Kendrick C. Fentress
Associate General Counsel

NCRH 20 / P.O. Box 1551
Raleigh, NC 27602

o: 919.546.6733

Kendrick.Fentress@duke-energy.com



August 16, 2022

**VIA ELECTRONIC FILING**

Ms. Shonta Dunston
Chief Clerk
North Carolina Utilities Commission
4325 Mail Service Center
Raleigh, North Carolina 27699-4300

**RE: Duke Energy Carolinas, LLC's Application for Approval of Vehicle-to-Grid Pilot Program**
**Docket No. E-7, Sub 1275**

Dear Ms. Dunston:

Enclosed for filing with and approval by the North Carolina Utilities Commission is Duke Energy Carolinas, LLC's Application for Approval of Vehicle-to-Grid Pilot Program.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Kendrick C. Fentress

Enclosures

cc: Parties of Record

**STATE OF NORTH CAROLINA**
**UTILITIES COMMISSION**
**RALEIGH**

DOCKET NO. E-7, SUB 1275

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

| | | |
|---|---|---|
| In the Matter of<br>Application by Duke Energy Carolinas, LLC For Approval of Electric Vehicle-to-Grid Pilot Program Pursuant to N.C. Gen. Stat. § 62 -133.9 and Commission Rule R8-68 | ) | **APPLICATION OF DUKE ENERGY CAROLINAS, LLC FOR APPROVAL OF ELECTRIC VEHICLE-TO-GRID PILOT PROGRAM** |

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Duke Energy Carolinas, LLC ("DEC," "Company," or "Applicant"), pursuant to North Carolina General Statute ("N.C. Gen. Stat.") § 62-133.9 and North Carolina Utilities Commission (the "Commission") Rule R8-68, hereby applies to the Commission for approval of the Company's new demand-side management ("DSM") program, the Electric Vehicle ("EV") Load Control Service Pilot ("Pilot"). This Pilot will provide valuable information on a relatively new technology - bi-directional Vehicle-to-Grid ("V2G") technology – and how that technology can enable the discharge of EV batteries to support the grid.

In support of this Application, DEC respectfully shows the Commission the following:

1. The Applicant's general office and mailing address is:

   Duke Energy Carolinas, LLC
   526 South Church Street
   Charlotte, NC 28202

2. The name and address of Applicant's attorney is:

Kendrick Fentress, Associate General Counsel
Duke Energy Corporation
P.O Box 1551/NCRH 20
Raleigh, North Carolina 27602
(919) 546-6733
kendrick.fentress@duke-energy.com

3. EV growth in North Carolina will greatly impact utility system loads, and it presents a significant opportunity to help manage peak load conditions by utilizing the EV's batteries as a dispatchable distributed energy resource ("DER"). While bi-directional charging capable EVs are just now entering the market, ultimately, full-scale commercial programs like this Pilot provide a large potential resource for the Company to reduce energy use during peak periods, which helps manage the grid, maintain reliability, and conserve natural resources. Thus, the purpose of this Pilot is to learn more about managing peak load conditions using EV batteries through evaluating: (i) the bi-directional V2G technology, (ii) the availability and performance of EV batteries, and (iii) the impact on battery life and functionality. Importantly, this Pilot will also provide valuable insights on customers' willingness to allow control of their respective EV batteries. From the learnings, the Company intends to propose a full-scale commercialized version of this Pilot. In fact, the Company may seek to develop full-scale commercialized offerings during the duration of this Pilot, if interim measured results lead the Company to do so.

4. Bi-directional charging technology is becoming increasingly common in newly-announced EVs in production. DEC has collaborated with a leading automotive original equipment manufacturer ("OEM") - Ford Motor Company ("Ford") - to develop opportunities for their mutual customers to benefit from

innovative program offerings, such as this Pilot. This collaboration results in both lower costs for the utility and allows DEC customers leasing EVs to recognize the full value of their eligible EV offers. For example, the Pilot design includes the vehicle OEM, like Ford, managing the acquisition of participants. The Company's demand response incentive will be applied at the time of purchase and have the effect of lowering a pilot participant's monthly lease payment for the EV. This collaboration is in keeping with the Commission's direction for EV Pilots to encourage: (i) the use of third-party funding or assistance whenever it is available and (ii) ownership and operation partnerships that provide the greatest benefit to customers. *Order Approving Electric Transportation Pilot, in Part*, Docket Nos. E-2, Sub 1197 and E-7, Sub 1195, issued Nov. 24, 2020, at 20-21. The estimated cost of the Pilot is approximately $500,000.[1]

5. The Pilot is available to individually metered residential customers who are leasing bi-directional capable EVs from a participating OEM and installing the necessary electric vehicle supply equipment ("EVSE" or "charger") at their primary residence. The Company anticipates launching the Pilot in early 2023 and initially anticipates the Ford F150 Lightning being the only EV for the Pilot. The Company, however, expects to expand to other models and other OEMs in the future. The Pilot is expected to consist of at least 35 participants and is capped at 100 participants.

6. The Company has identified customers who lease EVs as the participants in the Pilot for several reasons. First, working with customer leases allows

[1] This amount includes the cost of the Pilot and certain fixed evaluation, measurement, and verification costs.

for an easier implementation because the Company pays an incentive directly to Ford to reduce the customer's monthly EV lease payments. Second, based on conversations with Ford, a high number of EVs capable of participating in the pilot are anticipated to be leased to customers, and historically in North Carolina, less than 10% of lease customers relocate during the term of the lease. This data indicates a likely reduced risk of a leased EV owner relocating during the Pilot and removing the source of the utility system benefit from the Duke Energy Carolinas system. Moreover, it contributes to a more stable number of participants throughout the Pilot for purposes of Pilot learnings. Finally, the Company is able to limit the duration of the Pilot to align with the duration of the EV lease. The proposed tariff associated with the Pilot is attached hereto as Attachment G to Exhibit 1.

