



Energy / Context Metering

Hybrid Power Systems – Power + Insight + Control

Simon Daniel, CEO

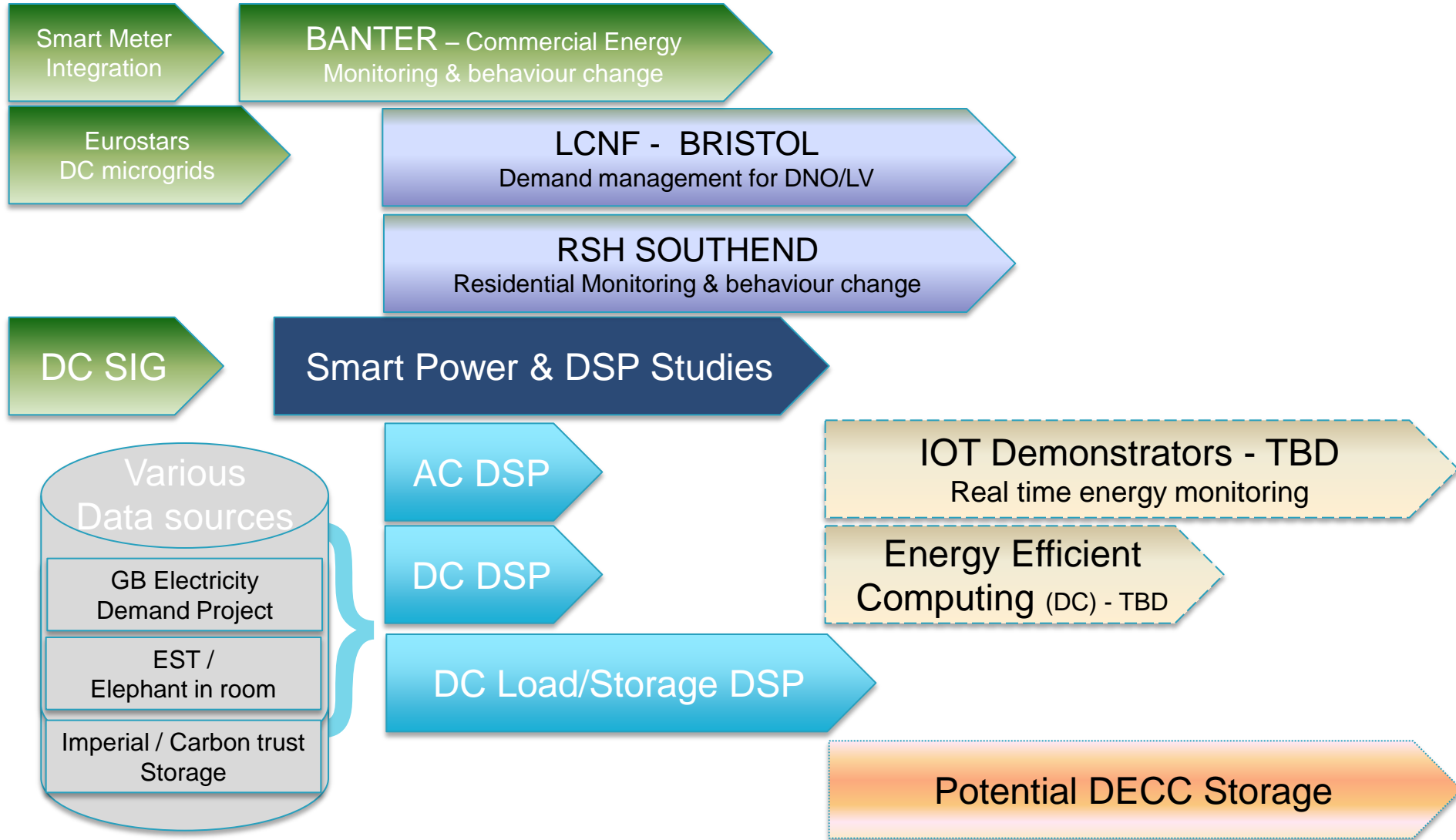
iHEAT Conference 2012 - Cambridge 13th Nov

