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# Electric Vehicles, Infrastructure Electrification and the Urban-Rural Divide

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## I. INTRODUCTION

The nation's transportation system finds itself at an inflection point as environmental policies and technological innovation transforms the automotive industry, bringing personal vehicles and public transit into the modern era and leaving behind the gas guzzling business model that has been the standard since the Ford Model T rolled onto the scene in 1908.[1]

Currently only a small proportion of the vehicle fleet sold worldwide is electrified, but interest is accelerating as more electric models are scheduled to hit the market in the coming years.[2] In 2018, more than two million electric vehicles (EVs) were sold, representing a sixty-four percent increase over EV sales in 2017.[3] While this only accounts for about two percent of all vehicle sales, demand is expected to see explosive growth due to a concerted shift by major auto manufacturers to have more electric vehicle options in their model lineups.[4] As the auto industry prepares to transition to an electric future, infrastructure must change as well.[5] Recent research presents a con-

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1. Camila Domonoske, *As More Electric Cars Arrive, What's the Future for Gas-Powered Engines?*, NAT'L PUB. RADIO (Feb. 16, 2019), https://www.npr.org/2019/02/16/694303169/as-more-electric-cars-arrive-whats-the-future-for-gas-powered-engines.

2. *See* Bill Canis et al., *Vehicle Electrification: Federal and State Issues Affecting Deployment*, CONGRESSIONAL RES. SERV. 1 (2019), https://crsreports.congress.gov/product/pdf/R/R45747.

3. *Id.*

4. Nick Carey & Joseph White, *Ford Plans $11 Billion Investment, 40 Electrified Vehicles by 2022*, REUTERS (Jan. 14, 2018, 4:32 PM), https://www.reuters.com/article/us-autoshow-detroit-ford-motor/ford-plans-11-billion-investment-40-electrified-vehicles-by-2022-idUSKBN1F30YZ; Mike Colias, *GM, Volkswagen Say Goodbye to Hybrid Vehicles*, WALL ST. J. (Aug. 12, 2019, 10:00 AM), https://www.wsj.com/articles/gm-volkswagen-say-goodbye-to-hybrid-vehicles-11565602200 ("GM plans to launch 20 fully electric vehicles worldwide in the next four years." "Auto companies are spending $225 billion to develop more than 200 new plug-in vehicles through 2023."); Edward Taylor, *Volkswagen Says Last Generation of Combustion Engines to be Launched in 2026*, REUTERS (Dec. 4, 2018), https://www.reuters.com/article/us-volkswagen-emissions-combustion/volkswagen-says-last-generation-of-combustion-engines-to-be-launched-in-2026-idUSKBN1O32O6 (VW to focus on electric cars).

5. *See* Amanda Myers, *How States Can Overcome The Looming Electric Vehicle Charging Infrastructure Gap*, FORBES (Apr. 3, 2019, 07:30 AM), http://

cerning image of preparedness, with "88 of the top 100 U.S. metropolitan areas looking at a charging infrastructure gap and an inability to support projected 2025 demand."[6] This major shift in both the electricity sector and transportation industry and the looming gap in preparation has spurred the development of a broad range of policies at every level of government in regard to EVs, EV charging stations, public utility investment, and sale of electricity for EV charging.[7] One of the primary issues facing policy makers is the prevalence of "range anxiety."[8] Range anxiety, the fear that the battery will run out before the car reaches its destination, stems from a lack of charging infrastructure, a concern that disproportionately affects rural America.[9] This note will focus on the narrower issue of the impending rural-urban infrastructure divide in EV charging, something we have seen before in the implementation of broadband and telecommunication infrastructure in recent years.[10] In analyzing the urban-rural divide, this note will (1) provide some background on electric vehicle charging technologies; (2) analyze the most advanced EV market globally in Norway and the policies and programs that the Norwegian government implemented to claim their spot as the industry leader; and (3) finally look at the current state of implementation in the United States.

