



21st ANNUAL CONFERENCE
28-30 MARCH 2017

 GLOBAL GOALS:
LOCAL ACTION



HEADLINE SPONSOR



The Long Road to Carbon Neutrality



Aston University
Birmingham

Headline Sponsor



CarbonCredentials



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- Aston University – a brief introduction
- The Birmingham District Energy Scheme – An overview of the city wide scheme
- Benefits of joining scheme - Aston's Perspective
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Aston University – a brief introduction



- A University since 1966
- Research led with five schools:
 - Life and Health Sciences
 - Engineering and Applied Science
 - Business School
 - Languages and Social Science
 - Medical School (opening 2018)
- 9,500 students FTE
- 2nd place in Times Higher Education analysis of the Teaching Excellence Framework

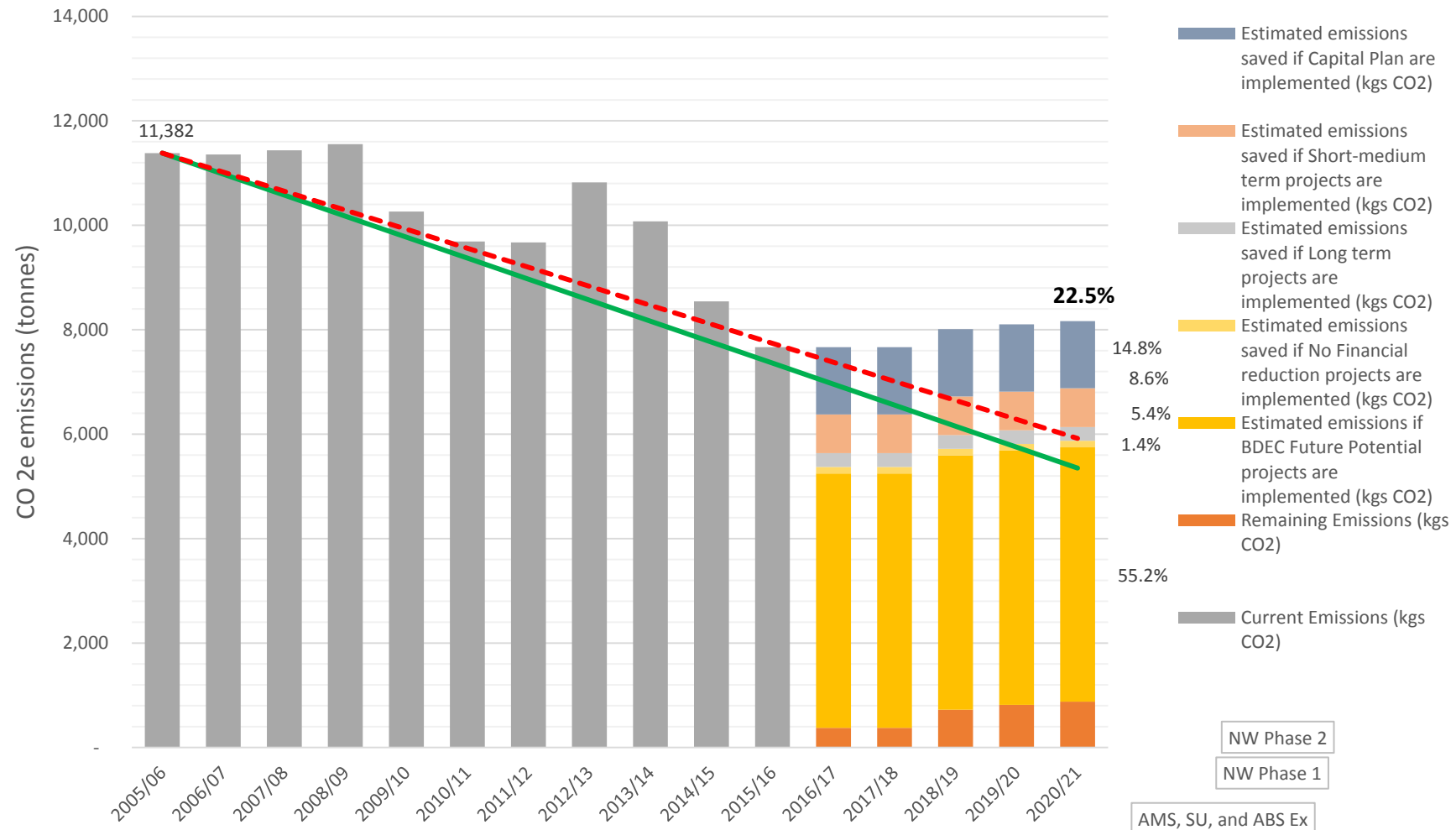


Some of Our Green Credentials



- The University is committed to reduce its 2005/06 emissions by 53% by 2020
- Ranked 6th out of 150 Universities in 2016 People and Planet University League
- Certified EcoCampus Platinum and ISO 14001 and 50001

Some of Our Green Credentials



Benefits of joining scheme



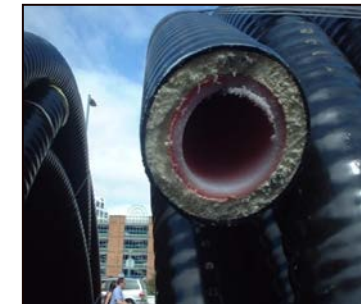
- CO_{2e} reductions
- 5-10% cost reduction
- Capital Costs spread out over contract period
- Reduced management of legal compliance
- Externally maintained
- (Future) Heat resilience – linking the schemes



What is District Energy?



