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Kentucky's Touchstone Energy® Cooperatives

EV Home Charging DR Program Pilot

Managing EV Charging at Home

- Significant kWh sales possible from EV charging at home – much like a water heater
- But, demand tends to hit during peak hours in the summer
  - Diversified demand is between 1kW-4kW per EV (but we don't know for sure)
  - Telsa chargers 11.2kW
  - Ford 19.2kW (some)
- Can we influence when EV owners charge at home to mitigate demand during peak hours?

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Managing EV Charging at Home

- Traditional ways to manage home charging
  - TOU or TOD rates
    - Whole Home (LG&E-KU offers this rate and is not popular)
    - EVs only – requires second meter at the home or 3rd party data
    - TOU requires significant on-peak vs off-peak rates (2-3 Xs)
      - The Carrot and Stick pricing
- Utility-controlled chargers
  - Level 2 home chargers, with Wi-Fi, controlled by the utility
    - Much like direct load control switches
    - Requires utility investment in the EV chargers at the home
    - Not popular with EV owners

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Managing EV Charging at Home

- TOU rate is a rate structured to shift EV load to off-peak. Simulates demand costs with-in the energy rates.
- TOU rate is the option currently used by most utilities
  - Studies show TOU works to shift charging to off-peak - if on-peak vs off-peak pricing is 3Xs differential
  - Causes less revenue for the utility (impacts rates for non-EV owners)
- TOU rates, in general, are not preferred by co-op end-use members
- For owner-member cooperatives, requires a rate tariff
  - Cost of Service “like” study required for each co-op
  - EV TOU rate cases for all owner-members (16)

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Managing EV Charging at Home

- Can we develop a DR incentive program that?:
  - Requires DR tariffs for EKPC and owner-members instead of rate cases
  - Avoids forcing the entire home to go to a TOU rate
  - Avoids the utility “control” of when the EV is charged
  - Avoids a 2nd meter – no one wants a second meter
    - Implement a metered hourly consumption data system 1-time supported by EKPC - much like Co-op Solar
    - KWh data to determine incentive amount only
  - Causes a shift in charging times to off-peak without a “stick” pricing approach – incentive program
  - Captures EV locations – better infrastructure planning
  - Captures load shapes of energy and demand – better load forecasting

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EV Home Charging DR Pilot

- Pilot for 3 years with up to 500 EVs – residential only
- Cost-effective per TRC – 2.47, combined RIM 1.32
- $0.02 incentive per kWh charged off-peak (~20% discount on kWhs)
- No disincentives from TOU rates and no “control” by the utility
- Requires EKPC to obtain kWh charging per hour at participating homes
  - Several companies offering to utilities kWh consumption data for the EVs while at the residence
- Program sign-up online webpage and portal – similar to Cooperative Solar
- No cost to the participants to implement!
- Participants program their EVs (1 time) to start charging at 10 PM and stop at 6 AM

