

Modernizing DC's Energy Delivery System

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Modernizing Energy System

**“Modernizing Energy Delivery System
for Increased Sustainability”**

**FC 1103 Buzzard Pt Substation
(minimum)**

FC 1130

**Aging
Infrastructure**

**Alternatives
Analysis**

**Customer
demand**

Quantifying Benefits of DER

Value	Affordability	Environment	Resilience
Reduce or defer infrastructure needs <ul style="list-style-type: none">• Close to load (no or minimal T/D)• Maker or Taker?	✓		✓
Renewable or low-carbon <ul style="list-style-type: none">• Caveat for CHP and storage• Timing is critical		✓	✓
Peak demand reduction	✓		✓
Energy reduction	✓	✓	

Quantifying Benefits of DER

DER brings these values but are all DER created equal?

Location, Location, Location

- Grocery store next to a supermarket vs. in a food-desert

Timing

- Peak demand reduction
- When can storage reduce GHG and NOx?

Prioritize system-wide benefits

- T&D deferral or reduction
- Reduce peak demand

Quantifying Benefits of DER

WHAT IS NEEDED?

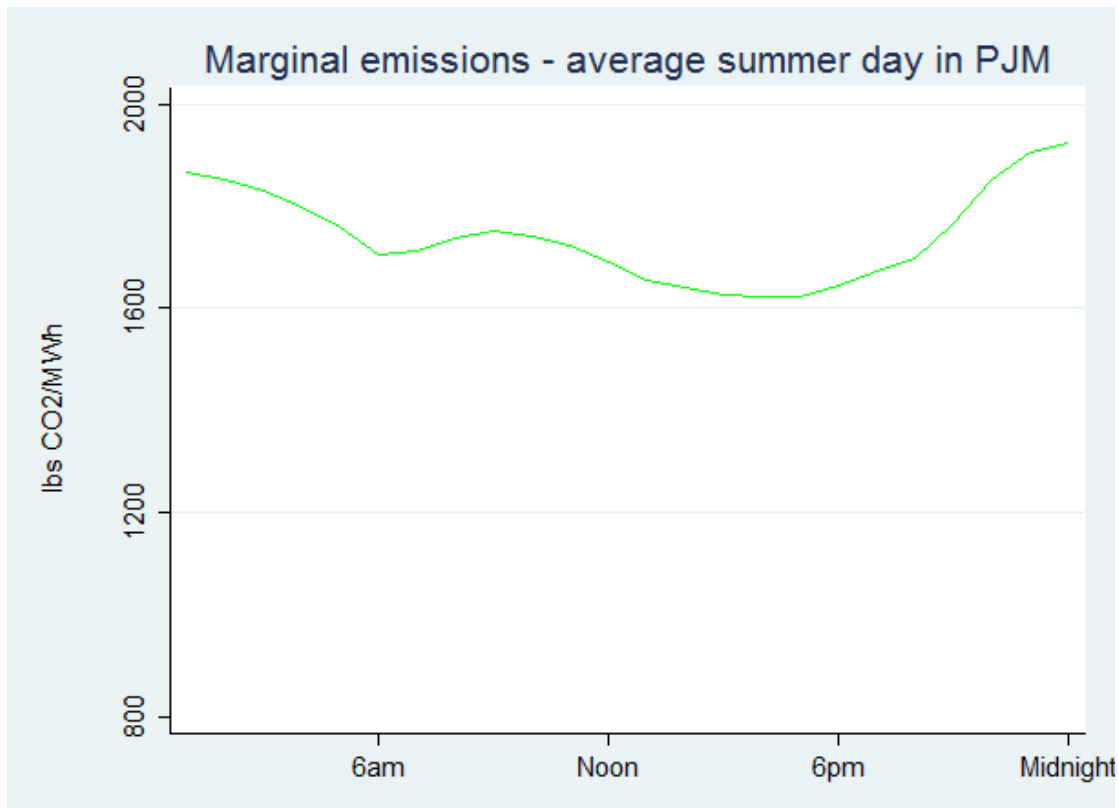
Quantifying Benefits of DER

As an example, reverse engineer the issues in FC 1103

- **Load visibility** (Baseline hourly load profile)
- **System visibility**
(Load forecast and existing capacity for feeders & substations)
- **DER-led solutions**
(scenarios of DER penetration levels)
(Demonstration project/technology proof)
- **Enabling policy and rules**
(Physical operation and market)

