



Addressing Climate Resilience in Schools

Module 1 in the Energy CLASS Prize “Resilience” Course
February 13, 2024

Welcome

Let's get to know each other!	10 mins
Lesson Plan <ul style="list-style-type: none"> • Fundamental Principles of Resistance • Characteristics of Resilience • Taking Action • Case Study – Orange County Public Schools 	1 hour 20 mins
Discussion	30 mins

Course Objective

Establish a baseline understanding of resistance and resilience, demonstrate how resilience can mitigate climate risk, and highlight tools and resources available to support districts in decision making.

1. Participants will understand the climate hazards that can impact schools and communities in different geographical areas.
2. Participants will understand the importance of climate resiliency in schools.
3. Participants will understand what pathways districts have to make their schools more resilient over time.

Today's Presenters



Mischa Egolf

NBI



Forest Tanier-Gesner

PAE



Robert Boyd

Orange County Public Schools



Jennifer Fowler



David Klawitter

Icebreaker

**Buddy Marmot says
Mentimeter is the way to go!**

Instructions:

- Scan the Mentimeter code on your phone or enter on your computer browser.
- Respond to the prompts and answers will populate real time.



Fundamental Principles

What is a resilient school?

- **Designed** and **operated** to defend against, and quickly bounce back from, natural or man-made disasters and other hazards like long-term climate change.



When extreme weather forces local utilities to cut power, schools remain online, powered by renewable energy that is generated and stored on-site.



When wildfire smoke fouls the air, school ventilation and filtration systems maintain clean cool air, providing respite for students and their families.



When temperatures soar, children play on tree-sheltered schoolyards with pervious, heat-deflecting surfaces and drought-tolerant landscaping.



When students struggle to make sense and find balance in the face of uncertainty, their schools offer connection, competence, and hope in the future.

Why resilience in schools is important

Resilient schools can offer a variety of benefits:

- ✓ Act as community resource center
- ✓ Ensure continuity in operations
- ✓ Stabilize future energy costs
- ✓ Reduce operating and maintenance costs
- ✓ Educate tomorrow's responsible citizens
- ✓ Set the example of what resilience can look like for your community

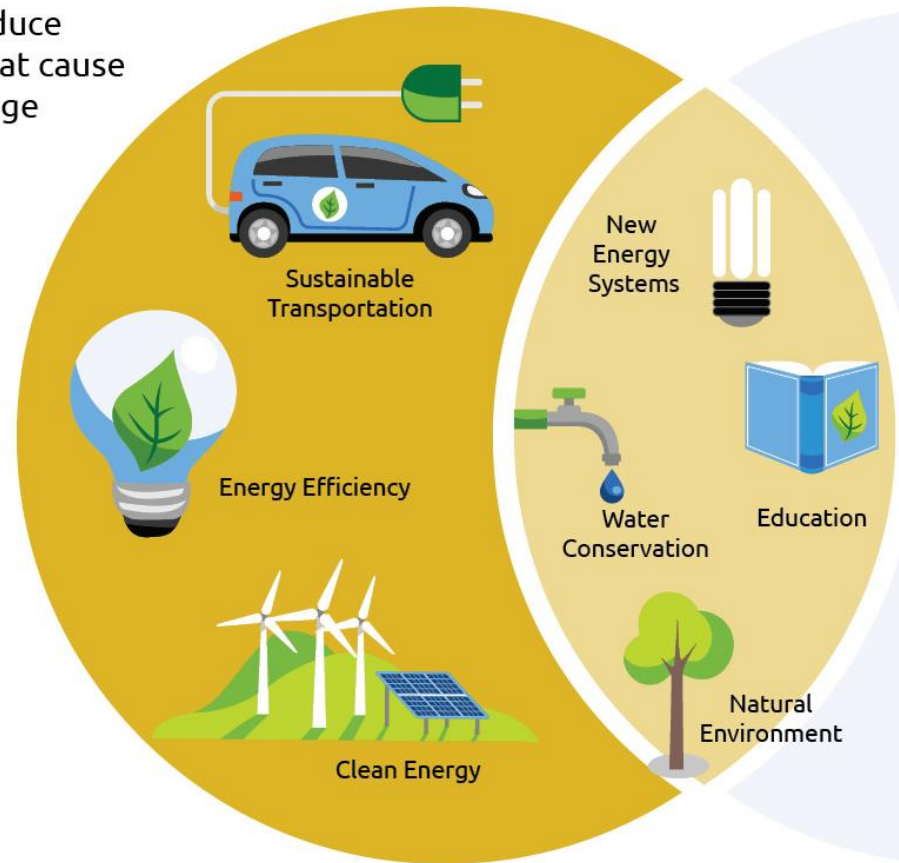
Basic terms and principles

- **Risk:** the likelihood of a hazard or threat occurring, and the magnitude of its impact.
- **Vulnerability:** how susceptible a building is to the negative effects of natural and manmade disasters and hazards. For example, the age of the infrastructure
- **Mitigation:** actions taken to prevent or reduce risk
- **Adaptation:** adjust to current or expected future conditions, lowering overall risk
- **Resistance:** protect and defend the building from being impacted by disasters and hazards
- **Resilience:** improve the building's ability to “bounce back” when disasters and hazards do strike

Mitigation vs Adaptation

Mitigation

Action to reduce emissions that cause climate change



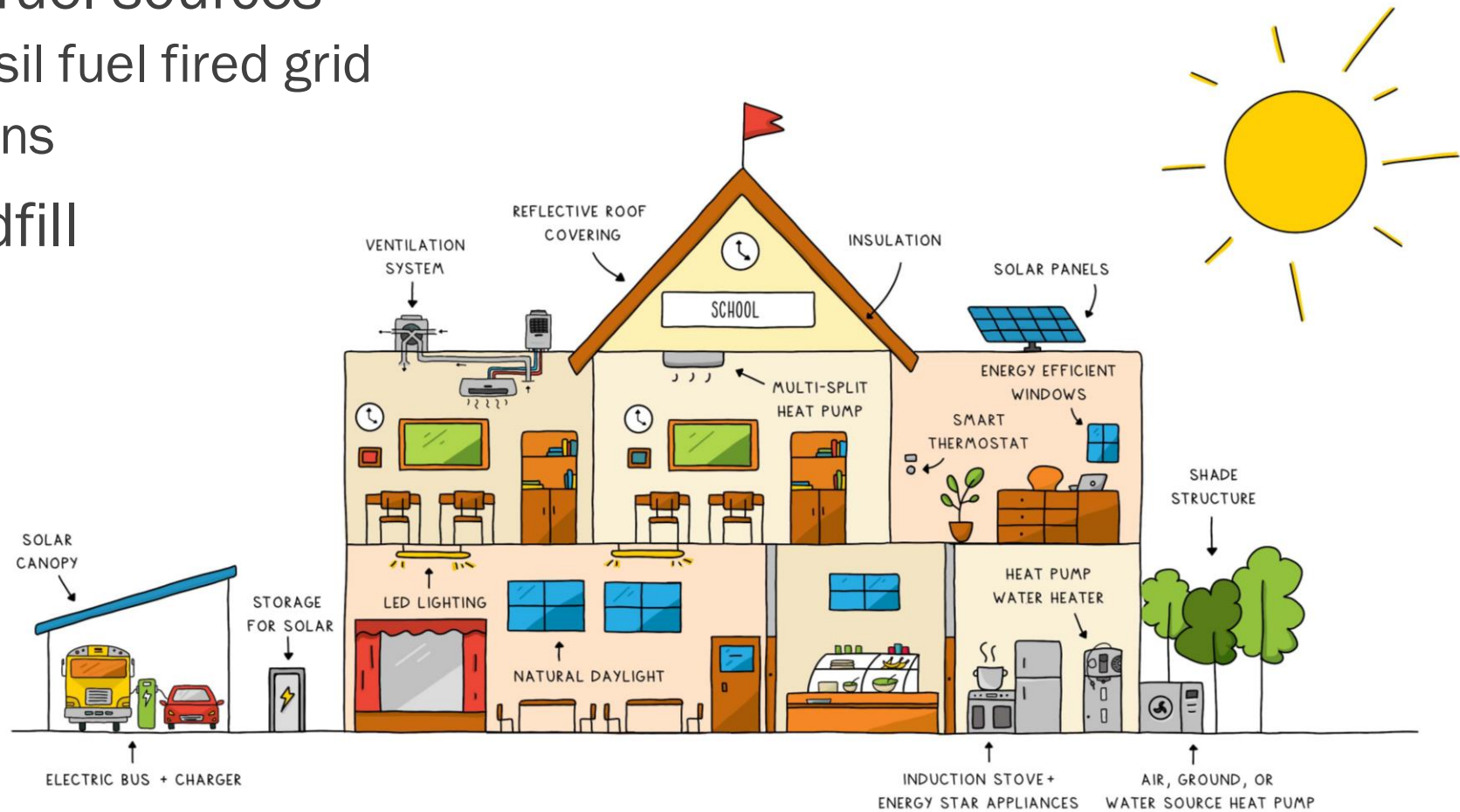
Adaptation

Action to manage the risks of climate change impacts



Mitigation in Schools

- Reducing use of fossil fuel sources
 - Electricity use from fossil fuel fired grid
 - Transportation emissions
- Reducing waste to landfill
- Increasing tree cover



