



PHEV-EV Charging Evaluation - Potential Impact on the Utility

PHEV 2007 Conference

By Alec Tsang

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Impact on the Utility

- Capacity
- Energy
- Power Quality (PQ)

Reliable power, at low cost, for generations. Reliable power, at low cost, for generations. Reliable power, at low cost, for generations. Reliable power, at low cost, for generations.

BC Hydro System

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

Opportunity:

Displacement of a oil as a transportation fuel

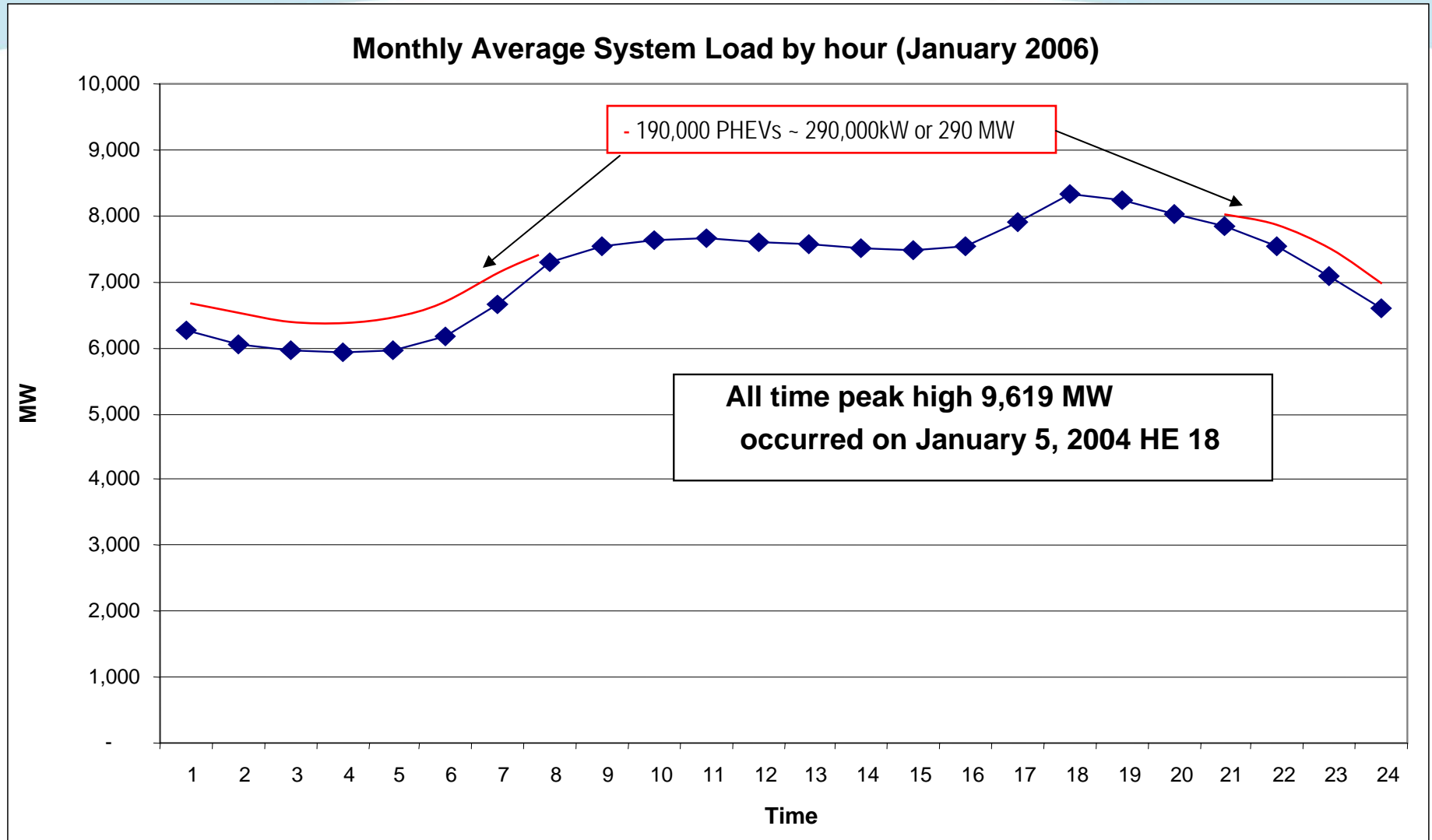
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Capacity - Delivery