Grid Performance Characteristics

- Modeling of hourly CO₂ & NO_x intensity of the DC electric grid
 - 2015 as baseline: **Carbon Intensity Map**



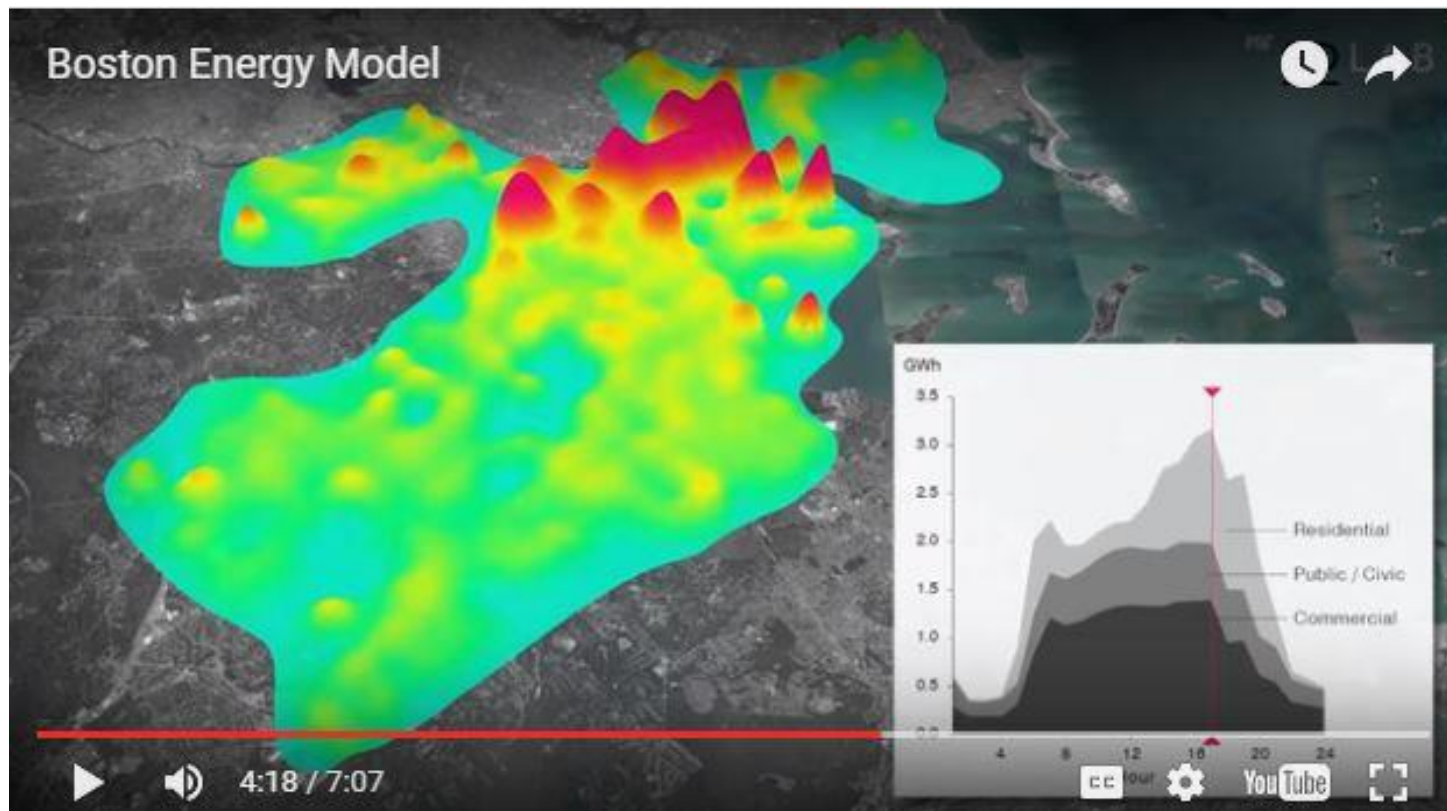
Storage's daily emission at peak hours = 1924 lbs/mWh