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www.moixatechnology.com

MOIXA R&D ACTIVITY

Experience & insight across multiple R&D grant & client pilots



ACCESS vs AUTOMATION

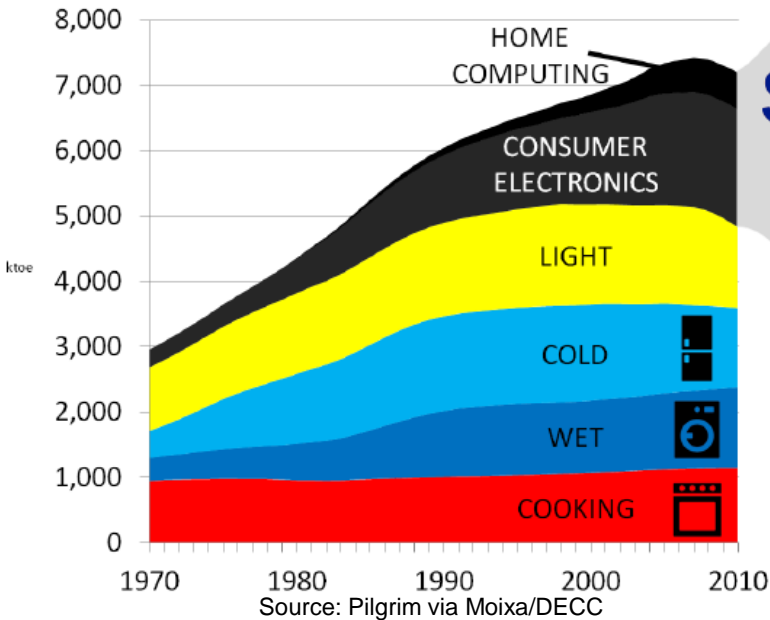


Insights - DC key >45% 2020

AC demand stable – slow moving goods

DC growing – fast product change cycles

The past might not be a good guide to the future



Past devices basis for planning?

- Historic demand well mapped
- Real-time meters – emerging

Future Added Demand Volatility?

- EVs & Electrification of heat
- What if IoT x 10 by 2020 (Cisco)
- ARM 150bn+ chips by 2020
- Robotics, 3D printing, batteries
- Assisted living / medical

Growing. Always on

Peak DSM difficult

SMART DC MICROGRID



MICROGENERATION



Easy-install solar

Innovative solutions to make installing micro solar easy, for example frames that allow you to hang a panel outside a window, or solar window shutters

SMART MONITORING



Energy monitoring

A helping hand. The system collects data on your grid and DC energy use and displays it in an intuitive view. Another view shows you how you compare to your peers

Smart meter integration

Industry standard Zigbee smart meters can be integrated, allowing grid energy consumption and pricing to be monitored and advice to be tailored to behaviour



SM001

SMART POWER MANAGEMENT

BMS003



HUB002



Smart energy hub

The system's ground control. Smart technology controls, monitors and streams power to your devices to maximise efficiency

Smart power storage

Squirrels away solar and cheap off-peak grid power for when you need it. Uses advanced LiFePo battery technology for maximum efficiency and a 10+ year life

SMART DC POWER

Power for DC devices

Moixa custom plug signals the voltage and current required by a particular device to the DC socket. Power is efficiently converted at the point of need



PS001



PS002



Smart light switch

Incorporates DC output socket and USB power socket. Talks to the hub via Zigbee. Designed to control LED lights and DC CFL fittings, enabling reuse of existing lighting circuits for DC power points around the home

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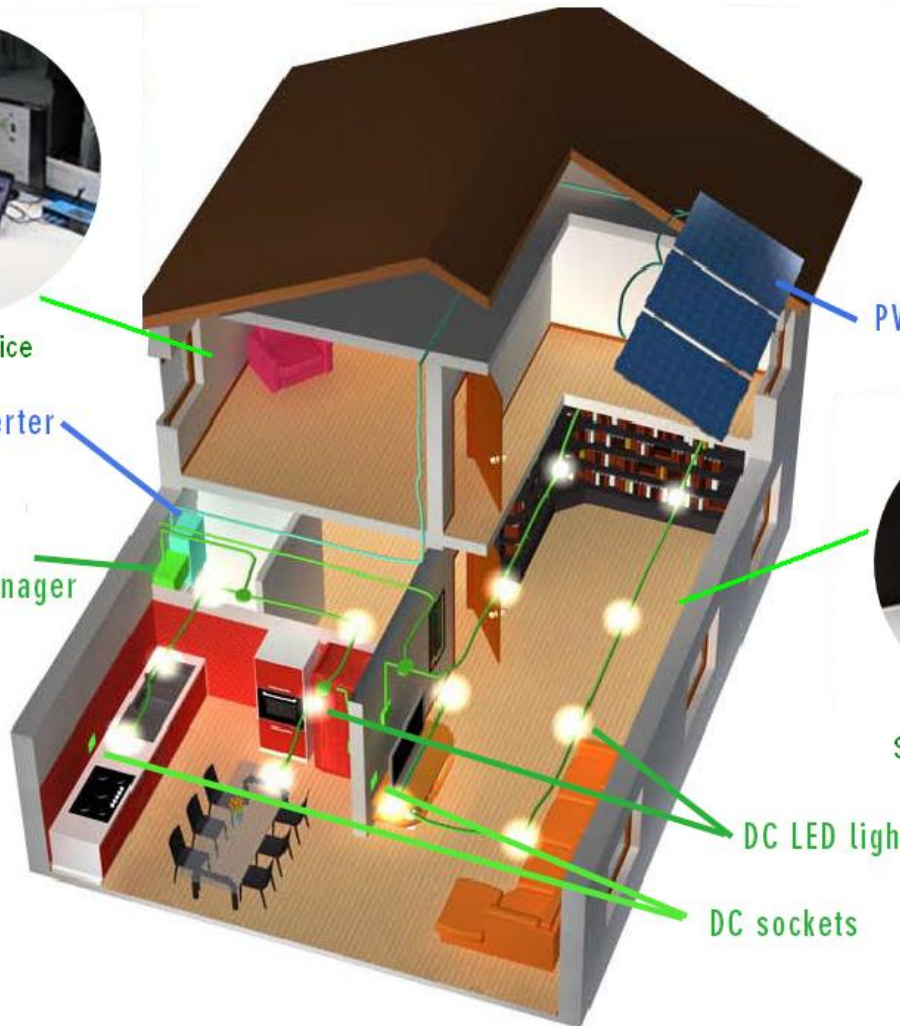
System overview

