Exhibit No.:	
Issues:	Electric Vehicle Charging Station Locations & Needs; Range Anxiety; Grid Considerations; CAFE Standards
Witness:	Parker Tinsley
Sponsoring Party:	Missouri Department of Economic Development – Division of Energy
Type of Exhibit:	Surrebuttal Testimony
Case No.:	ET-2016-0246

MISSOURI PUBLIC SERVICE COMMISSION

UNION ELECTRIC COMPANY d/b/a AMEREN MISSOURI

CASE NO. ET-2016-0246

SURREBUTTAL TESTIMONY

OF

PARKER J. TINSLEY

ON

BEHALF OF

MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT

DIVISION OF ENERGY

Jefferson City, Missouri
December 19, 2016

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 of a Tariff Setting a Rate for Electric Vehicle Charging Stations	)))))	Case No. ET-2016-0246

AFFIDAVIT OF PARKER TINSLEY

STATE OF MISSOURI)
) **ss**
COUNTY OF COLE)

Parker J. Tinsley, of lawful age, being duly sworn on his oath, deposes and states:

1. My name is Parker J Tinsley. I work in the City of Jefferson, Missouri, and I am employed by the Missouri Department of Economic Development as a Planner II, Division of Energy.
2. Attached hereto and made a part hereof for all purposes is my Surrebuttal Testimony on behalf of the Missouri Department of Economic Development – Division of Energy.
3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct to the best of my knowledge.

Parker J. Tinsley

Subscribed and sworn to before me this 19th day of December, 2016.

LAURIE ANN ARNOLD
Notary Public - Notary Seal
State of Missouri
Commissioned for Callaway County
My Commission Expires: April 26, 2020
Commission Number: 16808714

Notary Public

My commission expires: 4/26/20

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Parker J Tinsley. My business address is 301 West High Street, Suite 720, PO Box 1766, Jefferson City, Missouri 65102.

Q. What materials have you reviewed prior to submitting this testimony?

A. I have reviewed Rebuttal Testimony of Dr. Geoff Marke from the Office of Public Counsel for case ET-2016-0246, in addition to Union Electric Company's d/b/a Ameren Missouri ("Ameren Missouri" or "Company") filings, including the initial and revised Electric Vehicle Charging Pilot tariff and Application for Approval. Additionally, I have reviewed reports from both public and private entities in regards to electric vehicles, electric vehicle infrastructure, and grid impacts.

Q. Have you previously filed testimony in this case before the Missouri Public Service Commission ("PSC" or "Commission") on behalf of DE or any other party?

A. Yes. I filed Rebuttal Testimony on November 29, 2016.

II. PURPOSE AND SUMMARY OF TESTIMONY

Q. What is the purpose of your Surrebuttal Testimony in this proceeding?

A. The purpose of my testimony is to address certain arguments made by Office of Public Counsel ("OPC") witness Dr. Geoff Marke.[1] I respond to Dr. Marke's allegations regarding pilot project locations, range anxiety, stranded assets, grid load, electric storage, and Corporate Average Fuel Economy ("CAFE") Standards.

[1] Missouri Public Service Commission Case No. ET-2016-0246, *In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Approval of a Tariff Setting a Rate for Electric Vehicle Charging Stations*, Rebuttal Testimony of Geoff Marke Submitted on Behalf of the Office of the Public Counsel, November 29, 2016.

III. PILOT PROGRAM LOCATIONS AND FOCUS

A. LOCATIONS AND RANGE

Q. Dr. Marke argues that public charging is not yet necessary. Does DE agree with his conclusion?

A. No. Dr. Marke's testimony cites several studies[2,3,4] which purportedly indicate that accelerated deployment of Electric Vehicle Charging Stations ("EVCSs") is not necessary. These studies, though, focus on metropolitan areas (such as Los Angeles, San Diego, Austin, New York City, and so on). By contrast, Ameren Missouri's pilot is intended to facilitate long distance electric vehicle ("EV") travel, not placement of EVCSs in downtown or metropolitan areas. In fact, regarding the Idaho National Laboratory report, Dr. Marke omits from his citation[5] the following quote:

> "The answer is clear… the vast majority of charging was done at home and work… This is not to say that public charging stations are not necessary or desirable. Some Direct Current Fast Charging Stations ("DCFCSs"), all of which were accessible to the public, experienced heavy use, **which supported both intra and inter-city driving**. Also, a relatively small number of public AC Level 2 EVSE (Electric Vehicle Supply Equipment) sites saw consistently high use... Nevertheless, the

[2] Idaho National Laboratory (2016). Plug-in electric vehicle and infrastructure analysis. https://avt.inl.gov/sites/default/files/pdf/arra/ARRAPEVnInfrastructureFinalReportHqltySept2015.pdf
[3] Needel, Z.A. et al. (2016) Potential for widespread electrification of personal vehicle travel in the United States. *Nature Energy.* (1) 1-7. http://www.nature.com/articles/nenergy2016112
[4] Russo. E. (2016) Public electric-car charging stations sit idle most of the time. Seattle Times. http://www.seattletimes.com/seattle-news/public-electric-car-charging-stations-sit-idle-most-of-time/
[5] Rebuttal Testimony of Dr. Geoff Marke, p. 10-11, 21-4. ET-2016-0246

projects demonstrated that a ubiquitous charging network is not needed to support EV driving.[6]" (Emphasis added)

Furthermore, the same source states that, "… more research is needed to pinpoint these local factors"[7] in reference to EVCS use differences, which could be provided from the data that can be gathered from allowing Ameren Missouri to move forward with its pilot program tariff. Finally, there are commonalities between statements found in the Idaho National Laboratory report and the Direct Testimony filed by Company witness Mr. Mark Nealon regarding charging needs and locations: both sources state that the majority of EV charging will take place at home,[8,9] showing that Ameren Missouri is aware of EV driver charging behavior but believes that it is necessary to provide infrastructure that will allow drivers to travel longer distances without worry.

B. RANGE ANXIETY & STRANDED ASSETS

Q. Is range anxiety real or imagined?

A. The appropriate answer is "both." As Dr. Marke notes,[10] over 80 percent of vehicles currently on the road could be replaced with a low-cost EV without requiring drivers to charge throughout the day. Similarly, many drivers of internal combustion engine ("ICE") vehicles do not need to refuel every day or throughout the day in order for them to make it back to their starting locations. Though drivers do not routinely utilize every gas station along the roadway or highway, their anxieties can be quelled with the

[6] Idaho National Laboratory (2016). Plug-in electric vehicle and infrastructure analysis. https://avt.inl.gov/sites/default/files/pdf/arra/ARRAPEVnInfrastructureFinalReportHqltySept2015.pdf
[7] *Ibid.*
[8] *Ibid.*
[9] Direct Testimony of Mark Nealon, p. 32, 7-11. ET-2016-0246
[10] Rebuttal Testimony of Dr. Geoff Marke., p. 11,16-19. ET-2016-0246

knowledge that there are numerous gas stations to utilize along their daily routes should they need to find a source of fuel. The same is true of driving an EV: drivers can experience "range anxiety" knowing that their battery may run out of charge far from an EVCS.[11] Even as electric car batteries become less expensive while providing greater range,[12,13,14,15] it is still necessary that EVCS infrastructure be deployed to eliminate any real or perceived range anxiety.

Q. Should emerging technologies, such as wireless charging, limit EVCS deployment for fear of stranded assets?

A. No. As Dr. Marke indicates,[16] the Oak Ridge National Laboratory demonstrated a successful wireless charging system, which could mean that typical EVCSs could theoretically become obsolete. However, wireless charging pads still require wires to deliver electricity to the chargers, similar to the cords used to charge vehicles;[17,18,19] the only "wireless" aspect of the charging system is between the pad and the electric vehicle. This fact makes retrofitting existing EVCSs to accommodate wireless charging methods a