7. As noted above, the financial incentive designed to compensate the participant for energy and capacity savings realized by the utility system from their participation in this Pilot is $6.50/kW of eligible battery discharge capability in the form of monthly reduced lease payments. To promote participants making their EV batteries available for discharge during an event, at the end of each 12 months of the Pilot, if a participant's actual annual availability of the discharge capability exceeds the assumed capability, the Company will provide the participant with a $25 gift card.

8. Participants must agree to allow the Company to have the necessary control to discharge the EV's battery to reduce utility system demand through the stored energy in the vehicle's battery. The Company will also be allowed to call up to 24 discharge events per year. Three events per month will be in the winter months (December through February) and in the summer months (June through August). One

event per month will be in the shoulder months of September to November and March to May. Participants will be notified in advance of events, and discharge events will last no longer than four hours. As described in more detail below, participating customers must also be subject to evaluation, measurement, and verification ("EM&V") to validate savings and inform the Company's cost recovery.

9. As is the case with many Pilots, the Company has sought to minimize the overall costs by designing this Pilot to be as small as possible to achieve the Company's objectives. As a result of the Pilot's small scale and the fact that certain significant Pilot costs are fixed, such as EM&V costs, the Pilot itself does not project to be cost effective. However, the Utility Cost Test ("UCT") score is 1.24 when the Company models the Pilot's cost effectiveness to include a five-year period of commercialization, which exceeds the 1.0 UCT score required by the Company's Cost Recovery and Incentive Mechanism for DSM and EE Programs (the "DSM/EE Mechanism"), appended to the Commission's *Order Approving Revisions to Demand-Side Management and Energy Efficiency Cost Recovery Mechanisms*, Docket Nos. E-2, Sub 931 and E-7, Sub 1032 (Oct. 20, 2020). This indicates that, in addition to the valuable learnings this Pilot may offer to the Company about V2G technology, the benefits to the utility system exceed the costs.

10. A third party will validate the projected impacts through EM&V, consistent with the guidelines outlined in the DSM/EE Mechanism. The EM&V will consist of an impact and process evaluation by an independent third-party evaluator. The evaluator will model non-event day load to form an event baseline and will estimate demand impacts before, during, and after an event for the events. The

evaluator will then compare the baseline load to the event day load. The Company's independent third-party evaluator will also work with participating EV OEM's vehicle telematics to ascertain vehicle charging, battery and locational data that may be available for participants' EVs. To gauge participants' experiences, the evaluator will conduct online or phone surveys to learn more about the enrollment experience and the participant's experiences throughout the Pilot. Further, to ensure that the Company's learnings from use of the bi-directional V2G technology and customer behaviors in this Pilot are not unduly influenced by its approved Managed Charging Pilot, DEC customers participating in the DEC Managed Charging Pilot will not be allowed to participate in this Pilot. However, DEC will not prohibit eligible DEC customers who participate in DEC's Make Ready Credit Offering or, if approved, DEC's EVSE Program, from participating in this Pilot.

11. While an EM&V schedule cannot be determined at this time, tentative participation targets indicate that an EM&V evaluation could be possible approximately two years after initial Program implementation. DEC has not yet identified the independent third party it plans to use for purposes of EM&V; however, EM&V costs associated with a full-scale commercial offering are estimated not to exceed 5% of total Program costs. If approved, the Company will provide more specific EM&V costs in a future annual rider filing.

12. In light of the benefits of this Pilot, the Company requests Commission approval of the Pilot with an effective date of November 1, 2023. This effective date will allow Ford and other vehicle OEMs to communicate with the customers about the availability of the Pilot at the point of entering the lease, so that capable EVs anticipated

to be delivered in the first half of 2023 may be included. The Company further proposes to recover all costs incurred by the Company associated with the Pilot through the Company's DSM/EE rider in accordance with the DSM/EE Mechanism. Upon approval of the Pilot by this Commission, the Company will complete its implementation plans and make the Pilot available to customers on or about March 31, 2023.

13. The Company has attached hereto as Exhibit 1 the information required by Rule R8-68(c)(2) in support of the proposed Pilot.

WHEREFORE, the Company respectfully requests that the Commission:

1. Approve the Electric Vehicle Load Control Service Pilot and tariff attached hereto as Exhibit 1 and Attachment G thereto, effective November 1, 2023;
2. Find that the Electric Vehicle Load Control Service Pilot meets the requirements of a new DSM program consistent with N.C. Gen. Stat. §§ 62-133.8 and 62-133.9 and Rules R8-67 and R8-68; and
3. Find that all reasonable and prudent costs incurred by DEC associated with the Electric Vehicle Load Control Service Pilot will be eligible for cost recovery through the Company's annual DSM/EE rider in accordance with Rule R8-69(b).

Respectfully submitted, this the 16th day of August 2022.

By: _____

Kendrick Fentress
Associate General Counsel
Duke Energy Corporation
P.O. Box 1551/NCRH 20
Raleigh, North Carolina 27602
Telephone: (919) 546-6733
kendrick.fentress@duke-energy.com

