Analyzing Public vs. Utility Ownership of EV Charging Stations in Georgia

Figure 1: EV Charging Stations[1]

ISYE/PUBP 6701, Spring 2024

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1. “EV Charging Stations A Global Market Boom.” *First Energy Systems*, 13 July 2021, firstenergysystems.com/ev-charging-stations/.

Overview

- Research Question
- Background Information
- Ownership
- Public Policy
- Cost Analysis
- Further Research Areas

Research Question

- EV adoption is projected to grow by 7.4 million EVs by 2030[2] assuming that policy targets are met
- Necessitates a growing need for charging infrastructure
- Georgia has made it a goal to reduce its emissions through improving its EV charging infrastructure
- Owning, operating, & maintaining charging stations has a high capital cost

As Georgia expands its EV charging infrastructure network, who will own and pay for this infrastructure and what is the best option for consumers?

2. “Prospects for Electric Vehicle Deployment – Global EV Outlook 2023 – Analysis.” *IEA*, Apr. 2023, www.iea.org/reports/global-ev-outlook-2023/prospects-for-electric-vehicle-deployment.

Background Information (1)

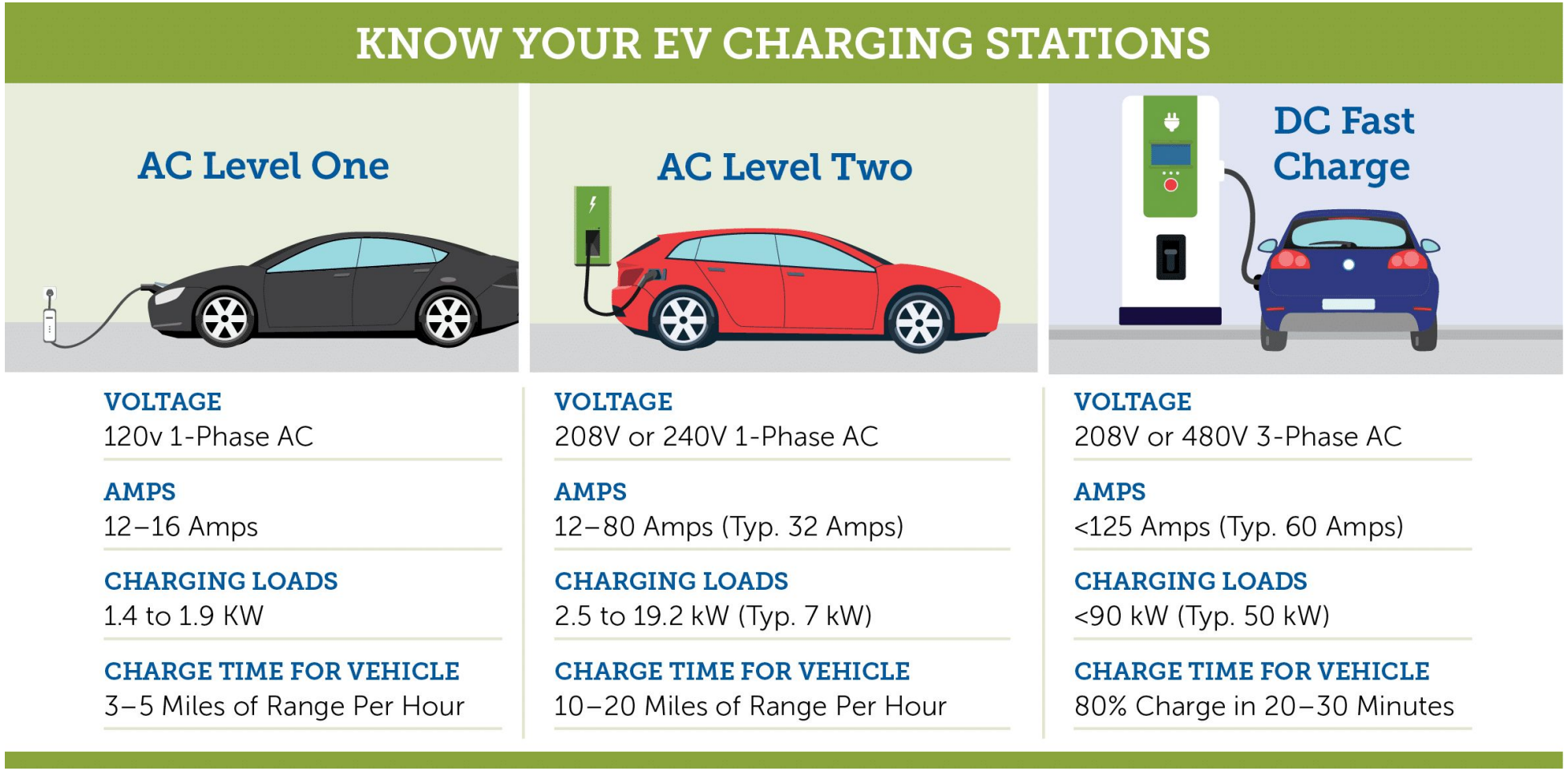

Figure 2: Types of EV Chargers[3]

