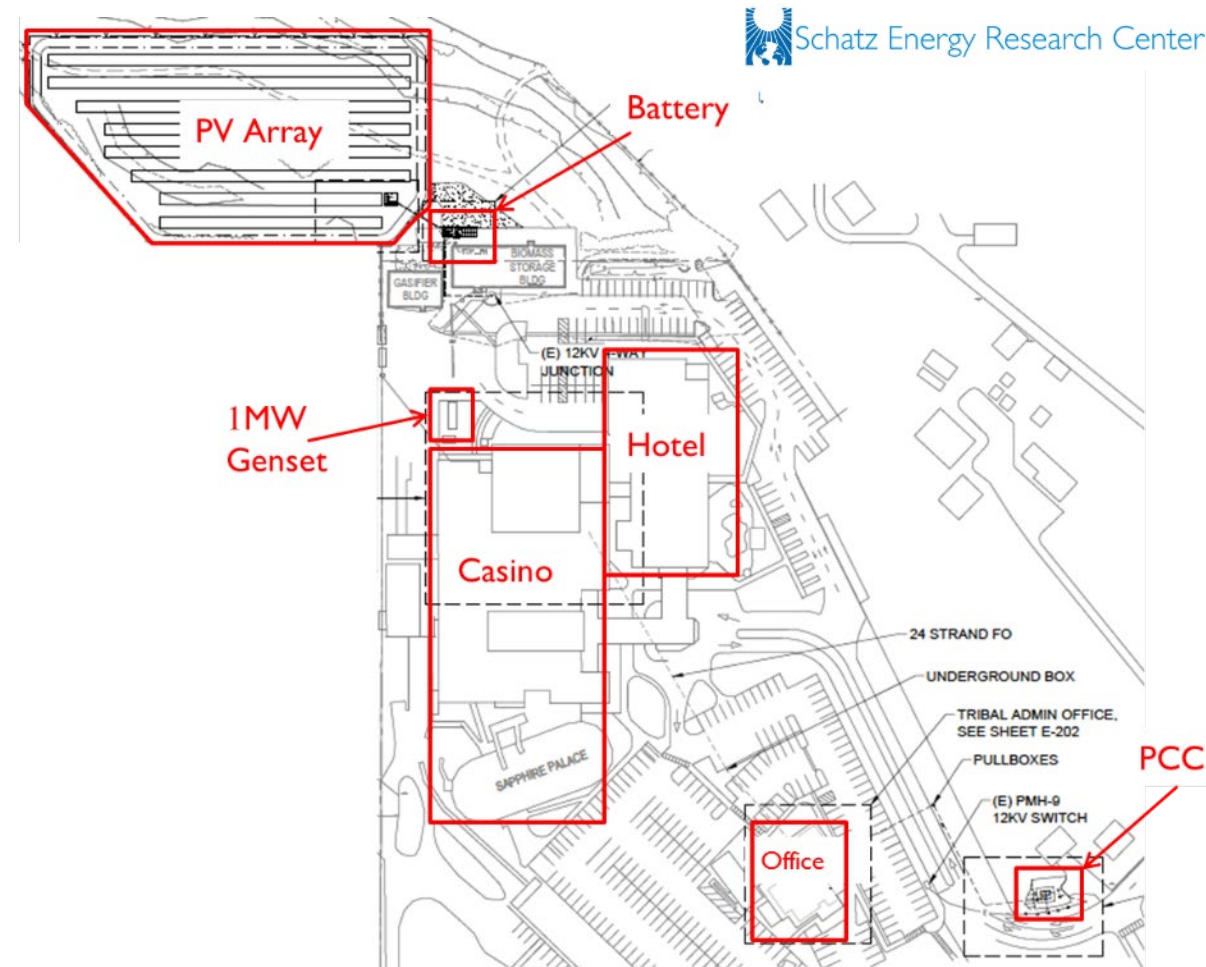
# BLR Low-carbon Microgrids

- ▶ Community scale – in operation since 2017
- ▶ Facility scale – in operation since 2020
- ▶ Campus scale – in design, full operation by ~2021/2022, will include ~10 residences
- ▶ New facility scale – to demonstrate nested microgrids
- ▶ Clustered microgrids allow for ongoing reliability and grid benefit studies



# Community Scale Microgrid

- ▶ Public/private partnership - Tribe, Schatz Energy Research Center, PG&E, Siemens, Tesla, CEC, CPUC, Idaho National Lab, other
- ▶ Funded by the Tribe, and a CEC R&D grant
- ▶ Powers tribal government offices, economic enterprises, critical lifeline sectors
- ▶ Can seamlessly island and reconnect to grid
- ▶ Solar PV; battery storage; legacy diesel gensets (used as a last resort)
- ▶ Annual energy cost savings ~\$200,000
- ▶ Annual greenhouse gas reductions ~200 tons



# Facility Scale Microgrid “Solar+”

- ▶ Public/private partnership - Tribe, Schatz Energy Research Center, PG&E, SunPower, Tesla, CEC, Lawrence Berkeley Nat. Lab, others
- ▶ Funded by the Tribe and a CEC R&D grant
- ▶ Supports fuel station / convenience store complex
- ▶ Solar PV (60kW) + storage (106kw/169kwh); islands from larger grid; advanced building control (efficiency, grid balance)
- ▶ Creates a replicable, low-carbon ‘resilience package’
- ▶ Normal operation: lower costs (~\$20k/yr), GHGs (50 tons/yr), better COOP
- ▶ In emergencies: supplies lifeline sectors to public and responders; very important where these facilities are only resource for lifeline sectors.