ATTORNEY FOR DUKE ENERGY CAROLINAS, LLC

# Vehicle to Grid/Home DR Pilot Program

| R8-68 Filing Requirements | |
|---|---|
| **Vehicle to Grid/Home DR Pilot Program** | |
| **Filing Requirements** | |
| **(c)(2)(i)(a)** | **Measure / Program Name** |
| | Vehicle to Grid/Home Pilot Demand Response (EV Manager Load Control Pilot) |
| **(c)(2)(i)(b)** | **Consideration to be Offered** |
| | Electric Vehicles ("EVs") capable of bi-directional charging with proper hardware and software will that allow for bi-directional charging and will allow the vehicle's battery to act as a demand side resource to provide the utility grid value. Additionally, Original Equipment Manufacturers are looking to effectively unlock the full value of the EVs capable of bi-directional charging to help reduce the customers' cost to lease these EVs. By allowing Duke Energy Carolinas, LLC ("DEC" or "Company") to call demand response ("DR") events using the stored energy of the EV, the customer will receive a financial incentive for participating in the Pilot and creating a DR benefit shared by the utility system. |
| **(c)(2)(i)(c)** | **Anticipated Total Cost of the Measure / Program** |
| | See Attachment B, line 13. |
| **(c)(2)(i)(d)** | **Source and Amount of Funding Proposed to be Used** |
| | All Pilot costs will be funded by DEC and subject to recovery through DEC's annual Demand-Side Management (DSM) and Energy Efficiency (EE) cost recovery rider consistent with Commission Rule R8-69(b). See Attachment B, Line 13 |
| **(c)(2)(i)(e)** | **Proposed Classes of Persons to Whom This Will be Offered** |
| | Lease Customers with proper bi-directional charging options. |
| **(c)(2)(ii)(a)** | **Describe the Measure / Program's Objective** |
| | The four main objectives of the Pilot are the following:<br>• Evaluate bi-directional charging technology<br>• Evaluate availability and performance of EV batteries<br>• Evaluate customer willingness to allow control of EV batteries<br>• Evaluate the impact of V2G programs on battery life and functionality<br><br>• The Pilot offers incentives to learn about customers' willingness to allow the Company to balance the energy and capacity needs on the utility system through discharging participants' EV battery up to 24 times per year in exchange for a financial incentive that reduces the customer's cost to lease the EV. The Pilot will also allow the Company to validate the amount of energy and capacity that can be discharged during events and vehicle availability during events. These learnings will help to develop a commercial scale offering to assist Duke Energy in balancing energy supply and demand, which helps manage the power grid, maintains system reliability, and conserves natural resources. This will be accomplished through DR events leveraging the capability of onboard battery storage on the EVs capable of bi-directional charging. |
| **(c)(2)(ii)(b)** | **Describe the Measure / Program Duration** |
| | This Pilot's duration will be the term of the vehicle lease; but the Company anticipates having verified results from the first two years of the Pilot to demonstrate and inform the launching of a commercial version of the program prior to the end of the Pilot period. |

| (c)(2)(ii)(c) | Describe the Measure / Program Sector and Eligibility Requirements |
|---|---|
| | Residential DEC customers leasing EVs capable of discharging battery to grid.<br>Bi-Directional Capable Charging Infrastructure<br>Minimum of 35 customers and maximum of 100 customers<br>Customer must be owner of the residence where EV is located/charged.<br>If the customer has other distributed energy resources ("DERs"), such as stand-alone batteries or solar panels, the combined capacity of the EV battery and the other DERs cannot exceed 20kW. |

| | |
|---|---|
| **(c)(2)(ii)(d)** | **Examples of Communication Materials and Related Cost** |
| | Cost associated with communications materials for this Pilot through dealership point of sale and digital communication.<br><br>This Pilot may be promoted by the program administrator through:<br>• Dealership Sales<br>• Company website |
| **(c)(2)(ii)(e)** | **Estimated Number of Participants** |
| | Minimum of 35 and maximum of 100. |
| **(c)(2)(ii)(f)** | **Impact that each measure or program is expected to have on the electric public utility or electric membership corporation, its customer body as a whole, and its participating North Carolina customers;** |
| | See Attachment A, lines 13-34. |
| **(c)(2)(ii)(g)** | **Any other information the electric public utility or electric membership corporation believes is relevant to the application, including information on competition known by the electric public utility or the electric membership corporation.** |
| | Not applicable. |
| **(c)(2)(iii)(a)** | **Proposed Marketing Plan Including Market Barriers and how the Electric Public Utility Plans to Address Them.** |
| | The participating auto manufacturers will have primary responsibility for customer acquisition. Duke Energy will create and maintain a customer website for questions and inquires as well as necessary collateral and contracts for the customer to agree to at the time of lease. |
| **(c)(2)(iii)(b)** | **Total Market Potential and Estimated Market Growth throughout the Duration of the Program;** |
| | While the Company believes that in the future the number of EVs participating in a bi-directional charging DR program may reach 15-25% of the total EV forecast, for this Pilot and the first five years of the commercialized program, the Company made very conservative participation assumptions. The projected commercialization view of the program assumed 2.5% of forecasted new personal EV sales in DEC's North Carolina service territory would participate in in year one, ramping up to 5% in year five of commercialization. |
| **(c)(2)(iii)(c)** | **Estimated Summer and Winter Peak Demand Reduction by Unit Metric and in the Aggregate by Year** |
| | See Attachment A, lines 13-22 and lines 28-29, and Attachment E, lines 1-10. |
| **(c)(2)(iii)(d)** | **Estimated Energy Reduction per Appropriate Unit Metric and in the Aggregate by Year** |
| | See Attachment A, lines 23-27 and lines 30-34. |
| **(c)(2)(iii)(e)** | **Estimated Lost Energy Sales per Appropriate Unit metric and in the Aggregate by Year** |
| | See Attachment A, line 35-44. |
| **(c)(2)(iii)(f)** | **Estimated Load Shape Impacts** |
| | See responses to (c)(2)(iii)(c) and (c)(2)(iii)(d). |