3. Nalley, Nick. “Electrical Car Charging Stations-Which One Is Right for You?” *509 Electric*, 3 July 2019, 509electric.com/electrical-car-charging-stations-which-one-is-right-for-you/.

Background Information (2)

Figure 3: Installation Costs For Level 2 Chargers[4]

		1 charger per site	2 chargers per site	3-5 chargers per site	6+ chargers per site
California	Labor	$2,471	$1,786	$1,491	$1,747
	Materials	$1,235	$958	$1,014	$908
	Permit	$283	$172	$110	$65
	Tax	$156	$121	$128	$115
	Total	**$4,148**	**$3,039**	**$2,745**	**$2,837**
Outside California	Labor	$1,544	$1,827	$1,647	$1,316
	Materials	$1,112	$1,039	$1,272	$874
	Permit	$82	$62	$59	$38
	Tax	$96	$89	$110	$75
	Total	**$2,836**	**$3,020**	**$3,090**	**$2,305**

Figure 4: Installation Costs For DC Fast Chargers[4]

	50 kW				150 kW			
	1 charger per site	2 chargers per site	3-5 charger per site	6-50 chargers per site	1 charger per site	2 chargers per site	3-5 chargers per site	6-20 chargers per site
Labor	$19,200	$15,200	$11,200	$7,200	$20,160	$15,960	$11,760	$7,560
Materials	$26,000	$20,800	$15,600	$10,400	$27,300	$21,840	$16,380	$10,920
Permit	$200	$150	$100	$50	$210	$158	$105	$53
Taxes	$106	$85	$64	$42	$111	$89	$67	$45
Total	$45,506	$36,235	$26,964	$17,692	$47,781	$38,047	$28,312	$18,577

4. Nicholas, Michael. “Estimating Electric Vehicle Charging Infrastructure Costs across Major U.S. Metropolitan Areas.” *International Council on Clean Transportation*, 12 Aug. 2019, theicct.org/publication/estimating-electric-vehicle-charging-infrastructure-costs-across-major-u-s-metropolitan-areas/.

Ownership (1)

Table 1: Charging Station Ownership Breakdown by State[5]

	Charging Station Ownership					
	Local/Municipal Gov	**Private**	Federal Gov	State/Provincial Gov	Jointly	Utility
California	13.3%	**74.3%**	7.3%	3.1%	0.1%	2.0%
New York	4.8%	**90.5%**	1.9%	1.6%	0.1%	1.1%
Florida	4.5%	**81.7%**	2.4%	0%	0%	11.4%
Texas	0.8%	**96.1%**	2.8%	0%	0%	0.4%
Massachusetts	13.1%	**70.2%**	2.3%	11.9%	0%	2.5%
Georgia	3.1%	**92.0%**	4.7%	0%	0%	0.2%

5. Data Retrieved from: "Alternative Fueling Station Locator." *Alternative Fuels Data Center: Alternative Fueling Station Locator*, afdc.energy.gov/stations/#/analyze?fuel=ELEC&ev_levels=all&region=US-GA&status=E&status=T. Accessed 1 Apr. 2024. Table created by team.

Ownership (2)