[11] Chris Mooney. *'Range anxiety' is scaring people away from electric cars — but the fear may be overblown*. The Washington Post. August 15, 2016. https://www.washingtonpost.com/news/energy-environment/wp/2016/08/15/range-anxiety-scares-people-away-from-electric-cars-why-the-fear-could-be-overblown/?utm_term=.61fb1ac59039
[12] Damien Carrington. *Electric cars will be cheaper than conventional vehicles by 2022*, The Guardian. February 25, 2016. https://www.theguardian.com/environment/2016/feb/25/electric-cars-will-be-cheaper-than-conventional-vehicles-by-2022
[13] Rebecca Harrington. *One dramatic chart shows why electric cars are about to become mainstream*, Business Insider. March 29, 2016. http://www.businessinsider.com/electric-vehicle-battery-cost-decreases-2016-3
[14] Dave Guilford, Ryan Beene. *Electric vehicles are getting better, cheaper, longer lasting*, Autoweek. October 3, 2016. http://autoweek.com/article/green-cars/electric-vehicles-get-better-cheaper-longer-lasting
[15] Daniel Gross. *The Electric Car Revolution is Finally Starting*, Slate. February 26, 2016. http://www.slate.com/articles/business/the_juice/2016/02/electric_cars_are_no_longer_held_back_by_crappy_expensive_batteries.html
[16] Rebuttal Testimony of Dr. Geoff Marke, p. 10, 8-12. ET-2016-0246
[17] Plugless. *Plugless Charging Station Electrical Installation – What to Expect*. https://www.pluglesspower.com/learn/plugless-vehicle-charger-installation/
[18] HEVO. *How it works*. http://hevopower.com/index.html#
[19] Keith Mallinson, *Wireless Charging Ready for Burgeoning Mass Market in EVs*. WiseHarbor Spotlight Report. https://www.qualcomm.com/documents/wiseharbor-spotlight-report-1-efficacy-english

"very simple installation," a fact which does not support the possibility of numerous stranded assets.[20] Furthermore, wireless charging does not automatically accommodate every electric vehicle: a wireless vehicle adapter must be purchased and installed in the vehicle prior to being able to utilize wireless charging methods.[21] Finally, wireless charging does not achieve the same efficiency as wired charging,[22] demanding more generation for less output.

In relation to stranded assets and emerging technology, the falling price and increasing range of EV batteries could prove to complement a long-distance EVCS corridor as consumers may respond to lower prices of EVs and take longer trips with their vehicles. This could then allow the competitive market to further deploy EVCSs in areas of need in order to appropriately respond to the charging needs of EVs.

IV. GRID LOAD AND ELECTRICITY STORAGE

Q. How might electric vehicle charging impact grid load for Ameren Missouri?

A. Ameren Missouri states that they are experiencing[23] the effects of flat or declining energy consumption[24] along with inflationary costs for goods and services[25] and the need to build non-revenue-generating infrastructure. Adding electric vehicle charging to the grid can allow Ameren Missouri to keep rates lower while providing the same or better

[20] Plugless. *Plugless Q&A.* https://www.pluglesspower.com/plugless-questions/
[21] Plugless. *Plugless Installation*. https://www.pluglesspower.com/install/
[22] Plugless. *Plugless Q&A.* https://www.pluglesspower.com/plugless-questions/
[23] Direct Testimony of Michael Moehn, p. 25, 12-14, p. 26, 5-15. ER-2016-0179
[24] U.S. Energy Information Administration, *Total consumption for all sectors, annual*. December 6, 2016. http://www.eia.gov/electricity/data/browser/#/topic/2?agg=0,1&fuel=8&geo=vvvvvvvvvvvvo&freq=A&start=2001&end=2015&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=
[25] U.S. Bureau of Labor Statistics, *The cost of 'basic necessities' has risen slightly more than inflation over the last 30 years*. June 2015. http://www.bls.gov/opub/btn/volume-4/pdf/the-cost-of-basic-necessities-has-risen-slightly-more-than-inflation-over-the-last-30-years.pdf

services to its customers. Please see the Rebuttal and Surrebuttal Testimony of DE witness Mr. Martin R. Hyman with regards to system cost recovery.