New/Retrofit – Power & Sensing

Smart Meter Integrated Lighting & Electronics



Smart DC Hub - office



UK Trials & Pilots

Technology Strategy Board
Driving Innovation

LCN Fund
Low Carbon Networks

SIEMENS WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

REALLY SMART HOUSE

Isle of Man Government

smart anglia

NUPHARO PARK

Roll out across trials



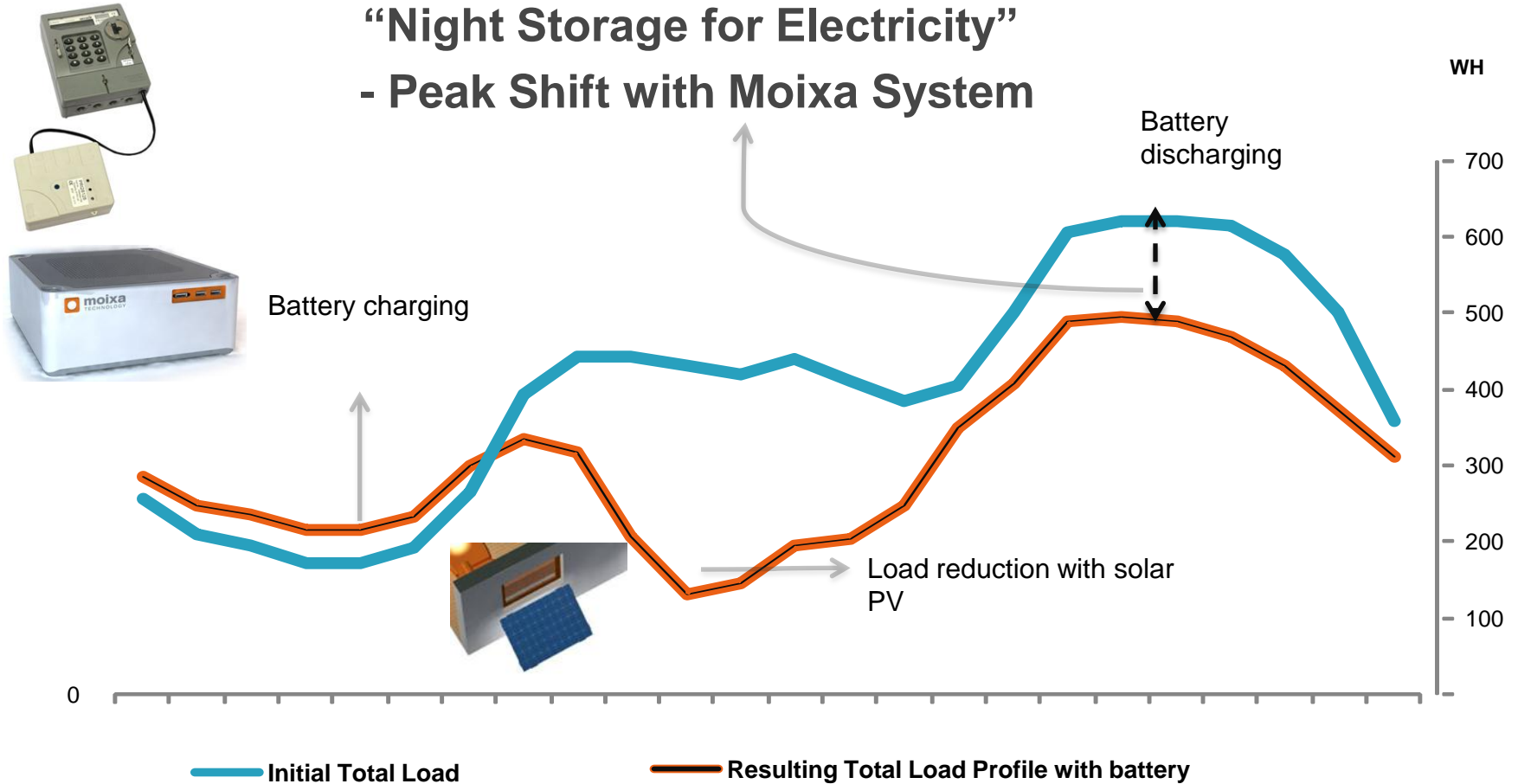
Smart DC Hub - media

- Building**
- DC Sensors**
- DC Lighting**
- DC Pumps**
- Consumer**
- DC Appliances**
- DC ICT/Gadgets**

Enables - peak DC grid shift

LED/CE load reduction & Storage Shift to PV/night

“Night Storage for Electricity”
- Peak Shift with Moixa System



Smart lighting, control, sensing

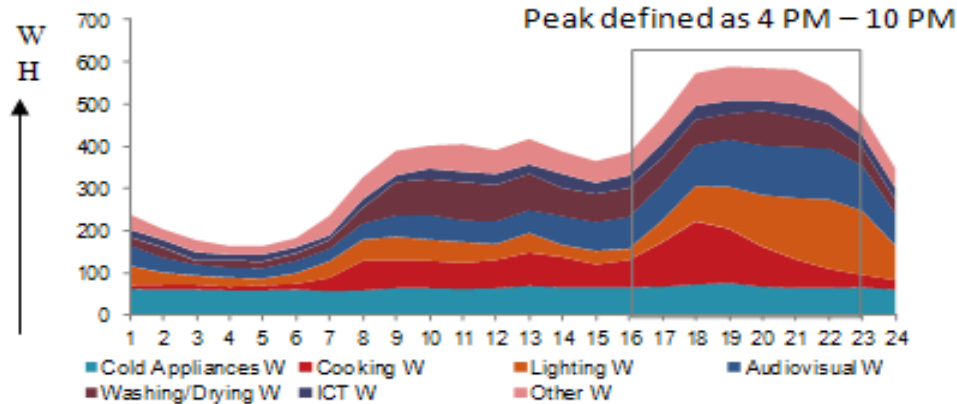
Local and remote interfaces hosted on smart hub

- Zigbee connected lighting control
- Sensors (Temp, Use, Occupancy)
- Personal control interfaces
- Link to cloud server for remote access
- Automation preferences



Household Shift opportunities

