

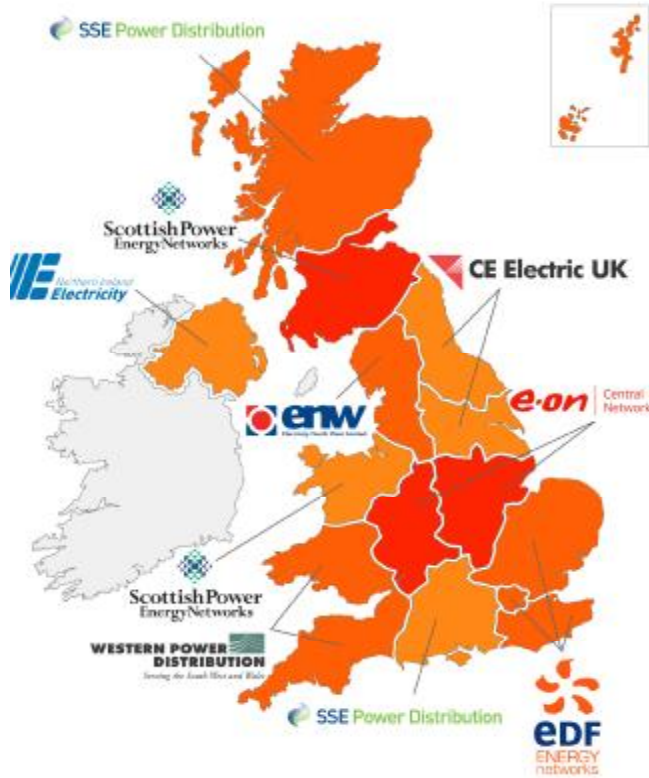
EXPLORING SMARTER NETWORKS

FRIDAY 22nd JANUARY 2010

OVERVIEW

- § WPD is a regulated monopoly
- § Income is fixed by our regulator Ofgem and reviewed every 5 years
- § The next price control period DPCR5 commences April 1 2010 and includes a range of incentives
- § Our focus for DPCR5 is in three key areas:
 - Ø Environment - to take an active role in tackling climate change
 - Ø Customers - to be truly customer centred
 - Ø Network - efficient investment for a reliable network
- § Our objective for today is to share with you our work to date on environmental projects and to generate potential project ideas that meet the criteria for Ofgem's IFI and LCNF incentives

Who are we?



UK Electricity Distribution Areas	Customers (m)	Network Length ('000 km)
EDF Energy Networks	7.8	179
Central Networks	4.9	133
CE Electric	3.7	91
Scottish Power	3.5	109
Scottish & Southern	3.5	122
Western Power Distribution	2.6	85
Electricity North West	2.3	56

Western Power Distribution (WPD) is owned by PPL Global LLC, a subsidiary of PPL Corporation of Allentown, Pennsylvania.

We are a network operator responsible for bringing a reliable electricity supply to 2.6m customers across South Wales & South West England.

We own and operate distribution system assets including 85,000 km of network and over 90,000 transformers plus associated switchgear.

INNOVATION FUNDING INCENTIVE

IFI ELIGIBILITY CRITERIA

- § “Eligible IFI projects are defined as those being designed to enhance the technical development of distribution networks and can embrace asset management from design through to commissioning, operation, maintenance and decommissioning.”
- § They must also meet tests against three key criteria;
- Technical development
 - Degree of innovation
 - Customer value