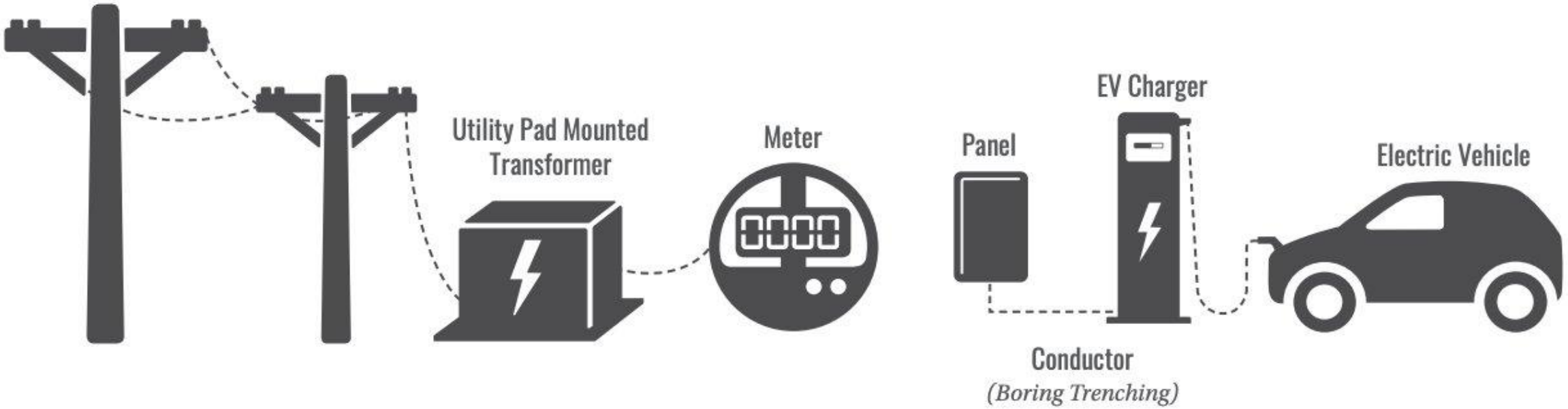

Figure 5: Components of EV Charging Infrastructure[6]

6. Gramlich, Rob, et al. *Serving Customers Best, The Benefits of Competitive Electric Vehicle Charging Stations*, Grid Strategies LLC and EA Consulting, May 2023, gridstrategiesllc.com/wp-content/uploads/2023/05/GS_EV-Paper.pdf.

Ownership (3)

- Public/Government
  - Financed through taxes
  - Money distributed through dedicated initiatives
  - Public private partnership (P3)
  - Driver: transition to clean, zero-emission electric vehicles throughout the state/nation
- Private
  - Private entity investments driven by generating profits
  - Driver: generate profits through charging itself or to attract additional business
- Utility
  - Public utilities invest in the infrastructure & provide electricity for charging
  - Make-Ready, Owner-Operator, & Utility Incentive Programs
  - Driver: better grid management and more consumer influence