Value points to Consumer / ToD Meter Tariffs / Utility Network : DNO, LV upgrade, STOR, peak plant, wind Heat shift / storage integration



Source: GB Electricity Demand / DECC / Intertek

DC Peak opportunity?

| Peak DC Load (WH,% total) | | |
|---------------------------|-------------|------------|
| Audiovisual | 761 | 19% |
| Lighting | 811 | 20% |
| ICT | 218 | 5% |
| Other DC | 381 | 11% |
| TOTAL | 2171 | 57% |

Accessible household AC peak shift? (heat/appl)

Table 2 Peak load composition of UK domestic electrical appliance end-use 2010⁴

| Type of load | Domestic Electrical Appliance | Average daily (24 hr) single household load, KWH | Peak load average single household (4 PM-10 PM), KW |
|--------------|-------------------------------|--|---|
| DC | Audiovisual | 1.6 | 0.8 (21%) |
| | Lighting | 1.5 | 0.8 (21%) |
| | ICT | 0.6 | 0.2 (5%) |
| | Other DC | 0.9 | 0.4 (11%) |
| AC | Washing/ Drying | 1.3 | 0.4 (11%) |
| | Cold Appliances | 1.6 | 0.5 (13%) |
| | Cooking | 1.3 | 0.6 (16%) |
| | Other AC | 0.2 | 0.1 (3%) |
| Total | | 9 KWH/ day/ home | 3.8 KWH peak load/day/hon |

