2.01 Net-Zero EV Charging Infrastructure for Texas through 2040

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Background Information

- Developing sustainable electric vehicle (EV) charging infrastructure in Texas in response to growing health and environmental concerns, and boost energy security.
- Forecasting the number of battery-powered EV (BEV) and Plug-in Hybrid Electric Vehicles (PHEVs) in 7 Texas regions.
- By 2040, over 45 million EV will run and need access to eco-friendly charging networks.

Problem Statement

EVs are classified into BEVs and PHEVs, which form the broader category of plug-in electric vehicles (PEVs). This project deploys how many Level 2 and Level 3 chargers are needed in 7 Texas regions to support the growing PEV fleet with net-zero emissions using wind and solar microgrid generation. We use EVI-Pro Lite, to estimate Texas EV fleet size through 2040 and design the necessary charging infrastructure to meet the demand.

Project Objectives

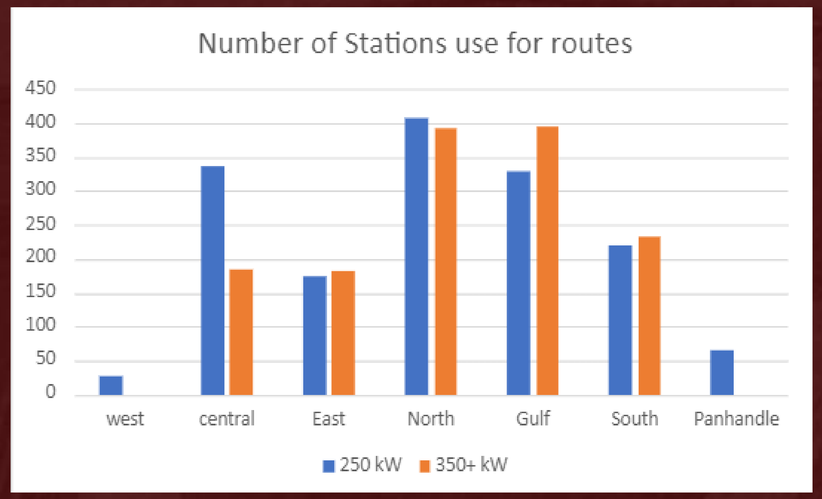
- Predict the number of EV charging stations required per region from 2020 – 2040.
- Determine wind and solar generation capacity to supply renewable energy to the entire charging network through 2040.
- Analyze the cost to determine the feasibility of deploying net- zero emissions EV transportation systems in Texas.

Project Purpose

- Achieving 55% EV penetration in Texas by 2040 aims to combat climate change.
- EVs charged with renewable energy achieve zero-emission.
- Charging EVs using the current grid would generate approximately 25.7 million tons of carbon annually.
- Planning Texas' first-ever, net-zero EV charging network maximizes EV benefits, improves air quality, and supports environmental sustainability innovation.

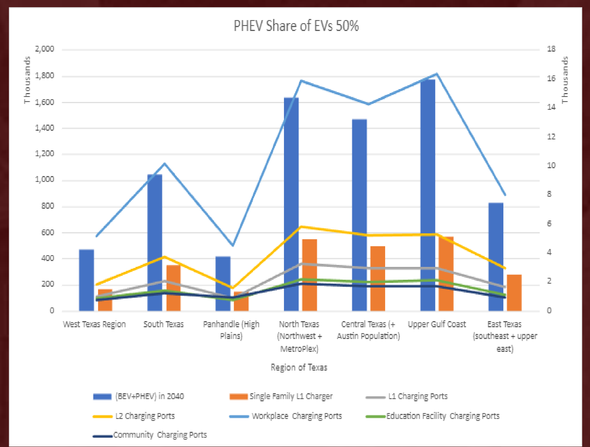
Analyse

- The data collected will be analyzed using available software from Texas State University and EPRI.
- Microsoft Excel for performing optimization.
- EPI Pro Light to forecast EV Charger type and quantities required.



Allocated Charging Port Levels = (Population of All Selected Cities) × Total Charging Port Levels
∑ The population of Specific City

Regions	Level 2	Level 3
West	117,008	0
Central	550,019	564
East	550019	564
North	1073577	1191
Gulf	1099708	1245
South	697531	716
Panhandle	285716	0



Solar and wind farm capacity needed to supply renewable energy to the EV charging stations from 2020 – 2040

$$P_t = W_t \eta A I_t [1 - 0.005(T_o - 25)]$$

$$T_o = 30 + 0.0175(I_t - 300) + 1.14(T_\alpha - 25)$$

$$P_w(v) = \begin{cases} 0 & v < v_c, v > v_s \\ P_m (v / v_r)^3 & v_c \le v \le v_r \\ P_m & v_r \le v \le v_s \end{cases}$$

$$v_h = v_g \left(\frac{h}{h_g} \right)^k$$

Region	Annual L2 Energy demand (E_year)	Annual L3 Energy demand (E_year)	Sum of L2 and L3 Energy demand	PV size (m^2)	WT (kW)
1 (Central)	1204541610	1235160	1205776770	2996000	178
2 (West)	256247520	0	256247520	471000	288.935
3 (Gulf Coast)	2408360520	2726550	2411087070	6372000	223.23
4 (North)	2351133630	2608290	2353741920	5865000	190.147
5 (South)	1527592890	1568040	1529160930	3725900	197.751
6 (Panhandle Plains)	625718040	0	625718040	110853	301.4679
7 (East)	1204541610	1235160	1205776770	2996000	440.000

Future Plans

- Evaluate the upfront costs of establishing the net-zero microgrid, including charging stations, renewable energy source and grid integration.
- Estimate ongoing costs associated with maintaining and operating the microgrid, considering factors like equipment upkeep, software updates and regular inspections.