

MADRI Working Group Meeting #52



Electric Vehicles

Impacts, Benefits, and Utility Strategies

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Introduction To Gabel Associates

- **Who We Are**

- An energy, environmental, and utility consulting firm
- Founded in 1993
- Specialized expertise with national reach, particular experience in PJM
- Analytic and technical skills, with particular strengths in economic, market, market development, regulatory, and policy matters
- Especially well known for pioneering projects in emerging markets

- **Key Practice Areas**

- Energy procurement
- Regional Energy Markets (RTOs, wholesale)
- Economic and financial modeling
- Market forecasting and simulation
- Regulatory affairs, policy development
- Utility services (filings, expert witness, benefit-cost analysis, etc)
- Advanced Energy Solutions (behind-the-meter)
- Market Development (emerging markets)

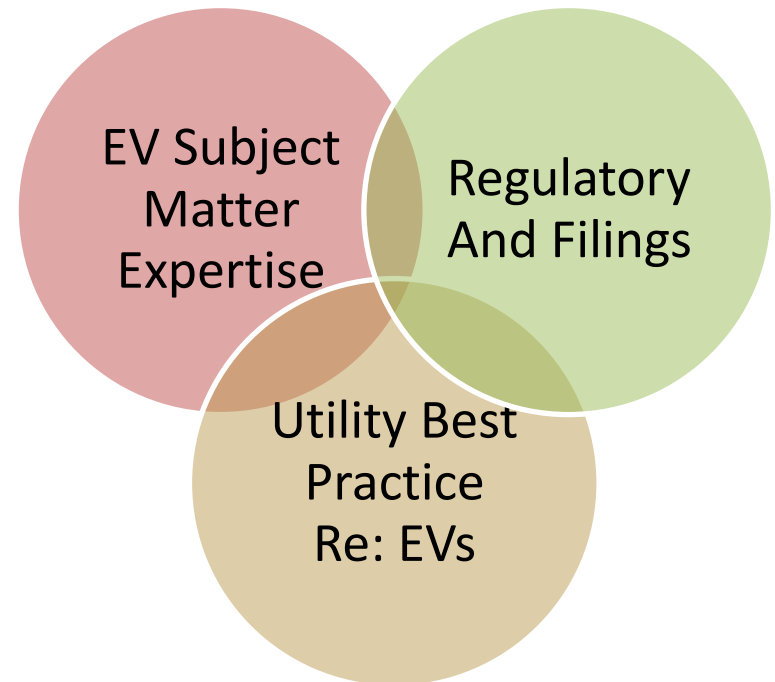
Gabel Associates: Electric Vehicle Activities

- **EV Market Focus Areas**









- Organizing, coalition-building, advocacy (example: ChargeEVC in NJ)
- Utility Support (currently supporting six utilities in five states)
 - ✓ Market benchmarking, forecasting, opportunity assessment
 - ✓ EV market strategy development
 - ✓ **Distribution system and market impact modeling**
 - ✓ EV offer development
 - ✓ Filing development – especially **benefit-cost analysis**
 - ✓ Filing support – discovery response, expert witness
 - ✓ Offer implementation support

- **Current Utility EV Engagements**

- DPL - DE
- PEPCO – DC
- BG&E - Maryland
- Atlantic City Electric - NJ
- PSEG- Long Island/LIPA
- PSE&G - NJ



Example Study Results: ChargeEVC - NJ

	EV Owner	Utility Customer	Society At Large	Total Benefits
				(statewide)  (per household) 
Vehicle "Fuel" Savings (fueling costs cut in half)	✓		✓	 \$1,440 In Fuel Savings Per Year (Two Evs, 2018)
Lower Electricity Costs (dilution and other effects)	✓	✓	✓	 12% Lower Electricity Costs (Average Usage, 2035)
Reduced Air Pollution (electric miles ~80% cleaner)	✓	✓	✓	 17,611 Fewer Pounds Of CO2/Yr (2 Evs, 2018)

(Present Value, Thru 2035)