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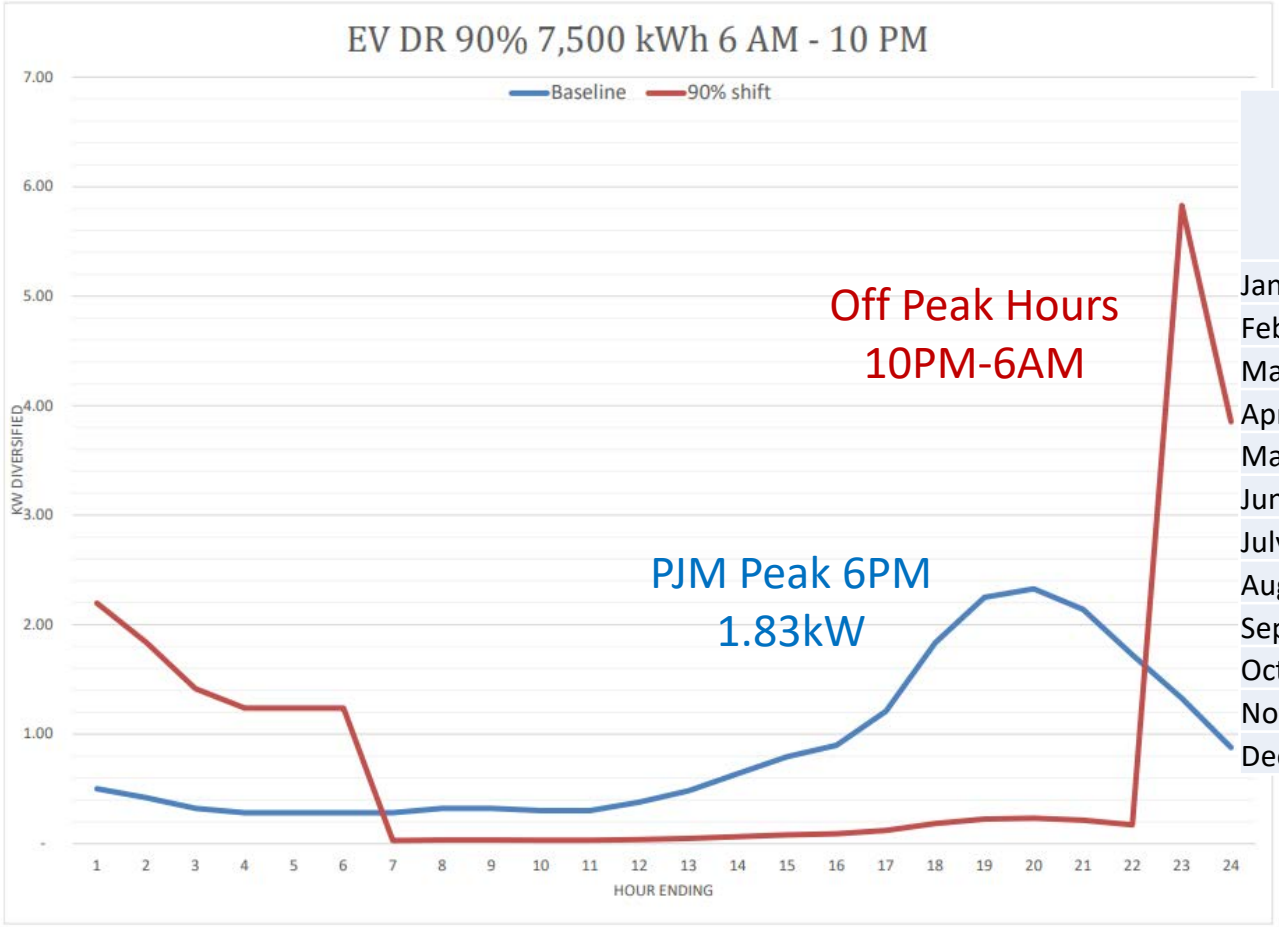

	EKPC CP (HE), 2021	Electric Vehicle average kW per vehicle (diversified)
January	9	0.32
February	8	0.32
March	8	0.32
April	8	0.32
May	18	1.83
June	18	1.83
July	19	2.25
August	18	1.83
September	18	1.83
October	17	1.21
November	8	0.32
December	8	0.32

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EV Home Charging DR Pilot

- Deliverables
  - Measure program effectiveness to shift energy and demand to off-peak hours
  - Measure cost and benefits of the program
    - Costs: incentives, usage data, admin, advertising, etc.
    - Benefits: avoided energy, demand/capacity, 2nd meter costs, etc.
  - Gauge impact of incentive levels, etc (survey participants)
  - Stand-up the hourly metering for participating EVs
    - 1-system at EKPC to collect hourly charging of EVs for all owner-member's participants
    - Incentive credit provided automatically by EKPC via CIS systems - like Cooperative Solar
    - Incentive credit automatically placed on end-use participant's monthly electric bill

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EV Home Charging DR Pilot

- Deliverables
  - Capture EV home charging load shapes
    - Load shapes known today via published studies are for urban and suburban locations, not rural KY
    - Impacts future load forecasting
    - Could provide some understanding of Beneficial Electrification risks
  - Identify homes that have an EV!
    - We don’t know for sure where EVs are located
    - Impacts owner-member cooperative’s system planning for Evs
  - EKPC will work closely with the owner-members to communicate the program offering to EV owners via different communication/advertising mediums.

