This material is based upon work supported by the U.S. Department of Energy's Grid Deployment Office under the Grid Resilience State and Tribal Formula Grants program, authorized by Section 40101(d) of the Infrastructure Investment and Jobs Act (IIJA), Public Law 117-58, under contract number 89303024CGD000002. The views expressed herein do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

# MONITORING AND CONTROL

## RESILIENCE TECHNOLOGY PROFILE

IFA ILLINOIS FINANCE AUTHORITY Illinois Climate Bank

See the GDO Monitoring and Control Investment Guide for more details.

## OVERVIEW

Monitoring and control equipment encompasses both hardware and software components designed to enhance system visibility and operational control. These technologies enable real-time data collection, analysis, and decision-making to improve the reliability, efficiency, and responsiveness of electric utility operations.[1]

The integration of two-way communication, automated control mechanisms, and computer processing is a key feature of modern monitoring and control systems.[1] A wide range of technologies fall under the umbrella of monitoring and control—several of which are detailed in the following sections.

### PROGRAM OVERVIEW

This document was developed under the **Customized Help and Expertise on Energy Resilience for States (CHEERS)** program. CHEERS is a community of practice focused on helping states implement **Infrastructure Investment and Jobs Act (IIJA) Section 40101(d) Grid Resilience State and Tribal Formula Grants ("40101(d)")**. CHEERS is managed by the U.S. Department of Energy (DOE) Grid Deployment Office (GDO), and convenes an annual cohort of states to deliver grid resilience technical assistance.

## RESILIENCE BENEFITS

**Real-Time Monitoring**. Monitoring and control equipment can alert grid operators and recommend corrective actions if a segment of the distribution network is at risk of failure.

**Automated Fault Detection and Restoration.** Monitoring and control equipment helps detect faults in real time, isolate affected areas, and restore service to the affected sections.

**Improved Outage Response.** Monitoring and control equipment helps identify the outage location and last known load data, enabling operators to prioritize outages and respond more quickly.

**Integration of Distributed Energy Resources.** Monitoring and controls technologies enhance grid flexibility by enabling seamless integration of both firm and distributed energy resources, decreasing vulnerability to outages.

Image Source: The Mercury

## CHECKLIST

*Consider this technology if you experience the following*:

- [ ] Need for faster grid restoration and automation
- [ ] Frequent or unexplained outages
- [ ] Lack of visibility into customer or member trends
- [ ] Difficulty managing distributed energy resources
- [ ] Lag time in detection of faults and equipment failure

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## 40101(D) APPLICABILITY

*The 'Monitoring and Controls' category offers broad flexibility in the types of technologies that can be funded through 40101(d). Eligible Uses of the 40101(d) Grid Resilience Formula Grants include:*

- **Protective Relays and Breakers**
- **Digital Relays, Smart Reclosers, and Early Fault Detection Technologies**
- **Supervisory Control and Data Acquisition (SCADA)**
- **Advanced Metering Infrastructure (AMI)**
- **Fault Location, Isolation, and Service Restoration (FLISR)**
- **Volt/VAR Optimization (VVO) Systems**

## KNOW BEFORE YOU DEVELOP

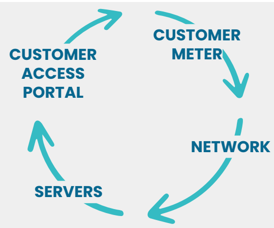
*Consider the following before choosing monitoring and control technologies for your 40101(d) application:*

- **Cybersecurity Risks.** Smart grid devices are often part of the broader 'Internet of Things', expanding the potential cyber attack surface.
- **Supporting Infrastructure.** These systems depend on reliable, high-speed communication networks to transmit and process data in real time.
- **Workforce Skillset.** Effective use of monitoring tools requires specialized training. Without it, utilities risk becoming 'information rich but data poor', where abundant data exists but is not actionable.
- **High Costs.** Deployment requires significant investment in grid sensors, systems integration, and communications infrastructure.

## SUBTECHNOLOGY PROFILES

## ADVANCED METERING INFRASTRUCTURE (AMI)

**Advanced Metering Infrastructure (AMI)** systems provide detailed, real-time data on electricity usage and energy efficiency through smart meters, continuous monitoring, and demand response programs. These technologies help utilities and customers better manage energy consumption and identify waste.




## CASE STUDY: APPALACHIAN ELECTRIC COOPERATIVE[2]


Image Source: Canva

Appalachian Electric Cooperative (AEC), serving parts of East Tennessee, transitioned from traditional electro-mechanical meters to AMI in 2013 to enhance service reliability, operational efficiency, and billing accuracy. AEC highlights numerous advantages over traditional metering, including:

- Fewer estimated readings, ensuring precise billing based on actual consumption data.
- Real-time detection of outages and verification of power restorations
- Reduced need for manual meter readings, lowering operational costs
- Detailed consumption data

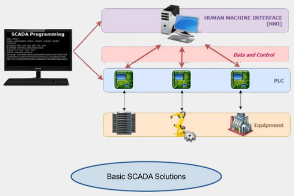
1. Lawrence Berkeley National Laboratory (2024). "Monitoring and Control Technologies," Grid Deployment Office
2. Appalachian Electric Cooperative (2025). "AMI Metering Facts"

# MONITORING AND CONTROL

## RESILIENCE TECHNOLOGY PROFILE

## SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

**Supervisory Control and Data Acquisition (SCADA)** systems collect data from sensors embedded in the grid to track electricity flow, demand, and potential faults. It provides operators with visibility into grid conditions and supports remote control of equipment. While SCADA typically requires human input for fault management, it can enable more efficient responses when combined with automation systems like FLISR.