Q. Dr. Marke claims electricity cannot be stored[26]. Does DE agree with this claim?

A. No. While Dr. Marke is referring to how electricity is currently generated and distributed during peak periods, there are energy storage solutions that provide power to the grid, sometimes instantaneously as with batteries. In fact, the National Renewable Energy Laboratory has been researching how EVs themselves can serve as an asset to the grid, for example through mobile storage and emergency back-up generation.[27] Grid storage can also serve to store excess energy from renewable energy sources.[28] If the price of electricity generation fluctuates throughout the day, storage can mitigate sudden price fluctuations from increased energy demand by supporting peak shaving, in turn reducing concerns about raising prices for all customers as well as increased peak emissions.[29,30] While time-of-use rates could be used to address peak-load demand, storage can provide benefits to the entire grid, such as reliability, while keeping mitigating sudden price fluctuations.[31]

V. CAFE STANDARDS AND EMISSION REDUCTIONS

[26] Rebuttal Testimony of Dr. Geoff Marke, p. 31, 16-22. ET-2016-0246
[27] National Renewable Energy Laboratory, *Electric Vehicle Grid Integration*. http://www.nrel.gov/transportation/project_ev_grid_integration.html
[28] Union of Concerned Scientists, *How Energy Works*, http://www.ucsusa.org/clean-energy/how-energy-storage-works#.WEWVFbIrKDI
[29] ABB, *Peak Shaving*, http://new.abb.com/substations/energy-storage-applications/peak-shaving
[30] Robert Corson, PE at al. *Implementing energy storage for peak-load shifting*. Consulting-Specifying Engineer Magazine, December 12, 2014. http://www.csemag.com/single-article/implementing-energy-storage-for-peak-load-shifting/95b3d2a5db6725428142c5a605ac6d89.html
[31] *Ibid*.

Q. Are CAFE Standards stringent enough to suggest that EV use is negligible in regards to efficiency and emissions?

A. No. Dr. Marke states that CAFE standards mandate that internal combustion engines' fuel economy must improve by a large margin, greatly reducing the emissions produced by ICE vehicles.[32] Some sources, such as the National Highway Traffic Safety Administration ("NHTSA") and the Center for Climate and Energy Solutions ("C2ES"), state that fuel efficiency of automaker fleets must be 54.5 mpg by model year 2025[33,34] while other sources such as the U.S. Energy Information Administration and the Energy Institute at Haas suggest that those fuel economies will not be reached until 2040.[35,36] Judging by these dates, the people of the United States would have to wait through an 8-to-23 year (from 2017) timeframe in which manufacturers **hopefully** reach these CAFE standards; historically, manufacturers have had difficulty reaching these standards.[37] Conversely, EVs can immediately reduce emissions in the transportation sector.

Second, the CAFE Standards include numerous provisions which weaken achieved fuel economy. First, an automobile manufacturer can have a small number of

[32] Rebuttal Testimony of Dr. Geoff Marke, p. 21, 8-10. ET-2016-0246
[33] NHSTA, *NHTSA and EPA Set Standards to Improve Fuel Economy and Reduce Greenhouse Gases for Passenger Cars and Light Trucks for Model Years 2017 and Beyond.* 2012. https://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/CAFE_2017-25_Fact_Sheet.pdf
[34] Center for Climate and Energy Solutions, *Federal Vehicle Standards*. http://www.c2es.org/federal/executive/vehicle-standards
[35] U.S. Energy Information Administration, *Annual Energy Outlook 2015 with projections to 2040.* April 2015. http://www.eia.gov/outlooks/aeo/pdf/0383(2015).pdf
[36] Archsmith, J. et al. *From Cradle to Junkyard: Assessing the Life Cycle Greenhouse Gas Benefits of Electric Vehicles*. Energy Institute at Haas. September 2015. https://pdfs.semanticscholar.org/e181/da70f37b983f03c11a32482320a337e261be.pdf
[37] John Lippert, *With $1.68-a-Gallon Gas, America's Big MPG Goals Are in Trouble*. January 12, 2016, Bloomberg. https://www.bloomberg.com/news/articles/2016-01-12/automakers-regulators-debate-fuel-economy-as-gas-prices-fall