## II. ELECTRIC VEHICLE CHARGING

The EV market consists of three main categories of EVs: Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Hybrid Electric Vehicles (HEVs).[11] We are focused primarily on BEVs for the pur-

www.forbes.com/sites/energyinnovation/2019/04/03/how-states-can-overcome-the-looming-electric-vehicle-charging-infrastructure-gap/.

6. *Id.*

7. Alexandra B. Klass, *Public Utilities and Transportation Electrification*, 104 Iowa L. Rev. 545, 547 (2019).

8. Bilegt Baatar et al., Preparing Rural America for the Electric Vehicle Revolution 9 (2019), https://epm.ucdavis.edu/sites/g/files/dgvnsk296/files/inline-files/Preparing%20Rural%20America%20for%20the%20Electric%20Vehicle%20Revolution.pdf.

9. *Id.*

10. *See* Christiana K. McFarland, Bridging the Urban-Rural Economic Divide 4 (2018), https://www.nlc.org/sites/default/files/2018-03/nlc-bridging-the-urban-rural-divide.pdf; *Government Support Key to Bridging Digital Divide in Rural America*, USTELECOM Media (July 11, 2018), https://www.ustelecom.org/government-support-key-to-bridging-digital-divide-in-rural-america/ [hereinafter *Government Support Key*]; Darrell M. West & Jack Karsten, *Rural and Urban America Divided by Broadband Access*, Brookings Inst. (July 18, 2016), https://www.brookings.edu/blog/techtank/2016/07/18/rural-and-urban-america-divided-by-broadband-access/.

11. *See* Baatar et al., *supra* note 8, at 6.

poses of this note. Further, there are three types of EV charging units: Level 1, Level 2, and Level 3 DC fast chargers.[12] A Level 1 charger is simply "a standard home electrical outlet, through a basic 120-volt plug, requiring no additional equipment."[13] On the other hand, a Level 2 charger can be plugged in at a home, garage, or parking lot and is capable of handling 240 volts and delivering a complete charge within several hours.[14] Finally, Level 3 chargers, or DC fast chargers, can charge an EV in as little as thirty minutes with new technology being developed that could provide DC fast chargers that cut charging time to a mere ten minutes, which would provide a favorable comparison to a quick stop at the local gas station.[15] Even with the advantage of shorter charging times, DC fast charging stations made up a mere 18.1 percent of the total market in 2017 due to their high cost of implementation.[16] DC fast chargers cost roughly $4,000–$51,000 per unit compared to $0–$3,000 to install a Level 1 unit or $600–$12,700 for Level 2.[17] Unlike Level 1 and Level 2 chargers, DC fast chargers also face the obstacle of not being universal.[18] Most experts do not consider the lack of a national standard for DC fast charging to be a barrier to EV adoption, as a majority of EV charging takes place at home using Level 1 and 2 chargers.[19] Further, adaptors are available to allow use of most DC fast chargers and charging stations are able to have multiple plugs and connectors in the same manner as gas pumps having diesel, ethanol, and gasoline hoses.[20]

## III. NORWAY: THE ULTIMATE CASE STUDY AND EV LEADER

Behind a substantial package of incentives promoting the adoption of zero-emission vehicles (electric or hydrogen), Norway is leading the way in the transition to EVs in transport.[21] First and foremost, the Norwegian Parliament set a national target for one hundred percent of new vehicle sales to be

12. *Id.* at 8.

13. Klass, *supra* note 7, at 559.

14. *Id.*

15. *Id.*

16. *Id.* at 560.

17. BAATAR ET AL., *supra* note 8, at 8.

18. Klass, *supra* note 7, at 560 ("There are two competing formats: CHAdeMO and CCS; Tesla also has its own format for high-speed charging, the Supercharger.").

19. Anders Hove & Daavid Sandalow, *Electric Vehicle Charging in China and the United States*, COLUM. CTR. ON GLOBAL ENERGY POL'Y 37 (Feb. 2019).

