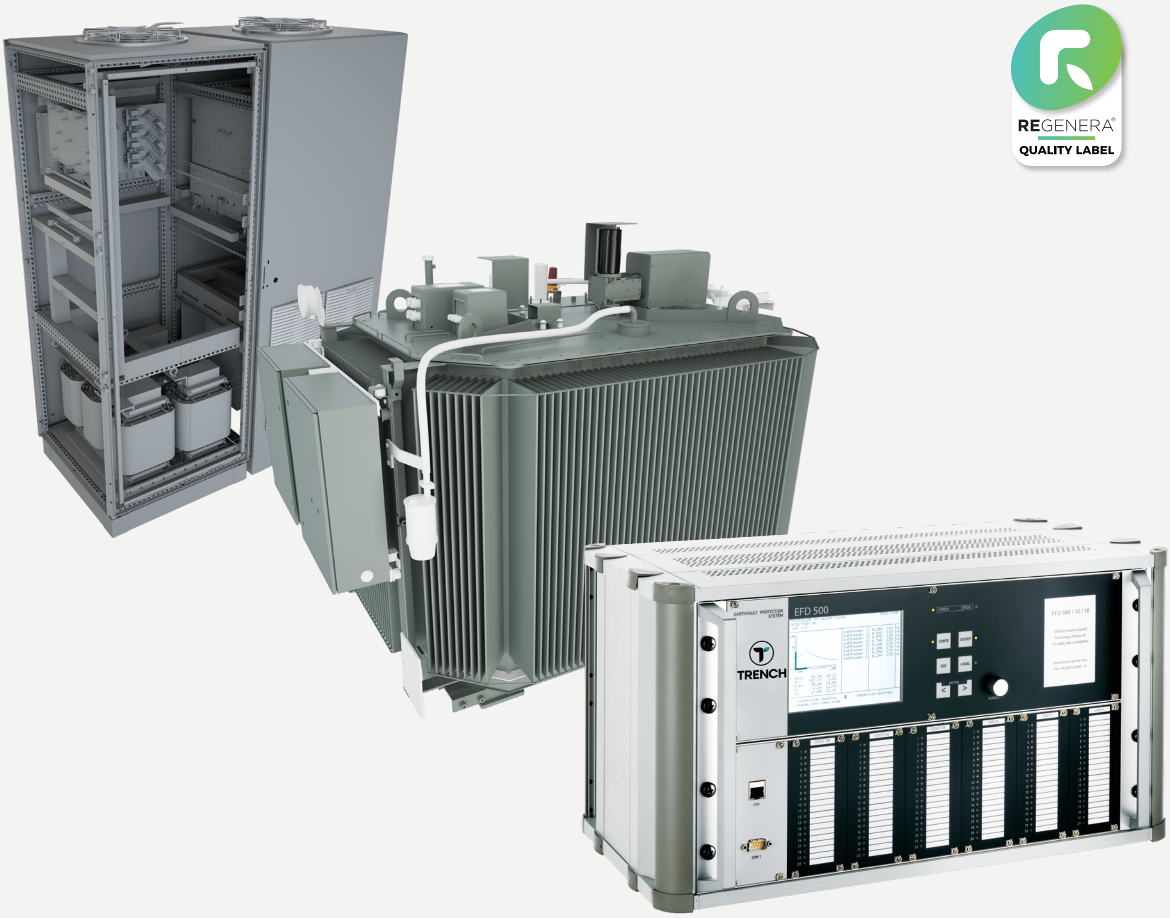
ARCC® WILDFIRE MITIGATION SYSTEM

ADVANCED RESIDUAL CURRENT COMPENSATION FOR WILDFIRE RISK REDUCTION IN MEDIUM VOLTAGE DISTRIBUTION GRIDS



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TRENCH
Sense the **Power**

This brochure summarizes electrical wildfire ignition mechanisms relevant to medium-voltage (MV) distribution systems. It describes how the **ARCC® Wildfire Mitigation System** reduces residual earth fault current and fault energy during single-line-to-ground faults.

Designed for **utility engineering, operations, risk management and regulatory stakeholders**, ARCC® provides an integrated, technically proven mitigation layer for resonant-grounded MV grids.

The following pages progress from wildfire as a grid risk, to MV ignition mechanisms, to the limitations of conventional grounding concepts, and finally to the ARCC® solution and its operational value.

WILDFIRE AS AN OPERATIONAL RISK

UTILITY PERSPECTIVE:

In wildfire-exposed regions, ignition risk is now a core element of **distribution-grid risk management**. Electrical faults on overhead feeders can coincide with dry fuels, wind events and limited access for manual intervention.