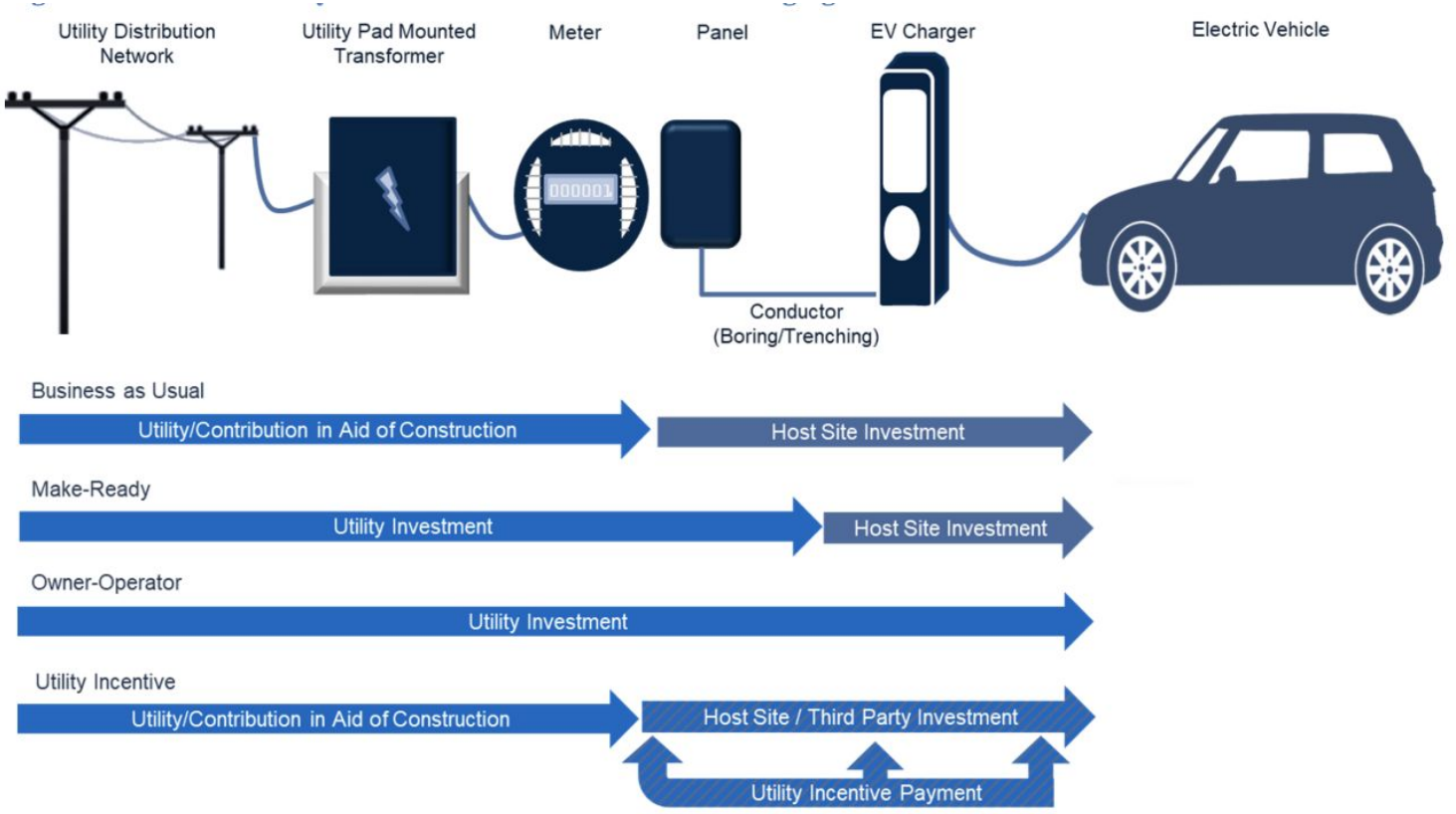

Figure 6: Utility Investment Programs[7]

7. Allen, Paul, et al. *Utility Investment in Electric Vehicle Charging Infrastructure: Key Regulatory Considerations*, M.J. Bradley & Associates and Georgetown Climate Center, Nov. 2017, www.georgetownclimate.org/files/report/GCC-MJBA_Utility-Investment-in-EV-Charging-Infrastructure.pdf.

Ownership (4)

- Key insights:
  - Public utilities are already a monopoly
  - Public utilities subjected to utility ratemaking, not allowing utilities to offer prices that are reactive in a volatile market
  - Private ownership inspires technological innovation and progress.
  - Brand loyalty/customer trust could play a part in reducing range anxiety.

Public Policy (1)

- Georgia[8]:
  - EV Charging Station Tax Credit
    - 10% of cost of station up to $2500
  - EV Commercial Charging Station Rebate – Georgia Power
  - EV Charging Station Rebate – Tennessee Valley Authority
    - Up to $150,000 per DCFC station
  - Peach State Voluntary Emission Reduction Plan[9]
    - AFV Infrastructure Tax Credit
    - Charging & Fueling Infrastructure Discretionary Grant Program
    - National Electric Vehicle Infrastructure (NEVI) Plan
    - Rebuilding American Infrastructure with Sustainability & Equity Discretionary Grant Program
- Related Policies:
  - No statewide EV Subsidy
  - Alternative Fuel & Advanced Vehicle Job Creation Tax Credit
  - HOV & HOT Lane Exemption
  - AFV Conversion Tax Credit

8. “Georgia Laws and Incentives.” *Alternative Fuels Data Center: Georgia Laws and Incentives*, afdc.energy.gov/laws/all?state=GA. Accessed 2 Apr. 2024.

9. “Georgia Climate Pollution Reduction Grant.” *Environmental Protection Division*, 8 Mar. 2024, epd.georgia.gov/georgia-climate-pollution-reduction-grant?utm_campaign=&utm_content=&utm_medium=email&utm_source=govdelivery&utm_term=

Public Policy (2)

- **California's Lead:** California's aggressive policies and investments have yielded a substantial number of projects.
- **Utility Involvement:** Utilities in California are integral to EV expansion, having underwritten extensive infrastructure growth through rebates, with programs that can cover up to 75% of installation costs.
- **Policy Proactivity:** California's CALeVIP program has driven the establishment of EV charging stations by funding 13 projects totaling $223 million.
- **TOU Pricing Incentives:** California's adoption of Time-of-Use pricing for EV charging underscores a successful strategy in reducing electricity costs during off-peak hours.