| | |
|---|---|
| **(c)(2)(iv)(a)** | **Estimated Total and Per Unit Cost and Benefit of the Measure / Program and the Planned Accounting Treatment for Those Costs and Benefits** |
| | Costs associated with this Pilot will be expensed as the corresponding revenues are earned.<br><br>Total estimated cost by category- see Attachment B lines 6-9.<br>Total estimated benefit- see Attachment B line 12.<br>Total estimated per unit cost by category – see Attachment D- lines 1-20.<br><br>Data shown on Attachment B represents present value of cost and benefits over the life of the measure. |
| **(c)(2)(iv)(b)** | **Type, Amount, and Reason for Any Participation Incentives and Other Consideration and to Whom They Will be Offered, Including Schedules Listing Participation Incentives and Other Consideration to be Offered** |
| | • Participants will receive a credit in the form of a reduction to their lease payment.<br>• Customers that provide additional kW above the yearly threshold will receive a $25 dollar gift card. |
| **(c)(2)(iv)(c)** | **Service Limitations or Conditions Planned to be Imposed on Customers Who do not Participate in the Measure / Program** |
| | None. |
| **(c)(2)(v)** | **Cost-Effectiveness Evaluation (including the results of all cost-effectiveness tests and should include, at a minimum, an analysis of the Total Resource Cost Test, the Participant Test, the Utility Cost Test, and the Ratepayer Impact Measure Test) Description of the Methodology Used to Produce the Impact Estimates, as well as, if Appropriate, Methodologies Considered and Rejected in the Interim Leading to the Final Model Specification** |
| | See Attachment B, line 14. |
| **(c)(2)(vi)** | **Commission Guidelines Regarding Incentive Programs (provide the information necessary to comply with the Commission's Revised Guidelines for Resolution of Issues Regarding Incentive Programs, issued by Commission Order on March 27, 1996, in Docket No. M-100, Sub 124, set out as an Appendix to Chapter 8 of these rules)** |
| | The Pilot does not provide any inducement or incentive affecting a residential customer's decision to install or adopt natural gas or electric service. |
| **(c)(2)(vii)** | **Integrated Resource Plan (explain in detail how the measure is consistent with the electric public utility's or electric membership corporation's integrated resource plan filings pursuant to Rule R8-60)** |
| | Energy and capacity reductions from this Pilot will be included for planning purposes in future integrated resource plans. |
| **(c)(2)(viii)** | **Other (any other information the electric public utility or electric membership corporation believes relevant to the application, including information on competition known by the electric public utility or the electric membership corporation)** |
| | Not applicable. |
| **Additional Filing Requirements** | |

| | |
|---|---|
| **(c)(3)(i)(a)** | **Costs and Benefits- Any Costs Incurred or Expected to be Incurred in Adopting and Implementing a Measure / Program to be Considered for Recovery Through the Annual Rider Under G.S. 62-133.9** |
| | See Attachment C, lines 31-35. |
| **(c)(3)(i)(b)** | **Estimated total costs to be avoided by the measure by appropriate capacity, energy and measure unit metric and in the aggregate by year** |
| | See Attachment A, lines 45-54. |
| **(c)(3)(i)(c)** | **Estimated participation incentives by appropriate capacity, energy, and measure unit metric and in the aggregate by year.** |
| | Incentive per cumulative kW - see Attachment E, lines 21-25.<br>Incentive per cumulative kWh - see Attachment F, lines 16-20.<br>Incentive per participant - see Attachment D, lines 11-15. |
| **(c)(3)(i)(d)** | **How the electric public utility proposes to allocate the costs and benefits of the measure among the customer classes and jurisdictions it serves.** |
| | The program costs for EE programs targeted at North Carolina and South Carolina retail residential customers are allocated to North Carolina retail jurisdiction based on the ratio of North Carolina retail kWh sales to total retail kWh sales, then recovered only from North Carolina residential customers. |
| **(c)(3)(i)(e)** | **The capitalization period to allow the utility to recover all costs or those portions of the costs associated with a new program or measure to the extent that those costs are intended to produce future benefits as provided in G.S. 62-133.9(d)(1).** |
| | No costs from this Pilot will be capitalized. |
| **(c)(3)(i)(f)** | **The electric public utility shall also include the estimated and known costs of measurement and verification activities pursuant to the Measurement and Verification Reporting Plan described in paragraph (ii).** |
| | The evaluation costs are estimated to be $240,000 for the Pilot. |
| **(c)(3)(ii)(a)** | **Measurement and Verification Reporting Plan for New Demand-Side Management and Energy Efficiency Measures: Describe the industry-accepted methods to be used to evaluate, measure, verify, and validate the energy and peak demand savings estimated in (2)(iii)c and d above**. |
| | Evaluation activities will consist of an impact and process evaluation during the Pilot period. The Company will contract with a third-party evaluator for the evaluation activities.<br><br>Estimated impacts are planned to be developed using a within-subjects approach, whereby the evaluator will model non-event day load to form the event day baseline. The evaluator will estimate demand impacts before, during, and after the event for events that occur throughout the duration of the Pilot. The evaluator will then compare the baseline load to event day load. It is expected that telematics will be used to identify discharge load via the within-subjects methodology, however AMI data may be used to validate reasonableness of estimated EV discharge.<br><br>For the process evaluation, the evaluator may conduct either online or phone surveys to assess customers' motivations for the technology, enrollment experience, and customers' perceptions throughout the Pilot. The evaluator may also conduct interviews with up to 12 participants to further probe motivations and potential barriers during the Pilot period. |
| **(c)(3)(ii)(b)** | **Measurement and Verification Reporting Plan for New Demand-Side Management and Energy Efficiency Measures: Provide a schedule for reporting the savings to the Commission;** |