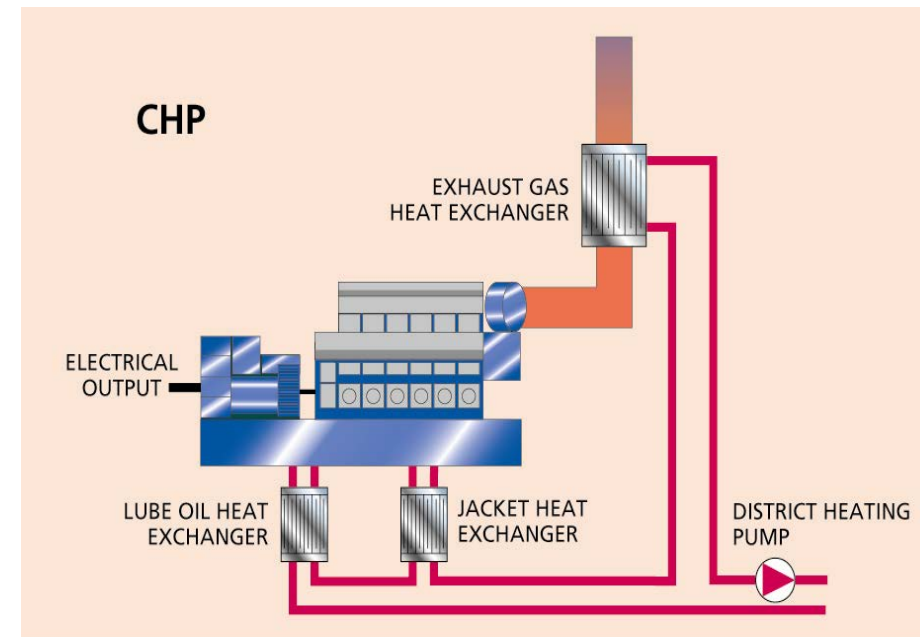
- Piped heating & cooling services to buildings – “Energy Linking”
- Pre-insulated pipe, buried circa 1-1.5m below ground in the highway
- Pipe can be plastic (HDPE) or Steel and is typically between 100mm and 500mm (OD)
- Heat losses generally $< 0.5^{\circ}\text{C}$ per km
- Reliability $\sim 100\%$ (e.g. 99.9% for Birmingham since scheme start)
- Networks last for > 50 years
- Energy density is key, i.e. Size of heat load and distance from network



Combined Heat & Power (CHP)



- CHP produces heat in the form of recovered hot water/steam and electricity
- Higher efficiency (80-85% compared with traditional thermal power station 25-35% and gas boilers)
- Gas turbines, steam turbine or reciprocating engines
- Fuel 'agnostic' – biogas, vegetable oil, biomass etc



