PHEV-EV Charging Evaluation - Potential Impact on the Utility

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Impact on the Utility

- Capacity
- Energy
- Power Quality (PQ)
BC Hydro System

- Serves 94% of BC’s population
- 11,000 MW
- 43,000 – 54,000 GWh/y
- 90% hydroelectric

Opportunity:

Displacement of oil as a transportation fuel
Capacity - Delivery

- Distribution bottleneck
- Copper losses from undersized conductors and transformers
- No impact on Transmission
Capacity – Supply

Monthly Average System Load by hour (January 2006)

- 190,000 PHEVs ~ 290,000kW or 290 MW

All time peak high 9,619 MW occurred on January 5, 2004 HE 18

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Energy

- 190,000 PHEVs
- PHEV Consumption: 1,100GWh/y
- BC Hydro Production: 43,000 – 54,000GWh/y
Energy - Overall Load Growth

The Emerging Gap

BC Hydro's electricity gap
BC Hydro's Supply and Demand Outlook

50% of incremental needs to be met by Conservation and Demand Side Management (DSM) programs.

PHEV Load Growth

50% DSM

drop reflects planned phase-out of Burrard

Historical Data

Forecasted Data

Energy (GWh)


Fiscal Year (year ending March 31)

85,000 80,000 75,000 70,000 65,000 60,000 55,000 50,000 45,000 40,000

BCHydro
PQ – In-field Study

Purpose: To assess the potential impact of a cluster of PHEVs

Representative of the following situations:

- Fleet
- Dense Residential (Condominium)
- Single Detached Dwelling Neighbourhood
PQ Project Description

• Golf cart fleet as a proxy for PHEV fleet
• Time of charging is representative of commercial fleets and person vehicles
• Battery charger technology is representative of future PHEVs
  > High frequency, power factor corrected chargers
  > Manufacturer is supplying to some of the major auto manufacturers that are developing PHEVs
PQ Project Site

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PQ Parameters

- Power Factor
- Harmonics
- Disturbances
- Voltage Flicker
PQ Results - Power Factor (at facility main)
PQ Results – Harmonics: THD% (Current at main bus)
PQ Results – Harmonics: THD% (Voltage at main bus)

Main Bus Average Voltage Harmonic Distortion

Pre-retrofit
Post-retrofit

Phase A VHD
Phase B VHD
Phase C VHD

VHD %


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PQ Results – Harmonics: THD% (Voltage, fleet charging panel) & correlating current
PQ Results – CBEMA Curve, Voltage Disturbances @ Facility Electrical Main
Summary

• **Capacity:** Distribution bottleneck – must shift PHEV load away from peak

• **Energy:** Minor load growth contribution – manage supply/demand balance via long term energy planning

• **Power Quality:** No outstanding issues – follow up with real PHEVs
Next Steps

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