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

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Capacity – Supply



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Energy

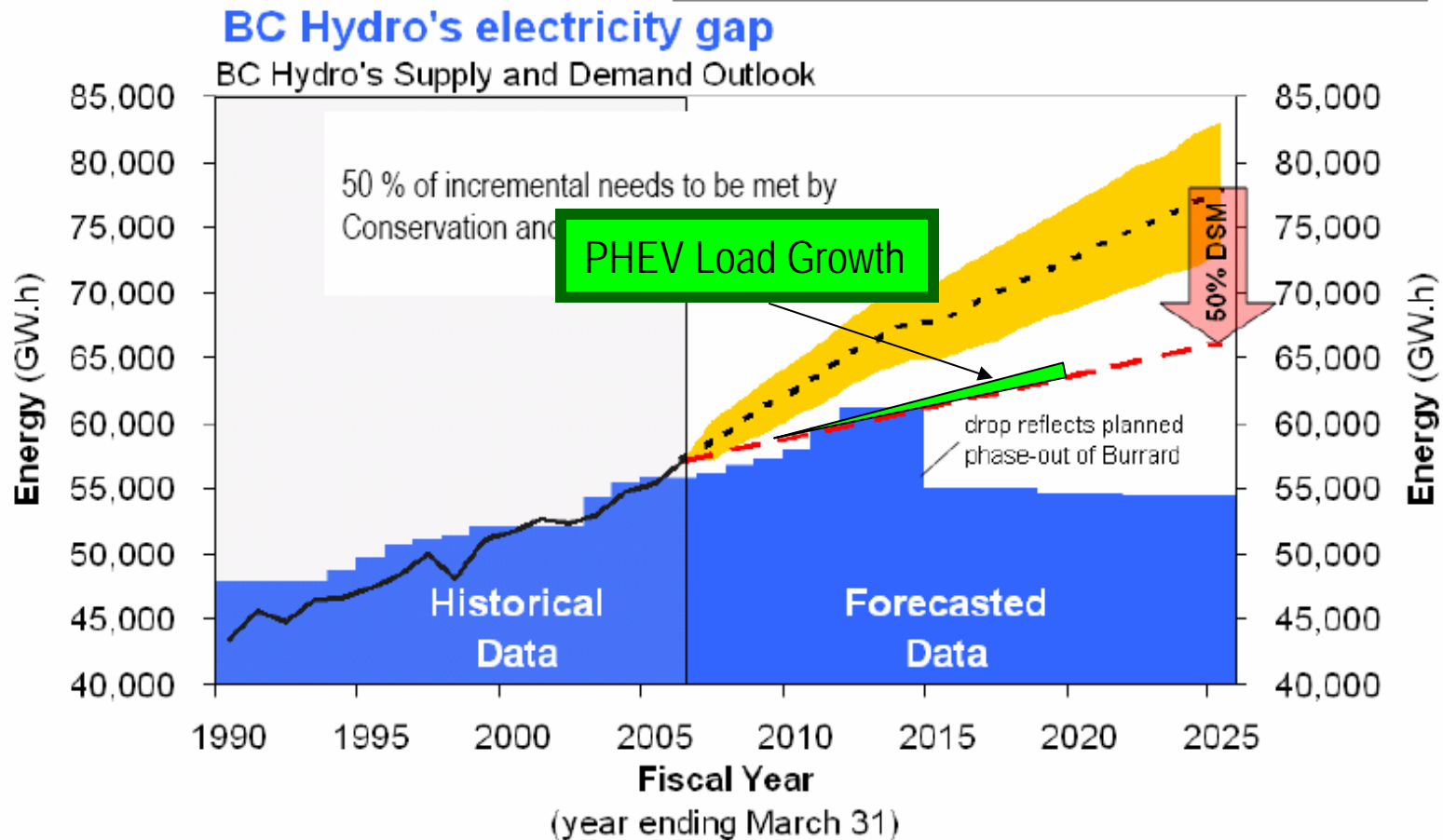
- 190,000 PHEVs
- PHEV Consumption: 1,100GWh/y
- BC Hydro Production: 43,000 – 54,000GWh/y

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Energy - Overall Load Growth

The Emerging Gap

- Forecasted Customer Demand
- Existing BC Hydro Supply
- - - Mid-range Demand Forecast
- Historical Customer Demand
- - - Mid Range Demand Forecast after 50% DSM target



Reliable power,

Based on BC Hydro's 2006 Load Forecast

or generations.

