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MISSOURI PUBLIC SERVICE COMMISSION

FILE NO. ET-2016-0246

SURREBUTTAL TESTIMONY

OF

MARK J. NEALON

ON

BEHALF OF

UNION ELECTRIC COMPANY
d/b/a Ameren Missouri

St. Louis, Missouri
December 19, 2016

DIRECT TESTIMONY

OF

MARK J. NEALON

FILE NO. ET-2016-0246

Q. Please state your name and business address.

A. My name is Mark J. Nealon and my business address is 1901 Chouteau Avenue, St. Louis, Missouri 63103.

Q. Are you the same Mark Nealon who provided direct testimony in this proceeding?

A. Yes.

Q. What is the purpose of your surrebuttal testimony in this proceeding?

A. The purpose of this surrebuttal testimony is to respond to the rebuttal testimonies of Office of Public Counsel ("OPC") witness Geoff Marke, Missouri Public Service Commission Staff ("Staff") witness Byron M. Murray, and ChargePoint, Inc. ("ChargePoint") witness Anne Smart.

Q. How is your testimony organized?

A. This testimony is organized under the following categorical headings – Nature of Proposed EV Charging Pilot Program, Market and Competitive Issues, Cost-Effectiveness Tests (UCT/PACT v. RIM), and Electric Vehicle Benefits.

Q. Did you note any common themes in the rebuttal testimony submitted by the OPC, Staff, and ChargePoint?

A. Yes. These parties appeared to focus on a variety of issues that are not actually germane to Ameren Missouri's request, including rate design, home charging,

and several other issues. As noted in the testimony of Ameren Missouri witness Thomas M. Byrne, Ameren Missouri's request in this proceeding is actually very limited – Ameren Missouri is merely requesting the opportunity to launch a small pilot project for the purposes of study. That said, I do correct some of the more substantive misconceptions regarding these issues below. However, please note that if I do not rebut a specific fact or argument raised, it does not mean Ameren Missouri is acquiescing to that argument.

I. NATURE OF PROPOSED EV CHARGING PILOT PROGRAM

Q. Can you clarify the actual rates to be charged EV drivers that Ameren Missouri proposed with the long distance charging corridor pilot project?

A. Yes. Per the revised tariff filed on October 7, 2016, Ameren Missouri is proposing to charge $0.17 per minute of plug-in time for Direct Current Fast-Charging ("DCFC") and $0.20 per kilowatt-hour for Level 2 Alternating Current ("AC") charging. These charging rates were misstated in different ways by both Mr. Murray and Dr. Marke in their respective rebuttal testimonies.

The Level 2 AC charging fee is a function of the energy dispensed to the vehicle, because different EV models charge at different rates at this level, i.e. primarily either 3.3 kilowatts ("kW") or 6.6 kW. To assess a fee based on connection time would invariably favor the faster-charging EV models (and their owners) at the expense of the slower-charging models. On the other hand, the DCFC charging fee is a function of the amount of time the vehicle is plugged in, because at this faster vehicle charging level all EV models fill their batteries at the same rate, roughly 50 kW. The time-based rate also helps account for the opportunity cost of having an EV remain plugged in long after battery

charging has finished. This in turn ensures EV customers assume the greatest responsibility for the cost of the charging island investment.

Mr. Murray wrote in rebuttal testimony that "Staff recommends the tariff list both of the rates as either a per minute rate or as a per kW rate at an equivalent dollar amount."[1] In light of there being no reasons offered for Staff's recommendation, Ameren Missouri feels its proposed rates, as revised in October, are the most appropriate for all stakeholders involved.

Staff also recommends "Ameren Missouri be required to gather data and report annually to the Commission and interested stakeholders on the impact of electric vehicle charging stations on grid reliability."[2] Ameren Missouri is very amenable and has already anticipated this reporting. The proposed tariff language – both as originally proposed in August and in the October revision – has a provision for an Annual Report within 60 days of each anniversary of the pilot program, which will include information on a number of charging station-related topics, including any ancillary benefits or costs of the program. Ameren Missouri has anticipated including in its Annual Reports a discussion of the program's effects on grid reliability. This reporting intent is further reiterated in my direct testimony.

Q. Can you clarify the purpose and intent of Ameren Missouri's proposed installation of EV charging facilities in a long-distance travel corridor setting like I-70 as opposed to another type of application?

A. Yes. All rebuttal testimony did a good job of summarizing the deployment plan details associated with Ameren Missouri's proposed EV charging pilot

[1] Byron M. Murray Rebuttal Testimony, Page 5, Lines 7-8.
[2] Byron M. Murray Rebuttal Testimony, Page 5, Lines 16-18.

along the I-70 corridor. However, there still appears to be some misunderstanding as to the motivation and intent behind our proposed undertaking.

Dr. Marke states in his rebuttal testimony that "Ameren Missouri claims that these six charging stations will ease range anxiety and induce adoption of an additional 7,050 EVs....in its service territory as a direct result of the presence of these stations over the next fifteen years."[3] He goes on to discuss the issue of range anxiety at length, and whether this phenomenon is "real or largely imagined."[4]

The issue of "range anxiety," and the consumer psychology associated with it, are not the basis for Ameren Missouri's proposal as Dr. Marke suggests. The term "range anxiety" neither appears in my direct testimony nor is intimated in any of its discussion. Rather, the basis for Ameren Missouri's proposal is an infrastructure gap that allows neither modern-day nor 2017 EV models the benefit of completing a long-distance trip, despite that capability being built into mainstream automakers' models for the first time next year. The levels of "confidence" or "anxiety" EV drivers have about attempting such trips have nothing to do with the fact that they are simply not possible today without tremendous inconvenience.

