



# Federal Climate Resiliency Actions & Tools

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November 2016

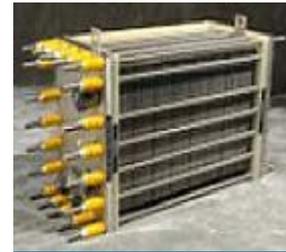
# About NREL

**Dedicated to Energy Efficiency and Renewable Energy**



# About NREL

## Broad Range of Clean Energy Solutions



### Energy Efficiency

Vehicle Technologies  
Building Technologies

### Renewable Resources

Wind and Water  
Solar  
Biomass  
Hydrogen  
Geothermal

### Systems Integration

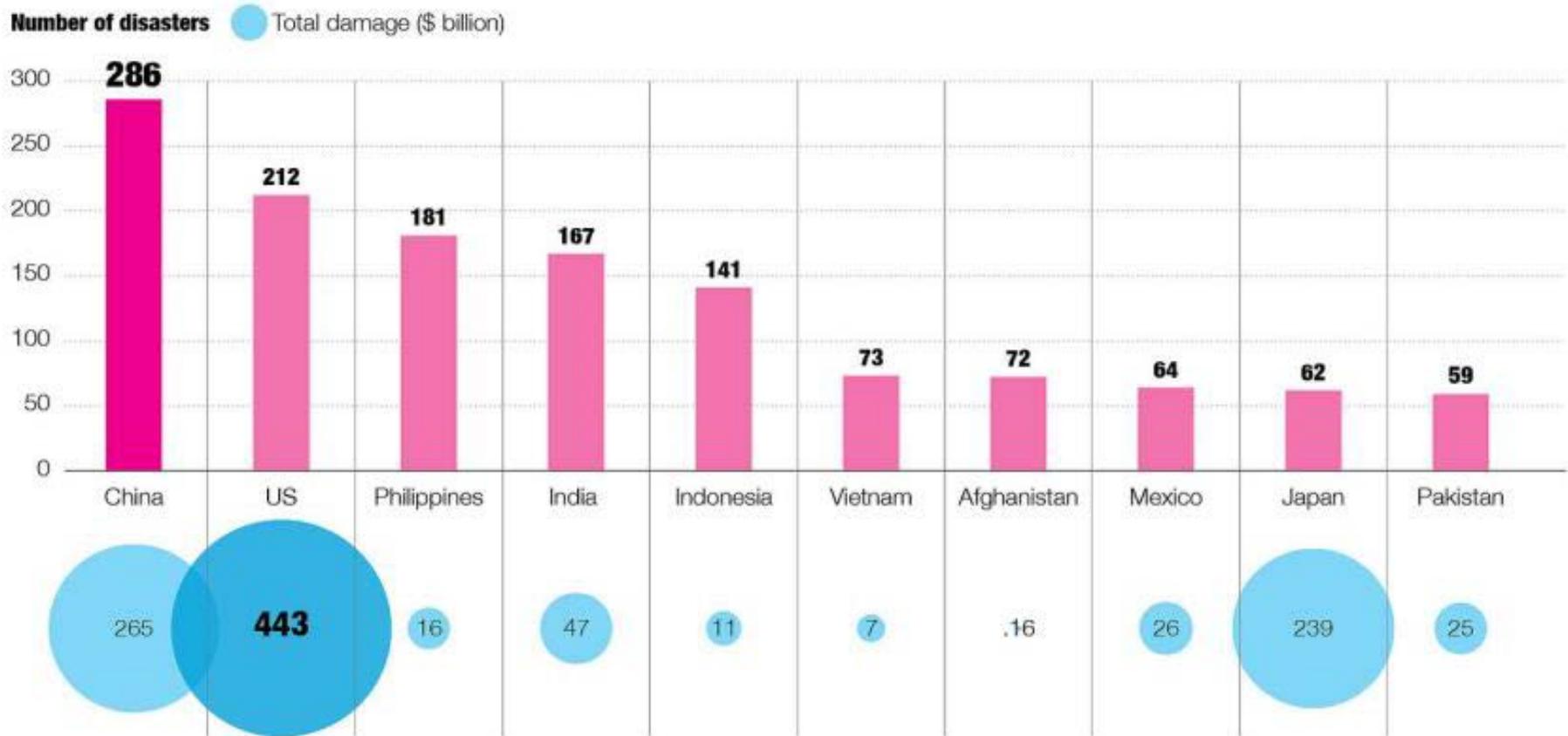
Grid Infrastructure  
– SmartGrid and RE Grid  
Battery and  
Thermal Storage