Innovation Good Practice Guide
ER G85 Dec 2007

IFI

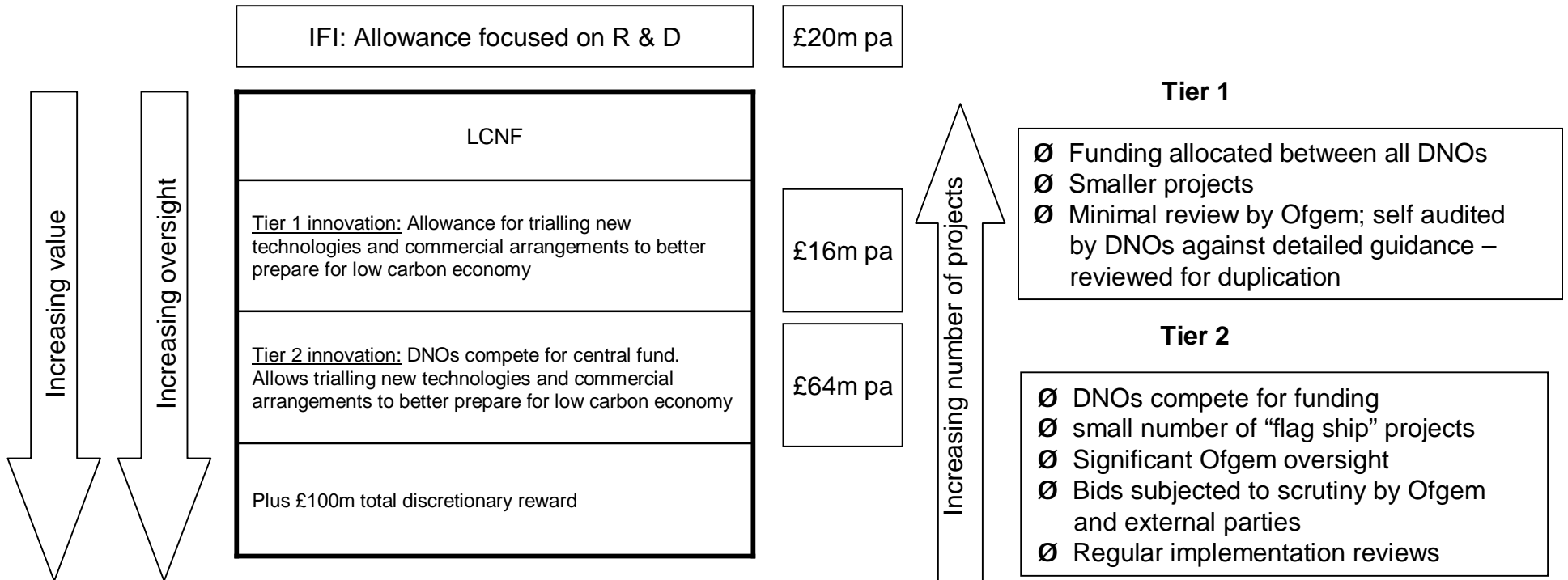
- § IFI is an existing incentive to allow DNOs to fund technical research and development (R&D) on distribution networks
- § IFI can be used to fund internal company expenditure or commission third parties to undertake work
- § IFI work is partially funded on a reduced sliding scale
- § The DPCR5 allowance for WPD is 0.5% of revenue per annum (approx £2m pa total) providing certain criteria are met
- § WPD publish an annual report outlining successful projects to date

LOW CARBON NETWORK FUND

LCNF

- § LCNF is a new £500m fund to encourage DNOs to use the DPCR5 period (2010 -2015) to prepare for their role in delivering the low carbon economy
- § Applies both to innovative technical trials and commercial arrangements
- § Small Scale Tier 1 projects (£16m pa) - to start 1 April 2010
- § Flagship Tier 2 projects (£64m pa) - projects submitted to Ofgem on a competitive basis for approval by end 2010 to start first quarter 2011

LCNF FRAMEWORK



LCNF ELIGIBILITY CRITERIA

Must involve the introduction of a technical or commercial application that;

- § Accelerates the development of a low carbon electricity system
- § Directly impacts on the performance of the network
- § Delivers benefits to existing and/or future customers that are expected to exceed the costs of the project, and
- § Generates new knowledge that can be shared amongst all GB licensed electricity DNOs
- § Tier 2 projects more likely to be successful if they include partnership working and third party funding

BRIEF DESCRIPTION - WPD RASSAU SMART NETWORK PROJECT

PART 1 BACKGROUND ON “PONTYPOOL TRIAL”

TRIAL AT PONTYPOOL NORTH 132kV SUBSTATION EARLY 2009

- § Driven by concern over network losses and inability to separate true “technical losses” from “data issues” and related incentives
- § Target was to measure loads/voltages at LV busbar level on every HV/LV distribution substation fed from an entire primary substation and show ability to integrate into SCADA and other systems

OBJECTIVES

- § Measure losses over the HV system for a clearly defined section of network
- § Compare measured losses with theoretical losses for that network
- § Record all costs associated with the project
- § Identify issues of practicality and accuracy
- § Identify other benefits of obtaining detailed network time based data

APPROACH

- § Install half hourly metering at a primary substation
- § Install half hourly meters at distribution substations fed from the primary substation
- § Where industrial/business customers take the whole load of a distribution substation, utilise half hourly data from the settlement system
- § Transfer data using the existing half hourly system

TASK

- § Meter box production set up at WPD Plant Centre to build 112 units
- § Pole mounted installations were started on 19th January 2009 and completed by 5th February 2009 at 91 locations
- § Ground mounted installations were started on 17th January 2009 and completed by 1st February 2009 at 17 locations
- § Industry standard data flows set up for 108 new meter points
- § Contract set up with STARK to capture data flows via mobile phone network

DATA ANALYSIS

§ Objectives

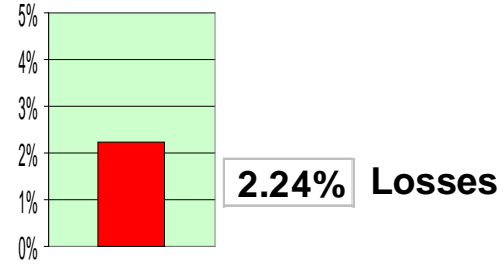
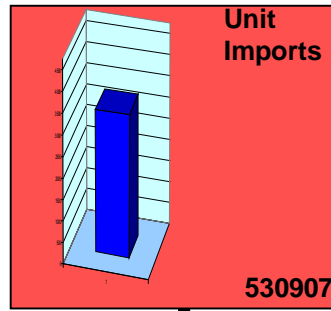
- Confirm the data flow & data integrity
- Calculate losses on HV network
- Compare these calculated losses to the theoretical losses
- Consider overall accuracy