20. *Id.*

21. *Norwegian EV Policy*, NORSK ELBILFORENING, https://elbil.no/english/norwegian-ev-policy/ (last visited Aug. 21, 2020).

zero emissions vehicles by 2025.[22] This ambitious path toward a zero-emission transport sector traces its roots back to 1990 when the first incentives for zero-emission cars were introduced.[23] Since 1990, the Norwegian Parliament incentive programs have included: (1) exemption from purchase/import taxes; (2) no annual road tax; (3) no toll road or ferry charges; (4) free municipal parking; (5) access to bus lanes; and (6) company car tax reductions.[24] Thanks to the combination of these longstanding incentives and ambitious zero emission goals, over one-third of all European EV sales are to Norwegian customers.[25] Compared to the United States, where the top-selling vehicles are all full size pickups, Norway's top-selling car is the fully electric Tesla Model 3.[26] Further, earlier this year, for the first time, EVs outsold traditional gasoline powered vehicles as almost sixty percent of vehicle sales in March 2019 were entirely electric.[27]

In addition to incentivizing the purchase of EVs, the Norwegian government also took steps to support the development of the necessary charging infrastructure.[28] Norwegian charging infrastructure programs were implemented in three primary phases: normal charging development in 2009–2010, fast charging development from 2010–2014, and in 2015, the government launched a program to finance the establishment of at least two multi-standard fast charging stations every fifty kilometers.[29]

Analyzing each phase in turn, the first program arose as a part of a financial stimulus following the Great Recession of 2008.[30] The program funded one hundred percent of installation costs up to 30,000 NOK or approximately $3,300 per charging point.[31] The program resulted in roughly

22. *Id.*

23. Erik Lorentzen et al., *Charging Infrastructure Experience in Norway – The World's Most Advanced EV Market* 3 (EVS30 Symp., Oct. 9–11, 2017), https://elbil.no/wp-content/uploads/2016/08/EVS30-Charging-infrastrucure-experiences-in-Norway-paper.pdf.

24. *Norwegian EV Policy*, *supra* note 21.

25. Brett Berk, *Norway Invites You to Explore Its Electric Vehicle Paradise*, WIRED (July 6, 2019, 8:00 AM), https://www.wired.com/story/norway-electric-vehicles-tourism/.

26. *Id.*

27. David Nikel, *Electric Cars: Why Little Norway Leads The World In EV Usage*, FORBES (June 18, 2019, 12:47 PM), https://www.forbes.com/sites/davidnikel/2019/06/18/electric-cars-why-little-norway-leads-the-world-in-ev-usage/#34321a1d13e3.

28. Lorentzen et al., *supra* note 23, at 3.

29. *Id.*

30. *Id.*

31. *Id.*

NOK 50 million funding and 1,800 charging points.[32] The downside to early adoption can be clearly seen through the results of this first phase of incentives, as the Schuko outlets (normal household outlets) installed have largely proven to be ill-suited to long term use with some already taken out of service due to high maintenance costs.[33] Further, most new and upgraded stations are Level 2 outlets.[34] In the second phase, the development of fast charging came with a very similar support scheme with up to one hundred percent of installation costs covered and ultimately a total cost of around NOK 50 million.[35] The Norwegian government did place a few increased demands on funding requiring charging stations to be "prepared for payment solutions, with a deadline for the payment system to be operational."[36] Finally, in the most recent phase, Enova, the Norwegian government enterprise focused on environmentally clean production and consumption of energy, announced the goal of implementing EV fast charging stations on all main roads at increments of fifty kilometers.[37] In an effort to reduce range anxiety and the risk of charging stations being out of service, all charging locations are required to have "at least two multi standard fast chargers (CHAdeMO and CCS) in addition to two 22 kW Type 2 charging points."[38] With only a few exceptions, the implementation has been successful, resulting in charging stations on all major roads across Norway.[39] Arguably the best sign that the government programs and incentives have worked (outside of the continued rise in EV sales) can be seen in the growing trend that fast charging operators are now building stations without government support.[40] Further, public surveys from 2014, 2016, and 2017 demonstrate a trend of increased usage of public fast chargers and a decreased usage of publicly accessible slow chargers.[41] Most charging still occurs with the use of private home chargers or slow charging stations located at workplaces.[42] This preference for at home charging and less frequent use of fast charging flows logically from normal vehicle usage patterns that see the typical Norwegian driver

32. *Id.*

33. *Id.*

34. Lorentzen et al., *supra* note 23, at 3.

35. *Id.*

36. *Id.*

37. *Id.* at 4.