Artwork by Nicole Kelner

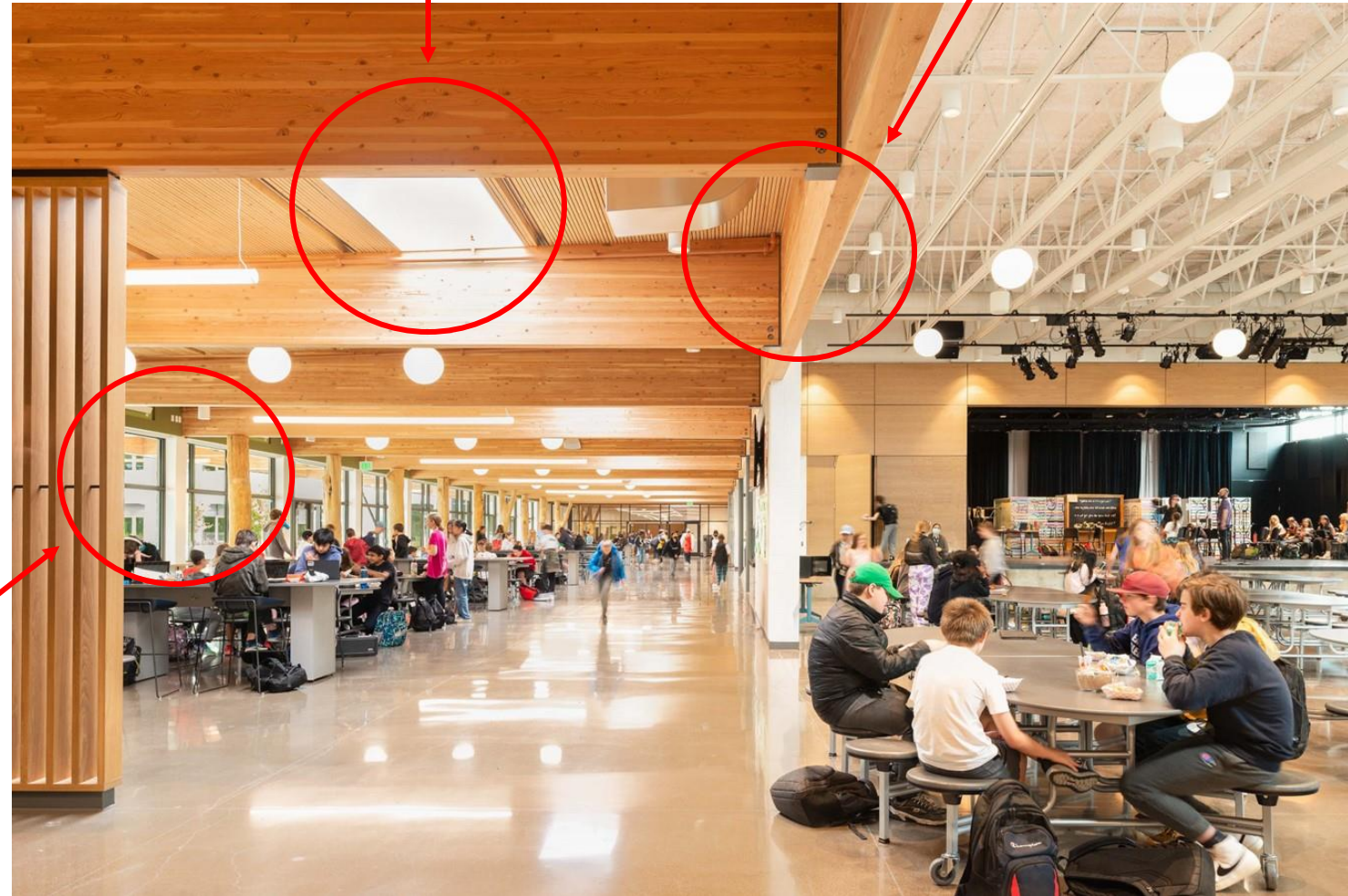
Adaptation in Schools

- Updating construction practices and standards to include resiliency
- Adjusting operations
- Diversifying sourcing
- Climate change education!

Passive cooling/
natural ventilation

Daylighting

Mass timber
structure



Lakeridge Middle School, Lake Oswego, OR
PAE Resilient School Project

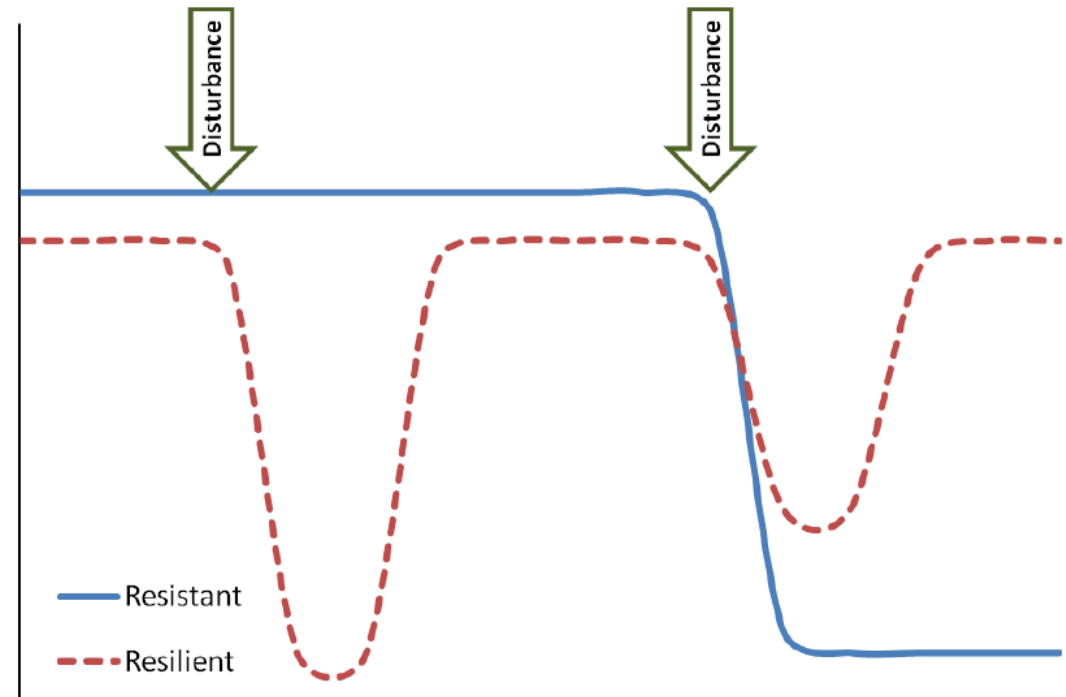
Resistance vs Resilience

Resistance

- Ability to remain unchanged in the face of a disturbance; foundational safety measures

Resilience

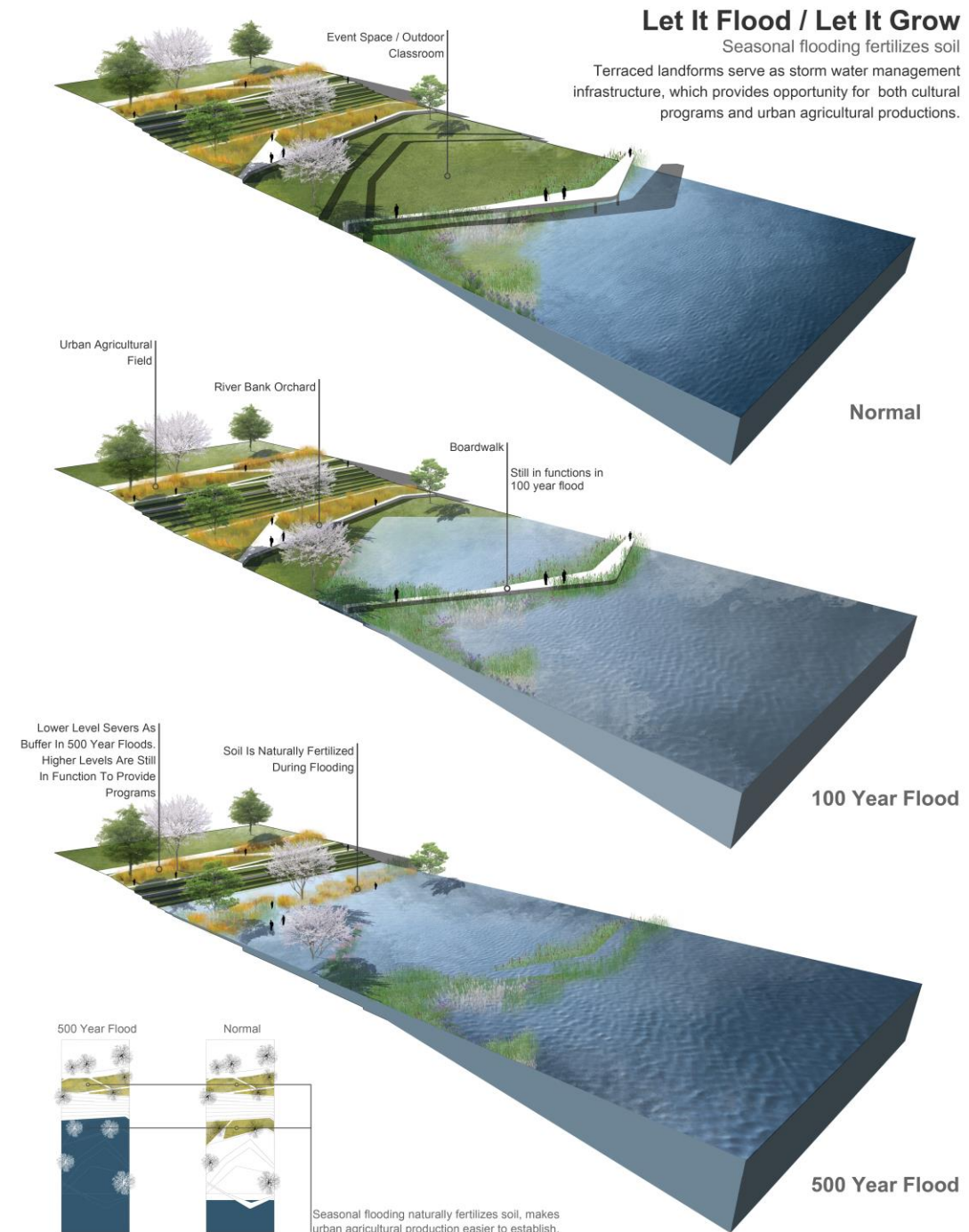
- Capacity to recover to normal after experiencing a disturbance.



