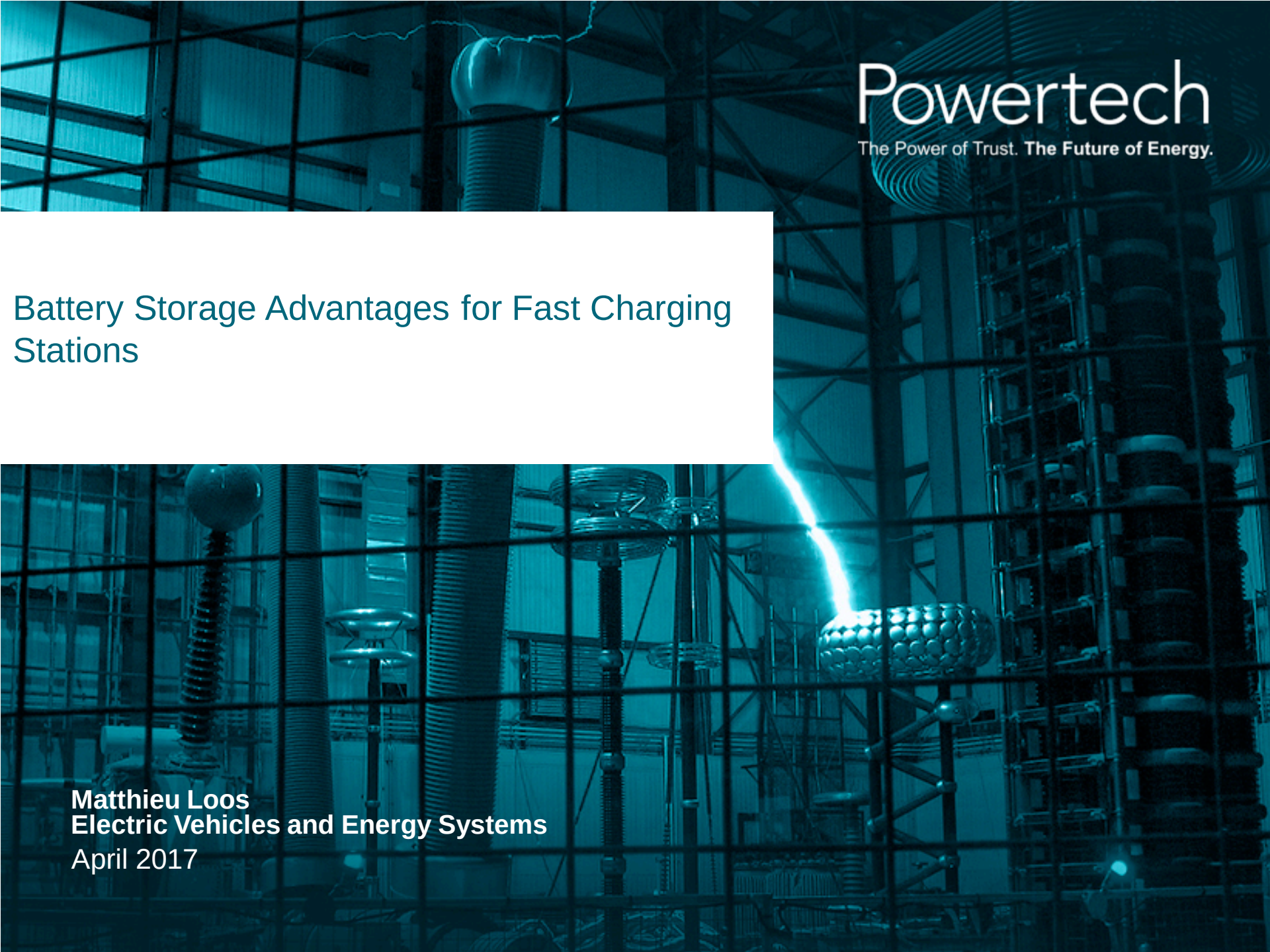


# Battery Storage Advantages for Fast Charging Stations

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# A typical fast charger for electric vehicle


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# Cost associated to DCFC

## Installation cost:

- Hardware
- Station upgrade
- Installation

## Operating cost:

- Energy (kWh)
- Demand Charge (kW peak)
- Maintenance
- Service provider

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# Comparison of three different scenarios