38. *Id.*

39. *Norwegian EV Policy*, *supra* note 21.

40. Lorentzen et al., *supra* note 23, at 4.

41. Int'l Energy Agency, Nordic EV Outlook 2018 Insights from Leaders in Electric Mobility 42 (2018), https://www.nordicenergy.org/wp-content/uploads/2018/05/NordicEVOutlook2018.pdf.

42. *Id.*

travel twenty to forty kilometers each day.[43] Thus, a reliable fast charging network is primarily important for planning out long distance trips and for consumers outside major urban areas.[44]

## IV. LEGAL BACKGROUND IN THE UNITED STATES

One of the major concerns restricting the sale of EVs is the prevalence of range anxiety in the customer base.[45] This anxiety demonstrates one of the key policy issues states must grapple with in the development and implementation of EV infrastructure: the growing rural versus urban infrastructure gap and the economic effects it could have.[46] This note will investigate this in two parts, first looking at infrastructure divides in past technologies and then turning to EV charging and the current policies being implemented at the state and regional levels to avoid a rural-urban divide in EV infrastructure.

### A. United States: A History of Urban-Rural Infrastructure Divide

This is not the first time that Americans have faced a stark divide in infrastructure development.[47] Most recently, the United States has been faced with what has been coined the "digital divide," or the rural-urban disparity in broadband access.[48] Overall, rural communities have thirty-seven percent more residents without broadband access, as compared to their urban counterparts.[49] On the surface this may not seem like a problem, as the internet appears to be a luxury primarily used for video games and video streaming, but in reality the digital divide limits rural residents from accessing online education, training, and job resources which in turn stunts a community's capacity to grow, attract business, and retain residents.[50] In response originally to an earlier gap in telecommunication access, the Federal Communication Commission (FCC) established the goal of universal service and made it a cornerstone of the Communications Act of 1934.[51] In the Telecommunications Act of 1996, the FCC expanded their goal of universal service to include access to high-speed internet for all consumers at affordable rates.[52] In 2007, the FCC took it a step further and redefined universal service to in-

43. *Id.* at 41.

44. *See, e.g.*, *id.*

45. Klass, *supra* note 7, at 561.

46. *See* McFarland, *supra* note 10, at 4.

47. West & Karsten, *supra* note 10.

48. McFarland, *supra* note 10, at 10.

49. *Id.* at 11.

50. *Id.* at 10.

51. *Universal Service*, Fed. Commc'ns Comm'n, https://www.fcc.gov/general/universal-service (last updated Aug. 21, 2020).

52. *Id.*

clude broadband.[53] Knowing there is a high barrier to entry associated with the initial costs of having to lay fiber or cable for new areas and markets, the FCC has worked to systematically mitigate up-front costs through subsidies and what is called the Connect America Fund.[54] The FCC has also created other programs as a part of its Universal Service Fund, including: (1) Lifeline, a program for low-income customers; (2) E-Rate, a program to help schools and libraries obtain affordable broadband access; and (3) the Rural Health Care Program to better provide the necessary telecommunications and broadband services needed by health care providers.[55]

Focusing on the E-Rate Program as a guide, more than 21 million students were still without adequate internet as recently as 2015.[56] However, in 2014, the FCC took steps to modernize the E-rate program and established three connectivity standards.[57] The connectivity standards specifically state goals of:

> (1) A fiber connection to every school, so that school bandwidth can reliably grow to meet the demands of digital learning over time.
> (2) Wi-Fi in every classroom, to support digital learning programs that require every student to have a device.
> (3) 100 kbps per student of Internet access, the minimum recommended bandwidth to enable digital learning in the classroom. Starting in 2018, the FCC raised this standard to 1 Mbps per student—the amount of bandwidth needed to support digital learning in every classroom, every day.[58]

These standards have delivered impressive results with over 22,000 schools since 2013 having been connected to the infrastructure required for digital learning and ninety-nine percent of America's K-12 public schools now having the fiber-optic connections needed to meet future connectivity needs.[59] Thanks to the joint efforts of school districts, service providers, and state and federal policymakers, the nation now has the foundation required by the continuing growth of digital learning in our classrooms and a guide for the suc-

53. West & Karsten, *supra* note 10.

54. *Id.*

55. *Universal Service*, *supra* note 51.