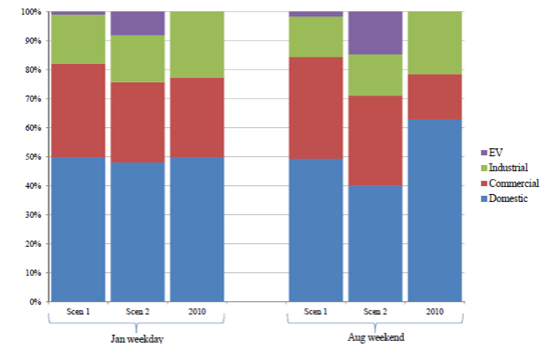


Fig 2 Breakdown of potentially shift-able demand during the evening peak (2025- Scen1: BAU, Scen2: Greenest)⁵

Software based – DC metering

Inference - Network Scan (MAC address tracking)

Explicit - DC Socket Monitoring (£) but future standard

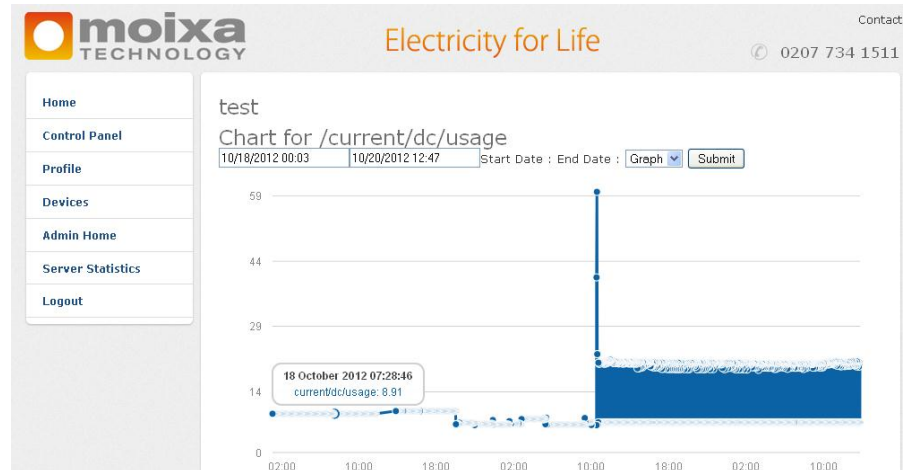
Moixa office



home office



BT Marlesham



Precise DC device use provides real-time occupancy, Device adoption, extra data for AC Fusion/Disaggregation

Hardware based - monitoring

Standard e.g. Alert Me : 10 sec data, single point of measurement, low cost, self install, large data set already available.



Smart Meter: accurate billing data, default is 1/2 hour data, possible to get Khz data for disaggregation (smarts needed in home). Standard, reasonably low cost.

Bespoke monitoring solution: When you need a system that delivers against specific objectives there is often no choice but to design a bespoke system.



Southend-on-Sea – RHS project

Project to test innovative retrofit energy efficiency technology

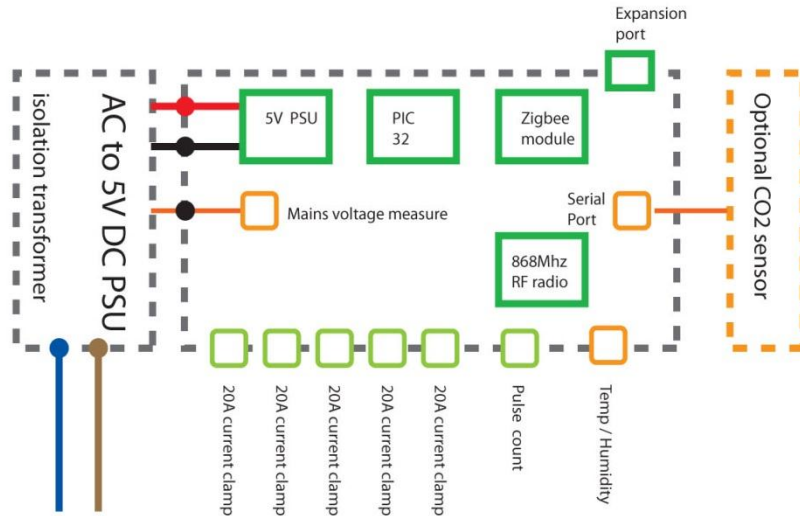
45 homes, single location, social landlord

Moixa developed monitoring:

- Electricity (5 channels) – clamp on meter + mains voltage
- Pulse count input for gas meters
- Temperature & Humidity
- CO2 in some houses
- Remote Temp / Light / opening (868Mhz RF)
- Custom – air flow / additional CO2 etc in some houses



Multi Channel Sensor



Dimensions



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 Proprietary and Patent Pending Technology (e.g. US20100076615)

Specification:

Power supply / voltage measurement unit

The Power supply has 2 functions. It provides a regulated DC supply for the sensor unit, and it also includes an isolation transformer, giving an output voltage proportional to the mains voltage.