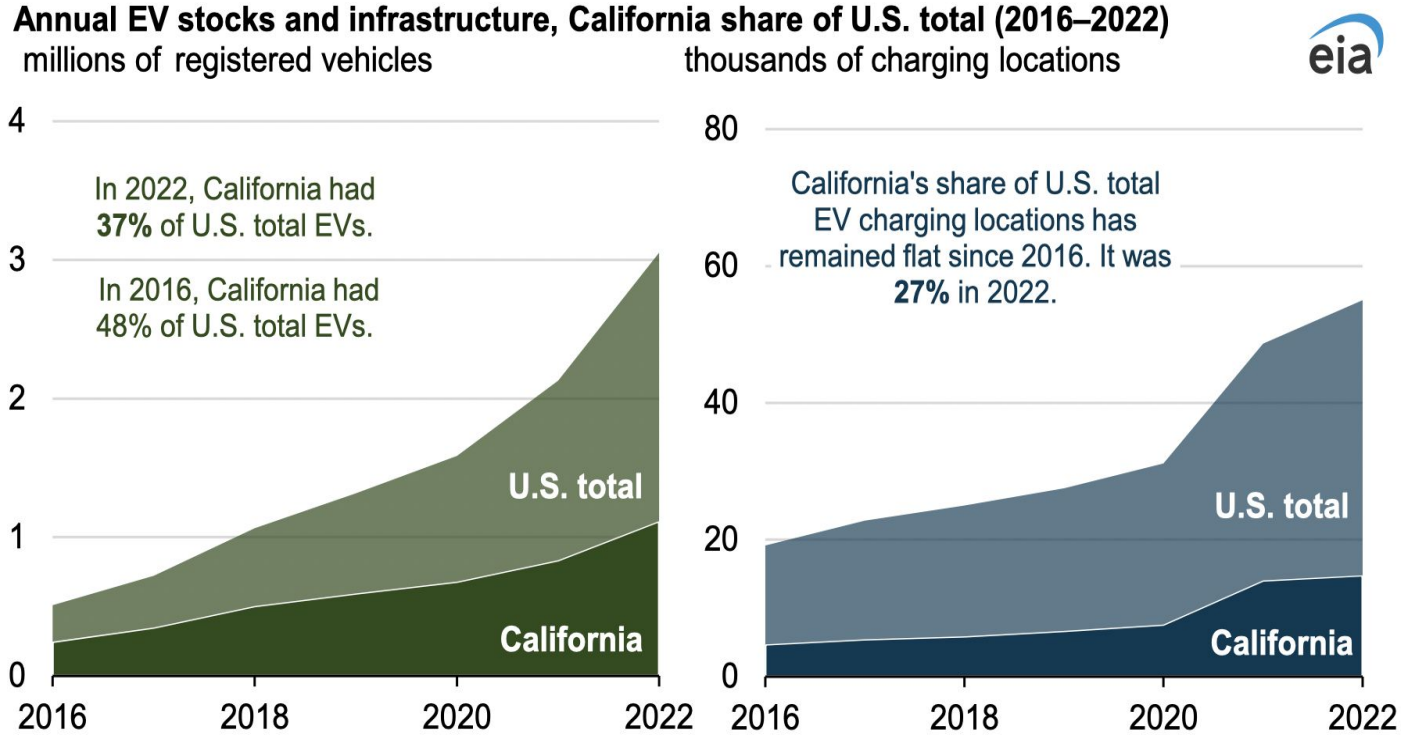

Figure 7: California's Share of EVs and Charging Infrastructure[10]

10. *California Leads the United States in Electric Vehicles and Charging Locations - U.S. Energy Information Administration (EIA)*, US Energy Information Administration, 14 Dec. 2023, www.eia.gov/todayinenergy/detail.php?id=61082.

Public Policy (3)

- **Significance of Ownership:** The predominance of privately-owned EV charging infrastructure in California, supported by state and utility incentives, underscores a key area for Georgia to enhance for EV market growth**.**
- **Simultaneous Growth in EVs and Infrastructure:** California's strategy ensures that incentives encourage growth in both EVs and charging infrastructure
- **Rebates and Tax Credits as Key Factors:** The positive correlation between financial incentives and EV adoption, highlighted by the significant impact of California's rebates and tax credits