56. Benjamin Herold, *School Internet Access Shows Big Progress, New Report Shows*, EDUC. WK. (Dec. 1, 2015), https://www.edweek.org/ew/articles/2015/12/02/school-internet-access-shows-big-progress-new.html.

57. EDUC. SUPERHIGHWAY, 2019 STATE OF THE STATES 6 (2019), https://s3-us-west-1.amazonaws.com/esh-sots-pdfs/2019%20State%20of%20the%20States.pdf.

58. *Id.*

59. *Id.* at 7.

cessful implementation of national infrastructure standards.[60] In order to avoid a continued or reemerging divide, the FCC must continue to expand access alongside advances in technology rather than after the fact in order to satisfy increased demands for faster internet with infrastructure growth.[61]

Learning from past mistakes and taking advantage of an unforeseen windfall stemming from Volkswagen's emissions scandal settlement, there are a couple of initiatives in place to support the implementation of state programs.[62] First, the Federal Highway Administration (FHWA) is working to establish a national network of alternative fuel corridors.[63] The intent of the program is to support multi-state and regional cooperation and to promote public interest through uniformity and signage.[64] The program has seen seventy-nine nominations from forty-six states and the District of Columbia over the course of the first three rounds in 2016, 2017, and 2018, some of which are detailed further in the next section.[65] Second, Volkswagen has created Electrify America as a condition of its settlement with federal regulators following its diesel emissions cheating scandal.[66] The subsidiary will pour $2 billion dollars over a ten-year period into developing a nationwide infrastructure of accessible fast chargers.[67] A number of the programs discussed in the next section are funded at least partially by Electrify America.[68] The $2 billion will be invested in phases allowing for a staggered roll out and the flexibility to adjust to the evolving EV landscape.[69]

### B. Rural EV Charging Implementation: Regional & State Programs

California has taken the lead at the state level, establishing not just Low Emission Vehicle (LEV) standards, but pushing the bar higher by establish-

60. *Id.* at 6.

61. West & Karsten, *supra* note 10.

62. *See Alternative Fuel Corridors*, U.S. DEP'T OF TRANSP., FED. HIGHWAY ADMIN., https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/ (last updated Apr. 24, 2019); Urvaksh Karkaria, *VW's Charge: Electrify America*, AUTOMOTIVE NEWS (Oct. 28, 2018, 1:00 AM), https://www.autonews.com/article/20181028/OEM06/181029805/vw-s-charge-electrify-america.

63. *Alternative Fuel Corridors*, *supra* note 62.

64. *Id.*

65. *Id.*

66. Karkaria, *supra* note 62.

67. *Our Investment Plan*, ELECTRIFY AM., https://www.electrifyamerica.com/our-plan (last visited Aug. 21, 2020).

68. *Phase II of Nevada Electric Highwat Kicked-Off*, NEV. GOVERNOR'S OFF. OF ENERGY (May 30, 2017), http://energy.nv.gov/Media/Press_Releases/2017/Phase_II_of_Nevada_Electric_Highway_Kicked-off/.