Resistance in Schools

- Fire and life safety codes¹ were created for resistance!
- Design and construction practices to be able to withstand a 500-yr (or greater) storm event
- Wind load modeling of roof-mounted solar arrays, and appropriate ballasting
- Health measures such as indoor air quality standards provide resistance

¹Fire and life safety codes include strategies to protect people based on building construction, protection, and occupancy features that minimize the effects of fire and related hazards.



Resilience in Schools

- Strategies exist for every major hazard
- Can be addressed in all phases of the building lifecycle:
 - Design and construction
 - Operation and maintenance
 - Retrofits, renovations, additions
- Lack of resiliency measures can have financial consequences
- FEMA states, “natural hazard mitigation saves \$6 on average for every \$1 spent.”



FEMA Saves Factsheet: https://www.fema.gov/sites/default/files/2020-07/fema_mitsaves-factsheet_2018.pdf

Resilience in Schools

Design and Construction

- Efficiency measures
- Future electrical infrastructure needs
- Backup power and energy storage
- Potable water backup

Operation and Maintenance

- Emergency preparedness and disaster recovery plans
- Shift electricity load
- Equipment upgrade/replacement planning

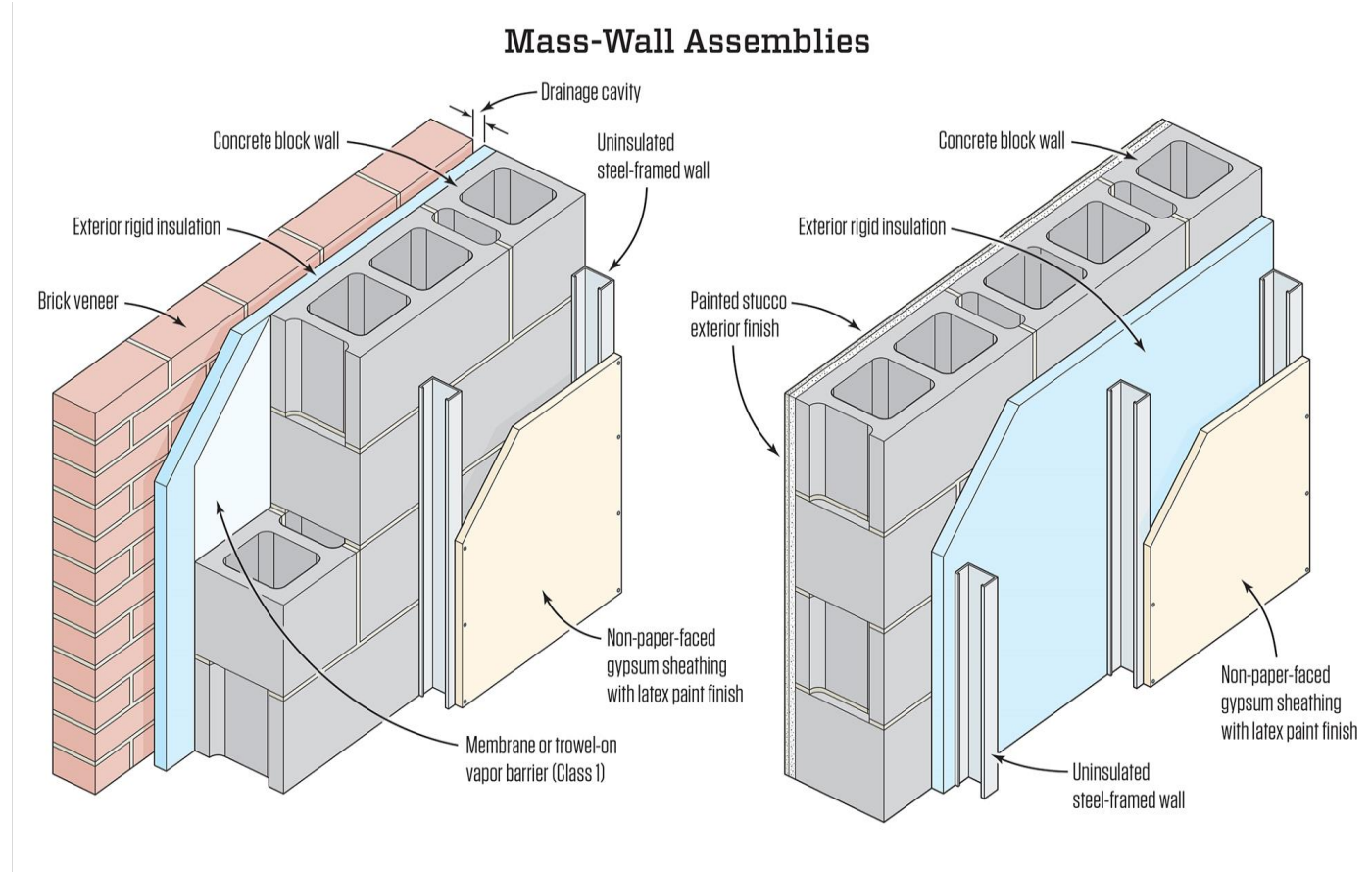
Retrofits and Renovations

- Seismic retrofits
- Efficiency measures
- Envelope improvements
- Use the opportunity to create a climate action plan
- Installing quick connects for generators

Adapted from: <https://knowledge.uli.org/en/Reports/Research%20Reports/2022/Resilient%20Retrofits>

Resilience in Schools

- Design and construction practices that allow for easy replacement of floor and wall tiles, and include electrical service installed at a height above potential flood levels
- Resources: [CHPS criteria](#), [RELi Standard](#), and [LEED Resilient Design Credits](#)



Mentimeter Time

What does resilience mean to your school district?



<https://www.menti.com/alz5ik8rrjxi>

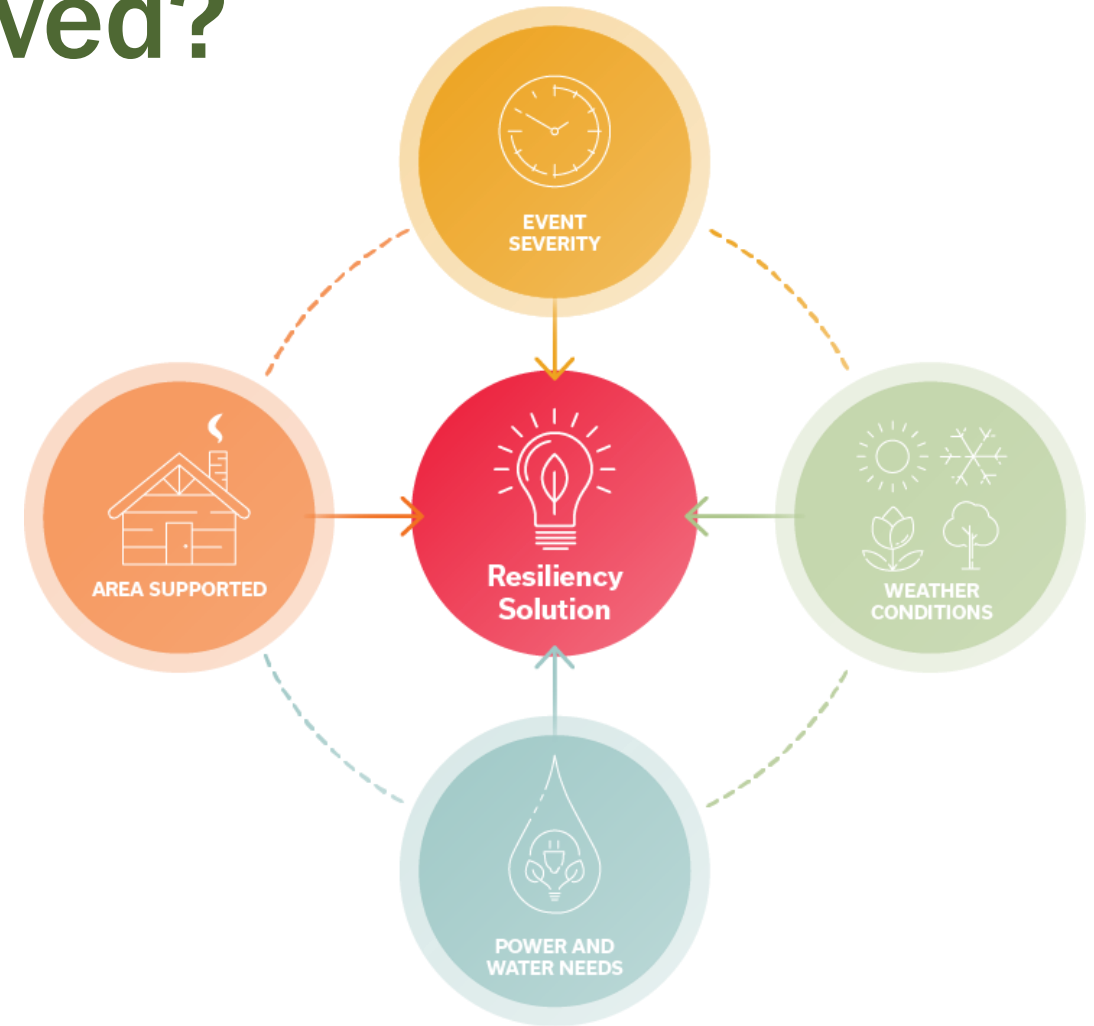


Characteristics of Resilience

Building on a base of resistance

How is Resiliency Achieved?

Resiliency is achieved through the integrated operation of multiple systems.



National Building Upgrade Prize

Four characteristics for resilience

1. Robustness
2. Resourcefulness
3. Rapid Recovery
4. Redundancy



Robustness

A characteristic of a building, system, or population being strong enough to withstand external challenge.