The following slides show samples only – showing first nesting of distribution substation and then some hour by hour

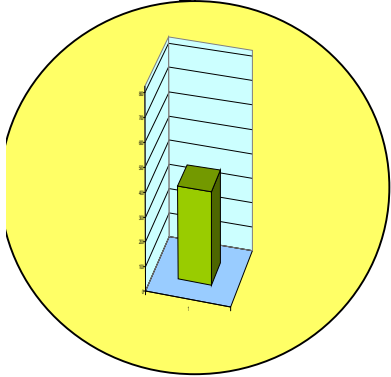
Pontypool North

kWh readings – 23/03/09

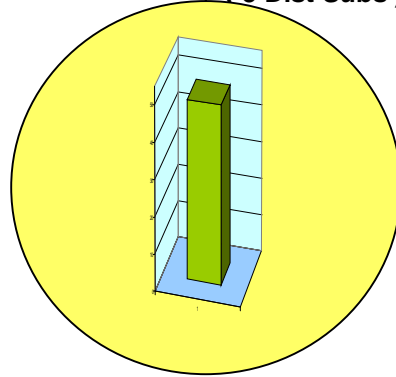
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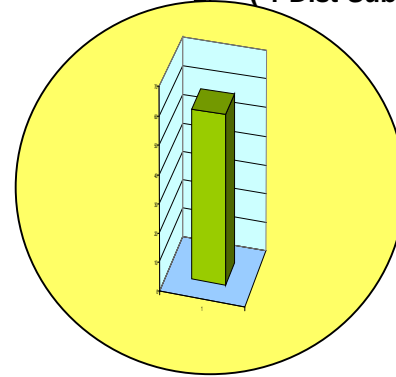
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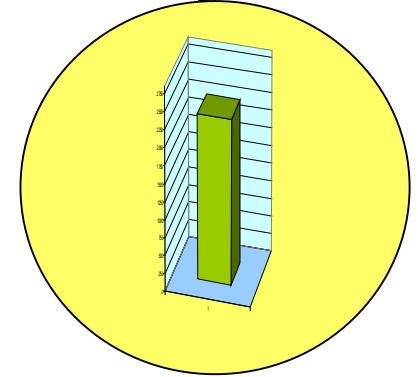
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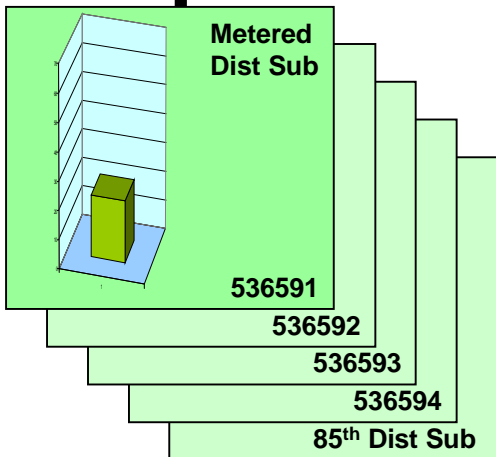
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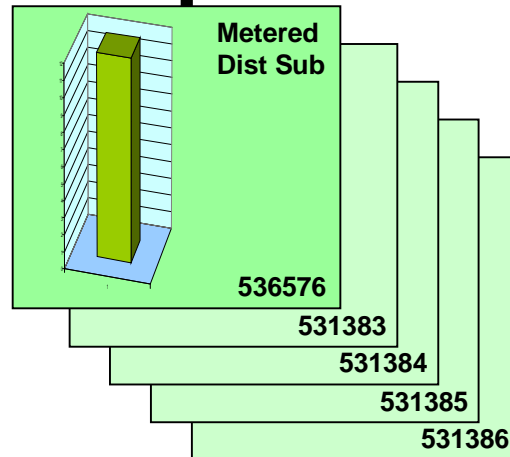
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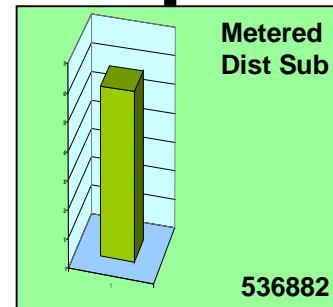
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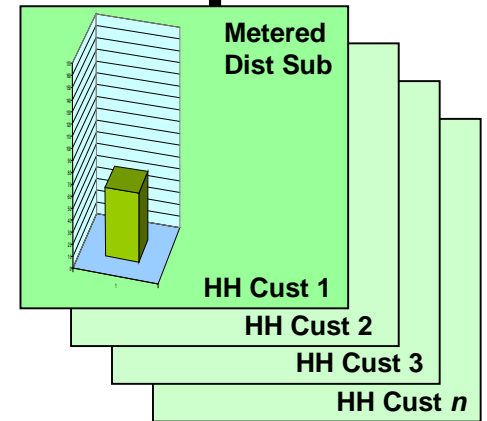
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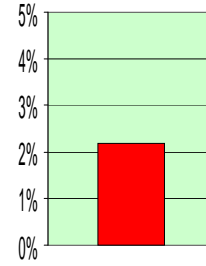
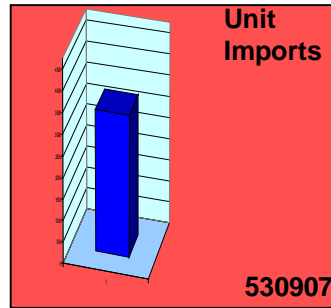
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kWh readings – 23/03/09