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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

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PQ Project Site



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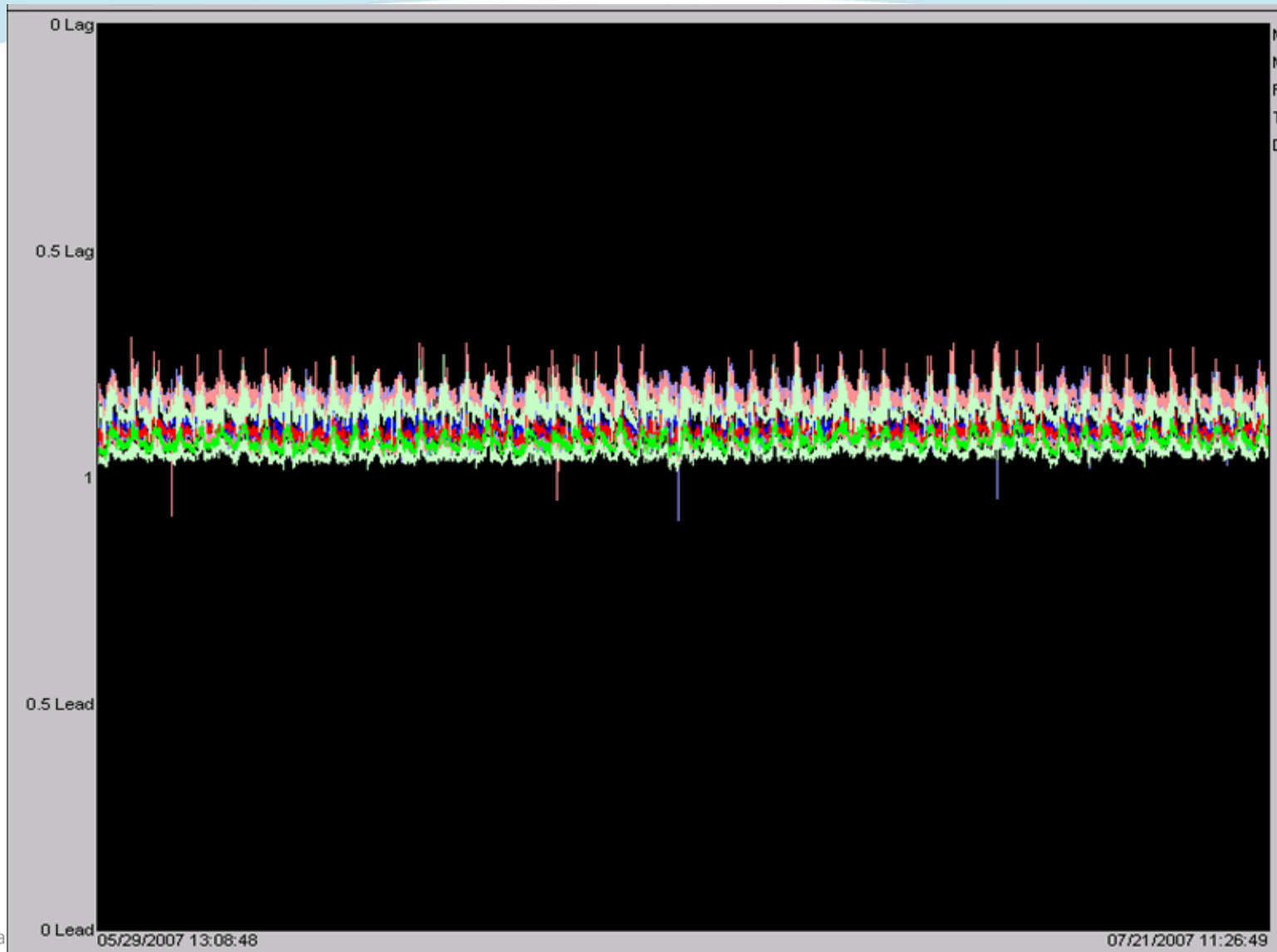
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PQ Parameters