Dr. Marke also elaborates on: (1) the continued predominance of home and workplace charging; (2) the lack of a need for ubiquitous charging means; and (3) the shortness of the vast majority of daily driving trips in the U.S. All of these conclusions are drawn from studies conducted by the Idaho National Laboratory, the Massachusetts

[3] Geoff Marke Rebuttal Testimony, Page 4, Lines 14-18.
[4] Geoff Marke Rebuttal Testimony, Pages 10-11.

Institute of Technology, and the Santa Fe Institute.[5] Ameren Missouri does not dispute these points; they're merely irrelevant to the aims of our long-distance charging pilot.

Most residences are already, by virtue of their 120-volt wall receptacles, EV charging stations. For this reason, there will likely never be a time when commercial electric fueling stations exist on "every street corner" per se, like gas stations do today. In my own direct testimony on page 32, I cite the 2009 National Household Travel Survey, noting that 95% of one-way trips made by the driving public in the U.S. are trips of fewer than 30 miles, most of which do not make use of interstates. Indeed, on this basis it's intuitive that the vast majority of EV charging – I indicated 80% to 90% of it – will continue to be done at home. This also heavily suggests a general lack of necessity of ubiquitous (i.e. "every-street-corner") charging networks. In fact, as EVs with 200-mile batteries and larger become commonplace, Ameren Missouri expects there will be less and less consumer concern over an EV's capability to handle the commuting and errand-related demands of a typical day; that is, the vehicles by themselves will ultimately be sufficient to address "range anxiety" issues absent the existence of urban-based, "ubiquitous" EV charging.

But none of this is germane to the purpose of Ameren Missouri's long-distance charging pilot. With the electric driving ranges that will be availed to consumers in 2017 and beyond, there will be only two places where vehicle charging remains a true necessity – at home (aided or not by residential charging stations) and along long-distance travel corridors. The Idaho National Laboratory ("INL") report Dr. Marke references – which focused more on metropolitan-based, "ubiquitous" charging – actually

[5] Geoff Marke Rebuttal Testimony, Pages 10-12.

goes on to say that "additionally, DCFCs along travel corridors were found to effectively enable long-distance range extension for Battery Electric Vehicles (BEVs)....their value is hard to quantify from the perspective of the charger [site] host, but when they were used, they provided a vital function to the BEV driver." The same INL study also stated, "The most highly utilized DCFCs tended to be located close to interstate highway exits. Interestingly, these units were used by local vehicles as much or more than they were used to recharge vehicles traveling along the interstate."[6]

Dr. Marke also alluded to an on-line article in the Seattle Times written about how "taxpayer-funded EV fast charging stations deployed throughout the city [of Eugene, Oregon] sit idle most of the time and run the risk of becoming a stranded asset."[7] Further reading of that article reveals that what was deployed were standard Level 2 AC charging stations (not DCFC) in an "urban" public setting (not along a travel corridor) for purposes of addressing range anxiety. The gist of the article is that those EV owners with large electric ranges relative to their daily commutes found little use for Level 2 AC charging stations, tipping instead in favor of home charging. All very predictable, and again, not applicable to Ameren Missouri's pilot program and its focus on the faster DCFC technology in the travel corridor setting.

Lastly, Dr. Marke mentions recent research at the Oak Ridge National Laboratory in the area of wireless vehicle charging, and the lab having recently achieved a 20 kW rate.[8] Ameren Missouri is familiar with this research, and noteworthy though it is, it's a

[6] Idaho National Laboratory (September 2015), *Plug-in Electric Vehicle and Infrastructure Analysis.* https://avt.inl.gov/sites/default/files/pdf/arra/ARRAPEVnInfrastructureFinalReportHqltySept2015.pdf
[7] Russo, Edward (2015), *Public electric-car charging stations sit idle most of time,* Seattle Times, http://www.seattletimes.com/seattle-news/public-electric-car-charging-stations-sit-idle-most-of-time/.
[8] Geoff Marke Rebuttal Testimony, Page 10, Lines 8-12.

laboratory demonstration that is still far from deployable. Twenty kW outpaces Level 2 AC charging by three times, but it's still less than half the 50 kW rate of DCFC charging. Wireless charging may also be in the EV industry's future, but it will complement direct connection charging, not replace it. But again, while these potential developments in EV charging technology are interesting, they have nothing to do with the pilot program Ameren Missouri has proposed.

Q. Are Time-of-Use ("TOU") rates, or any other type of rate design, aimed at demand-side management of loads within scope with this pilot program?

A. No. Again, Ameren Missouri's proposal is a highly targeted pilot program, small in scope, and aimed at providing a public charging service to EV drivers in a long-distance corridor setting. In the spirit of "first things first," the primary goals of this effort are to: (1) verify deployment of long-distance EV charging infrastructure has a positive and discernable effect on the consumer adoption of EVs; and (2) discern on this basis whether or not it is effective and appropriate for a regulated entity to be involved in the deployment, operation, and management of EV charging infrastructure tailored specifically to travel corridor drivers. Interstate travelers driving longer distances are not likely to plan specifically around the time of day they charge their vehicles, but rather around the time of day they actually arrive at their intended destinations. Home charging appears a more suitable target for rate designs aimed at incenting EV owners to charge during non-peak hours. However, the design and application of such a rate is not within scope with this pilot project.