International, Tribal, Federal Agencies, States, Local Communities, Private Sector

## Foundational Science

# Context: Growing Impact of Disasters

## Top 10 countries with most disasters, 2005-2014



China has the most disasters from 2005-2014 but the US has incurred the most damage, and while Japan is far behind in number of disasters, its economic loss is almost as big as that of China

# Context: Growing Impact of Disasters



## Costs of Natural Disasters in the State of Colorado from 2012 – 2015

**\$5 billion**...housing, infrastructure, economic and watershed impact from floods and wildfires

**\$1.7 billion**...federal, state, local, private resources to support flood recovery

**\$1.2 billion**...wildfire insurance claims paid in 2012 and 2013

**\$66.7 million**...flood insurance claims paid after the 2013 floods

**\$29.2 million**...flood disaster recovery loans to small businesses through Small Business Administration

**3,000**...homes destroyed by floods and wildfires

**100+**...property acquisitions for flood and landslide mitigation since 2013

# White House CEQ Preparedness Pilots

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### The White House

Office of the Press Secretary

For Immediate Release

July 16, 2014

## FACT SHEET: Taking Action to Support State, Local, and Tribal Leaders as They Prepare Communities for the Impacts of Climate Change

President Obama is focused every day on building on the progress America's economy is making by creating jobs and expanding opportunity for all hardworking Americans. As part of that effort, the President has put forward a comprehensive plan to invest in America's infrastructure in order to create jobs, provide certainty to states and communities, support American businesses, and grow our economy. Investing in infrastructure has never been more important. In addition to the **clear economic benefits** of building a world-class infrastructure system, the **third National Climate Assessment** released earlier this year confirms that the impacts of climate change are already taking a toll on communities. To support communities in need of a more resilient infrastructure that can withstand impacts like more extreme weather and increased flooding, President Obama is responding to guidance from governors, mayors, county and tribal officials who are proven leaders in helping their communities prepare for climate impacts.

# Resilience Planning Process

Identify stakeholders

Define resilience

Identify who has data

Collect data

Identify critical infrastructure

Create maps: many, many maps

Establish a baseline

Identify threats & vulnerabilities

Identify technical solutions

Set goals

Prioritize actions

Identify funding

Implement

Measure and verify

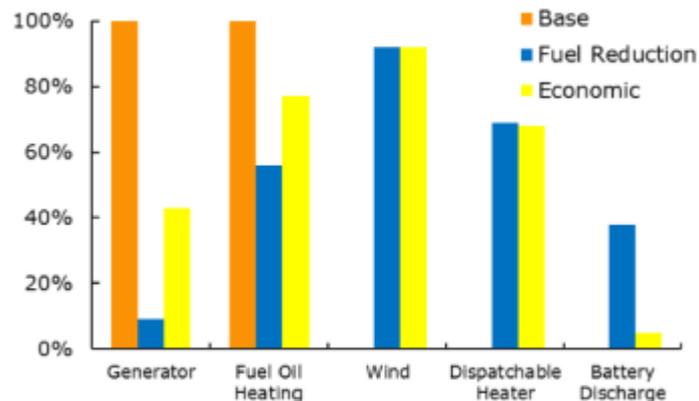


Image Source: **NIST's Community Resilience Guide**

# What is resilience?

A system's ability to anticipate, prepare for, and adapt to long-term changing conditions and withstand, respond to, and recover rapidly from disruptions through **sustainable, adaptable, and holistic planning and technical solutions.**