- Power Factor
- Harmonics
- Disturbances
- Voltage Flicker

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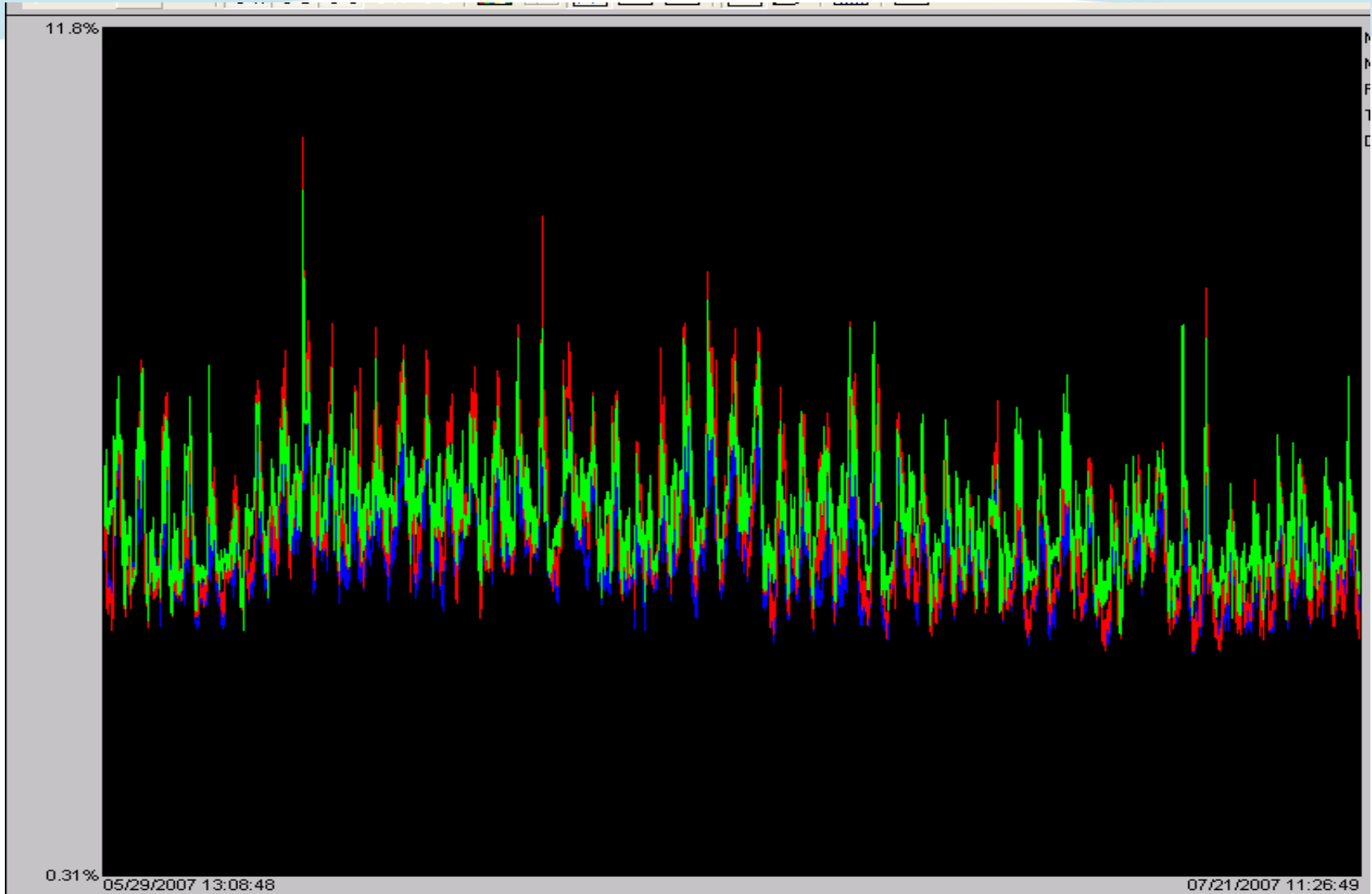
PQ Results - Power Factor (at facility main)