Utilities increasingly evaluate wildfire mitigation not only as an environmental issue, but as a matter of **public safety, reliability and long-term system resilience**.

CONSEQUENCE-DRIVEN RISK

In many US and APAC jurisdictions, a single ignition can escalate rapidly, leading to:

- Significant property damage and third-party claims
- Regulatory scrutiny and legal exposure
- Operational restrictions during high fire-weather periods

Mitigation measures that reduce ignition probability **at the fault location** support a more targeted and defensible wildfire strategy.

WHERE IGNITIONS ORIGINATE
MV DISTRIBUTION MECHANISMS

Electrical ignition mechanisms associated with overhead MV distribution grids, with emphasis on single-line-to-ground (SLG) faults.

SLG FAULTS AS A DOMINANT EVENT CLASS

In MV distribution systems, SLG faults are among the most frequent fault types. Under dry and windy conditions, even moderate sustained fault energy can increase ignition probability.

RESIDUAL EARTH FAULT CURRENT

The magnitude of residual earth fault current depends on the neutral grounding concept. In solidly or low-impedance grounded systems, residual current is typically significantly higher than in resonant grounded grids.

LIMITATIONS OF CONVENTIONAL APPROACHES

- **LOW-IMPEDANCE GROUNDING**
  Produces high earth fault current and releases high fault energy, relying on fast clearing rather than energy limitation.
- **ASC-ONLY COMPENSATION**
  Reduces the capacitive earth fault current while leaving resistive current components, such that energy is still present at the fault location, although at a significantly reduced level.
- **PROTECTION-CENTRIC DESIGN**
  Traditional protection schemes prioritize selectivity and asset protection, not ignition mitigation.
- **OPERATIONAL MEASURES**
  De-energization and switching limitations reduce exposure but directly impact customer reliability and restoration time.
  These approaches do not directly control **fault energy**, which is a key driver of ignition probability.

HIGH-RISK REGIONS (DATA-DRIVEN)

WHY MV FAULT-LEVEL PREVENTION MATTERS

The following table summarizes recurring high-risk regions identified in wildfire studies and explains the relevance of preventing earth fault ignition in MV distribution grids.

US REGION / STATE	STRUCTURAL OR ASSET EXPOSURE (FROM SOURCES)	WILDFIRE FREQUENCY OR TREND (FROM SOURCES)	RELEVANCE TO MV DISTRIBUTION GRIDS	WHY FAULT-LEVEL IGNITION PREVENTION MATTERS IN THIS REGION
WEST – CALIFORNIA	8.04 % of structures in "high to extreme" wildfire risk (1)	188 wildfires reported in 2024 (NIFC 1); 185k acres burned in 2024 (1). Stanford CEPP (2) documents high structural losses in some years and emphasizes increasing utility wildfire mitigation spending and associated rate impacts.	Large footprint of overhead distribution in fire-threat districts; MV single-line-to-ground faults and sustained arcing are a plausible ignition pathway during wind/fuel-critical conditions.	Where consequence is high, reducing residual earth fault current and limiting voltage rise can reduce energy at fault location — complementing operational measures (e.g., de-energization) and vegetation programs.
WEST – OREGON	4.02 % of structures in "high to extreme" wildfire risk (1)	3,890 wildfires reported in 2024; 12k+ acres burned in 2024 (1).	Overhead MV feeders traverse forested terrain; earth faults can persist depending on grounding/ protection behavior and fault impedance.	Fault-energy limitation is relevant where ignition probability increases with sustained arcing and access constraints can delay manual intervention.
WEST – WASHINGTON	2.18 % of structures in "high to extreme" wildfire risk (1)	355 wildfires reported in 2024; 2k+ acres burned in 2024 (1).	Overhead MV systems in wooded and wind-exposed areas; contact and fault events can coincide with red-flag periods.	Reducing residual current and limiting voltage rise reduces conditions that sustain arcing at the fault location.
SOUTHWEST – ARIZONA	2.30 % of structures in "high to extreme" wildfire risk (1)	347 wildfires reported in 2024; 538k acres burned in 2024 (1).	Dry fuels and wind-exposed corridors increase the consequence of arcing faults on overhead MV infrastructure.	Limiting sustained residual current during SLG faults reduces the electrical energy available for ignition under arid fuel conditions.
SOUTH – TEXAS	5.71 % of structures in "high to extreme" wildfire risk (1)	6,200 wildfires reported in 2024; 1k+ acres burned in 2024 (1).	Extensive overhead distribution with wind/debris contact potential; grass/ brush fuels can support fast-moving fires.	Fault-level energy limitation is relevant where ignition probability must be reduced without relying solely on broad-area de-energization.

