Global Challenges of Electric Vehicle Integration

ISGAN How2Guide
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Current market forces will drive PEV Adoption

<table>
<thead>
<tr>
<th>Automotive OEM</th>
<th>Consumer</th>
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<td><em>Increased regulation to reduce CO₂ emissions</em></td>
<td><em>Increasing consumer concern with environmental issues</em></td>
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<td><em>Increased fuel efficiency standards</em></td>
<td><em>Consumer adoption increased by government subsidies</em></td>
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<td><em>Decreased reliance on foreign oil supplies</em></td>
<td><em>Increasing urbanization and last mile transport needs</em></td>
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<td><em>Improved technology and decreasing costs</em></td>
<td><em>Consumer interest in alternative fuels and power trains</em></td>
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Anticipated PEV Market Size

Global Plug-In Vehicle Totals

Anticipated Plug-In Vehicles By Market

- New Vehicles
- China
- United States
- Europe
- Japan

2011

30 Chinese BEV models

1st gen refresh / 2nd gen testing

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The EV Market Will Create New Challenges for Participants

- Insufficient public charge spots will lead to range anxiety
- Consumer anxiety on seamless payment availability & security
- Secondary Uses for batteries, battery disposal / recycling
- Consumers will likely demand multiple payment options—an expensive challenge for service providers and utilities;
- Need to capture data on vehicle and battery performance for future improvement
- Theft and vandalism of public charge posts
- Anticipated PEV ‘fueling’ taxes will require report and audit to government entities
- Public charge posts will require appropriate siting, installation and maintenance
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**Market Challenges**

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<th>Impact: High</th>
<th>Moderate</th>
<th>Low</th>
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<td><strong>Utility</strong></td>
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Different actors, devices, and business models creates an interoperability challenge

- **Multiple ‘charge operators’ acting in the market place including:** utilities, municipalities, business owners, etc.

- **Distinct business models emerging**
  - **“Low Cost Public”**: Initiatives taken on by municipalities and public entities. Focused on ‘seeding’ the market with low cost and ‘open’ access to charge posts
  - **“Private & Differentiated”**: For profit business ventures by utilities and enterprise. Private access to chargers and value add services. Includes alternative models such as vehicle/battery licensing

- **Multiple device manufacturers, types, and communications methods**

- **Need to ensure interoperability across providers and utility service territories**

- **Think of the current ATM Network as a model for electric vehicles**
• Provision and proving of a Clearing House, to create interoperability of 13 different pilot projects (data and charge calculation)
• Introduction of centralized marketplace and advanced services
• Future proofing of protocols and interface
• Forty consortium partners spanning automotive, energy, and technology providers
Challenge of Fee Calculation / Billing

Charging for electricity as a fuel source

- In a given public charge event up to 5 entities need to be factored and settled:
  - Energy
  - Distribution
  - Charge Post
  - Parking
  - Taxes

- The number of permutations that will need to be accounted for when calculating fees for a public charge event will likely be immense

- Need for low cost multiparty settlement system

- New Tax implications forcing changes to billing systems
  - Electrons per mile
  - Clean fuels tax
Successful integration means requires deep insight into vehicle charging

- Different charge rates cause different grid impacts
- Understanding the usage patterns and users will be important:
  - Private Vehicle: Significant off peak charging but will also likely to plug in as often as possible (e.g., workplace, shopping centers, etc.) creating potential for significant on peak charge
  - Fleet Vehicle: Predominately off peak charging to capture cost savings. Route planning will allow for optimization of recharge schedule
- Knowing when and where these vehicles plug in will be imperative
- Understanding charge load will be difficult given profusion of device types, operators, and communications methods
Ultimately, managed charging will be essential

- Incentive based pricing strategies to motive off peak charging important but not sufficient
- Managed charging will be needed to prevent distribution asset overload
- Managed charging to capture benefits of electric vehicles
  - Renewable energy intermittency
  - Ancillary services and grid support
- How to make managed charging acceptable to end user?
  - Likely require charge guarantees / SLAs with participants
  - Will require shared economic benefit through decreased cost, payment, etc.
Grid Integration Project Example: Project EDISON

- **Design of an energy system for an entire country with support for large % EVs.**
- **National interest to optimize wind energy → prevent subsidized excess wind energy from crossing national borders**
- **Initial phase: Real-life testbed on the Danish Island of Bornholm (pop. 40,000)**
- **In scope: how do user profiles (e.g., ”Charge Guarantees” follow user when charging outside of ’home network’**

**IBM’s contribution:**
Development of management system to control charging of cars in accordance with the availability of wind energy while enabling optimal use of the electricity grid and enablement of charge roaming
Conceptual Overview: IBM EV Enablement Platform

Utilities (Grid Operator & Retailer)

Governments

Offices / BMS

Automotives

Drivers

Charge Service Operators (Municipalities/Companies)

IBM EV Enablement Platform

- Subscriber Management
- Analytics & Reporting
- Payment & Settlement
- Charge Calculation
- Transaction Management
- Process Orchestration
- Integration Services

- Dashboards
- Optimization & Load Control
- Asset & Service Mgmt
- Mobility Services
- Security

Payments & Settlements

Integration Services

Security

Analytics & Reporting

Charge Calculation
Policies and Regulatory changes required

TARIFF CHANGES FOR MANAGING CHARGE
- Initiate and complete rulemaking on qualifying EV standby and TOU tariffs
- Adopt state specific TOU rates for EV off peak charging through FERC and NERC guidelines
- Establish guidelines for a reduced electric charging tariff and standard regulatory oversight

INCENTIVE APPROACH
- United Kingdom: subsidies and tax incentives of up to aprox $8000 USD
- Italy: tax incentives of aprox. $5,000 USD
- Ireland: tax incentives of aprox. $8,000 USD
- Denmark: no registration tax and no road tax for PEVs
- China: maximum subsidy of up to $10,000 USD (aprox)

CHARGING INFRASTRUCTURE
- Extend consumer tax credits for home charging equipment for 220V fast charging ports
- Establish tax credits equal to 75 percent of the cost to construct public charging infrastructure
- Finalize all low and high speed charging standards for manufacturers
ありがとう * شكرا * 謝謝 * Merci * Danke * ありがとう * 謝謝 * terima kasih * ba تشکر از شما * gracias * tack * آپ کا شکریہ * terima kasih * gratias agimus tibi * σας ευχαριστώ * spасибо * gratias agimus tibi * Thank you!

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