



White Paper

# CRITICAL RISKS OF PRIMARY-SIDE ONLY MONITORING



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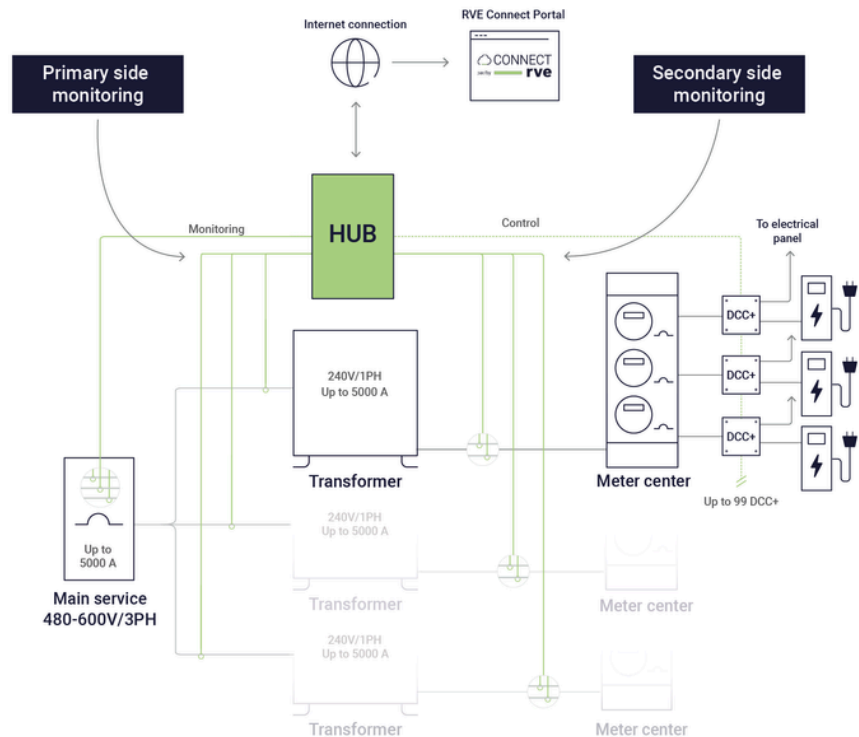
**In multifamily buildings, the electricity meters are supplied by transformers or by the main electrical service panel, whose capacity has not initially been planned to supply an electric vehicle charging infrastructure for 100% of the units simultaneously.**

To remedy this situation without having to upgrade the existing electrical infrastructure, all that is needed is to install an electric vehicle energy management system (EVEMS), whose role is to protect a building's electrical infrastructure while increasing charging performance to enable optimal charging outside peak hours (usually at night) for all vehicles being charged.

**Standardization:** As this type of system is fairly new, standardization is constantly evolving. Currently, two main standards stand out for regulating their application and ensuring compliance with code requirements: CSA 22.2 No. C343-25 and UL 3141. It should also be noted that the CSA C358 standard, covering Energy Regulating Equipment, is currently being drafted.

This is precisely what the RVE HUB does. It is an EVEMS designed to protect critical components of a building's electrical infrastructure through its monitoring and control functions.

To ensure the HUB effectively protects electrical infrastructure and prevents hardware failure, monitoring must occur where the load volatility exists: the secondary side. Relying solely on primary-side monitoring introduces significant blind spots that jeopardize equipment safety.



Schematic showing primary-side vs secondary-side monitoring

## Key Operational Vulnerabilities

### Code Compliance vs. Physical Integrity

Electrical codes often permit primary-side overcurrent protection to be sized at 125% (or more) of the transformer's rated current to account for inrush currents. As electric vehicles become more prevalent and operate under high-duty cycles, this otherwise compliant buffer allows the system to run continuously at levels that may exceed the thermal ratings of secondary lugs and wiring. Since the primary sensor monitors total power (kVA) rather than the specific amperage flowing through secondary terminations, it cannot detect when this "allowed" overload is physically endangering the lugs or insulation on the secondary side.

### Undetected Split-Phase Imbalance

Primary monitoring sees the transformer as a single block of power capacity, masking potential imbalances between secondary legs. Taking an extreme case, a critical overload on a single leg (e.g., L1) combined with zero load on L2 appears as a safe, partial load on the primary. This leaves the active winding and neutral conductor, which has no primary-side reference, to overheat without triggering a protective response.

### Aggregate Capacity Masking

Whether monitoring a bank of three transformers or a hexaphase configuration, primary sensors read the aggregate capacity of the entire system. Severe overloads on a single transformer within a bank (e.g., one unit at 100% while others are idle) or a specific phase in a hexaphase setup appear as negligible fluctuations on the main feeder. This situation blinds the system to localized hotspots, causing the EVEMS to incorrectly authorize additional load on an already-stressed component.

### Transformer Topology Diversity

The mathematical relationship between primary and secondary currents varies drastically depending on the specific transformer configuration (Delta-Wye, Wye-Wye, Delta-Delta, Wye-Delta, etc.). It is operationally impossible to create a universal primary-monitoring rule that accounts for the varying phase shifts and zero-sequence current behaviors across all these topologies. Secondary-side monitoring bypasses this complexity entirely by measuring the actual load output, rendering the upstream transformer configuration irrelevant to the safety logic.

**Recommendation :** The "best protection" is strictly achieved via secondary-side monitoring. This provides the HUB with the granular visibility required to detect phase-specific amperages and imbalances, ensuring protection logic triggers before physical damage occurs to windings, lugs, or conductors.

## Conclusion

In multifamily buildings, compliance with the Electrical Code alone does not guarantee effective protection of equipment. Monitoring limited to the primary side introduces blind spots that can lead to localized overloads, undetected imbalances, and ultimately, equipment failure.

To ensure effective and lasting protection of the electrical infrastructure, monitoring must be performed where the stresses actually occur: on the secondary side. This is precisely what RVE's HUB is designed to do. By providing granular monitoring and applying control logic adapted to the actual conditions of the building, the HUB protects critical infrastructure components while maximizing available charging capacity in a safe and scalable manner.