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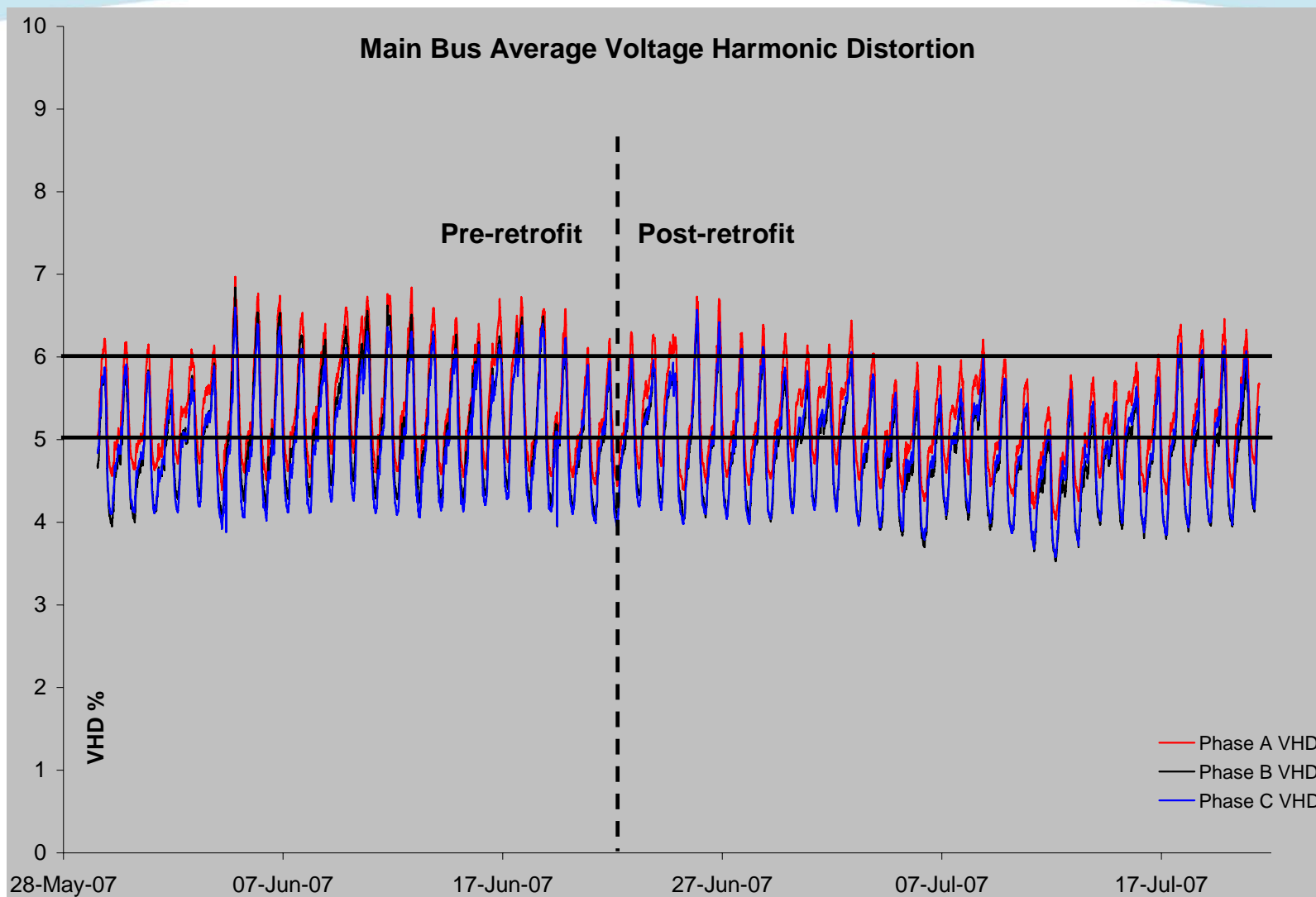
PQ Results – Harmonics: THD% (Current at main bus)