- *Resiliency Roadmap, NREL*



Cost-Optimal Pathways to 75% Fuel Reduction in Remote Alaskan Villages  
Lead Author: Travis Simpkins



Image Source: ISET International

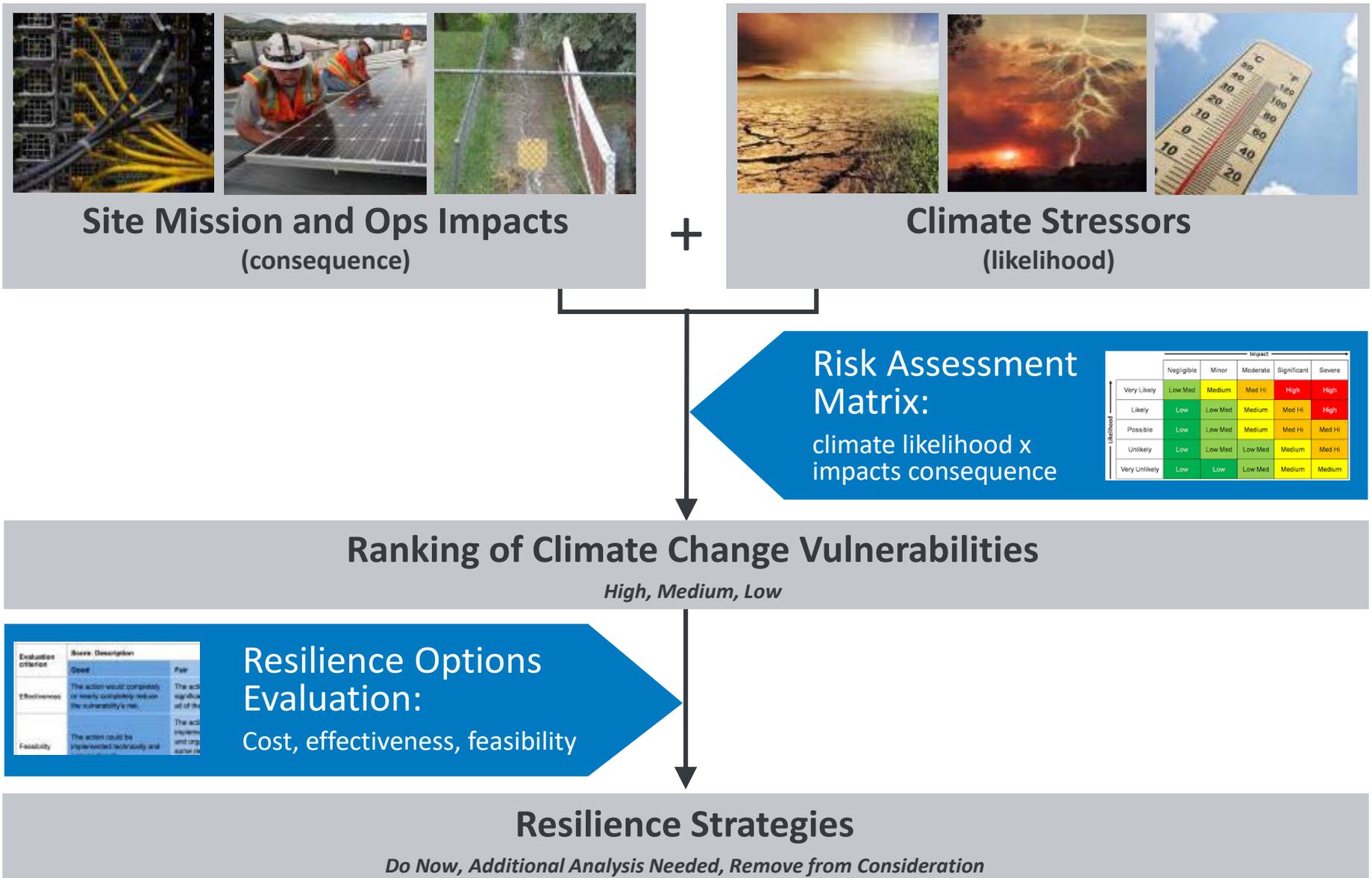
# Stakeholder Driven and Participatory Process



