Smart Community Demonstration Project in Manchester, U.K.

Sustainable Communities Summit
Thursday 16 June, 2016

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Director of Environment, Greater Manchester
Presentation Contents

- **Greater Manchester**
  - Governance: Combined Authority
  - Energy Demand / Future requirements
- **Smart Community Demonstration Project**
  - Project Overview
  - Aims & Objectives
  - Tenant engagement & Demand Side Response
  - Progress & Next Steps
- **Lessons Learnt**
- **The Future: following Grid Parity**
Greater Manchester Combined Authority

Greater Manchester (GM)

- UK’s largest & fastest growing regional economy: GVA £46bn
- 2.6 million residents and a workforce of 7.2 million people
- Low carbon and environmental goods sector worth £5.4 billion, which supports 37,000 jobs - projected to grow at more than 4% pa
- 1.2m households, 25% are social homes
- 95% of homes use gas for space and water heating
- Asset management plan to replace boilers in 160,000 properties by early 2020’s

Combined Authority (GMCA)

- AGMA established in 1986, GMCA formed in 2011
- 10 Local Authorities of Greater Manchester working at scale
- Established a Low Carbon Hub in 2012
  - A centre of excellence for achieving economic gain through integrated delivery of carbon reduction.
# Greater Manchester Energy Demand

<table>
<thead>
<tr>
<th></th>
<th>Estimated Required By 2035</th>
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<tbody>
<tr>
<td>Domestic demand</td>
<td>6GW even with optimal scheduling</td>
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<tr>
<td></td>
<td>Domestic ADMD 2kW – 14kW</td>
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<tr>
<td>Heating</td>
<td>Domestic heat pumps</td>
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<tr>
<td></td>
<td>350,000 fitted</td>
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<td></td>
<td>8-10kW for 8 hours</td>
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<tr>
<td></td>
<td>Additional &gt;2 GW</td>
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<tr>
<td>Transport</td>
<td>31% UK12M vehicles will be EV/hybrid</td>
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<tr>
<td></td>
<td>720,000 domestic EVs</td>
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<tr>
<td></td>
<td>80,000 E-Vans</td>
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<tr>
<td></td>
<td>3-8kW for 8+ hours</td>
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<tr>
<td></td>
<td>50kW fast chargers</td>
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<tr>
<td></td>
<td>Additional &gt;2 GW</td>
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<tr>
<td></td>
<td>Manchester &gt;400MW</td>
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<tr>
<td>Generation</td>
<td>93% from renewable / carbon neutral sources. Potential for 3,710MW</td>
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<tr>
<td></td>
<td>across GM from Heat Pumps</td>
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**Current Domestic demand profile**

**Domestic demand profile 2025**
Domestic Smart Energy Proposition

Reduce energy demand and cut carbon emissions by bringing together low carbon energy technologies with advanced IT.
Smart Communities Demonstrator Project

- Develop a Smart Communities Trial – MOU signed April 2014
- Combine domestic technologies with a smart network management £20+m
- Trial air source heat pump / demand aggregation in 600 social homes
- GMCA – Housing Companies, Electricity Northwest, UK Government Departments
- NEDO - Hitachi, Daikin, Mizuho,
Project Objectives, Greater Manchester

Establishment of an aggregation business model which manages energy load of heat pumps in the residential sector

### Objective

**Aggregation Technology and Systems**

Demonstration of usability and efficiency of load-balancing aggregation technology and systems for residential heat pumps (Daikin, Hitachi)

**Business Model**

Establishment of Business Model (Mizuho Bank, Daikin, Hitachi)

[UK’s Target]

2020: The renewable energy ratio: 15%
2030: Heat Pump penetration: 30%

Overview and features of solutions

**Overview**
- Demonstration and Development  April 2014 - March 2016
- Installation of heat-pumps (600 houses) • Development of the aggregation system
- Establishment of ICT systems • Establishment of Business Model

**Demonstration of ICT Systems Technology**

- Operation Management
- Telecommunications Management
- Data Processing
- Shared Functions
- Security
- Interconnectivity

**Demonstration of Heat Pump Technology**

- Heat Pump Controller
- Heat Storage
- Communications Device

**Demonstration of Aggregation Technology**

- Electric Power Aggregation Functions
- Electric Power Collection Plan
- Electricity Trading Plan
- Electricity Trading
- Heat Pump Aggregation Functions
- Individual Demand Planning Function
- Collection and Management Function for Operation Data

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*Demonstration project supported by METI (Ministry of Economy, Trade and Industry) & NEDO (New Energy and Industrial Technology Development Organization)*
Project Schedule

