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**BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI**

In the Matter of the Application of Union)
Electric Company d/b/a Ameren Missouri for) **File No. ET-2016-0246**
Approval of a Tariff Setting a Rate for)
Electric Vehicle Charging Stations)

**SURREBUTTAL TESTIMONY OF
NOAH GARCIA
ON BEHALF OF
NATURAL RESOURCES DEFENSE COUNCIL**

December 16, 2016

Table of Contents

Introduction and Qualifications.....	3
Purpose of Surrebuttal Testimony.....	4
Relationship between Electric Vehicles and Electric Vehicle Charging Stations.....	4
Status of Electric Vehicle Charging Infrastructure in Missouri.....	7
Public Policy Rationale for Utility Deployment of EV Charging Stations.....	12
Ameren Missouri Charging Station Procurement.....	21
Ameren Missouri Tariff Proposal.....	24
Conclusion.....	28
Appendix 1: Other Critical Electric Vehicle Charging Station Market Segments..	29

1 **Introduction and Qualifications**

2
3 **Q. Please state your name and address.**

4 A. My name is Noah Garcia and my business address is 20 North Wacker Drive, Chicago,
5 Illinois 60606.

6
7 **Q. What organization are you employed at and what is your position?**

8 A. I work at the Natural Resources Defense Council (NRDC) as a Schneider Fellow. NRDC
9 is a non-profit environmental organization with more than two million members and
10 online activists. NRDC uses law, science, and the support of its members to ensure the
11 rights of all people to clean air, clean water, and healthy communities. One of NRDC's
12 top priorities is to reduce transportation sector air pollutants.

13
14 **Q. Please describe your educational background and work experience.**

15 A. My educational experience includes a Bachelor of Arts in International Relations with a
16 concentration in economics from Stanford University and a Master of Arts in Public
17 Policy from Stanford University with a concentration in energy and environmental
18 policy.

19
20 During my time at Stanford, I was a research assistant at the Steyer-Taylor Center for
21 Energy Policy and Finance and analyzed the role of policy and market drivers behind
22 clean energy development. At NRDC, I have advocated and provided support for state-
23 based clean energy policies in various legislative and regulatory environments in Illinois.
24 I have also advocated for and collaborated with partners on utility-driven transportation
25 electrification programs in several jurisdictions in the Midwest. In Missouri, I
26 participated in the *Working Case Regarding Electric Vehicle Charging Facilities* (File
27 No. EW-2016-0123), providing substantive comments and materials on the necessity of
28 charging stations to the development of the plug-in electric vehicle (PEV) market and
29 how utilities could beneficially engage in this space. As part of the docketed proceeding,
30 I presented at the Missouri Public Service Commission's EV workshop on May 25, 2016;
31 along with Sierra Club and the Electric Power Research Institute, we expanded on the

1 environmental benefits of vehicle electrification and the need for strategic deployment of
2 charging infrastructure to realize these benefits.

3
4 **Purpose of Surrebuttal Testimony**

5
6 **Q. What is the purpose of your direct testimony in this proceeding?**

7 A. The purpose of this testimony is to respond to rebuttal testimony offered by the parties in
8 this case by expanding on the following topics:

- 9
10 1) The relationship between electric vehicles and electric vehicle charging stations;
11 2) The current status of electric vehicle charging infrastructure in Missouri;
12 3) The public policy rationale for utility deployment of electric vehicle charging
13 stations;
14 4) Ameren Missouri's charging station procurement for its pilot proposal;
15 5) Ameren Missouri's tariff proposal.

16
17 For the reasons described in the following testimony, I recommend the Commission
18 approve the revised tariff Ameren Missouri filed on October 7, 2016.¹

19
20 **Relationship between Electric Vehicles and Electric Vehicle Charging Stations**

21
22 **Q. Please describe the current status of national transportation sector greenhouse gas
23 and criteria pollutant emissions.**

24 A. In the summer of 2016, the US Energy Information Administration found that for the first
25 time since 1979, carbon emissions from the transportation sector surpassed those from
26 the power sector in the US and increased to 1,876 million metric tons (MMt).² Light-duty
27 vehicles (LDVs) are responsible for over half of the carbon emissions associated with the

¹ Tariff Revision (YE-2017-0052), File No. ET-2016-0246, Filed October 7, 2016

² Doug Vine, "Transportation Emissions Roll Over Power Sector Emissions," Center for Climate and Energy Solutions, <http://www.c2es.org/blog/vined/transportation-emissions-roll-over-power-sector-emissions> (accessed November 22, 2016)

1 transportation sector.³ Moreover, these LDVs are responsible for elevated levels of
2 harmful criteria pollutants in many urban areas. It is estimated over 50,000 Americans in
3 the lower 48 states die prematurely from traffic pollution every year, which is over one-
4 and-a-half times as many as die in traffic accidents.⁴ Any comprehensive effort to
5 beneficially reduce carbon emissions and criteria pollutant emissions pursuant to the
6 Clean Air Act must consider how to effectively decarbonize the domestic vehicle fleet.

7
8 **Q. Does transportation electrification play a significant role in achieving carbon**
9 **dioxide reductions?**

10 A. Numerous independent studies have come to the same conclusion: reducing greenhouse
11 gas emissions to 80 percent below 1990 levels by 2050 will require a dramatic shift to
12 electric-drive vehicles powered by zero-emitting energy sources.⁵ Because just 15 to 17
13 million passenger vehicles are sold each year in the U.S., it will take decades to transform
14 the existing U.S. stock of 250 million vehicles. To meet long-term global warming
15 pollution reduction targets, studies have estimated that PEVs will need to account for 40
16 percent or more of new vehicle sales by 2030.⁶

17
18 Regrettably, the transportation policy space rivals the traditional utility policy world in its
19 use of acronyms. **Error! Reference source not found.** harmonizes the categories of
20 vehicle technology described in sources used in these comments.

³ “Sources of Carbon Dioxide Emissions,” U.S. Environmental Protection Agency (EPA),
<https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#transportation>

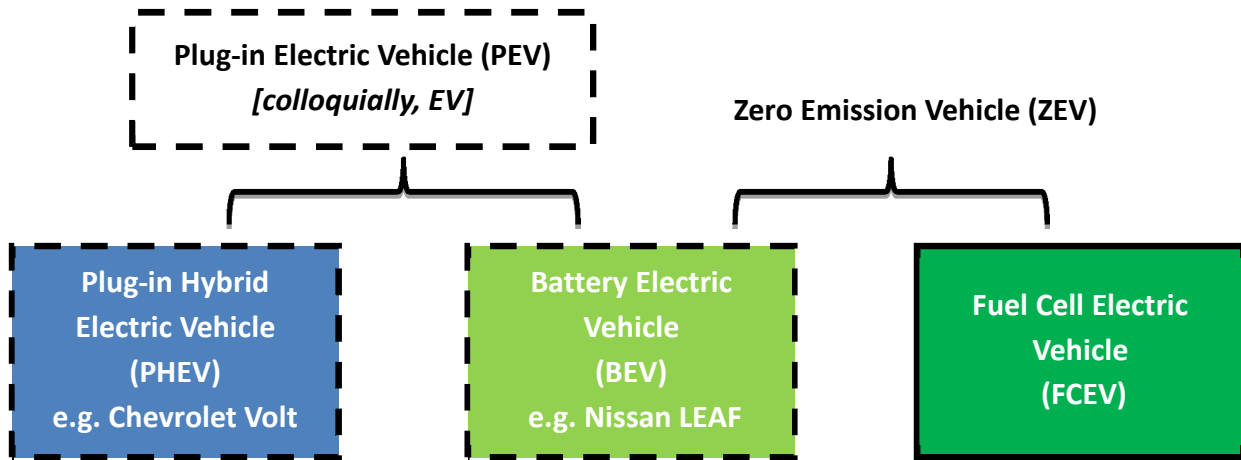
⁴ Fabio Caiazzo et al., *Air pollution and early deaths in the United States*, Atmospheric Environment, 2013; National Highway Traffic Safety Administration, Fatality Analysis Reporting System (FARS) Encyclopedia.

⁵ California Council on Science and Technology, *California’s Energy Future*, May 2011; Williams et al., *The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity, Science*, January, 2012; Joshua Cunningham (Air Resources Board), *Achieving an 80% GHG Reduction by 2050 in California’s Passenger Vehicle Fleet*, SAE International Journal of Passenger Cars, December, 2010; Max Wei et al., *Deep carbon reduction in California require electrification and integration across economic sectors*, Environ. Res. Lett. 8, 2013; Melaina and Webster, *Role of fuel carbon intensity in achieving 2050 greenhouse gas reductions within the light-duty vehicle sector*, Environ. Sci. Technol. 45, 3865–3871, 2011; International Energy Agency, *Transport, Energy, and CO2: Moving Towards Sustainability*, OECD/IEA, 2009; National Research Council, *Transitions to Alternative Vehicles and Fuels*, The National Academies Press, 2013.