Multi Channel sensor unit

A multitude of sensor inputs are included on this unit

5 channels for current clamp sensors, allowing multiple circuits to be monitored in any one location.

1 pulse count input, allowing for a pulse output from a gas meter to be monitored

Mains voltage measurement

A high quality **temperature** and **humidity** sensor is included in the unit

A serial port is included to allow the unit to include a **CO2 level** sensor, this is optionally fitted

A low power long range 868Mhz RF radio socket is provided allowing the use of battery powered external sensors to interface with the unit

External RF sensors

Light level sensor, these are very low power devices about the size of a matchbox, they send readings back to the multi channel sensor every 30 seconds, and should last around 1 year on a set of batteries. It can also be used as a window / door opening sensor.

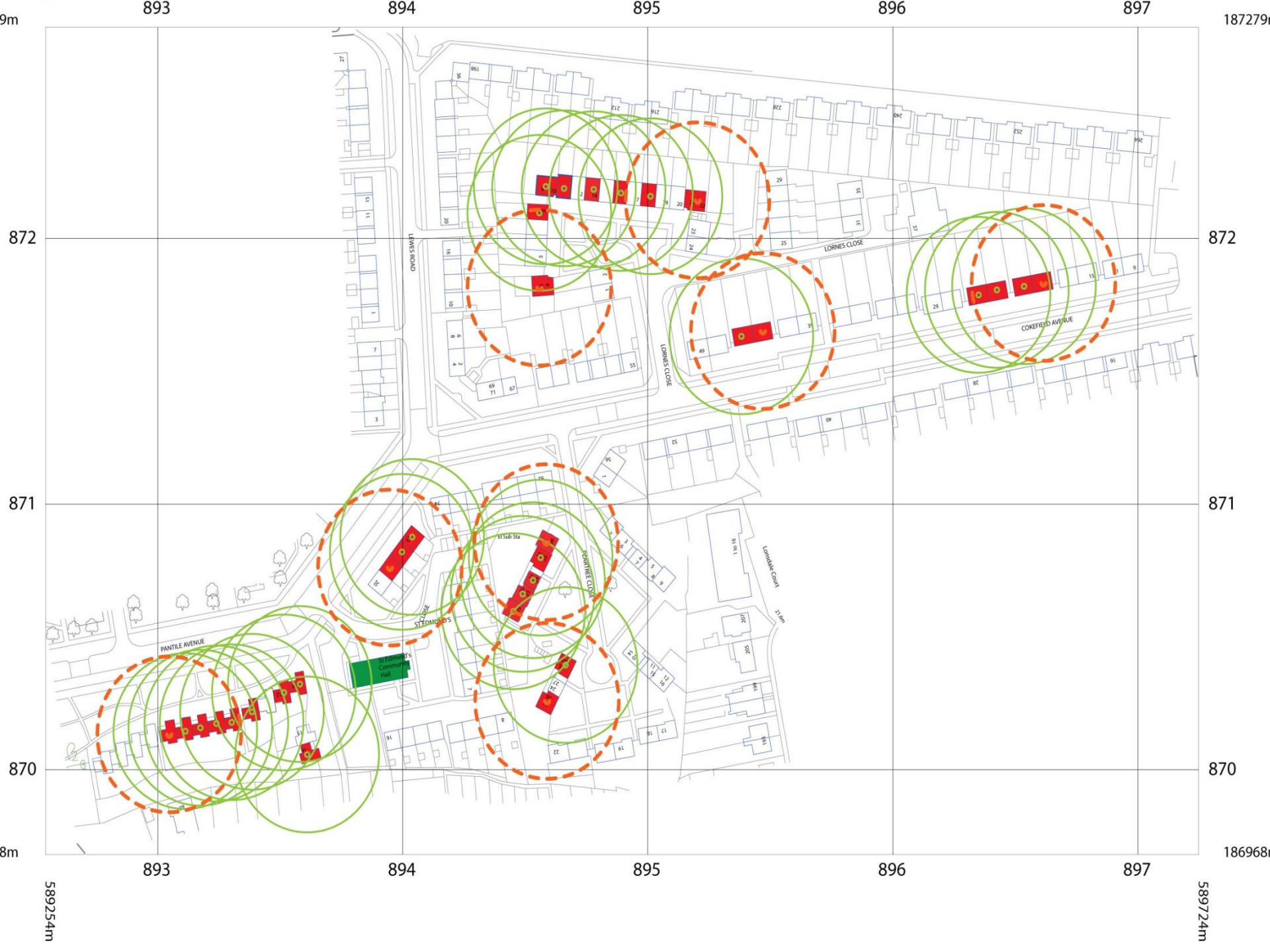
Temperature sensor, this is identical to the light sensor, except it takes temperature reading

Summary

The multi channel sensor unit is designed to allow the low cost, but very detailed monitoring of individual sites. It is designed to be extremely adaptable, even including an expansion port to enable additional serial based sensors to be attached.