| | |
|---|---|
| | The Company will report savings associated with this Program in its annual DSM/EE cost recovery proceedings. |
| **(c)(3)(ii)(c)** | **Measurement and Verification Reporting Plan for New Demand-Side Management and Energy Efficiency Measures: describe the methodologies used to produce the impact estimates, as well as, if appropriate, the methodologies it considered and rejected in the interim leading to final model specification; and** |
| | See (c)(2)(v). |
| **(c)(3)(ii)(d)** | **Measurement and Verification Reporting Plan for New Demand-Side Management and Energy Efficiency Measures: Identify any third party and include all of the costs of that third party, if the electric public utility plans to utilize an independent third party for purposes of measurement and verification** |
| | The Company intends to use a third party evaluator. See section (c)(3)(i)(f) for cost. |
| **(c)(3)(iii)** | **Cost Recovery Mechanism- Describe the Proposed Method of Cost Recovery From its Customers** |
| | Recovery of program costs thru the Company's approved EE/DSM Annual Rider. |
| **(c)(3)(iv)** | **Tariffs or Rates- Provide Proposed Tariffs or Modifications to Existing Tariffs That Will be Required to Implement Each Measure / Program** |
| | The tariff proposed by the Company for this Pilot is included as Attachment G. |
| **(c)(3)(v)** | **Utility Incentives- Indicate Whether it Will Seek to Recover Any Utility Incentives, Including, if Appropriate, Net Lost Revenues, in Addition to its Costs** |
| | The Company seeks to recover program costs, pursuant to DEP's Commission-approved DSM/EE cost recovery mechanism. The small scale of the Pilot impacts its cost-effectiveness, the Company's projection of cost recovery for the Pilot (not the Commercialized offering) does not include any requested PPI associated with the Pilot. |

## Attachment A
Participation

| Vehicle to Grid/Home Pilot | | |
|---|---|---|
| 1 | Measure Life (Average) | 1 |
| 2 | Free Rider % (Average) | 0.0% |
| 3 | Incremental Participants Year 1 | 385 |
| 4 | Incremental Participants Year 2 | 366 |
| 5 | Incremental Participants Year 3 | 2,082 |
| 6 | Incremental Participants Year 4 | 4,599 |
| 7 | Incremental Participants Year 5 | 7,864 |
| 8 | Cumulative Participation Year 1 | 385 |
| 9 | Cumulative Participation Year 2 | 366 |
| 10 | Cumulative Participation Year 3 | 2,082 |
| 11 | Cumulative Participation Year 4 | 4,599 |
| 12 | Cumulative Participation Year 5 | 7,864 |
| 13 | Cumulative Winter Coincident kW w/ losses (net free) Year 1 | 411 |
| 14 | Cumulative Winter Coincident kW w/ losses (net free) Year 2 | 390 |
| 15 | Cumulative Winter Coincident kW w/ losses (net free) Year 3 | 2,222 |
| 16 | Cumulative Winter Coincident kW w/ losses (net free) Year 4 | 4,909 |
| 17 | Cumulative Winter Coincident kW w/ losses (net free) Year 5 | 8,394 |
| 18 | Cumulative Summer Coincident kW w/ losses (net free) Year 1 | 411 |
| 19 | Cumulative Summer Coincident kW w/ losses (net free) Year 2 | 390 |
| 20 | Cumulative Summer Coincident kW w/ losses (net free) Year 3 | 2,222 |
| 21 | Cumulative Summer Coincident kW w/ losses (net free) Year 4 | 4,909 |
| 22 | Cumulative Summer Coincident kW w/ losses (net free) Year 5 | 8,394 |
| 23 | Cumulative kWh w/ losses (net free) Year 1 | 0 |
| 24 | Cumulative kWh w/ losses (net free) Year 2 | 0 |
| 25 | Cumulative kWh w/ losses (net free) Year 3 | 0 |
| 26 | Cumulative kWh w/ losses (net free) Year 4 | 0 |
| 27 | Cumulative kWh w/ losses (net free) Year 5 | 0 |
| 28 | Per Participant Weighted Average Coincident Saved Winter kW w/ losses | 1.0674 |
| 29 | Per Participant Weighted Average Coincident Saved Summer kW w/ losses | 1.0674 |
| 30 | Per Participant Average Annual kWh w/ losses (net free) Year 1 | 0 |
| 31 | Per Participant Average Annual kWh w/ losses (net free) Year 2 | 0 |
| 32 | Per Participant Average Annual kWh w/ losses (net free) Year 3 | 0 |
| 33 | Per Participant Average Annual kWh w/ losses (net free) Year 4 | 0 |
| 34 | Per Participant Average Annual kWh w/ losses (net free) Year 5 | 0 |
| 35 | Cumulative Lost Revenue (net free) Year 1 | $0 |
| 36 | Cumulative Lost Revenue (net free) Year 2 | $0 |
| 37 | Cumulative Lost Revenue (net free) Year 3 | $0 |
| 38 | Cumulative Lost Revenue (net free) Year 4 | $0 |
| 39 | Cumulative Lost Revenue (net free) Year 5 | $0 |
| 40 | Average Lost Revenue per Participant (net free) Year 1 | $0 |
| 41 | Average Lost Revenue per Participant (net free) Year 2 | $0 |
| 42 | Average Lost Revenue per Participant (net free) Year 3 | $0 |
| 43 | Average Lost Revenue per Participant (net free) Year 4 | $0 |
| 44 | Average Lost Revenue per Participant (net free) Year 5 | $0 |
| 45 | Total Avoided Costs/MW saved Year 1 | $171,804 |
| 46 | Total Avoided Costs/MW saved Year 2 | $176,900 |
| 47 | Total Avoided Costs/MW saved Year 3 | $182,223 |
| 48 | Total Avoided Costs/MW saved Year 4 | $187,937 |
| 49 | Total Avoided Costs/MW saved Year 5 | $193,806 |
| 50 | Total Avoided Costs/MWh saved Year 1 | N/A |
| 51 | Total Avoided Costs/MWh saved Year 2 | N/A |
| 52 | Total Avoided Costs/MWh saved Year 3 | N/A |
| 53 | Total Avoided Costs/MWh saved Year 4 | N/A |
| 54 | Total Avoided Costs/MWh saved Year 5 | N/A |