Solar+ at Blue Lake Rancheria



2018 East Coast hurricanes cause lines at fuel stations. Photo: Theindychannel.com

# Climate-smart Infrastructure is Working

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- ▶ Public Safety Power Shutoff (PSPS) - 10/9/19
  - ▶ Grid outage to prevent wildfires; lasted ~30 hours
  - ▶ 30 counties / millions of people across northern California
  - ▶ Tribe opened its EOC
  - ▶ Served ~10,000+ people (~10% of County) in 30 hours
  - ▶ Supplied general public and response agencies:
    - ▶ Electricity, gas/diesel, propane, ice, water, food, internet, device charging, ATMs
    - ▶ Critical medical housing in hotel; *credited with saving four lives*
    - ▶ Refrigeration to keep medicines cold
    - ▶ Electric vehicle (EV) charging stations
    - ▶ Community Support Center; Business Center
- ▶ ‘Heat dome’ event of Aug/Sept 2020: islanded the microgrids to ease pressure on regional grids; helped avoid major grid disruptions.



# Wildfire Outages, Microgrids, Reflections

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- ▶ The PSPS did its job – no wildfires
- ▶ The microgrids did their job – regional support
- ▶ Outages were relatively short; utilities worked to limit scope
- ▶ If outages lasted longer, there would have been other cascading issues
  - ▶ Cellular / internet communications outages (started happening at the ~24-hour mark)
  - ▶ Drinking water / wastewater systems failed (inadequate back up power)
  - ▶ Economic and social disruption (structure fires, loss of income, caring for infants, etc.)
- ▶ Tribe's COOP was well-received
  - ▶ Provided the lifeline sectors (energy, water, food, communication, transportation)
  - ▶ Increased interest in microgrids
  - ▶ PSPSs are estimated to last up to ten (10) days; occurring for the next decade.

# Climate-smart Microgrids as Solutions

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- ▶ Build low-carbon microgrids for stacked benefits
  - ▶ Resilience, emergency preparedness/response, new jobs, pollution reduction, climate solution, maintain critical infrastructure; support lifeline sectors
  - ▶ Microgrid knowledge transfer: learn from successful projects; avoid inappropriate technology, increase standardization, lower capital / O&M costs; increase R&D
- ▶ How to best operate and manage microgrids?
  - ▶ Regional expertise/capacity,
  - ▶ Ensure safety and coordinated grid benefits
  - ▶ What are tribes / utilities / tribal utilities roles?
- ▶ How is microgrid resilience valued?
  - ▶ In normal and emergency operations; climate targets; COOP





# Wraparound Resilience Initiatives



- ▶ Resiliency Training & Innovation Center (RTIC)
  - ▶ Bring more trainings to remote North Coast of California
  - ▶ Emergency preparedness (e.g., HazMat, NICS)
  - ▶ Regional planning (e.g., “Tsunami Con”)
  - ▶ First tribe (and first rural area) to host the National Emergency Management Advanced Academy (NEMAA)
  - ▶ > 1,200 certifications since Oct. 2017



# Wraparound Resilience Initiatives

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- ▶ Education
  - ▶ “Pathmakers”
    - ▶ K-12 Makerspace Program
    - ▶ Culturally responsive STEAM education and entrepreneurship
    - ▶ Internships and Scholarships
  - ▶ University undergraduate/graduate studies onsite
    - ▶ Feasibility projects; internships
    - ▶ Fellowship for Clean Energy Studies

- ▶ Workforce Development
  - ▶ Solar Workforce Training Program
    - ▶ Focused for Native Americans and Native American veterans
    - ▶ Partnership with Grid Alternatives
    - ▶ DOE funding
    - ▶ Hands-on training events
    - ▶ Solar career exploration

# Wraparound Resilience Initiatives

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- ▶ **TOMA Resilience Campus**
  - ▶ *A place to develop and launch solutions for clean energy and community resilience*
  - ▶ Training / event space (increase local training resources, workforce development)
  - ▶ Business incubator (clean energy resilience focus)
  - ▶ Makerspaces
  - ▶ Demonstration kitchen
  - ▶ Retail store | café
  - ▶ Education programs
  - ▶ Coordinate with tribal 'climate-smart' technologies
    - ▶ Clean energy microgrids, water and telecom grids
  - ▶ Estimated opening ~2023



**TOMA**  
RESILIENCE CAMPUS

# Final Thoughts

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- ▶ Tribe seemed to arrive “just in time” with appropriate energy sector resilience
  - ▶ Due to governance and investment.
- ▶ Strategy centering climate projections, pairing mitigation + adaptation works
  - ▶ Climate science, data, and models are proving correct, and *conservative*.
  - ▶ Tribe is undertaking a manageable transition to a climate-smart community.

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## Select Resilience Recognition

2019 “Green Power Leadership Award (Direct Project Engagement)” U.S. EPA

2019 “Microgrids for Greater Good Award (Grid-Connected)” Microgrid Knowledge

2018 “Project of the Year (DER Integration)” POWERGRID International, DistribuTECH

2017 “Whole Community Preparedness Award” FEMA

2015-2016 “Climate Action Champion” White House and U.S. Department of Energy