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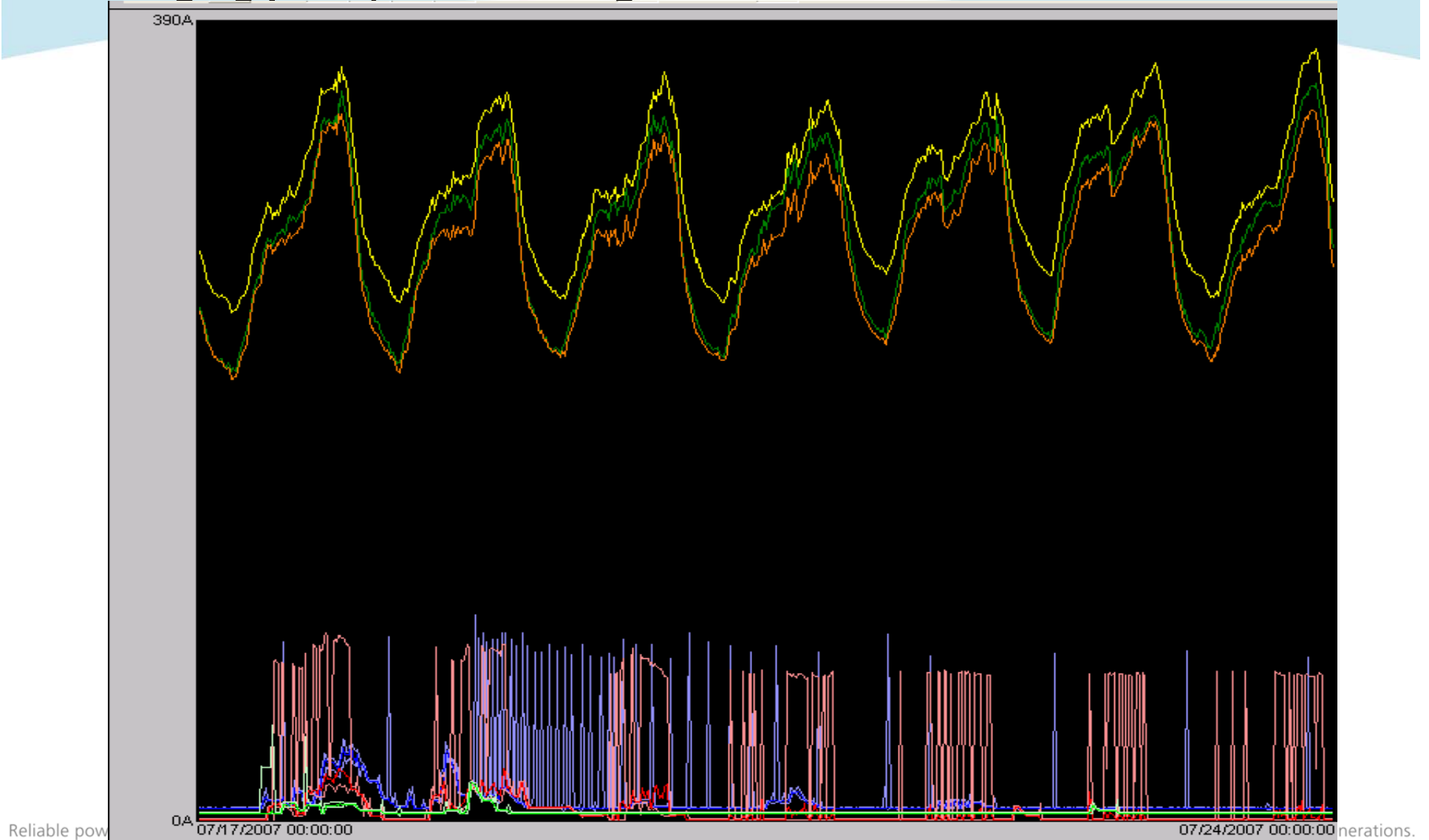
PQ Results – Harmonics: THD%