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Questions/Discussions

Kentucky's Touchstone Energy® Cooperatives

Mar-22	**Electric vehicle demand response**
Unit is 1 EV with Level 2 charging	***Year 1 is 2022*** Demand response with API tracker with incentive based on kWh shifted from on-peak to off-peak and kW reduction at time of PJM peak
Assumption	***Source***
Load Impacts Before Participant ***7,500*** *kWh,* ***1.83 kW*** *(diversified, coincident with summer peak),* ***0.32 kW*** *(winter).*	Typical electric vehicle charging profile, diversified. Level 2 charging, 7,500 kWh per year. Peaks are diversified, coincident with PJM peak. (hour **18** summer, hour **8** winter). Based on Duke Energy metered profile. **Savings**: **1.65 kW** coincident Summer peak; **0.29 kW** coincident Winter peak
After Participant ***7,500*** *kWh,* ***0.18 kW*** *(diversified, coincident with summer peak),* ***0.03 kW*** *(winter).* ***4,423 kWh*** *shifted*	Same vehicle with **90%** demand response. 90% of baseline on-peak EV kWh shifted to off-peak hours of **10 PM - 6 AM.**
Discount rate for TRC and RIM **Lifetime of impact: 10 years**	**5** percent per EKPC data, March 2021; 3.5 % societal test from Mercatus Center report to determine the annual $ value of the demand response provided
Generation Capacity Cost -PJM Market, 100% summer **$36.50** per kW-year in 2022	**PJM capacity performance market March 2021, start year is 2022. Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market, AEP-Dayton hub, **$30.31 /MWh** in 2022	based on March 3,2021 ACES Forward prices for AEP_Dayton hub. **$30.31 /MWh** in 2021. DSMore **Scenario 2, 1.193 esc in 2022**
Transmission Capacity Cost - OATT tariff **$ 24.31 per kW-year in 2022**	Network rate, 2020-21. 2.3% escalation rate. Applied to **summer** coincident peak.
Participant Costs $0	EKPC pays all costs for this program
Administrative Cost EK **$ $100** per participant per year, 0% esc	Cost for API only. Based on 2022 quote
Co-op **$0**	EKPC pays all administrative costs for this program
Rate Schedule - Retail Median Residential Rate for Co-ops Cust chrg **$16.09**, Energy Rate **$.088229**	Current rates in effect as of August 2022
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect as of August 2022
Participation - **1** unit in 2022 unit is 1 vehicle.	Using 1 participant to get per partic numbers
Rebates Co-op to Participant **$ 88.00** EK to Co-op **$ 44.00**	**2 cents per kWh shifted times 4,423 kWh shifted per year** EKPC pays **50%** of the rebate

Electric Vehicle DR shift: 7,500 kWh per year/2 kW case. 90% of on-peak kWhs shifted to off-peak hours of 10PM - 6AM. 2 cent/kWh incentive. 10 year analysis.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 1,003	Revenue Declines	$2
Rebates From EK	$357	Administrative Costs	$0
		Rebates Paid To Consumers	($713)
Total Benefits	$1,360	Total Costs	($712)

Benefit / Cost Ratio: 1.91

Participant Benefits		Participant Costs	
Electric Bill Declines	($1)	Up Front Investment	$0
Rebates From Distribution System	$ 540		
Reductions in O&M costs	$0		
Total Benefits	$538	Total Costs	$0

Benefit / Cost Ratio: #DIV/0!

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$639	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$978	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$386	EK Administrative Costs	($811)
Reduced Customer O&M costs	$0		
Total Benefits	$2,003	Total Costs	($811)

Benefit / Cost Ratio: 2.47

EK Benefits		EK Costs	
Avoided Energy Costs	$639	Decrease In Revenue	($1,003)
Avoided Gen Capacity Costs	$978	Rebates Paid	($357)
Avoided Transmission Expense	$386	Administrative Costs	($811)
Total Benefits	$2,003	Total Costs	($2,171)

Benefit / Cost Ratio: 0.92

Societal Benefits		Societal Costs	
Avoided Energy Costs	$679	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$1,046	Utility Admin Costs	($861)
Avoided Transmission Expense	$411		
Environmental Externalities	$0		
Total Benefits	$2,137	Total Costs	($861)

Benefit / Cost Ratio: 2.48

Combined RIM:

Total Benefits	$2,003	Total Costs	($1,523)

Benefit / Cost Ratio: 1.32