SOURCES: (1): Verisk: Wildfire Risk Report 2025, January 2026, https://www.verisk.com/resources/campaigns/location-fireline-state-risk-report
(2): Stanford: Stanford University: California Wildfire 2025: Emerging Trends & Policy Insights, November 2025, https://cepp.stanford.edu/california-wildfire-2025-emerging-trends-policy-insights

OTHER STATES COVERED IN THE VERISK STATE REPORT COMPILATION (REFERENCE ONLY):

Colorado; Idaho; Montana; Nevada; New Mexico; Oklahoma; Tennessee; Utah; Wyoming.

ENGINEERING INTERPRETATION:

Across wildfire-prone regions, a common risk pattern is observed: the overlap of overhead MV infrastructure with dry fuels and wind-driven conditions. In such environments, single-line-to-ground faults and sustained arcing represent a credible ignition pathway.
In these environments, mitigation of energy at the earth fault location complements vegetation management, situational awareness and operational controls, especially where large-scale line de-energization is not a sustainable solution.

THE ARCC® CONCEPT

ARCC® (Advanced Residual Current Compensation) is an integrated system for MV grids that combines arc suppression technology, earth fault detection and inverter-based residual current compensation.

This combination reduces residual earth fault current during single-line-to-ground faults and thereby limits electrical energy release at the fault location.

SYSTEM ELEMENTS

Arc Suppression Coil (ASC):
Continuously tuned to compensate the capacitive component of earth fault current as grid topology changes.

Earth fault Detection (EFD):
Monitors grid quantities and coordinates control actions to maintain stable compensation under dynamic conditions.

Residual current compensation inverter (IARCC):
Injects a controlled active current component to further reduce the residual current not addressed by capacitive compensation alone.

SUSTAINABILITY

Regenera® is Trench Group's Quality Label, awarded to offerings that combine technical excellence with environmental responsibility.

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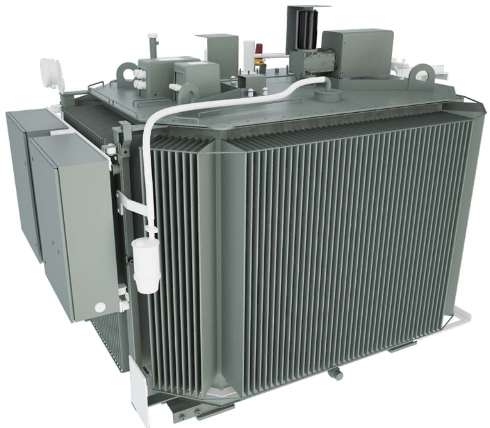
TECHNICAL DATA

ARC SUPPRESSION COIL (ASC) – ELECTRICAL RATINGS

PARAMETER	VALUE / RANGE
Coil type	Iron core, liquid insulated, plunger core coil
Maximum rated voltage	Up to 36 kV
Rated power range	Up to 15 MVAr
Frequency	50 Hz / 60 Hz
Regulation range	Continuous 1 : 10
Cooling	ONAN / KNAN
Installation	Indoor / Outdoor



EARTH FAULT DETECTION (EFD / EFDCC) – CONTROL & DETECTION CAPABILITY

PARAMETER	CAPABILITY
Function	Central earth fault detection and control
Compensation coordination	ASC and inverter
Measurement channels	Up to 48 analog channels
Harmonics	Up to 13th harmonic
Feeder monitoring	Typical ARCC context up to 16 feeders
Communication	Ethernet to inverter

INVERTER (IARCC) – ELECTRICAL KEY PARAMETERS

PARAMETER	VALUE	NOTES
Inverter function	Active residual earth fault current compensation	Single phase injection
Rated apparent power	320 kVA	System losses excluded
Supply voltage	Customer specific	3 phase
Supply frequency	50 Hz / 60Hz	
Inverter topology	3 level, interleaved	Low harmonic distortion
Output voltage	Up to 500 V RMS	Single phase
Output current	Up to 640 A RMS @ 500V	
Output frequency	50 Hz / 60 Hz + harmonics up to 13th	
Operating mode	Continuous	
Cooling	Forced air	

HOW ARCC® REDUCES IGNITION RISK

CAUSE–EFFECT CHAIN

Earth fault → residual fault current → sustained arcing / high fault energy → ignition probability