Flood waters in Naples, FL, during Hurricane Ian, 2022

PHOTO CREDIT @BOTHCOASTS ON X



Resourcefulness

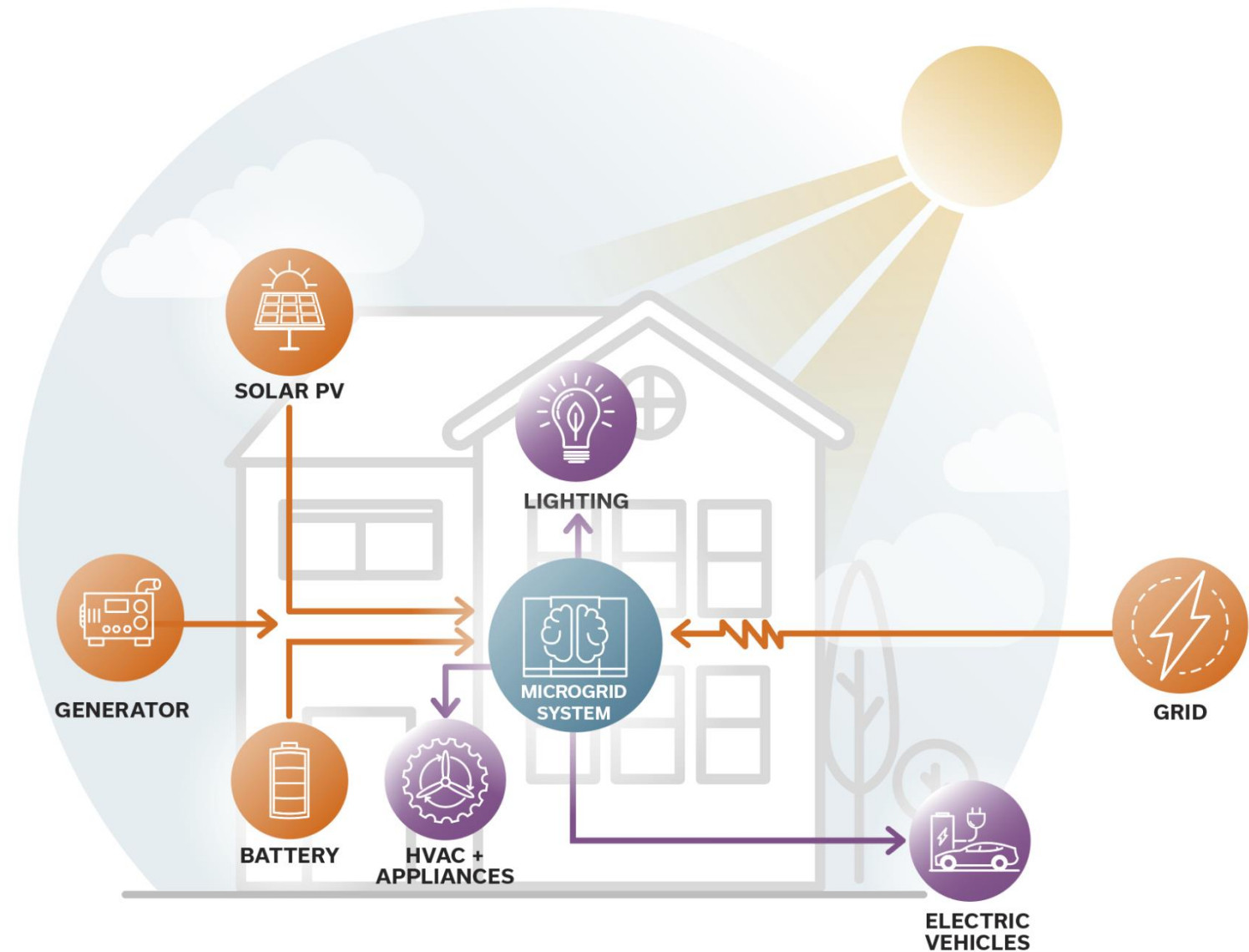
- Finding quick and clever ways to overcome external challenge(s).
- Skillfully preparing for, responding to, and managing a crisis or disruption as it happens

Image: Funding programs in New Orleans and other coastal towns historically impacted by storm surge events allow residents to raise their homes and become more resilient to future flooding events.



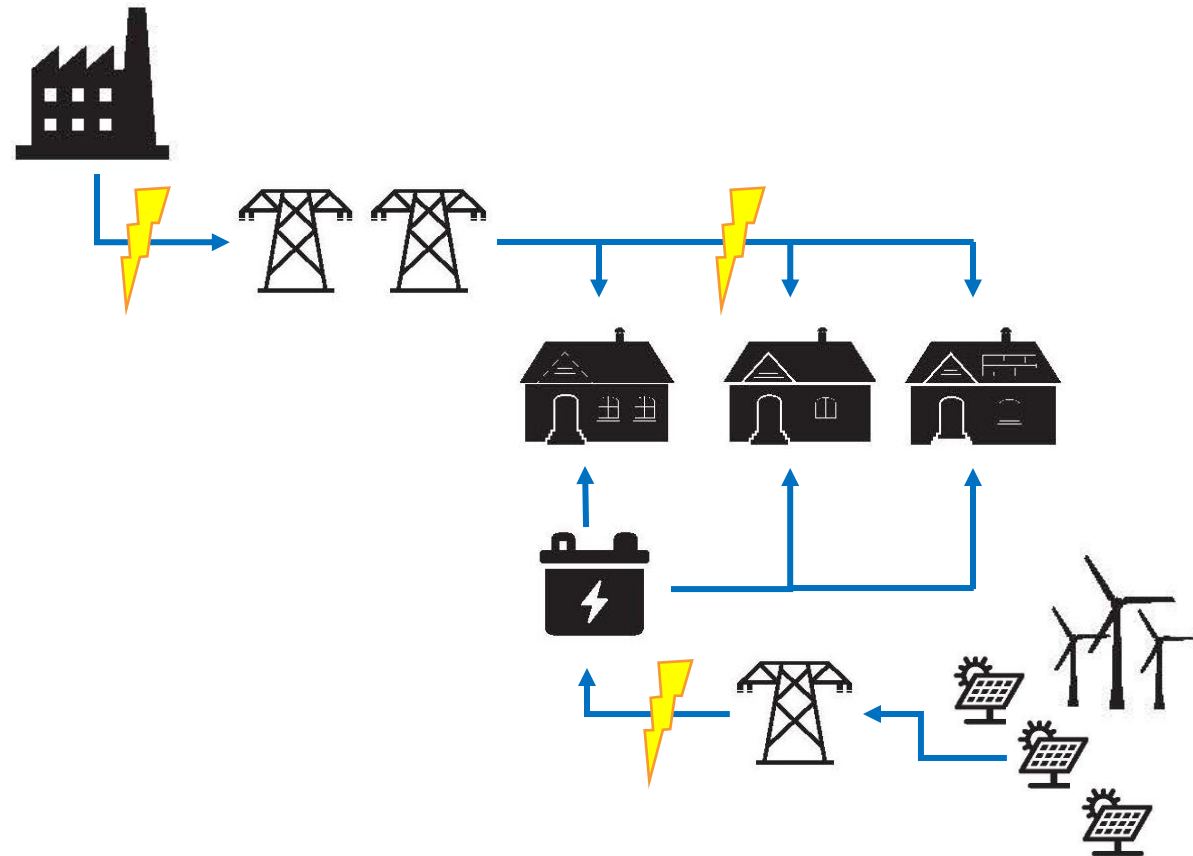
Resourcefulness

- Finding quick and clever ways to overcome external challenge(s).
- Skillfully preparing for, responding to, and managing a crisis or disruption as it happens



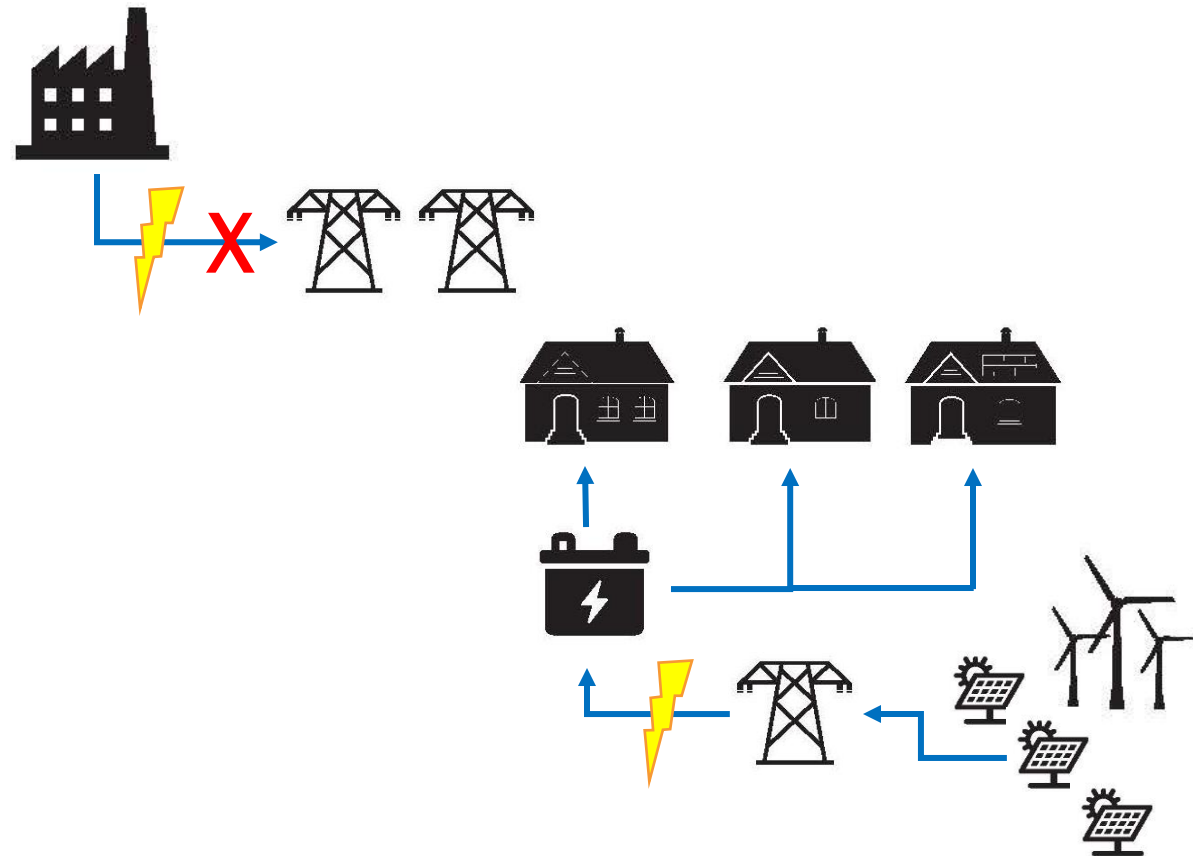
Rapid Recovery

- Resuming normal operations as quickly and efficiently as possible after experiencing an external challenge
- Distributed Energy Resources (DERs) with battery backups allow the homes to come back online without the need of the centralized plant.