02:00 - 03:00



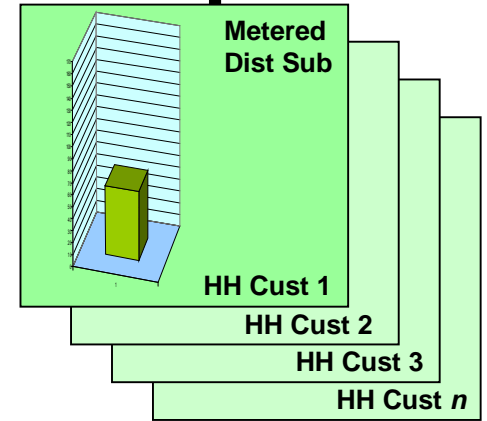
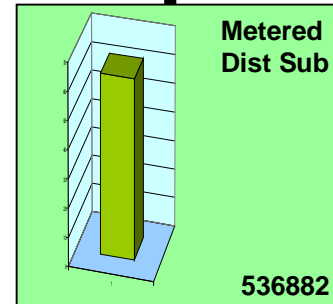
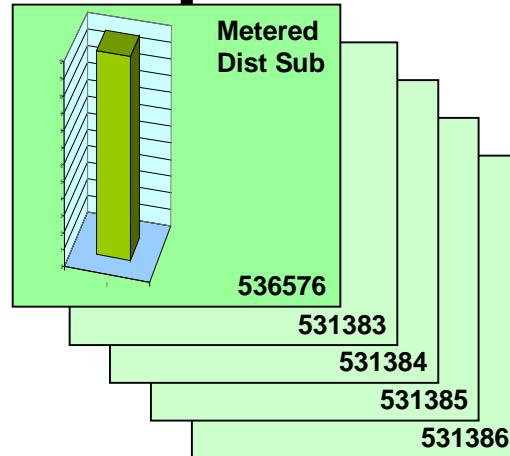
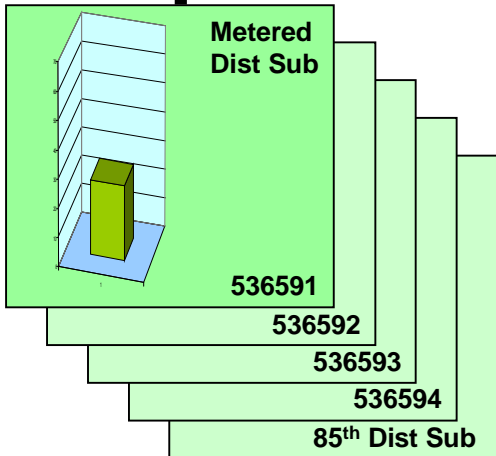
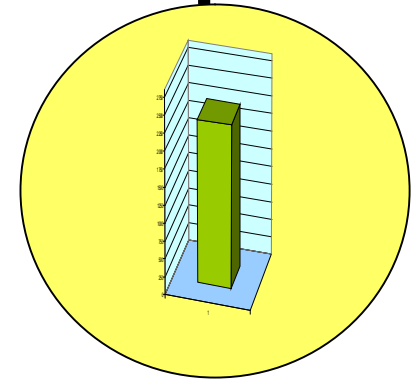
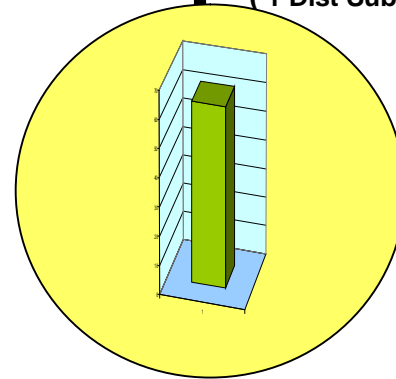
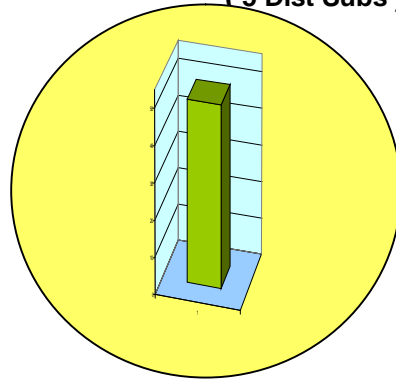
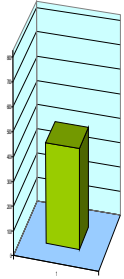
2.18% Losses