Additional clarifications on this topic are also warranted. In Mr. Murray's rebuttal testimony, he inquires whether or not I laid out "any plans Ameren Missouri has

to encourage EV users to utilize public charging stations over home chargers..."[9] Because of the pilot program's limited scope and purposes, this question is simply not relevant. There is no attempt being made here to encourage EV owners to use public charging stations over home charging. Home charging and long-distance corridor charging are completely complementary to each other. By virtue of well-documented consumer driving habits in the U.S., home charging will be far more prevalent than corridor charging will ever be, but one will never replace the other.

Also in his rebuttal testimony, Mr. Murray quotes my direct testimony to the effect that, "Ameren Missouri's electric grid, like most others across the nation, operates below maximum capacity for most of any given year. Aided by thoughtful load management, a considerable EV population could root itself in the service territory without the need for generation or line infrastructure upgrades, hence applying a consistent downward pressure on electric rates."[10] He immediately goes on to say that "Ameren Missouri has not specifically explained how the EV charging network will be incorporated into a demand response program or into supply-side resources."[11] It appears Mr. Murray interpreted my use of the term "load management" to insinuate the use of rate design and demand-side management, which it does not.

When I used the term "load management," I was referring to Ameren Missouri's daily management of instantaneous grid infrastructure loading relative to the rated capacities of myriad grid elements connecting energy centers to customers. I added that sufficient generation, substation, and line infrastructure already exists today to

[9] Byron M. Murray Rebuttal Testimony, Page 4, Lines 12-14.
[10] Byron M. Murray Rebuttal Testimony, Page 3, Lines 16-20.
[11] Byron M. Murray Rebuttal Testimony, Page 4, Lines 1-2.

accommodate a dramatic increase in EV population without the need for additional investment. In hindsight, it might have been more appropriate for me to use a term like "loading management" or "grid management" as opposed to "load management." In any event, this explanation should clear the matter up.

II. MARKET AND COMPETITIVE ISSUES

Q. Can you elaborate on the nature of the EV charging infrastructure Ameren Missouri proposes to deploy in Missouri for public use?

A. Yes. Ameren Missouri identified a specific need for EV owners to be able to charge their vehicles on medium to long-range trips as a means of: (1) further enabling the driving ranges available in today's EV models; and (2) fully enabling the 200+ mile ranges being built into 2017's EV models and beyond. As such, Ameren Missouri's pilot project is focused squarely on DCFC technology, its ability to quickly get EV drivers back on the road relative to other means, and its potential for allowing an EV to become a Missouri household's only vehicle.

Each of the six EV charging islands being proposed for I-70 and Jefferson City features two pieces of DCFC equipment for the sake of Battery Electric Vehicles ("BEV"), which operate on electric fuel only. Each island also features two Level 2 AC plugs in the form of a single dual port charging station, which tailor primarily for the sake of Plug-in Hybrid Electric Vehicles ("PHEV"), which use both electric and liquid fuels. There are some BEV models today not equipped to accept a DCFC charge that are, like all other non-Tesla EVs, compatible with Level 2 AC plugs. Ameren Missouri has deliberately chosen to include both types of charging means to ensure we're providing a truly "public" charging service that all EV owners can utilize.

Q. Can you elaborate on the nature of EV charging infrastructure that's been deployed to date in Missouri for public use?

A. Yes. This was a popular topic in rebuttal testimonies, with both Dr. Marke and Ms. Smart of ChargePoint weighing in. Both submitted maps of Missouri from different websites depicting various means of charging EVs that are situated in the vicinity of I-70. Unfortunately, the way these were presented was misleading relative to the context of our long-distance charging proposal.

Dr. Marke used PlugShare.com to locate "68 EV charging stations" within five miles of I-70 between Boonville and St. Louis.[12] More accurately, these are 68 "locations" where EV charging means are available to the public, and as of the date of this testimony, PlugShare actually shows 69 locations. Most of them offer the use of Level 2 AC chargers, Tesla chargers, and 120-volt wall receptacles, none of which is suitable for recovering the full range of a BEV in a reasonable timeframe, if at all. Only eight of these locations offer the use of DCFC, and those are located at various business locations – Commerce Bank branches, Nissan auto dealers, and a Best Western hotel – with fees situated both above and below Ameren Missouri's proposed tariff rate.

Ms. Smart used the U.S. Department of Energy's ("USDOE") Alternative Fuel Data Center website to determine that "there are 1,025 public charging ports in Missouri supporting....EV drivers," including "at least 37 [of ChargePoint's].... in Ameren Missouri's service territory in the St. Louis area, Jefferson City, and Columbia."[13] There is no question these facilities support EV drivers in Missouri, as Ms. Smart suggests. However, impressive though the numbers are, there are salient points regarding the nature

[12] Geoff Marke Rebuttal Testimony, Page 8, Line 6.
[13] Anne Smart Rebuttal Testimony, Page 6, Lines 19-22.

of these deployments that need to be understood, especially in relation to the objectives of Ameren Missouri's pilot project proposal. First, though it's little more than a technicality, Columbia is not in Ameren Missouri's electric service territory. Second, all 37 ChargePoint installations represent Level 2 AC charging ports; none is a DCFC, and therefore none serve to truly facilitate long-distance driving, especially for BEVs. Furthermore, of the 1,000+ charging stations on USDOE's website, 93% are a mix of 120-volt wall outlets and Level 2 AC chargers. Only 38 of the chargers shown on the website have non-Tesla DCFC plugs (3.7% of everything available in Missouri), and only eight of these are industry-standard DCFC plugs situated inside Ameren Missouri's service territory within five miles of I-70. Lastly, none of these is located in central Missouri, which is a major focus of Ameren Missouri's proposed pilot program.

Q. Is there a clear distinction between the EV charging infrastructure deployed to date in Missouri for public use and the infrastructure Ameren Missouri is proposing?