It uses a high power zigbee module to allow a series of unit to be monitored with a single data connection to the cloud, reducing costs.

Certification/compliance: lab r&d/ trials. Country requirements on request



8m

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589254m

589724m

What is the data used for?

Analysis / status / alerts

App specific language, allows coding for alerts

Data Store

Team Gaming

Visualization

THE ENERGY PROJECT

Home
Railways
Moixa Office
L_Block
Server Statistics
About

Railways

| Id | Description | Last Reading | Time |
|---|--|--------------|------------|
| alertHT_oven_No_2_green | Ok | false | 7:50:02 PM |
| alertHT_oven_No_2_red | ht oven is red | true | 7:50:02 PM |
| alertHounsel_Bake2_red | hounsel bake2 is red | true | 7:50:28 PM |
| alertUIC_preform_cell_red | uio preform cell is red | false | 7:50:28 PM |
| countHounsel_pad | hounsel press production count | 158 | 7:38:02 PM |
| light_sensor2 | cooler 2 on light - XRF_V1_5_LDR CODE_10 secs | 4.44 | 7:50:23 PM |
| light_sensor3 | Press Cell 3 ram light (for pad count) | 73.6 | 6:56:08 PM |
| light_sensor4 | Hounsell press pad count - XRF_V1_4_THERM CODE_10 secs | 73.6 | 7:50:29 PM |
| light_sensor6 | cooler 1 on light - XRF_V1_4_THERM CODE_10 secs | 73.6 | 7:50:28 PM |
| unit1/battery | U1 battery voltage in mV | 4202 | 7:50:15 PM |
| unit1/clamp1 | Not in use | 9479 | 7:50:14 PM |
| unit1/clamp2 | Not in use | 27 | 7:50:14 PM |

```
// combination_feed/energy_per_part * (8 / 100000));  
ur  
// 8p per kilowatt hour  
ur  
//should be multiplied by (8 / 1000), for now this is happening in the graph  
ur  
//Just for information cost in £  
ur  
/combination_feed/cost_per_part  
  (/combination_feed/energy_per_part * (8 / 100000));  
ur  
ur  
//TEAM SCORING  
ur  
/alert/team_winning_points (/combination_feed/cost_per_hundred_parts < 35);  
ur  
/alert/team_losing_points (/combination_feed/cost_per_hundred_parts > 45);  
ur  
/combination_feed/team_score  
  (if (/alert/team_losing_points) (0 - 5) else 0 +  
   if (/alert/team_winning_points) 5 else 0);
```