The typical planning process has been modified to include cross-collaboration:

- Creating working groups
- Understanding conditions
- Identifying shared interdependencies and vulnerabilities
- Developing a strategy and prioritizing action
- Adopting a plan, identifying funding and implementing
- Assessing impact and modifying plan, as needed

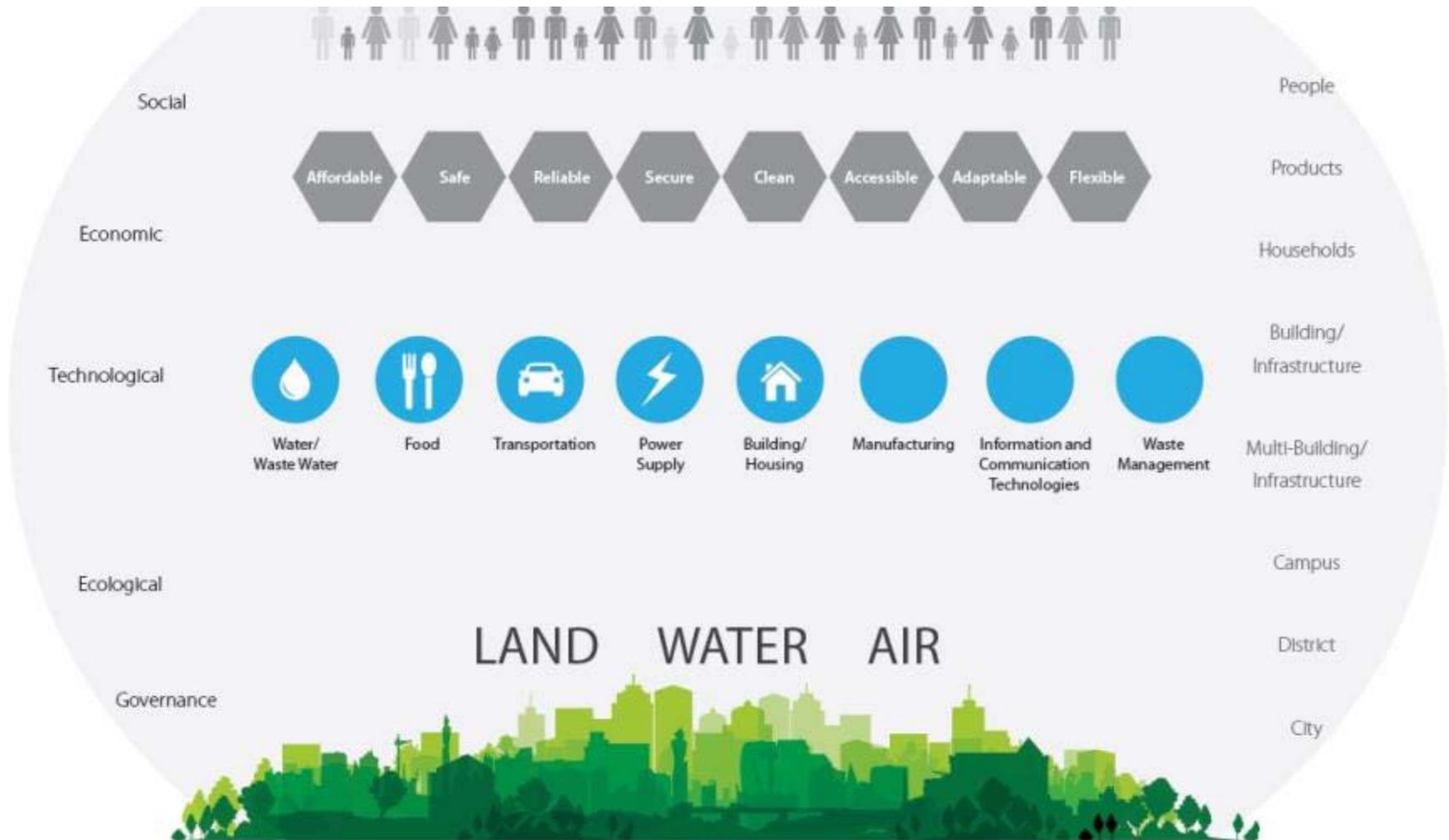
# Climate Change Risk Assessment Process