## Three different Fast Charging Stations

- Cost savings is done on the demand charge only
- Avoiding all demand charge
- Sizing for the biggest battery size (840 kWh delivered/day)
- Battery cost is estimated at 250$/kWh

| DCFC Power | Demand Charge |
|---|---|
| 50 kW (1 CHAdeMO, CCS)<br>150 kW<br>300 kW (4 Tesla superchargers) | $0 - 0 to 35 kW<br>$4.76 per kW – 36 kW to 150 kW<br>$9.13 per kW – 150 kW+ |

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# The 300 kW station could have a business case

| DCFC Power | Battery Capacity | Battery Cost | Max Utilization | Payback on Demand Charge |
|---|---|---|---|---|
| 50 kW | 252 kWh | 63 k$ | 70 % | 73 years |
| 150 kW | 644 kWh | 161 k$ | 23 % | 24 years |
| 300 kW | 742 kWh | 216 k$ | 12 % | 8 years |

## 50 kW:

- The 70% utilization rate requires a large battery and has small savings

## 150 kW:

- Demand charge fees not high enough
- Utilization rate too high and requires large battery

## 300 kW:

- Hits very expensive demand charge
- Battery capacity is slightly bigger than 150 kW

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# Utilization rate is key for battery

Nowadays, typical utilization rate is around 10 %

If utilization starts to be too high (>12% for 300 kW).

The DCFC station might be virtually down (Output only 35 kW where 300 kW could be expected).

However, it shouldn’t be overestimated:

- Utilization is not straight charging hours then inactivity
- One charging session does not always reach max power
- DCFCs are not continuously used (Time to recharge the batteries)

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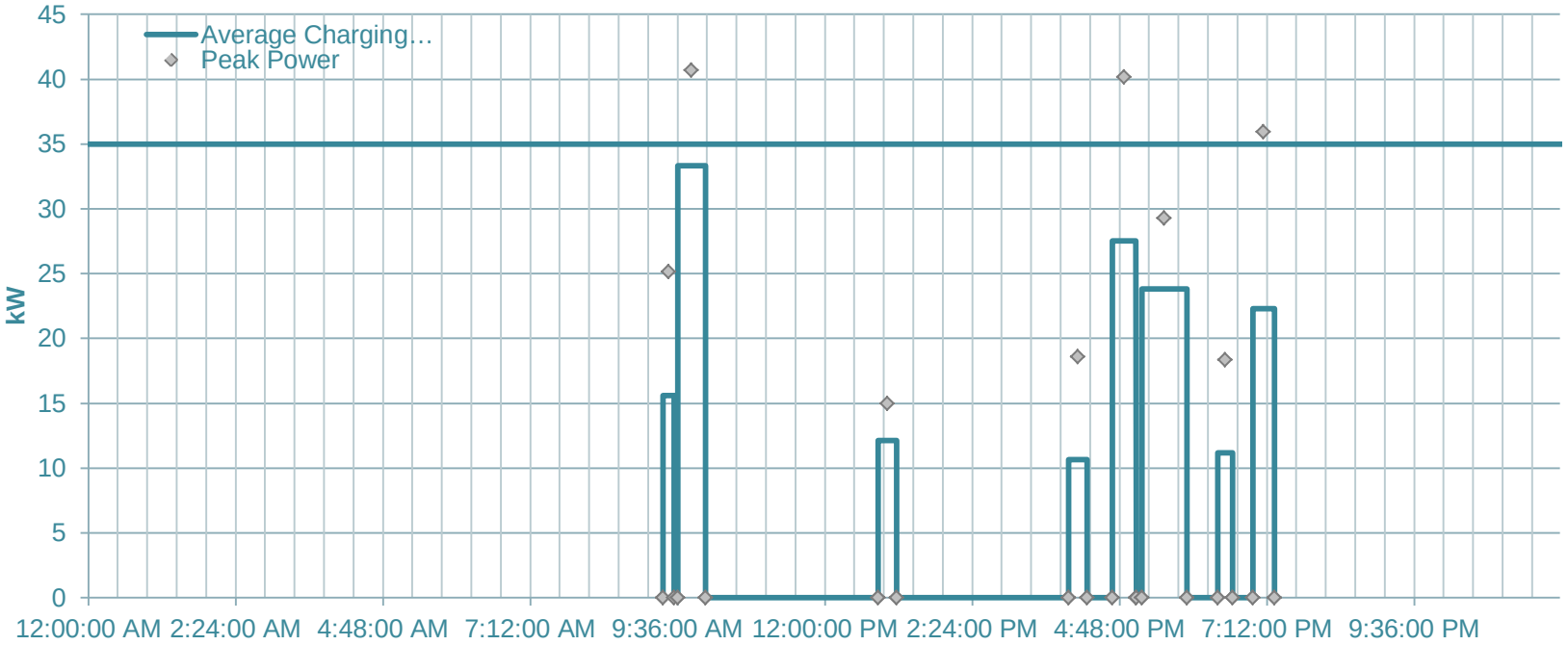
# Maximum power is rarely reached