<table>
<thead>
<tr>
<th>Key Milestone</th>
<th>FY2014</th>
<th>FY2015</th>
<th>FY2016</th>
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<tbody>
<tr>
<td></td>
<td>Apr-Jun</td>
<td>Jul-Sep</td>
<td>Oct-Dec</td>
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<tr>
<td>Implementation</td>
<td></td>
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<tr>
<td>Agreement</td>
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<tr>
<td>Joint Procurement</td>
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<td></td>
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<tr>
<td>Installation</td>
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<td></td>
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<tr>
<td>Tenant Engagement</td>
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</tr>
<tr>
<td>BC2</td>
<td>BD</td>
<td>DD</td>
<td>T</td>
</tr>
<tr>
<td>BC3</td>
<td>BD</td>
<td>DD</td>
<td>P&amp;T</td>
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<tr>
<td>BC5</td>
<td>BD</td>
<td>DD</td>
<td>P&amp;T</td>
</tr>
<tr>
<td>BC4</td>
<td>BD</td>
<td>DD</td>
<td>P&amp;T</td>
</tr>
</tbody>
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BD: Basic Design, DD: Detail Design, P: Production, T: Test, OT: Operation Test
Tenant Engagement

Purpose:
• Recruiting tenants and making the demonstrator a success.

Incentives:
• Free broadband
• Free tablet computer
• Insulation upgrades
• Expert energy advice
• Monitoring equipment
• Telecare function (optional)
Communications Process

**Tenant Engagement**

**Preparation**
- Prepare tenancy agreements
- Identify properties
- Prepare communications plan
- Prepare communications messages
- Test communications messages

**Property Selection**
- Agree which properties are suitable
- Allocate prioritisation to properties
- Issue initial letters to Wave 1
- Schedule town hall / residents meetings

**Waves: Quality properties**
- Visit each property
- Conduct site survey
- Confirm suitability and design
- Gain agreement from tenants
- Signed tenancy agreement

**Waves: Start work**
- Communicate with tenant to gain access
- Site access
- Main contractor does work
- Broadband is installed
- Provide training / materials
- Verification of work
- Repeat start work process: Thermometers, HGWW and tablets

**Waves: Follow up**
- Site visit
- Survey: Assess comfort & energy use
Analysis of actual power consumption data for Demand Response (26 Tenants)

**Purpose:** To understand power consumption profile - Time and Scale

**Tendency:** There are two peaks in a day. Peak time is larger at the weekend. Up to 500 [W] power per tenant can be anticipated at peak times.
Demand Response Patterns – Limited Trial

**DR Result: DR Success**

Outside temp; Max 11°C Min 5°C
Room Target temp 26 °C

**DR Result: DR Failure**

Outside temp; Max 11°C Min 5°C
Room Target temp 18°C (0600) → 19°C (0715) → 15°C (2000)
Progress and Next Steps

As at April 2016:
- Limited aggregation trail commenced (Oct’ 15)
- 1652 tenants engaged
- 533 tenants expressed interest
- 477 tenants formally signed – up
- 395 heat pumps installed (May 16)

Next Steps
- Complete heat pump, home gateways and EDMI Meters installations/reinstallation
- Issue User Interface tablets to users
- Commence full aggregation trial (Sep’ 16)
- Commemorative event (Oct’ 16)
- Analyse results and develop business case (Feb ‘17)
- Complete project (Mar’17)
Lessons Learnt

Issues Experienced:
- Perception of ASHPs
  - Increased noise (additional Planning Permission required for blocks of flats)
  - Lower radiator surface temperature*
- Space and layout
  - Larger, impact on room design*
  - Impact of existing furniture*
- Distribution system
  - Homegateway/EDMI firmware issues
- Customer culture / behaviours
  - Tenants unplugging router*
- Perceived increased customer fuel bills in small number of properties
  - Some installation problems*
- Impact on electricity network
  - Long timescale for implementing grid reinforcement work in some properties

Solutions:
- Increased tenant engagement required*
- Increased pilot testing of all new technology before rollout
- Increased technical expertise available on site when first heat pumps installed
- Earlier tenant engagement for planning/reinforcement
Post Grid Parity:
Technology Push to Customer Services Pull

- customer participation
- deployment
- roll-out
- behaviour change
- demand side response

- guests feel at home
- heats up quickly
- cosy ambience
- healthy
- safe & secure
- in control
- warm
- clean

AGMA
ASSOCIATION OF GREATER MANCHESTER AUTHORITIES

GMCA
GREATER MANCHESTER

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Empower People - data & control ecosystem

Establish clear expectation setting, for both comfort and cost

Establish the analytics for designing, pricing and targeting services

Establish commercial value sharing between actors to align motivation

Home Energy Services Platform
Stimulate Rapid Innovation In Energy Services

Establish rich data and control ecosystem in thousands of homes and make available to innovators
Explore architectures for a services-led supply chain

Home Energy Services Platform

Service Provider
Service Provider
Service Provider
Service Provider

Resource Trading Platform(s)
(using Smart Meter data)

'bandwidth' pricing
asset capacity trading
demand flexibility
infrastructure planning

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Thank You