THE ENERGY PROJECT

Chart for /combination_feed/all_clamps_base

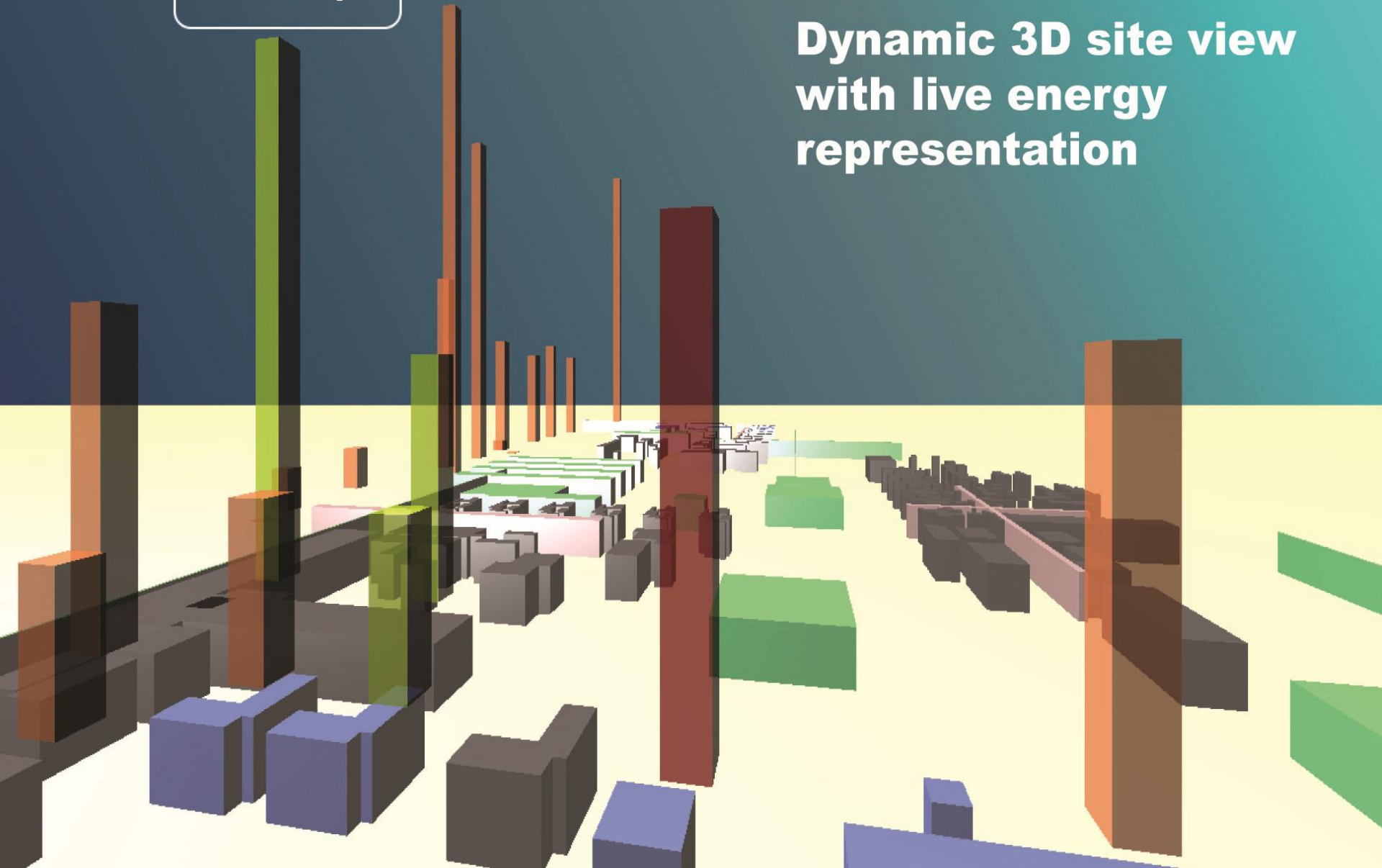
Start Date: 09/04/2012 14:23 End Date: 09/04/2012 15:16 Graph Submit

Tue Sep 04 2012 14:46:03 GMT+0100 (GMT Daylight Time)
combination_needat_clamps_base: 117,043.75

Home
Railways
Moixa Office
L_Block
Server Statistics
About

Railways

**Dynamic 3D site view
with live energy
representation**



Non intrusive, prompts to behaviour change

Wireless sensors



Existing data-feeds



Energy meter data



Cloud database / software

App specific language - calcs

```

286 //Just for information cost in £
287 /combination_feed/cost_per_part
288 (/combination_feed/energy_per_part * (8 / 100000));
289
290
291 //TEAM SCORING
292 /alert/team_winning_points (/combination_feed/cost_per_h
293
294 /alert/team_losing_points (/combination_feed/cost_per_hu
295
296 /combination_feed/team_score
297 (if (/alert/
298 if (/alert/
299
    
```

Data analysis tools



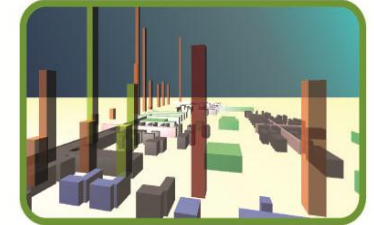
Railways

```

alert/Housnel_red Is the Housnel press running
alert/Press_cell_2_red Is Press 2 running idle?
alert/Press_cell_3_red Is Press 3 running idle?
alert/SCORES Scores are MONEY SAVED
alert/cooler_1_power_red Have you left pads in Cooler
                    2 hrs?
    
```

System status monitoring

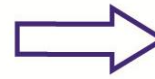
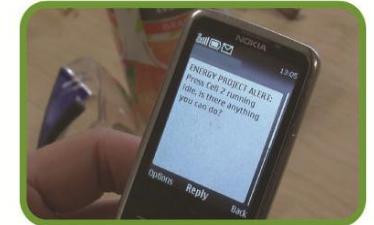
3D augmented reality



Gamification



Alerts multi platform









Prompts to action

Zigbee linked alert light – looked at a few alternatives with the residents, but this was judged by them to be their preferred.



DSP Change.. Reasonable?

| | | |
|-----------------|---|--|
| Lighting |  | Please turn out lights until day |
| Audio Visual |  | Please watch later on iplayer? |
| ICT |  | Please don't go on-line yet? |
| Cooking |  | How about a cold salad instead? |
| Washing |  | No?. At least wash a bit later? |
| Heating |  | Optimized on house/room occupancy |

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