⁶ California Air Resources Board, *Vision for Clean Air: A Framework for Air Quality and Climate Planning*, Public Review Draft, June 27, 2012; and National Research Council, *Transitions to Alternative Vehicles and Fuels*, National Academies of Science, 2013.

1

Figure 1 Vehicle Types



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The Pilot Program proposed by Ameren Missouri appropriately focuses on plug-in electric vehicles (PEVs), commonly referred to as “electric vehicles” or “EVs,” which can be charged with electricity from the electric grid. This includes both Battery Electric Vehicles (BEVs) that rely entirely upon electricity and Plug-in Hybrid Electric Vehicles (PHEVs) that rely upon electricity for daily driving needs, but use gasoline for longer trips. While PHEVs can be driven primarily on electricity, because they have tailpipe emissions when operating on gasoline, they are not referred to as Zero Emission Vehicles (ZEVs).

11

Q. Is a lack of charging infrastructure a barrier to the acceleration of EV adoption?

12

A. Yes, a dearth of strategically located charging infrastructure presents a significant barrier to transportation electrification and this phenomenon is recognized and well-documented by the National Academies of Science.⁷ Achieving significant PEV penetration levels requires the development of an extensive, well-planned charging station network that provides value to drivers.

17

18

19

20

⁷ Kassakian, John G., David Bodde, and Jeff Doyle. "Overcoming Barriers to Deployment of Plug-in Electric Vehicles." The National Academies Press. 2015.

1 **Status of Electric Vehicle Charging Infrastructure in Missouri**

2
3 **Q. What is the purpose of Ameren’s proposed EV charging station pilot?**

4 A. As stated in Mark Nealon’s testimony, the purpose of the pilot is to enable access to
5 highway corridor charging that facilitates long-distance electric vehicle travel to the
6 public and to support electric vehicle charging in communities along I-70.

7
8 *Each of the proposed charging sites, or “charging islands,” would be available*
9 *for use by the general public to charge electric vehicles used for both long-*
10 *distance driving and driving within communities situated along the I-70 corridor.⁸*

11
12 **Q. What does the Office of the Public Counsel (OPC) claim about the market for**
13 **charging services in Missouri?**

14 A. In his testimony, Geoff Marke makes the following statement:

15
16 *Both ratepayers and drivers are best served by a competitive market for charging*
17 *services rather than a regulated monopoly. There is no reason why Missouri*
18 *cannot have a competitive market in EV charging and Ameren Missouri (and*
19 *other investor-owned utilities “IOUs”) non-regulated services should be allowed*
20 *to participate in that market.⁹*

21
22 Throughout the section on competition in his testimony, Dr. Marke is generally of
23 the view that EV charging services constitute a competitive market in Ameren
24 Missouri’s service area, and that Ameren Missouri’s regulated services should not
25 be permitted to enter this market.

26
27 **Q. Does an assessment of the EV charging services market in Ameren**
28 **Missouri’s service area require a more nuanced examination?**

⁸ Direct Testimony of Mark Nealon, File No. ET-2016-0246 Filed August 15, 2016

⁹ Rebuttal Testimony of Geoff Marke, File No. ET-2016-0246 Filed November 29, 2016

1 A. Yes. The use, value, and ease of access to charging stations to both EV drivers
2 (i.e. demand side of the market) and charging station owners and operators (i.e.
3 the supply side) will vary depending on the type of site host, the site host location,
4 and the type of charging station.¹⁰ For this reason, it is useful to stratify the
5 general EV charging services market that Dr. Marke describes into more distinct,
6 location-based charging service markets. For the purpose of the proposal under
7 consideration, Ameren Missouri is specifically addressing inter-city, highway
8 corridor charging. Other conceivable markets may include the home, workplace,
9 and intra-city locations. These categories are referenced and discussed in Sierra
10 Club’s testimony:

11
12 *In particular, AC charging at home is a “virtual necessity” and must potentially*
13 *be available before a potential electric vehicle driver will make an electric vehicle*
14 *purchase. Employers with employees who commute any significant distance will*
15 *need workplace charging. For extended range travel using battery electric*
16 *vehicles, fast charging must be available along enough routes to effectively*
17 *connect most trip origin-destination combinations.*¹¹

18
19 **Q. What is the current state of the highway corridor charging services market in**
20 **Ameren Missouri’s territory?**

21 A. Currently, Missouri has few AC charging stations and even fewer DC Fast Chargers
22 located along its highway corridors. According to Plugshare – an accessible,
23 comprehensive charging station locator application – only a couple of locations have non-
24 Tesla DC Fast Chargers in Missouri outside of St. Louis and Kansas City metropolitan
25 areas.¹² Dr. Marke confirms in his testimony that the vast majority of charging stations in
26 Ameren Missouri’s service area are concentrated in St. Louis and neighboring St. Charles

¹⁰ See footnote 7
¹¹ Rebuttal Testimony of Douglas Jester, File No. ET-2016-0246, Filed November 29, 2016
¹² See <https://www.plugshare.com/> I focus on non-Tesla DC Fast Charging stations because Tesla employs proprietary charging technology that is only accessible to owners of Tesla vehicles. In order to assuage range anxiety and meaningfully accelerate the PEV market, access to fast and reliable highway corridor charging is a necessity for all PEV models.

1 counties.¹³ Aside from one Tesla Supercharger location in Columbia, there are currently
2 no locations outside of the St. Louis area that offer DC fast charging along I-70 in
3 Ameren Missouri’s service territory.
4

5 **Q. Are there private companies currently providing electric vehicle charging services**
6 **to site hosts in Missouri?**

7 A. Yes. This is clearly stated in ChargePoint’s testimony. Ms. Smart explains that
8 companies like ChargePoint, EVgo, and others provide charging stations in the state.¹⁴
9 However, it is evident that for a set of reasons related to the charging services market
10 described below, there has been very little charging infrastructure developed along
11 Missouri’s highway corridors – even the most trafficked ones.
12

13 **Q. Does Ameren’s EV charging station proposal address a market segment that will be**
14 **critical for accelerating vehicle electrification in Missouri?**

15 A. Yes. A robust network of charging stations along highway corridors is needed to
16 accelerate the electric vehicle market. In particular, the development of direct current
17 (DC) Fast Charging stations – which charge at a significantly faster rate than traditional
18 AC charging stations and come closer to replicating the gas station experience – will be
19 critical for this particular segment.¹⁵ They enable long-distance, all-electric travel without
20 significantly altering the time it takes to reach a particular destination. Electric Power
21 Research Institute’s analysis reveals that one in ten weekdays a vehicle is driven, it is
22 driven in excess of 70 miles, which approaches the point at which most drivers of typical
23 pure battery electric vehicles would begin to suffer from range anxiety.¹⁶ The fear of
24 being stranded is not just a source of anxiety for those who have already purchased
25 BEVs, but a significant barrier to a mass market for BEVs. Although most PEV charging
26 will occur at home, consumer research shows the lack of “robust DC fast charging

¹³ See footnote 9

¹⁴ Rebuttal Testimony of Anne Smart, File No. ET-2016-0246, Filed November 29, 2016

¹⁵ While AC Level 2 charging is able to deliver 10-20 miles of range per hour of charging, DC fast charging can deliver 150-210 miles of range per hour of charging. See Alternative Fuels Data Center, “Developing Infrastructure to Charge Plug-In Electric Vehicles,” U.S. Department of Energy available at:

http://www.afdc.energy.gov/fuels/electricity_infrastructure.html

¹⁶ Marcus Alexander, *Transportation Statistics Analysis for Electric Transportation*, Electric Power Research Institute, December, 2011.

1 infrastructure is seriously inhibiting the value, utility and sales potential” of BEVs.¹⁷
2 Advances in battery technology that enable affordable longer range all-electric vehicles,
3 such as the forthcoming Chevrolet Bolt, will not reduce but increase the need for DC fast
4 charging stations. As more automakers introduce vehicles that can complete the
5 occasional longer trip while re-fueling during stops that would likely be made regardless
6 to eat meals or use restrooms, demand for DC fast charging stations will increase
7 significantly. Other critical market segments for PEV charging stations are outlined in
8 Appendix 1.

9
10 Would-be EV drivers need to know that they can drive from St. Louis to Columbia or
11 Kansas City when they need to and have access to reliable and affordable fuel along the
12 way. The I-70 corridor is a critical and underserved market that needs to be addressed to
13 unlock consumer demand in Missouri for vehicles that do not depend on gasoline or
14 diesel refined outside of the state. Overall, developing the highway corridor fast charging
15 market will be critical for the acceleration of the electric vehicle market.