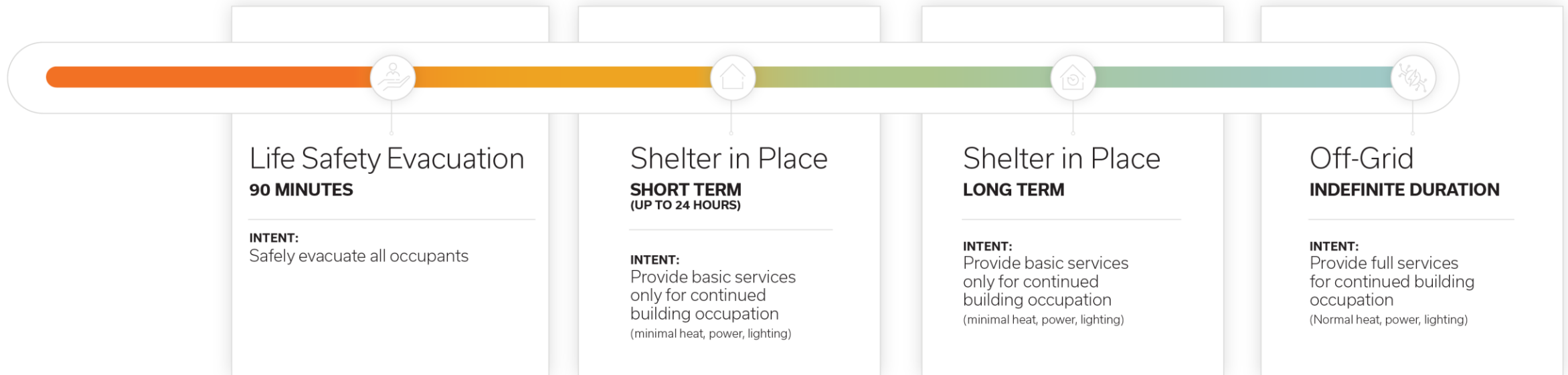
Rapid Recovery

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How is Recovery Defined?

RESILIENCY SPECTRUM



Redundancy

A characteristic of an organization or system, which allows for certain components to fail without the whole organization or system failing; backup resources support the originals in case of failure.

Daylighting
For continued learning
in an outage



Daylit classroom at Flora Arca Mata Elementary School, Stockton, CA
Photo: American Modular Systems

**Back-up generation
(or storage)**
For critical IT or refrigeration



Solar Classroom at Discovery Elementary, Arlington, VA
Photo: VMDO and CMTA

Operational Resiliency System Options



Passive



BESS



PV + BESS



Diesel Generator



**Natural Gas
Generator**

Mentimeter Time

Where on the path toward resilience is your school district organization?



<https://www.menti.com/alz5ik8rrjxi>



Taking Action

Get started

- Outline your goals
- Determine what is most important to protect
- Explore questions:
 - What past hazards have we experienced?
 - When are hazards most likely to occur (season, time of day)?
 - How are potential hazards changing?
 - How likely is each hazard?



Not all communities face the same climate risk

Climate Risk and Vulnerability Assessment

Climate Exposure
Impacts

Climate-related
Geographic Sensitivity

Climate-induced
Socioeconomic
Sensitivity

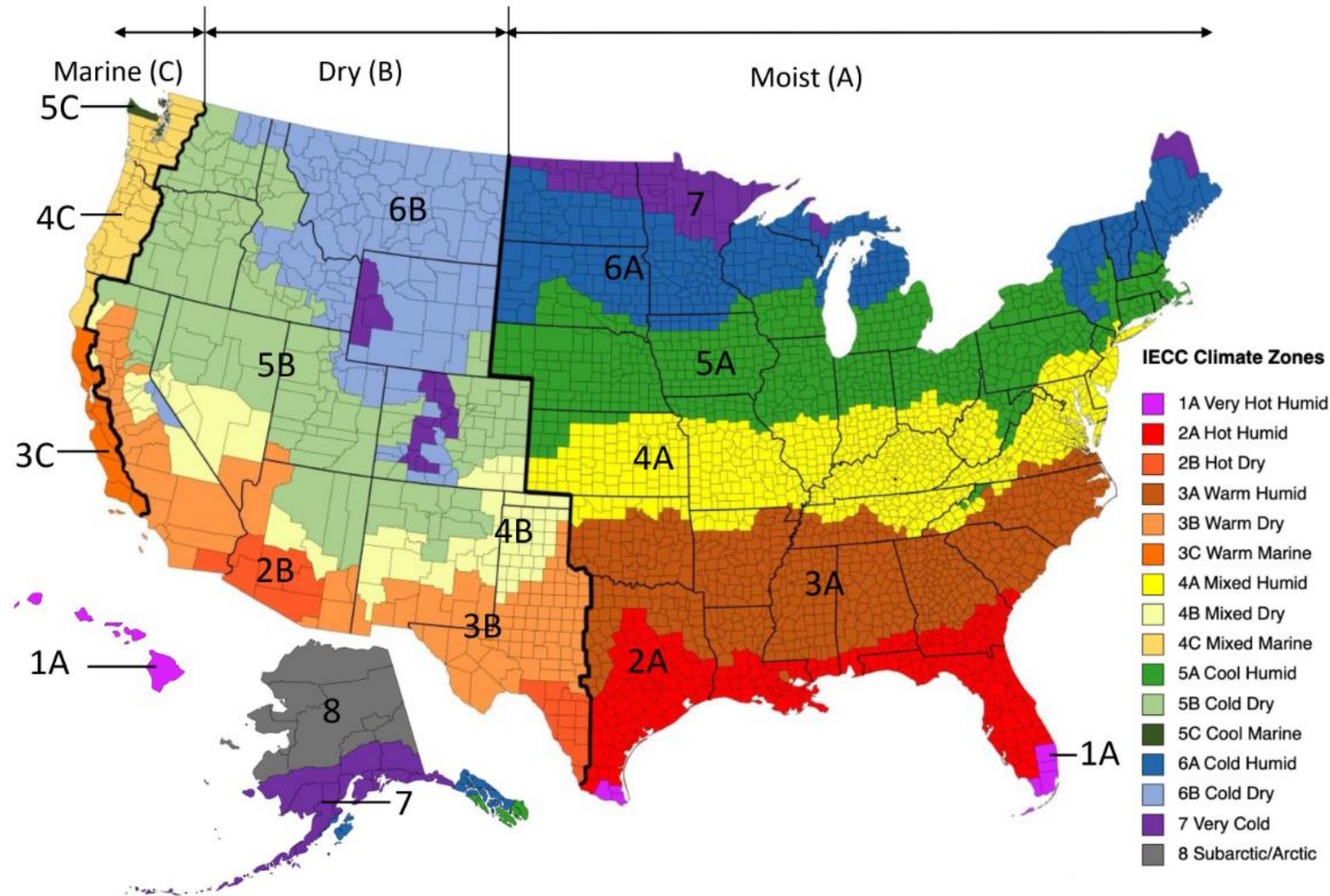
Understanding what impacts your community may experience is the first step to creating a resilience plan.

Key Resource: <https://toolkit.climate.gov/steps-to-resilience/assess-vulnerability-risk>