## CASE STUDY: MIDLAND POWER COOPERATIVE[3]


Image Source: PICRYL

Midland Power Cooperative, in Iowa, approved a $2.1 million, five-year initiative to install Supervisory Control and Data Acquisition (SCADA) systems across its 27 substations. This project, initiated in November 2023, aims to modernize the cooperative's infrastructure and improve service delivery. The newly installed SCADA systems enable remote monitoring and control of critical equipment, such as transformers and breakers. This allows operators to detect and address issues promptly, often without the need for on-site intervention. Additionally, the integration of SCADA facilitates predictive maintenance, enabling the cooperative to identify potential equipment failures before they lead to service disruptions.

## FAULT LOCATION, ISOLATION, AND SERVICE RESTORATION (FLISR)

**Fault Location, Isolation, and Service Restoration (FLISR)** is an advanced software-driven system that automatically detects faults on the grid, isolates the affected section, and quickly restores power to unaffected areas. It utilizes smart switches, reclosers, and sensors to carry out these functions—often autonomously, without manual operator input. Key components of a FLISR system include smart grid devices, robust communications infrastructure, SCADA systems, and intelligent software analytics.

## CASE STUDY: CASS COUNTY ELECTRIC COOPERATIVE[4]

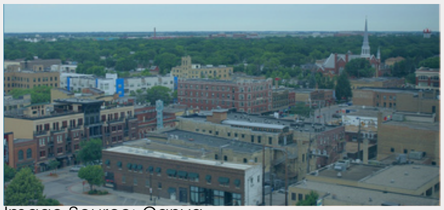


Image Source: Canva

Cass County Electric Cooperative (CCEC), in Fargo, North Dakota, recently (2024) implemented FLISR to minimize outage frequency and duration. Through the integration of FLISR, SCADA, and user-friendly reporting tools, CCEC demonstrates a robust approach to modernizing grid operations and enhancing service reliability for its members.

3. Midland Power Cooperative (2025). "SCADA upgrades utilize tech to trim down outage times"
4. Cass County Electric (2024). "2024 FLISR Demo"

# MONITORING AND CONTROL

## RESILIENCE TECHNOLOGY PROFILE

## INTELLIRUPTER

An **IntelliRupter** is an advanced smart switch or recloser that is capable of precise fault detection, real-time communication, and integration with distribution automation systems like SCADA and FLISR. It communicates real-time data to utility operators and works with other devices to reroute power, improving grid reliability and reducing outage times as part of a smart grid system.

## CASE STUDY: LUMBEE RIVER EMC (LREMC)[5]

Image Source: LREMC

Lumbee River EMC in North Carolina recently installed IntelliRupter PulseCloser Fault Interrupters. Unlike traditional reclosers, which can cause additional damage by applying high force during fault testing, the IntelliRupters use a low-energy pulse to detect faults, minimizing stress on the system and improving long-term reliability. This self-healing technology is a major step in LREMC's efforts to strengthen grid reliability and resilience. During outages, the IntelliRupters quickly interrupt faults, identify alternative power paths, and restore service in milliseconds—reducing both outage duration and the number of affected members. By isolating faulted sections automatically, these interrupters help ensure a more stable and responsive power supply for members.

## TRIPSAVER

A **TripSaver,** also known as a smart fuse, replaces traditional fuses to minimize outage duration and impact. Unlike regular fuses, which blow and cause full outages, TripSavers can detect faults, try to restore power if the fault is temporary, and limit outages to smaller areas. While they operate autonomously and lack full communication or direct FLISR control, they complement FLISR systems by quickly clearing temporary faults and reducing the need for more complex auomated actions.

## CASE STUDY: CHOCTAWHATCHEE ELECTRIC COOPERATIVE, INC.[6]

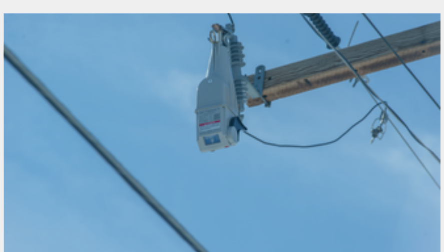


Image Source: CHELCO

In 2023, Choctawhatchee Electric Cooperative, which serves a portion of the Florida panhandle, began installing automated TripSaver devices across its service area, including Eglin Air Force Base, to reduce the frequency, duration, and impact of outages. Acting like advanced circuit breakers, the TripSavers can automatically re-energize lines within seconds after temporary faults, such as tree limbs brushing the lines. For more serious issues, they isolate the affected area to minimize the number of impacted customers and help pinpoint fault locations to speed up restoration. Nearly 15 TripSavers have been installed so far, with 25 more planned.

5. Lumbee River EMC (2022). "Upgrading the Grid with S&C IntelliRupters."
6. Choctawhatchee Electric Cooperative, Inc.(2025). "New Automated "TripSaver" Devices Help Reduce Duration of Power Outages"