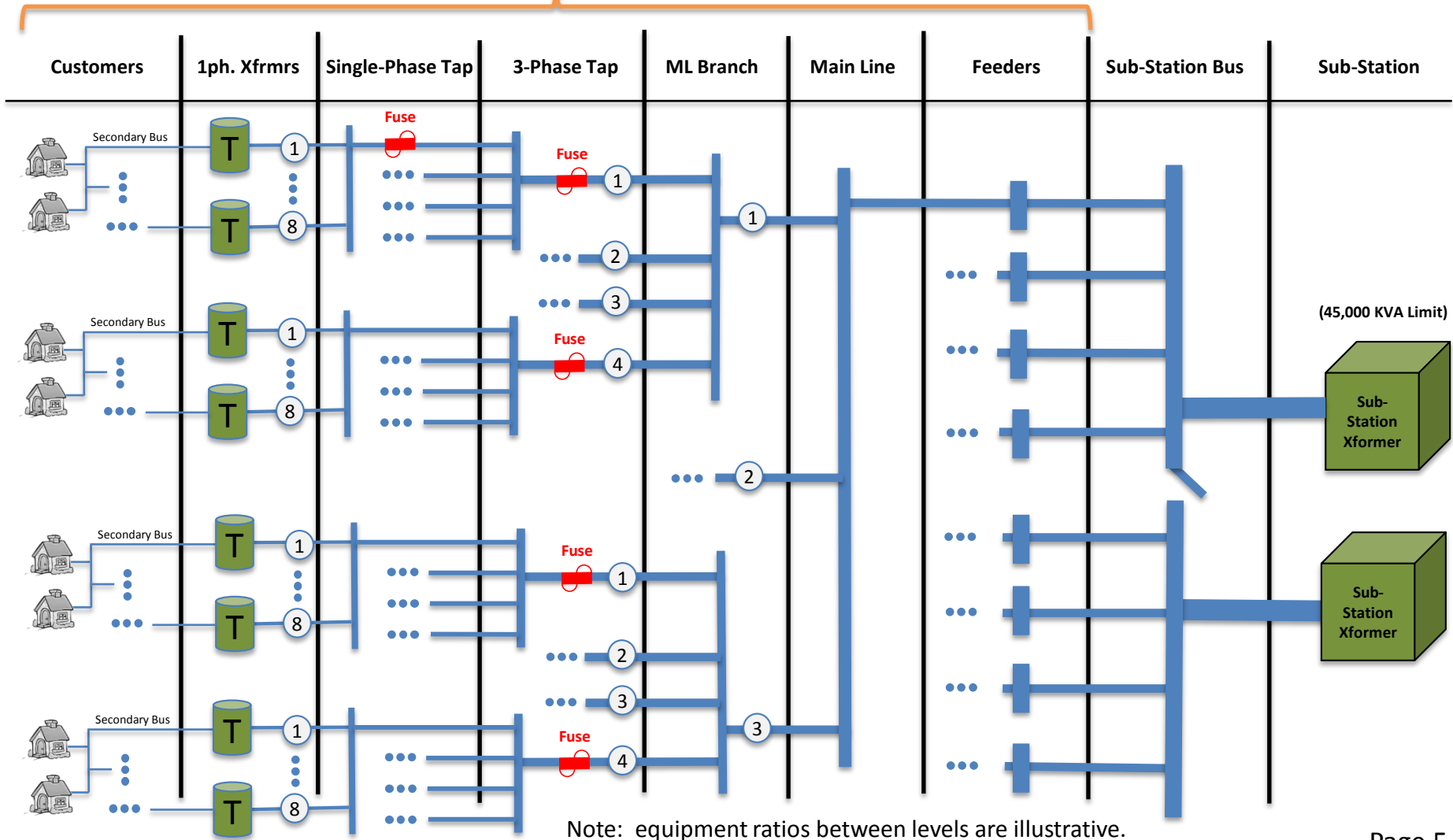
Benefit/Cost Ratio: 2.19

NET Benefits: \$11.3B

**Benefits Increase Strongly With Adoption,
Faster EV Growth Means Bigger/Faster Benefits**
(Goto www.chargevc.org to see full study report)