Utilization rate of 12 % (Excellent day)

On the 3hours of service, only 50 minutes were above 35 kW

Battery utilization rate would be approximately 3.5%




Demand charge Threshold

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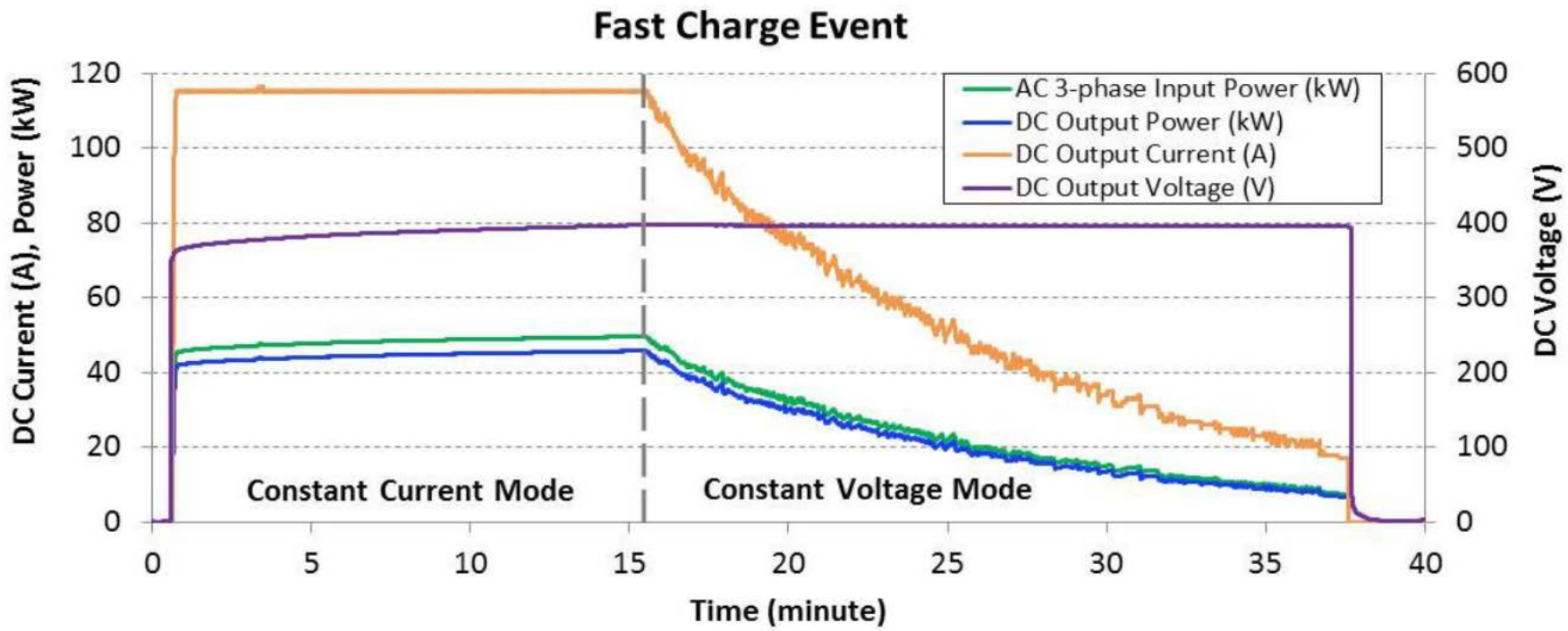
# Mainly vehicle constraint

