Digital Egypt Pioneers

ASSUMPTIONS MAPPING

U.S. ELECTRIC GRID OUTAGE ANALYSIS

DEPI-GIZ1_DAT2_G1e
-Group1-

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AGENDA

01 Data Consolidation

02 Data Quality Issues

03 ASSUMPTIONS

04 NERC Region

05 Event Types

Data Consolidation

- Column names have changed over time (since 2010), and the number of columns is not consistent across all sheets.
- Similar data is stored in different columns across sheets.
- Data entries do not always start in the first row, with some beginning on the second row.
- Some years include a combined datetime column for restoration events, while later years split these into separate date and time columns.
- In certain sheets, data that should be in a single cell is spread across multiple rows.
- There are rows containing non-data elements, such as headers or totals.

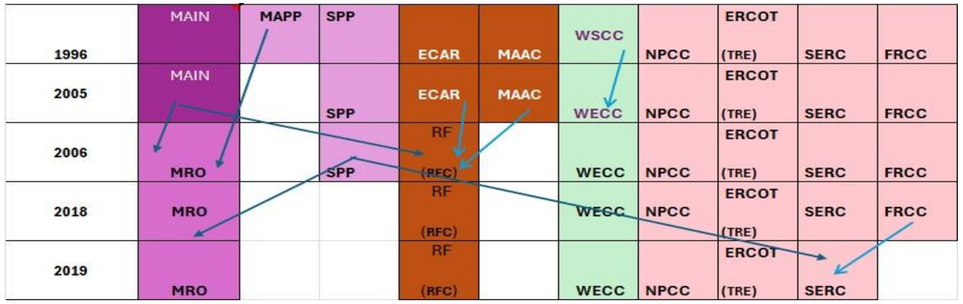
Data Quality Issues

- Time entries vary in format, including both strings (e.g., "1:10 p.m.") and standard time formats (e.g., "13:10:00").
- Descriptive text (e.g., "Approximately" or "Midnight") appears in time columns and must be standardized.
- The "Area Affected" column lacks consistency in how areas are named, with spelling mistakes and no clear distinction between states, regions, or cities.
- The "NERC Region" column contains typos, multiple regions per incident, and outdated regions.
- The "Event Type" column is inconsistent and contains many spelling errors, with some improvement after 2010.
- "Alert Criteria" may contain multiple criteria but is only available from 2015, limiting analysis of emergency types in earlier years.
- Numeric columns such as "Loss of Megawatts" and "Number of Customers Affected" often contain descriptive text (e.g., "million," "peak") or unknown values instead of numbers.

ASSUMPTIONS

Field	Operation	ASSUMPTION DESCRIPTION	Notes
Time Event Began	Replace	Specific text (Midnight replaced with a specific time).	Filtered out 12 events that have the wrong restoration time (attached). Wrong Duration
	Remove	Removes 'NA','N/A', 'Approximately ', 'Ongoing', 'unknown', 'UNK', 'None', and at peak' from the text.	
Time of Restoration	Replace	Specific text ('Evening', 'Noon' and midnight replaced with a specific time).	
	Remove	Removes 'NA','N/A', 'Approximately ', 'Ongoing', 'unknown', 'UNK', 'None', and at peak' from the text.	
Date of Restoration	Replace	Replaces wrong dates in year 2011 '29-08-2077' with '29-08-2011', '18.03.2001' with '18.03.2011', in year 2019 '08/18/2018' with '08/18/2019'	
	Remove	Removes 'NA','N/A', 'Approximately ', 'Ongoing', 'unknown', 'UNK', 'None', and at peak' from the text.	
Demand Loss (MW)	Replace	Replaces 'All', 'Unknown', 'Approx.', ' at peak,', 'NA', 'N/A', 'unknown' and 'UNK' with null. Replaces 'None' with '0'.	
	Convert	Converts the textual value to a numeric value. Converts values in range to minimum for example 75-90 to 75.	
Customers Affected	Replace	Replaces the '1 PG&E', 'UNK' and 'Unknown', 'All' 'N/A' and 'NA' with null. Replaces 'Interruptible Tariff 1-6 customers' from the text. Replaces 'GRE (1,900) Total' from the text. Replaces '(industrial)' and '(utilities)', with null.	
	Remove	Removes 'Greater than', 'Under ', 'at peak,', '(Peak)', and 'Approx.' from the text.	
	Convert	Converts the textual value '1.1 million and 100,000 gas customers' to '1100000'. Converts '700,000 (peak) 2,500,000 (actual)' to '700000'. Converts 'peak 320,00 9/18/03 7:00 p.m.' to '32000'. Converts '1.8 million' to '1800000'. Converts '1.5 million' to '1500000'. Converts 'None' to '0'.	