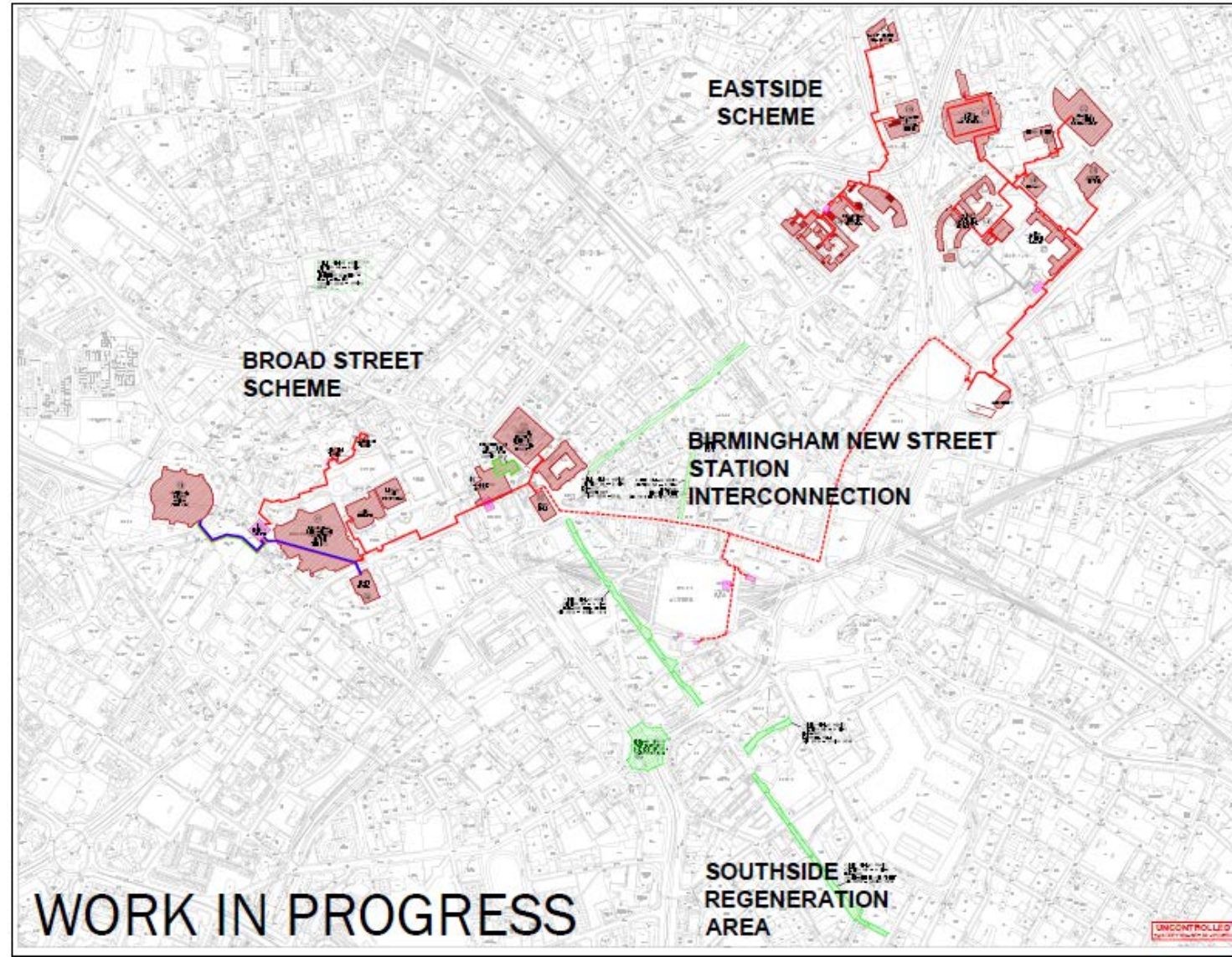
Existing Scheme



- 3 Separate District Energy Networks
- 5 Core Partners (Aston University, Childrens Hospital, NIA, Birmingham City Council and Engie)
- 56MW heating capacity
- 12MW cooling capacity
- 4 km of heating and cooling network
- 4 Energy Centres:
 - Aston University Campus, Birmingham Childrens Hospital
 - The Barclaycard Arena, International Convention Centre
 - Library of Birmingham, Birmingham New Street Station