The battery pack of the vehicle cannot handle more power:

- State of charge is too high
- Battery Temperature




INL The EV Project – ABB DCFC Testing

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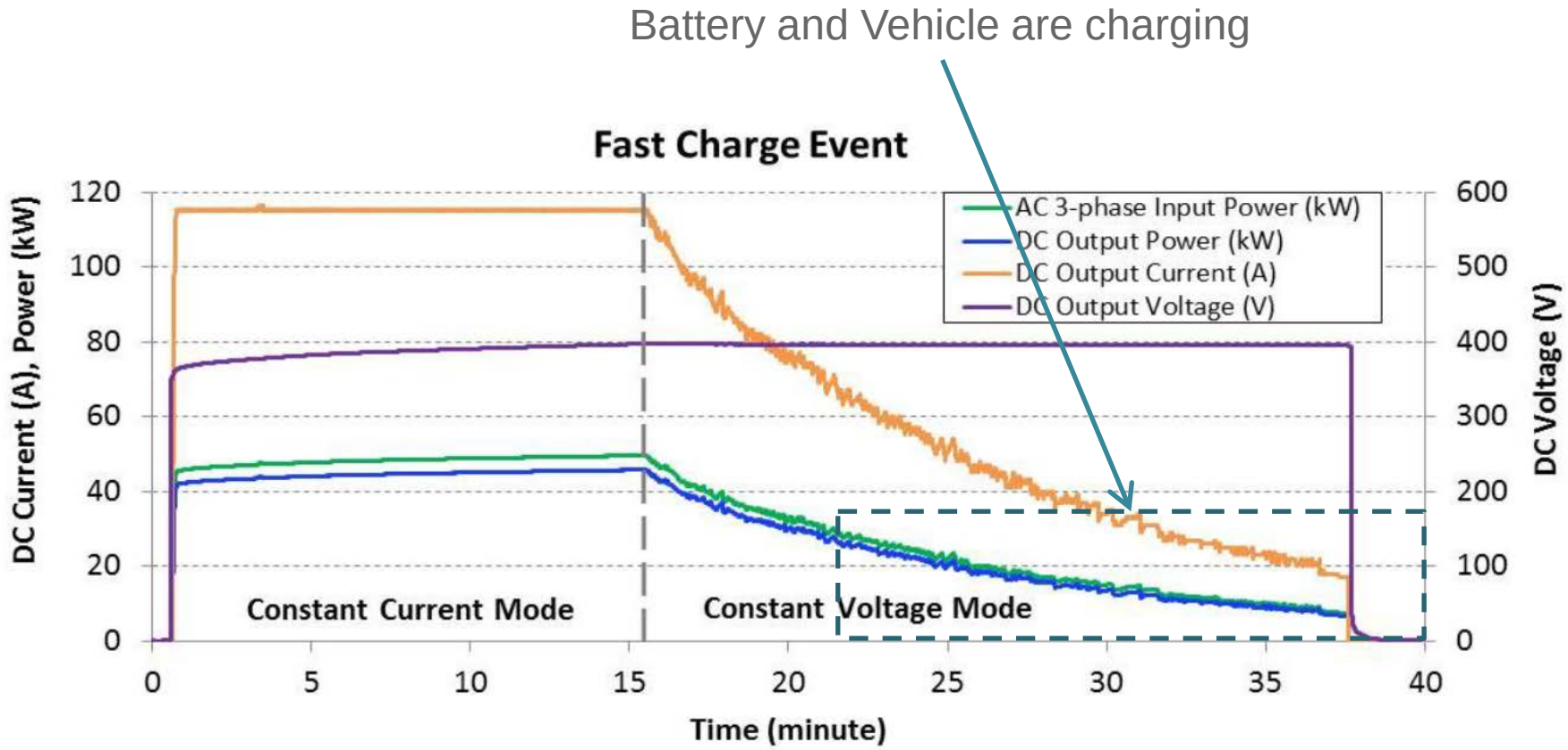
# Half of the session, the battery charges