69. Karkaria, *supra* note 62.

ing The Zero Emission Vehicle Program (ZEV).[70] ZEV is a California state regulation requiring auto manufacturers to sell a minimum number of electric vehicles proportional to their total vehicle sales in the state.[71] Nine states have followed suit and adopted both the ZEV and LEV programs of California by passing regulation for EV implementation.[72] Even with state policies encouraging EV adoption, low utilization rates and the high capital costs associated with EV charging installation have made it difficult to attract outside capital investment on the infrastructure front.[73]

With the important role rural charging infrastructure plays in easing range anxiety and encouraging adoption of EVs, a lack of capital investment has led to a number of state and regional development programs.[74] Current policies and programs encourage investment through grants designed to cut down on installation costs, an emphasis on installing stations in strategic "high usage" locations, regional planning and the establishment of EV corridors along major interstates and in rural city centers.[75] These programs include the Nevada Electric Highway, Great River Energy Revolt Program, REV West and the Fresno County Solar Powered EV Charging Program.[76] REV West and Nevada Electric Highway both represent one program category in the electrification of major regional corridors.[77]

The Nevada Electric Highway program will place charging stations at strategic locations no more than fifty miles apart.[78] The program began by installing chargers along I-95 connecting Reno and Las Vegas and the com-

70. *See* BAATAR ET AL., *supra* note 8, at 13–14.

71. *Id.* at 14.

72. *Id.*

73. *Id.* at 19.

74. *See id.* at 14–16, 19.

75. *See id.* at 14.

76. *Nevada Electric Highway*, NEV. GOVERNOR'S OFF. OF ENERGY, http://energy.nv.gov/Programs/Nevada_Electric_Highway/ (last visited Aug. 21, 2020); GREAT RIVER ENERGY, SHAPING OUR FUTURE 2017 ANNUAL REPORT 6 (2017), https://greatriverenergy.com/wp-content/uploads/2018/04/GRE20170019-2017_Annual_Report_r13_Fv5_FINAL_TOC.pdf; *Regional Electric Vehicle (REV) West Plan*, U.S. DEP'T OF ENERGY, https://afdc.energy.gov/laws/11875 (last visited Aug. 21, 2020); *Solar Powered Electric Vehicle Chargers Deployed in 13 Rural Cities in Fresno County*, CALSTART (May 24, 2017), https://calstart.org/solar-powered-electric-vehicle-chargers-deployed/.

77. *Nevada Further Expands Electric Vehicle Infrastrcutre*, NEVADA DOT (Mar. 8, 2018 12:07 PM), https://www.nevadadot.com/Home/Components/News/News/3506/395.

78. *Nevada Electric Highway*, NVENERGY, https://www.nvenergy.com/cleanenergy/electric-vehicles/evhighway (last visited Aug. 21, 2020).

plete program will deploy chargers along all remaining Nevada highways.[79] Programs such as Nevada's not only encourage customers to purchase EVs, it should lead to environmental benefits and boost rural economies by encouraging regional tourism.[80] To encourage adoption and promote the program, Nevada's state-built charging stations are operated free of cost over their first five years.[81] The Regional Electric Vehicle Plan for the West (REV West) represents a broader approach to the problem, as Wyoming joined Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah in signing a memorandum of understanding to create what they have termed the Intermountain West Electric Vehicle Corridor.[82] The corridor through collaboration will ease anxiety and allow consumers to travel across the major interstates of all signatory states.[83] By taking a collaborative approach, EV charging best practices can be identified and implemented quickly.[84]

The Fresno County Solar Powered EV Charging Program and Great River Energy Revolt Program provide examples of a more regional coverage approach.[85] The Fresno Program is a partnership between CALSTART (a national non-profit), the Fresno County Rural Transit Agency, and the San Joaquin Valley Air Pollution Control District.[86] The program provides solar powered EV charging stations in thirteen rural incorporated cities in Fresno County, becoming the first program to link all rural cities in a single county.[87] Perhaps most importantly, twelve of the thirteen units are placed in disadvantaged communities where the solar nature of the chargers means they provide no-cost charging making EV ownership more obtainable.[88]

79. *Nevada Electric Highway*, *supra* note 76.

80. LAUREN ROSENBLATT & MARIE K. STEELE, ELECTRIFYING: NEVADA'S 21ST – CENTURY TRANSPORTATION SYSTEM 7 (2019), https://www.leg.state.nv.us/Session/80th2019/Exhibits/Assembly/GI/AGI70H.pdf.