16
17 **Q. What challenges do current charging station providers – such as private charging**
18 **station companies, automakers, and governments – face in the deployment of**
19 **charging services along highway corridors?**

20 A. Although OPC is quick to dismiss utility development of highway corridor EV charging
21 infrastructure on the grounds that a competitive market exists for such products, OPC
22 fails to consider the challenges that have hindered current market participants from
23 deploying adequate infrastructure. Entities active in the PEV charging space today will
24 likely not be able to develop the infrastructure necessary to achieve widespread
25 electrification. Unfortunately, without extremely high utilization rates, it is difficult for
26 independent firms to realize a profit in the time frame required for most private
27 enterprises.¹⁸ This problem may be acute for investments in DC Fast Chargers, which are
28 much more expensive per unit than AC charging stations today. Next, automakers
29 generally do not see themselves as the appropriate actor to make significant charging

¹⁷ Norman Hajjar, [New Survey Data: BEV Drivers and the Desire for DC Fast Charging](#), California Plug-in Electric Vehicle Collaborative, March 11, 2014.

¹⁸ The EV Project, [Lessons Learned on the EV Project and DC Fast Charging](#), April, 2013.

1 station investments. While Tesla has successfully built and operated a DC charging
2 station network, NRDC does not expect charging station deployment to become a core
3 business of automakers, which did not enter the service station business to sell gasoline to
4 gasoline-powered vehicles. Likewise, while state and federal programs have supported
5 some of the existing charging network nationwide, public funding alone will likely not be
6 sufficient to meet the scale of the challenge.

7
8 Automakers, governments, charging station companies, and other entities that deploy
9 charging stations also currently face a market coordination problem that hampers the
10 development of charging networks necessary to sustain the growing EV market. This
11 market coordination problem – otherwise known as the “chicken and egg” dilemma –
12 arises when the underdevelopment of one complementary or “networked” good leads to
13 underdevelopment of the other networked good.¹⁹ In this specific case, low penetration
14 of charging stations inhibits the growth of the PEV market, and vice versa: customers
15 may be unwilling to purchase a PEV if there is not sufficient charging network
16 development, and charging station providers may be unable to build out a network with
17 insufficient demand. As a result, there is an under-provision of charging stations in this
18 scenario. However, as charging stations are built out, the value of owning an electric
19 vehicle increases and the EV market grows. This in turn may attract the deployment of
20 additional charging stations by private entities. These trends are supported by researchers
21 at Cornell University who analyzed network effects associated with quarterly PEV sales
22 in 353 metro areas and found, “the increased availability of public charging stations has a
23 statistically and economically significant impact on EV adoption decisions.”^{20 21}

¹⁹ Ryan, Nancy E., and Luke Lavin. “Engaging Utilities and Regulators on Transportation Electrification.”
Energy+Environmental Economics. March 1, 2015.

²⁰ Li et al., *The Market for Electric Vehicles: Indirect Network Effects and Policy Design*, Cornell University, May,
2016. The authors of this research concluded that “a 10% increase in the number of public charging stations would
increase EV sales by about 8% while a 10% growth in EV stock would lead to a 6% increase in charging station
deployment.” These results are not meant to predict or forecast network effects for any particular geographic area.

²¹ Springel, *Network Externality and Subsidy Structure in Two-Sided Markets: Evidence from Electric Vehicle
Incentives*, University of California, Berkeley, November 1, 2016. Katalin Springel at the University of California,
Berkeley has also found that in Norway, subsidies for electric vehicle charging stations were more than twice as
effective at spurring EV purchases as equivalent subsidies for EVs themselves between 2010 and 2015.

1 **Q. Are electric utilities capable of overcoming this market coordination problem and**
2 **deploying widespread, strategic charging infrastructure needed to accelerate vehicle**
3 **electrification?**

4 A. Yes. For several reasons, electric utilities are uniquely positioned to accelerate the vehicle
5 electrification process. Several utilities are already actively developing their own PEV
6 infrastructure programs in the Midwest.²²

7
8 First, utilities have extensive knowledge of the grid and would be able to deploy
9 infrastructure in a way that minimizes risk to the electrical system and maintains
10 reliability. Utilities can also leverage established customer relations to effectively
11 communicate the public benefits of vehicle electrification. These characteristics not only
12 could allow electric utilities to reliably jump start charging station deployment at large,
13 but also target and educate market segments that are underserved by the existing
14 market. Utilities are uniquely situated to capture the system-wide benefits of a
15 comprehensive charging network. As noted in a recent National Academies of Science
16 study, utilities can capture the “incremental revenue from additional electricity that EV
17 drivers consume at home, where roughly 80 percent of the charging takes place” and use
18 that revenue to reduce rates and bills for all customers.²³

19 20 **Public Policy Rationale for Utility Deployment of EV Charging Stations**

21
22 **Q. What is the public policy rationale for utility investment in the strategic, widespread**
23 **deployment of PEV charging infrastructure?**

24 A. As described above, the prudent development of charging station networks increases EV
25 adoption. This not only benefits utility customers who drive electric vehicles or who are
26 considering purchasing one; it delivers important benefits to utility customers as a whole.

²² Andy Balaskovitz, “Michigan utility plans statewide electric vehicle charging network,” July 27, 2016 available at: <http://midwestenergynews.com/2016/07/27/michigan-utility-plans-statewide-electric-vehicle-charging-network/>; Dan Gearino, “AEP increases proposed rates to add tech features, like charging stations,” November 28, 2016 available at: <http://www.dispatch.com/content/stories/business/2016/11/28/aep-ups-cost-of-proposed-rates-to-add-tech-features-like-charging-stations.html>

²³ Committee on Overcoming Barriers to Electric-Vehicle Deployment et al., *Overcoming Barriers to Deployment of Plug-in Electric Vehicles*.

1 First, widespread and intelligently integrated vehicle charging could lower electric rates
2 for all utility customers. As described in Natural Resources Defense Council's *Driving
3 Out Pollution: How Utilities Can Accelerate the Market for Electric Vehicles:*

4
5 *Charging electric vehicles predominantly during off-peak electricity hours (when
6 the electric grid is underutilized and there is plenty of spare capacity in the
7 generation, transmission, and distribution system) allows utilities to avoid new
8 capital investments while capturing additional revenues, lowering the average
9 electricity cost for all their customers. This effect is the opposite of the utility
10 "death spiral," whereby increasing costs borne by a decreasing pool of
11 customers causes rate increases that drive away more customers, leaving those
12 who cannot afford distributed generation or home energy storage to pay for an
13 aging grid.²⁴*

14
15 This increased electric load from PEVs exerts downward pressure on rates by spreading
16 the utility's fixed costs over a greater amount of kilowatt-hour (kWh) sales. As described
17 above, utility customers and the utility have the potential to benefit from increased load
18 without commensurate increases in costs to serve that incremental load.

19
20 This downward pressure on rates as a result of increased electric vehicle load is
21 consistent with the findings of researchers at the Pacific Northwest National Laboratory.
22 They conclude there is sufficient spare generation capacity in the nation's electric grid to
23 power virtually the entire light-duty passenger vehicle fleet without necessitating the
24 construction of any new power plants, if vehicle charging load is integrated during off-
25 peak hours and at lower power levels.²⁵ The same researchers also modelled impacts on
26 the marginal price of electricity associated with transformative transportation
27 electrification on two utilities, Cincinnati Gas & Electric and San Diego Gas & Electric

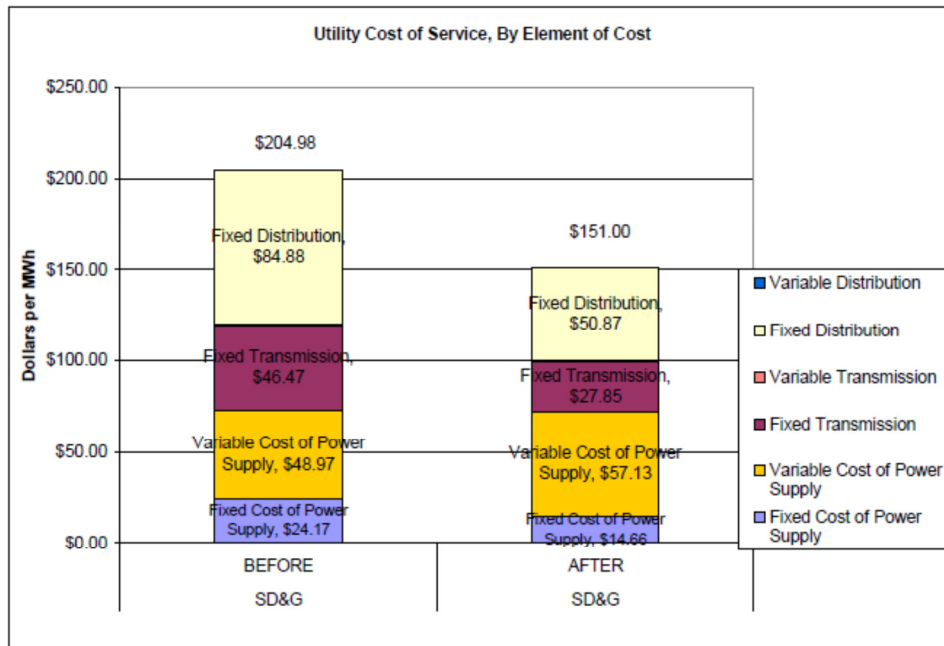
²⁴ Max Baumhefner, Roland Hwang, Pierre Bull, *Driving Out Pollution: How Utilities Can Accelerate the Market for Electric Vehicles*, Natural Resources Defense Council, June 2016.