highly efficient vehicles in its fleet while still producing vehicles with efficiency standards much lower than the ones mandated,[38] thus possibly contributing very little to emissions reductions. Though it could be argued that the fuel efficient vehicles would reduce overall emissions, the sales of vehicles indicate otherwise. For example, Ford sells two F-Series trucks for every passenger vehicle they sell (excluding Police Interceptor Sedans and Mustangs).[39] While Ford may produce fuel efficient vehicles for its fleet, thus achieving CAFE standards, the vehicles most often purchased have fuel economy ranges from only 15 mpg up to 26 mpg.[40] This provides evidence that relying on CAFE standards is a precarious solution. Furthermore, developing alternative fuel vehicles allows automobile manufacturers to multiply emission "credits" from manufacturing efficient or "flex-fuel" vehicles (which can use either conventional gasoline or a higher ethanol blend) to make up for their inefficient vehicles.[41]

Q. How else could transportation-sector emissions be addressed?

A. Notwithstanding these caveats, I agree with Dr. Marke that fuel economy standards only go so far: people need more efficient cars and, as suggested by *Car and Driver*, people, "… must drive less to have the greatest impact on emissions reductions."[42] Decreasing vehicle miles traveled through the expansion of public transportation would provide great

[38] National Highway Traffic Safety Administration, *CAFE Overview – Frequently Asked Questions*, http://lobby.la.psu.edu/_107th/126_CAFE_Standards_2/Agency_Activities/NHTSA/NHTSA_Cafe_Overview_FAQ.htm
[39] Ford Motor Company, *Ford Motor Company 2016 U.S. Sales Results*. October 2016. https://corporate.ford.com/content/dam/corporate/en/investors/investor-events/Sales%20Calls/2016/October-sales-FINAL.pdf
[40] Ford Motor Company. *The F-150 is Available in 7 Tough Models*. December 7, 2016. http://www.ford.com/trucks/f150/models/
[41] Center for Climate and Energy Solutions. *Federal Vehicle Standards*. http://www.c2es.org/federal/executive/vehicle-standards
[42] Csaba Csere, *How Automakers Will Meet 2016 CAFÉ Standards*. May 2010, Car and Driver. http://www.caranddriver.com/features/how-automakers-will-meet-2016-cafe-standards

benefits to the people of Missouri and the U.S., such as a reduced carbon footprint and decreased fuel consumption;[43] however, such initiatives are often difficult to promote or sustain due, in part, to issues such as pricing and payment structures, delays, and/or infrastructure deficiencies.[44, 45] Allowing people to drive personal vehicles at their discretion while producing fewer emissions seems to align more closely to the desires of drivers, who may find themselves traveling to inter- or intra-city destinations throughout the day. To that end, EVs provide drivers the ability to travel where they desire while reducing emissions.

VI. CONCLUSIONS

Q. Please summarize your conclusions and the positions of DE.

A. In this case, deploying EVCSs will support a long-distance corridor while also promoting the adoption of EVs. Encouraging EVCS deployment and corridor development can benefit both private and public actors in the EV sector through the data gathered by this pilot program and can also alleviate range anxiety. Furthermore, the fear of stranded assets is overstated, and the addition of EV charging as a service can help put downward pressure on rates, especially with the addition of flexible and advanced storage solutions.

Q. Does this conclude your Surrebuttal Testimony in this case?

A. Yes.

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[43] American Public Transportation Association. *Public Transportation Benefits.* http://www.apta.com/mediacenter/ptbenefits/Pages/default.aspx

[44] Jeff McMahon, *Top Eight Reasons People Give Up on Public Transit*. March 6, 2013. Forbes. http://www.forbes.com/sites/jeffmcmahon/2013/03/06/top-eight-reasons-people-give-up-on-public-transit/#6d985c5c741e

[45] Chris Brown, *6 Growing Transportation Problems – and Potential Solutions*. February 25, 2015. Business Fleet. http://www.businessfleet.com/blog/auto-focus/story/2015/02/6-growing-transportation-problems-and-potential-solutions.aspx