(Voltage at main bus)

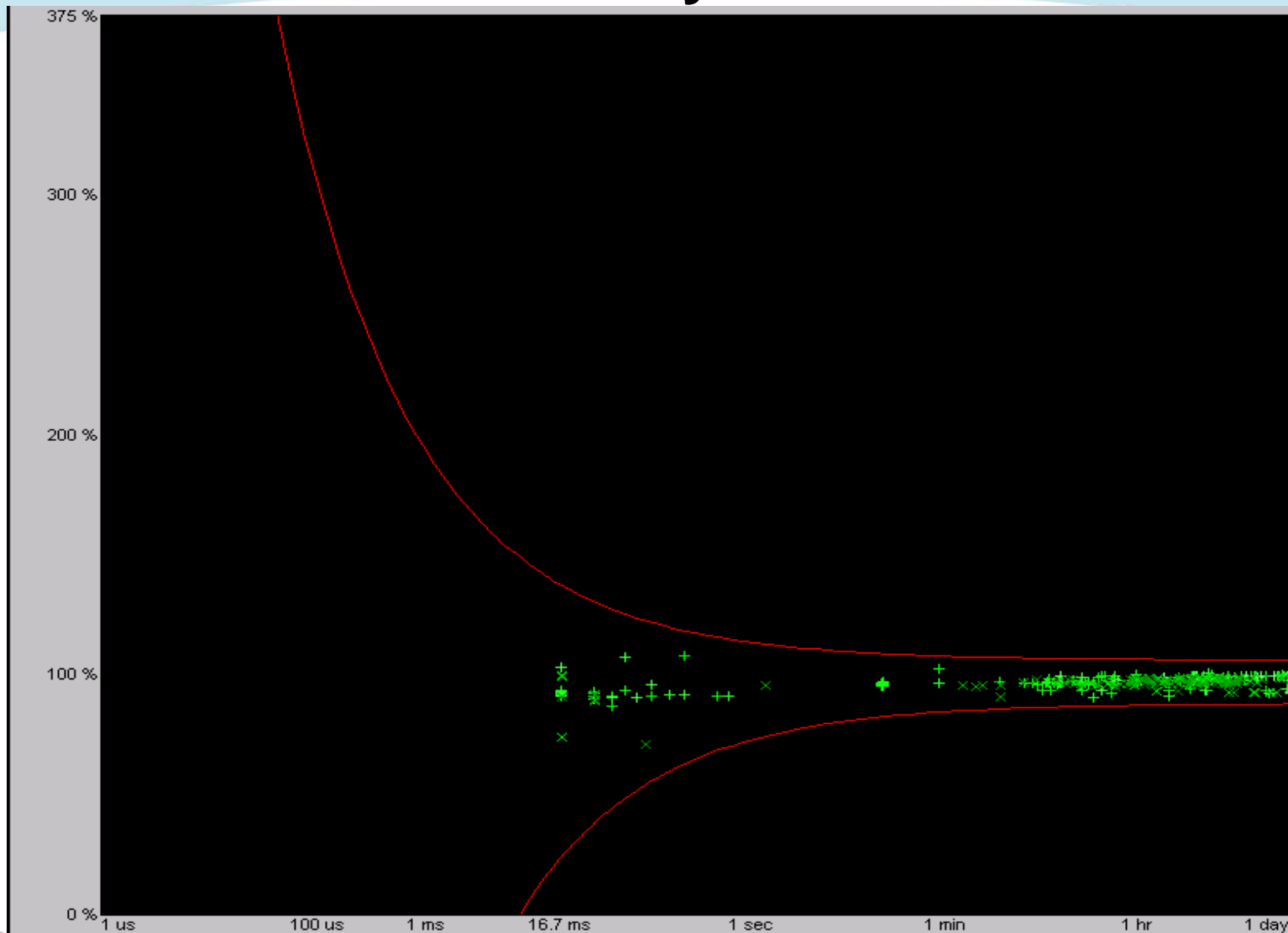


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PQ Results – Harmonics: THD% (Voltage, fleet charging panel) & correlating current