**Attachment B**
Cost-Effectiveness Evaluation

| Vehicle to Grid/Home Pilot | | | | | |
|---|---|---|---|---|---|
| | | **UCT** | **TRC** | **RIM** | **Participant** |
| 1 | Avoided T&D Electric | $10,461,662 | $10,461,662 | $10,461,662 | $0 |
| 2 | Cost-Based Avoided Elec Production | $0 | $0 | $0 | $0 |
| 3 | Cost-Based Avoided Elec Capacity | $7,022,189 | $7,022,189 | $7,022,189 | $0 |
| 4 | Participant Elec Bill Savings (gross) | $0 | $0 | $0 | $0 |
| 5 | Net Lost Revenue Net Fuel | $0 | $0 | $0 | $0 |
| 6 | Administration (EM&V) Costs | $783,395 | $783,395 | $783,395 | $0 |
| 7 | Implementation Costs | $4,432,413 | $4,432,413 | $4,432,413 | $0 |
| 8 | Incentives | $7,311,399 | $0 | $7,311,399 | $7,311,399 |
| 9 | Other Utility Costs | $1,604,620 | $1,604,620 | $1,604,620 | $0 |
| 10 | Participant Costs (gross) | $0 | $0 | $0 | $0 |
| 11 | Participant Costs (net) | $0 | $0 | $0 | $0 |
| 12 | Total Benefits | $17,483,851 | $17,483,851 | $17,483,851 | $7,311,399 |
| 13 | Total Costs | $14,131,827 | $6,820,428 | $14,131,827 | $0 |
| 14 | **Benefit/Cost Ratios** | **1.24** | **2.56** | **1.24** | |

**Data represents present value of costs and benefits over the life of the program.**

**Attachment C**
Program Costs by Year

| | Vehicle to Grid/Home Pilot | |
|---|---|---|
| 1 | Incremental Participants Year 1 | 385 |
| 2 | Incremental Participants Year 2 | 366 |
| 3 | Incremental Participants Year 3 | 2,082 |
| 4 | Incremental Participants Year 4 | 4,599 |
| 5 | Incremental Participants Year 5 | 7,864 |
| 6 | Total Participant Costs Year 1 | $0 |
| 7 | Total Participant Costs Year 2 | $0 |
| 8 | Total Participant Costs Year 3 | $0 |
| 9 | Total Participant Costs Year 4 | $0 |
| 10 | Total Participant Costs Year 5 | $0 |
| 11 | Administration (EM&V) Costs Year 1 | $60,000 |
| 12 | Administration (EM&V) Costs Year 2 | $60,000 |
| 13 | Administration (EM&V) Costs Year 3 | $60,000 |
| 14 | Administration (EM&V) Costs Year 4 | $60,000 |
| 15 | Administration (EM&V) Costs Year 5 | $95,102 |
| 16 | Implementation Costs Year 1 | $22,000 |
| 17 | Implementation Costs Year 2 | $20,900 |
| 18 | Implementation Costs Year 3 | $118,944 |
| 19 | Implementation Costs Year 4 | $262,808 |
| 20 | Implementation Costs Year 5 | $449,362 |
| 21 | Total Incentives Year 1 | $120,875 |
| 22 | Total Incentives Year 2 | $831 |
| 23 | Total Incentives Year 3 | $545,217 |
| 24 | Total Incentives Year 4 | $827,601 |
| 25 | Total Incentives Year 5 | $1,204,856 |
| 26 | Other Utility Costs Year 1 | $79,500 |
| 27 | Other Utility Costs Year 2 | $50,000 |
| 28 | Other Utility Costs Year 3 | $140,081 |
| 29 | Other Utility Costs Year 4 | $186,191 |
| 30 | Other Utility Costs Year 5 | $247,831 |
| 31 | Total Utility Costs Year 1 | $282,375 |
| 32 | Total Utility Costs Year 2 | $131,731 |
| 33 | Total Utility Costs Year 3 | $864,243 |
| 34 | Total Utility Costs Year 4 | $1,336,600 |
| 35 | Total Utility Costs Year 5 | $1,997,151 |

**Attachment D**
Program Costs per Participant

| Vehicle to Grid/Home Pilot | | |
|---|---|---|
| 1 | Average Per Participant Administration (EM&V) Costs Year 1 | $155.84 |
| 2 | Average Per Participant Administration (EM&V) Costs Year 2 | $164.05 |
| 3 | Average Per Participant Administration (EM&V) Costs Year 3 | $28.83 |
| 4 | Average Per Participant Administration (EM&V) Costs Year 4 | $13.05 |
| 5 | Average Per Participant Administration (EM&V) Costs Year 5 | $12.09 |
| 6 | Average Per Participant Implementation Costs Year 1 | $57.14 |
| 7 | Average Per Participant Implementation Costs Year 2 | $57.14 |
| 8 | Average Per Participant Implementation Costs Year 3 | $57.14 |
| 9 | Average Per Participant Implementation Costs Year 4 | $57.14 |
| 10 | Average Per Participant Implementation Costs Year 5 | $57.14 |
| 11 | Average Per Participant Incentives Year 1 | $313.96 |
| 12 | Average Per Participant Incentives Year 2 | $2.27 |
| 13 | Average Per Participant Incentives Year 3 | $261.93 |
| 14 | Average Per Participant Incentives Year 4 | $179.95 |
| 15 | Average Per Participant Incentives Year 5 | $153.21 |
| 16 | Average Per Participant Other Utility Costs Year 1 | $206.49 |
| 17 | Average Per Participant Other Utility Costs Year 2 | $136.71 |
| 18 | Average Per Participant Other Utility Costs Year 3 | $67.30 |
| 19 | Average Per Participant Other Utility Costs Year 4 | $40.48 |
| 20 | Average Per Participant Other Utility Costs Year 5 | $31.52 |
| 21 | Average Per Participant Total Utility Costs Year 1 | $733.44 |
| 22 | Average Per Participant Total Utility Costs Year 2 | $360.17 |
| 23 | Average Per Participant Total Utility Costs Year 3 | $415.20 |
| 24 | Average Per Participant Total Utility Costs Year 4 | $290.62 |
| 25 | Average Per Participant Total Utility Costs Year 5 | $253.97 |