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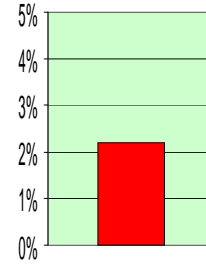
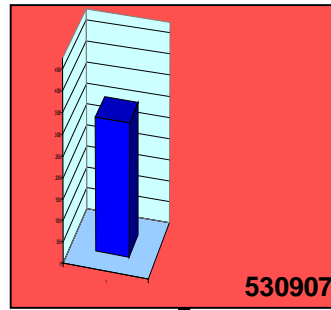
HV Feeder *n*



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kWh readings – 23/03/09

03:00 - 04:00



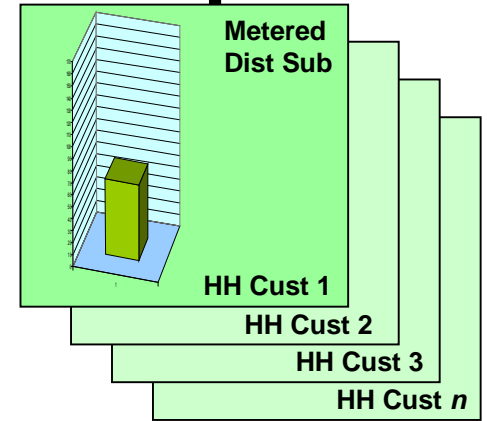
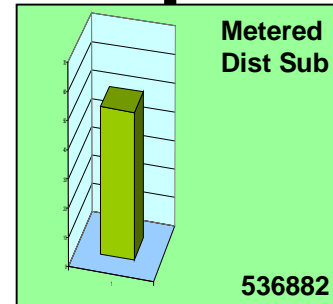
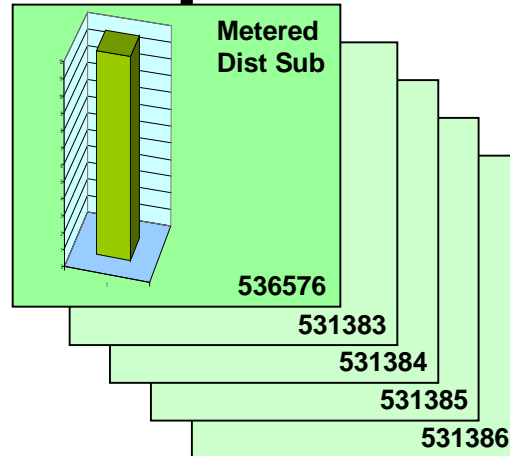
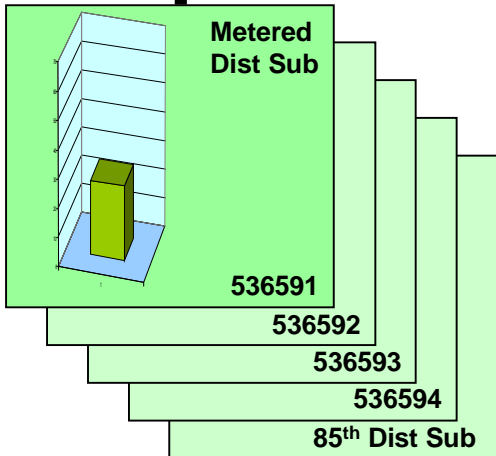
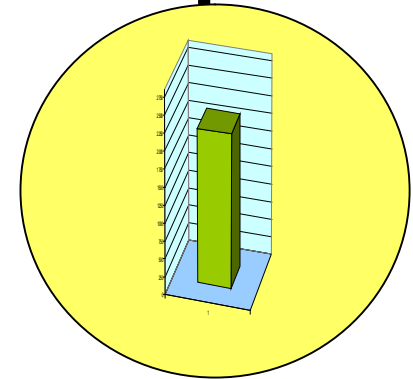
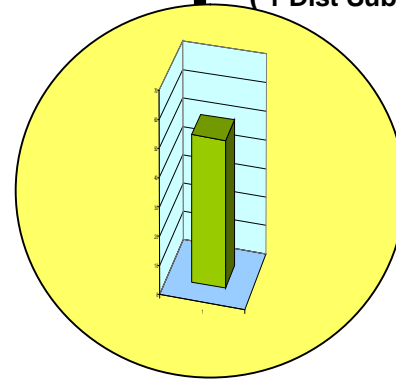
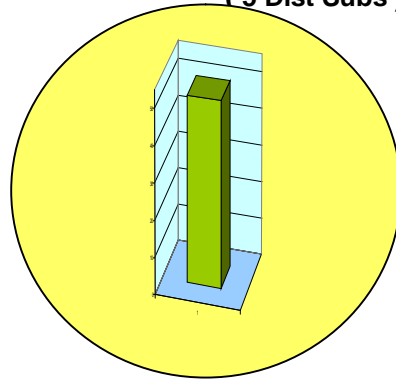
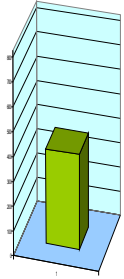
2.19% Losses