²⁵ Michael Kintner-Meyer Kevin Schneider Robert Pratt, *IMPACTS ASSESSMENT OF PLUG-IN HYBRID VEHICLES ON ELECTRIC UTILITIES AND REGIONAL U.S. POWER GRIDS: PART 2: ECONOMIC ASSESSMENT*, November, 2007, p. 11 available at: <https://www.ferc.gov/about/com-mem/5-24-07-technical-analy-wellinghoff.pdf>

1 (SDG&E). The results of a 100 percent PEV penetration scenario (1.1 million plug-in
 2 electric vehicles) in SDG&E territory are illustrated in Figure 2.²⁶

3
 4
 5

Figure 2: Short Run Impact of Electric Vehicle Off-Peak Charging on Components of System Cost for San Diego Gas & Electric



6 Source: Pacific Northwest National Laboratory

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These results should not be construed as a forecast, but the directional shift (approximately 25 percent reduction in the cost of electricity) is significant. Non-PEV customers would benefit from such efficient transportation electrification in the form of lower electricity bills. Ameren Missouri’s pilot alone will certainly not be sufficient to facilitate this level of PEV adoption, but it could play a critical role in accelerating adoption early in the market. In sum, greater electric vehicle load can help flatten load curves, improve the efficiency and utilization of fixed distribution assets, and achieve cost savings for the body of utility customers.

²⁶ It is important to note that the analysis assumes that charging occurs during the “valley-filling” period between 10 pm and 6 am. Establishing residential rate structures that generally encourage off-peak charging are crucial to ensuring widespread vehicle electrification delivers system-wide net benefits in the long run.

1 **Q. What other public policy arguments can be made in support of Ameren Missouri's**
2 **EV pilot proposal and vehicle electrification more generally?**

3 A. There is a public benefit associated with the reduction of greenhouse gas emissions from
4 electric vehicles relative to gasoline-powered vehicles. In an attempt to refute this point,
5 Dr. Marke carefully makes the claim that increased adoption of EVs will not reduce
6 *Ameren Missouri's* carbon emissions.

7
8 *Q. Will increased use of EVs reduce Ameren Missouri's carbon emissions?*

9 *A. No. Ameren Missouri is largely dependent on coal and natural gas/oil fossil*
10 *fuel mix to supply its generation needs. This means that electric vehicles will*
11 *require Ameren Missouri to continue burning carbon intense fossil fuels.*

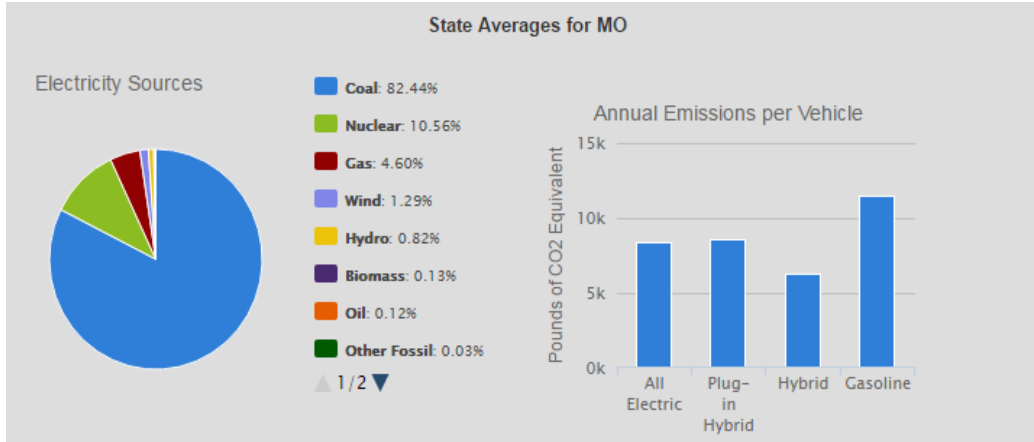
12
13 **Q. What is your response to OPC's assertion regarding the environmental impacts of**
14 **EVs in this case?**

15 A. If one is to look narrowly at how Ameren Missouri's emissions profile changes as EV
16 adoption increases, then Ameren Missouri's emissions would increase as a result of
17 increased generation from its fossil-fuel power plants. This would be the case for
18 virtually every other vertically-integrated regulated utility in the United States. In
19 answering the question above, OPC ignores how the total fuel emissions from electric
20 vehicles compare to gasoline-powered vehicles. However, in Figure 3 of Dr. Marke's
21 testimony, OPC appears to not have a problem comparing electric vehicle and gasoline
22 vehicle emissions when making the claim that vehicle electrification makes more
23 environmental sense in Vermont relative to Missouri.²⁷ If the goal is to assess the
24 environmental impacts of PEVs, it must be done in comparison to gasoline-powered
25 vehicles.

26
27 To his benefit, Dr. Marke correctly points out that Ameren Missouri still relies heavily on
28 coal generation. He presents a figure from the Department of Energy that shows – using
29 2014 data from the Energy Information Administration – that coal comprised
30 approximately 82 percent of the state's generation. This is shown in Figure 3 below.

²⁷ Rebuttal Testimony of Geoff Marke p. 20, File No. ET-2016-0246 Filed November 29, 2016

1
2 **Figure 3: Comparison of Annual Electric and Gasoline Vehicle**
3 **Emissions with 2014 Missouri Generation Assumptions**



4 Source: *Department of Energy Alternative Fuels Data Center*

5
6 It is strikingly clear that even with Missouri’s coal-heavy generation mix in 2014, PEVs still emit
7 less CO₂ equivalent than gasoline-powered vehicles under equivalent driving conditions –
8 approximately 27 percent less.²⁸ However, the Department of Energy’s assumptions are already
9 out of date: 2015 EIA state generation data reveals that coal’s share of the generation mix
10 dropped four percentage points from 82 percent in 2014 to 78 percent along with increases in
11 zero-emitting generation.²⁹ This suggests that under the Department of Energy’s assumptions,
12 electric vehicles in Missouri ran on cleaner fuel in 2015 than in 2014. And we expect this
13 phenomenon to continue. As market trends and policies shift Missouri’s generation mix and that
14 of the country as a whole towards lower carbon generation sources, the clean air and carbon
15 emissions benefits from PEVs will continue to increase. As shown in Figure 4, on today’s
16 national electricity mix, PEVs emit half as much greenhouse gas pollution per mile (even when
17 accounting for emissions resulting from the manufacturing of batteries) than current
18 conventional vehicles, a margin that will only increase as the US electricity mix becomes less

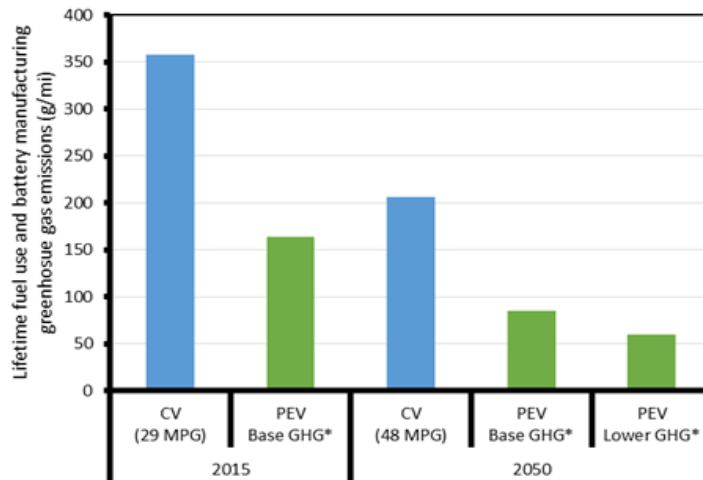
²⁸ Alternative Fuels Data Center, “Emissions from Hybrid and Plug-In Electric Vehicles,” U.S. Department of Energy (accessed November 22, 2016) available at: http://www.afdc.energy.gov/vehicles/electric_emissions.php#wheel

Upon rolling over the individual results on AFDCs website, one can see a battery electric (all electric) vehicle emits 8,328 lbs of CO₂ equivalent and gasoline vehicles emit 11,435 lbs of CO₂ equivalent. Hence, a 27% reduction compared to gasoline powered vehicles.