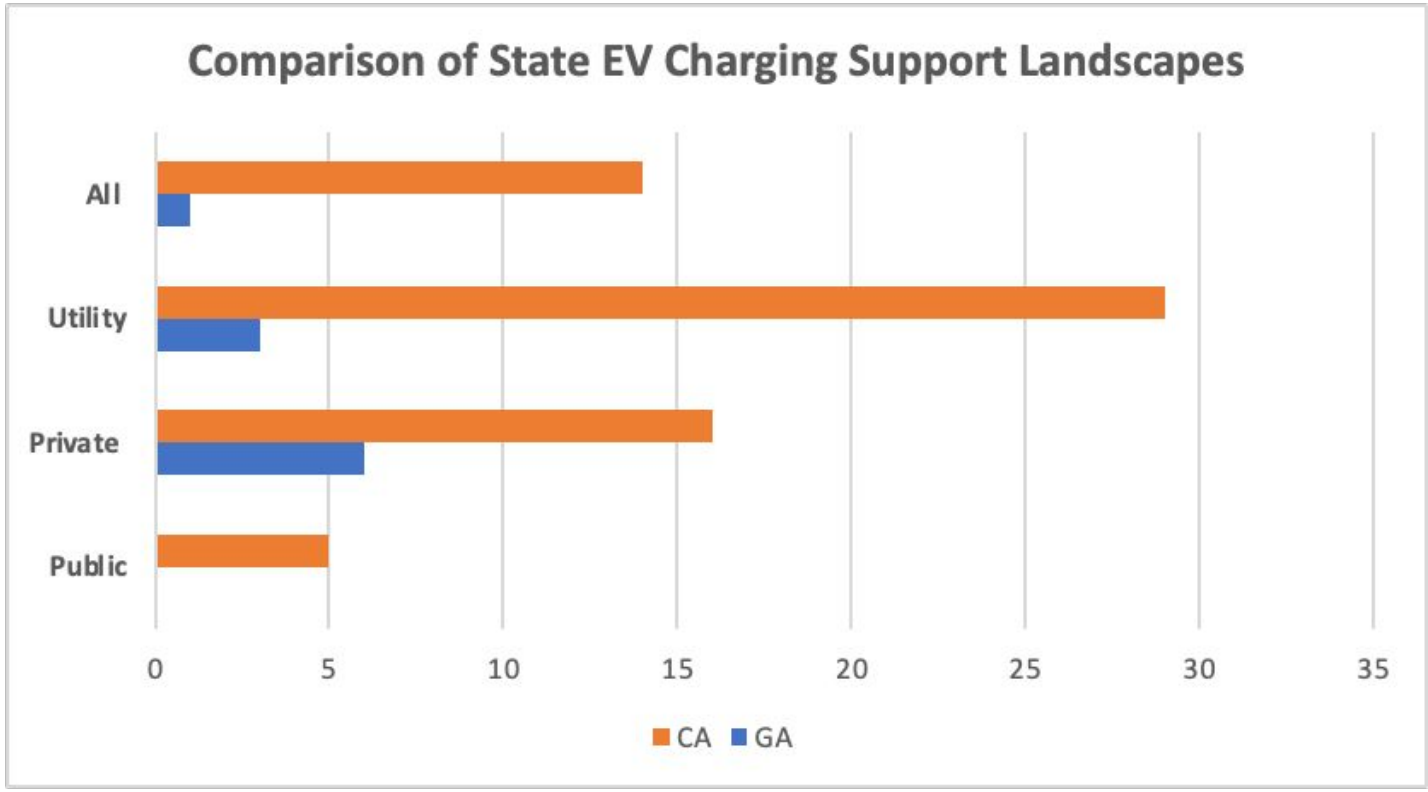

Figure 8: Number of EV Charging Incentives in CA vs. GA[11]

11. Data Retrieved from: "California Laws and Incentives." *Alternative Fuels Data Center: California Laws and Incentives*, afdc.energy.gov/laws/all?state=ca. Acces 2 Apr 2024.
Chart created by team.

Public Policy (4)

- Key insights:
  - "Chicken or the egg" dilemma
  - Incentives for EV charging infrastructure are equally as important as incentives for EV adoption
  - Georgia can learn from leaders like California by generating additional rebates/subsidies/tax credits on a more local level and through other agencies such as the Air Protection Branch of the Georgia Environmental Protection Division
  - **These increased incentives will stimulate privately-owned EV charging infrastructure growth**
    - 0.2% of EV chargers are utility-owned and no additional incentives specifically target utilities

Public Policy (5)

Table 2: EV Adoption Scenarios[12]

Year	# EVs		
	BAU	Additional Incentive Scenario	Increase
2023	110,000	110,000	-
2030	830,000	1,070,000	240,000
2040	2,930,000	3,740,000	810,000
2050	5,040,000	5,870,000	830,000

Table 3: EV Charging Station Installation Scenarios[13]

Year	# EV Charging Stations		
	BAU	Additional Incentive Scenario	Increase
2023	2,048	2,048	-
2030	3,392	3,508	116
2040	5,517	892,398	892,398
2050	7,641	1,707,713	1,700,072

Optimistic Projections with Subsidies: If Georgia implements robust incentives, projections indicate the potential for a dramatic increase in EV adoption underlining the impact of strategic subsidies.

12. Data Retrieved from: Energy Innovation RMI Energy Policy Simulator, energypolicy.solutions/simulator/georgia/en. Accessed 7 April. 2024.
13. Data Retrieved from: "Alternative Fueling Station Locator." *Alternative Fuels Data Center: Alternative Fueling Station Locator*, afdc.energy.gov/stations/#/analyze?fuel=ELEC&ev_levels=all&region=US-GA&status=E&status=T. Accessed 1 Apr. 2024.
Tables created by team.