# Stakeholder Driven and Participatory Process

- **Steering Committee**
- **Workgroups for Stakeholder Input and Engagement from the Tribal Community**
- **Climate Science and Resilience Experts**

# Identify Vulnerabilities and Interdependencies



# Examples of Climate Related Vulnerabilities



Single Electricity Supply



Transportation Access and Drainage  
(physical landscape and infrastructure)



Proximity to Potential Disasters



Single Water Supply

# The Resiliency Roadmap

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Office of Energy Efficiency & Renewable Energy

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### Climate Change Resilience Roadmap

A Collaborative Approach to Multi-Jurisdictional Planning



To mitigate the hazards and risks associated with climate change and environmental disasters, the Climate Change Resilience Roadmap offers comprehensive guidance for federal, state, and local entities to effectively convene at the regional level for holistic and sustainable planning.

This type of multi-jurisdictional approach requires major cooperation across boundaries, considerable reliance on partnerships and multi-agency collaborations, and significant utilization of interdisciplinary teams.

Step-by-Step Process

#### WHAT IS RESILIENCE?

The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions through sustainable, adaptable, and holistic planning and technical solutions.

## Climate Change Resilience Roadmap

New interactive tool walks government entities through a collaborative disaster planning process.

[READ MORE](#) >



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Federal mandates

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[Overview of options](#)



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The U.S. Department of Energy's Federal Energy Management Program works with key individuals to accomplish energy change within organizations by bringing expertise from all levels of project and policy implementation to enable federal agencies to meet energy-related goals and provide energy leadership to the country.

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OCTOBER 5, 2016

[DOE Announces \\$30 Million Investment in Hydrogen and Fuel Cells as Industry Continues](#)

# Climate Change Resilience Roadmap

A Collaborative Approach to Multi-Jurisdictional Planning



To mitigate the hazards and risks associated with climate change and environmental disasters, the Climate Change Resilience Roadmap offers comprehensive guidance for federal, state, and local entities to effectively convene at the regional level for holistic and sustainable planning.

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## Step-by-Step Process

To constructively lead intergovernmental planning efforts with tangible outputs, follow these steps in order:

- 1 Intergovernmental Preparation and Coordination
- 2 Planning and Strategy Development
- 3 Plan Adoption, Implementation, and Evaluation

### WHAT IS RESILIENCE?

The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions through sustainable, adaptable, and holistic planning and technical solutions.

The National Renewable Energy Laboratory developed this application with support from the U.S. Department of Energy's Federal Energy Management Program. For information about working with NREL on resilience planning, contact Eliza Hotchkiss.



## 1 Intergovernmental Preparation and Coordination

Intergovernmental coordination and preparation are critical first steps to resilience planning with multiple jurisdictions. Planning for various hazards across multiple management entities or system operators entails a higher level of communication and collaboration to be coordinated and effective at the regional scale.

### Convene

#### Establish Steering Committee

Define Geographic Region

Identify Stakeholders

### Understand

Define Resilience

Identify Critical Infrastructure

Ascertain Hazards & Threats

## Convene

Multi-jurisdictional planning requires convening stakeholders who represent a diverse range of perspectives on an issue. While convening is particularly important it places significant demands on people's time and resources. Therefore, prepare ahead as much as possible and make informed decisions about why, when, and how to bring a group together.

### Establish Steering Committee

Prior to setting outcomes and goals, establish a planning steering committee to:



- Convene
  - Establish Steering Committee
  - Define Geographic Region
  - Identify Stakeholders
- Understand**
  - Define Resilience
  - Identify Critical Infrastructure
  - Ascertain Hazards & Threats
- Prepare
  - Create Workplan
  - Complete Energy Profile
  - Establish Resilience Baseline
- Resources

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# Understand

For the planning process, it is most effective when jurisdictions understand existing conditions. Without it, the planning process stalls due to a lack of actionable data.