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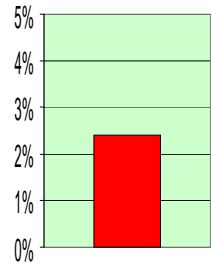
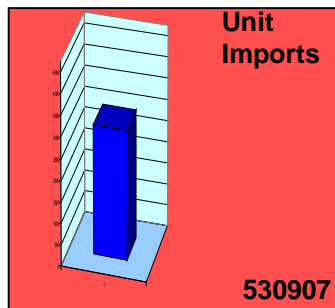
HV Feeder *n*



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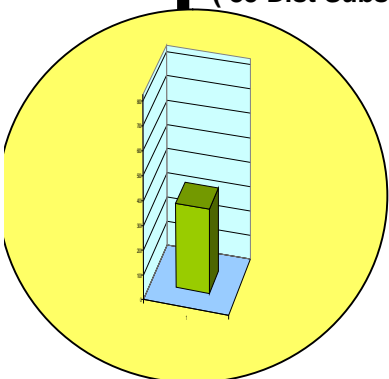
kWh readings – 23/03/09

04:00 - 05:00

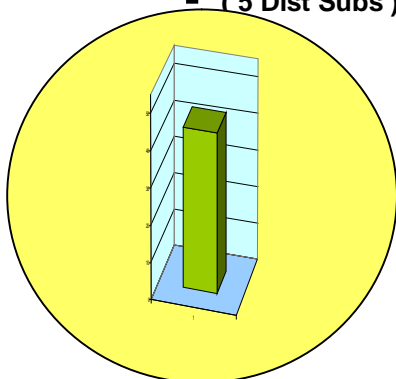


2.40% Losses

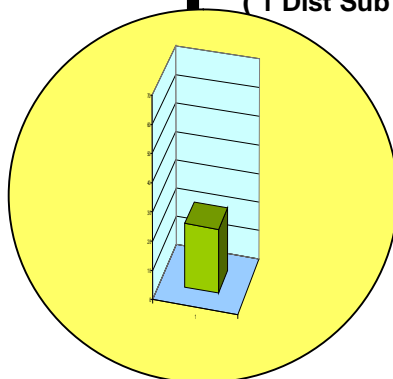
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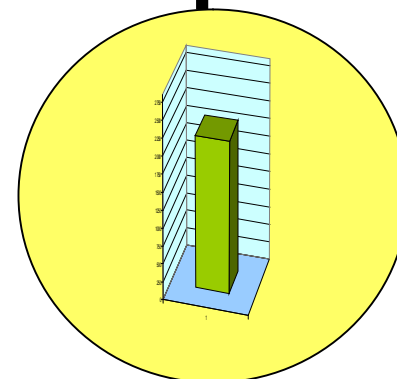
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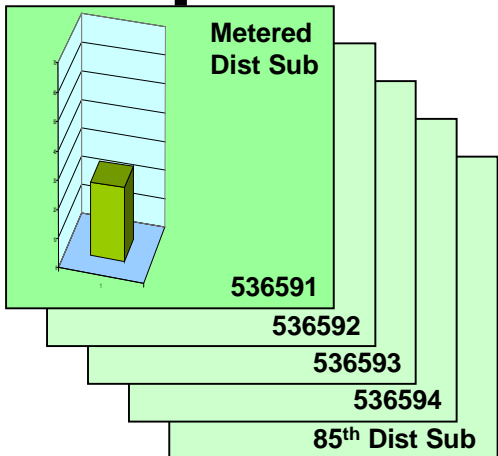
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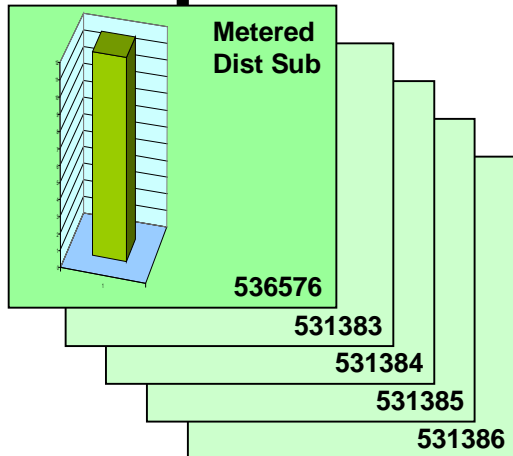