The vehicle pack cannot take power higher than demand charge



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# Resizing the battery, better business cases

## Assumptions:

- Provide 1 hr at maximum power continuously
- Charge for 2 hours between sessions

| DCFC Power | Battery Capacity | Battery Charging time | Battery Cost | Utilization Rate | Payback on Demand Charge |
|---|---|---|---|---|---|
| 50 kW<br>150 kW<br>300 kW | 15 kWh<br>160 kWh<br>585 kWh | 25 min<br>4 hr 30 min<br>16 hr 45 min | 3.8 k$<br>40 k$<br>146 k$ | 70 %<br>18 %<br>10 % | 4.4 years<br>6 years<br>6.4 years |

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# Risk can be monitored

The battery pack of the vehicle cannot handle more power:

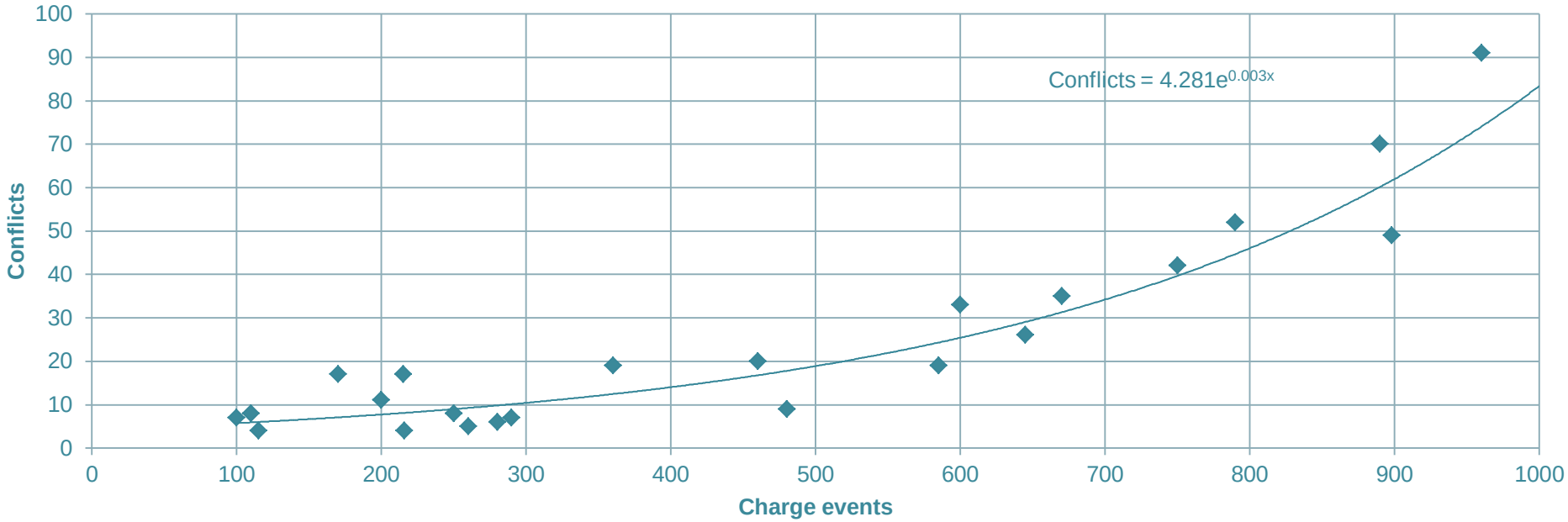
- EV sales are growing
- New models with better battery pack
- DCFC utilization rate growth

However, battery can still be used to reduce the demand charge cost (shave the peak) and continue to improve operating cost.

# Conflict rate is an important parameter

Conflict rate is when vehicles are queuing to charge.

Conflicts are exponential with utilization rate.




Can statistically help managing the battery system (or designing one to install on existing DCFC).

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# Conclusions

Local batteries storage could help improve operating cost of DC Fast chargers.

The following parameters have been identified:

- Utilization rate
- Conflicts rate
- Demand charge fees

Future Work:

- Local renewable energy integration
- Sensitivity analysis
- More complex scenarios (e.g. peak shaving)

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# The future is electric


# Thank You!

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