Global Examples (1)

- **Enhanced Collaboration through Public-Private Partnerships:** Emulating China's strategy, fostering partnerships between public agencies and private enterprises can streamline the rollout of EV charging infrastructure, leveraging mutual strengths for comprehensive network development[14].
- **Utility Leadership in Infrastructure Expansion**: As demonstrated by the State Grid Corporation of China[15], utility companies can significantly influence the growth of EV charging networks by leading infrastructure projects, which supports broader electrification goals.
- **Innovative Utility Involvement:** Utilities can adopt roles beyond energy suppliers, as seen with Electrify America[16], where utility involvement extends to providing advanced charging solutions and integrating renewable energy sources to power charging networks.
- **Strategic Infrastructure Investments:** Similar to the investment strategies of Ionity and Electrify America, utilities can use their capital and expertise to strategically place charging stations, optimizing network coverage and accessibility for EV users.
- **Utility-Driven Technological Advancements:** By incorporating smart grid technologies and offering diverse pricing models, utilities can enhance the efficiency and user experience of EV charging, as exemplified by China's approach to integrating advanced technologies within their EV infrastructure.

14. "Charging Networks." *U.S. Department of Transportation*, 4 May 2023, www.transportation.gov/rural/ev/toolkit/ev-partnership-opportunities/charging-networks.
15. Ruoting, Wang. "State Grid Completes World's Largest Electric Vehicle Charging Network." *State Owned Assets Supervision and Administration Commission of the State Council*, 30 Nov. 2020, en.sasac.gov.cn/2020/11/30/c_6134.htm.
16. "Our Investment Plan." *Electrify America*, www.electrifyamerica.com/our-plan/. Accessed 29 Mar. 2024.

Cost Analysis (1)

Table 4: Levelized Cost of Energy Global Inputs

Input Variables:	**(Per Port - Excludes volume based discounts)**
Infrastructure Lifespan (Years):	30
Yearly Maintenance Cost:	2500
Discount Rate:	0.05
Type of Charger:	DCFC
Charger Output (kW):	50
Charger Net Cost:	20000
Infrastructure Cost:	12000
Utilization Percent:	0.4

Table 5: Levelized Cost of Energy Plan Specific Inputs

City/Plan	Max Rebate (Max = Net Cost)	Min Rebate (Max = Net Cost)	State Electricity Cost Per kWh	Low Cost Land	High Cost Land
Boston	32000	32000	0.2111	100000	500000
California	20000	24000	0.199	200000	560000
New York	19200	19200	0.193	250000	750000
Georgia Private (No Georgia Power)	2500	2500	0.1226	0	0
Make Ready - Georgia Private	2500	2500	0.1226	0	0
Georgia Power to meter	2500	2500	0.1226	0	0
Georgia Power entirely	2500	2500	0.1226	55000	150000

17. Yantao Huang, Kara M. Kockelman, Electric vehicle charging station locations: Elastic demand, station congestion, and network equilibrium, Transportation Research Part D: Transport and Environment, Volume 78, 2020, 102179, ISSN 1361-9209, https://doi.org/10.1016/j.trd.2019.11.008.
18. Electric Choice. (n.d.). *See electricity rates and plans offered in your area:* https://www.electricchoice.com/electricity-prices-by-state/

Cost Analysis (2)

Table 6: Levelized Cost of Energy Calculations

Annualized Capital Cost Low	Annualized Capital Cost High	Annual Energy Output Hours	Levelized Cost Low	Levelized Cost High
11384.00114	37404.57517	3468	0.065651679	0.21571266
18409.55613	42088.2785	3468	0.106168144	0.242723636
21974.37477	54500.09231	3468	0.126726498	0.314302724
6797.874966	6797.874966	3468	0.039203431	0.039203431
2358.114522	2358.114522	3468	0.013599276	0.013599276
5496.846264	5496.846264	3468	0.031700382	0.031700382
11384.00114	11384.00114	3468	0.065651679	0.065651679

Make-Ready Infrastructure Program Provides Lowest Levelized Cost (Utility owns up to meter and private entity owns charging infrastructure)

Cost Analysis (3)