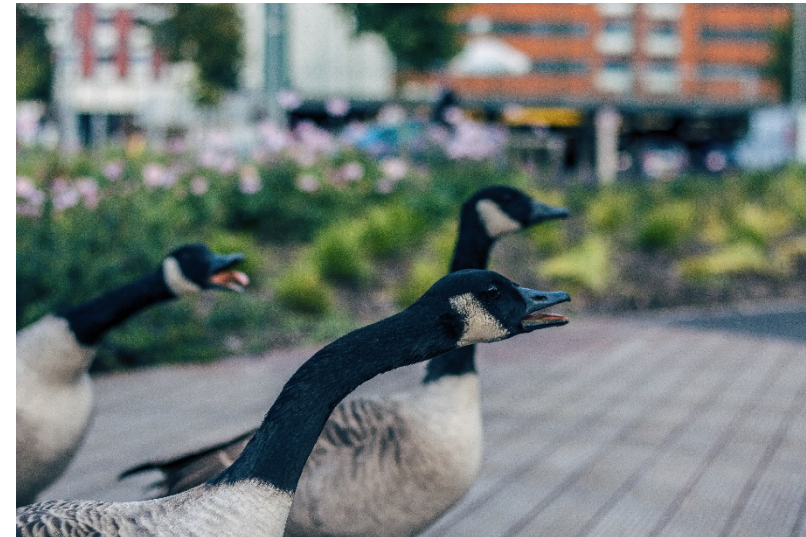
BDEC Network Overview



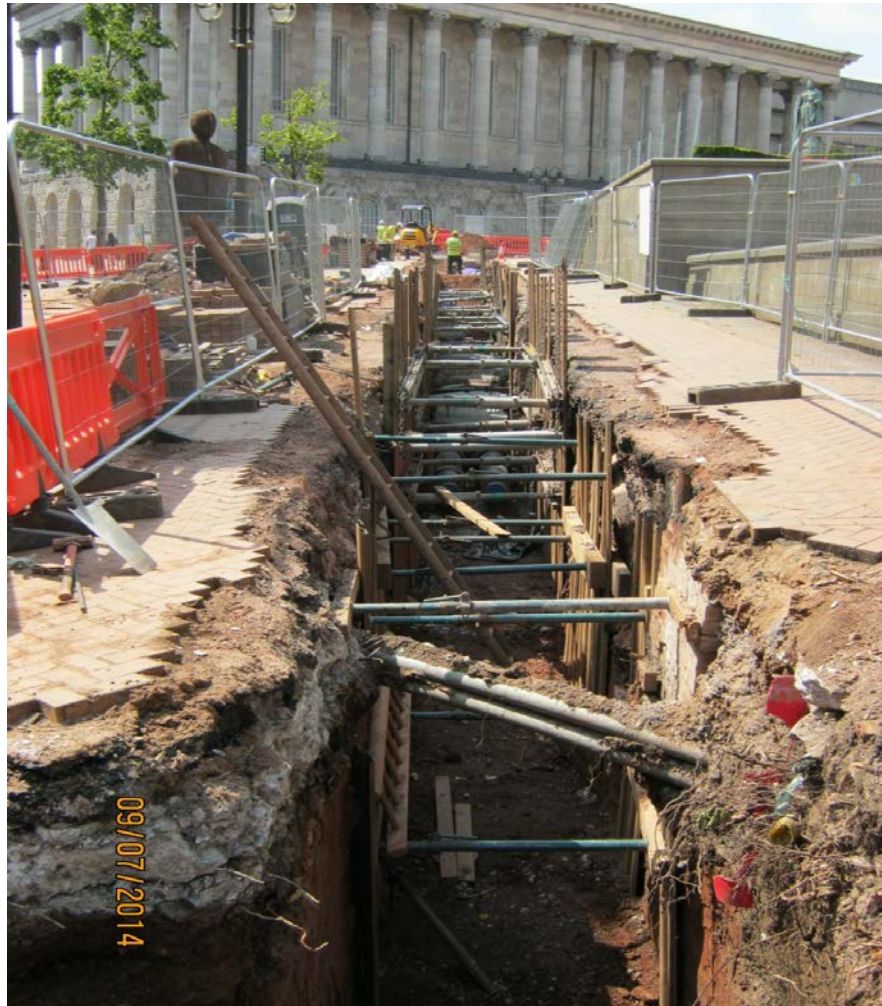
Aston University Scheme



- 3 MWh CHP (1+2 MWh CHP's) and three emergency boilers
- Feeds heat to:
 - Main Building and Wings (Including Hot Water to taps)
 - Library
 - Woodcock Sports Centre
 - Half of ABS building
 - And all the new ASV halls (not Lakeside)
- Generates 60-70% of our electricity requirements
- Supply's heat to third party buildings off campus including:
 - Woodcock Birmingham City Council Building
 - Mass house residential block



Installation Works to add New Street Station



Interconnection Benefits



- Capacity increase through addition of satellite CHP engine on the network
- Increased resilience to the Broadstreet and Eastside district energy schemes
- Supply of low carbon heating and electricity to BNSS and John Lewis
- Additional tonnes of CO2 saved p.a.
- Gateway to provide district heating benefits to buildings within the heart of Birmingham City Centre



CO_{2e} reductions



Original Carbon Saving Calculations				
CHP	kWh	CO2 kg/kWh	CO2/ tonnes	
Gas into CHP	29,915,900	0.191	5714	
Gas into Boilers	7,151,785	0.191	1366	
Heat Produced	17,928,517			
Electricity Produced	10,435,416			
Conventional - like for like				
Gas	23,904,689	0.191	4566	
Electricity	10,435,416	0.664	6929	
		CO2 Saving	4415	tonnes CO2

- EMR only include total gas and any grid electricity
- Current Carbon Factor for DEC's = 0.12 kg CO_{2e}

Cost reductions



		Do Nothing Option	
	kWh	Annualised life cycle cost	Current overall average p/kWh
Heat	17,928,517	£707,202	3.94
Electricity	19,766,620	£1,114,493	5.64

Join the scheme Option							
Agreed Saving	Annual Energy Service Company Charges	Proposed overall average p/kWh	P1 - Energy Revenues/ utility costs (74%)	Proposed Unit charge (p/kWh)	P2 - Fixed Charges (26%)	Monthly fixed charges	Annual Saving
5%	£671,841.90	3.75	£498,144	2.78	£173,698	£14,475	£35,360
5%	£1,058,768.35	5.36	£785,034	3.97	£273,734	£22,811	£55,725

Capital Cost Savings



- Redundant boilers had to be replaced at some time
- Capital Cost paid for by Engie - including CHP engines and the replacement of our main boiler (at some point during the contract)
- Costs are dissipated into our unit costs – heat unit cost on paper is higher than basic gas unit cost
- Financial model must be shown in any new connection



Reduced management of legal compliance



- Fell out of CRC Energy Efficiency Scheme after phase 1 saving £120,000 a year
- EU Emissions Trading Scheme (EU ETS) is now managed by Engie
- Tendering for energy procurement goes through Engie
- Reduced Display Energy Certificates grades on buildings on the scheme