A. Yes. In my direct testimony I said that Ameren Missouri views the opportunity to deploy long distance EV charging infrastructure – "especially amidst the dormancy of free market activity to seize it – as lying comfortably within our domain.... as an electric service provider...." At least one party apparently interpreted this statement as an accusation "that the private sector market failed to support future EV drivers" in general.[14]

Ameren Missouri acknowledges that over 1,000 available charging plugs represent a substantial amount of competitive free market activity, if only in the area of

[14] Anne Smart Rebuttal Testimony, Page 7, Lines 12-13.

selling charging station hardware and its associated network software. The reference to "dormant free market activity" in my direct testimony was made in the context of the long-distance charging corridor pilot project and the two glaring EV infrastructure gaps that exist today, even 1,000+ charging plugs later: (1) the lack of regional connectivity; and (2) the lack of fast-charging service equipment in the state of Missouri. Putting aside the maps that Ms. Smart and Dr. Marke included in rebuttal, the following is the only charging station infrastructure map that is truly relevant to Ameren Missouri's I-70 corridor proposal:

The map above is a PlugShare map showing all the DCFC that are available to the EV driving public in the vicinity of I-70 as it traverses Missouri, and does not include the proprietary Tesla charging stations that exist in the St. Louis, Columbia, and Kansas City areas. There are 37 public fast-charging "locations" above in total, which include Illinois charging sites just outside the St. Louis area and Kansas charging sites just outside the Kansas City area. (The only other public DCFC location in all of Missouri is at a Hy-Vee store in St. Joseph.) Together they make for a striking visual, illustrating a distinct lack

of the very thing that is the focus of Ameren Missouri's proposed pilot project – public DCFC facilities along Missouri's long-distance travel corridors, particularly along I-70.

In eastern Missouri, the westernmost public DCFC facility is a bank location in Wentzville, while in western Missouri, the easternmost public DCFC facility is a retail store in Blue Springs. Those two locations are separated by 190 miles of I-70 corridor. The long distance trips I said are not possible for EVs earlier in this testimony are not possible for precisely this reason. While DCFCs represent the type of charging facility best suited for long distance EV driving, they have been installed neither in sufficient quantity nor in sufficient locations to facilitate that end use in Missouri. Instead, they were installed for the same reason all urban-based charging stations have been installed in U.S., DCFC or not – to support the more frequent "topping off" of EV batteries by local patrons.

Q. Why has the private sector not made the move to deploy EV charging infrastructure along long-distance travel corridors, and why does is make more sense for Ameren Missouri to do so?

A. As a direct result of the financial analysis Ameren Missouri performed as part of this pilot project proposal, it became clear why the private sector – despite all its urban-based market activity to date – hasn't made the move to deploying EV charging infrastructure that tailors to the long-distance traveler. Deploying DCFC facilities is an expensive undertaking relative to Level 2 AC, and given the relative infrequency of medium to long-range trips for the average driver – one-way trips greater than 30 miles constitute only 5% of all trips taken per the 2009 National Household Travel Survey – the

business case is bleak for any free market entity expecting corridor charging revenues to garner a quick return on investment.

On the other hand, Missouri's 2015 State Energy Plan offers that "electric utilities are uniquely positioned to help support electric vehicle infrastructure and charging station networks." This is very true, and for several reasons. Ameren Missouri is, by its nature, an infrastructure company and has been providing safe and reliable energy for over a century. As a direct consequence of the essential service we provide Missouri customers, the electric grid is quite literally everywhere civilization exists, and is already adjacent to remotest of locations where EV fueling would be necessary. Providing dependable and affordable EV charging infrastructure virtually anywhere and for the long haul is well within Ameren Missouri's natural capabilities.

Additionally, and as I stated in my direct testimony, Ameren Missouri is "uniquely positioned" to provide this public service by virtue of its generating both corridor charging revenues from EV drivers and incremental home charging revenues from those participating customers who make their EV purchase decision in direct response to our deployments. This is the very thing that makes the downward rate pressure benefit possible for all utility customers, and the longer the infrastructure barriers to widespread EV consumer adoption persist in the interstate arena, the longer the full measure of this benefit – and others – are forestalled.

Consumer adoption of EVs in Missouri may someday be substantial enough to create a more viable business case for the private sector in the travel corridor setting, though we feel this will take many years, if it's possible at all. But Ameren Missouri is staunch in its conviction that our "unique positioning" compels us to begin leading the

corridor charging transformation, lest the type of consumer adoption necessary to create more market-competitive business cases is never realized.

Q. In Dr. Marke's rebuttal testimony, he compared the regulation of Ameren Missouri's 18 pieces of EV charging station hardware along I-70 to the regulation of bottled water. Is this a valid analogy?

A. No. Dr. Marke observed in his rebuttal that "the Commission has not felt the need to regulate the resale of water from Anheuser Busch or Coca-Cola. Both entities repackage and resell water as part of their respective products even though that water service was obtained from a single point supplied through Missouri American Water – a faucet – in order for it to serve its intended purpose."[15]

Ameren Missouri concedes that the Commission never regulated bottled water. However, bottled water never needed a "push" in order to get it started in the market. If fresh water had ever required the installation of expensive dispensing equipment and the private sector was not able to cost-effectively deploy such equipment, it seems quite likely a regulated entity would have been tasked with providing it, especially if there were many layers of benefits associated with providing bottled water.