**Attachment E**
Program Costs per kW

| Vehicle to Grid/Home Pilot | | |
|---|---|---|
| 1 | Cumulative Winter Coincident kW w/ losses (net free) Year 1 | 411 |
| 2 | Cumulative Winter Coincident kW w/ losses (net free) Year 2 | 390 |
| 3 | Cumulative Winter Coincident kW w/ losses (net free) Year 3 | 2,222 |
| 4 | Cumulative Winter Coincident kW w/ losses (net free) Year 4 | 4,909 |
| 5 | Cumulative Winter Coincident kW w/ losses (net free) Year 5 | 8,394 |
| 6 | Cumulative Summer Coincident kW w/ losses (net free) Year 1 | 411 |
| 7 | Cumulative Summer Coincident kW w/ losses (net free) Year 2 | 390 |
| 8 | Cumulative Summer Coincident kW w/ losses (net free) Year 3 | 2,222 |
| 9 | Cumulative Summer Coincident kW w/ losses (net free) Year 4 | 4,909 |
| 10 | Cumulative Summer Coincident kW w/ losses (net free) Year 5 | 8,394 |
| 11 | Administration (EM&V) Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 1 | $146.01 |
| 12 | Administration (EM&V) Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 2 | $153.69 |
| 13 | Administration (EM&V) Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 3 | $27.01 |
| 14 | Administration (EM&V) Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 4 | $12.22 |
| 15 | Administration (EM&V) Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 5 | $11.33 |
| 16 | Implementation Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 1 | $53.54 |
| 17 | Implementation Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 2 | $53.54 |
| 18 | Implementation Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 3 | $53.54 |
| 19 | Implementation Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 4 | $53.54 |
| 20 | Implementation Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 5 | $53.54 |
| 21 | Incentives / Cumulative Winter Coincident kW w/ losses (net free) Year 1 | $294.15 |
| 22 | Incentives / Cumulative Winter Coincident kW w/ losses (net free) Year 2 | $2.13 |
| 23 | Incentives / Cumulative Winter Coincident kW w/ losses (net free) Year 3 | $245.40 |
| 24 | Incentives / Cumulative Winter Coincident kW w/ losses (net free) Year 4 | $168.59 |
| 25 | Incentives / Cumulative Winter Coincident kW w/ losses (net free) Year 5 | $143.55 |
| 26 | Other Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 1 | $193.46 |
| 27 | Other Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 2 | $128.08 |
| 28 | Other Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 3 | $63.05 |
| 29 | Other Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 4 | $37.93 |
| 30 | Other Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 5 | $29.53 |
| 31 | Total Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 1 | $687.16 |
| 32 | Total Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 2 | $337.44 |
| 33 | Total Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 3 | $388.99 |
| 34 | Total Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 4 | $272.28 |
| 35 | Total Utility Costs / Cumulative Winter Coincident kW w/ losses (net free) Year 5 | $237.94 |

**Attachment F**
Program Costs per kWh

| Vehicle to Grid/Home Pilot | | |
|---|---|---|
| 1 | Cumulative kWh w/ losses (net free) Year 1 | 0 |
| 2 | Cumulative kWh w/ losses (net free) Year 2 | 0 |
| 3 | Cumulative kWh w/ losses (net free) Year 3 | 0 |
| 4 | Cumulative kWh w/ losses (net free) Year 4 | 0 |
| 5 | Cumulative kWh w/ losses (net free) Year 5 | 0 |
| 6 | Administration (EM&V) Costs / Cumulative kWh w/ losses (net free) Year 1 | N/A |
| 7 | Administration (EM&V) Costs / Cumulative kWh w/ losses (net free) Year 2 | N/A |
| 8 | Administration (EM&V) Costs / Cumulative kWh w/ losses (net free) Year 3 | N/A |
| 9 | Administration (EM&V) Costs / Cumulative kWh w/ losses (net free) Year 4 | N/A |
| 10 | Administration (EM&V) Costs / Cumulative kWh w/ losses (net free) Year 5 | N/A |
| 11 | Implementation Costs / Cumulative kWh w/ losses (net free) Year 1 | N/A |
| 12 | Implementation Costs / Cumulative kWh w/ losses (net free) Year 2 | N/A |
| 13 | Implementation Costs / Cumulative kWh w/ losses (net free) Year 3 | N/A |
| 14 | Implementation Costs / Cumulative kWh w/ losses (net free) Year 4 | N/A |
| 15 | Implementation Costs / Cumulative kWh w/ losses (net free) Year 5 | N/A |
| 16 | Incentives / Cumulative kWh w/ losses (net free) Year 1 | N/A |
| 17 | Incentives / Cumulative kWh w/ losses (net free) Year 2 | N/A |
| 18 | Incentives / Cumulative kWh w/ losses (net free) Year 3 | N/A |
| 19 | Incentives / Cumulative kWh w/ losses (net free) Year 4 | N/A |
| 20 | Incentives / Cumulative kWh w/ losses (net free) Year 5 | N/A |
| 21 | Other Utility Costs / Cumulative kWh w/ losses (net free) Year 1 | N/A |
| 22 | Other Utility Costs / Cumulative kWh w/ losses (net free) Year 2 | N/A |
| 23 | Other Utility Costs / Cumulative kWh w/ losses (net free) Year 3 | N/A |
| 24 | Other Utility Costs / Cumulative kWh w/ losses (net free) Year 4 | N/A |
| 25 | Other Utility Costs / Cumulative kWh w/ losses (net free) Year 5 | N/A |
| 26 | Total Utility Costs / Cumulative kWh w/ losses (net free) Year 1 | N/A |
| 27 | Total Utility Costs / Cumulative kWh w/ losses (net free) Year 2 | N/A |
| 28 | Total Utility Costs / Cumulative kWh w/ losses (net free) Year 3 | N/A |
| 29 | Total Utility Costs / Cumulative kWh w/ losses (net free) Year 4 | N/A |
| 30 | Total Utility Costs / Cumulative kWh w/ losses (net free) Year 5 | N/A |

Attachment G
Tariff

Duke Energy Carolinas, LLC

Electricity No. 4

North Carolina Original Leaf No. 256

RIDER EVM (NC)

EV MANAGER LOAD CONTROL SERVICE PILOT

AVAILABILITY (North Carolina Only)

Available to up to 100 individually metered residential customers receiving concurrent service from the Company where a bi-directional home integration system involving an eligible electric vehicle (EV) is installed on the Customer's side of the delivery point, for the Customer's own use, interconnected with and operated in parallel with the Company's distribution system. Participating Customers must be leasing a bi-directional capable electric vehicle from a participating OEM and have the necessary eligible Electric Vehicle Supply Equipment (EVSE) installed at the primary residence and allow the Company to have the necessary control to discharge the vehicle's battery to reduce utility system demand. The Company shall be allowed to monitor their operation under the provisions of this Pilot.