Other Benefits



- Externally maintained
 - Fixed fees including maintenance and staff costs are passed through
- Linking to New Street Station (and EBRI) aims to introduce:
 - Heat resilience
 - Potential cost savings
 - Potential energy and emission savings
 - Improves the green credentials of the scheme
- The contract highlights that future 'green' technologies need to my investigated
- Profit Share



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University of St Andrews

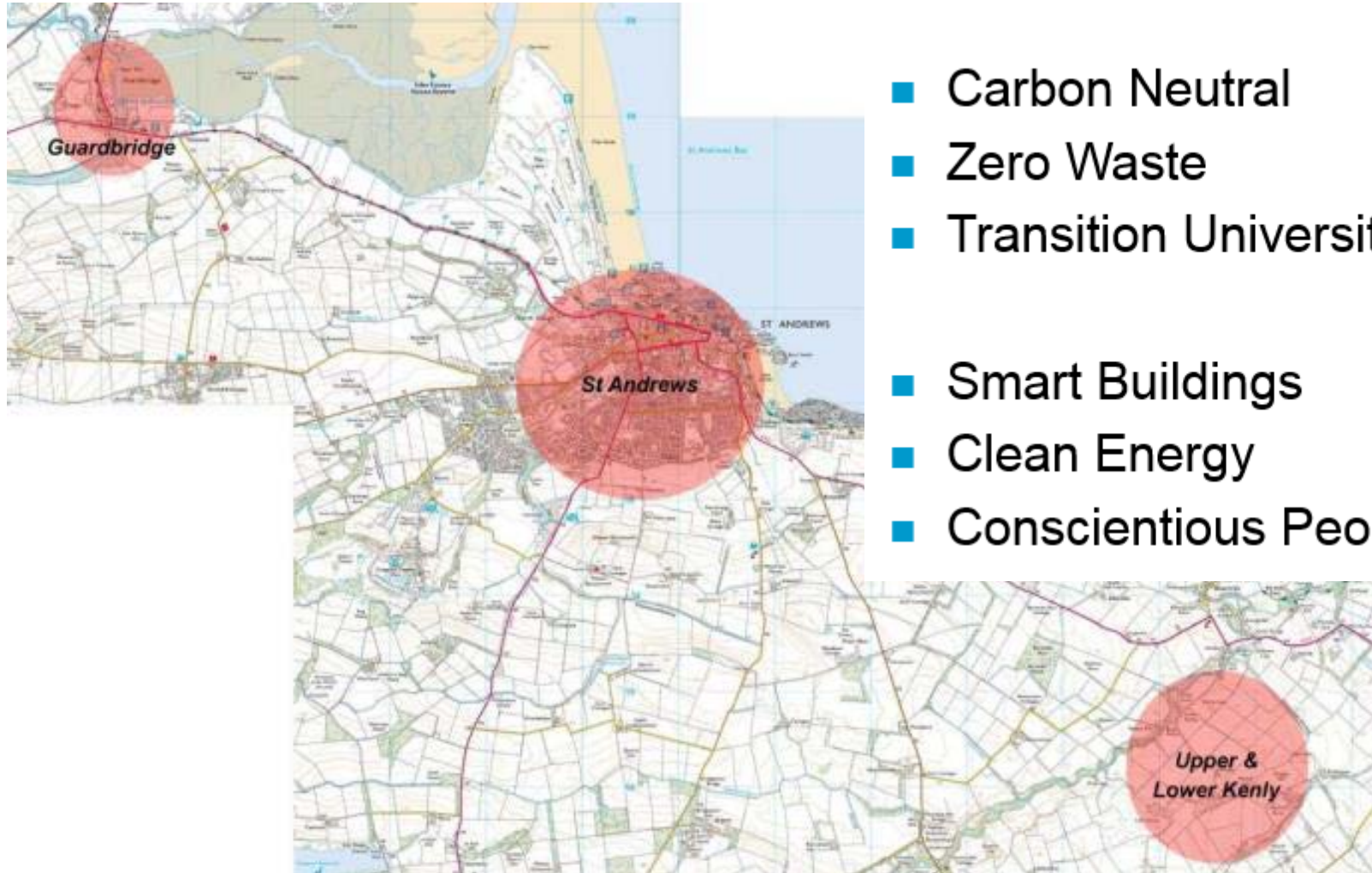
– a brief introduction



- A University since 1413
- 8,500 students FTE
- 2,300 staff
- 149 Buildings
- Gross area of all buildings is 253,000m²
- 210 acres excluding farmland
- Oldest building is St Leonard's Chapel (1413)