Prior to collaboration, agencies and governments should gather and document data related to:

- Emergency plans
- Existing community plans
- Ordinances and codes
- Maps and data on geographic location of critical infrastructure systems or facilities
- Community utility needs (e.g., energy, water and fuel use and generation)
- Completed climate preparedness evaluation for the community, if in existence.

**DEFINING RESILIENCE EXERCISE**

Use this worksheet to record resilience definitions and current resilience projects.

[DOWNLOAD](#) 

## Define Resilience

Resilience is defined differently in various sectors, as well as stakeholder groups. A clear definition of resilience and understanding of what it means to all stakeholders involved in the planning process will



- Convene
  - Establish Steering Committee
  - Define Geographic Region
  - Identify Stakeholders

- Understand
  - Define Resilience
  - Identify Critical Infrastructure
  - Ascertain Hazards & Threats

- Prepare
  - Create Workplan
  - Complete Energy Profile
  - Establish Resilience Baseline**

Resources

completed an evaluation for their own climate resilience.

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## Resources

### Successful Convening

[Gather. The Art & Science of Effective Convening](#)

### Resilience Baseline

[Climate Smart Resilience Planning — Planning Evaluation Tool](#)

### Community Climate and Resilience Planning for Critical Infrastructure

[Presidential Policy Directive 21: Critical Infrastructure Security and Resilience](#)

[Guide to Community Energy Strategic Planning](#)

#### U.S. ENVIRONMENTAL PROTECTION AGENCY

- [Being Prepared for Climate Change — A Workbook for Developing Risk-Based Adaptation](#)
- [Climate Ready Water Utilities](#)

#### NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

- [Digital Coast — Coastal Resilience 2.0](#)
- [Digital Coast — Hazards U.S. Multi Hazard](#)

# Climate Change Resilience Roadmap

A Collaborative Approach to Multi-Jurisdictional Planning



## 2 Planning and Strategy Development

- Develop
- Coordinate Workshops
  - Analyze Interdependencies
  - Identify Vulnerabilities
  - Set Performance Goals
  - Determine Strategy

- Prioritize
- Reach Consensus
  - Evaluate Achievability
  - Consider Performance Goals

For climate change resilience, the process for intergovernmental and multi-jurisdictional planning and strategy development involves a series of workshop activities. The workshop format creates a forum for the in-person dialogue necessary to move the regional planning effort through development of a resilience roadmap.

**SUCCESSFUL WORKSHOP OUTCOMES**

- An established interjurisdictional understanding of shared infrastructure interdependencies, shared vulnerabilities, and operational performance goals.
- A developed set of resilience strategies that is responsive to shared vulnerabilities, address interjurisdictional and regional interdependencies, and further progress toward achieving the performance goals of multiple stakeholders.



Develop

Coordinate Workshops

**Analyze Interdependencies**

Identify Vulnerabilities

Set Performance Goals

Determine Strategy

Prioritize

Reach Consensus

Evaluate Achievability

Consider Performance Goals

Commit

Gain Buy-In

Obtain Letters of Support

Resources

For intergovernmental resilience planning efforts, untangle the complex nature of critical infrastructure systems. In doing so, stakeholders are able to conceptualize how impacts to critical infrastructure systems that are 'upstream' have a direct effect on the viability and performance of their own abilities to maintain performance and operations.

**WORKSHOP ACTIVITY #1**

Guide discussions related to analyzing interdependencies.

[DOWNLOAD](#)

**Identify Vulnerabilities**

Exploring vulnerabilities among multiple stakeholders is augmented by the work completed by jurisdictions and governmental entities through the baselining exercises. The outcome from those activities provides a foundational for understanding each jurisdiction's vulnerabilities. These could include the system shocks, stressors, or hazards such as natural hazards, technological hazards, threats or human-caused incidents. These are detailed further as potential vulnerabilities:

- Natural hazards. Resulting from acts of nature, severe weather, changes in climate (e.g., severe winter storm, floods, earthquakes, hurricanes, solar flares, etc.).
- Technological hazards. Resulting from accidents or the failures of systems and structures (e.g., bridge collapse, grid outage).
- Threats or human-caused incidents. Resulting from the threats or intentional actions of an adversary (e.g., cyber acts of terror).

