

Guide to Resilience Solutions

Introduction

Power sector resilience solutions often include some combination of resource or technological diversity, redundancy, decentralization, transparency, collaboration, flexibility, and foresight considerations¹. A mix of solutions should be considered because no single intervention will address all potential vulnerabilities. Additionally, every power system is unique, and any solutions will have to be tailored to fit with specific power system characteristics.

Solutions may fall into different categories of power sector interventions:

- **Long-term planning** in the form of comprehensive community plans, threat mitigation plans, watershed plans, and others.
- **Regulations and policies**, such as zoning, subdivision codes, floodplain regulations, and building codes.
- **Programs** like capacity building, land acquisition, and low-income housing.
- **Capital projects**, such as capital improvement, decentralized backup energy generation for critical facilities, passive stormwater management system designs, etc.

Key Term

Power sector resilience—the ability of the power sector to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions through adaptable and holistic planning and technical solutions.¹

Renewable energy solutions, especially as distributed generation sources, can play a valuable role in power sector resilience through redundancy and energy diversification.

Planning for resilience solutions should always be part of an integrated and existing planning process, include stakeholder engagement (including nonutility entities), be linked to implementation and financing mechanisms, and should be periodically revisited. This process should involve a prioritization of resilience actions that can be based on such factors as priority threats, cost, difficulty, or number and priority of enhanced systems. Some examples of power system resilience solutions are shown in Table 6.

The first two activities in this section provide an approach to identify and prioritize technical solutions to support power sector resilience. The exercises are high level and can be tailored to, and elaborated on, to thoroughly assess possible solutions. For more detailed background and examples of resilience solutions, refer to the slides at the end of this section.

Power sector resilience solutions will fit within a broader planning process. Figure 4 provides one such example and can be tailored to meet the needs of individual countries and jurisdictions. The *Activity: Developing A Resilience Planning Process* provides a high-level activity that can inform a more thorough power sector resilience planning process.

Table 6: Examples of Resilience Solutions and their Impact on Power System Resilience

Example Resilience Solution	Impact on Power System Resilience
Spatial and Generation Diversification	Reduces the vulnerability of the energy supply system and the probability of an event to damage the larger system of critical locations, which increases system resilience.
Microgrids	A microgrid capable of islanding may ensure customers have access to power during long-term power outages that impact central grid systems occurring after major events. Microgrids can also be used in demand-response programs to reduce peak loads.
Redundancy	Including additional resources beyond those that are required for daily operations increases a power system's resilience because these resources can be relied on during other infrastructure failures or fuel shortages.
Policy	An enabling policy landscape helps to accelerate the adoption of power system resilience solutions. Restrictive policies can stifle resilience efforts.
Others: Supply chain assurance, critical load panels in emergency facilities, passive survivability, load shedding, energy storage.	

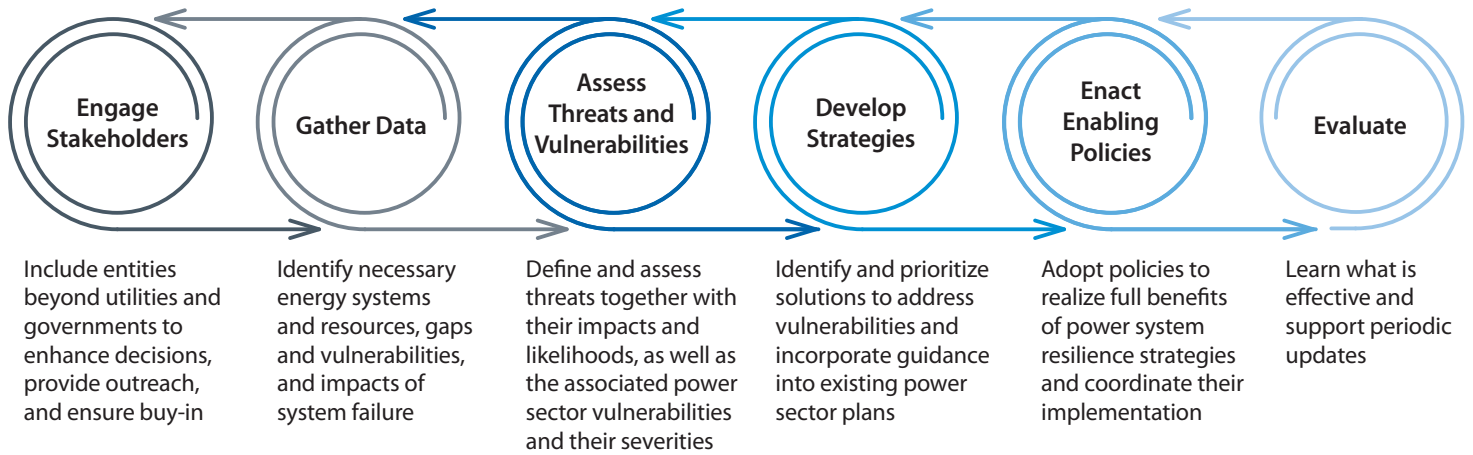


Figure 4. Planning for power sector resilience