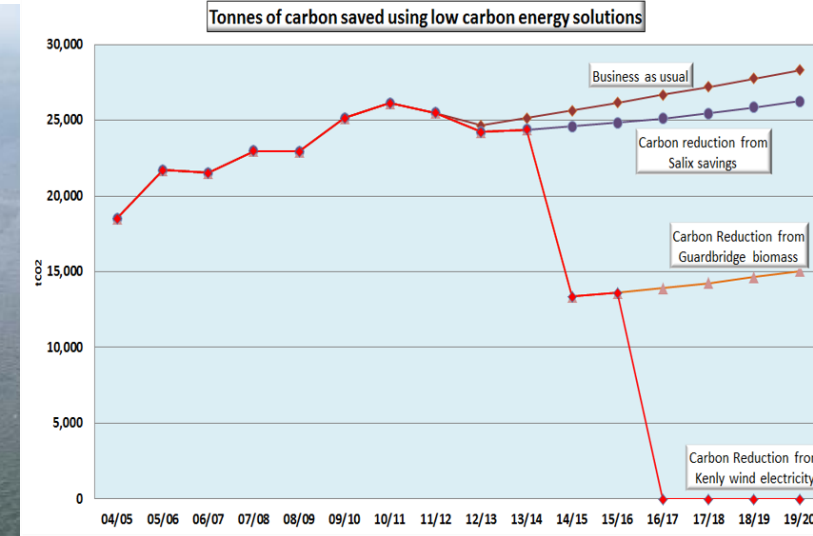
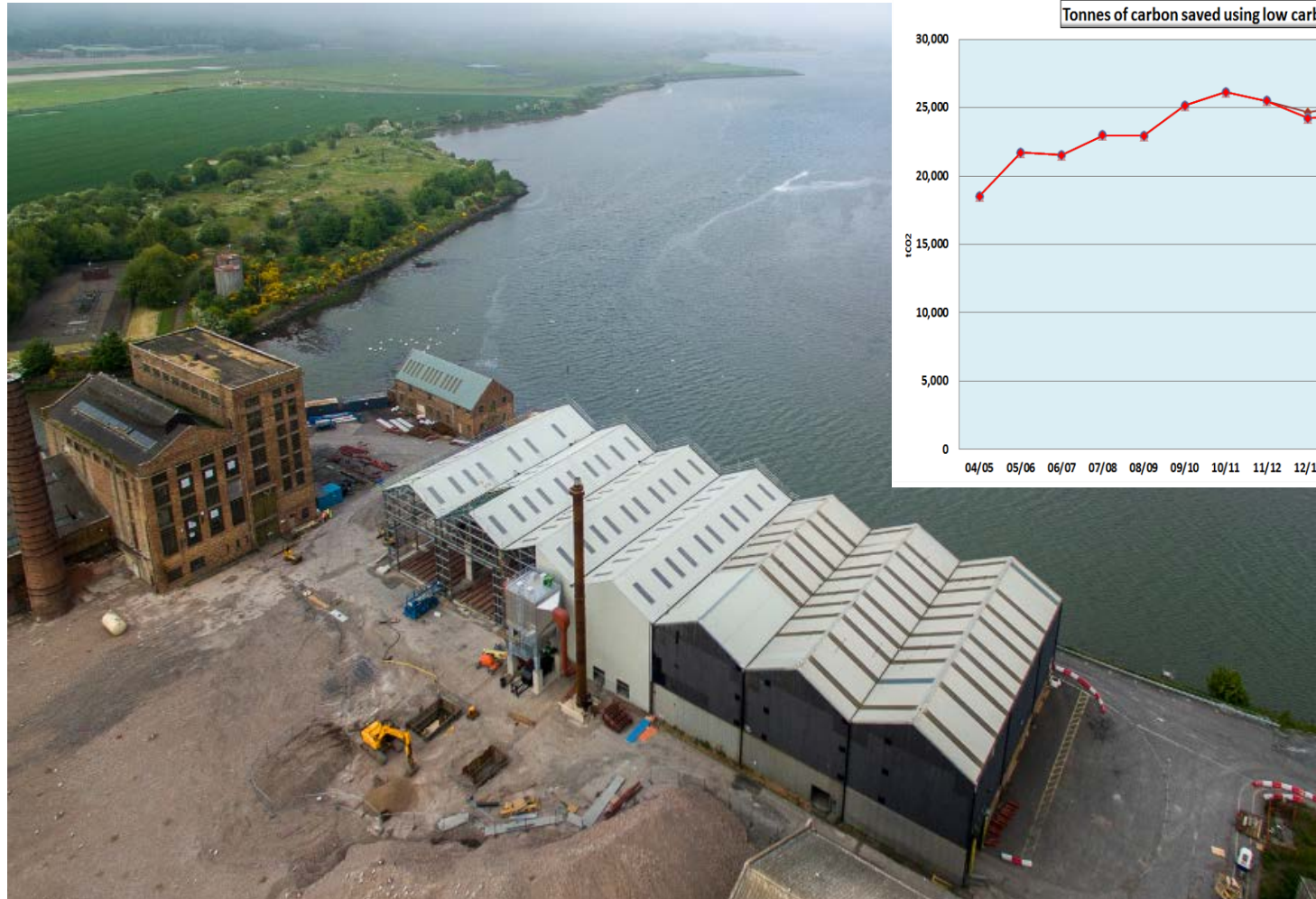
University of St Andrews Sustainability