²⁹ U.S. Energy Information Administration, “Form EIA-923 detailed data” (accessed November 22, 2016) available at: <https://www.eia.gov/electricity/data/eia923/>

1 carbon intensive.³⁰ By 2050, under a base case, PEVs will still emit less than half as much
 2 carbon than a gasoline vehicle with a fuel economy of 48 miles-per-gallon. Under a scenario in
 3 which the transition to lower carbon generation sources occurs more quickly, PEVs emit only a
 4 quarter as much as a very efficient gasoline vehicle.³¹

6 **Figure 4: Conventional Vehicle and Plug-In Electric Vehicle Lifecycle Greenhouse**
 7 **Gas Emissions**



8
 9 Source: *Electric Power Research Institute and Natural Resources Defense Council*

10
 11 This concept – known as “environmentally beneficial electrification” – is becoming
 12 increasingly familiar with power sector experts.³² All else equal, cleaner electric
 13 generation coupled with the improved efficiency of end-use technologies like electric
 14 vehicles and electric heat pumps *increases* electric generation while providing the
 15 opportunity to simultaneously *decrease* overall emissions relative to other non-electrified
 16 end-use technologies. In short, PEVs provide significant environmental benefits today
 17 and those benefits will only increase as the electric grid becomes cleaner. And as noted

³⁰ Marcus Alexander, Roland Hwang, and Luke Tonachel, *Environmental Assessment of a Full Electric Transportation Portfolio Volume 2: Greenhouse Gas Emissions*, Electric Power Research Institute and Natural Resources Defense Council (September 2015)

³¹ *Ibid.*

³² Keith Dennis, Ken Colburn, and Jim Lazar, “Environmentally Beneficial Electrification: The Dawn of ‘Emissions Efficiency’”, *The Electricity Journal* 29 (July 2016): 52-58 available at: http://ac.els-cdn.com/S1040619016301075/1-s2.0-S1040619016301075-main.pdf?_tid=c0ef3efe-ad0e-11e6-908a-00000aacb35d&acdnat=1479419136_7977bb870b5feb0cd2198d0783d05673

1 below, PEVs can also help reduce the costs of transitioning to renewable sources of
2 electricity.

3
4 **Q. Are there other public policy reasons for advancing vehicle electrification in**
5 **Ameren Missouri?**

6 A. Yes. Related to the power sector transition described above, electric vehicles
7 could also facilitate the integration of renewable energy onto the grid. Missouri
8 currently has a Renewable Portfolio Standard that requires the investor owned utilities in
9 the state to source 15 percent of their annual electric sales from renewable generation by
10 2021.³³ PEV load is particularly flexible, so it can be managed in a manner such that it
11 soaks up renewable generation, reducing the need for curtailment and ensuring the value
12 of new renewable assets.³⁴ In wind-rich states like Missouri, nighttime wind generation
13 peaks can be absorbed by electric vehicles plugged in at home. As early as 2009, BMW
14 and the European utility Vattenfall demonstrated the potential for the PEVs to integrate
15 variable wind generation by ramping charging up and down when the PEV drivers slept,
16 awakening to fully charged vehicles.³⁵ The development of Missouri's renewable energy
17 resources could also bolster the in-state clean energy economy. With 11 active wind
18 manufacturing plants and over 112 solar companies throughout the state, Missouri could
19 magnify the in-state economic benefits of vehicle electrification with increases in
20 renewables manufacturing and deployment.³⁶ For these reasons, electric vehicle charging
21 could allow Missouri to meet the requirements of its Renewable Portfolio Standard at
22 lower cost while providing economic benefits to the state.

23
24 Finally, there is a public benefit associated with the decreased dependence on petroleum
25 in Missouri. According to the Missouri Comprehensive Energy Plan, the state spent \$15

³³ DSIRE, "Renewable Energy Standard", NC Clean Energy Technology Center available at:
<http://programs.dsireusa.org/system/program/detail/2622>

³⁴ "California Transportation Electrification Assessment Phase 2: Grid Impacts." Energy+ Environmental
Economics. October 23, 2014.

³⁵ Vattenfall AG, *Klimaentlastung durch den Einsatz erneuerbarer Energien im Zusammenwirken mit
emissionsfreien Elektrofahrzeugen* ("Climate Change Mitigation Through Usage of Renewable Energy Sources in
Combination with Emission Free Electric Vehicles"), March 2011.

³⁶ American Wind Energy Association, "Missouri Wind Energy" available at: [http://awea.files.cms-
plus.com/FileDownloads/pdfs/Missouri.pdf](http://awea.files.cms-plus.com/FileDownloads/pdfs/Missouri.pdf); Solar Energy Industries Association, "Missouri Solar" available at:
<http://www.seia.org/state-solar-policy/missouri>

1 billion in 2012 on transportation fuels, the majority of which was gasoline for light duty
2 vehicles.³⁷ While the state has an established renewable energy industry, “Missouri is not
3 a major oil producer or refiner and therefore all gasoline used for transportation purposes
4 is imported to the state.”³⁸ It stands to reason that reducing the state’s dependence on
5 imported oil is a clear economic benefit for Missourians. Furthermore, despite recent
6 increases in domestic production, the United States is still a major importer of oil.³⁹
7 Consuming less oil enhances Missouri’s energy security by shielding utility customers
8 and business from the volatility of global oil markets that can disproportionately impact
9 low-income drivers.⁴⁰ In contrast, retail electricity rates are relatively stable over the last
10 quarter century in real terms.⁴¹ National historical gasoline and electricity prices in an
11 equivalent eGallon format are shown in Figure 5.⁴²
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³⁷ Department of Economic Development – Division of Energy, *Missouri Comprehensive State Energy Plan*, October 2015, p. 101 available at: <https://energy.mo.gov/energy/docs/MCSEP.pdf>

³⁸ *Ibid.*

³⁹ U.S. Energy Information Agency, “U.S. Imports by Country of Origin” (accessed November 22, 2016) available at: https://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbb1_a.htm

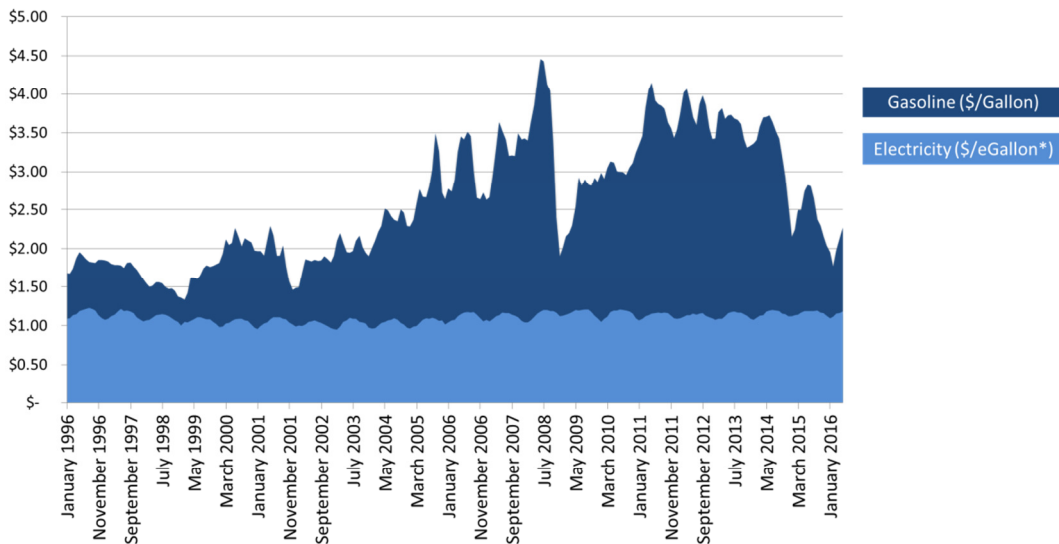
⁴⁰ U.S. Energy Information Agency, “Real Prices Viewer” (accessed November 22, 2016) available at: <http://www.eia.gov/forecasts/steo/realprices/>

⁴¹ *Ibid.*

⁴² An eGallon is the cost of fueling a vehicle with electricity compared to a similar vehicle that runs on gasoline. See <http://energy.gov/maps/egallon>

1

Figure 5: Historical Domestic Retail Gasoline and Electricity Prices: 1996 - 2016



2

3 *an **“eGallon”** is the cost of fueling a vehicle with electricity compared to a similar vehicle that runs on
4 gasoline.