Dr. Marke goes on to testify that, "[c]ertainly, the currently operating EV charging stations run by competitive private firms would be adversely impacted if the Commission were to determine that charging stations should function as an extension of regulated utilities service."[16] But the DCFC charging station map and related discussion presented earlier in my surrebuttal testimony show the number of private firms that run EV charging stations and actually compete for long-distance corridor charging service

[15] Geoff Marke Rebuttal Testimony, Page 7, Lines 2-6.
[16] Geoff Marke Rebuttal Testimony, Page 7, Lines 6-8.

along I-70 – or any Missouri travel corridor, for that matter – is zero. So Dr. Marke's concerns about adversely affecting competition are unfounded.

Q. What is the nature of ChargePoint's opposition to Ameren Missouri's EV corridor charging pilot project as it was proposed, and what changes are recommended?

A. In her rebuttal testimony, Ms. Smart testifies she is "concerned that the design of Ameren Missouri's pilot, including selecting a single vendor for the charging stations, and seeking to regulate pricing to drivers, could negatively impact the competitive EV charging market in Ameren Missouri's service territory."[17] Among the things ChargePoint recommends to combat this is for Ameren Missouri to qualify multiple RFP respondents so as to avoid locking in a single market winner for the duration of any given project. But ChargePoint obviously appears to be more concerned about the competition for selling charging stations rather than competition for providing a travel corridor charging service. Nonetheless, Ameren Missouri considers the recommendation sound under the right circumstances.

The pilot project being proposed is intentionally as small in scope as possible while still providing the desired learning and intelligence. At the center of this intended learning are customer satisfaction, driver charging behavior, and consumer adoption elements – not vendor comparisons. Eighteen pieces of EV charging equipment is the sum total of the intended I-70 deployment, and Ameren Missouri doesn't believe a project this small warrants the involvement of multiple vendors. Ameren Missouri employed a vigorous sourcing process, and is convinced its vendor decision will provide

[17] Anne Smart Rebuttal Testimony, Page 8, Lines 14-17.

both very reliable hardware and a sound managing network at the most affordable level of investment. But for a much larger deployment initiative, Ameren Missouri would likely consider using multiple vendors, given: (1) it helps maintain degrees of "internal" competition amongst them; and (2) Ameren Missouri has direct experience with this very practice.

ChargePoint also recommends that local site hosts: (1) actually make the choice as to which vendor's products will be deployed on their property; (2) pay Ameren Missouri for this privilege; and (3) take control of the pricing charged to their EV driver patrons. All this is a clear departure from what Ameren Missouri is pursuing with this pilot project. Discussions with potential site hosts in each community have begun, and a couple things have already become obvious. First, their interest in hosting a charging island depends on their assessment of the patronage it would help to attract relative to the "intrusion" it represents on their properties. Second, potential hosts in out-state Missouri are not interested in contributing to the cost of the charging islands; in fact, some actually expressed a desire to be compensated for losing the parking spots the islands require.

Ameren Missouri believes that in the travel corridor setting, EV drivers are going to stop at I-70 charging islands because they need to charge, not because they need (or even choose) to be at the host site location. This is the fundamental difference between "corridor charging" and "destination charging." Ameren Missouri is doing its best to select communities and site host locations along I-70 that provide several "dwell time" options for EV occupants when they stop. But the fact remains that the primary focus of this proposed service offering is to allow the EV driver to "fill up" at a transparent non-volatile price and then get back on the road. To the extent site host partners can cater to

them while they wait is both welcome and intended, but Ameren Missouri doesn't envision a higher stake for them in this setting, lest it become for them too great a burden.

III. COST-EFFECTIVENESS TESTS – UCT/PACT v. RIM

Q. Please discuss the concerns expressed in Dr. Marke's rebuttal testimony regarding the nature of the cost-effectiveness test Ameren Missouri chose for its rate model analysis of the corridor charging pilot program.

A. In my direct testimony I identified the rate model analysis we performed as a Utility Cost Test, a.k.a. Program Administrator Cost Test ("UCT/PACT"). In contrast, Dr. Marke believes the Rate Impact Measure Test ("RIM") is more appropriate for analysis of load-building programs.

Five cost-effectiveness tests were developed in California in 1983, specifically for the evaluation of energy efficiency ("EE") and demand response programs, and these approaches continue to be used today all across the U.S., primarily to evaluate such programs. While California's initial motivations for doing this had little to do with load-increasing programs like Ameren Missouri's EV charging pilot, the cost and benefit elements included in two of those tests – the UCT/PACT and the RIM – provide a valid financial basis for determining the merits of a project like the EV corridor charging pilot.

The nature of the proposed pilot program and the direct impact we believe it will have on energy revenues over time actually resulted in Ameren Missouri's analysis taking on attributes of both tests. Notwithstanding, and regardless of the label attached to the test performed, the end result of Ameren Missouri's analysis remains the same and clearly illustrates a rate benefit to all utility customers in the form of substantive long-term downward pressure.

Q. Can you elaborate on Ameren Missouri's application of these cost-effectiveness tests in its analysis of the proposed corridor charging pilot program?

A. Yes. Referencing the California Standard Practice Manual that Dr. Marke footnoted in his rebuttal testimony, Ameren Missouri's analysis draws from the UCT/PACT in that the costs considered are those incurred by Ameren Missouri alone (the "program administrator") and not any EV drivers (the "participants"). These costs include increased supply costs – i.e. capacity, generation, transmission and distribution – for periods in which load increases (which is every year in this case). Per the test definition, they include both initial and annual costs, including the cost of utility equipment, its installation, operation, and maintenance, in addition to costs for the program's monitoring and administration. Likewise, revenue shifts are viewed as transfer payments between EV customers (the "participants") and all utility customers (the "ratepayers"). But Ameren Missouri's analysis represents a departure from the UCT/PACT in that it does not measure the net costs of the proposed pilot program relative to another resource option other than "doing nothing."