- Carbon Neutral
- Zero Waste
- Transition University
- Smart Buildings
- Clean Energy
- Conscientious People

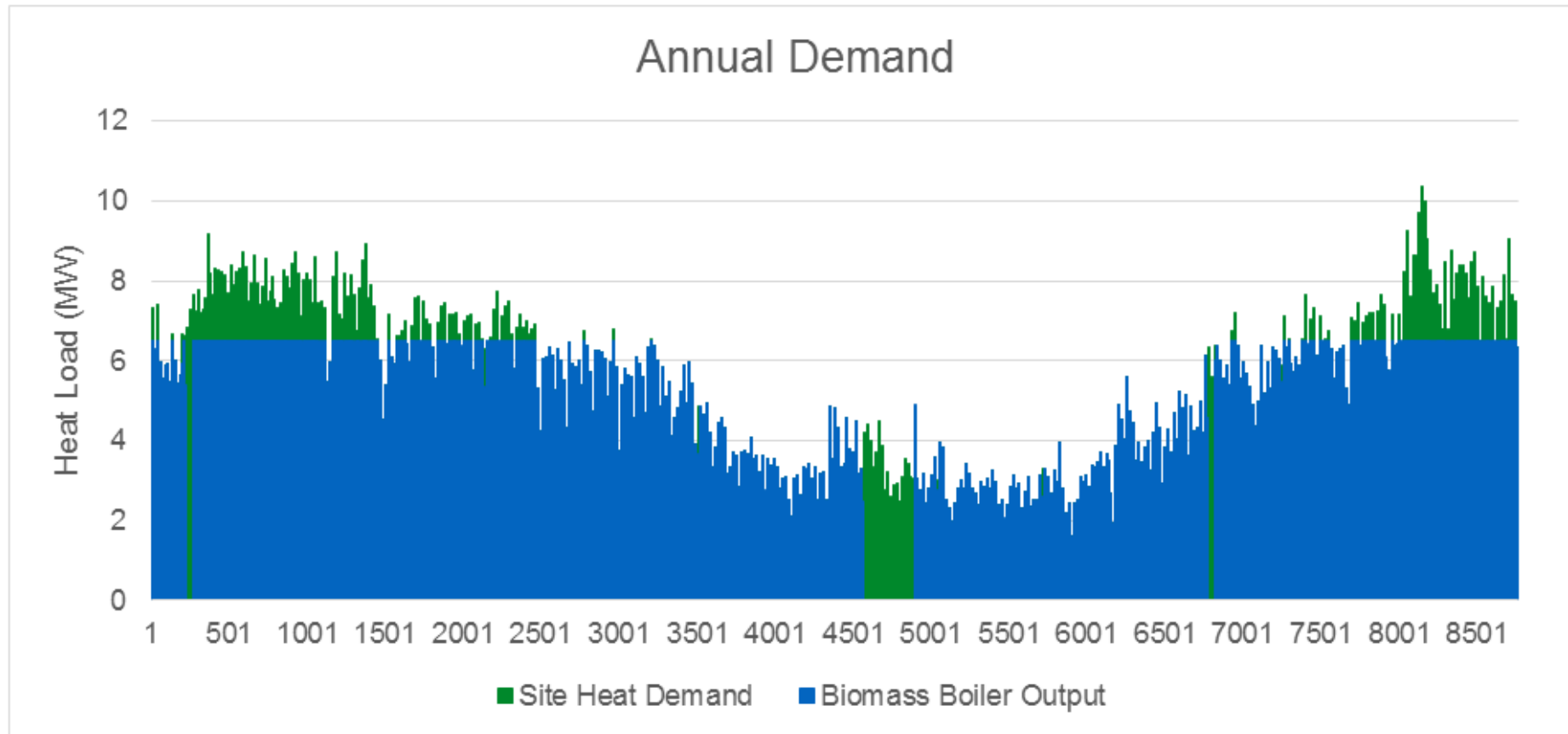
University of St Andrews

Carbon Reduction



University of St Andrews

Carbon Reduction Effectiveness



University of St Andrews

Project Summary



23km of district heating
pipework, connecting 41
campus plant rooms

University of St Andrews Innovation



- > **Insulation qualities**
 - > 0.027 W/m K @ 50 C
 - > Made use of industry leading insulation products (Series 3)
 - > Zero ODP & GWP
- > **Band Jointing method**
 - > Maintains insulation quality
 - > Maintains vapour barrier across joints
 - > Warranty for 50 years
- > **Pre-formed fittings**
- > **Leak Detection**



University of St Andrews Innovation



The entire energy centre was designed around providing future learning and education.

We constructed a classroom and viewing platform to allow safe access around the energy centre and fuel store.

University of St Andrews Environmental Considerations



- > Electrostatic precipitator
- > Reduces particulate emissions
- > Fly ash and grate ash collected separately

University of St Andrews Environmental Considerations



- > Re-use of existing brownfield site
- > Renovation of existing building for energy centre

University of St Andrews Environmental Considerations



- > Ecology Report – breeding seasons, replanting
- > BRE Greenprint Exemplar accreditation
- > Considerate constructors scheme (Noise, dust, etc.)