Table 7: Comparison of Utilization Breakeven Points with State Electricity Costs

Utilization:	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65
Utilization Hours:	433.5	867	1300.5	1734	2167.5	2601	3034.5	3468	3901.5	4335	4768.5	5202	5635.5
High Cost Plan:													
Boston	1.72570128	0.86285064	0.57523376	0.43142532	0.34514026	0.28761688	0.24652875	0.21571266	0.19174459	0.17257013	0.15688193	0.14380844	0.13274625
California	1.92978421	0.96489211	0.6432614	0.48244605	0.38595684	0.3216307	0.27568346	0.24122303	0.21442047	0.19297842	0.17543493	0.16081535	0.14844494
New York	2.51442179	1.2572109	0.8381406	0.62860545	0.50288436	0.4190703	0.35920311	0.31430272	0.2793802	0.25144218	0.2285838	0.20953515	0.19341706
Georgia Private (No Georgia	0.31362745	0.15681372	0.10454248	0.07840686	0.06272549	0.05227124	0.04480392	0.03920343	0.03484749	0.03136274	0.02851159	0.02613562	0.02412519
Make Ready - Georgia Priva	0.05252134	0.02626067	0.01750711	0.01313034	0.01050427	0.00875356	0.00750305	0.00656517	0.0058357	0.00525213	0.00477467	0.00437678	0.0040401
Georgia Power to meter	0.25360306	0.12680153	0.08453435	0.06340076	0.05072061	0.04226718	0.03622901	0.03170038	0.02817812	0.02536031	0.02305482	0.02113359	0.01950793
Georgia Power entirely	0.52521343	0.26260672	0.17507114	0.13130336	0.10504269	0.08753557	0.07503049	0.06565168	0.05835705	0.05252134	0.04774668	0.04376779	0.04040103
Low Cost Plan:													
Boston	0.52521343	0.26260672	0.17507114	0.13130336	0.10504269	0.08753557	0.07503049	0.06565168	0.05835705	0.05252134	0.04774668	0.04376779	0.04040103
California	0.86135003	0.43067501	0.28711668	0.21533751	0.17227001	0.14355834	0.12305	0.10766875	0.09570556	0.086135	0.07830455	0.07177917	0.06625769
New York	1.01381198	0.50690599	0.33793733	0.253453	0.2027624	0.16896866	0.14483028	0.1267265	0.11264578	0.1013812	0.09216473	0.08448433	0.07798554
Georgia Private (No Georgia	0.31362745	0.15681372	0.10454248	0.07840686	0.06272549	0.05227124	0.04480392	0.03920343	0.03484749	0.03136274	0.02851159	0.02613562	0.02412519
Make Ready - Georgia Priva	0.05252134	0.02626067	0.01750711	0.01313034	0.01050427	0.00875356	0.00750305	0.00656517	0.0058357	0.00525213	0.00477467	0.00437678	0.0040401
Georgia Power to meter	0.25360306	0.12680153	0.08453435	0.06340076	0.05072061	0.04226718	0.03622901	0.03170038	0.02817812	0.02536031	0.02305482	0.02113359	0.01950793
Georgia Power entirely	0.52521343	0.26260672	0.17507114	0.13130336	0.10504269	0.08753557	0.07503049	0.06565168	0.05835705	0.05252134	0.04774668	0.04376779	0.04040103

19. Bauer, G. (n.d.). *Charging up America: Assessing the growing need for U.S. ...* Charing Up America: Assessing the Growing Need for U.S. Charging Infrastructure Through 2030. https://theicct.org/sites/default/files/publications/charging-up-america-jul2021.pdf
20. Fröde, P., Lee, M., & Sahdev, S. (2023, October 5). *Can public EV fast-charging stations be profitable in the United States?*. McKinsey & Company. https://www.mckinsey.com/features/mckinsey-center-for-future-mobility/our-insights/can-public-ev-fast-charging-stations-be-profitable-in-the-united-states

Cost Analysis (4)

- Key insights:
  - Increasing utilization is key for driving return on investment
  - Make-Ready program that is privately-owned with utility-ownership up to the meter allowed for the lowest price
  - Constant economies of scale[21] because installing additional charging ports at a particular location does not directly generate more revenue
    - Therefore the market is better suited for many small operations of chargers which is more likely for privately-owned infrastructure
  - Types of pricing models:
    - Time-based, energy-based, fixed-rate, & hybrid
    - Explore what is optimal for customers

21. Gramlich, Rob, et al. *Serving Customers Best, The Benefits of Competitive Electric Vehicle Charging Stations*, Grid St.rategies LLC and EA Consulting, May 2023, gridstrategiesllc.com/wp-content/uploads/2023/05/GS_EV-Paper.pdf.

Further Research Areas For Final Report

- Equity impacts
- Applications for commercial fleets (trucking)
- Grid developments
  - Greener Electric Grid
- Effect on job development

Thank you for listening!