Ameren Missouri's analysis draws from the RIM in that it measures what happens to utility customer bills due to changes in utility revenues and operating costs caused by the pilot project. The treatment of costs with the RIM is identical to their treatment in the UCT/PACT. Likewise, the treatment of additional revenues as "benefits" of the program is identical with both tests. Lastly, the results of both tests can be expressed as a net present value ("NPV") or a benefit-cost ratio, and Ameren Missouri does both, though the NPV is expressed on a per ratepayer basis as a means of illustrating the downward pressure nature of EV adoption benefits.

Ameren Missouri makes no mistake in confusing EV charging stations with energy efficiency programs. All told, however, in the complete absence of energy efficiency program elements like: (1) a third party administrator; (2) lost revenues; (3) avoided energy-related and capacity related costs; (4) incentive payments; and (5) fuel substitutions, UCT/PACT and RIM analyses of Ameren Missouri's travel corridor charging project are largely rendered one and the same. It might have been more intuitive for me to have placed a "RIM" label on Ameren Missouri's analysis instead of the "UCT" label I used in direct testimony. Admittedly, the annual pitting of a program's revenues (i.e. "benefits") versus its costs over a period of time, and determining whether utility customers would ultimately benefit from the program are both more germane to the RIM as the California Standard Practice Manual describes it. Regardless, the results remain the same, indicating a solid benefit to utility customers.

Q. Dr. Marke's rebuttal testimony suggests he doesn't believe the UCT/RIM was calculated correctly. Does Ameren Missouri have a response to this concern?

A. Yes. The financial analysis Ameren Missouri performed on the EV charging pilot project is both valid and correctly calculated to the best of our knowledge. Ameren Missouri included all applicable costs – including those considered highly confidential – in its calculation of revenue requirements and appropriately applied a valid discount rate to the time-based financial analysis. There are neither any mathematical errors nor any misapplications of the RIM that any stakeholder in this case has brought forward, including Dr. Marke, despite all of them having had a fully functioning copy of the analysis for over four months.

As if in support of his argument, Dr. Marke paraphrases a statement from my direct testimony to the effect the charging pilot "program would not be cost-effective during the three-year pilot period under any scenario."[18] Assuming the term "cost-effectiveness" is synonymous with "applying downward rate pressure," this statement is correct, and Ameren Missouri has been absolutely transparent on this issue. Indeed, the fundamental premise being tested with the pilot program we propose is that deploying long-distance charging infrastructure will have a positive discernable effect on the consumer adoption of EVs. Such adoption isn't anticipated to take off until the three-year study period is nearly over, but then the charging equipment will still be in service at least another ten years after that, and producing the anticipated rate relief benefit for all utility customers. The point of this small-scale pilot project is to learn, and Ameren Missouri's intent is to either prove this hypothesis or disprove it – which we will be able to do in the three-year pilot period.

Still, true to Dr. Marke's statement, Ameren Missouri is resolved to the notion that such accelerated adoption, regardless of its magnitude, will not be enough to "pay back" the anticipated $0.45 utility customer subsidy within the first three years, and I state this clearly in testimony. (Ameren Missouri's analysis shows annual net revenues going positive for the first time in Year 5, with "free and clear" downward rate pressure beginning in Year 8.) But there will also be no subsidy the entire period rates set in the pending general rate case remain in effect, which will be at least one of the three years of the proposed pilot.

[18] Geoff Marke Rebuttal Testimony, Page 14, Lines 24-25.

Based on his follow-up remarks in rebuttal, what Dr. Marke actually seems to be challenging is neither the correctness of calculations nor the application of tests, but rather the assumption Ameren Missouri makes regarding the accelerated adoption we claim to be able to impact with our deployment of long-distance travel corridor charging equipment.

As I state in direct testimony, once long-distance travel corridor charging is deployed (thus enabling the long-distance range capabilities being built into 2017 EV models and beyond), Ameren Missouri believes EV adoption in the state will begin accelerating from its current "straight line" progression at the same rate Missouri consumers began adopting hybrid electric vehicles back in 2000. While Dr. Marke states "there is no guarantee that EV's will materialize at the[se] levels,"[19] Ameren Missouri contends that real consumer data from real Missouri consumers in response to real vehicle technology are difficult to refute and represent the most reasonable prediction possible.

Our model assumes that solving two important issues will accelerate the adoption of EVs. First, automakers must offer relatively affordable EVs that have reasonably long ranges, and that is happening in the marketplace. Second, the fast-charging long-distance corridor infrastructure that will enable these long-distance EVs to actually travel long-distance will need to be developed. While both of these factors are critical and Ameren Missouri might have attributed 50% to infrastructure, we chose to more conservatively assume that the corridor charging equipment was "25% responsible" for the incremental growth in EV adoption, while automakers offering "the right EVs at the right price" are

[19] Marke Rebuttal Testimony, Page 10, Lines 3-4.

responsible for 75% of incremental growth. It is this 25% of incremental growth and the corresponding corridor-based and home-based charging revenues through 2030 that Dr. Marke challenges, stating that "reasonable minds have already differed over the appropriateness of solely crediting Ameren Missouri a 25% increase for future EV adoption."[20]

Ameren Missouri actually tested this 25% EV consumer adoption assumption on "reasonable minds" in a meeting with stakeholders on July 27, 2016, in Jefferson City, which Dr. Marke attended. In fact, every last assumption that went into both the rate model and the I-70 traffic analysis was openly shared with over 20 stakeholder attendees for the express purpose of getting constructive feedback on their reasonableness and propriety. In the end, there was no comment made in this meeting or through subsequent correspondence on the merits of this assumption, though there was a good deal of gratitude expressed for what was perceived as a consistent conservatism regarding all facets of the study Ameren Missouri shared with them.