5 Data source: *Energy Information Administration, June 2016. Monthly averages.*

6

7 In Missouri, the average price of regular gasoline as of December 3, 2016 was \$2.04 per
8 gallon; at the same time, the cost of an eGallon in Missouri, based on residential
9 electricity prices, was \$1.02.⁴³

10

11 **Q. What is Staff’s recommendation regarding the proposed tariff and EV charging
12 station regulation generally?**

13 A. In testimony, Mr. Murray writes:

14

15 *Staff recommends that the Commission only approve Ameren Missouri’s revised*
16 *tariff sheets on the condition that all revenues, expenses and investment*
17 *associated with the program being recorded below-the-line in order to hold*
18 *ratepayers harmless.*⁴⁴

⁴³ *Ibid.*

⁴⁴ Rebuttal Testimony of Byron Murray, File No. ET-2016-0246, Filed November 29, 2016

1 **Q. What is your response to Staff’s position?**

2 A. NRDC appreciates Staff’s consideration of these issues, but does not agree with Staff that
3 all investment associated with the pilot be recorded “below-the-line.” Between rebuttal
4 testimony offered by Mr. Murray and recommendations offered by Ms. Payne, Staff
5 offers little very little explanation to defend this position save for the following claim:
6

7 *Staff notes that Ameren Missouri ratepayers should not be required to subsidize a*
8 *program for which the majority of its ratepayers will receive no direct benefit.*⁴⁵
9

10 Given the explanation above on the benefits of vehicle electrification to all utility
11 customers and the critical role charging infrastructure plays in that process, NRDC
12 questions the merit of Staff’s position. Ameren Missouri’s pilot proposal has the ability to
13 engender these aforementioned utility customer benefits; for that reason, the utility
14 should have the opportunity to recover costs associated with the development of the pilot.
15

16 **Q. Does this mean that entities other than utilities should be excluded from developing**
17 **charging stations in Ameren Missouri or elsewhere?**

18 A. No. Other entities should still have the ability to build, sell, install, own, operate, and
19 maintain charging stations as they currently do. NRDC also supports Sierra Club’s
20 recommendation that the Commission make clear that these non-utility owners of electric
21 vehicle charging stations are not public utilities subject to Commission jurisdiction
22 simply by operating these stations.⁴⁶
23

24 **Ameren Missouri Charging Station Procurement**
25

26 **Q. What other concerns does the Office of the Public Counsel have regarding utility**
27 **deployment of electric vehicle charging stations?**

28 A. OPC appears to be concerned that utility engagement in the deployment of charging
29 stations will create barriers to entry for new market participants and unjustly penalizes

⁴⁵ Recommendations of Whitney Payne, File No. ET-2016-0246, Filed

⁴⁶ Rebuttal Testimony of Douglas Jester p. 29, File No. ET-2016-0246, Filed November 29, 2016

1 private players in the market. Dr. Marke also explains that the utility can subvert
2 competition and could potentially “reduce efficiency.”⁴⁷ Additionally, OPC fears that
3 utility assets will become stranded assets that become obsolete and outdated relative to
4 private market alternatives.

5
6 **Q. Within the context of Ameren Missouri’s pilot proposal, do these issues merit the
7 Commission’s concern?**

8 A. No. It must be made clear that in no way is Ameren Missouri proposing to develop,
9 manufacture, or deploy its own charging station products to serve this project. As far as I
10 am aware, no other approved or pending utility charging infrastructure proposal specifies
11 that the utility itself will be responsible for providing its own charging station hardware
12 and software. Instead, Ameren Missouri has developed a competitive solicitation or
13 “Request for Proposals” through which private charging station companies have the
14 opportunity to provide the equipment necessary for its EV pilot proposal. Anne Smart
15 confirms there is an RFP in her testimony:

16
17 *Q. Did ChargePoint respond to Ameren’s EV charging pilot RFP?*

18 *A. Yes, ChargePoint responded to the RFP.*

19
20 Other private charging station providers also presumably responded to the RFP. If it is
21 designed well, it can sufficiently address OPC’s concerns on several fronts. Rather than
22 creating *market barriers* for new participants, Ameren Missouri’s proposal provides new
23 participants with opportunities for *market access* that did not exist before. Rather than
24 penalizing market players and stifling competition, an RFP can engender the competition
25 that OPC claims is missing from utility involvement to deliver the best possible products
26 from the private market. Finally, because the hardware and software for the proposal is
27 coming from private companies, there should be little concern that Ameren Missouri is
28 not using competitive, quality products and services from the industry.

29

⁴⁷ See footnote 9

1 If OPC is concerned that the deployment of existing private technologies will be obsolete
2 before the end of their useful lives, then by that logic, very few technologies these days
3 would be procured or developed. Companies and consumers do not shy away from
4 procuring iPhone 7s out of fear that the iPhone 8 will render their devices obsolete. Just
5 the same, Ameren Missouri should not wait to procure technology that has not been
6 developed yet, especially at this critical stage of the PEV market.

7
8 **Q. Does NRDC have responses to other parties regarding the EV pilot procurement**
9 **process?**

10 A. Yes. With regard to the RFP, ChargePoint recommends the following in testimony:

11
12 *Ameren should consider qualifying multiple RFP respondents to provide charging*
13 *station equipment and services in its pilot.*

14
15 While NRDC generally does not have a position on this aspect of utilities' RFP design
16 for charging products and services, for the purposes of this pilot, it seems unreasonable
17 and inefficient to require Ameren to qualify multiple vendors for such a small project.
18 For scale, Ameren Missouri is proposing six charging islands with four ports each (24
19 ports); San Diego Gas & Electric and Southern California Edison were granted
20 approval by the California Public Utilities Commission to procure 3,500 and 1,500
21 stations, respectively.⁴⁸ In this regard, NRDC agrees with and supports Sierra Club's
22 recommendation that procurement be done through "utility procurement," as Douglas
23 Jester describes, with equipment specifications that satisfy the utility's needs in this
24 case.⁴⁹

25
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27

⁴⁸ The 1,500 stations approved in Southern California Edison (SCE) is considered to be part of Phase 1. Contingent upon Commission approval, SCE will be allowed to deploy up to 30,000 additional charging stations in Phase 2. Herman K. Trabish, "CA regulators approve \$45M SDG&E electric vehicle charger rollout," February 1, 2016 available at: <http://www.utilitydive.com/news/ca-regulators-approve-45m-sdge-electric-vehicle-charger-rollout/413015/>

⁴⁹ Rebuttal Testimony of Douglas Jester p. 29, File No. ET-2016-0246, Filed November 29, 2016

1 **Ameren Missouri Tariff Proposal**

2
3 **Q. Are there beneficial rates that would be presumptively approvable by the**
4 **Commission that would help increase the benefits of vehicle electrification?**

5 A. Yes. A survey of over 16,000 PEV drivers reveals that “saving money on fuel costs” is
6 the single most important decision factor driving PEV purchases.⁵⁰ Therefore, to ensure
7 that a utility charging infrastructure proposal achieves its goal of developing the electric
8 vehicle market, it is crucial that PEV drivers generally realize fuel cost savings when
9 switching from gasoline to electric fuel. Charging for electricity in excess of equivalent
10 gasoline costs at certain stations would dilute the incentive to purchase a PEV or charge
11 one at the stations in question, jeopardizing the use and usefulness of those charging
12 stations as well as the overall success of a network. For these reasons, reasonable and
13 transparent tariffs that give drivers the potential to achieve fuel cost savings relative to
14 gasoline are an essential element of a utility charging network.

15
16 **Q. Does Ameren Missouri’s revised tariff provide EV drivers with the opportunity**
17 **to realize these fuel cost savings?**

18 A. Yes. Even though the AC and DC tariffs are above those for residential retail electric
19 service, they still provide drivers with the opportunity to save money on fuel costs. Under
20 the assumptions that average gasoline vehicle fuel efficiency is 28 miles per gallon, a
21 gallon of gasoline in Missouri is \$2.04, EV fuel efficiency is .32 kWh/mile, and
22 electricity prices are \$.20/kWh for AC stations and \$.17/minute for 50 kW DC stations, I
23 show the cost per mile of operating each vehicle shown below in Table 1.⁵¹

50 Center for Sustainable Energy (2016). California Air Resources Board Clean Vehicle Rebate Project, EV
Consumer Survey Dashboard. Retrieved [date retrieved] from <http://cleanvehiclerebate.org/survey-dashboard/EV>.

51 Tariff Revision (YE-2017-0052), File No. ET-2016-0246, Filed October 7, 2016

I make the assumption that gasoline powered vehicles attain an efficiency of 28 miles/gallon, EV efficiency is 0.32 kWh/mile (sales weighed average of 2016 model year vehicles in 2015), a gallon of regular gas is \$2.04 (average Missouri gasoline price) and electricity is \$0.20/kWh as specified in Ameren’s tariff for AC and \$.17/minute for 50 kW DC chargers. See http://www.afdc.energy.gov/vehicles/electric_emissions_sources.html for assumptions.