At off-peak hours: 1622 lbs/mWh

Source: WattTime

Grid Performance Characteristics

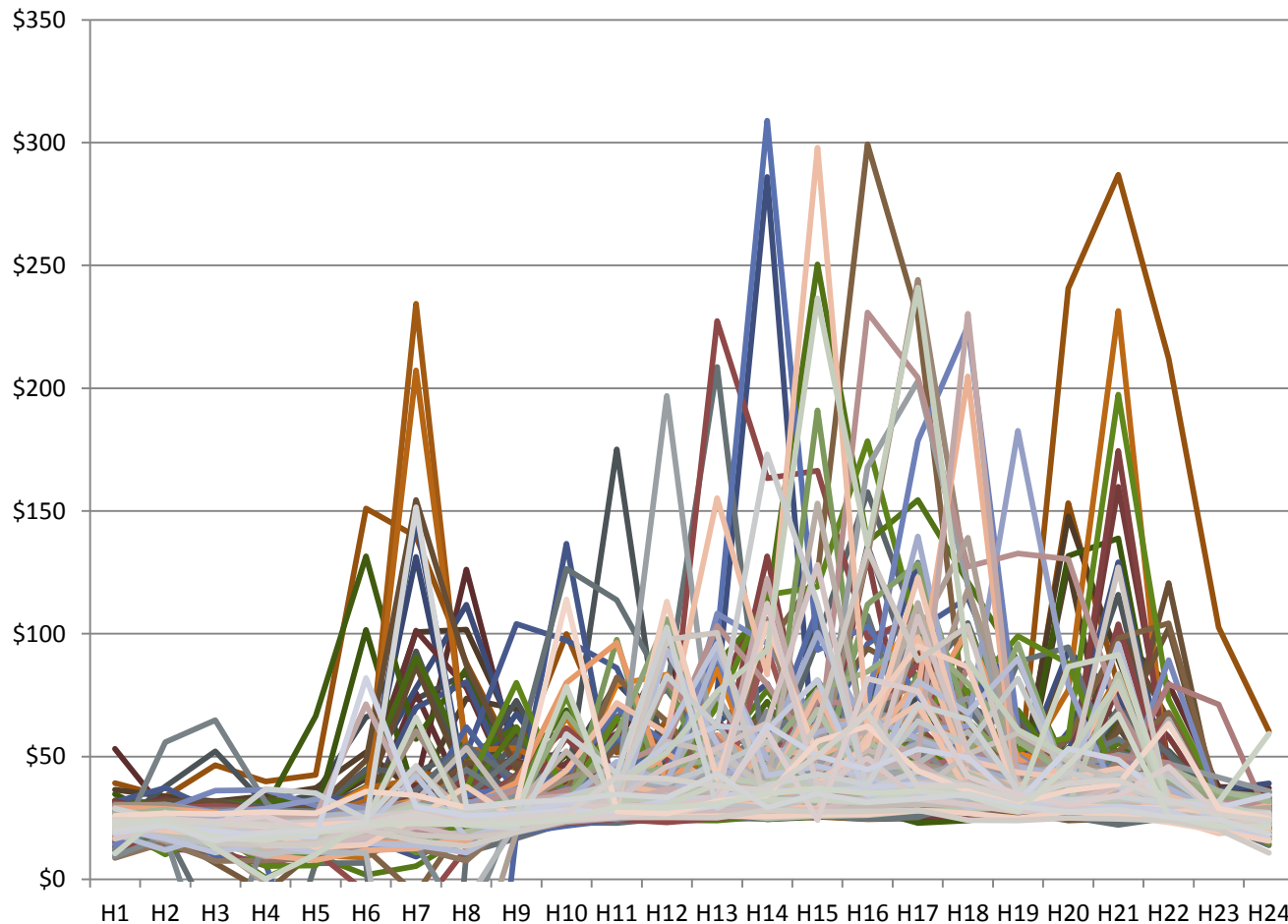
- Modeling of hourly energy demand for the buildings in DC based on actual and simulated data: **Locational Load Map**