Example: Idealized Feeder Model

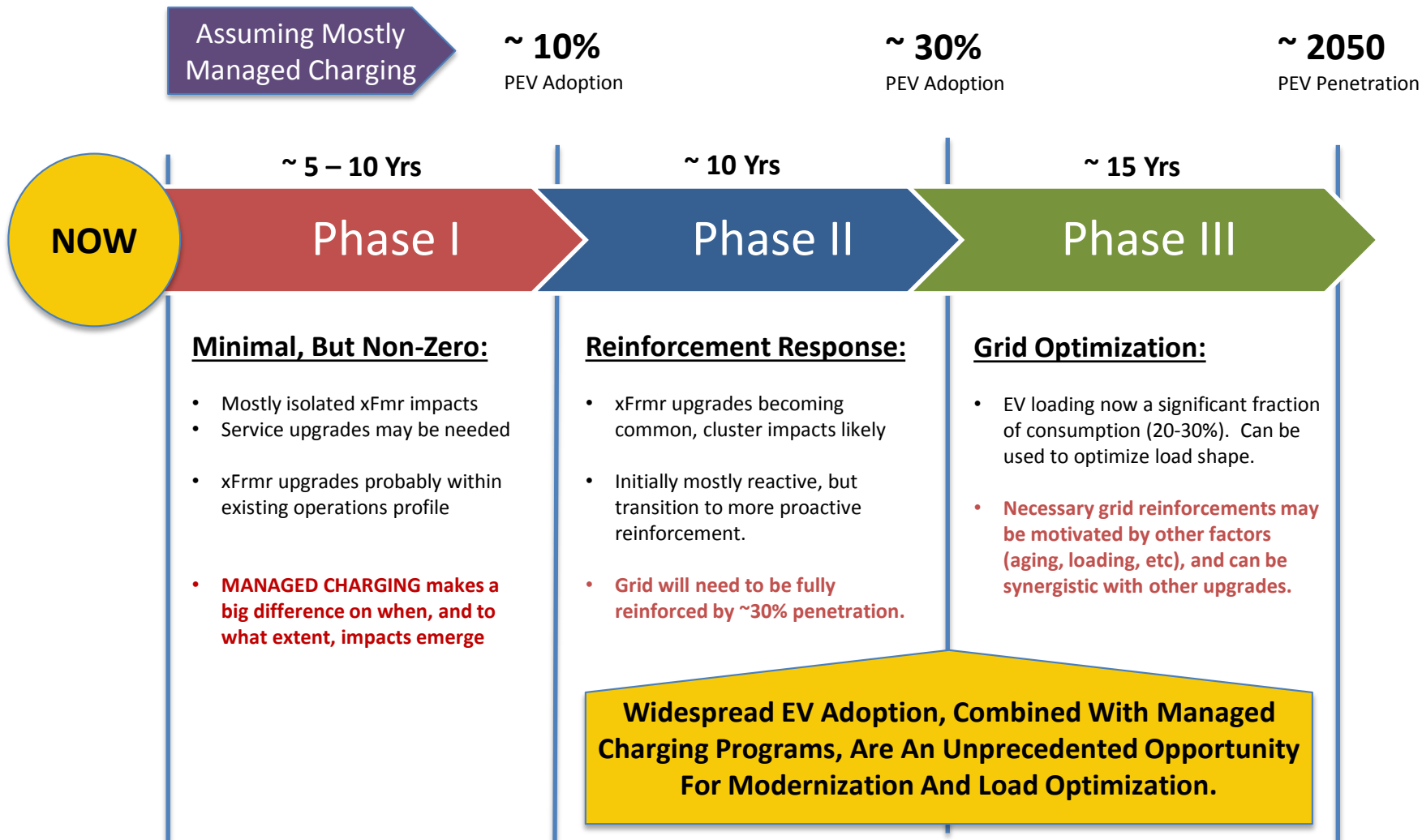
Each Feeder



Generalized Conclusions: Multiple Studies & Territories

- **Vehicle charging will have a significant impact on energy consumption**
 - Increases residential consumption 30-50%
 - For territories with an average two cars per household, nearly doubles residential load
- **Power implications are significant**
 - A Level-2 charger will typically ~double typical residential peak load
 - Natural charging behaviors could drive this load onto existing peaks
 - Example: In NJ, if HALF existing light duty vehicles started charging at once - ~20GW
 - Conversely, if most vehicle charging is off-peak, significant benefits accrue
- **Unlike many loads, most vehicle charging can be scheduled flexibly**
 - Residential vehicle charging is an unprecedented opportunity to optimize grid loading
 - Implementing “Managed Charging” Programs are key to realizing this opportunity
- **In most cases, existing infrastructure can handle modest levels of EV adoption**
- **But at 5-10% adoption levels, systemic impacts will start to emerge quickly**
- **Impacts emerge first on residential single-phase transformers**
- **Widespread electric vehicle use brings significant benefits to multiple beneficiaries:**
 - Lower overall electricity costs (dilution, more off-peak consumption, increased utilization)
 - Significantly reduced GHG and other emissions
 - Massive reductions in vehicle operating costs (typically about a factor of two)

Ensuring Responsible Grid Integration



High Impact Utility Focus Areas

Looking At The Intersection Of:

- Requirements For Responsible Grid Integration
- Actions That Address Market Needs, Have Large/Positive Market Impact
- Opportunities Where Utilities Are Uniquely Able To Contribute
- Contribute to Market Ecosystem, Don't Displace Competitive Market
- Regulatory Receptiveness

Three “Big Win” Utility Focus Areas (charging infrastructure):

- **Residential Managed Charging**
 - Helps address consumer concerns about “how will I charge at home”
 - Encourages acquisition of “smart chargers”, rather than non-networked alternatives
 - Establishes a foundation to encourage/ensure optimized charging schedules
 - Could evolve into more sophisticated “V2G” solutions longer term (EVs as two-way DERs)
- **Public DCFC Chargers**
 - Absence of fast public charging is PRIMARY adoption barrier
 - Economics for private investment are extremely challenging
 - Utilities can help with equipment investment, make-ready, and rate-solutions (e.g. demand charges)
- **Multi-Family Residential Charging**



Managed Charging Programs

What Is Managed Charging (Residential):

- Smart Charger: A level-2 charger that can communicate
- A “Network Services” backend: interfaces with multiple chargers
- Programs that encourage optimized charging transactions
- NOTE: managed charging is more than TOU-tariffs !!
- NOTE: managed charging is more than a smart meter !!

Managed Charging Interactions:

- Basic metering for charging transactions (one-way communication, one-way energy)
- Charge management (two-way communication, one-way energy)
- V2G Interactions (two-way communication, two-way energy)

Program Evolution Over Time:

- Short term, deploy network-enabled L2 chargers (test equipment adoption)
- Adopt “bundled solutions” that collect transaction data from the charger
- Use data from charger to provide incentive for off-peak charging (test scheduling)
- Deploy advanced charge management functions (scheduling, power throttling, etc)
- Migrate to standards-based solutions: equipment and back-end interoperability
- Begin to add V2G functionality to vehicles, chargers, networks

Managed Charging Is As Much An Information Transaction As An Energy Exchange