Gasoline Powered Vehicle Fuel Costs per mile: $(\$2.04/\text{gal})/(28 \text{ miles}/\text{gal}) = \mathbf{\$0.073/\text{mile}}$

EV Fuel Costs per mile (AC): $(\$0.20/\text{kWh}) * (.32 \text{ kWh}/\text{mile}) = \mathbf{\$0.064/\text{mile}}$

EV Fuel Costs per mile (DC): $(\$0.17/\text{minute}) * (60 \text{ minutes}) / (50 \text{ kWh}) = (\$0.204/\text{kWh}) * (.32 \text{ kWh}/\text{mile}) = \mathbf{\$0.065/\text{mile}}$

1 **Table 1: Vehicle Fuel Cost Comparison using Ameren Missouri’s Revised Pilot**
 2 **Tariff**

Vehicle Type and Charger	Cost per Mile of Operation
Gasoline Vehicle	\$0.073 per mile
EV – AC Charger (\$.20/kWh)	\$0.064 per mile
EV – DC Charger (\$.17/minute)	\$0.065 per mile

3
 4 In sum, under the proposed tariffs, PEV drivers will still enjoy modest savings relative to
 5 gasoline while re-fueling during the occasional trip along the I-70 corridor, and will
 6 continue to enjoy significant savings from their everyday charging which will generally
 7 occur at home overnight.⁵²

8
 9 **Q. Are there beneficial rate structures that would be presumptively approvable by**
 10 **the Commission that would further increase the benefits of vehicle electrification?**

11 A. Yes. Consistent with the findings in Staff’s report from *A Working Case Regarding*
 12 *Electric Vehicle Charging Facilities* (File No. EW-2016-0123) and the Missouri
 13 Comprehensive State Energy Plan, NRDC generally finds a time-of-use rate to be
 14 effective in managing *residential* PEV load and augmenting the benefits of vehicle
 15 electrification.⁵³ Transportation electrification done at a scale necessary to meet air
 16 quality and climate goals will have significant implications for the electrical grid. If it is
 17 done poorly, the costs will be substantial and could undermine the viability of a strategy
 18 that is critical to meet mid- and long-term goals. However, with the right policies and
 19 programs in place, the electrification of the transportation sector could be cost-effective
 20 and maximize benefits for all utility customers. It is important to note that current and
 21 near-term EV penetration in Ameren Missouri’s service will very likely not pose any
 22 significant challenges for the utility’s existing grid infrastructure:

23
⁵² See <https://www.ameren.com/-/media/missouri-site/Files/Rates/UECSheet54Rate1MRES.pdf>

⁵³ Department of Economic Development – Division of Energy, *Missouri Comprehensive State Energy Plan*, October 2015, p. 101 available at: <https://energy.mo.gov/energy/docs/MCSEP.pdf>; [Missouri Public Service Commission Staff Report, File No. EW-2016-0123, Filed August 5, 2016](#)

1 *Ameren Missouri’s electric grid, like most others across the nation, operates*
2 *below maximum capacity for most of any given year. Aided by thoughtful load*
3 *management, a considerable EV population could root itself in the service*
4 *territory without the need for generation or line infrastructure upgrades, hence*
5 *applying a consistent downward pressure on electric rates. This carries a*
6 *necessary presumption that Ameren Missouri’s grid infrastructure is, in its*
7 *present form, ready to accommodate considerable growth at the hands of the*
8 *electric transportation movement, without the burden of such investment.*⁵⁴

9
10 In California – which now has over 250,000 PEVs – there have been virtually no electric
11 system upgrades driven by increased electric vehicle load: approximately 0.1 percent of
12 PEV sales have resulted in service line or distribution system upgrades.⁵⁵ According to the
13 Missouri Comprehensive State Energy Plan, there were approximately 1,600 PEVs in
14 Missouri in 2015.⁵⁶ Real world data from the Department of Energy’s “EV Project”
15 demonstrate that, in jurisdictions without active utility PEV programs where time-of-use
16 tariffs are either not available or not widely adopted, PEV customers will plug in and
17 charge immediately upon returning home from work, exacerbating evening system-wide
18 peak demand, but that in jurisdictions with effective utility education and outreach and
19 time-variant price signals, the vast majority of PEV charging occurs during off-peak
20 hours.⁵⁷ This is shown in Figures 6 and 7. In other words, active utility programs, time-
21 variant rates, and effective customer education and outreach will be needed to ensure that
22 efficient transportation electrification benefits all utility customers in the long-term.

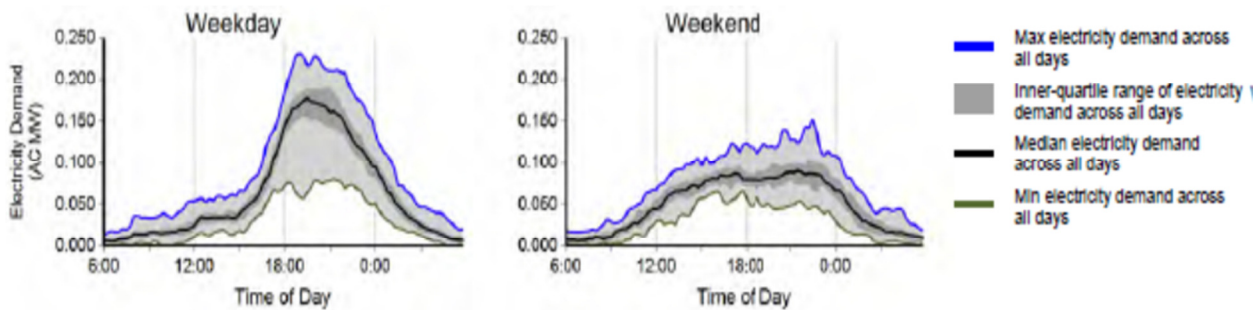
⁵⁴ Direct Testimony of Mark Nealon at 32, File No. ET-2016-0246 Filed August 15, 2016

⁵⁵ See [California Auto Outlook](#), February, 2016; Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, *Joint IOU Electric Vehicle Load Research Report 4th Report*, Filed on December 24, 2015. ; California Plug-In Electric Vehicle Collaborative, “PEV Sales Dashboard,” (accessed December 12, 2016) available at: <http://www.pevcollaborative.org/pev-sales-dashboard>

⁵⁶ Department of Economic Development – Division of Energy, *Missouri Comprehensive State Energy Plan*, October 2015, p. 106 available at: <https://energy.mo.gov/energy/docs/MCSEP.pdf>

⁵⁷ *Idaho National Laboratory, 2013 EV Project Electric Vehicle Charging Infrastructure Summary Report*, January 2013 through December 2013.

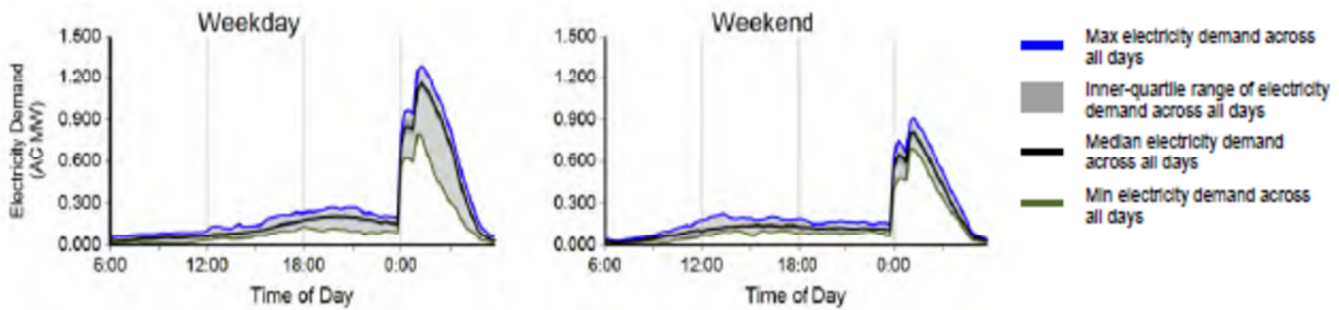
Figure 6: Dallas/Fort Worth Electric Utility PEV Load Profile



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Source: *The EV Project, U.S. Department of Energy*

Figure 7: San Diego Electric Utility Load PEV Profile



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11

Source: *The EV Project, U.S. Department of Energy*

12 **Q. What is ChargePoint’s view on pricing at Ameren Missouri’s proposed charging stations?**

13 **A.** On the topic of pricing, ChargePoint shares the following in testimony:

14
15
16 *ChargePoint is not opposed per say to the pricing proposed by Ameren in its tariff*
17 *revision filed on October 7. However in order to support competition, the site*
18 *host, rather than the utility, should control pricing to drivers who are using the*
19 *charging service located on their own property.*

1 **Q. What is your response to ChargePoint’s position on pricing at Ameren**
2 **Missouri’s proposed charging stations?**

3 A. PEV drivers charging at the stations Ameren proposes to deploy in the pilot should pay
4 the prices proposed in the associated tariff approved by the Commission and should not
5 be subject to discretionary mark-ups by site-hosts and third-party charging service
6 providers. As noted above, the margin between the proposed tariffs and the equivalent
7 gasoline costs is slim; any mark-up by site-hosts and third-party charging service
8 providers would erase that margin.