University of St Andrews Environmental Considerations



> Guardbridge Guarantee

> Resilience

> Cost certainty – bulk buy of round wood

> Engagement, Engagement, Engagement!

University of St Andrews Environmental Considerations



Key Factors

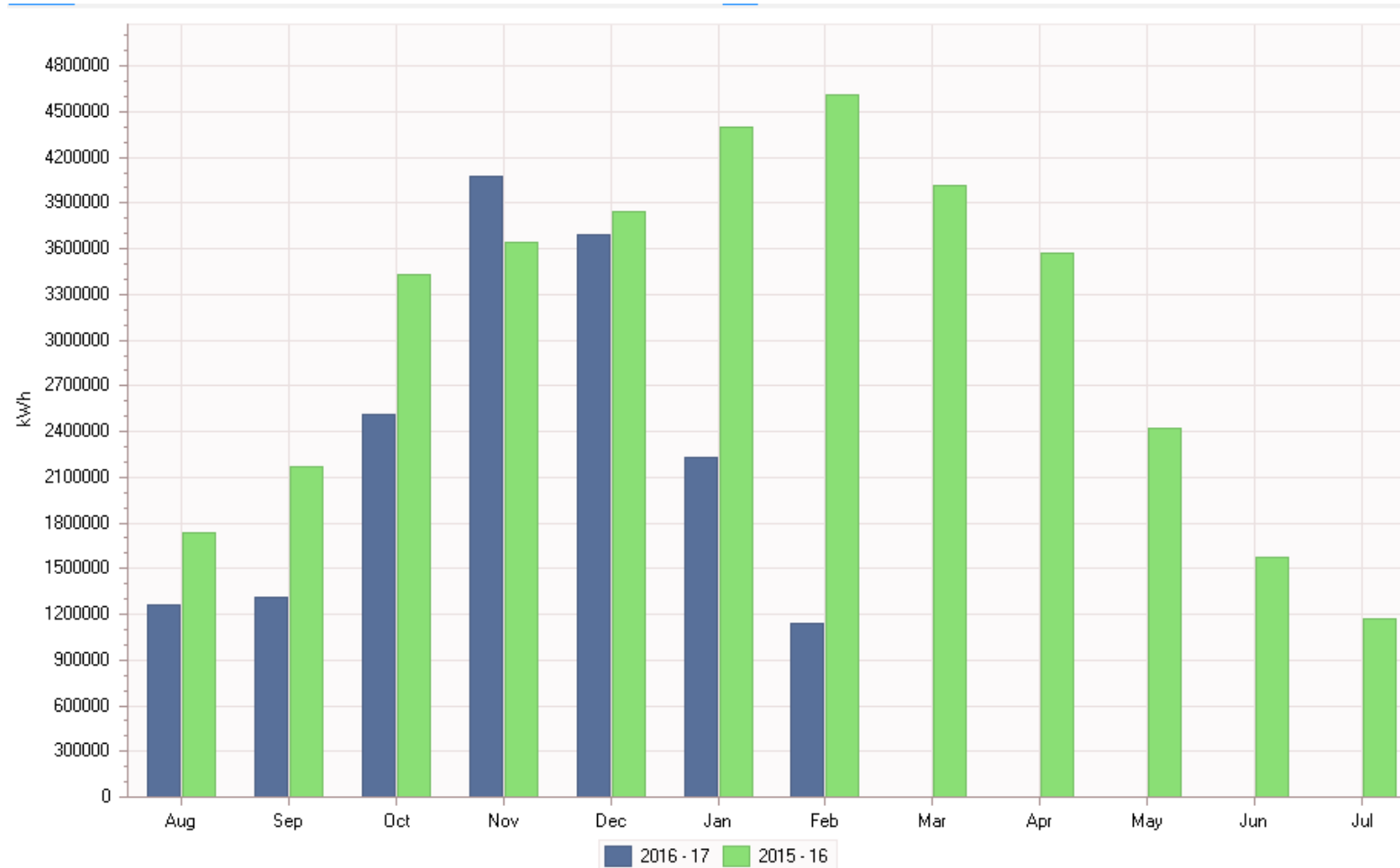
- > Sheer scale - one of the largest biomass boiler installations in the UK
- > One of the longest DH interconnecting pipelines in the UK
- > Connecting to live and operational buildings ensuring no loss of service
- > Currently providing almost all heating and hot water demands for 41 buildings on the University Campus

University of St Andrews Operations



University of St Andrews

Gas reduction due to biomass



University of St Andrews Staff Engagement



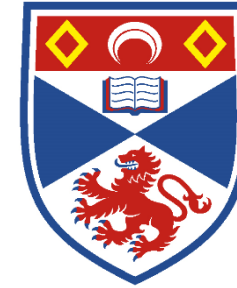
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