Allowing for Off-Peak Price Incentives to Reduce Electric Vehicle Distribution Grid Congestion

Maryland legislators have set in motion financial investments, tax incentives and Public Service Commission directives to encourage and accommodate electric vehicle market expansion in the state. To combat potential capacity reliability disruptions caused by EVs, electric utilities must begin to design residential electricity price signals that will incentivize EV users to plug in their vehicles off-peak, where demand congestions are least likely to occur.

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I. The Maryland State Push for an Expanded EV Market

In 2011 the MD legislators passed several bills into law to encourage EV expansion in the state. MD Senate Bill 176 established a Maryland Electric Vehicle Infrastructure Council representing a broad spectrum of EV stakeholders, including Maryland legislators, the Maryland Energy Administration, the Maryland Public Service Commission (PSC), local municipalities, county associations, electric utility companies, electric vehicle manufacturers, and the environmental communities. Among other goals the mission of

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the Council is to ''develop an action plan to facilitate the rapid and seamless integration of electric vehicles in the State's transportation network.''[1]

MD Senate Bill 179 requires the PSC to establish a pilot program for electric customers to recharge electric vehicles during off-peak hours, with a commencement date on or before June 30, 2013. The bill authorizes an electric company to request to participate in the pilot. In addition the bill requires the program to include certain incentives for the residential customers to increase the efficiency/reliability of the electric distribution system and to lower electricity use at times of high demand. One of the incentives cited by the bill is ''Time-of-Day Pricing of Electricity.''[2]

MD Senate Bill 163 allows for a state tax credit per individual electric vehicle (EV) recharging system for the tax years 2011 through 2013. A taxpayer's credit is equal to 20 percent of the estimated cost of the qualified electric vehicle recharging equipment but cannot exceed $400 for a given tax year.[3] Another tax incentive initiated by the Maryland state government in 2011 includes the opportunity for purchasers of qualified EVs to apply for a tax credit up to $2,000 against the imposed excise tax.

Other EV incentives initiated by the Maryland state government in 2011 include granting EVs access to high-occupancy vehicle lanes regardless of number of customers through July 2013. In addition the Maryland Energy Administration has allocated $600,000 in American Recovery and Reinvestment Act funds to help in the development and integration of electric transportation by investing in 65 electric charging stations throughout the Baltimore-Washington DC Metropolitan Area.[4]

Despite the EV incentives already in gear in the state of Maryland, forecasts of the number of EV vehicles penetration in the state for the next several years vary widely. An EV working group of regulatory stakeholders established by the Maryland PSC through SB Bill 179 in its Final Report to the Commission has estimated about 1,000 EV vehicle owners contemplated in Maryland for commencement of an EV pilot program in 2013. But for the 2013–2015 forecast periods the Working Group found it ''difficult to formulate a reliable projection.''[5] Other EV projections for just the Central Maryland area show EV penetration rates by the year 2013 at a range of 4,000–6,000 EVs and by year 2020 at a range of 7,000–30,000 EVs.[6]

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No matter how optimistic or pessimistic one is about EV penetration in the state of Maryland, there is no question of the government's intent to have a robust EV market. Consequently, local utility distribution planners must evaluate the worst case or the high end of the forecasts in terms of degraded distribution reliability, and ultimately should seek their electricity pricing department experts to create efficient price incentives for EV customers to plug in during non-congested distribution periods.

II. The Process for Developing Meaningful Electricity Price Incentives that Will Encourage EV Customers to Plug in during the Distribution Off-Peak

A. Evaluating when substation transformers and feeders peak

In developing meaningful EV TOU rates, the distribution utility planners must identify first when distribution peaks occur and to next develop high enough peak electricity prices to discourage EV plug-ins outside of those congested distribution periods so as to avoid transformer overload.

In **Figure 1**, the *Y*-axis shows the number of distribution utility

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