NERC Region ASSUMPTIONS



Operation	Old Value	New Value	Notes
Replace Text	NPPC	NPCC	
	RFC, SERC	RF/SERC	
	NPCC, RFC	NPCC/RF	
	NPCC; RFC	NPCC/RF	
	SPP, SERC, TRE	SPP/SERC/TRE	
	Midwest ISO (RFC	RF	
	WeEnergiesMAIN	MRO	
	MR0	MRO	
	REC	SERC	
	SPP RE	SPP	
	MRO / RF	MRO/RF	
	SERC / RF	SERC/RF	
	, (comma)	/ (slash)	
	; (semicolon)	/ (slash)	
	RFC	RF	
	TRE	ERCOT	The formal name of TRE
	TE	ERCOT	According to Area affected
	RE	ERCOT	According to Area affected
	NP	NPCC	According to Area affected
	PR	Not_NERC	Puerto Rico
	NA	Not_NERC	All "null" & "NA" values has been treated according to the Area affected
	null	Not_NERC	

Operation	Old Value	New Value	Notes
Add Cond. Column	MAIN	Multiple	**(MAIN)** was representing parts of the Midwest. In 2006, it was dissolved, and its responsibilities were split primarily between **(MRO)** and **(RFC)**.
	MAPP	MRO	The **(MAPP)** was responsible for the upper Midwest and central U.S. before its responsibilities were transitioned to **(MRO)** in 2005. By 2015, MAPP's functions had been fully integrated into MRO.
	SPP	Multiple	The Southwest Power Pool (**SPP**) is currently part of the **MRO** and **SERC** regions after it ceased functioning as a NERC Regional Entity in 2018
	ECAR	RF	**ECAR** was a key NERC region until it was consolidated into the Reliability First Corporation **(RFC)** in 2006 .
	MAAC	RF	**MAAC** was a NERC regional entity until it was merged into the Reliability First Corporation **(RFC)** in 2006
	WSCC	WECC	**WSCC** was responsible for reliability coordination in the Western U.S. and was eventually replaced by **(WECC)** in 2002
	FRCC	SERC	**FRCC** Initially part of the **SERC (Southeastern Electric Reliability Council)**, FRCC became its own NERC region in 1996 and is responsible for Florida . In 2019, the FRCC dissolved its regional entity functions, with its responsibilities and registered entities transitioning back to the **SERC.**
	Contains("/")	Multiple	for any data with the pattern: (SERC **/** FR) or (FR **/** MOR **/** WECC)
	HI, HECO, MECO	Not_NERC	**HECO**, **MECO**, and **HELCO** are part of Hawaiian Electric Industries, which serves the Hawaiian Islands, but they are **not directly governed by NERC.** The reporting could help in benchmarking their performance against broader national standards
	Any Other NERC Region	*As it is*	--

According to the book: The History of the North American Electric Reliability Corporation

Event Types ASSUMPTIONS

Summary of Event Classifications

- **Weather-Related**: Focuses on extreme weather conditions like extreme temperatures, heavy snowfall, and lightning strikes affecting power systems.
- **Cyber Events**: Includes incidents such as cyber-attacks, potential threats, and suspected cybersecurity breaches.
- **Fuel Supply Issues**: Refers to problems with fuel supply, including shortages, contractual issues, and transportation disruptions.
- **Load Shedding**: Covers planned power outages, emergency load reductions, and measures to prevent system overloads.
- **Natural Disasters**: Encompasses weather-related events like storms, floods, earthquakes, and wildfires that impact power infrastructure.
- **Operational Issues**: Involves maintenance errors, human mistakes during operations, and equipment malfunctions affecting electricity supply.
- **Physical Attacks**: Includes incidents of vandalism, sabotage, and unauthorized access to critical infrastructure.
- **Public Appeals**: Represents instances where public requests are made to reduce power usage, such as during peak demand or emergency situations.
- **Transmission Issues**: Covers problems with power transmission, including power line failures, transformer malfunctions, and grid instability.
- **Unknown/Other**: Accounts for incidents that do not fit into other categories, including miscellaneous or unidentified causes of outages.

Main Event Type	Sub-Event Types
Weather-Related	Extreme Temperature Effects
	Heavy Snowfall
	Lightning Strikes
Cyber Events	Cyber Attack
	Cyber Event
	Cyber Event with Potential to Cause Impact
	Cyber Threat From Internet
	Suspected Cyber Attack
Fuel Supply Issues	Fuel Shortage
	Supplier Contract Issue
	Transportation Disruption
Load Shedding	Planned Power Outage
	Emergency Load Reduction
	Overload Prevention Measures
Natural Disasters	Storm Impact
	Flooding
	Earthquake
	Wildfires
Operational Issues	Maintenance Error
	Human Error During Operation
	Equipment Malfunction
Physical Attacks	Vandalism
	Sabotage
	Unauthorized Access Attempt
Public Appeals	Request for Reduced Power Usage
	Conservation Appeals
Transmission Issues	Power Line Failure
	Transformer Malfunction
	Grid Instability
Unknown/Other	Miscellaneous Incident
	Unknown Cause of Outage