Source: MIT

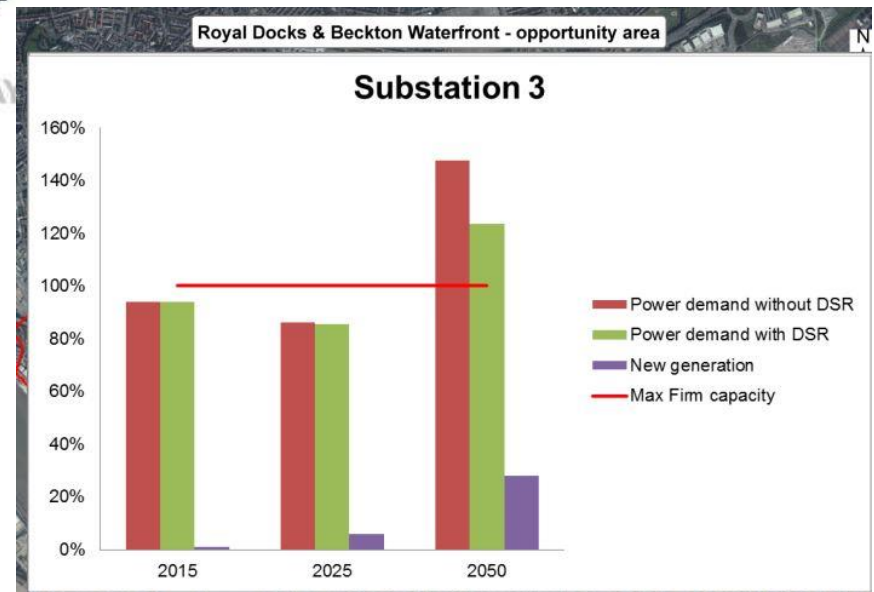
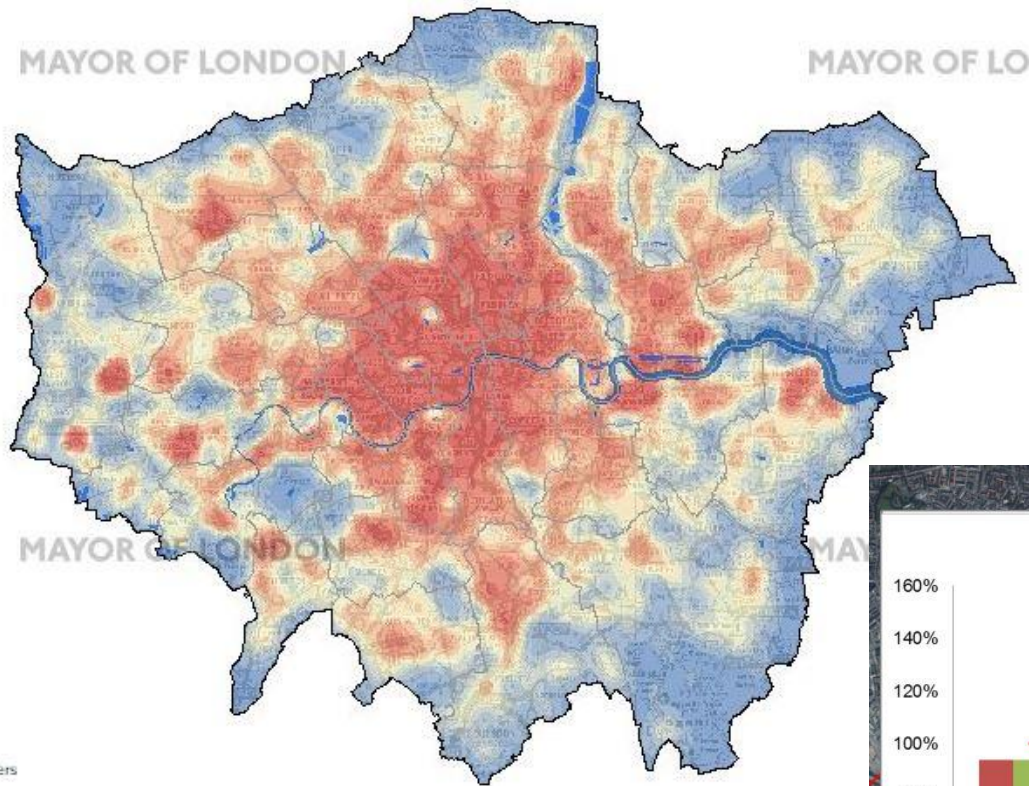
Grid Performance Characteristics

Hourly LMP at a price node in DC in 2015



Source: PJM

Grid Performance Characteristics



Source: Greater London Authority