RESIDUAL CURRENT REDUCTION

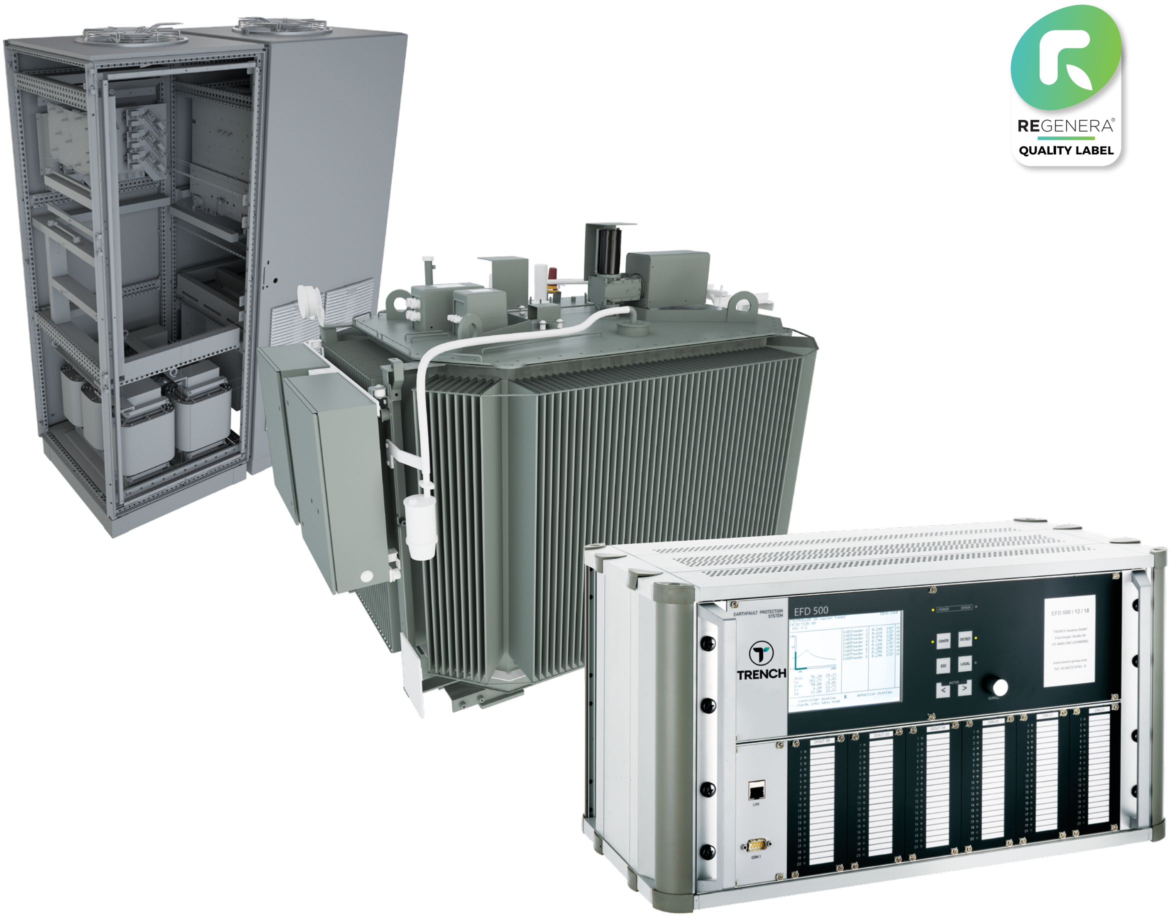
By combining capacitive compensation (ASC) with controlled active current injection (IARCC), ARCC® addresses both components of earth fault current that contribute to sustained arcing.

THEREBY:

- Limiting energy at the fault location
- Reducing conditions that sustain ignition
- Supporting safer operation during elevated fire-risk periods

COMPLEMENTARY ROLE

ARCC® addresses an electrical root cause at the point of fault. It complements, but does not replace, vegetation management, situational awareness and operational control measures.



UTILITY VALUE & REPRESENTATIVE USE CASES

- **OPERATIONAL VALUE**
  Supports controlled operation of resonant grounded MV grids during certain earth faults, even under elevated fire-risk conditions.

- **RISK-MITIGATION VALUE**
  Targets a defined ignition mechanism by limiting fault energy during SLG faults.

- **REGULATORY RELEVANCE**
  Provides a clear engineering rationale linking mitigation investment to ignition-risk reduction.

- **NEUTRAL GROUNDING CONTEXT**
  Aligned with resonant grounded strategies such as **REFCL**.

CONCLUSION

For utilities operating in wildfire-exposed regions, reducing ignition risk requires **engineering solutions that act where ignition originates** – at the fault location.

The **ARCC® Wildfire Mitigation System** limits residual earth fault current and fault energy in overhead MV grids, strengthening grid safety while supporting reliable operation. Integrated with established mitigation programs, ARCC® supports a safer, more resilient distribution grid.

NOTES

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