

NHEC Electric School Bus Project (Vehicle to Grid)

NEDC Partner Meeting
October 20, 2021

Electric School Bus Concept (Vehicle to Grid): Overview

- Why EV school buses?
 - Can serve as a grid resource when they are parked and connected to an appropriate charger (V2G)
 - Initial analysis shows the EV buses have favorable operation economics compared to diesel buses
 - No point carbon emissions
- There are an estimated 2,600 school buses in NH
 - At a 60 kW charge rate there is a potential of 156 MW to use to modify NH's load shape
 - Charged once a day (120 kWh capacity) would equal an increase of 114,000 MWh/yr in electric load
- This initiative would engage school bus operators and school districts in our service territory as to how EV buses may meet their needs
- What role can NHEC play to help create this transition (if any)



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Electric School Bus Vendor Relationship: Initial

- Significant benefit over 10 years from NHEC avoided costs
- NHEC will pay for the load reduction achieved by discharging the bus batteries.
- Vendor responsibilities
 - Engagement with New Hampshire school districts and bus contractors
 - Provision of bus and charger or charger only
 - Can assist with bus procurement
 - Transportation as a Service model
- NHEC responsibilities
 - Forecasting/Scheduling discharges
 - Fixed payment stream
 - Possibility of engagement with school districts or bus operators in partnership with Nuvve

Transactive Energy Business Model: Transactive Energy Rate (TER)

- What
 - A single price signal that members, third-party aggregators, and programmable devices can respond to
 - Price signal could be for the whole home or a member could sign up just a single device
- When
 - NHEC will not “control” devices, only send a price signal
 - Distribution costs not included
 - Price signals will be updated every afternoon for the next day
 - Price signals will vary hourly

Transactive Energy Rate Example												
Month	1	1	1	1	1	1	1	1	1	1	1	1
Day	21	21	21	21	21	21	21	21	21	21	21	21
Year	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019
Hour Ending	1	2	3	4	5	6	7	8	9	10	11	12
NHEC Rate (\$/kWh)	\$0.11	\$0.11	\$0.09	\$0.10	\$0.10	\$0.12	\$0.14	\$0.13	\$0.14	\$0.15	\$0.15	\$0.15
Battery kWh +/-	0	0	10	10	7	0	0	0	0	0	0	0
Member Charge/(Credit)			\$0.9	\$1.0	\$0.7							

Transactive Energy Rate Pilot: Battery Use Example

Transactive Energy Rate Example												
Month	1	1	1	1	1	1	1	1	1	1	1	1
Day	21	21	21	21	21	21	21	21	21	21	21	21
Year	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019
Hour Ending	1	2	3	4	5	6	7	8	9	10	11	12
NHEC Rate (\$/kWh)	\$0.11	\$0.11	\$0.09	\$0.10	\$0.10	\$0.12	\$0.14	\$0.13	\$0.14	\$0.15	\$0.15	\$0.15
Battery kWh +/-	0	0	10	10	7	0	0	0	0	0	0	0
Member Charge/(Credit)			\$0.9	\$1.0	\$0.7							

Member charges the battery pulling energy from NHEC during lowest cost hours

Transactive Energy Rate Example												
Month	1	1	1	1	1	1	1	1	1	1	1	1
Day	21	21	21	21	21	21	21	21	21	21	21	21
Year	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019
Hour Ending	13	14	15	16	17	18	19	20	21	22	23	24
NHEC Rate (\$/kWh)	\$0.15	\$0.15	\$0.15	\$0.14	\$0.16	\$0.20	\$0.17	\$0.16	\$0.14	\$0.14	\$0.13	\$0.14
Battery kWh +/-	0	0	0	0	0	-10	-10	-7	0	0	0	0
Member Charge/(Credit)						(\$2.0)	(\$1.7)	(\$1.1)				

Member discharges the Battery selling energy to NHEC during highest credit hours

*Example of two Tesla Powerwall 2 batteries 27 kWh total storage, example creates a \$2.20 credit for the day.