Customers are not permitted to participate in other managed EV charging programs while participating in the Pilot.

PARTICIPATION INCENTIVES

In recognition of the energy and capacity benefits to the utility system, customers participating in the Pilot will receive a financial incentive in the amount of approximately $6.50/kW of eligible battery discharge capability. The incentive is based on an assumed availability factor when the EV will be plugged into the EVSE. At the end of each 12 months of a customer's participation, if a customer's actual annual availability of the discharge capability exceeds the assumed capability, the Company will provide the customer with a performance incentive in the form of a $25 gift card.

PAYMENT OF INCENTIVES

The Company's payment of Incentives will be conveyed as a monthly financial credit in the form of a reduction in the customer's monthly EV lease payment.

INTERRUPTION

The Company may call up to 24 battery discharge events per year, with up to three events occurring in each Winter Month (December – February) and each Summer Month (June – August) and up to one event occurring in each shoulder month (September – November and March – May). Customers will be notified at least 18 hours ahead of a discharge event.

Company shall be allowed, at its discretion, to discharge the participating customers EV battery for up to four (4) hours during each event. Company reserves the right for interruption outside of these parameters in the event continuity of service is threatened.

The Company reserves the right to test the connectivity and discharge capability of the participant's EV battery at any time, without notice, and such test periods shall be counted toward the maximum number of events. Customer shall have the option to opt out of a discharge control event; however, if Customer exceeds two (2) control event opt-outs in a single Winter or Summer control season, Customer may be subject to removal from the program and forfeit receipt of program incentives. A control event opt-out includes non-participation from part or whole of the discharge time period when the EV is connected to the EVSE.

EQUIPMENT INSPECTION AND SERVICING

For EVSE used to discharge participating customers' EV batteries, the Company or its agents shall have the right of ingress and egress to Customer's premises at all reasonable hours for the purpose of inspecting the equipment to ensure connection and operability to effectively discharge participant's EV batteries. Company and Customer shall schedule a convenient time for such purposes whenever it is necessary to inspect a Customer's EVSE.

SAFETY, INTERCONNECTION, AND INSPECTION REQUIREMENTS

This Pilot is only applicable for installed generation systems and equipment that comply with the provisions outlined in the North Carolina Interconnection Procedures, Forms, and Agreements for State-Jurisdictional Generator Interconnections (hereinafter "Interconnection Procedures") as approved by the North Carolina Utilities Commission.

The Customer must submit an Interconnection Request Application, which must be accepted by the Company, pay an application fee, comply with the liability insurance requirements of the Interconnection Procedures and enter into a specific contract providing for interconnection to the Company's system.

In order to ensure protection of the Company's system, the Company reserves the right, at its discretion, to inspect the Customer's generation system and equipment at any time upon reasonable notice to the Customer in an effort to ensure compliance with the Interconnection Procedures and Standards. The Company reserves the right to disconnect electric service to the premises if the Company determines that the Customer's generation system and equipment is not in compliance with the Interconnection Procedures or Standards and is being operated in parallel with the Company's system.

The Customer shall be responsible for any costs incurred by the Company pursuant to the Interconnection Procedures. The Company reserves the right to require additional interconnection facilities, furnished, installed, owned and maintained by the Company, at the Customer's expense, if the Customer's system, despite compliance with the Interconnection Procedures, causes safety, reliability or power quality problems.

CONTRACT PERIOD

The Contract Period shall be consistent with the term of a Customer's EV lease. The Customer or Company may terminate participation under the Pilot by providing 60 days prior notice to the other party. If Customer transfers electric service to a different location within the Company's service territory, participation in the Pilot shall be transferred to the new service location upon re-installation of the EVSE. If the Customer discontinues electric service and relocates outside the Company's service territory or otherwise discontinues participation in the Pilot within 12 months of initial participation, the Customer shall remit to the Company a Termination Payment equal to the sum of all financial incentives received.

COMPANY RETENTION OF PROGRAM BENEFITS

Incentives and other considerations offered under the terms of this Pilot are understood to be an essential element in the recipient's decision to participate in the Pilot. Upon payment of these considerations, Company will be entitled to any and all environmental, energy efficiency, and demand reduction benefits and attributes, including all reporting and compliance rights, associated with participation in the Pilot. None of the energy discharged during a load control event shall be considered eligible for resale to the Company, and any value associated with the discharged energy shall be considered to be compensated for as part of the participant's incentive.

**CERTIFICATE OF SERVICE**

I certify that a copy of Duke Energy Carolinas, LLC's Application for Approval of Electric Vehicle-to-Grid Pilot Program, in Docket No. E-2, Sub 1275, has been served by electronic mail, hand delivery or by depositing a copy in the United States mail, postage prepaid to the parties of record.

This, the 16th day of August, 2022.

Kendrick C. Fentress

Kendrick C. Fentress
Associate General Counsel
Duke Energy Corporation
P.O. Box 1551/NCRH 20
Raleigh, North Carolina 27602
Tel 919.546.6733
Kendrick.Fentress@duke-energy.com