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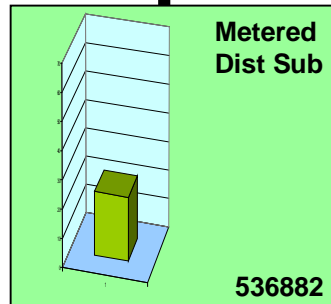
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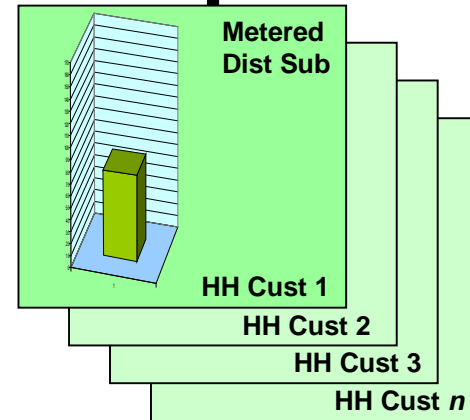
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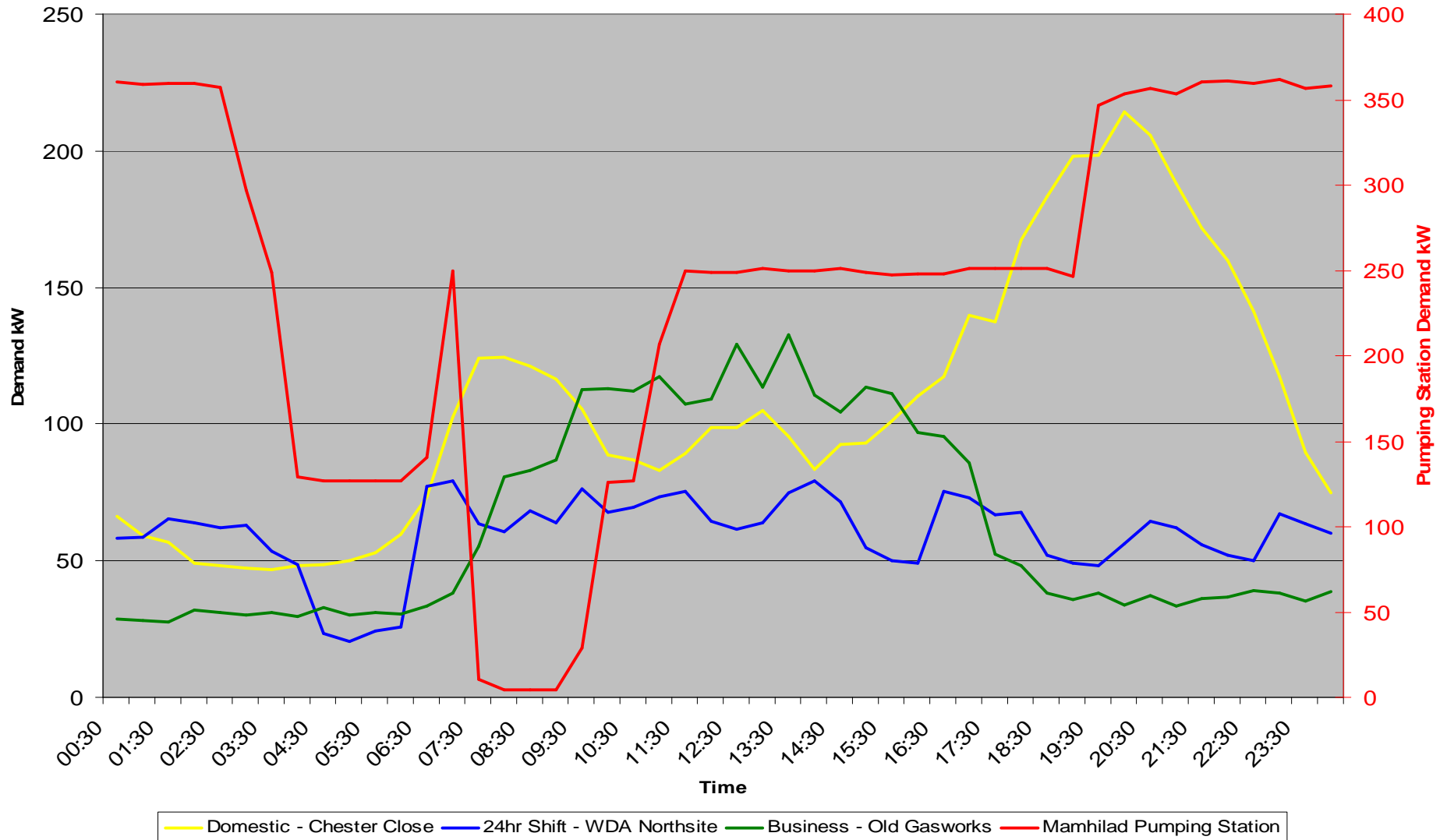


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MEASURED DAILY LOAD PROFILES

Daily Load Profiles



PART 2

PROPOSED PROJECT ON RASSAU SUPERGRID AREA

SMART NETWORKS

- § No common definition, but most commentators include;
DG, renewables, monitoring, comms and control, preventive and corrective actions, flexible, adaptable, autonomous? intelligent?