81. NV ENERGY, NEVADA ELECTRONIC HIGHWAY 10 (2016), https://www.leg.state.nv.us/App/InterimCommittee/REL/Document/2634.

82. *Regional Electric Vehicle (REV) West Plan*, *supra* note 76.

83. *See id.*

84. *See id.*; BAATAR ET AL., *supra* note 8, at 4; DALE HALL & NIC LUTSEY, EMERGING BEST PRACTICES FOR ELECTRIC VEHICLE CHARGING INFRESTRUCTURE iv (2017), https://theicct.org/sites/default/files/publications/EV-charging-best-practices_ICCTwhite-paper_04102017_vF.pdf.

85. *See* BAATAR ET AL., *supra* note 8, at 14–15.

86. *Solar Powered Electric Vehicle Chargers Deployed in 13 Rural Cities in Fresno County*, *supra* note 76.

87. *Id.*

88. *Id.*

## V. CONCLUSION

Currently, EVs make up only a sliver of the overall automotive market and total vehicles on the road.[89] With policies currently in place both on the environmental front motivating manufacturers to adapt and innovate and on the consumer side in the form of financial incentives and tax cuts, EV sales and usage are set to see a trend of strong growth in coming years.[90] While policies are in place to encourage the adoption of EVs, policies are also needed on the infrastructure side, as range anxiety rooted in a lack of reliable infrastructure will ultimately put a ceiling on EV growth choking out any gains before a foundation is even established.[91]

The growth of charging infrastructure in urban areas is already underway, but development in rural America will ultimately play a major role in the widespread adoption of EVs.[92] To truly combat range anxiety and avoid leaving a quarter of Americans behind, the network of EV charging stations must reach past the city limits and into the heartland.[93] With increased public awareness, financial incentives encouraging EV purchases, and the impending release of EV trucks and SUVs from established players like Ford and industry newcomers, like Rivian, the sole remaining piece of the EV puzzle would appear to be the implementation of a reliable national charging grid.[94] The policy foundation is in place thanks to the FHWA's alternative fuel corridor initiative and the initial influx of funding for state programs coming from the Volkswagen settlement and the creation of Electrify America.[95] These programs being implemented demonstrate a level of foresight and intentionality, but as the telecommunication industry has made evident over the last couple of decades, even established programs and the best laid plans can struggle to keep up with the technologies continual march forward.[96] Thus, there is still a long way to go before the EV charging network in the United States can reach the levels seen in more developed markets as demonstrated

89. *Electric Car Owners, Brace for a Jolt. A Chicago Democrat Wants to Charge You $1,000 – Every Year*, CHI. TRIB. (May 10, 2019), https://www.chicagotribune.com/opinion/editorials/ct-edit-electric-vehicles-registration-fee-20190510-story.html. *See* Klass, *supra* note 7.

90. Canis et. al, *supra* note 2, at 1, 8, 14.

91. *See id.* at 3; EDISON ELEC. INST., ACCELERATING ELECTRIC VEHICLE ADOPTION 2, 5 (2018), https://www.eei.org/issuesandpolicy/electrictransportation/Documents/Accelerating_EV_Adoption_final_Feb2018.pdf.

92. BAATAR ET AL., *supra* note 8, at 6, 8.

93. *See id.* at 9.

94. *Id.* at 10.

95. *Id.* at 12; Matt Bearzotti, *Volkswagen Settlement and Electric Vehicles*, SOLAR UNITED NEIGHBORS (Aug. 24, 2018), https://www.solarunitedneighbors.org/news/volkswagen-settlement-electric-vehicles/.

96. *See Government Support Key*, *supra* note 10.

by market leading Norway, and the FWHA should take note of the lessons learned by the FCC and not rest on their laurels.[97] With continued emphasis on state and regional implementation, the U.S. market could foresee a near future outcome of not only increased EV production and sales, but a self-sufficient EV charging marketplace as is just now being achieved in Norway.[98]

97. *See generally* Lorentzen et al., *supra* note 23; *see also* West & Karsten, *supra* note 10.

98. Lorentzen et al., *supra* note 23, at 2.