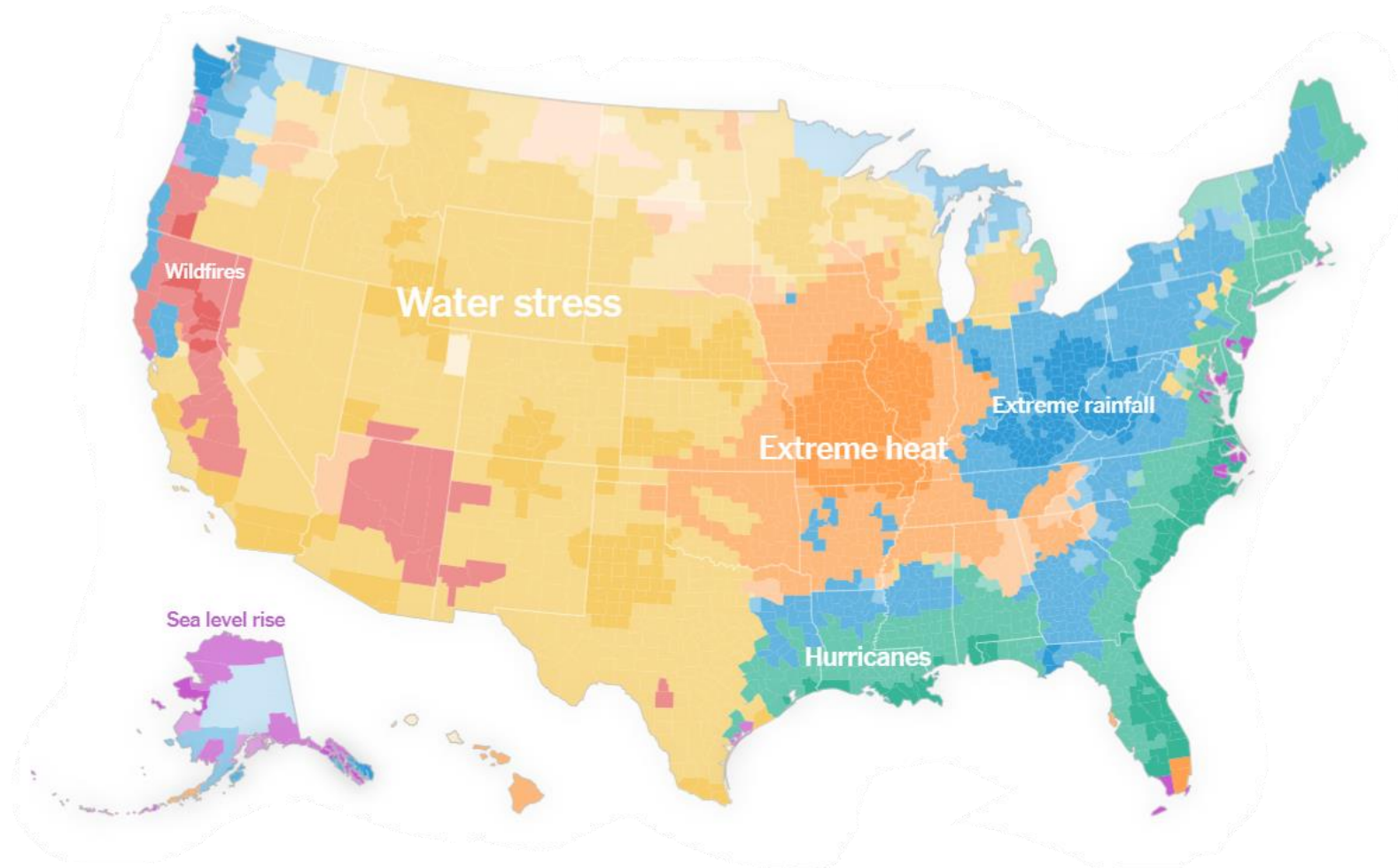
Every district has a different risk profile



Climate Zones are Baseline for Risk...



...as well as geographical location



Common Climate Hazards that Affect School Operation

- Flooding
- Heat
- Fire (localized)
- Fire Smoke (regional or from afar)
- Extreme cold/snow, ice storms
- Violent storms (e.g., hail, wind)

Why a fire scientist sees climate fingerprints on the suburban Boulder County fires

By Sam Brasch · Jan. 3, 2022, 5:12 pm

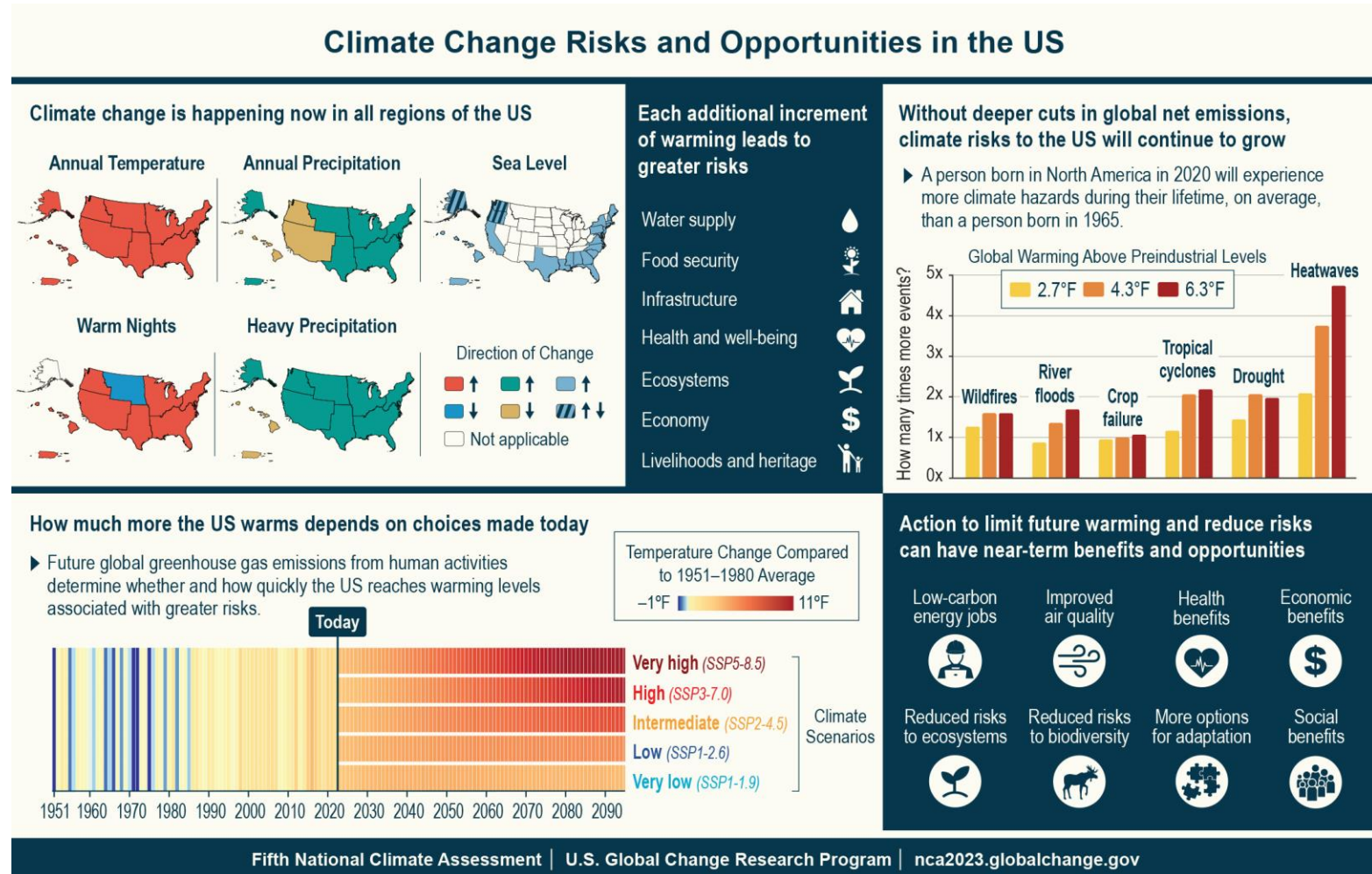


Hart Van Denburg/CPR News

Thursday's wildfires in Boulder County destroyed hundreds of homes and other structures.

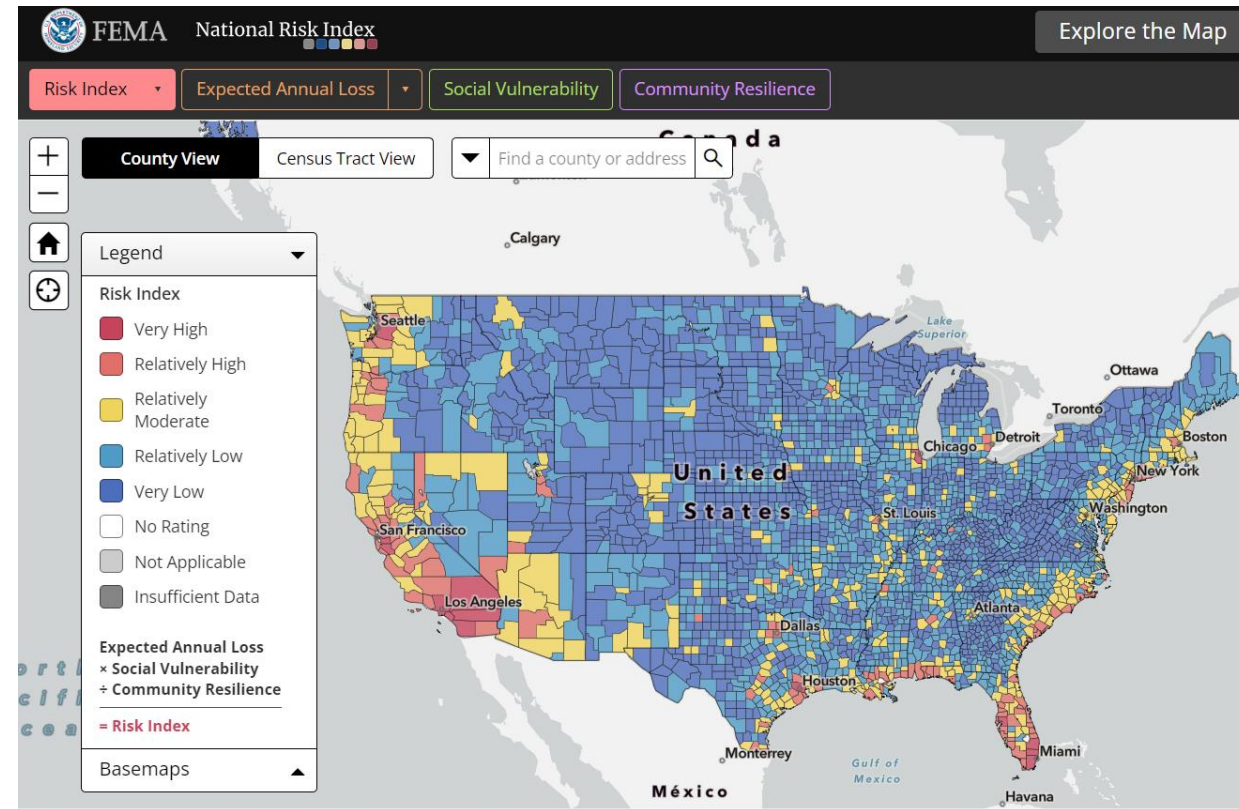
Assessing local and regional climate risk: key resources

- [Fifth National Climate Assessment \(NCA5\)](#)



Assessing local and regional climate risk: key resources

- U.S. Climate Resilience Toolkit: [Climate Mapping for Resilience and Adaptation](#)
- FEMA National Risk Index: <https://hazards.fema.gov/nri/map>
- CRiSTAL project planning tool: [Community-based Risk Screening Tool – Adaptation and Livelihoods](#)
- Local emergency management or community preparedness organizations



Putting hazards into context

- How long could operations be affected?
- What resources are most likely to be impacted?
 - Operational
 - Functional
 - Consumable
 - Structural
 - Occupational



What is the Resiliency Event*?