Lastly, Ameren Missouri became solidly rooted in this 25% consumer adoption assumption before having any idea of its effect on the financial model we filed as a workpaper. In fact, as key as this input is to Ameren Missouri's case, to use Dr. Marke's word, no other percentage had ever been tested prior to the August tariff filing. But since it has come up in Dr. Marke's rebuttal testimony, Ameren Missouri tested more conservative adoption assumptions for the first time, using the same functional model. It turns out that "free and clear" downward rate pressure becomes a reality for all Ameren Missouri's utility customers within the 15-year useful life of the charging islands, even if

[20] Geoff Marke Rebuttal Testimony, Page 15, Lines 5-7.

the Company directly impacts the decisions of only 5% of these consumers. Considering our 25% assumption and its 7,050 incremental increase in EVs by 2030, it's important to understand that by that time, all utility customers will have already been realizing downward rate pressure benefits associated with the charging revenues of the other 30,573 EVs in Ameren Missouri's service territory.

Q. Are any other elements of Ameren Missouri's financial analysis being challenged in rebuttal testimony?

A. The only other financial input being challenged is Ameren Missouri's marketing cost estimate. Without having pursued the details, Ameren Missouri estimated spending a total $30,000 for purposes of marketing and consumer awareness associated with the proposed I-70 charging infrastructure. Dr. Marke is correct in his supposition such marketing would include our pursuit of spots on the blue fueling "logo" signage, which is familiar to all Missouri interstate drivers. However, Ameren Missouri's only communication to date with the Missouri Department of Transportation on this topic involved our obtaining a contact with whom to consult directly when the time came.

If it turns out Ameren Missouri can confirm the type of annual pricing Dr. Marke cites for this kind of advertising, we will definitely reconsider this option. Ameren Missouri is comfortable making this statement only because we're aware that the vast majority of EV drivers actually use national EV charging website registries to locate fueling facilities via smart phone apps and on-board vehicle navigation, which would identify the I-70 charging stations at no cost to our company. There are but a handful of these websites/apps that are considered "mainstream" in the EV community, but they are free to charging station owners who wish to register and advertise their equipment. They

not only have charging infrastructure accurately mapped out, they can guide drivers directly to them, provide information on charging station type, pricing, and status, and even suggest EV "travel routes" that include charging means along the way from "Point A to Point B."

Participation on the blue fueling exit signs would have the added benefit of enhancing EV charging awareness with the general public in addition to just EV owners, but Ameren Missouri will pass on this kind of expense pending a more detailed investigation of the costs involved.

IV. ELECTRIC VEHICLE BENEFITS

Q. Dr. Marke warns of the threat of stranded assets looming over a regulated deployment of EV charging stations. Is there agreement on the nature of such a threat in this case?

A. No. Dr. Marke notes correctly that "assets can become stranded in a dynamic system when new technologies are introduced and new companies out-compete incumbents."[21] Ameren Missouri consciously chose the charging equipment it did based on the industry-standard plugs with which all EV models can charge – Level 2 AC and, for those EVs having DCFC capability, the two predominant DCFC plugs worldwide. In other words, the chargers Ameren Missouri has selected can charge virtually all EVs on the road today. There are certainly technology advances being made in EV service equipment today, primarily in the area of charging speeds, and Ameren Missouri is following all of it. With faster speeds may come more robust charging plugs eventually,

[21] Geoff Marke Rebuttal Testimony, Page 9, Lines 15-16.

but we fully expect the proposed equipment will provide service to EVs throughout its expected 15-year useful life.

In the end, Dr. Marke's concern about stranded investment is overblown, if for no other reason than the amount of investment involved in the proposed pilot is so small. In my direct testimony I stated our financial analysis showed if all costs of the pilot were included in rates from day one, the impact on retail rates would be approximately $.01/customer/month. Because retail electric customers will pay nothing to support the pilot the entire time rates set in File No. ER-2016-0179 are in effect, and also because the capital assets will be depreciated over 15 years (which will begin when the assets are installed and operating), the amount of any stranded investment after the three-year pilot is finished will be miniscule.

Q. Dr. Marke questions if increased use of EVs will reduce Ameren Missouri's carbon emissions. Is this a valid question?

A. Yes, the question is valid, albeit irrelevant to this particular case since the requested approval covers such a limited scope pilot. Increased use of EVs in Ameren Missouri's service territory will, by itself, increase system load by virtue of the charging that takes place. This would absolutely not reduce Ameren Missouri's carbon emissions, nor does Ameren Missouri claim it would. But that fact alone does not tell the whole story of the effect increased EV usage will have on carbon emissions.

Q. Dr. Marke attempts to paraphrase your direct testimony to the effect that Ameren Missouri claims "a 2011 internal analysis showed carbon dioxide

("CO_2") emissions were 35% less than CO_2 tailpipe emissions."[22] Is this an accurate restatement of your testimony?

A. Absolutely not, because it's completely lacking of any context. My statement in direct testimony was that, as a result of the 2011 analysis, it was determined that mile for mile, based on Ameren Missouri's power generation fuel mix at the time, the CO_2 emissions produced from charging an EV in its service territory is approximately 35% less than the CO_2 tailpipe emissions of a comparable gasoline-fueled vehicle. The point is that a region's carbon footprint is reduced overall with an increase in EV adoption therein, even when that region is a service territory like Ameren Missouri's, where the dependence on fossil fuels is still relatively high. And for every subsequent action in Ameren Missouri's clean energy transition, from significant mass-based emission reductions associated with coal plant retirements to replacement generation in the form of a mix of renewable and natural gas generation, the environmental benefits of transportation electrification accelerate. Environmentally-based conclusions similar to Ameren Missouri's 2011 analysis were presented on May 25, 2016, at Staff's EV Charging Facilities Workshop, by representatives from the Electric Power Research Institute, the Sierra Club, and the Natural Resources Defense Council.