9

10 **Conclusion**

11 **Q. In summary, what have you illustrated in this testimony?**

12 A. I have explained the necessity of charging infrastructure in the development of the
13 electric vehicle market in Missouri, and I have shown that there is currently a dearth of
14 charging stations along the route where Ameren Missouri proposes to develop its pilot.
15 For several reasons, non-utility entities are not filling this infrastructure gap. However,
16 utilities are well-positioned to address this highway corridor charging market segment, as
17 well as other segments. I describe the benefits that would be experienced by all utility
18 customers with the development of pilot, and recommend that Ameren Missouri receive
19 cost recovery for the costs incurred for the pilot. I address market and competition
20 concerns related to the utility deployment of charging stations, and I find that the tariff
21 proposal will generally allow drivers to realize fuel cost savings relative to gasoline.
22 Finally, I have identified charging station rate structures that further beget the benefits of
23 vehicle electrification.

24

25 For the reasons described in testimony, I recommend the Commission approve the
26 revised tariff submitted by Ameren Missouri on October 7, 2016.⁵⁸ With performance
27 improvements to existing PEV models and the advent of a new, affordable, and long-
28 range generation of PEVs on the horizon, it is imperative that a robust and reliable
29 charging network is in place to sustain the growth of this market.

⁵⁸ Tariff Revision (YE-2017-0052), File No. ET-2016-0246, Filed October 7, 2016

Appendix 1: Other Critical Electric Vehicle Charging Station Market

Segments

Q. Please identify target market segments – in addition to highway corridors – where charging infrastructure will have the greatest impact in accelerating vehicle electrification.

A. Ameren Missouri correctly points out that the majority of PEV charging takes place at the home, and this is the most essential segment to spur PEV adoption. In a recent report of the National Research Council of the National Academies of Science (commissioned by the Department of Energy at the direction of the U.S. Congress) entitled, “Overcoming Barriers to the Deployment of Plug-in Electric Vehicles,” the authors characterize home charging as follows:

First, home charging is a virtual necessity for all EV classes given that the vehicle is typically parked at a residence for the longest portion of the day. Accordingly, the home is (and will likely remain) the most important location for charging infrastructure, and homeowners who own EVs have a clear incentive to install home charging. Residences that do not have access to a dedicated parking spot or one with access to electricity clearly have challenges to overcome to make EV ownership practical for them.

Following this argument, drivers are very unlikely to purchase plug-in vehicles if they cannot plug in at home, where cars are typically parked for 12 hours out of the day.⁵⁹ Unfortunately, less than half of U.S. vehicles have reliable access to a dedicated off-street parking space at an owned residence where charging infrastructure could be installed.⁶⁰ To date, almost 90 percent of PEV drivers in the country’s largest EV market live in

⁵⁹ Adam Langton and Noel Crisotomo, *Vehicle-Grid Integration*, California Public Utilities Commission, October, 2013, p. 5; see also Marcus Alexander, [Transportation Statistics Analysis for Electric Transportation](#), Electric Power Research Institute, December, 2011.

⁶⁰ Traut et al., *US Residential Charging Potential for Electric Vehicles, (Transportation Research Part D)*, November, 2013. Available at: <http://www.cmu.edu/me/ddl/publications/2013-TRD-Traut-et-al-Residential-EV-Charging.pdf>

1 single-family detached homes.⁶¹ As the National Research Council notes: “Lack of
2 access to charging infrastructure at home will constitute a significant barrier to PEV
3 deployment for households without a dedicated parking spot or for whom the parking
4 location is far from access to electricity.”⁶² It is essential for the PEV market to move
5 beyond single family detached homes to scale up to achieve the benefits described in the
6 most recent Missouri Comprehensive State Energy Plan.⁶³ Installing charging stations at
7 apartment buildings and other multi-unit dwellings could unlock the potential for a
8 broader, younger, and more diverse market for PEVs. This targeted approach to charging
9 station deployment at multi-unit dwellings has been adopted by San Diego Gas and
10 Electric, Southern California Edison, and Avista Utilities in their respective approved
11 PEV infrastructure programs.⁶⁴
12

13 The range-extending function and visibility of charging stations in the social context of a
14 workplace can also spur additional vehicle sales. Nissan credits a workplace charging
15 initiative with a five-fold increase in monthly PEV purchases by employees at Cisco
16 Systems, Coca Cola, Google, Microsoft, and Oracle.⁶⁵ Likewise, the Department of
17 Energy recently concluded that employees of companies who participated in its
18 “Workplace Charging Challenge” were 20 times more likely to drive a PEV than the
19 average worker.⁶⁶ Workplace charging can effectively double the electric miles driven on
20 a daily basis by PEVs. This is especially important for PHEVs.⁶⁷ Workplace charging can
21 also improve the utility of BEVs and help alleviate “range anxiety” for drivers who want
22 to make the occasional longer trip after work.
23

⁶¹ Center for Sustainable Energy, *California Plug-in Electric Vehicle Owner Survey Dashboard*, available at: <https://cleanvehiclerebate.org/eng/survey-dashboard/ev>

⁶² National Research Council of the National Academies of Sciences, *Overcoming Barriers to the Deployment of Plug-in Electric Vehicles*, the National Academies Press, 2015, p. 116.

⁶³ Department of Economic Development – Division of Energy, *Missouri Comprehensive State Energy Plan*, October 2015, p. 104 available at: <https://energy.mo.gov/energy/docs/MCSEP.pdf>

⁶⁴ Herman K. Trabish, “If you build it, will they charge? Utilities cautious in plans to spur electric vehicle adoption,” August 10, 2016, available at <http://www.utilitydive.com/news/if-you-build-it-will-they-charge-utilities-cautious-in-plans-to-spur-elec/423982/>

⁶⁵ Brandon White, Senior Manager of EV Sales Operations, Nissan North America, at EPRI Plug-in 2014, “Taking the ‘Work’ Out of Workplace Charging.”

⁶⁶ U.S. Department of Energy, *Workplace Charging Challenge – Progress Update 2014: Employers Take Charge*.

⁶⁷ California New Car Dealers Association, *California Auto Outlook*, February, 2015.

1 In brief, workplace charging can drive the adoption of both BEVs and PHEVs, as
2 summarized by the National Research Council:

3
4 *Charging at workplaces provides an important opportunity to encourage the*
5 *adoption of PEVs and increase [electric vehicle miles traveled]. BEV drivers*
6 *could potentially double their daily range as long as their vehicles could be fully*
7 *charged both at work and at home, and PHEV drivers could potentially double*
8 *their all-electric miles. Extending the electric range of PHEVs with workplace*
9 *charging improves the value proposition for PHEV drivers because electric*
10 *fueling is less expensive than gasoline. For BEVs and PHEVs, workplace*
11 *charging could expand the number of people whose needs could be served by a*
12 *PEV, thereby expanding the market for PEVs. Workplace charging might also*
13 *allow households that lack access to residential charging the opportunity to*
14 *commute with a PEV.*⁶⁸

15
16 Workplace charging is also essential to allow the Commission to leverage the growing
17 customer investment in PEVs to support the integration of variable renewable generation.
18 Missouri PEV drivers have already purchased batteries that collectively represent about
19 40 megawatt-hours of advanced chemical energy storage that could be used to address
20 this new load shape by absorbing afternoon solar generation and overnight wind
21 generation.⁶⁹ The Commission should take advantage of that growing sunk investment to
22 benefit all utility customers. Combining both workplace and residential charging will
23 provide maximum availability to help cost-effectively integrate renewables. Workplace
24 and home charging are needed to make this possible; PEVs that are not connected to the
25 grid cannot support the grid.

26
27 **Q. Does this conclude your testimony?**

28 **A.** Yes, it does.

⁶⁸ National Research Council of the National Academies of Sciences, *Overcoming Barriers to the Deployment of Plug-in Electric Vehicles*, the National Academies Press, 2015, p. 117.

⁶⁹ Assuming sales-weighted average battery size of 24.6 kWh, based on sales data from the Department of Energy's Alternative Fuels Data Center and the Missouri Department of Economic Development's estimate of 1,600 PEVs in the state.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Union Electric)
Company d/b/a Ameren Missouri for Approval) **File No. ET-2016-0246**
Of a Tariff Setting a Rate for Electric Vehicle)
Charging Stations)

County of Cook)
State of Illinois)

AFFIDAVIT OF NOAH GARCIA

Noah Garcia, of lawful age, on his oath states; that he has participated in the preparation of the following surrebuttal testimony in question and answer form, consisting of 31 pages to be presented in the above case; that the answers in the following surrebuttal testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such answers are true to the best of his knowledge and belief.


Noah Garcia

14th In witness whereof I have hereunto subscribed my name and affixed my official seal this day of December, 2016.



