**Research Question**

Which Ontario electricity zones exhibit the greatest operational stress and infrastructure volatility, and how can a composite Smart Grid Readiness Index guide strategic investment prioritization?

**Part 1:**

**How does demand variability differ across Ontario zones, and which zones exhibit the highest intra-day and inter-day fluctuations?**

* **Data Used:** Hourly Zonal Demand Report, Real-Time Demand.
* **Metric:** Coefficient of Variation (CV) for hourly and daily demand.
* **Purpose:** Identifies zones with unstable or peaky load patterns, signaling operational stress.

**Part 2:**

**What is the relationship between zonal price volatility and dispatch deviations, and do certain zones experience more frequent mismatches between scheduled and actual dispatch?**

* **Data Used:** Hourly Zonal Price Report, Dispatch Deviation Report.
* **Metric:** Normalized standard deviation of price vs. frequency of deviation types (NC, OSL, ACE, etc.).
* **Purpose:** Detects zones where market signals and grid operations diverge, implying control risk or inadequacy.

**Part 3:**

**How do transmission outage frequency and duration correlate with observed grid stress indicators in each zone?**

* **Data Used:** Transmission Outages, Real-Time Demand, Dispatch Deviation.
* **Metric:** Outage Frequency Index (OFI), temporal alignment with deviation and demand spikes.
* **Purpose:** Quantifies physical infrastructure reliability and links it to systemic performance.

**RELEVANT LITERATURE**