Figures 2 and 3 in Dr. Marke's rebuttal testimony actually corroborate the emissions benefits I described in my direct testimony. The bar graphs entitled "Annual Emissions per Vehicle" on the right side of the "State Averages for MO" portion of each figure[23] indicate approximately 11,435 pounds of CO_2 equivalent emissions for gasoline vehicles, 8,328 pounds for BEVs, and 8,552 pounds for PHEVs, which represent 27%

[22] Geoff Marke Rebuttal Testimony, Page 17, Lines 8-9.
[23] Geoff Marke Rebuttal Testimony, Page 19, Line 1 and Page 20, Line 4.

and 25% reductions, respectively. All told, the fuel mix of a region's energy production can act as a decelerator to the environmental benefits associated with electric transportation for that region, but it will never stop them. Generation fuel mixes, vehicle emission distributions, and advanced biofuel mandates aside, the answer to the question, "Is there a positive difference being made in the environment by promoting EV adoption in a highly fossil fuel-dependent region like Missouri?" is, absolutely, "Yes." Another of Ameren Missouri's surrebuttal witnesses, Dr. Phil Sheehy, also discusses Dr. Marke's analysis of the effect of increased EV on net carbon emissions, and describes several errors and shortcomings in that analysis.

Q. Does Ameren Missouri have any comment to OPC's concerns regarding the rate-base treatment of travel corridor charging stations?

A. Yes. Dr. Marke testified to "a concern that the long-term benefits purported by Ameren Missouri for all ratepayers are highly speculative [and] will not materialize until well into the future..."[24] and added that "it is difficult to justify raising rates on households that struggle to make ends meet..."[25]

Ameren Missouri has fashioned a travel corridor charging pilot project of extremely small scope as a means of determining the propriety of its deploying such infrastructure in a regulated setting for the benefit of all utility customers. This benefit takes the form of a downward rate pressure, which is the direct result of an increased EV charging presence in the service territory that requires no generation or grid infrastructure upgrades to support. Utility customers are enjoying such downward rate pressure currently, and that downward pressure would likely become much greater, especially

[24] Geoff Marke Rebuttal Testimony, Page 24, Lines 4-6.
[25] Geoff Marke Rebuttal Testimony, Page 24, Line 10-12.

with a model that was acknowledged in stakeholder meetings to be responsibly conservative in nature. The subsidy involved is a total $0.45, or $0.113 annually for each of four years, and that assumes all costs are included in retail rates on Day 1 of the pilot, which will not happen. On the other hand, the 15-year NPV of this downward rate pressure is $3.63. For Ameren Missouri, it is difficult to justify denying "households that struggle to make ends meet" their $3.63 because $0.45 is deemed oppressive. Anyone who has utility customers' best interests in mind should want this pilot project to be not only successful, but wildly so – $3.63 is a veritable windfall relative to the $0.45 that's required to confirm such a windfall is possible. It could be much more than that as well. We implore all stakeholders to work with Ameren Missouri so together we can learn how best to enable and nurture these beneficial technological advances.

Q. Dr. Marke suggests a potential equity issue that takes the form of "EV drivers [who] would not be paying their fair share of the transportation infrastructure in Missouri."[26] Is this an accurate assessment?

A. No. EV drivers registered in Missouri will be paying for infrastructure. Tom Blair, an engineer with MoDOT who is heading up the "Road to Tomorrow" initiative, informed Ameren Missouri's EV Team of the Department of Revenue's ("DOR") special fuel decal program. According to the DOR's website page,[27] in lieu of related taxes, the owner of a motor vehicle that operates with alternative fuel (including liquid petroleum, electricity, and natural gas) must annually purchase a special fuel decal prior to January 31 and pay the annual decal fee, which is $75 in the case of an EV. This seems appropriate, as $75 represents the amount of tax paid by an owner of a gasoline-

[26] Geoff Marke Rebuttal Testimony, Page 28, Lines 16-17.
[27] Special Fuel Decals, Missouri Department of Revenue, http://dor.mo.gov/motorv/decals.php.

powered vehicle in Missouri that travels just over 13,000 miles during the course of a year and gets 30 MPG. Dr. Sheehy's surrebuttal testimony also addresses this issue, pointing out further errors in Dr. Marke's analysis.

Q. Does this conclude your surrebuttal testimony?

A. Yes, it does.

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 MARK NEALON

STATE OF MISSOURI)
) ss
CITY OF ST. LOUIS)

Mark Nealon, being first duly sworn on his oath, states:

1. My name is Mark Nealon. I work in the City of St. Louis, Missouri, and I am employed by Union Electric Company d/b/a Ameren Missouri as Director, Engineering Design & Project Management.

2. Attached hereto and made a part hereof for all purposes is my Surrebuttal Testimony on behalf of Union Electric Company d/b/a Ameren Missouri consisting of 30 pages, all of which have been prepared in written form for introduction into evidence in the above-referenced docket.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

Mark Nealon

Mark Nealon

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

Geri A. Best

Notary Public

My commission expires:

GERI A. BEST
Notary Public - Notary Seal
State of Missouri
Commissioned for St. Louis County
My Commission Expires: February 15, 2018
Commission Number: 14839811