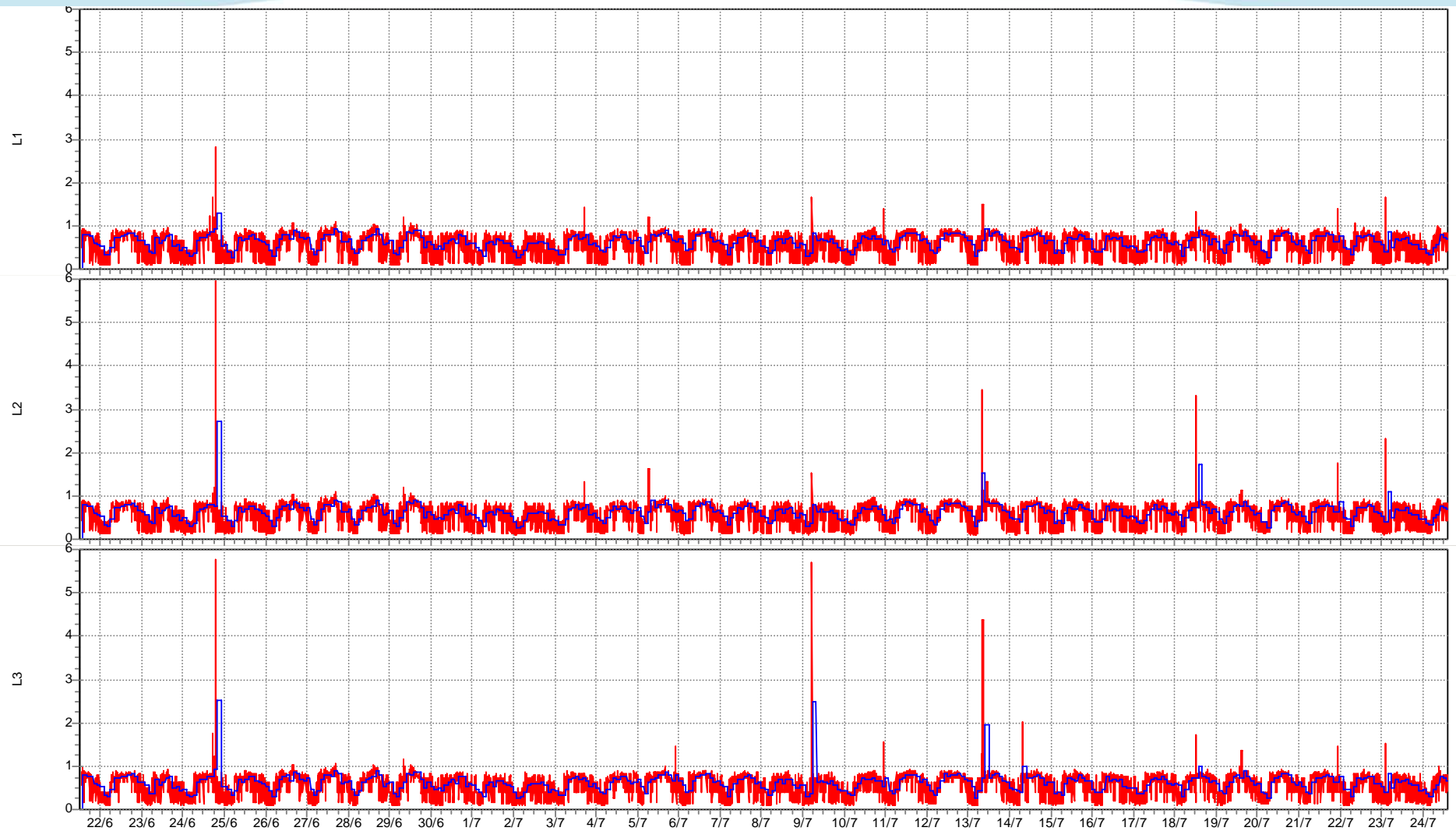


PQ Results – CBEMA Curve, Voltage Disturbances @ Facility Electrical Main



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PQ Results – Flicker



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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

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Next Steps



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