Unspecified Utility Outage

AVAILABLE SERVICES:



UNAVAILABLE SERVICES:



Severe Weather

(ex: Wind, Snow, or Extreme Hot/Cold)

AVAILABLE SERVICES:



UNAVAILABLE SERVICES:



OTHER CONSIDERATIONS:



Earthquake

UNAVAILABLE SERVICES:



OTHER CONSIDERATIONS:



Flooding

UNAVAILABLE SERVICES:



OTHER CONSIDERATIONS:



Wildfire

AVAILABLE SERVICES:



UNAVAILABLE SERVICES:



OTHER CONSIDERATIONS:



Pandemic

AVAILABLE SERVICES:



OTHER CONSIDERATIONS:



*This list is not intended to be comprehensive and will vary depending on region



WATER



NATURAL GAS



SEWER



TRANSPORTATION



ELECTRICITY



UNAVAILABLE SERVICES

Identify solutions and take action

- Brainstorm solutions
- Draw from regional plans and resources
- Consolidate actions into a cohesive plan
- Create a timeline and milestones to track progress
- Implement and monitor results
- Iterate as needed



Regional plans and resources

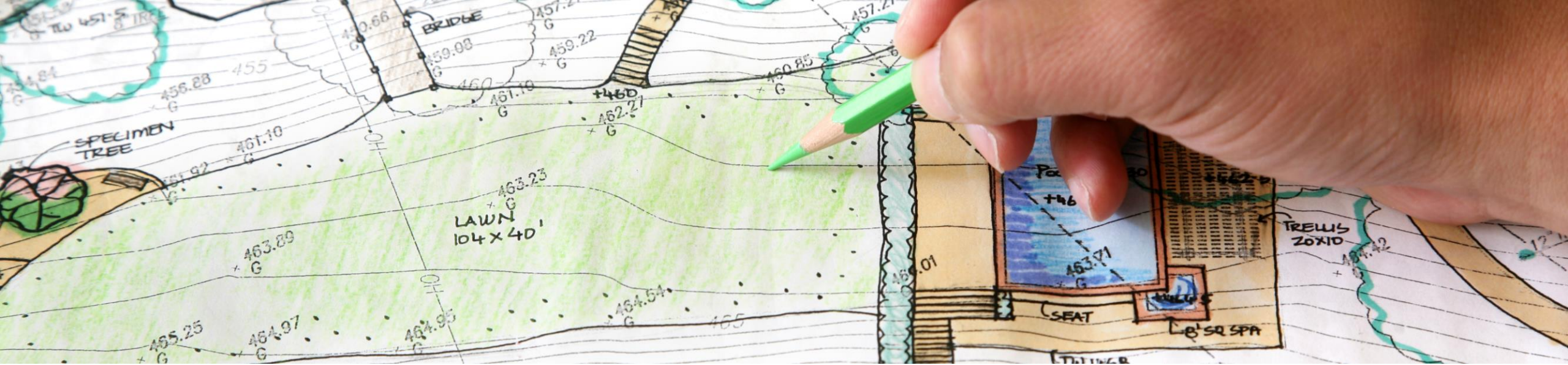
- Georgetown Climate Center's [State Adaptation Progress Tracker](#) allows users to view state and local adaptation plans



View State Progress

The following table is sortable by state and the number of adaptation goals in each state. Hover over a progress bar to see more information about a state's progress. Click on a state name to view a state's complete profile, including local resources.

STATE	ADAPTATION PLAN(S)	SECTOR/AGENCY PLANS	LOCAL/REGIONAL PLANS
ALABAMA	No state-led adaptation plan finalized.	-	✓
ALASKA	Alaska's Climate Change Strategy: Addressing Impacts in Alaska	✓	✓
ARIZONA	No state-led adaptation plan finalized.	✓	✓
ARKANSAS	No state-led adaptation plan finalized.	-	-
CALIFORNIA	Safeguarding California Plan: 2018 Update	✓	✓
	Safeguarding California: Reducing Climate Risk - 2014 Update to the 2009 CA Climate Adaptation Strategy		
	California 2009 Climate Adaptation Strategy		



Consolidate actions into a cohesive plan

- Triple Bottom Line of Resilience:
 - Campus
 - Community
 - Curriculum

Plan components

Campus

- Sustainable construction
- Green schoolyards
- Renewables and energy storage
- Electric school buses

Community

- Providing social-emotional support to staff and students
- Acting as a model for development and renewal of other community sites
- Connecting students with climate allies in the community

Curriculum

- Facilitate climate-oriented discussion
- Link to campus improvements
- Teacher education and professional development

Adapted from: <https://www.climate-readyschoolscoalition.org/ourwork/climate-resilient-schools-report>

Considerations for Operations

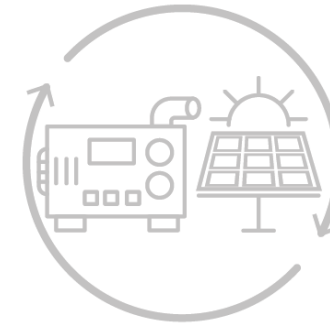


Clear Operating Modes

- Planned short duration events
- Unplanned long duration events



Simplified operation and controls strategies



Better utilization of generator with PV/BESS systems



Key resource: DOE Designing Resilient Buildings

- The Guide for Distributed Generation (DG) Resilience Planning
- Commercial Property Assessed Clean Energy (CPACE)
- CHP Technical Assistance Partnerships

Case Study – Orange County Public Schools

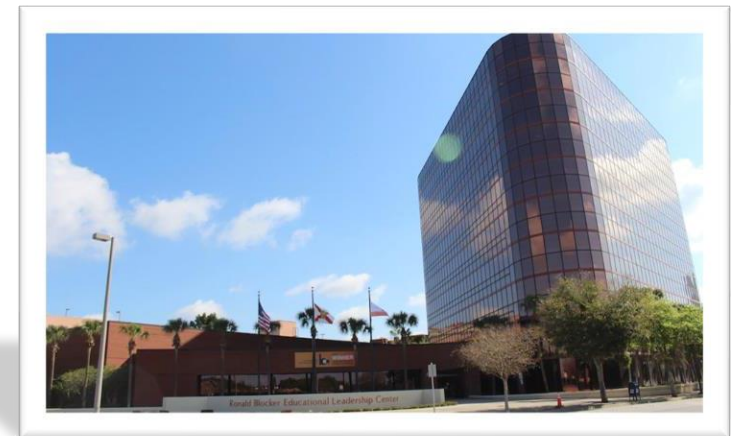
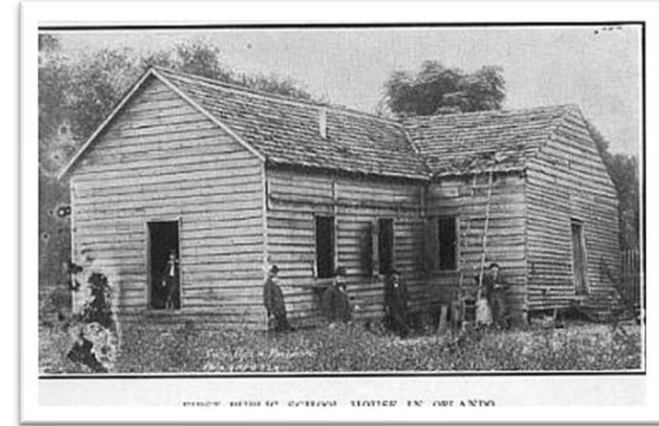


Building Resilience Through Education

Orange County Public Schools
Office of Emergency Management

About Orange County Public Schools (OCPS)

- Established in 1869
- 8th largest district in the nation
- 210 “traditional” schools
- Over 24,000 employees
- Over 208,000 students from 165 countries



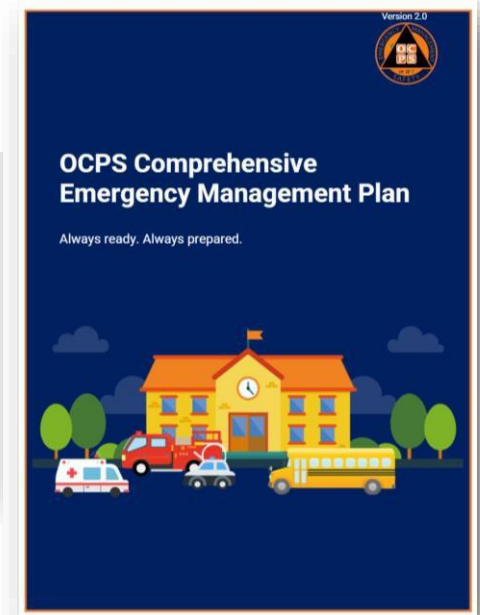
About the Office of Emergency Management



- OEM Vision Statement
“To foster preparedness and resilience across the OCPS community”
- Lead district business continuity, disaster recovery, and emergency management programs
- Coordinate the district's response to critical incidents and emergencies to include on-scene operational support

Planning: The Foundation for Resilience

- Build organizational resilience to adverse events, business disruptions and emergencies
- Develop and implement comprehensive emergency management and business continuity policies, plans, and procedures



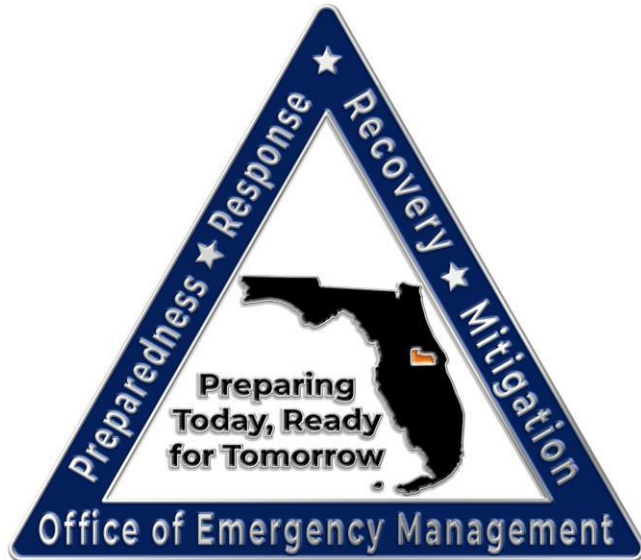
How Do You Keep Buses Safe During A Hurricane?