# Downloadable Exercises

## Climate Change Resilience Roadmap

*A Collaborative Approach to Multi-Jurisdictional Planning*

### Activity 1: Analysis of Interdependencies

#### Discussion Questions:

- Where do critical infrastructure systems cross jurisdictional boundaries?
- How have stakeholder jurisdictions/governments planned for system redundancy and flexibility, system failure or outage?
- What governmental operations are reliant on infrastructure systems owned and operated by another entity?
- What is the relationship of infrastructure systems provider/buyer between each participating jurisdiction and governmental entity?
- What are shared assets and capabilities?

#### Discussion Tool:

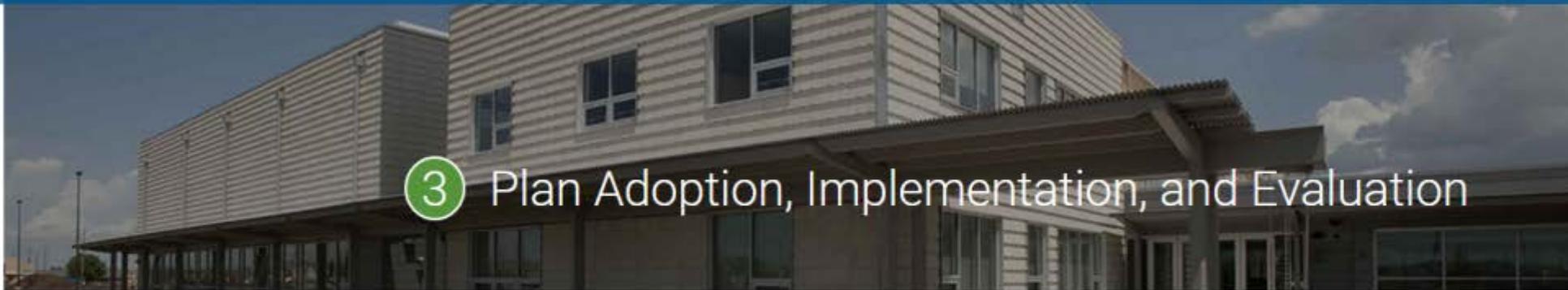
The following worksheet is available for facilitators to frame and record the conversation.

	Activity 1: Analysis of Shared Interdependencies			
Energy 				
Water 				
Wastewater 				
Transportation & Roads 				
Communications & IT 				
	Federal Facility Operations 	Municipal Operations 	County Operations Tribal Operations 	State Operations 

Activity 1: Sample worksheet for facilitators (printable, full-size version on back)

# Climate Change Resilience Roadmap

A Collaborative Approach to Multi-Jurisdictional Planning



## 3 Plan Adoption, Implementation, and Evaluation

### Implement

- Create Action Plan
- Check Progress
- Institutionalize Plan

### Fund

- Public-Private Partnerships
- Bond Financing
- Financial Institutions
- Grant Funding

After establishing the climate change resilience plan, the next steps are implementing it, measuring progress, and adjusting it to ensure success.

## Implement

To varying degrees, outputs of this regional collaboration will be integrated at the jurisdictional level. Examples of resilience plan and/or strategy adoption and institutionalization include:

- Strategy and project integrated in multi-stakeholder; cross jurisdictional non-binding plan for city and agency adoption.
- Integration into local planning efforts (zoning/land use; comprehensive plan; climate action/adaptation plan; energy plan; sustainability plan; and similar for guiding federal

# Thank you!

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<http://energy.gov/eere/femp/federal-energy-management-program>

[http://www.nrel.gov/tech\\_deployment/resilience-planning-roadmap/](http://www.nrel.gov/tech_deployment/resilience-planning-roadmap/)

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