WPD HV/LV PONTYPOOL TRIAL

Already provided many elements required for evolution to smart network

- § The connections already made for voltage, frequency, current measurement
- § Ready accessible CT for p.l.c. injection, or hub for local area comms such as Zigbee, for automatic outage monitoring, demand side management, automatic meter reading (if required by Supplier), distributed generation voltage and load control, power quality monitoring
- § Communication hub back to WPD server

Consequently worked up proposal for wider area project to test scalability, and comms technologies to handle real time “smart network” requirements

PROPOSAL WORKED UP FOR RASSAU SUPERGRID GROUP

- § Mid Wales – likely to be later in most smart meter roll outs
- § Richer in renewable resource
- § Limited interconnections to other groups = reduced cost of additional 132kV boundary metering



RASSAU PROPOSAL

- § Installations of high end metering/processor and comms hubs to central WPD servers/ENMAC at 8,500 pole and ground mounted substation
- § Real time comms and network monitoring
- § End to end demonstration of integration of customer end smart meters – data flows/volumes – (sample size in hundreds depending on supplier involvement) - needed to demonstrate utilisation benefit levels - eg for DG & DSM on EVs, heat pumps

WHY CAN'T REAL TIME DATA BE CAPTURED FROM VIRTUAL AGGREGATION OF CUSTOMER SMART METERS?

- § It might – but for near equivalence would need real time comms link open all the time from every meter, central server to hold connectivity model and then for processing to aggregate to (LV) feeder level and signal back to DNO for actions (for WPD a ratio of 28 customers to one distribution substation)
- § Misses out LV losses and un-metered supplies
- § Needs more resilient comms/server infrastructure than basic (non real time) supplier smart meter requirement

BENEFITS

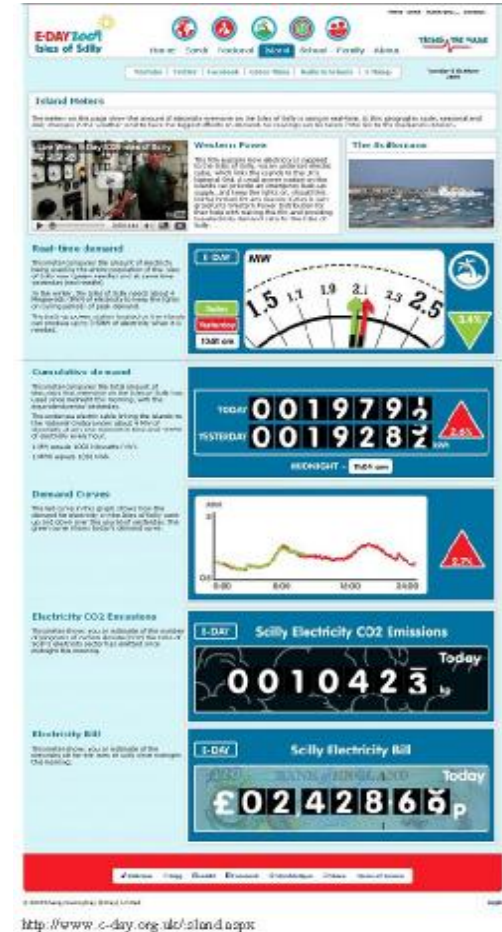
- § Accurate network utilisation data present day loads – reinforcement/connection cost
- § Future ability to stretch network utilisation for DG, EV, heat pumps etc
- § Can provide alternative comms path for smart meters – both at “basic” level (batch comms and low real time need) to real time tariff interactions for DSM etc
- § Improved loss of supply information aiding restoration times
- § PQ and PF monitoring

BENEFITS

- § Provision of data for community energy saving schemes such as “e-day” (sample next slide)
- § Site-specific CBAs for loss reduction initiatives such as transformer change outs
- § Identification and targeting of overhead line circuits impacted by de-rating caused by climate change
- § Loss reduction through identification of metering connections and data errors
- § Targeting of action following loss of radio teleswitching

ISLES OF SCILLY COMMUNITY ENERGY SAVING INITIATIVE

- § Heavily featured BBC October 2009
- § Community lead
- § WPD provided live minute by minute energy measurement feed to their web-site
- § www.e-day.org.uk sample page here >>>>
- § WPD in discussion with promoter over possible future engagement in Wales
- § WPD in discussion with Welsh Assembly Government on synergies with related community energy projects



OUR PRIORITY AREAS FOR DISCUSSION

Our aim today is to generate some practical ideas for some physical projects.
Our particular areas of interest are;

- § Collection and provision of network information e.g. community programmes involving smart metering
- § Demand side management initiatives
- § Storage schemes
- § Electric vehicle use e.g. profiles and cost behaviour
- § Distributed network control
- § Solutions to voltage rise issues associated with the connection of generation