Park Them Really Close Together, Obviously



Preparedness: Making Resilience a Reality



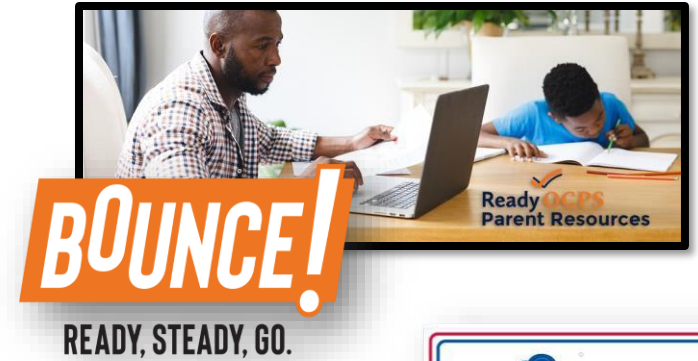
- Develop and standardized emergency preparedness training programs
- Plan, coordinate, and deliver emergency preparedness training
- Provide direct support to schools ensuring readiness and resilience

Teamwork Makes the Dream Work



Building a More Resilient Future

- Partnering with the National Weather Service to ensure the district is prepared for ever-changing extreme weather events
- Identifying emerging/evolving threats and developing new plans and procedures to mitigate the risks they pose
- Building personal resilience among employees, students, parents, and the greater OCPS community



Hurricane Ian Impacts Across Orange County

- No tornado damage reported
- Average of 40 to 60 MPH wind gusts
- 6.5" to 17"+ of rainfall



Flooding at Riverdale Elementary School



Flooding at Riverdale Elementary School



How Do You Relocate an Entire School?




Making It Work



 **ocpsnews** @OCPSnews · Oct 3, 2022

The cleanup is underway at [@RiverdaleOCPS](#), which took on up to a foot of water during [#HurricaneIan](#). Superintendent [@maria_f_vazquez](#) visited the school to check on the progress. [@OCPSFacilities](#) [@OCPSGreen](#) [@RiverdaleOCPS](#) [@OcpsEast](#) [@EastRiverHS](#) [@ucfalum](#)



5 14 47



Two Rivers, One Family



Putting Riverdale Back Together Again



And It Only Took ...

- 40,000 square feet of drywall
- 350 gallons of paint
- 70,000 square feet of new flooring
- 68,000 square feet of new ceiling tile
- 60,000 hours of labor
- 10 months
- \$8,000,000

Epilogue



Thank you for joining us today!





Resiliency

February 13, 2024

Environmental Compliance & Sustainability

- District Incident Management Team (DIMT)
- Hurricane Preparedness
- Emerging Climate Risks
 - Extreme Heat



Response Timeline

- 72 Hours Out
 - Provide utilities with final list of OCPS critical sites (shelters, feeding, etc.)
 - Upon notification of districtwide closures, change event schedules to reduce HVAC usage
 - Follow up with Solid Waste and Recycling providers for timeline of when pick-ups may be stopped due to winds.
- 24 Hours Out
 - Assign Energy Advisor to Orange County EOC for power outage assessment and report-outs

Response Timeline

- Impact
- 24 Hours Post Impact
 - Reporting to Emergency Coordination Center (ECC)
 - Follow up with Solid Waste and Recycling Providers for return to service
 - Communicate with FNS on schools that have power failures and require food disposal for additional solid waste services – Notify the provider
 - Receiving report outs from Orange County EOC
 - Relaying initial inspections to Facilities Maintenance/Environmental Compliance
- 48 Hours Post Impact
 - Continues until schools reopened

Emerging Climate Risks

- Energy Management Team
 - Balance between energy conservation and comfort parameters
- Management Directive B10
 - Energy conservation parameters for start times
 - 1 hour before the bell schedule
 - Unoccupied mode 1-2 hrs after the bell schedule
 - District temperature set points for occupied and unoccupied times
 - 74° - 77° F Occupied
 - 85° F Unoccupied
- 2023-2024 School Year
 - First Day of School – August 10th



WEATHER

Jonathan Kegges, Meteorologist

Published: August 14, 2023 at 1:40 PM

Updated: August 14, 2023 at 1:59 PM

Tags: Record, Orlando, Heat, Weather,
Weather News

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The Orlando area just saw its hottest week on record

Daytona Beach, Sanford also saw hottest week



Sun (Pixabay)

- 8/10/23 - 98 °F
- 8/12/23 – 100 °F

- 8/11/23 – 99 °F
- 8/13/23 - 96 °F

Emerging Climate Risks

Standard of Practice

- Energy conservation parameters for start times
 - 1 hour before the bell schedule
- Custodial Staff Schedule
 - Evening hours until 10:00 pm
- Mechanical System Designs
 - 95 °F max load

Climate Adjustments

- Start Times
 - 2 hours before the bell schedule
- Custodial Schedules
 - Maintain district standards – extend occupied mode
- Future planning
 - No longer about bell schedules or hours of operation
 - Dependent on temperatures and equipment capabilities

Our Promise. Your Support. Their Success.

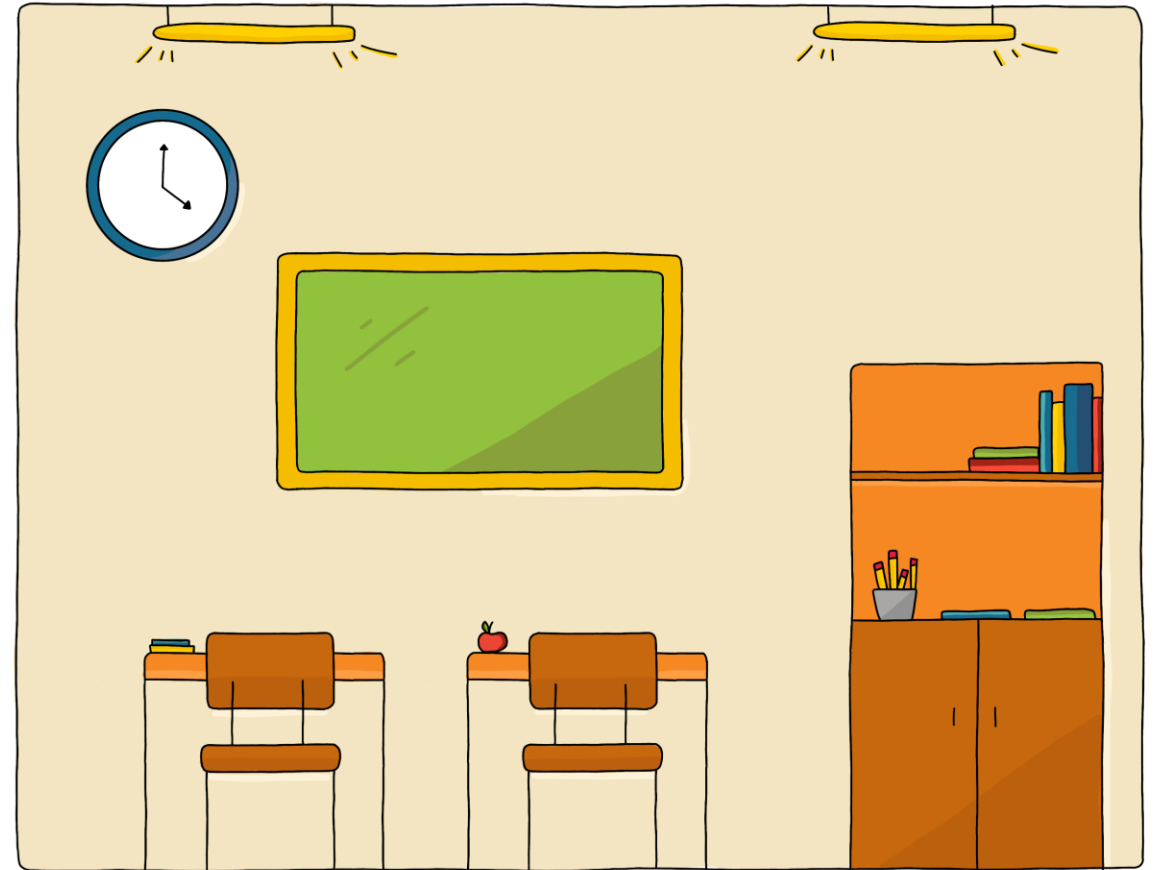
Our Promise. Your Support. Their Success.

Our Promise. Your Support. Their Success.



Next Up in CLASS...

- **February 20th 1-3 PM ET:** Making Resiliency Reality Through Electrification, Renewable Energy, and Electric School Buses
- **February 27th 1-2 PM ET:** Resiliency Cohort
- **May 17th:** Phase 2 Submission Deadline



Discussion

Putting together a district-level plan

1. What topics covered this week changed or was additive to your project plans?
2. What ways do you see your local climate directly impacting your planning efforts?
3. What aspects of resilience to foresee as being the most challenging?
4. What topics covered this week do you want to/need to learn more about?

Thank you!

